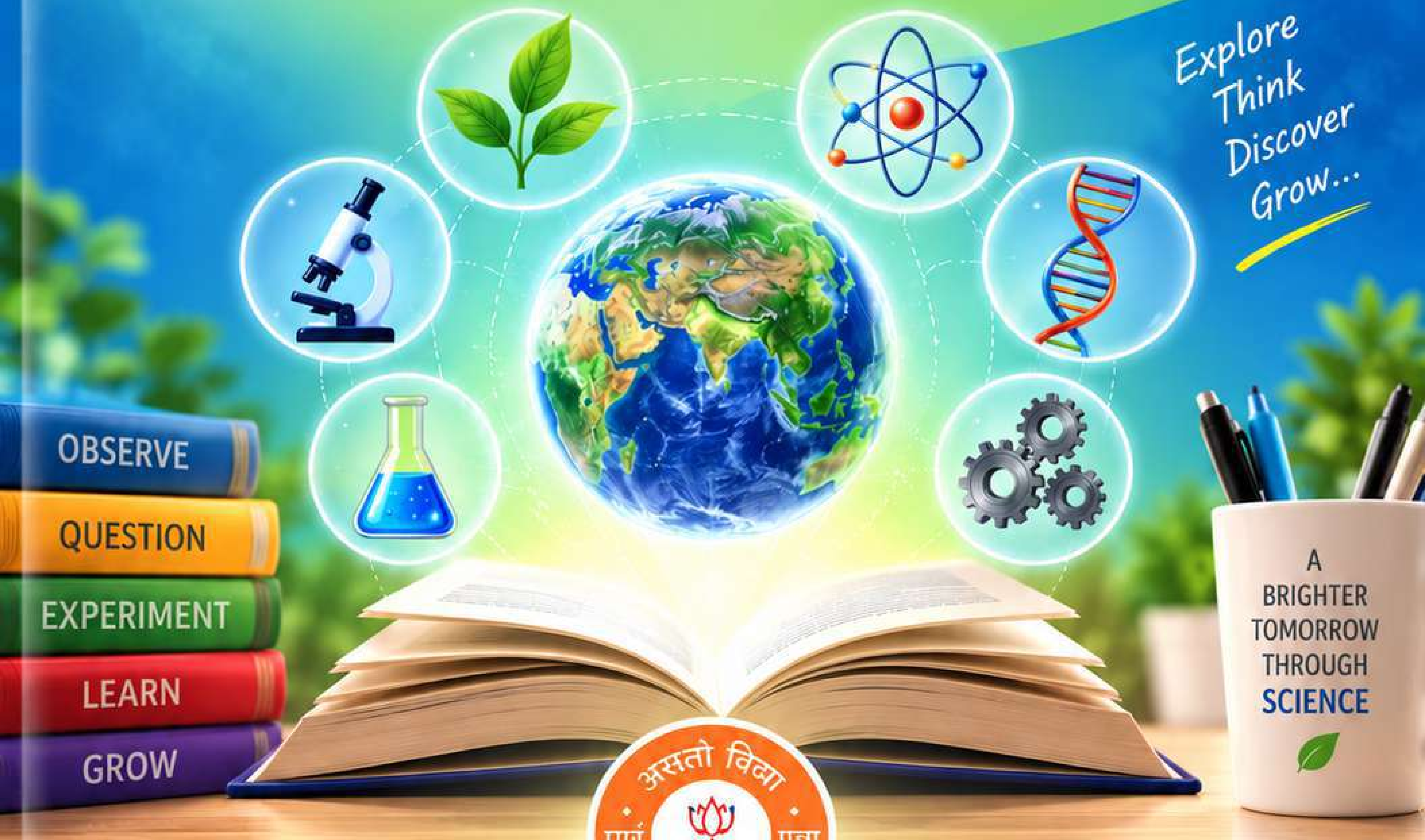
Super Power Series Book

CURIOSITY FOR YOUNG INTELLECTS

Study Material BOOK for 8th Standard Science Subject

NCERT/CBSE Curriculum Based



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Science
for a
Better Tomorrow

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Study Material BOOK for 8th Standard Science Subject

(Prepared as per Poornaprajna Integrated Student Support Model)

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PREFACE

Science education at the middle-school level has an important role in transforming **curiosity into systematic inquiry, knowledge into understanding, and understanding into application**. *Curiosity for Young Intellects – Study Material Book for 8th Standard Science Subject* has been developed as an **NCERT/CBSE Curriculum-based** learning resource with the help of AI-driven GPTs, to provide comprehensive academic support to Grade 8 students. Covering thirteen chapters across scientific investigation, microorganisms, health, electricity, forces, pressure, matter, solutions, light, astronomy, ecosystems, and Earth, the book seeks to strengthen conceptual foundations while encouraging students to **observe, question, experiment, reason, analyse, and discover**. It is designed to support students not only in their **regular school examinations**, but also in developing the scientific aptitude and problem-solving abilities required for **competitive examinations such as Olympiads**.

The book has been systematically developed in accordance with the **Poornaprajna Integrated Student Service Model**, which provides a structured framework for supporting students at different levels of learning and assessment. Each chapter is supported by **chapter summaries, fill-in-the-blank questions, one-mark, two-mark, three-mark and five-mark descriptive questions**, along with applied five-mark questions that encourage practical and experiential learning. The model also specifically provides for **Multiple Choice Questions for Olympiad examinations**, together with best practices in teaching-learning. In addition, the book incorporates both **Lower Order Thinking Skills (LOTS)** and **Higher Order Thinking Skills (HOTS)** so that students' progress from remembering and understanding scientific concepts to **application, analysis, reasoning, inference, problem-solving, and scientific investigation**. This integrated approach is intended to make learning systematic while giving teachers a rich resource for classroom discussion, assessment, revision, and enrichment.

A central purpose of this book is to help students develop the mindset of a **young scientist** rather than merely memorise scientific facts. By combining **curriculum-based preparation, examination-oriented practice, HOTS and LOTS questions, applied learning, and Olympiad-oriented challenges**, this book aims to bridge the requirements of classroom achievement and competitive-examination readiness. We hope that it will serve as a valuable companion for **students, teachers, and parents**, inspiring every learner to explore confidently, think critically, investigate independently, and apply scientific knowledge meaningfully. Above all, *Curiosity for Young Intellects* seeks to nurture the enduring habits of **"Observe, Question, Experiment, Learn and Grow"**, preparing young minds not only for examinations, but also for a lifetime of scientific thinking and discovery.

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8th Standard Science Book Chapter 1

Chapter 1: Exploring the Investigative World of Science:

1.1 Summary of the Chapter:

Chapter 1: Exploring the Investigative World of Science:

(1) Science Begins with Curiosity:
The chapter emphasizes that science starts with asking questions about everyday phenomena. Students are encouraged to observe their surroundings, think critically, and ask "Why?" and "How?" questions to develop a scientific attitude.

(2) From Learning Facts to Investigating:
In Grade 8, students move beyond simply learning scientific facts to understanding how scientific knowledge is discovered. Scientific investigation involves asking focused questions, making observations, conducting experiments, and drawing evidence-based conclusions.

(3) Scientific Thinking Requires Balance:
The textbook uses the symbols of **roots** and a **kite** to represent two essential qualities of science—careful observation grounded in evidence and creative thinking that explores new ideas. Both are necessary for successful scientific investigation.

(4) A Journey Across Many Scientific Topics:
The chapter introduces the topics students will study during the year, including microorganisms, health and diseases, electricity, forces, pressure, matter, light, the Moon, ecosystems, and climate change. These topics demonstrate how science explains both everyday life and global challenges.

(5) Understanding the Natural World:
Students will learn how microbes affect health, how electricity powers our lives, how forces and pressure influence motion and weather, and how matter is made of tiny particles that form elements, compounds, mixtures, and solutions.

(6) Light, Astronomy, and Calendars:
The chapter explains that the study of light helps us understand mirrors, lenses, and vision. It also describes how the phases of the Moon and the movements of celestial bodies led humans to develop calendars through careful observation.

(7) Protecting Our Planet Through Science:
The Earth supports life because of its suitable atmosphere and distance from the Sun. However, human activities are causing climate change, making it essential to use scientific knowledge and investigation to understand environmental problems and find sustainable solutions.

(8) Scientific Investigation Using Everyday Examples:
The chapter demonstrates the scientific method using the example of a **puri puffing during frying**. Students learn to identify variables, conduct controlled experiments, make careful observations, record data, and ask new questions based on their findings.

(9) The Importance of Systematic Experiments:
A good scientific experiment changes only one variable at a time while keeping all other conditions constant. Observations should be carefully recorded, and conclusions should be based on evidence rather than assumptions.

(10) Curiosity is the Foundation of Scientific Discovery:
The chapter concludes by encouraging students to remain curious, observe carefully, ask meaningful questions, and investigate everyday phenomena. It reminds learners that even simple observations are not always fully understood by scientists, making science a continuous journey of discovery.

1.2 Important Formulae:

Important Formulae:

1. Speed:

Speed = Distance/Time

or

v= d/t

Where:

- (v) = speed (m/s)
- (d) = distance (m)
- (t) = time (s)

Application: Measuring motion during scientific investigations.

---

2. Pressure:

Pressure= {Force/Area}

or

P= {F/A}

Where:

- (P) = Pressure (Pa)
- (F) = Force (N)
- (A) = Area (m^2)

Application: Understanding how force produces pressure, winds, storms, and cyclones.

---

3. Density:

$\rho = mV$

Where

- (ρ rho) = Density (kg/m^3)
- (m) = Mass (kg)
- (V) = Volume (m^3)

Application: Particle nature of matter and properties of substances.

---

4. Percentage:

% = {Part/Whole}x 100

Application: Analysing experimental observations and data.

---

5. Average (Mean):

Average = {Sum of observations / Number of observations}

Application: Repeated experiments and measurement analysis.

---

6. Temperature Conversion:

Celsius to Fahrenheit

F = (9/5){C+32}

Fahrenheit to Celsius

C = (5/9) (F-32)

Application: Experiments involving heating and boiling.

---

7. Time Measurement:

Time Taken = {t_2 - t_1}

Application: Measuring the time required for an experiment (for example, how long a puri takes to puff).

---

8. Unit Conversion:
Length
- (1 m = 100 cm)
- (1 cm = 10 mm)
- (1km =1000 m)

Mass
- (1kg =1000 g)

Time
- (1 min =60 s)
- (1 hour =3600 s)

---

9. SI Units Used in Science:

Physical Quantity	SI Unit
Length	metre (m)
Mass	kilogram (kg)
Time	second (s)
Temperature	degree Celsius (°C) or kelvin (K)
Force	newton (N)
Pressure	pascal (Pa)
Area	square metre (m^2)
Volume	cubic metre (m^3)

---

10. Experimental Variables (Conceptual Formula):
Scientific investigations follow the relationship:
Outcome = f (Independent Variable)
where:
- **Independent Variable** = factor changed
- **Dependent Variable** = factor measured
- **Controlled Variables** = factors kept constant

For example, in the **puri experiment**:
- Independent Variable = Oil temperature or dough thickness
- Dependent Variable = Time taken to puff or whether it puffs
- Controlled Variables = Size of dough, type of flour, frying method, etc.

Formulae Most Likely to be Asked in Examinations:
1. v= (d/t) (Speed)
2. P = (F/A) (Pressure)
3. ρ = (m/V) (Density)
4. Percentage Formula
5. Average Formula
6. Temperature Conversion Formula
7. Time Difference Formula
8. SI Unit Conversions

Note: Chapter 1 is primarily an **introductory chapter** that focuses on scientific inquiry and experimental methods rather than numerical calculations. Therefore, quantitative problems from this chapter are likely to involve **measurement, data recording, averages, percentages, pressure, unit conversions, and basic calculations** rather than complex numerical formulae.

1.3 Fill-Up the Blank LOTS type questions with Answers: (30 Questions)

Fill in the Blanks (LOTS – Lower Order Thinking Skills)
Fill in the blanks with the most appropriate word(s).

(1) Science begins with __________ about the world around us.
Answer: Curiosity

(2) In Grade 8, students enter the __________ World of Science.
Answer: Investigative

(3) Investigation in science involves asking focused questions and conducting simple __________.
Answer: experiments

(4) The image of the __________ represents a strong foundation of knowledge.
Answer: root

(5) The __________ symbolizes curiosity taking flight towards the unknown.
Answer: kite

(6) Investigation in science works best when careful observation is balanced with __________ thinking.
Answer: creative

(7) Some microorganisms help us digest our __________.
Answer: food

(8) Harmful microorganisms can cause __________.
Answer: infections

(9) Nutritious food, exercise, medicines and __________ help us fight diseases.
Answer: vaccines

(10) The heating effect of electric current helps keep us __________.
Answer: warm

(11) The magnetic effect of electric current helps __________ run.
Answer: motors

(12) A ball thrown into the air falls back to the ground because of __________.
Answer: force

(13) Pressure is the distribution of __________ over an object.
Answer: force

(14) A large pressure difference can lead to strong winds and __________.
Answer: cyclones

(15) Everything around us is made up of tiny __________.
Answer: particles

(16) Materials can be classified into elements, compounds and __________.
Answer: mixtures

(17) Sugar dissolves in tea to form a __________.
Answer: solution

(18) Light bends when it passes through __________.
Answer: lenses

(19) Corrective glasses help us see __________.
Answer: clearly

(20) The changing positions of the Earth, Moon and Sun produce the __________ of the Moon.
Answer: phases

(21) The first calendars were developed by observing the __________ of the Moon.
Answer: phases

(22) Every ecosystem depends on air, water, sunlight and other __________.
Answer: organisms
(23) Earth has an atmosphere that provides the __________ we breathe.
Answer: oxygen
(24) Human activities can disrupt Earth's __________ patterns.
Answer: climate
(25) Science can help us __________ climate change and guide our actions.
Answer: understand
(26) Simple scientific experiments can even be performed in the __________ at home.
Answer: kitchen
(27) In an experiment, scientists should change only __________ variable at a time.
Answer: one
(28) Scientists should keep the other conditions the __________.
Answer: same
(29) During an investigation, it is important to __________ observations carefully.
Answer: record (or keep notes of)
(30) The systematic study of a problem through observation and experimentation is called scientific __________.
Answer: investigation

These questions are directly based on the uploaded chapter and assess **LOTS (Remembering and Understanding)** level learning outcomes, making them suitable for Grade 8 class tests, worksheets, and formative assessments.

1.4 Fill-Up the Blank HOTS type questions with Answers: (25 Questions)

Fill in the Blanks (HOTS – Higher Order Thinking Skills)

Instructions: Fill in the blanks by applying scientific reasoning and concepts learned in the chapter. These questions test **application, analysis, and critical thinking** rather than simple recall.

(1) If a student changes only the temperature of the oil while keeping all other conditions the same, the temperature becomes the __________ variable.
Answer: independent (or controlled)
(2) To determine whether oil temperature affects puffing, the thickness of the dough should remain __________.
Answer: constant (or the same)
(3) If two variables are changed simultaneously during an experiment, it becomes difficult to identify the actual __________ of the result.
Answer: cause
(4) Measuring the time taken for a puri to puff provides __________ evidence instead of mere opinion.
Answer: measurable
(5) A scientist repeats an experiment several times to improve the __________ of the results.
Answer: reliability
(6) If observations do not support the original expectation, a scientist should modify the __________ rather than ignore the evidence.
Answer: explanation (or hypothesis)
(7) Asking "What happens if...?" is the first step towards developing a scientific __________.
Answer: investigation
(8) Curiosity alone is not enough; it must be supported by careful __________.
Answer: observation

(9) The chapter suggests that scientific knowledge grows by asking __________ questions rather than accepting facts blindly.
Answer: focused
(10) The image of the root reminds students that creative ideas should always be supported by __________.
Answer: evidence (or observations)
(11) Since rough surfaces also reflect light, reflection does not require a __________ surface alone.
Answer: polished
(12) Observing the changing phases of the Moon helped early humans develop __________ based on repeated observations.
Answer: calendars
(13) Because Earth's atmosphere blocks harmful ultraviolet rays, it plays an important role in supporting __________.
Answer: life
(14) Understanding ecosystems requires studying the __________ among living organisms and their surroundings.
Answer: relationships
(15) If microorganisms can both help and harm humans, they should be studied based on scientific __________ rather than assumptions.
Answer: evidence
(16) The chapter suggests that solving climate-related problems requires both scientific knowledge and responsible __________.
Answer: actions
(17) When a scientist carefully records every observation during an experiment, the conclusions become more __________.
Answer: reliable
(18) If a puri does not puff after changing only one variable, the next investigation should involve forming a new __________.
Answer: question (or hypothesis)
(19) A kitchen can become a science laboratory when observations are made in a __________ manner.
Answer: systematic
(20) The chapter emphasizes that science is a process of __________ rather than merely memorizing facts.
Answer: investigation
(21) Even simple everyday phenomena may not be completely understood, showing that science is always __________.
Answer: evolving
(22) A good scientific investigation depends on observing, measuring, experimenting, and drawing __________ from evidence.
Answer: conclusions
(23) Climate change can be better understood when scientific observations are combined with careful __________ of evidence.
Answer: analysis
(24) If experimental results raise new doubts, scientists should ask __________ questions instead of stopping the investigation.
Answer: further (or new)

(25) The chapter concludes that careful observations should guide students in exploring the __________ world of science.
Answer: investigative

These questions are designed at the **HOTS (Higher Order Thinking Skills)** level of Bloom's Taxonomy, assessing **application, analysis, inference, experimental design, reasoning, and scientific thinking**, while remaining fully aligned with the concepts presented in the uploaded chapter.

1.5 One-mark questions with Answers of LOTS Type: (34 Questions)

One-Mark Descriptive Questions with One-Sentence Answers (LOTS – Lower Order Thinking Skills):

Instructions: Answer each question in **one sentence**.

(1) **What is the main theme of Chapter 1?**
Answer: The chapter introduces students to the investigative nature of science and scientific inquiry.

(2) **What is the starting point of science?**
Answer: Science begins with curiosity and questioning.

(3) **What kind of questions are students encouraged to ask in Grade 8?**
Answer: Students are encouraged to ask focused scientific questions.

(4) **What does scientific investigation involve?**
Answer: Scientific investigation involves observing, experimenting, and explaining observations.

(5) **Who are students encouraged to become in this chapter?**
Answer: Students are encouraged to become young investigators and scientists.

(6) **What does the root symbol represent in the textbook?**
Answer: The root represents a strong foundation of knowledge.

(7) **What does the kite symbol represent?**
Answer: The kite represents curiosity and creative thinking.

(8) **What should be balanced during scientific investigation?**
Answer: Careful observation should be balanced with creative thinking.

(9) **What is the purpose of the questions given at the beginning of the chapter?**
Answer: They are meant to spark curiosity and encourage scientific thinking.

(10) **Why are the first-page questions not meant for examinations?**
Answer: They are intended to inspire curiosity rather than test memory.

(11) **What are microorganisms?**
Answer: Microorganisms are tiny living organisms that cannot be seen with the naked eye.

(12) **How do beneficial microorganisms help humans?**
Answer: Beneficial microorganisms help digest food and produce medicines.

(13) **What can harmful microorganisms cause?**
Answer: Harmful microorganisms can cause infections.

(14) **What helps our body fight infections?**
Answer: Nutritious food, exercise, medicines, and vaccines help fight infections.

(15) **What effect of electric current keeps us warm?**
Answer: The heating effect of electric current keeps us warm.

(16) **What effect of electric current helps motors run?**
Answer: The magnetic effect of electric current helps motors run.

(17) **Why does a ball thrown upward fall back to the ground?**
Answer: It falls back because of the action of forces.

(18) **What is pressure?**
Answer: Pressure is the distribution of force over an object.
(19) **What weather phenomena can result from large pressure differences?**
Answer: Large pressure differences can produce strong winds and cyclones.
(20) **What are all materials made of?**
Answer: All materials are made of tiny particles.
(21) **Name the three categories of materials mentioned in the chapter.**
Answer: Materials are classified as elements, compounds, and mixtures.
(22) **Why do we study light?**
Answer: We study light to understand reflection, refraction, and the working of many objects.
(23) **Why does the Moon appear to change its shape?**
Answer: The Moon appears to change shape because of its changing positions relative to the Earth and the Sun.
(24) **How were the first calendars developed?**
Answer: The first calendars were developed by observing the cycles of the Moon and the Sun.
(25) **What is an ecosystem?**
Answer: An ecosystem is a system in which living organisms interact with one another and their environment.
(26) **Why is Earth suitable for life?**
Answer: Earth is suitable for life because it has liquid water and a protective atmosphere.
(27) **What is causing climate change according to the chapter?**
Answer: Human activities are causing changes in Earth's climate.
(28) **How can science help protect the Earth?**
Answer: Science helps us understand environmental changes and guides our actions to protect the planet.
(29) **Where can simple scientific experiments be performed?**
Answer: Simple scientific experiments can even be performed in a home kitchen.
(30) **What is the main rule while conducting a scientific experiment?**
Answer: Only one variable should be changed at a time while keeping the others constant.
(31) **Why should observations be recorded during an experiment?**
Answer: Observations should be recorded to accurately analyse the results.
(32) **What is meant by systematic investigation?**
Answer: Systematic investigation is the process of solving scientific problems through careful observation and experimentation.
(33) **Is the reason why a puri puffs up completely understood by scientists?**
Answer: No, the chapter states that it is not yet completely understood.
(34) **What message does the chapter give to young learners?**
Answer: The chapter encourages students to remain curious and investigate the world scientifically.

1.6 One-mark questions with Answers of HOTS Type: (30 Questions)

One-Mark Descriptive Questions with One-Sentence Answers (HOTS – Higher Order Thinking Skills):

Instructions: Answer each question in **one sentence**. These questions assess **application, analysis, reasoning, and scientific thinking** based on the concepts presented in the chapter.

(1) **Why should a scientist ask focused questions instead of general questions?**
Answer: Focused questions help scientists design meaningful investigations and obtain reliable answers.

(2) **Why should only one variable be changed during an experiment?**
Answer: Changing only one variable helps identify its effect accurately while keeping other factors constant.

(3) **Why is careful observation as important as curiosity in science?**
Answer: Careful observation provides evidence that supports or rejects scientific ideas.

(4) **Why should scientific conclusions be based on observations rather than guesses?**
Answer: Observations provide reliable evidence for drawing scientific conclusions.

(5) **Why should an experiment be repeated more than once?**
Answer: Repeating an experiment increases the reliability of the results.

(6) **Why does the chapter compare a kitchen to a science laboratory?**
Answer: A kitchen offers many everyday situations that can be investigated scientifically.

(7) **Why should scientists keep notes during an experiment?**
Answer: Recording observations helps compare results and avoid missing important details.

(8) **Why should a scientist ask new questions after completing an experiment?**
Answer: New questions help extend scientific investigations and improve understanding.

(9) **Why is scientific investigation described as a systematic process?**
Answer: It follows organized steps of questioning, observing, experimenting, and concluding.

(10) **Why does the chapter state that science is always evolving?**
Answer: Science evolves because new evidence can improve or change existing knowledge.

(11) **Why is the root used as a symbol in the textbook?**
Answer: The root reminds students that scientific ideas should be built on strong evidence and knowledge.

(12) **Why is the kite used as a symbol in the textbook?**
Answer: The kite represents imagination and curiosity that encourage scientific exploration.

(13) **Why must creative thinking be combined with careful observation?**
Answer: Creative ideas become scientifically meaningful only when supported by evidence.

(14) **Why do scientists study microorganisms even though they cannot be seen with the naked eye?**

Answer: They are studied because they significantly affect human health and the environment.

(15) **Why are vaccines considered important according to the chapter?**
Answer: Vaccines help protect the body against infections.

(16) **Why does understanding force help explain everyday events?**
Answer: Force explains the motion and stopping of objects in daily life.

(17) **Why can a small difference in air pressure produce different weather conditions?**
Answer: Changes in pressure control the movement of air, creating breezes or storms.

(18) **Why must scientists study particles to understand materials?**
Answer: The properties of materials depend on the nature and movement of their particles.

(19) **Why is classification important in science?**
Answer: Classification helps scientists organize and study materials systematically.

(20) **Why do corrective glasses work according to the chapter?**
Answer: Corrective glasses work because they bend light to improve vision.

(21) **Why did ancient people observe the Moon regularly?**
Answer: They observed the Moon to develop calendars based on its repeating phases.

(22) **Why is Earth described as being 'just right' for life?**
Answer: Earth has liquid water and a protective atmosphere that supports life.

(23) **Why does the chapter emphasize protecting ecosystems?**
Answer: Ecosystems are essential because all living organisms depend on them for survival.

(24) **Why does the chapter say that humans are both the problem and the solution to climate change?**
Answer: Humans cause climate change but can also reduce it through scientific understanding and responsible actions.

(25) **Why is the question about a puffing puri considered scientific?**
Answer: It encourages observation, experimentation, and evidence-based reasoning.

(26) **Why should the thickness of the dough remain the same while testing oil temperature?**
Answer: Keeping the dough thickness constant ensures that only the effect of oil temperature is tested.

(27) **Why should measurable observations be preferred over opinions in an experiment?**
Answer: Measurable observations produce objective and reliable scientific evidence.

(28) **Why is it important to ask 'What happens if...?' during an investigation?**
Answer: Such questions help scientists explore cause-and-effect relationships.

(29) **Why is the puffing of a puri still scientifically interesting?**
Answer: It remains interesting because its complete scientific explanation is still not fully understood.

(30) **Why does the chapter encourage students to think like scientists in everyday life?**
Answer: Everyday observations can lead to meaningful scientific discoveries when explored systematically.

1.7 Two-mark questions with Answers of LOTS Type: (22 Questions)

Two-Mark Descriptive Questions with Answers (LOTS – Lower Order Thinking Skills):

Instructions: Answer each question in **two sentences**.

1. What is the main objective of Chapter 1?

Answer: The chapter introduces students to the investigative nature of science. It encourages them to ask questions, make observations, and conduct simple investigations.

2. How does science begin according to the chapter?

Answer: Science begins with curiosity and the desire to understand the world. It starts by asking simple "Why?" and "How?" questions.

3. What is meant by scientific investigation?

Answer: Scientific investigation is the process of answering questions through observation and experimentation. It helps us understand natural phenomena using evidence.

4. Why are students called young investigators?

Answer: Students are encouraged to observe and explore the world around them. They learn science by asking questions and conducting simple experiments.

5. What does the root symbol in the textbook represent?

Answer: The root represents a strong foundation of knowledge. It reminds students to stay connected to nature, traditions, and scientific observation.

6. What does the kite symbol represent?

Answer: The kite symbolizes curiosity and creative thinking. It encourages students to explore new ideas while remaining guided by evidence.

7. How do beneficial microorganisms help humans?

Answer: Beneficial microorganisms help us digest food. They are also used in the production of medicines.

8. How do vaccines help us?

Answer: Vaccines protect our bodies against infections. They help us remain healthy by improving immunity.

9. Name two effects of electric current mentioned in the chapter.

Answer: Electric current produces a heating effect that keeps us warm. It also produces a magnetic effect that helps motors and machines function.

10. What is pressure?

Answer: Pressure is the distribution of force over an object. Differences in air pressure can produce winds and cyclones.

11. What are materials made of?

Answer: All materials are made up of tiny particles. The movement of these particles differs in solids, liquids, and gases.

12. Name the three types of materials mentioned in the chapter.

Answer: Materials are classified as elements, compounds, and mixtures. This classification helps scientists study matter systematically.

13. What does the chapter explain about light?

Answer: The chapter explains that light reflects from mirrors and rough surfaces. It also bends when passing through lenses.

14. How were the first calendars developed?

Answer: The first calendars were developed by observing the repeating phases of the Moon. Careful observations of the Sun and Moon helped humans measure time.

15. What is an ecosystem?

Answer: An ecosystem is a system in which living organisms interact with one another and their environment. It supports life by maintaining natural balance.

16. Why is Earth suitable for life?

Answer: Earth is at the right distance from the Sun, allowing water to remain liquid. Its atmosphere also provides oxygen and protects us from harmful ultraviolet rays.

17. What causes climate change according to the chapter?

Answer: Human activities can change Earth's temperature. These changes disturb climate patterns and may have harmful consequences.

18. Why can a kitchen be considered a science laboratory?

Answer: Many scientific observations and experiments can be performed in a kitchen. Everyday activities provide opportunities for scientific investigation.

19. What should be changed during a scientific experiment?

Answer: Only one variable should be changed at a time. All other conditions should be kept the same to obtain reliable results.

20. Why should observations be recorded during an experiment?

Answer: Recording observations helps compare results accurately. It also helps scientists identify patterns and draw correct conclusions.

21. What is meant by systematic investigation?

Answer: Systematic investigation is a step-by-step method of solving scientific problems. It involves observing, experimenting, recording, and analysing results.

22. What message does the chapter give to students?

Answer: The chapter encourages students to remain curious and think like scientists. It motivates them to investigate everyday phenomena through careful observation and experimentation.

1.8. Two-mark questions with Answers of HOTS Type: (20 Questions)

Two-Mark Descriptive Questions with Answers (HOTS – Higher Order Thinking Skills):

Instructions: Answer each question in **two sentences (or two points)**. These questions assess **application, analysis, reasoning, inference, and problem-solving skills** based on the concepts presented in the chapter.

1. Why should scientists ask focused questions instead of broad questions?

Answer: Focused questions make investigations more systematic and easier to test through experiments. They help scientists collect accurate observations and reach reliable conclusions.

2. Why should only one variable be changed during an experiment?

Answer: Changing only one variable helps identify its exact effect on the outcome. Keeping all other conditions constant ensures that the results are reliable.

3. Why is curiosity alone not enough to become a good scientist?

Answer: Curiosity must be supported by careful observation and experimentation. Scientific conclusions should always be based on evidence rather than guesses.

4. Why should observations be recorded during an investigation?

Answer: Recording observations helps compare results accurately and detect patterns. It also enables scientists to verify and improve their conclusions later.

5. How does the example of a puffing puri demonstrate scientific thinking?

Answer: It shows that even everyday events can become scientific investigations when questions are asked. Scientists identify variables, conduct experiments, and analyse observations before drawing conclusions.

6. Why is repeating an experiment important?

Answer: Repeating an experiment helps confirm whether the results are consistent. It reduces the chances of drawing conclusions from accidental observations.

7. Why should scientists continue asking questions even after completing an experiment?

Answer: One investigation often leads to new questions that require further study. This process helps scientific knowledge continue to grow and improve.

8. Why are the root and kite symbols used together in the textbook?

Answer: The root represents careful observation and a strong foundation of knowledge. The kite represents imagination and creativity, both of which are necessary for successful scientific investigation.

9. Why is understanding particles important for explaining the properties of matter?

Answer: The behaviour of particles determines the properties of solids, liquids, and gases. Studying particles helps explain many physical changes and everyday phenomena.

10. Why is classification considered an important part of science?

Answer: Classification helps organise materials into meaningful groups for easier study. It also allows scientists to compare substances based on their properties.

11. Why is the study of the Moon important even today?

Answer: The Moon's phases helped humans develop calendars and understand time. Its movements continue to be useful in astronomy and scientific observation.

12. Why does the chapter connect scientific investigation with solving climate change?

Answer: Climate change can only be understood through careful observation, measurement, and experimentation. Scientific investigation also helps us develop solutions to environmental problems.

13. Why does the chapter encourage students to perform experiments in a kitchen?

Answer: A kitchen contains many everyday situations that can be investigated scientifically. This shows that science is not limited to laboratories but is present in daily life.

14. Why is evidence more important than personal opinion in science?

Answer: Scientific evidence can be observed, measured, and verified by others. Personal opinions may differ, but evidence leads to objective conclusions.

15. Why does the chapter state that science is always evolving?

Answer: New observations and experiments may improve or change existing explanations. Therefore, scientific knowledge continues to develop as new evidence becomes available.

16. Why should scientists measure results whenever possible instead of simply observing them?

Answer: Measurements provide precise and objective data that can be compared and analysed. Numerical data also makes scientific conclusions more reliable.

17. Why are ecosystems described as interconnected systems?

Answer: Every living organism depends on air, water, sunlight, and other living organisms for survival. A change in one part of an ecosystem can affect the entire system.

18. Why should scientific investigations begin with observations from everyday life?

Answer: Everyday events often raise meaningful scientific questions that can be investigated. Many important scientific discoveries have originated from careful observation of common phenomena.

19. Why does the chapter describe humans as both the problem and the solution to climate change?

Answer: Human activities contribute to climate change by altering Earth's environment. At the same time, humans can use science and responsible actions to reduce its harmful effects.

20. Why is systematic investigation considered the foundation of scientific research?

Answer: Systematic investigation follows a logical sequence of questioning, observing, experimenting, recording, and concluding. This organised approach produces dependable scientific knowledge.

1.9. Three-mark questions with Answers of LOTS Type: (15 Questions)

Three-Mark Descriptive Questions with Answers (LOTS – Lower Order Thinking Skills):

Instructions: Answer each question in **three sentences (or three points)**.

---

1. What is scientific investigation?

Answer:

1. Scientific investigation is the process of finding answers to scientific questions.
2. It involves careful observation, experimentation, and recording of evidence.
3. It helps us understand natural phenomena in a systematic way.

---

2. How does the Grade 8 Science textbook encourage students to think like scientists?

Answer:

1. It encourages students to ask focused scientific questions.
2. It motivates them to perform simple experiments and make careful observations.
3. It teaches them to explain their findings using evidence.

---

3. Explain the significance of the root and kite symbols used in the textbook.

Answer:

1. The root represents a strong foundation of knowledge and careful observation.

2. The kite represents curiosity, imagination, and creative thinking.
3. Together, they show that science requires both evidence and creativity.

---

4. State any three ways in which microorganisms are related to human life.

Answer:

1. Some microorganisms help us digest food.
2. Some are used in producing medicines.
3. Others cause infections and diseases.

---

5. Mention three uses or effects of electric current discussed in the chapter.

Answer:

1. The heating effect of electric current keeps us warm.
2. The magnetic effect helps motors run.
3. Electricity makes many machines function and improves our daily life.

---

6. Explain the relationship between force and pressure.

Answer:

1. Pressure is the distribution of force over an object.
2. Differences in pressure cause the movement of air.
3. Large pressure differences can produce strong winds and cyclones.

---

7. What does the chapter explain about matter and particles?

Answer:

1. Everything around us is made up of tiny particles.
2. Particles in solids are closely packed, while those in gases move freely.
3. The behaviour of particles helps explain the properties of materials.

---

8. How are materials classified according to the chapter?

Answer:

1. Materials are classified as elements, compounds, and mixtures.

2. Elements are pure substances.
3. Mixtures can be separated by physical methods.

---

9. What does the chapter explain about light and the Moon?

Answer:

1. Light reflects from mirrors as well as rough surfaces.
2. Light bends while passing through lenses.
3. The changing positions of the Earth, Moon, and Sun produce the phases of the Moon.

---

10. How were the first calendars developed?

Answer:

1. Early humans carefully observed the phases of the Moon.
2. They also observed the rising and setting of the Sun.
3. These regular observations helped them develop the first calendars.

---

11. Explain the importance of ecosystems.

Answer:

1. An ecosystem consists of living organisms and their environment.
2. Every organism depends on air, water, sunlight, and other organisms.
3. Ecosystems support and maintain life on Earth.

---

12. Why is Earth suitable for life?

Answer:

1. Earth is at the right distance from the Sun.
2. It has liquid water and an oxygen-rich atmosphere.
3. Its atmosphere protects living beings from harmful ultraviolet rays.

---

13. What does the chapter say about climate change?

Answer:

1. Human activities can increase Earth's temperature.

2. These changes disturb climate patterns.
3. Science helps us understand these changes and guide our actions.

---

14. How can a kitchen become a science laboratory?

Answer:

1. Many everyday activities in the kitchen can be scientifically investigated.
2. Students can observe, ask questions, and perform simple experiments.
3. Curiosity and careful observation are enough to begin scientific investigation.

---

15. Describe the steps suggested in the chapter for conducting a scientific experiment.

Answer:

1. Ask a scientific question and identify the variables that can be changed.
2. Observe or measure the results while changing only one variable at a time.
3. Record observations carefully and draw conclusions based on evidence.

1.10. Three-mark questions with Answers of HOTS Type: (15 Questions)

Three-Mark Descriptive Questions with Answers (HOTS – Higher Order Thinking Skills):

Instructions: Answer each question in **three sentences (or three points)**. These questions assess **application, analysis, reasoning, problem-solving, and scientific investigation skills** based on the uploaded chapter.

---

1. Why should a scientist change only one variable at a time during an experiment?

Answer:

1. Changing only one variable helps identify its exact effect on the result.
2. Keeping the remaining variables constant makes the experiment fair.
3. This method produces reliable and valid conclusions.

---

2. A student observes that one puri puffs up while another does not. How should the student investigate this scientifically?

Answer:

1. The student should identify the factors that may affect puffing, such as dough thickness or oil temperature.

2. Only one factor should be changed in each experiment while the others remain constant.
3. The observations should be recorded and compared before drawing conclusions.

---

3. Why is careful observation considered more valuable than guessing in scientific investigations?

Answer:

1. Careful observations provide evidence that can be verified.
2. Guesses may not be supported by facts or experiments.
3. Scientific conclusions should always be based on observed evidence.

---

4. How do the root and kite symbols together explain the nature of scientific thinking?

Answer:

1. The root represents careful observation and a strong foundation of knowledge.
2. The kite represents imagination and curiosity to explore new ideas.
3. Good scientific thinking requires both evidence and creativity working together.

---

5. Why does the chapter encourage students to ask questions about everyday events?

Answer:

1. Everyday events often hide interesting scientific principles.
2. Investigating common phenomena develops scientific thinking and observation skills.
3. Many important discoveries begin with simple questions from daily life.

---

6. How can understanding particles help explain the properties of materials?

Answer:

1. Different materials contain particles arranged in different ways.
2. The movement of particles determines the behaviour of solids, liquids, and gases.
3. Studying particles helps explain many physical and chemical phenomena.

---

7. Why should scientific investigations include measurements whenever possible?

Answer:

1. Measurements provide accurate and objective information.
2. Numerical data can be compared more easily than opinions.
3. This increases the reliability of scientific conclusions.

---

8. How does the chapter show that science is useful in solving environmental problems?

Answer:

1. Science helps us understand climate change through observation and investigation.
2. Scientific knowledge guides people in making informed environmental decisions.
3. Careful investigation can help protect Earth's ecosystems and climate.

---

9. Why is recording observations an important part of every scientific investigation?

Answer:

1. Written observations help compare different experimental results.
2. They reduce the chances of forgetting important details.
3. They also help generate new questions for further investigation.

---

10. Explain why science is described as a continuously evolving subject.

Answer:

1. Every scientific answer often leads to new questions.
2. New observations and experiments improve existing knowledge.
3. Therefore, scientific understanding develops continuously over time.

---

11. Why should students think of multiple possible causes before conducting an experiment?

Answer:

1. Considering different possibilities helps identify all relevant variables.
2. It allows the investigation to be planned more effectively.
3. It increases the chances of finding the correct explanation.

---

12. How does the chapter connect scientific investigation with responsible citizenship?

Answer:

1. It explains that humans influence Earth's climate through their activities.
2. It encourages the use of science to understand environmental changes.
3. It motivates students to apply scientific thinking to solve future global challenges.

---

13. Why can a kitchen be considered an ideal place for beginning scientific investigations?

Answer:

1. Everyday cooking activities involve observable scientific phenomena.
2. Students can ask questions and perform simple experiments safely.
3. This demonstrates that science is part of everyday life, not only laboratory work.

---

14. Why does the chapter state that the puffing of a puri is still scientifically interesting?

Answer:

1. It is an everyday phenomenon that raises meaningful scientific questions.
2. Scientists continue to investigate its complete explanation.
3. This shows that even familiar events can become subjects of scientific research.

---

15. Explain why systematic investigation is considered the foundation of scientific research.

Answer:

1. It follows an organised sequence of questioning, observing, experimenting, and analysing.
2. It ensures that conclusions are based on evidence rather than assumptions.
3. This approach makes scientific knowledge accurate, reliable, and repeatable.

1.11 Five-mark questions with Answers of LOTS Type: (5 Questions)

Five-Mark Descriptive Questions with Answers (LOTS – Lower Order Thinking Skills):

Instructions: Answer each question in **five sentences (or five points)**.

---

1. Explain how the Grade 8 Science textbook introduces students to the investigative world of science.

Answer:

1. The chapter encourages students to become young investigators instead of only learning scientific facts.
2. It explains that science begins with curiosity and asking meaningful questions.
3. Students are encouraged to observe carefully and perform simple experiments.
4. The chapter teaches that scientific understanding grows through evidence and investigation.
5. It motivates students to explore everyday phenomena using scientific thinking.

---

2. Explain the significance of the root and kite symbols used throughout the textbook.

Answer:

1. The root represents a strong foundation of knowledge and careful observation.
2. It reminds students to stay connected to nature, traditions, and scientific evidence.
3. The kite represents curiosity, imagination, and creative thinking.
4. Together, these symbols show that science requires both observation and creativity.
5. They encourage students to investigate the world with an open and logical mind.

---

3. Describe the different scientific topics introduced in this chapter.

Answer:

1. The chapter introduces microorganisms and their role in health and disease.
2. It explains electricity, forces, pressure, and their applications in daily life.
3. It discusses particles, matter, classification of materials, and the behaviour of light.
4. It also introduces the Moon, calendars, ecosystems, Earth, and climate change.
5. These topics show how science helps us understand both everyday life and the natural world.

---

4. Explain how the chapter suggests conducting a simple scientific investigation using the example of a puffing puri.

Answer:

1. The chapter begins with a scientific question about why one side of a puri is thinner than the other.
2. It suggests identifying the factors that can be changed, such as dough thickness, flour type, or oil temperature.

3. It recommends observing measurable results such as whether the puri puffs up and the time taken.
4. It advises changing only one variable at a time while keeping all other conditions constant.
5. Finally, it encourages recording observations and drawing conclusions from the evidence collected.

---

5. Explain the importance of systematic investigation in science.

Answer:

1. Systematic investigation begins with asking a scientific question.
2. It involves making careful observations and conducting controlled experiments.
3. Scientists record observations and measurements during the investigation.
4. Conclusions are drawn only after analysing the collected evidence.
5. This organised approach makes scientific knowledge reliable and helps answer new questions.

1.12 Five-mark questions with Answers of HOTS Type: (8 Questions)

Five-Mark Descriptive Questions with Answers (HOTS – Higher Order Thinking Skills):

Instructions: Answer each question in **five sentences (or five points)**. These questions assess **application, analysis, reasoning, investigation, evaluation, and problem-solving skills** based on the concepts presented in the chapter.

---

1. A student wants to find out whether the temperature of oil affects the puffing of a puri. How should the investigation be planned?

Answer:

1. The student should prepare puris of the same size and thickness.
2. Only the oil temperature should be changed while keeping all other conditions constant.
3. The student should observe whether the puri puffs and measure the time taken.
4. All observations should be recorded carefully for each trial.
5. The conclusion should be drawn only after comparing the recorded results.

---

2. Why is scientific investigation considered more reliable than guessing or personal opinion?

Answer:

1. Scientific investigation is based on careful observation and evidence.
2. It uses experiments to test ideas instead of making assumptions.
3. Results can be measured, recorded, and verified by others.
4. Conclusions are drawn only after analysing observations.
5. Therefore, scientific investigation produces dependable and objective knowledge.

---

3. Explain how curiosity and careful observation together help in making scientific discoveries.

Answer:

1. Curiosity encourages people to ask meaningful scientific questions.
2. Careful observation helps collect accurate evidence to answer those questions.
3. Experiments are then designed to test possible explanations.
4. New observations often generate further questions for investigation.
5. Thus, curiosity and observation together drive scientific progress.

---

4. Suppose two students obtain different results while performing the same experiment. What should they do before drawing conclusions?

Answer:

1. They should compare whether all experimental conditions were kept the same.
2. They should check if only one variable was changed during the investigation.
3. They should repeat the experiment carefully and record fresh observations.
4. They should compare all recorded measurements before interpreting the results.
5. Only after analysing the evidence should they arrive at a scientific conclusion.

---

5. Explain how scientific thinking can help solve environmental problems such as climate change.

Answer:

1. Scientific observation helps identify changes occurring in Earth's environment.
2. Measurements and experiments help scientists understand the causes of climate change.
3. Scientific evidence guides people in making informed environmental decisions.

4. Responsible use of science can help protect ecosystems and maintain ecological balance.
5. Therefore, scientific investigation is essential for solving present and future environmental challenges.

---

6. Why is the kitchen described as a good place to begin scientific investigations?

Answer:

1. Many everyday activities in the kitchen involve scientific phenomena.
2. Students can observe, ask questions, and conduct simple experiments safely.
3. Common events such as a puri puffing provide opportunities for investigation.
4. These activities help students apply scientific methods to real-life situations.
5. The chapter shows that science exists everywhere, not only in laboratories.

---

7. Explain why the chapter encourages students to continue asking questions even after completing an experiment.

Answer:

1. One experiment often raises new scientific questions.
2. New questions lead to additional observations and investigations.
3. This process helps improve existing knowledge continuously.
4. Scientific understanding grows through repeated inquiry and experimentation.
5. Therefore, science is an ongoing process of learning and discovery.

---

8. How do the root and kite symbols represent the qualities of a successful scientist?

Answer:

1. The root represents a strong foundation of knowledge and evidence.
2. The kite represents curiosity, imagination, and innovative thinking.
3. A successful scientist remains grounded in careful observation.
4. At the same time, the scientist explores new ideas creatively.
5. Balancing evidence with imagination leads to meaningful scientific discoveries.

1.13 Five-mark questions with Answers of Applied Type: (8 Questions)

Five-Mark Descriptive Questions with Answers (Applied Type):

Instructions: Answer each question in **five points (or five sentences)** by applying the scientific concepts learned in the chapter to real-life situations.

---

1. While making puris at home, you observe that some puris puff up completely while others do not. As a young scientist, how would you investigate this problem?

Answer:

1. I would identify variables such as dough thickness, flour type, oil temperature, and the way the dough is placed in the oil.
2. I would change only one variable at a time while keeping the others constant.
3. I would observe whether the puri puffs and measure the time taken.
4. I would record all observations carefully after each trial.
5. Finally, I would compare the results and draw conclusions based on the evidence collected.

---

2. Your school wants to investigate why some classrooms become hotter than others during summer. Describe how you would conduct the investigation.

Answer:

1. I would identify factors such as sunlight, ventilation, window direction, and classroom size.
2. I would measure the temperature in different classrooms at the same time each day.
3. I would change only one factor at a time, if possible, while keeping other conditions similar.
4. I would record all observations and compare the data collected.
5. Based on the evidence, I would identify the factor responsible for the temperature difference.

---

3. A farmer notices that the wind is becoming stronger before a storm. Using the concepts from the chapter, explain how science helps understand this situation.

Answer:

1. Changes in air pressure cause the movement of air.
2. A large pressure difference can produce strong winds.
3. Scientists observe and measure these pressure changes to predict storms.
4. Such investigations help people prepare for severe weather conditions.

5. Scientific knowledge improves public safety and disaster preparedness.

---

4. Your class wants to reduce pollution in your neighbourhood. How can the scientific method help achieve this goal?

Answer:

1. Students should first observe and identify the major sources of pollution.
2. They should collect data through measurements and surveys.
3. Possible solutions should be tested on a small scale and their effectiveness observed.
4. The results should be recorded and compared before selecting the best solution.
5. Evidence-based actions can then be implemented to reduce pollution effectively.

---

5. A student says that science is useful only inside laboratories. Using ideas from the chapter, explain why this statement is incorrect.

Answer:

1. Science can be observed in everyday activities such as cooking in the kitchen.
2. Simple questions about daily life can lead to meaningful investigations.
3. Careful observation and experiments do not always require expensive laboratory equipment.
4. Scientific thinking helps explain common events occurring around us.
5. Therefore, science is a part of everyday life and not limited to laboratories.

---

6. Suppose your friend believes that one experiment is enough to prove a scientific fact. How would you convince your friend otherwise?

Answer:

1. I would explain that one experiment may produce accidental or unusual results.
2. Scientific experiments should be repeated to confirm consistency.
3. Observations should be recorded carefully every time.
4. Conclusions should be based on repeated evidence rather than a single observation.
5. This makes scientific knowledge more accurate and reliable.

---

7. Your family wants to know why corrective glasses improve vision. How would you explain it using concepts from the chapter?

Answer:

1. Light bends when it passes through lenses.
2. Corrective glasses use specially designed lenses to bend light properly.
3. This helps light focus correctly on the eye.
4. As a result, blurred vision becomes clearer.
5. This is an application of the scientific study of light.

---

8. A group of students wants to protect a nearby pond ecosystem. Explain how the investigative approach described in the chapter can help them.

Answer:

1. Students should first observe the plants, animals, and water conditions in the pond.
2. They should identify possible causes of pollution or environmental damage.
3. Measurements and observations should be recorded systematically over time.
4. They should suggest solutions based on scientific evidence.
5. Continuous investigation will help conserve the ecosystem and maintain its balance.

1.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

Science Olympiad–Type Multiple Choice Questions (MCQs):

Instructions: Choose the most appropriate answer. These questions are designed in the style of **Science Olympiad Foundation (SOF), NSTSE, NSO, and other competitive examinations**, emphasizing conceptual understanding, logical reasoning, and application. Based on the uploaded chapter.

---

1. The primary objective of scientific investigation is to:

A. Memorize scientific facts
B. Win science competitions
C. Discover answers using observation and evidence
D. Read more textbooks

Answer: ✅ C

---

2. Which pair of symbols in the textbook represents scientific thinking?

A. Sun and Moon
B. Tree and Bird
C. Root and Kite
D. Earth and Globe

Answer: ✅ C

---

3. The root symbol mainly represents:

A. Imagination
B. Deep foundation of knowledge
C. Air pressure
D. Electricity

Answer: ✅ B

---

4. The kite symbol mainly encourages students to:

A. Fly kites
B. Remember facts
C. Develop curiosity and creative thinking
D. Measure temperature

Answer: ✅ C

---

5. According to the chapter, investigation in science begins with:

A. Writing conclusions
B. Asking meaningful questions
C. Buying laboratory equipment
D. Reading reference books

Answer: ✅ B

---

6. Which of the following is an example of a beneficial microorganism?

A. One that causes infection
B. One that digests food in our body
C. One that spoils food
D. One that damages crops

Answer: ✅ B

---

7. Vaccines help humans mainly by:

A. Increasing body temperature
B. Fighting infections
C. Producing electricity
D. Increasing blood pressure

Answer: ✅ B

---

8. Which effect of electric current helps motors work?

A. Chemical effect
B. Heating effect
C. Magnetic effect
D. Cooling effect

Answer: ✅ C

---

9. Pressure is defined as:

A. Speed of an object
B. Distribution of force over an object
C. Amount of electricity
D. Rate of evaporation

Answer: ✅ B

---

10. A large difference in air pressure may result in:

A. Rainbow formation
B. Gentle breeze only
C. Strong winds and cyclones
D. Earthquakes

Answer: ✅ C

---

11. Which statement about particles is correct?

A. Solids have no particles.
B. Gas particles move more freely than solid particles.
C. Solid particles move faster than gas particles.
D. Liquids have no particles.

Answer: ✅ B

---

12. Which of the following is classified as a pure substance?

A. Mixture
B. Solution
C. Element
D. Suspension

Answer: ✅ C

---

13. Sugar dissolving in tea is an example of:

A. Reflection
B. Solution formation
C. Condensation
D. Magnetism

Answer: ✅ B

---

14. Corrective glasses work because:

A. Light is absorbed completely.
B. Light bends while passing through lenses.
C. Mirrors produce electricity.
D. Glass emits light.

Answer: ✅ B

---

15. Which celestial object reflects sunlight?

A. Moon
B. Earth
C. Mars only
D. Stars

Answer: ✅ A

---

16. Early calendars were developed mainly by observing:

A. Volcanoes
B. Ocean tides
C. Sunrises, sunsets, and Moon's phases
D. Clouds

Answer: ✅ C

---

17. An ecosystem includes:

A. Only plants
B. Only animals
C. Living organisms and their environment
D. Only microorganisms

Answer: ✅ C

---

18. Earth supports life mainly because it:

A. Is the largest planet
B. Has rings around it
C. Is at the right distance from the Sun and has an atmosphere
D. Has the strongest gravity

Answer: ✅ C

---

19. According to the chapter, climate change is mainly influenced by:

A. Human activities
B. Moonlight
C. Wind direction only
D. Earth's rotation alone

Answer: ✅ A

---

20. Which place does the chapter identify as a good location for simple scientific investigations?

A. Only a research laboratory
B. Kitchen at home
C. Airport
D. Observatory

Answer: ✅ B

---

21. In an experiment, changing only one factor at a time helps to:

A. Finish quickly
B. Increase cost
C. Identify the effect of that factor accurately
D. Avoid observations

Answer: ✅ C

---

22. Which of the following is a controlled variable while testing the effect of oil temperature on a puri?

A. Oil temperature
B. Thickness of the dough

C. Time taken to puff
D. Whether the puri puffs

Answer: ✅ B

---

23. Which of the following is a measurable observation?

A. Oil looks nice.
B. Puri tastes good.
C. Time taken for the puri to puff.
D. The kitchen feels warm.

Answer: ✅ C

---

24. Why should observations be recorded during experiments?

A. To decorate notebooks
B. To compare results and draw valid conclusions
C. To increase homework
D. To avoid experiments

Answer: ✅ B

---

25. Which statement best describes systematic investigation?

A. Guessing the answer immediately
B. Repeating textbook definitions
C. Asking questions, experimenting, observing, recording, and concluding
D. Performing experiments without recording results

Answer: ✅ C

---

26. According to the chapter, even the puffing of a puri is:

A. Completely understood by scientists
B. A solved mathematical problem
C. Not yet completely understood scientifically
D. Impossible to investigate

Answer: ✅ C

---

27. Which quality is NOT associated with a good scientific investigator?

A. Curiosity
B. Careful observation

C. Creative thinking
D. Blind assumptions

Answer: ✅ D

---

28. If a student changes both the oil temperature and dough thickness simultaneously, the experiment becomes unreliable because:

A. Two variables are changed together.
B. The oil becomes cold.
C. The puri becomes heavier.
D. The flour changes colour.

Answer: ✅ A

---

29. Which of the following best reflects the message of the chapter?

A. Science is limited to laboratories.
B. Science is only about memorising facts.
C. Science is a continuous process of questioning and investigation.
D. Science ends when one experiment is completed.

Answer: ✅ C

---

30. Which sequence correctly represents the scientific method suggested in the chapter?

A. Conclusion → Experiment → Question → Observation
B. Observation → Question → Experiment → Record → Conclusion
C. Experiment → Conclusion → Observation
D. Record → Question → Guess

Answer: ✅ B

These questions are aligned with the concepts and investigative approach presented in Chapter 1, including curiosity, scientific inquiry, experimentation, variables, observations, ecosystems, particles, forces, light, and climate awareness.

1.15 Best Practices Opportunity List from the Chapter: (10 Ideas)

Best Practices for Teaching Chapter 1: ***Exploring the Investigative World of Science:***

The chapter emphasizes **curiosity, observation, scientific inquiry, experimentation, and evidence-based thinking** rather than memorization. Therefore, classroom teaching should be highly **activity-oriented, inquiry-based, and experiential**.

1. "Question of the Day" (Curiosity Corner)

Activity

- Begin every class with one interesting question similar to those given in the chapter.
- Examples:
  - Why does a puri puff up?
  - Why do ice cubes float on water?
  - Why is the sky blue?
  - Why do leaves have different shapes?
- Allow students 3–5 minutes to discuss possible answers before teaching.

Learning Outcome

- Develops curiosity and scientific questioning.
- Encourages students to think independently rather than memorize facts.

Best Practice: Maintain a **"Curiosity Wall"** where students write one scientific question every week.

---

2. Kitchen Science Investigation

Activity

Conduct simple investigations using household materials.

Examples:

- Observe why a puri or chapati puffs.
- Compare sugar dissolving in hot and cold water.
- Observe steam formation while boiling water.
- Compare different types of flour.

Students should record:

- Question
- Variables changed
- Observations
- Conclusion

Learning Outcome

- Introduces students to controlled experiments.
- Connects science with daily life.

Best Practice: Ask students to maintain a **Kitchen Science Journal** with one home experiment every month.

---

3. "Think Like a Scientist" Observation Diary

Activity

Provide every student with a small notebook.

Students record:

- One interesting observation every day.
- One question arising from that observation.
- Their possible explanation.

Examples:

- Rainbow after rain
- Rusting of iron
- Growth of plants
- Shadows during different times

Learning Outcome

- Develops observation skills.
- Encourages scientific reasoning.

Best Practice: Dedicate five minutes each week for students to share their best observations.

---

4. Classroom Mini-Laboratory (No Expensive Equipment Required)

Activity

Create an "Investigation Corner" using simple materials:

- Magnifying glass
- Magnet
- Torch
- Mirror
- Thermometer
- Measuring tape
- Stopwatch
- Water
- Balloons

Students investigate:

- Reflection
- Shadows
- Air pressure
- Temperature
- Motion

Learning Outcome

- Promotes hands-on learning.
- Reinforces the idea that science can be explored anywhere.

Best Practice: Assign different student groups to manage the Investigation Corner each week.

---

5. Scientific Method Role Play

Activity

Divide the class into groups.

Each group performs roles such as:

- Observer
- Questioner
- Experimenter
- Recorder
- Presenter

Example problem:
"Why does one balloon burst before another?"

Students:

- Form hypotheses.
- Plan experiments.
- Record observations.
- Present conclusions.

Learning Outcome

- Reinforces systematic investigation.
- Develops teamwork and scientific communication.

Best Practice: Rotate roles so every student experiences each stage of scientific inquiry.

---

6. "Science Around Us" Photo Collection

Activity

Ask students to click or draw photographs of scientific phenomena such as:

- Reflection in water
- Rainbow
- Cloud formation
- Electric appliances
- Plants
- Moon phases
- Windmills

Students explain the science behind each photograph.

Learning Outcome

- Connects textbook concepts with the real world.
- Improves observation and explanation skills.

---

7. Moon Observation Project

Activity

Students observe the Moon every evening for one month.

Record:

- Date
- Shape of the Moon
- Time observed
- Sketch

Finally, compare observations with the lunar phases discussed in the chapter.

Learning Outcome

- Develops long-term observation skills.
- Demonstrates how scientific knowledge is built through repeated observations.

Best Practice: Display students' Moon journals on a classroom science board.

8. Environmental Investigation Walk

Activity

Conduct a school campus or neighbourhood nature walk.

Students identify:

- Living organisms
- Non-living components
- Food chains
- Sources of pollution
- Human impact on the environment

Learning Outcome

- Helps students understand ecosystems.
- Builds environmental awareness and responsibility.

Best Practice: Students prepare a simple "School Ecosystem Report" with photographs or drawings.

9. "One Variable Challenge"

Activity

Present simple investigation scenarios such as:

- Paper airplane flight
- Seed germination
- Melting ice
- Dissolving sugar

Ask students to identify:

- Independent variable
- Dependent variable
- Controlled variables

Learning Outcome

- Strengthens understanding of fair testing.
- Develops analytical and experimental design skills.

Best Practice: Conduct this activity before introducing formal experiments.

10. Student Science Exhibition – "Everyday Science"

Activity

Organize a classroom exhibition where students demonstrate everyday scientific phenomena, such as:

- Why objects float or sink
- Air occupies space
- Reflection using mirrors
- Density experiments
- Simple weather observations
- Homemade periscope

Learning Outcome

- Enhances confidence and communication.
- Encourages inquiry-based learning and peer teaching.

Best Practice: Assess projects on **scientific question, investigation, observation, evidence, creativity, and presentation**, rather than on the correctness of the result alone.

Expected Learning Outcomes of These Best Practices

By adopting these classroom practices, students will be able to:

- Develop curiosity and ask meaningful scientific questions.
- Observe natural phenomena systematically.
- Plan and conduct simple investigations.
- Identify variables and perform fair experiments.
- Record and analyse observations objectively.
- Apply scientific concepts to everyday life.
- Build critical thinking and problem-solving skills.
- Foster environmental awareness and responsible citizenship.

These practices closely align with the chapter's central message that **science is learned by questioning, observing, experimenting, and investigating the world around us**, rather than by memorizing facts alone.

1.16 Innovations Opportunity List from the Chapter: (12 Ideas)

The chapter emphasizes **curiosity, observation, questioning, experimentation, and systematic investigation**. Therefore, innovative classroom practices should transform students from passive learners into **young investigators and problem-solvers**.

---

1. "Become a Young Scientist" Investigation Challenge

Innovation

Instead of beginning with definitions, present an everyday mystery such as:

- Why does a puri puff up?
- Why do wet clothes dry faster in sunlight?
- Why do balloons burst?

Students work in small groups following the **scientific investigation cycle**:

- Observe
- Ask Questions
- Predict
- Experiment
- Record
- Present Findings

Innovation Outcome

- Inquiry-based learning
- Scientific temperament
- Problem-solving skills
- Communication skills

21st Century Skills: Critical Thinking + Collaboration + Creativity

---

2. QR Code "Science Hunt"

Innovation

Paste QR codes around the classroom.

Each QR code links to:

- A short experiment video
- A scientific phenomenon
- An observation challenge

- A puzzle
- A microscope image
- A weather animation

Students scan the QR code and complete a small investigation.

Example:

"Why do mirrors reflect light but black paper does not?"

Innovation Outcome

- Blended Learning
- Digital Literacy
- Active Learning

---

3. AI-powered "Ask a Scientist"

Innovation

Students ask an AI assistant questions such as:

- Why does dough rise?
- Why is one side of a puri thinner?
- Why is the Moon changing shape?
- Why does sugar dissolve?

Students then compare the AI explanation with the textbook explanation and identify:

- Similarities
- New ideas
- Scientific evidence

Innovation Outcome

- AI Literacy
- Information Evaluation
- Scientific Reasoning

Note: The teacher guides students to verify AI-generated information with textbook concepts.

---

4. Classroom Citizen Science Project

Innovation

Students become citizen scientists.

Each student investigates one real-world problem.

Examples:

- Daily temperature
- Rainfall
- Types of insects
- Bird species
- Plastic waste
- Plant diversity

Students collect data for two weeks.

Finally,

- Prepare graphs
- Draw conclusions
- Present findings.

Innovation Outcome

Students realise that science is based on data collected from the real world.

---

5. "Science Detective" Escape Room

Innovation

Create a classroom escape game.

Students receive clues.

Example clues:

✓ A balloon

✓ Mirror

✓ Magnet

✓ Thermometer

✓ Flashlight

Each clue requires students to solve one scientific puzzle before moving to the next.

Example:

"Find which object demonstrates reflection."

Correct answer unlocks the next clue.

Innovation Outcome

Gamification increases motivation and curiosity.

---

6. Augmented Reality (AR) Science Experience

Innovation

Use free AR applications to visualize:

- Moon phases
- Human eye
- Microorganisms
- Ecosystems
- Weather systems

Students rotate 3D objects instead of looking only at textbook pictures.

Innovation Outcome

- Better conceptual understanding
- Improved spatial visualization
- Increased classroom engagement

The chapter introduces concepts such as particles, light, the Moon, ecosystems, and climate, making AR particularly effective.

---

7. "Curiosity Podcast"

Innovation

Each week one student records a **2-minute science podcast**.

Topic examples:

- Why does tea become sweet?
- Why does the Moon change shape?
- Why do storms occur?
- What is pressure?

Other students listen and ask questions.

Innovation Outcome

- Improves communication

- Enhances scientific explanation
- Builds confidence

---

8. Home Science Innovation Challenge

Innovation

Students perform one safe home investigation every week.

Examples:

- Reflection using a spoon
- Melting ice
- Floating objects
- Shadow length
- Germination

Students upload:

- Photos
- Short videos
- Observations

Innovation Outcome

Transforms home into a learning laboratory.

This reflects the chapter's message that **science is everywhere and even a kitchen can become a place for investigation.**

---

9. Design Your Own Investigation

Innovation

Instead of giving experiments,

Teacher asks:

"Design an experiment to answer your own scientific question."

Students prepare:

- Scientific Question
- Hypothesis
- Variables
- Materials

- Procedure
- Expected Observation

Teacher evaluates the **design**, not only the answer.

Innovation Outcome

- Inquiry learning
- Research skills
- Experimental design

---

10. Digital Science Portfolio (e-Portfolio)

Innovation

Each student creates a digital portfolio using presentation software or an online classroom platform.

Portfolio sections include:

- My Scientific Questions
- Weekly Observations
- Home Experiments
- Photos
- Reflection Journal
- My Best Discovery

Innovation Outcome

Students document their learning journey instead of only submitting written assignments.

---

11. "Innovation Fair – Everyday Science"

Innovation

At the end of the chapter, organise a mini exhibition where groups demonstrate the science behind everyday phenomena such as:

- Puffed puri
- Dissolving sugar
- Reflection from mirrors
- Air pressure using balloons
- Moon phase models

- Ecosystem models

Visitors (teachers, parents, and students) ask questions, and presenters explain the scientific principles.

Innovation Outcome

- Experiential learning
- Scientific communication
- Confidence building
- Peer learning

---

12. Innovation through Reflection Journal

Innovation

Every Friday students answer three questions:

1. What surprised me this week?
2. What scientific question do I still have?
3. What experiment would I like to perform next?

Innovation Outcome

Encourages lifelong curiosity and reflective thinking, which are central themes of the chapter.

Expected Outcomes of These Innovations

By integrating these innovative strategies, Grade 8 students will:

- Develop curiosity-driven learning habits.
- Think and work like young scientists.
- Design and conduct simple investigations.
- Apply scientific concepts to everyday life.
- Improve collaboration, creativity, communication, and critical thinking.
- Build digital, AI, and scientific literacy.
- Strengthen observation, data collection, and evidence-based reasoning.
- Foster environmental awareness and responsible citizenship.

These innovations closely align with the chapter's vision of helping students **learn how to discover scientific knowledge through questioning, observing, experimenting, and investigating**, rather than simply memorizing facts.

1.17: Practicing Questions/Question Bank

Below is a **comprehensive Question Bank Blueprint** for **Chapter 1 – *Exploring the Investigative World of Science*** (Grade 8 Science). The questions are balanced across **LOTS, HOTS, Applied, Competency-Based, and Inquiry-Based** learning outcomes, in alignment with the themes of curiosity, observation, experimentation, and systematic investigation emphasized in the chapter.

A. Fill-in-the-Blank Questions (20 Questions)"

LOTS:

1. Science begins with __________.
2. Grade 8 introduces students to the __________ World of Science.
3. The root symbol represents a strong foundation of __________.
4. The kite symbol represents __________ and imagination.
5. Investigation begins with asking __________ questions.
6. Beneficial microorganisms help us digest __________.
7. Harmful microorganisms may cause __________.
8. The heating effect of electric current keeps us __________.
9. The magnetic effect of electric current helps __________ run.
10. Everything around us is made up of tiny __________.

HOTS / Applied:

11. During an experiment, only one __________ should be changed at a time.
12. Scientific conclusions should always be based on __________.
13. A kitchen can become a __________ laboratory.
14. Scientists record __________ to analyse experimental results.
15. The Moon reflects __________ from the Sun.
16. Ecosystems depend on interactions between living organisms and their __________.
17. Human activities can influence Earth's __________.
18. Measuring the time taken for a puri to puff provides __________ evidence.
19. Repeating an experiment improves the __________ of the results.
20. Scientific investigation combines curiosity with careful __________.

B. One-Mark Descriptive Questions (25 Questions):

1. What is scientific investigation?
2. What is the first step in scientific investigation?

3. What does the root symbol represent?
4. What does the kite symbolize?
5. Why does science begin with curiosity?
6. Define microorganisms.
7. Name one beneficial microorganism activity.
8. Name one harmful effect of microorganisms.
9. What is the heating effect of electric current?
10. What is the magnetic effect of electric current?
11. Define pressure.
12. Why does a ball thrown upward fall back?
13. What are particles?
14. What is an element?
15. What is a mixture?
16. What is a solution?
17. Why do corrective glasses work?
18. What causes the phases of the Moon?
19. What is an ecosystem?
20. Why is Earth suitable for life?
21. What causes climate change according to the chapter?
22. Why should observations be recorded?
23. Why should only one variable be changed during an experiment?
24. What is meant by systematic investigation?
25. Why is the puffing of a puri scientifically interesting?

C. Two-Mark Descriptive Questions (20 Questions):

1. Explain scientific investigation.
2. Why does science begin with curiosity?
3. Explain the significance of the root and kite symbols.
4. State two benefits of microorganisms.
5. Explain two effects of electric current.
6. Explain the relationship between force and pressure.
7. Differentiate between elements and mixtures.

8. Explain how particles behave in solids and gases.
9. Why do rough surfaces reflect light?
10. Explain how the Moon helped humans develop calendars.
11. Explain the importance of ecosystems.
12. Why is Earth called the "right planet" for life?
13. Explain two causes of climate change.
14. Why is a kitchen considered a science laboratory?
15. Explain independent and controlled variables with an example.
16. Why should experiments be repeated?
17. Explain the importance of recording observations.
18. Why should scientific conclusions be evidence-based?
19. Explain how science helps solve environmental problems.
20. Explain why science is a continuously evolving subject.

D. Three-Mark Descriptive Questions (15 Questions):

1. Describe the process of scientific investigation.
2. Explain how Grade 8 Science differs from Grades 6 and 7.
3. Describe the scientific topics introduced in this chapter.
4. Explain the importance of microorganisms in daily life.
5. Explain the effects of force and pressure with examples.
6. Describe the particle nature of matter.
7. Explain the classification of materials.
8. Explain reflection and refraction with examples.
9. Describe the formation of the Moon's phases.
10. Explain the importance of ecosystems.
11. Explain the role of science in protecting the environment.
12. Describe the scientific method using the puri investigation.
13. Explain the importance of controlling variables.
14. Describe the role of observation in scientific investigations.
15. Explain why science is everywhere.

E. Five-Mark Descriptive Questions (10 Questions):

LOTS:

1. Explain the investigative approach introduced in Grade 8 Science.
2. Describe the significance of the root and kite symbols.
3. Explain the major scientific themes introduced in this chapter.
4. Describe the steps involved in conducting a scientific investigation.
5. Explain the importance of systematic investigation.

HOTS / Applied:

6. Design an investigation to find out why one puri puffs more than another.
7. Explain how scientific investigation helps solve real-life environmental problems.
8. Describe how careful observation and experimentation work together in scientific discovery.
9. A student obtains different results from repeated experiments. Explain how the student should analyse the situation scientifically.
10. Explain how scientific thinking can be applied in everyday life outside the classroom.

F. Competency-Based Questions (Suggested):

1. Identify the independent, dependent, and controlled variables in a simple experiment.
2. Analyse an observation table and draw conclusions.
3. Design a fair experiment using household materials.
4. Interpret a simple investigation diagram.
5. Predict the outcome when one variable changes.
6. Compare two experimental procedures and identify the better one.
7. Suggest improvements for an incomplete investigation.
8. Draw a flowchart of the scientific method.

G. Higher Order Thinking (HOTS) Questions:

1. Why is curiosity alone insufficient for scientific investigation?
2. Why should evidence be preferred over opinions?
3. How can a kitchen become a scientific laboratory?
4. Why do scientists repeat experiments?
5. Explain how climate change demonstrates the importance of scientific investigation.
6. Why is the Moon still important in modern science?
7. How do observations lead to new scientific questions?

8. Explain how one experiment can generate several new investigations.
9. Why should measurements accompany observations whenever possible?
10. Explain why science is considered a never-ending process.

H. Olympiad / Competitive Thinking Questions:

1. Assertion–Reason questions.
2. Match the Following.
3. Case-based MCQs.
4. Data Interpretation questions.
5. Observation-based questions using pictures.
6. Experimental-design questions.
7. Identify the incorrect statement.
8. Predict-the-outcome questions.
9. Multi-concept MCQs.
10. Scientific reasoning questions.

Suggested Distribution for a Comprehensive Question Bank:

Question Type	Suggested Number
Fill in the Blanks	20
One-Mark Questions	25
Two-Mark Questions	20
Three-Mark Questions	15
Five-Mark Questions	10
MCQs (LOTS + HOTS + Olympiad)	30
Competency-Based Questions	8
Applied Questions	10
Case-Based Questions	5
Assertion–Reason Questions	10

This structure provides a well-balanced question bank that covers **knowledge, understanding, application, analysis, investigation, scientific reasoning, and competency-based assessment**, while remaining closely aligned with the chapter's emphasis on **curiosity, observation, experimentation, and systematic investigation**.

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8th Standard Science Book Chapter 2

Chapter 2: The Invisible Living World: Beyond Our Naked Eye

2.1 Summary of the Chapter:

Chapter 2: ***The Invisible Living World: Beyond Our Naked Eye*** **— Summary**

(1) **The microscope opened the invisible world:** Many tiny living organisms cannot be seen with the naked eye. The development of lenses and microscopes enabled scientists to observe cells and microorganisms. Robert Hooke first used the term **"cell"** after observing cork, while Antonie van Leeuwenhoek observed microorganisms such as bacteria.

(2) **Cell is the basic unit of life:** All living organisms are made up of **cells**. A typical cell has three basic parts—**cell membrane, cytoplasm and nucleus**. The cell membrane controls the movement of substances, cytoplasm is where many life processes occur, and the nucleus regulates cellular activities and growth.

(3) **Plant and animal cells have differences:** Plant cells have a **cell wall** that provides rigidity and strength. They may also contain **chloroplasts** for photosynthesis and a large **vacuole** for storage and maintaining cell shape. Animal cells generally lack a cell wall and chloroplasts, and their vacuoles, when present, are usually small.

(4) **Cells vary according to their functions:** Cells differ in shape, size and structure depending on the work they perform. For example, **nerve cells** are long and branched to transmit messages, while **muscle cells** are spindle-shaped and suited for contraction and relaxation.

(5) **Living bodies have different levels of organisation:** In multicellular organisms, similar cells form **tissues**, tissues form **organs**, organs combine into **organ systems**, and organ systems together form an **organism**. Thus, the sequence is **Cell → Tissue → Organ → Organ System → Organism**.

(6) **Microorganisms are tiny living organisms:** Organisms too small to be seen with the naked eye are called **microorganisms or microbes**. They occur in water, soil, air and even inside our bodies. Major groups discussed include **bacteria, protozoa, fungi and some algae**. They may be unicellular or multicellular.

(7) **Microorganisms are diverse:** Examples include **Amoeba and Paramecium** among protozoa, different forms of **algae, fungi and bacteria**. Viruses are different because they are **acellular** and multiply only after entering a living cell.

(8) **Microbes are important environmental cleaners:** Bacteria and fungi act as **decomposers**, breaking down dead plants, animals and organic waste into simpler substances. This process returns nutrients to the soil, produces manure and helps keep the environment clean. Some microorganisms can also help produce **biogas** from plant and animal waste.

(9) **Microorganisms are useful in food production and agriculture: Yeast** releases carbon dioxide during fermentation, making bread and cakes soft and fluffy. **Lactobacillus** helps convert milk into curd and is involved in food fermentation. **Rhizobium** bacteria living in the root nodules of legumes trap atmospheric nitrogen and improve soil fertility.

(10) **Microalgae are valuable to life and the environment:** Microalgae make food through photosynthesis, release oxygen, support aquatic food chains and can help clean water. Some, such as **Spirulina and Chlorella**, are also used by humans, while microalgae can contribute to biofuel production. The chapter therefore highlights how the microscopic world is closely connected with **food, agriculture, environmental health and life itself**.

2.2 Important Formulas:

The following formulas and quantitative relationships are useful for solving numerical/application questions that can be framed from the chapter.

Important Formulas / Quantitative Relationships

No.	Concept	Formula / Relationship	Use
1	**Magnification**	**Magnification = Image size ÷ Actual size**	Finding how many times an organism/cell appears enlarged
2	**Image size**	**Image size = Actual size × Magnification**	Finding the apparent size under a microscope
3	**Actual size**	**Actual size = Image size ÷ Magnification**	Finding the real size of a microscopic object
4	**Percentage**	**Percentage = (Part ÷ Total) × 100**	Problems involving composition, observations, nutrients, etc.
5	**Percentage of a quantity**	**Amount = (Percentage ÷ 100) × Total amount**	Especially useful for the Spirulina example
6	**Percentage increase**	**% Increase = [(Final value − Initial value) ÷ Initial value] × 100**	Comparing increase in dough volume during fermentation
7	**Percentage decrease**	**% Decrease = [(Initial value − Final value) ÷ Initial value] × 100**	Possible decomposition/experimental problems
8	**Rate of change**	**Rate = Change in quantity ÷ Time taken**	Growth, fermentation or decomposition observations
9	**Unit conversion – length**	**1 cm = 10 mm; 1 mm = 1000 µm; 1 µm = 1000 nm**	Comparing sizes of cells and microorganisms
10	**Repeated cell division**	**Number of cells = 2^n**	If one cell divides into two in every round, after *n* divisions

1. Microscope Magnification — Most Important

The chapter repeatedly discusses magnification. Robert Hooke's microscope enlarged objects about **200–300 times**, ordinary microscopes mentioned in the chapter magnify microbes about **100–400 times**, while an electron microscope can magnify a cell about **10,00,000 times**.

$$\boxed{\text{Magnification} = \frac{\text{Size of image}}{\text{Actual size of object}}}$$

Therefore,

$$\boxed{\text{Image size} = \text{Actual size} \times \text{Magnification}}$$

and

$$\boxed{\text{Actual size} = \frac{\text{Image size}}{\text{Magnification}}}$$

Example: If a microorganism is actually 0.02 mm long and is viewed at 400×:

$$0.02 \times 400 = 8 \text{ mm}$$

So its image would appear **8 mm long**.

2. Length and Microscopic Unit Conversions

These conversions are useful when comparing cells and microorganisms:

$$\boxed{1\ \text{cm} = 10\ \text{mm}}$$
$$\boxed{1\ \text{mm} = 1000\ \mu\text{m}}$$
$$\boxed{1\ \mu\text{m} = 1000\ \text{nm}}$$

Therefore,

$$\boxed{1\ \text{mm} = 10^6\ \text{nm}}$$

The chapter, for example, states that the yolk of an ostrich egg is a single cell measuring approximately **130–170 mm in diameter**.

3. Percentage

$$\boxed{\text{Percentage} = \frac{\text{Part}}{\text{Total}} \times 100}$$

Conversely,

$$\boxed{\text{Part} = \frac{\text{Percentage}}{100} \times \text{Total}}$$

This is particularly relevant to **Spirulina**, which the chapter states contains **more than 60% protein by body weight**.

Example: If 50 g of Spirulina contains 60% protein:

$$\text{Protein} = \frac{60}{100} \times 50 = 30\ \text{g}$$

4. Percentage Increase in Volume

The chapter's yeast experiment asks students to observe changes in the **volume of dough** after fermentation.

For numerical questions:

$$\boxed{\%\ \text{Increase} = \frac{\text{Final Volume} - \text{Initial Volume}}{\text{Initial Volume}} \times 100}$$

For example, if dough increases from 400 mL to 600 mL:

$$\frac{600 - 400}{400} \times 100 = \boxed{50\%}$$

5. Percentage Decrease

For decomposition or experimental observations:

$$\boxed{\%\ \text{Decrease} = \frac{\text{Initial Quantity} - \text{Final Quantity}}{\text{Initial Quantity}} \times 100}$$

6. Rate of Change

For questions involving microbial growth, fermentation or decomposition over time:

$$\boxed{\text{Rate of change} = \frac{\text{Final quantity} - \text{Initial quantity}}{\text{Time taken}}}$$

The chapter uses several time-based observations—for example, the yeast dough experiment is observed after **4–5 hours**.

7. Repeated Cell Division

The chapter explains that the life of a complex multicellular organism begins with a single egg cell, which divides repeatedly to produce many cells.

If each cell divides into **two cells**, a useful mathematical relationship is:

$$\boxed{N = 2^n}$$

where

N = number of cells

n = number of rounds of division.

Thus:

1 → 2 → 4 → 8 → 16 → 32 ...

For example, after 6 rounds:

$$2^6 = \boxed{64 \text{ cells}}$$

Note: This formula is **not explicitly given in the textbook**; it is a useful extension for constructing quantitative problems from the chapter.

Most important formulas for Grade 8 examination preparation

Students should particularly remember:

$$\boxed{\text{Magnification} = \frac{\text{Image size}}{\text{Actual size}}}$$

$$\boxed{\text{Actual size} = \frac{\text{Image size}}{\text{Magnification}}}$$

$$\boxed{\text{Percentage} = \frac{\text{Part}}{\text{Total}} \times 100}$$

$$\boxed{\%\ \text{Increase} = \frac{\text{Increase}}{\text{Original value}} \times 100}$$

$$\boxed{\text{Rate} = \frac{\text{Change in quantity}}{\text{Time}}}$$

and the conversions **1 mm = 1000 µm** and **1 µm = 1000 nm**.

Important distinction: the chapter itself does not present most of these as prescribed formulas. They are the **mathematical relationships most suitable for creating and solving competency-based quantitative questions from the concepts and numerical information given in Chapter 2**.

2.3 Fill-Up the Blank LOTS type questions with Answers: (40 Questions)

1. The basic unit of life is the __________.
   Answer: Cell
2. Robert Hooke published his famous book *Micrographia* in the year __________.
   Answer: 1665
3. Robert Hooke observed small compartments in a thin slice of __________.
   Answer: Cork
4. Antonie van Leeuwenhoek is known as the Father of __________.
   Answer: Microbiology
5. The three basic parts of a cell are cell membrane, cytoplasm and __________.
   Answer: Nucleus
6. The outer covering of an animal cell is called the __________.
   Answer: Cell membrane
7. The space between the cell membrane and nucleus is filled with __________.
   Answer: Cytoplasm
8. Most of the life processes of a cell take place in the __________.
   Answer: Cytoplasm
9. The __________ regulates the activities and growth of a cell.
   Answer: Nucleus
10. Plant cells have an additional outer covering called the __________.
    Answer: Cell wall
11. Chloroplasts contain the green pigment called __________.
    Answer: Chlorophyll
12. The large empty-looking space found in a plant cell is called the __________.
    Answer: Vacuole

13. A human muscle cell is generally __________-shaped.
    Answer: Spindle
14. Nerve cells are also known as __________.
    Answer: Neurons
15. A group of similar cells forms a __________.
    Answer: Tissue
16. Different tissues combine to form an __________.
    Answer: Organ
17. Several organs working together form an __________.
    Answer: Organ system
18. The correct sequence of organisation is cell → tissue → organ → organ system → __________.
    Answer: Organism
19. Organisms that are too small to be seen with the naked eye are called __________.
    Answer: Microorganisms / Microbes
20. Amoeba is a __________ organism.
    Answer: Unicellular
21. Amoeba and Paramecium belong to the group called __________.
    Answer: Protozoa
22. Bread mould belongs to the group of microorganisms called __________.
    Answer: Fungi
23. Viruses multiply only after entering a __________ cell.
    Answer: Living
24. The process by which microorganisms break down complex waste substances into simpler substances is called __________.
    Answer: Decomposition
25. Fungi and bacteria help convert plant waste into nutrient-rich __________.
    Answer: Manure
26. Biogas contains a high proportion of __________ gas.
    Answer: Methane
27. Yeast belongs to the group of microorganisms called __________.
    Answer: Fungi
28. During respiration, yeast releases __________ gas, which makes dough soft and fluffy.
    Answer: Carbon dioxide
29. The bacterium commonly involved in curd formation is __________.
    Answer: Lactobacillus
30. Lactobacillus converts lactose into __________ acid.
    Answer: Lactic
31. The bacteria found in the root nodules of legumes are called __________.
    Answer: Rhizobium
32. Rhizobium bacteria help plants by trapping __________ from the air.
    Answer: Nitrogen
33. Beans, peas and lentils are examples of __________ plants.
    Answer: Legumes
34. Microalgae make their own food using __________.
    Answer: Sunlight
35. Spirulina, Chlorella and Diatoms are examples of __________.
    Answer: Microalgae

36. Spirulina contains more than __________ **per cent** protein by body weight.
Answer: 60
37. A bacterium does not have a well-defined nucleus; instead, it has a __________.
Answer: Nucleoid
38. Fungal cells have a cell wall but do not have __________.
Answer: Chloroplasts
39. Plants and animals are examples of __________ organisms because their bodies contain many cells.
Answer: Multicellular
40. Yeast is a unicellular fungus, whereas mould is a __________ fungus.
Answer: Multicellular

2.4 Fill-Up the Blank HOTS type questions with Answers: (30 Questions)

HOTS – Fill in the Blanks with Answers

1. If the cell membrane of a cell loses its ability to control the movement of substances, the entry of essential materials and removal of __________ would be affected.
Answer: waste materials
2. If the nucleus of a cell is damaged, its activities and __________ are likely to be affected.
Answer: growth
3. A plant cell remains relatively firm because its __________ provides rigidity and strength.
Answer: cell wall
4. If chloroplasts did not contain chlorophyll, the plant cell would be unable to carry out __________ effectively.
Answer: photosynthesis
5. A nerve cell can quickly transmit messages to different parts of the body because of its elongated and __________ structure.
Answer: branched
6. Muscle cells in the food pipe can push food towards the stomach because they can __________ and relax in a wave-like manner.
Answer: contract
7. If muscle cells lost their flexibility, the movement of food through the food pipe would become __________.
Answer: difficult
8. The differences in the shapes of nerve cells and muscle cells indicate that the structure of a cell is related to its __________.
Answer: function
9. If several tissues work together to perform a particular function, the resulting structure is called an __________.
Answer: organ
10. If one organ in an organ system fails to perform its function, the functioning of the entire __________ may be affected.
Answer: organ system
11. Since a single-celled Amoeba performs all necessary life processes within one cell, it is classified as a __________ organism.
Answer: unicellular

12. An organism containing specialised cells that cooperate with one another for survival is most likely a __________ organism.
Answer: multicellular
13. A student observes an organism that cannot be seen with the naked eye but becomes visible under a microscope. It can be classified as a __________.
Answer: microorganism
14. An unknown microorganism is green because it contains chlorophyll. Based on this observation, it could belong to the group called __________.
Answer: algae
15. If a microscopic organism has branched filaments but lacks chlorophyll, it is most likely a __________.
Answer: fungus
16. If a microscopic cell has no well-defined nucleus but instead possesses a nucleoid, it is most likely a __________ cell.
Answer: bacterial
17. If microorganisms responsible for decomposition disappeared, dead plant and animal matter would __________ in the environment.
Answer: accumulate
18. A gardener mixes vegetable peels with soil and finds dark, nutrient-rich material after a few weeks. The material formed is __________.
Answer: manure
19. If decomposer microorganisms are absent from soil, the recycling of __________ back into the soil would decrease.
Answer: nutrients
20. A compost pit kept under unsuitable temperature and moisture conditions may produce manure more __________.
Answer: slowly
21. Two bowls contain identical dough, but yeast is added to only one. If that dough becomes fluffy, the gas responsible for the change is __________.
Answer: carbon dioxide
22. If yeast-containing dough is kept under unsuitable temperature conditions, the dough may rise more __________.
Answer: slowly
23. A balloon attached to a container containing yeast and sugar solution inflates because yeast releases __________ during respiration.
Answer: carbon dioxide
24. If yeast did not release carbon dioxide during the process, bread dough would be less __________.
Answer: fluffy
25. If equal quantities of curd are added to warm and cold milk, curd is expected to form faster in the __________ milk.
Answer: warm
26. If curd becomes increasingly sour when kept in warm conditions, the increased sourness can be linked to the production of __________ by bacteria.
Answer: lactic acid
27. A farmer who regularly grows beans in rotation with other crops may require less nitrogen fertiliser because __________ bacteria help increase nitrogen availability in the soil.
Answer: Rhizobium

28. If Rhizobium bacteria disappeared from the root nodules of legumes, the plants' natural supply of usable __________ would decrease.
    Answer: nitrogen
29. A major decline in microalgae could disturb Earth's oxygen balance because microalgae release __________ while making their own food.
    Answer: oxygen
30. If pollution and climate change greatly reduce microalgal populations, aquatic food chains and Earth's __________ balance could be affected.
    Answer: oxygen

These questions deliberately use **"if–then," prediction, cause–effect, observation-based identification, application, and inference** formats, making them more appropriate as **HOTS fill-in-the-blank questions** than direct textbook-recall questions.

2.5 One-mark questions with Answers of LOTS Type: (30 Questions)

1. **What is a cell?**
   Answer: A cell is the basic unit of life.
2. **Who first used the term "cell" in science?**
   Answer: Robert Hooke first used the term "cell" after observing a thin slice of cork.
3. **Why is Antonie van Leeuwenhoek known as the Father of Microbiology?**
   Answer: He was the first person to clearly see and describe tiny living things such as bacteria.
4. **Name the three basic parts of a cell.**
   Answer: The three basic parts of a cell are the cell membrane, cytoplasm, and nucleus.
5. **What is the function of the cell membrane?**
   Answer: The cell membrane encloses the cell and controls the entry of essential materials and exit of wastes.
6. **What is cytoplasm?**
   Answer: Cytoplasm is the material between the cell membrane and nucleus where most life processes take place.
7. **What is the function of the nucleus?**
   Answer: The nucleus regulates the activities and growth of the cell.
8. **What is the function of the cell wall in plants?**
   Answer: The cell wall provides rigidity and strength to plant cells.
9. **What are plastids?**
   Answer: Plastids are tiny rod-shaped structures found in plant cells.
10. **What is the function of chlorophyll in chloroplasts?**
    Answer: Chlorophyll gives chloroplasts their green colour and helps in photosynthesis.
11. **What is the function of a vacuole in a plant cell?**
    Answer: A vacuole stores substances, removes wastes, and helps maintain the shape of the plant cell.
12. **What is the shape of a muscle cell?**
    Answer: A muscle cell is spindle-shaped.
13. **What is the function of a nerve cell?**
    Answer: A nerve cell carries messages to different parts of the body.
14. **What is a tissue?**
    Answer: A tissue is a group of similar cells working together.
15. **What is an organ?**
    Answer: An organ is a structure formed by different tissues organised together.

16. **What is an organ system?**
Answer: An organ system is a group of organs working together to perform a major function of the body.
17. **Write the levels of organisation in a living organism.**
Answer: The levels are cell → tissue → organ → organ system → organism.
18. **What are multicellular organisms?**
Answer: Organisms made up of many cells are called multicellular organisms.
19. **What are microorganisms?**
Answer: Microorganisms are tiny living organisms that cannot be seen with the naked eye.
20. **Name four major categories of microorganisms mentioned in the chapter.**
Answer: Protozoa, algae, fungi, and bacteria are four major categories of microorganisms.
21. **What is a unicellular organism?**
Answer: An organism made up of a single cell is called a unicellular organism.
22. **Give two examples of unicellular microorganisms.**
Answer: Bacteria and Amoeba are examples of unicellular microorganisms.
23. **What is decomposition?**
Answer: Decomposition is the breakdown of complex substances into simpler nutrient-rich substances by microorganisms.
24. **How do microorganisms help in making manure?**
Answer: Microorganisms such as fungi and bacteria break down plant waste into nutrient-rich manure.
25. **How do microbes help to clean the environment?**
Answer: Microbes clean the environment by decomposing plant and animal wastes.
26. **What type of microorganism is yeast?**
Answer: Yeast is a type of fungus.
27. **Why does dough become soft and fluffy when yeast is added?**
Answer: Carbon dioxide released by yeast forms bubbles that make the dough soft and fluffy.
28. **Which bacterium helps in the formation of curd?**
Answer: Lactobacillus helps in the formation of curd.
29. **Why does curd taste sour?**
Answer: Curd tastes sour because Lactobacillus produces lactic acid during fermentation.
30. **How does Rhizobium help leguminous plants?**
Answer: Rhizobium traps nitrogen from the air and makes it useful for leguminous plants.

2.6 One-mark questions with Answers of HOTS Type: (30 Questions)

1. **Why can we not observe microorganisms clearly with our naked eyes?**
Answer: Microorganisms are too small to be seen by the unaided human eye and therefore require magnification.
2. **Why does a water-filled round-bottom flask make printed letters appear larger?**
Answer: The curved water-filled flask acts like a magnifying glass and enlarges the appearance of the letters.
3. **Why is safranin added while preparing an onion-peel slide?**
Answer: Safranin stains the cells and increases their visibility under the microscope.

4. **What might happen if glycerin is not added to an onion-peel slide?**
   Answer: The cells may dry out, making clear microscopic observation difficult.
5. **Why should a coverslip be placed carefully over a specimen?**
   Answer: A coverslip should be placed carefully to prevent air bubbles from becoming trapped and interfering with observation.
6. **Why are onion-peel cells firm and closely arranged?**
   Answer: Their cell walls provide rigidity and strength, allowing the cells to remain compactly arranged.
7. **Why do nerve cells have a long and branched structure?**
   Answer: Their elongated and branched structure helps them reach different parts of the body and transmit messages quickly.
8. **Why are muscle cells thin, flexible, and spindle-shaped?**
   Answer: Their shape allows them to contract and relax efficiently to produce movement.
9. **What would happen to a cell if its cell membrane could no longer control the movement of materials?**
   Answer: The cell's survival would be affected because essential materials could not be properly taken in and wastes removed.
10. **Why are chloroplasts found mainly in the green parts of plants?**
    Answer: Chloroplasts contain chlorophyll, which helps green plant parts perform photosynthesis.
11. **Why is the vacuole generally larger in a plant cell than in an animal cell?**
    Answer: The large vacuole helps a plant cell store substances, remove waste, maintain its shape, and provide support.
12. **Why is a cell compared to a brick in a wall?**
    Answer: A cell is compared to a brick because cells are the basic building blocks from which living organisms are formed.
13. **If tissues in an organ stop working together, how could the organ be affected?**
    Answer: The organ may fail to perform its function properly because its different tissues must work together.
14. **Why can an Amoeba survive even though it consists of only one cell?**
    Answer: Its single cell can carry out all the functions necessary for its survival.
15. **Why is a microscope necessary for studying pond-water microorganisms?**
    Answer: A microscope magnifies the microorganisms because they are too small to be observed with the naked eye.
16. **If an organism observed under a microscope is green, what can you infer about it?**
    Answer: We can infer that it may contain chlorophyll and be capable of making its own food.
17. **Why can microorganisms be found even in extreme environments?**
    Answer: Different microorganisms can survive under diverse conditions ranging from hot springs to extremely cold regions.
18. **Why does fruit left outside for a long time often develop a cotton-like growth?**
    Answer: Microorganisms present in the surroundings grow on the fruit and cause the visible cotton-like growth.
19. **Why do pickles and murabbas remain uninfected by microorganisms for longer periods?**
    Answer: Their high concentrations of salt or sugar prevent microorganisms from growing effectively.

20. **What would happen to fallen leaves if decomposing microorganisms were absent?**
    Answer: Fallen leaves would accumulate because microorganisms would not be available to break them down into simpler substances.
21. **How does microbial decomposition indirectly help plants grow?**
    Answer: Decomposition returns nutrient-rich substances to the soil, which improves plant growth.
22. **Why is decomposition important for keeping the environment clean?**
    Answer: Decomposition breaks down plant and animal wastes and recycles their nutrients back into nature.
23. **Why is dough containing yeast fluffier than dough without yeast?**
    Answer: Yeast releases carbon dioxide during respiration, and the gas bubbles make the dough soft and fluffy.
24. **Why is dough containing yeast usually kept in a warm place?**
    Answer: It is kept warm because yeast grows and carries out its activities well under warm conditions.
25. **Why does lukewarm milk form curd faster than cold milk?**
    Answer: Lukewarm conditions favour the growth and activity of Lactobacillus bacteria.
26. **Why does curd become sour after it is formed?**
    Answer: Lactobacillus produces lactic acid while fermenting milk, which gives curd its sour taste.
27. **Why can farmers grow legumes to improve soil fertility instead of relying only on nitrogen fertilisers?**
    Answer: Rhizobium in the root nodules of legumes traps atmospheric nitrogen and makes it useful to plants.
28. **Why are legumes often grown in rotation with other crops?**
    Answer: Legumes naturally increase nitrogen in the soil and help keep it fertile for the next crop.
29. **How could a decline in microalgae affect life on Earth?**
    Answer: A decline in microalgae could disturb oxygen balance and reduce an important food source for aquatic organisms.
30. **Why should microalgae be conserved even though they are microscopic?**
    Answer: Microalgae should be conserved because they contribute greatly to Earth's oxygen supply, aquatic food chains, water cleaning, and other useful processes.

2.7 Two-mark questions with Answers of LOTS Type: (25 Questions)

1. What is a cell? Why is it called the basic unit of life?
Answer:
1. A cell is the basic structural and functional unit that makes up all living organisms.
2. It is called the basic unit of life because cells contain components that perform functions necessary for the survival of organisms.

2. Name the three basic parts of a cell and state their location.
Answer:
1. The three basic parts of a cell are the cell membrane, cytoplasm, and nucleus.
2. The cell membrane forms the outer boundary, while the cytoplasm fills the space between the membrane and the nucleus.

3. State any two functions of the cell membrane.
Answer:

1. The cell membrane encloses the cytoplasm and nucleus and separates one cell from another.
2. It allows essential materials to enter the cell and waste materials to leave it.

4. What are the functions of the nucleus in a cell?
Answer:
1. The nucleus regulates the activities occurring within the cell.
2. It also regulates the growth of the cell.

5. What is the function of the cell wall in plant cells?
Answer:
1. The cell wall provides rigidity and strength to plant cells.
2. It helps the cells remain compactly arranged and firm in structure.

6. What are chloroplasts? State their function.
Answer:
1. Chloroplasts are plastids that contain the green pigment chlorophyll.
2. Chlorophyll gives them their green colour and helps plants carry out photosynthesis.

7. State any two functions of the vacuole in a plant cell.
Answer:
1. The vacuole helps the plant cell store important substances and get rid of waste.
2. It also helps maintain the shape of the cell and provides strength and support.

8. Describe the shape of muscle cells and nerve cells.
Answer:
1. A muscle cell is thin, flexible, and spindle-shaped.
2. A nerve cell is very long and has branches that help it carry messages to different parts of the body.

9. What is a tissue? What is an organ?
Answer:
1. A group of similar cells working together forms a tissue.
2. Different tissues organised together form an organ.

10. Write the levels of organisation in a living organism.
Answer:
1. The levels of organisation begin with **cell → tissue → organ**.
2. They continue as **organ → organ system → organism**.

11. What are multicellular organisms? Give two examples.
Answer:
1. Living beings made up of many cells are called multicellular organisms.
2. Plants and animals, including humans, are examples of multicellular organisms.

12. What are microorganisms? Where are they commonly found?
Answer:
1. Microorganisms are tiny living organisms that cannot be seen with the naked eye.
2. They are found in water, soil, air, food, and even inside our bodies.

13. Name four major categories of microorganisms mentioned in the chapter. Give one example of any one category.
Answer:
1. The major categories mentioned are protozoa, algae, fungi, and bacteria.
2. Amoeba is an example of a protozoan microorganism.

14. Describe any two features of bacteria observed in soil suspension.
Answer:
1. Bacteria may be spherical, comma-shaped, spiral-shaped, or rod-shaped.
2. They may have one long hair-like structure and many small hair-like projections around the cell.

15. What are viruses? How do they multiply?
Answer:
1. Viruses are microscopic and acellular entities that may infect plants, animals, or bacterial cells.
2. They multiply only when they enter a living cell.

16. What is decomposition? How is it useful to the environment?
Answer:
1. Decomposition is the breakdown of complex substances in dead matter and waste into simpler substances by microorganisms.
2. It recycles nutrients back into the soil and helps clean the environment.

17. How do microorganisms help in the formation of manure?
Answer:
1. Microorganisms such as fungi and bacteria break down plant waste into simpler substances.
2. This process produces nutrient-rich manure that increases soil fertility.

18. What is biogas? Mention any two of its uses.
Answer:
1. Biogas is a mixture of gases, containing carbon dioxide and a high proportion of methane, produced when certain microorganisms decompose waste.
2. It can be used for cooking and heating, as well as for generating electricity and running vehicles.

19. What is yeast? How does it make dough soft and fluffy?
Answer:
1. Yeast is a microorganism belonging to the group called fungi.
2. During respiration, it releases carbon dioxide that forms bubbles and makes the dough soft and fluffy.

20. What is the role of Lactobacillus in curd formation?
Answer:
1. Lactobacillus feeds on lactose, multiplies, and ferments milk to form curd.
2. It produces lactic acid, which gives curd its sour taste.

21. How does Rhizobium help leguminous plants?
Answer:
1. Rhizobium lives in the root nodules of legumes such as beans, peas, and lentils.
2. It traps nitrogen from the air and makes it useful to plants, thereby helping improve soil fertility.

22. What are microalgae? Mention two important roles played by them.
Answer:
1. Microalgae are microscopic plant-like organisms that make their own food using sunlight and release oxygen.
2. They serve as food for many aquatic animals and also help in cleaning water.

23. Write any two uses of microalgae to humans.
Answer:
1. Microalgae such as Spirulina, Chlorella, and Diatoms are used as health supplements and medicines.
2. Microalgae are also used in the production of biofuel.

24. Differentiate between unicellular and multicellular organisms.
Answer:
1. Unicellular organisms such as bacteria and protozoa consist of a single cell that performs all necessary life functions.

2. Multicellular organisms such as plants and animals consist of many cells that perform specialised functions and cooperate with one another.

25. State two features that distinguish bacterial cells from many other cells.

Answer:

1. Bacteria do not have a well-defined nucleus or nuclear membrane.
2. Instead of a true nucleus, their genetic material occurs in a region called the nucleoid.

2.8. Two-mark questions with Answers of HOTS Type: (25 Questions)

1. A student observes onion peel cells and cheek cells under a microscope. How can the student identify which cells are from the onion?

Answer:

1. Onion peel cells can be identified by their nearly rectangular shape, compact arrangement and the presence of a cell wall.
2. Cheek cells are polygon-shaped and have a cell membrane but no cell wall.

2. Why would a plant cell lose its firmness if its cell wall were damaged?

Answer:

1. The cell wall provides rigidity and strength to the plant cell.
2. If it is damaged, the cell will lose structural support and may not remain firm.

3. Suppose the cell membrane stopped allowing materials to pass through it. How would this affect the cell?

Answer:

1. Essential materials required for life processes would not be able to enter the cell.
2. Waste materials would also accumulate because they could not leave the cell.

4. A nerve cell is very long and branched, whereas a cheek cell is thin and flat. Explain how these shapes are related to their functions.

Answer:

1. The long and branched structure of a nerve cell helps it reach different parts of the body and transmit messages quickly.
2. Thin and flat cheek cells form a protective lining on the inner surface of the cheek.

5. What might happen to digestion if the muscle cells of the food pipe could not contract and relax? Give a reason.

Answer:

1. Food would not be pushed efficiently from the food pipe towards the stomach.
2. This is because the contraction and relaxation of muscle cells produce the wave-like movement required to move food.

6. A microorganism is made of only one cell. How can it survive without tissues and organs?

Answer:

1. In a unicellular organism, the single cell carries out all the functions necessary for survival.
2. Therefore, it does not require specialised tissues, organs or organ systems to perform its life processes.

7. A student finds microorganisms in both pond water and soil suspension. What conclusion can be drawn from these observations?

Answer:

1. Microorganisms are not restricted to a single habitat and can occur in different environments.
2. Their presence in both samples shows that tiny living organisms are widely distributed around us.

8. Pickles remain unspoiled for a longer time when sufficient salt or sugar is added. Why?

Answer:

1. A high concentration of salt or sugar prevents microorganisms from growing well in pickles and murabbas.
2. Therefore, salt and sugar act as preservatives and delay microbial spoilage.

9. What would happen to fallen leaves and dead organisms if decomposing microorganisms disappeared from Earth?

Answer:

1. Dead matter and organic waste would accumulate because microorganisms would no longer break them down.
2. Nutrient recycling would also be disturbed because nutrients from dead matter would not efficiently return to the soil.

10. A gardener puts fruit peels, dry leaves and other plant waste into a pit instead of throwing them away. Why is this useful?

Answer:

1. Microorganisms such as fungi and bacteria decompose the plant waste and convert it into nutrient-rich manure.
2. The manure increases soil fertility while also helping to recycle organic waste.

11. Two bowls contain similar dough, but yeast is added only to Bowl A. Why does the dough in Bowl A become fluffy while that in Bowl B does not?

Answer:

1. Yeast respires and releases carbon dioxide, which forms bubbles in the dough of Bowl A.
2. These bubbles cause the dough to rise and become soft and fluffy, while Bowl B lacks this yeast activity.

12. A student keeps yeast-containing dough in a refrigerator instead of a warm place. Predict how this may affect the rising of the dough.

Answer:

1. The dough is likely to rise more slowly because yeast grows well in warm conditions.
2. Cooler conditions reduce yeast activity and therefore decrease the production of carbon dioxide that makes the dough fluffy.

13. Two bowls containing milk and a little curd are kept overnight—one in a warm place and another in a refrigerator. Which one will form curd better and why?

Answer:

1. The bowl kept in a warm place will form curd better because Lactobacillus grows well under warm conditions.
2. The bacteria multiply and ferment lactose to produce lactic acid, which converts the milk into sour curd.

14. Why do farmers grow beans or peas in rotation with other crops?

Answer:

1. Leguminous plants have root nodules containing Rhizobium bacteria that trap nitrogen from the air and make it useful to plants.
2. Growing legumes therefore naturally increases soil nitrogen and improves soil health for the next crop.

15. A farmer grows wheat while another grows beans. Why might the wheat farmer need nitrogen fertiliser while the bean farmer may not?

Answer:

1. Beans have root nodules containing Rhizobium bacteria that make atmospheric nitrogen useful to the plant.

2. Wheat does not receive nitrogen through such Rhizobium-containing root nodules and may therefore require nitrogen-rich fertiliser.

16. Pollution causes a large decline in microalgae in a pond. Predict two possible consequences.

Answer:

1. Aquatic animals may lose an important source of food because microalgae form part of their food supply.
2. Oxygen production may also decrease because microalgae release oxygen while making their food using sunlight.

17. Why can fungi not prepare their own food in the same way as green plants?

Answer:

1. Fungal cells do not contain chloroplasts.
2. Therefore, they cannot carry out photosynthesis to make their own food as green plants do.

18. A student observes a cell with a cell membrane and cell wall but without a well-defined nucleus. What type of cell is it likely to be? Justify your answer.

Answer:

1. It is likely to be a bacterial cell because bacteria possess a cell membrane and cell wall but lack a well-defined nucleus.
2. Their genetic material is present in a region called the nucleoid instead of a membrane-bound nucleus.

19. Why is an electron microscope more suitable than an ordinary microscope for studying very small structures inside a cell?

Answer:

1. Very small subcellular components require much higher magnification to become visible.
2. An electron microscope can magnify a cell about 10,00,000 times, allowing more internal structures to be observed.

20. A balloon is fixed over a test tube containing sugar solution and yeast and kept in a warm place. Why does the balloon inflate after a few hours?

Answer:

1. Yeast breaks down food during respiration and releases carbon dioxide gas.
2. The carbon dioxide collects inside the balloon and causes it to inflate.

21. Why is the cell compared to a brick in a wall? Explain the analogy.

Answer:

1. Just as many bricks are organised together to construct a wall, cells combine to form the bodies of living organisms.
2. Cells form tissues, tissues form organs, and organs work together in organ systems to build a complete organism.

22. A bread slice kept near a sink develops mould faster than one kept in a refrigerator. Give two possible reasons.

Answer:

1. The bread near the sink is likely to experience warmer and more favourable conditions for microbial growth.
2. The low temperature inside the refrigerator slows the growth and activity of microorganisms.

23. Why does curd become more sour when it is left outside for a longer time?

Answer:

1. Lactobacillus continues to feed on lactose and ferment it when conditions remain suitable.

2. More lactic acid is consequently produced, increasing the sourness of the curd.

24. If decomposers break down plant and animal waste, how do they benefit both plants and the environment?

Answer:

1. Decomposition releases nutrients back into the soil, where they can support plant growth.
2. At the same time, the breakdown of organic waste helps clean the environment and recycle matter.

25. A scientist discovers a bacterium capable of breaking down a particular pollutant. How could such a microorganism be environmentally useful?

Answer:

1. The bacterium could be used to break the pollutant into simpler substances and help clean contaminated areas.
2. This application is supported by the example of Ananda Mohan Chakrabarty's bacterium developed to break down oil spills.

2.9. Three-mark questions with Answers of LOTS Type: (15 Questions)

1. What is a cell? Name its three basic parts.

Answer:

1. A cell is the **basic unit of life** and all living organisms are made up of cells.
2. The three basic parts of a cell are the **cell membrane, cytoplasm and nucleus**.
3. These parts perform different functions that help the cell carry out its life processes.

2. State the functions of the cell membrane, cytoplasm and nucleus.

Answer:

1. The **cell membrane** encloses the cytoplasm and nucleus and allows essential materials to enter and waste materials to leave the cell.
2. The **cytoplasm** contains various cell components and is the site where most life processes take place.
3. The **nucleus** regulates the activities occurring within the cell and also regulates its growth.

3. Describe three important features of a plant cell.

Answer:

1. A plant cell has a **cell wall** outside the cell membrane, which provides rigidity and strength.
2. It contains **plastids**, including chloroplasts that contain chlorophyll and help in photosynthesis.
3. It usually has a **large vacuole** that stores substances, helps remove waste and maintains the shape of the cell.

4. Describe the structure and function of a nerve cell.

Answer:

1. A nerve cell, also called a **neuron**, is very long and has branches.
2. Nerve cells carry messages from one part of the body to another.
3. Their elongated and branched structure helps them reach different parts of the body and pass messages quickly.

5. Explain the different levels of organisation in a multicellular organism.

Answer:

1. A group of similar **cells** forms a **tissue**, and different tissues combine to form an **organ**.
2. Several organs work together to form an **organ system** that performs a major function.
3. All the organ systems together make up a complete **organism**.

6. What are microorganisms? Mention where they are found.
Answer:
1. Microorganisms are tiny living organisms that cannot be seen with the naked eye.
2. They can be unicellular, such as bacteria and Amoeba, or multicellular, such as some fungi and algae.
3. They are found in **water, soil, air and even inside our bodies**.

7. Name three major groups of microorganisms and give one example of each.
Answer:
1. **Protozoa** include microorganisms such as *Amoeba* and *Paramecium*.
2. **Fungi** include microorganisms such as yeast and mould.
3. **Bacteria** include useful forms such as *Lactobacillus* and *Rhizobium*.

8. Describe any three features of bacteria.
Answer:
1. Bacteria are **unicellular microorganisms** and may have spherical, comma, spiral or rod-like shapes.
2. Their cells have a cell membrane and cell wall.
3. They do not have a well-defined nucleus; instead, their genetic material occurs in a region called the **nucleoid**.

9. Explain how microorganisms help in decomposition and manure formation.
Answer:
1. Microorganisms such as **fungi and bacteria** act on plant and animal wastes.
2. They break down complex waste materials into simpler, nutrient-rich substances through **decomposition**.
3. The resulting manure adds nutrients to the soil and helps increase soil fertility.

10. Explain the role of yeast in making bread and cakes.
Answer:
1. Yeast is a microorganism belonging to the group **fungi** and grows well under warm conditions.
2. During respiration, yeast breaks down food and releases **carbon dioxide**.
3. Carbon dioxide forms bubbles in the dough, making it rise and become soft and fluffy.

11. Explain how curd is formed from milk.
Answer:
1. Curd contains several bacteria, including **Lactobacillus**, which grows well under warm conditions.
2. Lactobacillus feeds on lactose present in milk and ferments the milk to form curd.
3. During fermentation, it produces **lactic acid**, which gives curd its sour taste.

12. Explain the role of Rhizobium bacteria in agriculture.
Answer:
1. **Rhizobium** bacteria live in root nodules of legumes such as beans, peas and lentils.
2. These bacteria trap nitrogen from the air and make it useful to plants.
3. This naturally increases nitrogen in the soil, improves soil health and reduces the need for chemical fertilisers.

13. State three important roles of microalgae.
Answer:
1. Microalgae make their own food using sunlight and release a large amount of **oxygen**.
2. They are rich in nutrients and serve as food for many aquatic animals.
3. Microalgae are also useful in cleaning water and in the production of **biofuel**.

14. Differentiate between unicellular and multicellular organisms.
Answer:

1. **Unicellular organisms** are made up of a single cell, whereas multicellular organisms are made up of many cells.
2. In unicellular organisms, one cell performs all functions necessary for survival, while cells in multicellular organisms perform specialised functions.
3. Bacteria and protozoa are examples of unicellular organisms, whereas plants and animals are multicellular organisms.

15. Why is the cell considered the basic unit of life?
Answer:
1. The bodies of all living organisms are made up of one or more **cells**.
2. Each cell contains various components that enable it to perform essential life functions.
3. In multicellular organisms, specialised cells work together to perform different functions and ensure the survival of the organism.

2.10. Three-mark questions with Answers of HOTS Type: (15 Questions)

1. A student observes that onion peel cells are firm and regularly arranged, while human cheek cells are irregular. Explain why.
Answer:
1. Onion peel cells have a **cell wall** outside the cell membrane, which provides rigidity and strength.
2. Human cheek cells do not have a cell wall and hence are comparatively flexible in shape.
3. Therefore, the presence of a cell wall makes onion cells appear more compact and regularly arranged.

2. Suppose a nerve cell were round and had no branches. How might this affect its function?
Answer:
1. Nerve cells need to carry messages from one part of the body to another.
2. Their elongated and branched structure helps them reach different parts of the body and transmit messages quickly.
3. If they were round and without branches, their ability to communicate efficiently over distances would be reduced.

3. Why would damage to the cell membrane affect the survival of a cell?
Answer:
1. The cell membrane encloses the cytoplasm and nucleus and separates one cell from another.
2. It controls the entry of essential materials and the exit of waste materials.
3. If it is damaged, this controlled exchange may be disturbed, affecting the cell's life processes and survival.

4. A student keeps yeast dough in a refrigerator and finds that it does not rise well. Give reasons.
Answer:
1. Yeast grows well and carries out its activities effectively under **warm conditions**.
2. In a refrigerator, the low temperature slows down yeast activity and therefore less carbon dioxide is produced.
3. Since carbon dioxide bubbles make dough rise and become fluffy, the refrigerated dough will not rise well.

5. Two bowls of milk containing a spoonful of curd are kept separately in a warm room and a refrigerator. Predict and explain the results.
Answer:

1. The milk kept in the warm room will form curd faster because **Lactobacillus grows well under warm conditions**.
2. The bacteria ferment lactose and produce lactic acid, which makes the curd sour.
3. In the refrigerator, bacterial activity is slower, so curd formation will be delayed or may not occur within the same period.

6. Why might a farmer grow beans or peas before growing another crop instead of repeatedly adding nitrogen fertilisers?
Answer:
1. Beans and peas are legumes whose root nodules contain **Rhizobium bacteria**.
2. Rhizobium traps nitrogen from the air and makes it useful to plants, naturally increasing nitrogen in the soil.
3. Therefore, growing legumes can improve soil health and reduce the need for chemical nitrogen fertilisers for the next crop.

7. What would happen to the environment if decomposing microorganisms suddenly disappeared?
Answer:
1. Dead plants, animals and organic wastes would accumulate because microorganisms would no longer decompose them efficiently.
2. Nutrients present in these wastes would not be returned effectively to the soil.
3. As a result, natural nutrient recycling and soil fertility would be adversely affected.

8. A gardener finds that vegetable peels kept in a compost pit gradually turn into dark manure. Explain how this happens.
Answer:
1. Microorganisms such as bacteria and fungi present in the soil act on the vegetable waste.
2. They decompose complex substances in the waste into simpler, nutrient-rich substances.
3. The resulting manure returns nutrients to the soil and helps improve its fertility.

9. A bread slice kept near a sink develops mould faster than one kept in a refrigerator. Why?
Answer:
1. Microorganisms grow better when suitable conditions such as **moisture and optimal temperature** are available.
2. The area near the sink is likely to provide warmer and more favourable conditions for mould growth than a refrigerator.
3. Therefore, mould is expected to grow faster on the bread kept near the sink.

10. Pickles remain unspoiled for a longer time even though microorganisms are present everywhere. How can you explain this?
Answer:
1. Pickles contain high concentrations of **salt, sugar or other preserving ingredients**.
2. High concentrations of salt or sugar do not allow microorganisms to grow effectively.
3. Therefore, microbial growth and spoilage are reduced, allowing pickles to remain preserved for longer periods.

11. Why is the shape of a cell closely related to the function it performs? Explain with suitable examples.
Answer:
1. Cells have different shapes and structures that enable them to perform specialised functions efficiently.
2. Nerve cells are elongated and branched for carrying messages, while muscle cells are thin, flexible and spindle-shaped to contract and relax.

3. Thus, the structure of a cell is adapted to the particular function it performs in the organism.

12. Pollution causes a major decline in microalgae in a water body. Predict two possible consequences for the ecosystem.

Answer:

1. A decline in microalgae can reduce oxygen production because microalgae release oxygen while making their food using sunlight.
2. Aquatic animals that depend on microalgae as a food source may also be affected.
3. Thus, loss of microalgae can disturb both the **oxygen balance and food relationships** in aquatic ecosystems.

13. A scientist observes a microscopic cell that has a cell wall but no chloroplasts. Can it automatically be identified as a plant cell? Justify your answer.

Answer:

1. No, the presence of a cell wall alone does not prove that it is a plant cell.
2. Fungal cells also have cell walls, but they do not contain chloroplasts and therefore cannot perform photosynthesis.
3. Hence, other cellular characteristics must also be examined before identifying the type of organism.

14. A microorganism has a cell membrane but does not possess a well-defined nucleus. What could it be? Give reasons.

Answer:

1. The microorganism could be a **bacterium** because bacterial cells do not have a well-defined nucleus or nuclear membrane.
2. Instead of a true nucleus, bacteria contain their genetic material in a region called the **nucleoid**.
3. This characteristic distinguishes bacteria from organisms such as yeast, protozoa, algae, fungi, plants and animals.

15. A student says, "Microorganisms are too small to have any major effect on our lives." How would you prove this statement incorrect?

Answer:

1. Microorganisms decompose plant and animal wastes, recycle nutrients and help clean the environment.
2. Microorganisms such as yeast and Lactobacillus are useful in preparing foods such as bread, cakes and curd.
3. Other microorganisms such as Rhizobium improve soil fertility, showing that microscopic size does not limit their importance.

2.11 Five-mark questions with Answers of LOTS Type: (10 Questions)

1. What is a cell? Describe the basic parts of a cell and their functions.

Answer:

1. A **cell is the basic unit of life**, and all living organisms are made up of one or more cells.
2. The **cell membrane** encloses the cytoplasm and nucleus and separates one cell from another.
3. The cell membrane allows essential materials to enter and waste materials to leave the cell.
4. The **cytoplasm** contains different cell components and is the place where most life processes occur.

5. The **nucleus** regulates the activities occurring within the cell and also regulates its growth.

2. Explain the different levels of organisation in a living organism.

Answer:

1. The **cell** is the basic unit of life.
2. A group of similar cells working together forms a **tissue**.
3. Different tissues are organised together to form an **organ**.
4. Several organs working together form an **organ system** that performs a major body function.
5. All the organ systems together make up a complete **organism**, so the sequence is: **Cell → Tissue → Organ → Organ system → Organism**.

3. What are microorganisms? Describe their main characteristics.

Answer:

1. **Microorganisms or microbes** are tiny living organisms that cannot normally be seen with the naked eye.
2. They can be observed using a **microscope**, which magnifies them and makes them visible.
3. Microorganisms are found in water, soil, air and even inside our bodies.
4. Some microorganisms, such as bacteria and Amoeba, are **unicellular**, while some fungi and algae are multicellular.
5. Major categories of microorganisms discussed in the chapter include **bacteria, fungi, protozoa and some algae**.

4. Describe the role of microorganisms in cleaning the environment.

Answer:

1. Microorganisms such as **bacteria and fungi** act on plant and animal wastes.
2. They break down complex substances in wastes into simpler substances through **decomposition**.
3. Fruit and vegetable peels can thus be converted into dark-coloured, nutrient-rich **manure**.
4. The nutrients released during decomposition return to the soil and help plants grow better.
5. Thus, microorganisms help **recycle waste, restore nutrients and clean the environment**.

5. Explain how yeast is useful in the preparation of food.

Answer:

1. **Yeast is a microorganism belonging to the group fungi**.
2. It grows well under warm conditions and breaks down food to release energy.
3. During this process, yeast releases **carbon dioxide gas**.
4. The carbon dioxide forms bubbles in the dough and makes it **soft and fluffy**.
5. This property of yeast is used in making foods such as **bread and cakes**.

6. Explain how curd is formed from milk.

Answer:

1. Curd contains several types of bacteria, including **Lactobacillus**.
2. Lactobacillus feeds on **lactose**, the sugar present in milk.
3. The bacteria multiply and **ferment the milk**, causing it to form curd.
4. During fermentation, the bacteria produce **lactic acid**, which gives curd its sour taste.
5. Lactobacillus grows well under **warm conditions**, and therefore curd forms more readily in warm milk.

7. Describe the importance of Rhizobium bacteria in agriculture.

Answer:

1. **Rhizobium** is a useful bacterium associated with certain leguminous plants.
2. It lives in swollen regions called **root nodules** found in legumes such as beans, peas and lentils.
3. Rhizobium traps **nitrogen from the air** and makes it useful to plants.
4. This helps plants grow better and can reduce their dependence on chemical nitrogen fertilisers.
5. Farmers therefore grow legumes in rotation with other crops to **increase soil nitrogen and maintain soil health**.

8. Write five points about microalgae and their importance.
Answer:

1. **Microalgae** are microscopic plant-like organisms found in water, soil, air and even on trees.
2. They make their own food using **sunlight** and release oxygen during the process.
3. Microalgae collectively produce **more than half of the Earth's oxygen supply**.
4. They are rich in nutrients and provide food for many aquatic animals; some, such as Spirulina and Chlorella, are also used by humans.
5. Microalgae also help in **cleaning water and producing biofuel**, making them important to the environment and humans.

9. Differentiate between unicellular and multicellular organisms.
Answer:

1. **Unicellular organisms** are made up of only one cell, whereas **multicellular organisms** consist of many cells.
2. In unicellular organisms, a single cell performs all the functions necessary for survival.
3. Bacteria and protozoa are examples of **unicellular microorganisms**.
4. In multicellular organisms, different cells may perform specialised functions and cooperate with one another.
5. Plants and animals are multicellular, while among fungi, **yeast is unicellular and mould is multicellular**.

10. Describe how the shape and structure of different cells are related to their functions.
Answer:

1. Cells differ in their **shape, size and structure** according to the functions they perform.
2. Inner cheek cells are **thin and flat** and form a protective lining inside the cheek.
3. Nerve cells are **long and branched**, helping them carry messages to different parts of the body.
4. Muscle cells are **thin, flexible and spindle-shaped**, allowing them to contract and relax.
5. Some plant cells form **long tubes** that help transport water throughout the plant.

2.12 Five-mark questions with Answers of HOTS Type: (10 Questions)

1. A student observes a nerve cell and a cheek cell under a microscope. Why are their shapes very different? Explain how their shapes help them perform their functions.
Answer:

1. Different cells have different shapes because their **structure is related to the function they perform**.
2. Cheek cells are **thin and flat**, enabling them to form a protective lining inside the mouth.
3. Nerve cells are **long and branched** so that they can reach different parts of the body.
4. Their elongated structure helps nerve cells **carry and transmit messages quickly** over distances.

5. Thus, the difference between cheek and nerve cells shows that cells are **structurally adapted to perform specialised functions**.

2. Two bowls contain the same amount of flour and sugar. Yeast is added only to Bowl A, and both are kept in a warm place. Predict what will happen and explain why.

Answer:

1. The dough in **Bowl A will rise and become soft and fluffy**, while the dough in Bowl B will show much less change.
2. Yeast grows well under **warm conditions** and uses the available food for its life processes.
3. During this process, yeast releases **carbon dioxide gas**.
4. The carbon dioxide gets trapped as bubbles in the dough, causing its **volume to increase**.
5. Therefore, the difference between the two bowls demonstrates the important role of **yeast in making bread and cakes soft and fluffy**.

3. A farmer grows beans in a field without adding nitrogen-rich fertilisers, but the plants still grow well. How can you explain this?

Answer:

1. Bean plants are **leguminous plants** whose roots contain special swollen regions called nodules.
2. These root nodules contain useful bacteria called **Rhizobium**.
3. Rhizobium traps **nitrogen from the air** and makes it available to the plants.
4. Therefore, bean plants can grow well even without the addition of chemical nitrogen fertilisers.
5. Growing legumes can also **increase nitrogen in the soil**, making the soil healthier for the next crop.

4. Imagine that decomposing microorganisms suddenly disappeared from the Earth. What consequences would you expect?

Answer:

1. Dead plants, fallen leaves and animal wastes would **accumulate in the environment**.
2. Organic wastes would not be efficiently broken down into **simpler substances**.
3. The natural formation of **nutrient-rich manure** would decrease.
4. Important nutrients would not be efficiently returned to the soil, which could **reduce soil fertility and affect plant growth**.
5. Thus, without decomposing microorganisms, **waste recycling and the natural nutrient cycle would be seriously disturbed**.

5. A student keeps two bowls containing milk and a spoonful of curd. One is kept in a warm place and the other in a refrigerator. Predict the results and justify your answer.

Answer:

1. The milk kept in the **warm place will turn into curd more quickly**.
2. The milk kept in the refrigerator may not curdle properly because the low temperature slows bacterial activity.
3. Curd contains bacteria such as **Lactobacillus**, which grow well under warm conditions.
4. Lactobacillus feeds on lactose and ferments the milk, producing **lactic acid**.
5. Hence, suitable temperature is important for bacterial growth, fermentation and **successful curd formation**.

6. Why would a nerve cell not be able to perform its function effectively if it were flat and compact like a cheek cell?

Answer:

1. A nerve cell has to **carry messages to different parts of the body**.
2. Its long and branched structure allows it to reach cells located at different places.

3. A flat and compact cell would not have the same extended structure needed to **transmit messages over distances**.
4. Cheek cells are flat because their main function is to form a **protective lining**, not to transmit messages.
5. Therefore, this example demonstrates that the **shape and structure of a cell are closely related to its function**.

7. A gardener puts vegetable peels and dry leaves into a pit and covers them with soil. After a few weeks, the waste becomes dark-coloured manure. Explain the changes taking place.

Answer:

1. Soil naturally contains various microorganisms, including **bacteria and fungi**.
2. These microorganisms act on the vegetable peels, leaves and other plant wastes.
3. They break complex substances into simpler substances through a process called **decomposition**.
4. The decomposed material becomes **nutrient-rich manure**, which can increase soil fertility.
5. Thus, the activity shows how microorganisms **recycle waste, return nutrients to the soil and help clean the environment**.

8. A student finds that bread kept near a sink develops mould faster than bread kept in a refrigerator. Analyse the possible reason.

Answer:

1. Microorganisms are present in our surroundings and can grow on food under **suitable conditions**.
2. The area near a sink is generally warmer and may provide more favourable moisture conditions than a refrigerator.
3. Such conditions favour the **growth of mould and other microorganisms** on bread.
4. The low temperature inside a refrigerator slows the growth and activity of microorganisms.
5. Therefore, bread kept near the sink is likely to show **visible microbial growth earlier** than refrigerated bread.

9. Why can the destruction of microalgae have serious effects on aquatic ecosystems as well as humans?

Answer:

1. Microalgae make their own food using sunlight and release **oxygen** during this process.
2. Collectively, they produce **more than half of the Earth's oxygen supply**.
3. They are also an important **food source for many aquatic animals**.
4. Some microalgae are useful to humans as nutritional supplements, medicines, for cleaning water and for producing biofuel.
5. Therefore, a major decline in microalgae could disturb **oxygen balance, aquatic food relationships and several human uses**, making their conservation important.

10. A student says, “A single cell cannot be a complete living organism because it is too small.” Do you agree? Justify your answer.

Answer:

1. No, the statement is incorrect because some organisms consist of **only one cell**.
2. Bacteria and protozoa are examples of **unicellular organisms**.
3. Their single cell carries out **all the functions necessary for survival**.
4. In contrast, multicellular organisms contain many cells that perform specialised functions and cooperate with one another.
5. Therefore, the ability to perform essential life functions, rather than the **number or size of cells**, determines whether an organism can survive independently.

2.13 Five-mark questions with Answers of Applied Type: (10 Questions)

1. Riya prepared two bowls of dough. She added yeast to one bowl but not to the other and kept both in a warm place. After a few hours, one dough became soft and fluffy. Apply your knowledge of microorganisms to explain this observation.
Answer:
1. The dough containing **yeast** becomes soft and fluffy because yeast is a microorganism belonging to the group fungi.
2. In warm conditions, yeast grows and breaks down the available food to release energy.
3. During this process, yeast releases **carbon dioxide gas**.
4. The carbon dioxide forms bubbles inside the dough, causing it to **rise and become fluffy**.
5. This property of yeast is practically used in making **bread, cakes and other bakery products**.

2. Your family wants to prepare curd quickly during winter. What steps would you suggest based on your knowledge of microorganisms? Explain the science behind your suggestion.
Answer:
1. The milk should be made **lukewarm** before adding a small quantity of curd.
2. The added curd contains bacteria such as **Lactobacillus**.
3. The container should be covered and kept in a **warm place** because these bacteria grow better under warm conditions.
4. Lactobacillus feeds on lactose in milk and ferments it, producing **lactic acid**.
5. Lactic acid makes the milk sour and converts it into curd; therefore, maintaining warmth helps in **faster curd formation**.

3. A farmer wants to improve the nitrogen content of his field naturally and reduce the use of chemical fertilisers. What method would you recommend? Explain.
Answer:
1. The farmer should grow **leguminous crops such as beans, peas or lentils** in rotation with other crops.
2. The roots of these plants contain swollen regions called **root nodules**.
3. These nodules contain useful bacteria called **Rhizobium**.
4. Rhizobium traps nitrogen from the air and makes it available to the plants for their growth.
5. Therefore, growing legumes in crop rotation can **naturally increase soil nitrogen and maintain soil fertility**, reducing dependence on chemical fertilisers.

4. Your school produces a large quantity of dry leaves and fruit and vegetable peels every day. Suggest an eco-friendly method of managing this waste using microorganisms.
Answer:
1. The biodegradable waste can be collected in a **compost pit or container** and covered with soil.
2. Soil contains microorganisms such as **bacteria and fungi** that act on plant waste.
3. These microorganisms break down complex waste materials into simpler substances through **decomposition**.
4. After some time, the waste gets converted into **nutrient-rich natural manure**.
5. The manure can be used in the school garden, thereby **reducing waste, improving soil fertility and keeping the environment clean**.

5. While preparing an onion-peel slide, a student finds that the cells are not clearly visible under the microscope. What steps should the student take to improve the slide?
Answer:

1. The student should use a **thin and transparent onion peel** so that individual cells can be observed clearly.
2. The peel should be stained with **safranin**, which gives colour to the cells and improves their visibility.
3. Excess stain should be removed by gently **rinsing the peel with water**.
4. A drop of **glycerin** should be added to prevent the cells from drying and to improve clarity.
5. The coverslip should be placed slowly so that **no air bubbles are trapped**, and the prepared slide should then be observed under the microscope.

6. A child keeps one slice of bread near the kitchen sink and another in the refrigerator. After three days, more mould appears on the slice near the sink. Apply your knowledge to explain the result.

Answer:

1. Bread can support the growth of microorganisms such as **mould**, which belongs to fungi.
2. Microorganisms grow better when environmental conditions such as **temperature and moisture are favourable**.
3. The bread kept near the sink is likely to experience conditions more favourable for microbial growth.
4. The low temperature inside the refrigerator **slows down the growth and activity of microorganisms**.
5. Hence, refrigeration is commonly used to **delay microbial growth and preserve food for a longer period**. The chapter itself suggests comparing bread kept near a sink with refrigerated bread as an application activity.

7. A gardener notices large quantities of fallen leaves in a garden. Instead of burning them, how can the gardener use microorganisms to solve the problem?

Answer:

1. The gardener can collect the fallen leaves and other plant wastes in a **pit for decomposition**.
2. Bacteria and fungi present in the soil will act upon this organic waste.
3. These microorganisms break complex substances into **simpler, nutrient-rich substances**.
4. The decomposed material becomes natural manure, and its nutrients are **returned to the soil**.
5. Thus, composting instead of burning leaves helps **manage waste, recycle nutrients and improve plant growth**.

8. A student observes an unknown cell under a microscope and notices a cell wall, cell membrane, cytoplasm, nucleus and chloroplasts. How can the student identify the type of cell? Explain the functions of the observed features.

Answer:

1. The presence of a **cell wall and chloroplasts** indicates that the observed cell is a plant cell.
2. The **cell wall** provides rigidity and strength to the plant cell.
3. The **cell membrane** encloses the cytoplasm and nucleus and allows the movement of necessary materials and wastes.
4. The **nucleus** regulates the activities and growth of the cell.
5. The **chloroplast contains chlorophyll**, which helps the plant carry out photosynthesis.

9. A village has plenty of animal dung and plant waste. Suggest how microorganisms can help convert this waste into a useful source of energy.

Answer:

1. Plant and animal wastes can be placed under **oxygen-free conditions** where certain microorganisms can act on them.
2. Some bacteria and fungi can decompose such wastes in the absence of oxygen.
3. During decomposition, they release a mixture of gases known as **biogas**.
4. Biogas contains carbon dioxide and a high proportion of **methane**.
5. This biogas can be used as a fuel for **cooking, heating, generating electricity and even running vehicles**, thereby converting waste into useful energy.

10. A pond in a village is polluted, and the population of microalgae begins to decrease. Apply your knowledge to explain why protecting microalgae is important.
Answer:

1. Microalgae are microscopic plant-like organisms that **make their own food using sunlight**.
2. During this process, they release oxygen and collectively contribute **more than half of the Earth's oxygen supply**.
3. They are rich in nutrients and serve as an important **food source for many aquatic animals**.
4. Some microalgae are also useful for **cleaning water, producing biofuel, and as health supplements and medicines**.
5. Therefore, protecting microalgae is important for **aquatic life, environmental health, useful human applications and maintaining oxygen balance on Earth**.

2.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

Olympiad-Type Multiple Choice Questions:
1. A student observes two cells under a microscope. Cell P has a cell wall, cell membrane, cytoplasm and nucleus, while Cell Q has only a cell membrane, cytoplasm and nucleus among these structures. Which conclusion is most appropriate?
A. P must be bacterial and Q must be fungal
B. P could be a plant cell and Q could be an animal cell
C. P must be animal and Q must be plant
D. Both P and Q must be bacterial
Answer: B. P could be a plant cell and Q could be an animal cell

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2. During preparation of an onion-peel slide, a student forgets to add safranin. What is the most likely consequence?
A. The cells will immediately die
B. The cell wall will disappear
C. The cells will be more difficult to see clearly because of poor contrast
D. The onion cells will become animal cells
Answer: C. The cells will be more difficult to see clearly because of poor contrast

---

3. Four students describe an unknown cell:

- Ravi: It has a cell membrane.
- Meera: It has a cell wall.
- Ali: It does not contain chloroplasts.
- Diya: It contains a well-defined nucleus.

Which of the following could satisfy **all four observations**?
A. Fungal cell
B. Typical animal cell

C. Bacterial cell
D. Human cheek cell
Answer: A. Fungal cell

---

4. A nerve cell is very long and branched, whereas a cheek cell is thin and flat. What is the best explanation for this difference?
A. All cells randomly acquire different shapes
B. Cell shape and structure are related to the function performed
C. Nerve cells contain no cytoplasm
D. Cheek cells are not true cells
Answer: B. Cell shape and structure are related to the function performed

---

5. A student arranges the following levels of biological organisation:
Cell → Organ → Tissue → Organ system → Organism
Which change will make the sequence correct?
A. Exchange cell and organ
B. Exchange tissue and organ
C. Exchange organ system and organism
D. No change is required
Answer: B. Exchange tissue and organ
Correct sequence: **Cell → Tissue → Organ → Organ system → Organism**.

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6. A microorganism consists of a single cell and can perform all activities necessary for its survival. Which statement is correct?
A. It cannot be considered an organism because it has only one cell
B. It is necessarily a bacterium
C. It is a unicellular organism
D. It must contain chlorophyll
Answer: C. It is a unicellular organism

---

7. A student observes an organism from pond water. It is single-celled, moves from place to place and has an irregular shape. Which organism is it most likely to be?
A. Bread mould
B. Amoeba
C. Rhizobium
D. Yeast
Answer: B. Amoeba

---

8. A microorganism observed in a soil suspension has branched filaments, lacks chlorophyll and possesses brush-like structures. It most likely belongs to:
A. Protozoa
B. Algae
C. Fungi
D. Bacteria
Answer: C. Fungi

---

9. A scientist discovers a microscopic structure that can multiply only after entering a living cell. Based on the chapter, it should most appropriately be classified as:
A. Bacterium
B. Virus

C. Fungus
D. Protozoan
Answer: B. Virus

---

10. Four identical pieces of fruit are stored under different conditions. Which condition would most likely help prevent microbial growth?
A. High moisture and moderate temperature
B. Warm conditions without preservatives
C. High concentration of sugar
D. Warm and moist surroundings
Answer: C. High concentration of sugar
High concentrations of salt or sugar act as preservatives because they do not allow these microorganisms to grow well.

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11. Two identical bowls of dough are prepared. Yeast is added only to bowl X. Both are kept warm. After five hours, X is fluffy. Which gas is primarily responsible for this observation?
A. Oxygen
B. Nitrogen
C. Carbon dioxide
D. Hydrogen
Answer: C. Carbon dioxide

---

12. In the experiment above, why is the warm condition important?
A. Yeast grows well in warm conditions
B. Warmth converts yeast into bacteria
C. Warmth directly produces carbon dioxide from flour
D. Warmth destroys microorganisms other than yeast
Answer: A. Yeast grows well in warm conditions

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13. Aanandi adds yeast to a sugar solution in a test tube and attaches a balloon to its mouth. After a few hours in a warm place, the balloon inflates. Which is the best inference?
A. Sugar evaporated and entered the balloon
B. Yeast released a gas while breaking down food
C. The balloon produced gas
D. Yeast converted carbon dioxide into oxygen
Answer: B. Yeast released a gas while breaking down food

---

14. Two bowls contain milk with equal amounts of curd added. Bowl P contains lukewarm milk and is kept warm, while Bowl Q contains cold milk and is refrigerated. Which result is most likely?
A. Q forms curd faster
B. Both form curd at exactly the same rate
C. P forms curd faster
D. Neither can form curd
Answer: C. P forms curd faster

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15. Curd becomes increasingly sour when kept under favourable conditions. Which substance is mainly responsible for the sourness according to the chapter?
A. Carbon dioxide
B. Lactic acid

C. Alcohol
D. Nitrogen
Answer: B. Lactic acid

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16. Consider the following statements:
I. Yeast belongs to fungi.
II. Yeast releases carbon dioxide during the process described in dough preparation.
III. Lactobacillus produces lactic acid during curd formation.
IV. Rhizobium helps trap nitrogen from air and makes it useful to plants.
Which option is correct?
A. I and II only
B. II and III only
C. I, II and III only
D. I, II, III and IV
Answer: D. I, II, III and IV

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17. Farmer A repeatedly grows wheat and uses nitrogen-rich fertiliser. Farmer B grows beans in rotation with other crops. Farmer B may require less nitrogen fertiliser mainly because:
A. Bean leaves absorb nitrogen directly from soil
B. Rhizobium in root nodules helps make atmospheric nitrogen useful to plants
C. Beans do not require nitrogen
D. Fungi in bean leaves produce nitrogen
Answer: B. Rhizobium in root nodules helps make atmospheric nitrogen useful to plants

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18. If Rhizobium bacteria disappeared from the root nodules of leguminous plants, which effect would be most directly expected?
A. Increased natural enrichment of soil nitrogen
B. Reduced ability to make atmospheric nitrogen useful to the plants
C. Increased photosynthesis in roots
D. Immediate formation of curd in the soil
Answer: B. Reduced ability to make atmospheric nitrogen useful to the plants

---

19. A gardener places fruit peels, vegetable peels and dry leaves in a pit under suitable moisture and temperature conditions. After several weeks, nutrient-rich manure forms. Which organisms are mainly responsible?
A. Bacteria and fungi
B. Viruses only
C. Plants only
D. Animals only
Answer: A. Bacteria and fungi

---

20. Imagine that microorganisms capable of decomposition suddenly disappeared. Which would be the most likely long-term consequence?
A. Dead organic matter would decompose faster
B. Nutrient recycling would be severely affected
C. Soil would automatically become more fertile
D. Plant and animal wastes would instantly turn into manure
Answer: B. Nutrient recycling would be severely affected

---

21. Some bacteria decompose plant and animal waste under oxygen-free conditions and produce biogas. Which gas forms a high proportion of this biogas?
A. Oxygen
B. Nitrogen
C. Methane
D. Hydrogen
Answer: C. Methane

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22. Ananda Mohan Chakrabarty developed a special bacterium capable of breaking down oil spills. Which broader scientific principle does this example best illustrate?
A. All bacteria are harmful
B. Microorganisms can be used to solve environmental problems
C. Bacteria can survive only inside humans
D. Microorganisms cannot act on pollutants
Answer: B. Microorganisms can be used to solve environmental problems

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23. Pollution drastically reduces the number of microalgae in a large aquatic ecosystem. Which combination of effects is most consistent with the chapter?
A. Increase in oxygen production and aquatic food availability
B. Decrease in oxygen contribution and food availability for many aquatic animals
C. Increase in nitrogen fixation by Rhizobium
D. Faster conversion of milk into curd
Answer: B. Decrease in oxygen contribution and food availability for many aquatic animals
Microalgae release oxygen during food production and serve as food for many aquatic animals.

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24. Which of the following correctly matches the microorganism with its application?

Microorganism	**Application**
P. Yeast	1. Curd formation
Q. Lactobacillus	2. Dough rising
R. Rhizobium	3. Increasing soil nitrogen

Choose the correct combination:
A. P–1, Q–2, R–3
B. P–2, Q–1, R–3
C. P–3, Q–2, R–1
D. P–2, Q–3, R–1
Answer: B. P–2, Q–1, R–3

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25. Three cells—P, Q and R—show the following characteristics:
- **P:** Cell membrane, cytoplasm, nucleus; no cell wall
- **Q:** Cell membrane, cytoplasm, cell wall, chloroplast
- **R:** Cell membrane, cytoplasm, cell wall; no well-defined nucleus

Which identification is most appropriate?
A. P–Plant, Q–Animal, R–Fungus
B. P–Animal, Q–Plant, R–Bacterium
C. P–Bacterium, Q–Animal, R–Plant
D. P–Fungus, Q–Bacterium, R–Animal
Answer: B. P–Animal, Q–Plant, R–Bacterium

Answer Key:

1-B | 2-C | 3-A | 4-B | 5-B | 6-C | 7-B | 8-C | 9-B | 10-C | 11-C | 12-A | 13-B | 14-C | 15-B | 16-D | 17-B | 18-B | 19-A | 20-B | 21-C | 22-B | 23-B | 24-B | 25-B

2.15 Best Practices Opportunity List from the Chapter: (8 Ideas)

Suggested "Best Practices" Opportunities:

No.	Best Practice	Suggested Classroom Implementation
1	🔬 **Microscope-Based Experiential Learning**	Give students hands-on opportunities to prepare and observe **onion peel, cheek cells, pond water and soil suspension**. Students can maintain an observation sheet with sketches, similarities and differences. The chapter specifically provides procedures for onion-peel and cheek-cell microscopy.
2	🧪 **Learning Through Controlled Experiments**	Use the chapter's experiments as **Prediction–Observation–Explanation (POE)** activities. For example, compare dough **with and without yeast**, or curd formation under **warm and cold conditions**. Students should predict the result before performing the experiment and scientifically explain the outcome afterward.
3	🌱 **Microbe-to-Manure Mini Project**	Create a small **classroom/school composting project** using fruit and vegetable peels, dry leaves and soil. Students can record changes weekly and connect their observations with decomposition, nutrient recycling, soil fertility and environmental sustainability.
4	🕵️ **"Microbe Detective" Inquiry Activity**	Give students unknown pictures/descriptions of **Amoeba, Paramecium, algae, fungi and bacteria** and ask teams to identify them using clues such as shape, movement, chlorophyll, filaments and cellular characteristics. This can develop observation, classification and scientific reasoning skills.
5	🍞 **Science from the Kitchen**	Ask students to investigate everyday microbial processes such as **bread/dough rising, curd formation, idli/dosa fermentation and food preservation**. This helps students realise that microbiology is part of their everyday life rather than merely textbook knowledge.
6	🌿 **School-Garden Rhizobium Investigation**	Students can examine roots of **beans, peas or other legumes** for root nodules and connect these observations with *Rhizobium*, nitrogen availability, crop rotation and reduced dependence on chemical fertilisers.
7	🧠 **Cell Structure–Function Challenge**	Instead of asking students simply to memorise cell parts, give them structures such as **nerve cells, muscle cells and cheek cells** and ask, "Why does this cell have this particular shape?" Students then connect structure with function. For example, the chapter explains how the elongated, branched structure of neurons helps them transmit messages.
8	🌍 **Microbes as Environmental Problem-Solvers**	Conduct a problem-solving session: **"How could microorganisms help us build a cleaner and more sustainable community?"** Teams can propose solutions involving composting, biogas, wastewater treatment, biofuels or pollution control. The chapter itself presents microbes as agents of decomposition and environmental cleanup.

Five strongest ideas for a lesson plan/teacher record
If you need to mention **only five Best Practices**, I suggest:

1. **Microscope-Based Experiential Learning**
2. **Prediction–Observation–Explanation (POE) Experiments**
3. **Microbe-to-Manure / Composting Project**
4. **Microbe Detective – Inquiry & Classification Activity**
5. **Science from the Kitchen – Fermentation-Based Learning**

These would make the chapter **activity-oriented, inquiry-based, experiential and connected to everyday life**, rather than limiting it to definitions and diagrams.

2.16 Innovations Opportunity List from the Chapter: (10 Ideas)

Innovative Teaching–Learning Ideas

No.	Innovation	How it can be implemented
1	📱 **Smartphone Microscope Innovation**	Create a simple low-cost microscope using a smartphone and suitable magnifying lens/foldable paper microscope. Students can capture enlarged images of onion peel, pond water or other specimens and build a **digital microscopic gallery**. The chapter itself introduces low-cost foldable paper microscopes.
2	🥽 **Virtual Microbiology Lab**	Use interactive simulations or virtual microscope activities before the actual laboratory session. Students can virtually explore **plant cells, animal cells, bacteria, fungi, Amoeba and Paramecium**, then compare the virtual images with their real microscope observations.
3	🤖 **AI as a "Microbe Detective"**	After observing or drawing an unknown microorganism, students can use a teacher-supervised AI tool to help generate possible identifications. They must then **verify the AI answer using textbook characteristics** such as shape, movement, chlorophyll and cellular structure rather than simply accepting the answer. The chapter provides observable characteristics for several microorganisms.
4	🦠 **DIY Microbe Investigation Station**	Set up different investigation stations—**pond water, soil suspension, onion cells, fermentation and decomposition**. Small groups rotate through the stations, observe, record evidence and finally present what they discovered. This transforms the classroom into a miniature research laboratory.
5	📷 **Time-Lapse Science Project**	Students photograph a controlled decomposition/composting setup at regular intervals and combine the pictures into a **time-lapse presentation** showing how organic waste changes over 2–3 weeks. They can relate the changes to microbial decomposition and nutrient recycling described in the chapter.
6	🧩 **Build-a-Cell 3D Challenge**	Teams create innovative **3D models of plant, animal and bacterial cells** using reusable/waste materials or simple digital 3D-design tools. Instead of merely labelling parts, each student must explain how a particular structure contributes to the functioning of the cell.

No.	Innovation	How it can be implemented
7	🎮 **"Journey of a Microbe" Gamified Learning**	Convert the chapter into a classroom game. Students become **bacteria, fungi, protozoa, algae or yeast** and earn points by solving challenges about habitat, structure, food production, fermentation, decomposition and environmental roles.
8	🌍 **Microbes for Sustainable Development – Innovation Challenge**	Give groups a real-world problem such as **food waste, polluted water, declining soil fertility or renewable energy** and ask them to design a microbe-based solution. This directly connects with the chapter's discussion of decomposition, biogas and microorganisms used to address environmental problems.
9	🍞 **"Microbiology in My Kitchen" Digital Investigation**	Students investigate **curd, idli/dosa batter, bread or dough** at home and prepare a short photo/video report explaining the microbial process involved. This directly applies the chapter's treatment of yeast and *Lactobacillus* in food preparation.
10	💡 **Young Scientist Innovation Pitch**	After completing the chapter, teams propose an invention titled **"How Can Microorganisms Solve a Problem in 2035?"** Ideas might involve waste management, agriculture, biofuel or water purification. Each team gives a 2-minute scientific pitch and classmates vote based on **scientific validity, creativity and usefulness**.

Best 5 to record under "Innovations"
For a formal lesson plan/academic observation record, I would select:
1. Smartphone/Foldable Microscope & Digital Microscopic Gallery
2. Virtual Microbiology Laboratory
3. AI-Assisted "Microbe Detective" Activity
4. Time-Lapse Microbial Decomposition Project
5. Microbes for Sustainable Development – Student Innovation Challenge
These five demonstrate genuine innovation through a combination of **digital technology, AI, experiential learning, student research, creativity and real-world problem-solving**, rather than simply converting conventional classroom activities into group work.

2.17: Practicing Questions/Question Bank

The chapter covers cells and their structures, levels of organisation, microorganisms, decomposition, fermentation, *Rhizobium*, microalgae, and applications of microbes.

A. Fill in the Blanks – 1 Mark Each

1. The basic unit of life is the ___________.
2. Robert Hooke first used the term ___________ while observing a thin slice of cork.
3. The outer boundary of a typical cell is called the ___________.
4. The jelly-like substance present between the cell membrane and nucleus is called ___________.
5. The ___________ regulates the activities and growth of a cell.
6. Plant cells have an additional outer covering called the ___________.
7. The green pigment present in chloroplasts is called ___________.

8. A group of similar cells forms a __________.
9. Organisms consisting of only one cell are called __________ organisms.
10. Tiny living organisms that cannot be seen with the naked eye are called __________.
11. Amoeba belongs to the group called __________.
12. Yeast belongs to the group of microorganisms called __________.
13. Bacteria do not have a well-defined nucleus; instead, they have a __________.
14. The process by which microorganisms break down complex waste into simpler substances is called __________.
15. The gas released by yeast that makes dough soft and fluffy is __________.
16. The bacterium involved in curd formation is __________.
17. __________ bacteria are found in the root nodules of legumes.
18. *Rhizobium* helps plants by trapping __________ from the air.
19. __________ is a microalga that is described as a superfood in the chapter.
20. Biogas contains a high proportion of __________ gas.

The questions on unicellular organisms, yeast, mould and the bacterial nucleoid directly reflect the chapter's treatment of cellular organisation.

B. One-Mark Questions

1. What is a cell?
2. Who first used the term “cell” in science?
3. Who is known as the Father of Microbiology?
4. Name the three basic parts of a typical cell.
5. State one function of the cell membrane.
6. What is the function of the nucleus?
7. What is the function of the cell wall in plant cells?
8. What are microorganisms?
9. Give one example of a unicellular microorganism.
10. Give one example of a multicellular fungus.
11. What is a nucleoid?
12. Name one protozoan found in pond water.
13. Name the microorganism used in making bread.
14. Which gas makes dough rise when yeast is added?
15. Name the bacterium involved in curd formation.
16. What is decomposition?

17. Name the bacteria present in the root nodules of legumes.
18. Mention one use of biogas.
19. Name any one useful microalga mentioned in the chapter.
20. Why are viruses different from other microorganisms?

C. Two-Mark Questions

1. Write any **two differences between plant cells and animal cells**.
2. State any **two functions of the cell membrane**.
3. What are unicellular and multicellular organisms? Give one example of each.
4. Why are nerve cells long and branched?
5. Why are muscle cells spindle-shaped?
6. Differentiate between a **cell and a tissue**.
7. Mention any two places where microorganisms are found.
8. Give two examples of beneficial uses of microorganisms.
9. How do fungi and bacteria help in the formation of manure?
10. Why does dough become soft and fluffy when yeast is added?
11. Why does curd form faster in warm conditions than in cold conditions?
12. What role does *Lactobacillus* play in curd formation?
13. How does *Rhizobium* help leguminous plants?
14. Mention any two ways in which microalgae are useful.
15. Give two differences between a bacterial cell and a typical plant/animal cell.

The chapter specifically connects cell shape with function—for example, branched neurons carry messages, while spindle-shaped muscle cells facilitate contraction and relaxation.

D. Three-Mark Questions

1. Explain the functions of **cell membrane, cytoplasm and nucleus**.
2. Give three differences between plant cells and animal cells.
3. Explain the sequence of levels of organisation in a multicellular organism:
   Cell → Tissue → Organ → Organ system → Organism.
4. Explain how the structure of a nerve cell helps it perform its function.
5. What are microorganisms? Classify them into any three major groups with examples.
6. Explain how microorganisms help in cleaning the environment.
7. Describe how fruit and vegetable waste is converted into manure.
8. Explain the role of yeast in bread making.
9. Describe the role of *Lactobacillus* in converting milk into curd.

10. Explain how *Rhizobium* improves soil fertility.
11. What are microalgae? Mention any two ways in which they are useful to humans or the environment.
12. Differentiate between **bacteria, fungi and algae** on the basis of any three characteristics.
13. Explain why a cell is considered the basic unit of life.
14. How are unicellular organisms different from multicellular organisms? Give suitable examples.
15. Explain three ways in which microorganisms are useful in our daily life.

The chapter emphasizes that bacteria and fungi break down plant waste into nutrient-rich manure, thereby recycling nutrients and cleaning the environment.

E. Five-Mark Descriptive Questions

1. **Draw a neat labelled diagram of a plant cell.** Label the cell wall, cell membrane, cytoplasm, nucleus, vacuole and chloroplast. Explain the functions of any four parts.
2. **Compare plant, animal and bacterial cells.** Write their similarities and differences with reference to cell membrane, cell wall, nucleus/nucleoid and chloroplast.
3. Explain the **levels of organisation in a living organism**, starting from a cell and ending with an organism. Give suitable examples.
4. Describe the **preparation and observation of an onion-peel slide under a microscope**. Mention the role of safranin and glycerin in the activity.
5. "**Microorganisms are important cleaners of nature.**" Explain the statement with reference to decomposition, manure formation and nutrient recycling.
6. Describe an experiment to demonstrate the **role of yeast in fermentation**. What observations would you expect, and why?
7. Explain the importance of microorganisms in food preparation with reference to **yeast and *Lactobacillus***.
8. Explain how microorganisms contribute to **agriculture and soil fertility**, with special reference to decomposition and *Rhizobium*.
9. Discuss the importance of **microalgae** to life on Earth. Include their role in oxygen production, aquatic food chains, water cleaning, biofuel and human use.
10. "**Microorganisms can help solve environmental problems.**" Justify this statement using examples of decomposition, biogas production and the use of bacteria to break down pollutants.

These higher-mark questions are strongly supported by the chapter's real-life applications: decomposition and nutrient recycling, fermentation, nitrogen enrichment by *Rhizobium*, and environmental roles of microalgae.

Particularly Good Competency-Based 5-Mark Question

A student prepares two bowls of dough. Yeast is added only to Bowl A. Both bowls are kept in a warm place for five hours. Bowl A becomes soft and fluffy, while Bowl B shows little change. Answer the following:

(a) Why did Bowl A become fluffy?
(b) Which gas was produced?
(c) To which group of microorganisms does yeast belong?
(d) Why was a warm condition provided?
(e) Mention one other food application of microorganisms.

This would be an excellent **CBSE-style competency/application question**, since the chapter itself uses a two-bowl experimental comparison to investigate the action of yeast.

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8th Standard Science Book Chapter 3

Chapter 3: Health: The Ultimate Treasure:

3.1 Summary of the Chapter:

(1) **Health is more than the absence of disease.** According to the chapter, true health includes **physical, mental, and social well-being**. A healthy person can work efficiently, cope with difficulties, maintain a positive mindset, and build good relationships.

(2) **Healthy living depends on good habits and surroundings.** Nutritious food, personal hygiene, regular exercise, proper sleep, limited screen time, relaxation, yoga, and avoiding harmful substances such as tobacco and alcohol are important for maintaining health.

(3) **A clean environment supports good health.** Clean air, safe water, sanitation, and hygienic surroundings reduce the chances of illness, while polluted and dirty environments can increase the risk of disease. Mental well-being is also supported by healthy relationships with family and friends.

(4) **Signs and symptoms help us recognise illness.** A **symptom** is something a person feels, such as pain, tiredness, or dizziness, whereas a **sign** is something that can be observed or measured, such as fever, rash, swelling, or high blood pressure.

(5) **Diseases are broadly of two types—communicable and non-communicable.** Communicable diseases are caused by pathogens such as bacteria, viruses, fungi, worms, and protozoa and can spread from one person to another. Non-communicable diseases such as diabetes, cancer, and asthma do not spread between people and are often linked to lifestyle, diet, nutrition, or environmental factors.

(6) **Communicable diseases spread in different ways.** Pathogens may spread through air, contaminated food and water, direct or indirect contact, and vectors such as mosquitoes and houseflies. Diseases such as common cold, chickenpox, tuberculosis, cholera, typhoid, malaria, and dengue illustrate these different modes of transmission.

(7) **Prevention of infectious diseases depends on hygiene and responsible behaviour.** Regular handwashing, covering the mouth and nose while coughing or sneezing, avoiding the sharing of personal items, keeping food and water clean, controlling mosquitoes, and staying home when unwell can help reduce disease transmission.

(8) **Immunity and vaccination protect the body from disease.** The immune system helps the body fight pathogens, while vaccines train the immune system to recognise harmful germs and develop acquired immunity. The chapter also discusses Edward Jenner's smallpox vaccine and India's earlier practice of variolation.

(9) **Antibiotics are useful only against bacterial infections.** They do not work against viruses or protozoa. Misuse, unnecessary use, or incomplete courses of antibiotics can lead to **antibiotic resistance**, making bacterial infections more difficult to treat.

(10) **Prevention, early diagnosis, and healthy lifestyle choices are central to disease control.** Communicable diseases can often be prevented through sanitation, vaccination, and hygiene, while non-communicable diseases can be managed or reduced through balanced diets, physical activity, stress management, regular care, and timely treatment.

3.2 Important Formulas:

Important Formulas for Quantitative Problems – Chapter 3

No.	Formula	Use
1	**Total = Sum of all observations**	Finding total cases, patients, etc.

No.	Formula	Use
2	**Average (Mean) = Sum of observations ÷ Number of observations**	Finding average number of disease cases per month
3	**Percentage = (Part ÷ Total) × 100**	Finding percentage of cases occurring in a particular month/period
4	**Percentage Increase = [(New Value − Original Value) ÷ Original Value] × 100**	Measuring increase in disease cases
5	**Percentage Decrease = [(Original Value − New Value) ÷ Original Value] × 100**	Measuring reduction in disease cases
6	**Change = New Value − Original Value**	Finding increase/decrease in cases between two periods
7	**Ratio = Quantity 1 : Quantity 2**	Comparing disease cases between two months/groups
8	**Rate = Number of events ÷ Time period**	Cases occurring per day, week, month, etc.
9	**Fraction of Total = Particular Number ÷ Total Number**	Expressing cases in a particular category as a fraction of total cases
10	**Range = Highest Value − Lowest Value**	Measuring variation between highest and lowest number of cases

Particularly Important for the Dengue Data
The chapter gives monthly dengue cases as **10, 12, 15, 18, 22, 40, 65, 65, 65, 30, 30, and 20** and asks students to construct and analyse a bar graph.
For this problem, students should especially know:
1. Total number of dengue cases

$$\text{Total Cases} = \sum \text{Monthly Cases}$$

2. Average monthly cases

$$\text{Average} = \frac{\text{Total Cases in 12 Months}}{12}$$

3. Percentage of annual cases in a month

$$\text{Percentage} = \frac{\text{Cases in that Month}}{\text{Total Annual Cases}} \times 100$$

4. Increase between two months

$$\text{Increase} = \text{Later Month Cases} - \text{Earlier Month Cases}$$

5. Percentage increase

$$\%\ \text{Increase} = \frac{\text{Increase}}{\text{Earlier Month Cases}} \times 100$$

6. Range

$$\text{Range} = \text{Maximum Monthly Cases} - \text{Minimum Monthly Cases}$$

Graph-related quantitative concept
For the chapter's bar-graph question:

- **X-axis → Months**
- **Y-axis → Number of dengue cases**
- A suitable scale should be selected, for example, **1 division = 10 cases**.
- The **highest value** represents the peak month(s), while the **lowest value** represents the month(s) with the fewest cases. The textbook specifically asks students to identify these and relate the peak to natural/environmental factors.

Note: Formulas such as BMI, incidence rate, prevalence rate, mortality rate, or vaccine efficacy are **not introduced in this chapter**, so I would not include them as required formulas unless you want to create **additional competency-based numerical problems beyond the textbook**.

3.3 Fill-Up the Blank LOTS type questions with Answers: (40 Questions)

Fill in the Blanks – LOTS Type

1. According to WHO, health is a state of complete physical, mental, and ________ well-being.
   Answer: social
2. Following a daily routine in Ayurveda is known as ________.
   Answer: dinacharya
3. Following a seasonal routine in Ayurveda is known as ________.
   Answer: ritucharya
4. The Air Quality Index is commonly abbreviated as ________.
   Answer: AQI
5. What we feel when we are unwell, such as pain or tiredness, is called a ________.
   Answer: symptom
6. Something that can be seen or measured, such as fever or rash, is called a ________.
   Answer: sign
7. A condition that affects the normal working of the body or mind is called a ________.
   Answer: disease
8. Disease-causing organisms are called ________.
   Answer: pathogens
9. Diseases that can spread from one person to another are called ________ diseases.
   Answer: communicable
10. Diseases that do not spread from one person to another are called ________ diseases.
    Answer: non-communicable
11. Insects such as mosquitoes and houseflies that spread pathogens are called ________.
    Answer: vectors
12. Common cold and influenza are caused by ________.
    Answer: viruses
13. Tuberculosis is caused by ________.
    Answer: bacteria
14. Tuberculosis mainly affects the ________.
    Answer: lungs
15. Hepatitis A mainly affects the ________.
    Answer: liver
16. Cholera is caused by ________.
    Answer: bacteria
17. Ascariasis is caused by ________.
    Answer: worms
18. Malaria is caused by a ________.
    Answer: protozoan
19. Dengue fever is caused by a ________.
    Answer: virus
20. Diseases caused by a lack of specific nutrients in the diet are called ________ diseases.
    Answer: deficiency
21. Diseases that persist for more than three months are referred to as ________ diseases.
    Answer: chronic

22. The natural ability of our body to fight diseases is known as ________.
    Answer: immunity
23. The special system in our body that helps fight diseases is called the ________ system.
    Answer: immune
24. Protection developed after exposure to a pathogen or a vaccine is known as ________ immunity.
    Answer: acquired
25. The traditional Indian method used to protect against smallpox was called ________.
    Answer: variolation
26. People who traditionally performed variolation in India were known as ________.
    Answer: teekedaars
27. The English doctor associated with the development of the first smallpox vaccine was ________.
    Answer: Edward Jenner
28. Vaccines are ________, not curative.
    Answer: preventive
29. Medicines that kill disease-causing bacteria are called ________.
    Answer: antibiotics
30. Antibiotics do not work against infections caused by ________.
    Answer: viruses
31. The first antibiotic, penicillin, was discovered by ________.
    Answer: Alexander Fleming
32. Penicillin was discovered in the year ________.
    Answer: 1928
33. The ability of bacteria to survive and multiply despite treatment with an antibiotic is called antibiotic ________.
    Answer: resistance
34. Antibiotics should be taken only when prescribed by a ________.
    Answer: doctor
35. Kamal Ranadive studied how hormones and certain viruses are linked to ________.
    Answer: cancer
36. Maharaj Kishan Bhan played a key role in developing the ________ vaccine.
    Answer: Rotavirus
37. The Rotavirus vaccine protects children from ________.
    Answer: diarrhoea
38. Keeping our surroundings clean and practising basic ________ can help prevent communicable diseases.
    Answer: hygiene
39. Yoga and simple breathing exercises such as ________ can be practised regularly for a healthy lifestyle.
    Answer: pranayama
40. Diabetes, cancer, and asthma are examples of ________ diseases.
    Answer: non-communicable

3.4 Fill-Up the Blank HOTS type questions with Answers: (35 Questions)

HOTS – Fill in the Blanks

1. Rohan eats nutritious food and exercises regularly but constantly feels lonely and stressed. According to the WHO concept of health, his ________ and social well-

being may be affected.
Answer: mental

2. A student spends several hours every night on a mobile phone and consequently does not get adequate sleep. To improve health, the student should reduce ________ time.
Answer: screen
3. Two children live in the same environment, but one falls sick more frequently than the other. A possible difference between them could be their level of ________.
Answer: immunity
4. A child has pain in the body, while the doctor records a high body temperature. In this case, pain is a symptom, whereas high body temperature is a ________.
Answer: sign
5. A playground has stagnant water, garbage, and many mosquitoes. Children living nearby may have a greater risk of contracting ________ or dengue.
Answer: malaria
6. If stagnant water around houses is regularly removed, the spread of mosquito-borne diseases is likely to ________.
Answer: decrease
7. A family travelling to an area where malaria is common should carry mosquito nets and ________ to reduce the risk of infection.
Answer: repellents
8. A person develops fever, headache, muscle pain, and joint pain after being repeatedly bitten by mosquitoes. Based on the symptoms and mode of transmission, the suspected disease could be ________.
Answer: dengue fever
9. If several students with influenza continue coughing and sneezing in a crowded classroom without covering their mouths, the disease is likely to spread through the ________.
Answer: air
10. During a flu outbreak, asking infected students to stay at home can protect others because it reduces the chances of disease ________.
Answer: transmission
11. If drinking water becomes contaminated and several people develop severe diarrhoea and dehydration, the likely disease is ________.
Answer: cholera
12. If a community starts using clean toilets and reduces open defecation, cases of diarrhoea and infections are expected to ________.
Answer: decrease
13. A person eats processed and sugary foods frequently and rarely exercises. Such a lifestyle may increase the risk of developing a ________ disease such as diabetes.
Answer: non-communicable
14. If a disease continues for more than three months and requires long-term management, it can be classified as a ________ disease.
Answer: chronic
15. A child who lacks specific essential nutrients for a long period may develop a ________ disease rather than an infectious disease.
Answer: deficiency
16. If a vaccinated person encounters the corresponding pathogen later, the immune system can recognise and attack it because vaccination develops ________ immunity.
Answer: acquired

17. When the body encounters the same pathogen for a second time, its immune response is generally ________ than during the first exposure.
Answer: stronger
18. A healthy student takes a vaccine expecting it to protect against a future infection. This is appropriate because vaccines are ________ rather than curative.
Answer: preventive
19. If most people in a community are vaccinated against a particular infectious disease, its spread through the community is likely to ________.
Answer: decrease
20. A patient suffering from influenza demands antibiotics. The doctor may refuse because influenza is caused by a ________, against which antibiotics do not work.
Answer: virus
21. A person stops taking prescribed antibiotics as soon as they feel better instead of completing the prescribed duration. Such misuse can contribute to antibiotic ________.
Answer: resistance
22. When antibiotics kill susceptible bacteria but resistant bacteria survive and multiply, the proportion of ________ bacteria increases.
Answer: resistant
23. If antibiotics are used unnecessarily and repeatedly in a community, bacterial infections may eventually become more difficult to ________.
Answer: treat
24. To slow down antibiotic resistance, antibiotics should be taken in the correct dose and for the correct ________ as prescribed by a doctor.
Answer: duration
25. A doctor does not prescribe an antibiotic for malaria even though the patient has an infection. This is because malaria is caused by a ________, not bacteria.
Answer: protozoan
26. If a city experiences increasing air pollution from vehicles and factories, respiratory problems such as coughing and ________ may become more common.
Answer: asthma
27. A person who eats well and lives in clean surroundings may still not experience complete health if they are continuously lonely and upset because health also includes ________ well-being.
Answer: mental
28. If people wash their hands, cover their mouths while coughing, avoid sharing personal items, and keep their surroundings clean, the spread of ________ diseases can be reduced.
Answer: communicable
29. The dengue data given in the chapter show the highest number of cases—65 each—in July, August, and September. A reasonable preventive strategy would therefore be to control mosquito ________ before and during these peak months.
Answer: breeding
30. If unhealthy eating, lack of exercise, and obesity continue to increase in a population, the occurrence of lifestyle-related diseases such as diabetes is likely to ________.
Answer: increase
31. A child vaccinated against a disease may respond more effectively when exposed to its pathogen later because the vaccine has already ________ the immune system to recognise the pathogen.
Answer: trained

32. If people with an infectious disease stay at home while unwell, they not only recover but also minimise the ________ of the disease to others.
    Answer: spread
33. If antibiotics are prescribed for a bacterial infection but the patient takes an incomplete dose, some bacteria may survive and develop ________.
    Answer: resistance
34. If mosquito breeding increases during the rainy season, the number of dengue cases may also ________.
    Answer: increase
35. A person may be free from disease but still cannot be considered completely healthy if their physical, mental, and ________ well-being are not maintained.
    Answer: social

These questions are **HOTS-oriented despite being fill-in-the-blank**, because students must first interpret the situation, identify cause-and-effect relationships, and then apply the appropriate chapter concept to determine the missing word.

3.5 One-mark questions with Answers of LOTS Type: (35 Questions)

1. **What is health according to the World Health Organization (WHO)?**
   Answer: Health is a state of complete physical, mental, and social well-being and not merely the absence of disease.
2. **Mention any two habits that help us stay healthy.**
   Answer: Eating a balanced diet and exercising regularly help us stay healthy.
3. **Why is adequate sleep important for good health?**
   Answer: Adequate sleep helps the body and mind to rest and recover.
4. **What is a disease?**
   Answer: A disease is a condition that affects the normal working of the body or mind.
5. **What is a symptom?**
   Answer: A symptom is something a person feels when unwell, such as pain, tiredness, or dizziness.
6. **What is a sign of disease?**
   Answer: A sign is something that can be seen or measured, such as fever, rash, or swelling.
7. **What are pathogens?**
   Answer: Pathogens are disease-causing organisms such as bacteria, viruses, fungi, worms, and protozoa.
8. **What are communicable diseases?**
   Answer: Communicable diseases are diseases caused by pathogens that can spread from one person to another.
9. **Give any two examples of communicable diseases.**
   Answer: Typhoid and dengue are examples of communicable diseases.
10. **What are non-communicable diseases?**
    Answer: Non-communicable diseases are diseases that are not caused by pathogens and do not spread from one person to another.
11. **Give any two examples of non-communicable diseases.**
    Answer: Diabetes and asthma are examples of non-communicable diseases.
12. **What are vectors?**
    Answer: Vectors are organisms such as mosquitoes and houseflies that spread disease-causing pathogens.

13. **How do common cold and influenza spread?**
    Answer: Common cold and influenza mainly spread through the air from an infected person.
14. **Name the causal agent of tuberculosis.**
    Answer: Tuberculosis is caused by bacteria.
15. **Which organ is mainly affected by tuberculosis?**
    Answer: Tuberculosis mainly affects the lungs.
16. **Name the causal agent of malaria.**
    Answer: Malaria is caused by a protozoan.
17. **Mention one preventive measure against malaria.**
    Answer: Using mosquito nets is one preventive measure against malaria.
18. **What causes dengue fever?**
    Answer: Dengue fever is caused by a virus.
19. **Mention any one symptom of dengue fever.**
    Answer: Fever is a common symptom of dengue fever.
20. **What are deficiency diseases?**
    Answer: Deficiency diseases are diseases caused by a lack of specific nutrients in the diet.
21. **What are chronic diseases?**
    Answer: Diseases that persist for a long time, usually more than three months, are called chronic diseases.
22. **Mention any two factors that may contribute to diabetes.**
    Answer: Unhealthy eating habits and lack of physical activity may contribute to diabetes.
23. **What is immunity?**
    Answer: Immunity is the natural ability of our body to fight diseases.
24. **What is the function of the immune system?**
    Answer: The immune system helps the body fight against diseases.
25. **What is acquired immunity?**
    Answer: Acquired immunity is protection developed after exposure to a pathogen or a vaccine.
26. **What is the main function of a vaccine?**
    Answer: A vaccine trains the immune system to recognise and attack harmful germs.
27. **Who discovered the first vaccine?**
    Answer: Edward Jenner discovered the first vaccine against smallpox.
28. **What was variolation?**
    Answer: Variolation was a traditional method of using material from a smallpox sore to create a mild infection and build immunity.
29. **What are antibiotics?**
    Answer: Antibiotics are medicines that kill bacteria responsible for bacterial infections.
30. **Why are antibiotics not effective against viral infections?**
    Answer: Antibiotics are not effective against viruses because they specifically target parts of bacterial cells.
31. **Who discovered penicillin?**
    Answer: Alexander Fleming discovered penicillin in 1928.
32. **What is antibiotic resistance?**
    Answer: Antibiotic resistance is a condition in which bacteria survive and multiply despite treatment with an antibiotic.

33. **How should antibiotics be used to reduce antibiotic resistance?**
    Answer: Antibiotics should be taken only when prescribed by a doctor, in the correct dose and for the prescribed duration.
34. **What is the role of sanitation in preventing diseases?**
    Answer: Good sanitation helps reduce the spread of communicable diseases.
35. **Why should we cover our mouth and nose while coughing or sneezing?**
    Answer: Covering the mouth and nose helps prevent the spread of pathogens to other people.

3.6 One-mark questions with Answers of HOTS Type: (35 Questions)

1. **Ravi eats nutritious food but always feels lonely and stressed; can he be considered completely healthy? Why?**
   Answer: No, because complete health includes mental and social well-being along with physical well-being.
2. **A student spends several hours on a mobile phone every night and sleeps very late; how might this habit affect health?**
   Answer: Excessive screen time and inadequate sleep may negatively affect both physical and mental well-being.
3. **Why might a person living in a polluted area fall sick more often even if they maintain personal hygiene?**
   Answer: Polluted surroundings may expose the person to harmful substances and disease-causing organisms.
4. **A person has a high body temperature but does not complain of pain; is the high temperature a sign or a symptom? Why?**
   Answer: It is a sign because body temperature can be observed and measured.
5. **Two people live in the same environment, but one falls sick more frequently; what could explain this difference?**
   Answer: Their ability to fight disease may differ because individuals can have different levels of immunity.
6. **Why should a person with flu cover the mouth and nose while coughing or sneezing?**
   Answer: Covering the mouth and nose reduces the spread of pathogen-containing droplets to other people.
7. **If several students in a class develop flu, what immediate step could help prevent further spread?**
   Answer: Infected students should stay at home and follow proper hygiene to minimise transmission.
8. **Why can sharing a towel with an infected person increase the risk of disease?**
   Answer: The towel may carry pathogens from the infected person and transmit them indirectly to another person.
9. **Why are mosquito nets useful in preventing both malaria and dengue?**
   Answer: Mosquito nets prevent mosquito bites and thereby reduce the transmission of pathogens causing malaria and dengue.
10. **A neighbourhood has many containers filled with stagnant rainwater; what health risk can you predict?**
    Answer: Mosquito breeding may increase and raise the risk of mosquito-borne diseases such as dengue.

11. **Why might dengue cases increase during and after the monsoon season?**
Answer: Rainwater can collect in stagnant pools and containers that provide breeding sites for mosquitoes.
12. **If drinking water becomes contaminated with disease-causing organisms, which type of diseases is likely to increase?**
Answer: Water-borne communicable diseases such as cholera, typhoid, and hepatitis A are likely to increase.
13. **Why can improving sanitation in a community reduce cases of diarrhoea and infections?**
Answer: Better sanitation reduces contamination and limits the transmission of disease-causing pathogens.
14. **A child frequently eats processed food and rarely exercises; what long-term health risk may increase?**
Answer: Such a lifestyle may increase the risk of non-communicable diseases such as obesity and diabetes.
15. **Why can regular exercise help in preventing some non-communicable diseases?**
Answer: Regular exercise supports a healthy body weight and reduces lifestyle-related health risks.
16. **A person with diabetes takes medicine but continues an unhealthy lifestyle; why may disease management become difficult?**
Answer: Managing non-communicable diseases often requires lifestyle changes along with medication and continuous care.
17. **Why is early diagnosis especially useful in managing chronic diseases?**
Answer: Early diagnosis helps control disease progression and reduces the risk of complications.
18. **A student takes an antibiotic whenever they develop a common cold; why is this practice incorrect?**
Answer: Antibiotics do not cure the common cold because they act against bacteria and not viruses.
19. **Why should antibiotics be taken only when prescribed by a doctor?**
Answer: Unnecessary use of antibiotics can promote the development of antibiotic-resistant bacteria.
20. **What may happen if a patient stops taking prescribed antibiotics before completing the recommended course?**
Answer: Some bacteria may survive and contribute to the development of antibiotic resistance.
21. **Why is antibiotic resistance considered a serious public health problem?**
Answer: Antibiotic resistance makes common bacterial infections harder to treat and increases the risk of complications.
22. **A person suffering from influenza asks a doctor for antibiotics; why might the doctor refuse?**
Answer: The doctor may refuse because influenza is caused by a virus and antibiotics work only against bacterial infections.
23. **Why can vaccination protect a person even before they encounter the actual disease-causing pathogen?**
Answer: Vaccination trains the immune system to recognise and respond to the pathogen before a future infection.
24. **Why does the body generally respond more strongly when it encounters the same pathogen again?**

Answer: Previous exposure develops acquired immunity that enables the immune system to respond more effectively to the pathogen.

25. **Why does vaccination protect not only the vaccinated person but also people around them?**
Answer: Vaccination reduces the chance of infection spreading from the vaccinated person to others.
26. **Why can vaccines prevent diseases but not normally cure an infection that has already developed?**
Answer: Vaccines prepare the immune system before disease occurs rather than treating an existing infection.
27. **What conclusion could Edward Jenner draw after observing that milkmaids who had cowpox did not develop smallpox?**
Answer: Jenner could infer that exposure to cowpox provided protection against smallpox.
28. **Why did mass vaccination contribute to the eradication of smallpox?**
Answer: Mass vaccination reduced the number of susceptible people and interrupted the spread of smallpox.
29. **If a school wants to reduce both communicable and non-communicable diseases, why should its health programme include both hygiene and exercise?**
Answer: Hygiene helps prevent infectious diseases while exercise helps reduce the risk of lifestyle-related diseases.
30. **Why is the statement "A person without any disease is always healthy" incorrect?**
Answer: A person may be free from disease but still have poor mental or social well-being.
31. **Why should people avoid areas with stagnant water during a dengue outbreak?**
Answer: Stagnant water provides breeding sites for mosquitoes that can transmit the dengue virus.
32. **If two diseases have similar symptoms, why should a person avoid self-medication?**
Answer: Similar symptoms can have different causes, so proper diagnosis is necessary before choosing treatment.
33. **Why is prevention often considered better than cure in the case of communicable diseases?**
Answer: Preventive measures can stop infection and transmission before disease develops or spreads to others.
34. **How can maintaining a health diary help a student improve health?**
Answer: A health diary can reveal unhealthy patterns in diet, exercise, sleep, screen time, hygiene, and emotional well-being.
35. **A city improves its air quality but ignores water sanitation; why might its population still face health problems?**
Answer: Contaminated water can still transmit pathogens and cause communicable diseases even when the air is clean.

3.7 Two-mark questions with Answers of LOTS Type: (30 Questions)

1. **What is health? Mention its three main aspects.**
Answer: Health is a state of complete well-being and not merely the absence of disease. Its three main aspects are **physical, mental, and social well-being**.

2. **Mention any two habits that help us stay healthy.**
   Answer: We should eat a healthy and balanced diet and exercise regularly. We should also maintain personal hygiene and get enough sleep.
3. **What is meant by a healthy lifestyle? Give two examples.**
   Answer: A healthy lifestyle consists of habits that support the proper functioning of our body and mind. Eating a balanced diet and staying physically active are examples of a healthy lifestyle.
4. **Mention two unhealthy habits that should be avoided.**
   Answer: Spending too much time on mobile phones or digital screens is an unhealthy habit. Eating junk food regularly and sleeping very late should also be avoided.
5. **Why is a clean environment important for good health?**
   Answer: A clean environment reduces our exposure to pollution, flies, mosquitoes, and other health hazards. Clean air and water also help us remain healthy and prevent health problems.
6. **What are symptoms and signs of a disease? Give one example of each.**
   Answer: A symptom is something a sick person feels, such as pain or tiredness. A sign is something that can be seen or measured, such as fever or a rash.
7. **What is a disease? Mention any two causes of diseases.**
   Answer: A disease is a condition that affects the normal working of the body or mind. Diseases may be caused by pathogens, poor nutrition, or an unhealthy lifestyle.
8. **What are pathogens? Give two examples.**
   Answer: Pathogens are disease-causing organisms that can cause communicable diseases. Bacteria and viruses are two examples of pathogens.
9. **Differentiate between communicable and non-communicable diseases.**
   Answer: Communicable diseases are caused by pathogens and can spread from one person to another. Non-communicable diseases do not spread from person to person and are often associated with lifestyle, diet, or environmental factors.
10. **Name any two communicable diseases and two non-communicable diseases.**
    Answer: Typhoid and dengue are examples of communicable diseases. Diabetes and asthma are examples of non-communicable diseases.
11. **Mention any two ways by which communicable diseases spread.**
    Answer: Communicable diseases can spread through air when an infected person coughs or sneezes. They can also spread through contaminated food or water, direct contact, or disease-carrying insects.
12. **What are vectors? Give two examples.**
    Answer: Vectors are organisms such as insects that carry and transmit disease-causing pathogens. Mosquitoes and houseflies are common examples of vectors.
13. **Mention two measures to prevent the spread of common cold and influenza.**
    Answer: We should wash our hands frequently and avoid sharing personal items. We should also cover our mouth and nose using a mask when necessary.
14. **State two symptoms and two preventive measures of tuberculosis (TB).**
    Answer: Cough, fever, fatigue, loss of appetite, and night sweats are common symptoms of TB. Avoiding close contact with infected people, maintaining hygiene, covering the mouth and nose, and vaccination help prevent it.
15. **Mention the cause and two symptoms of cholera.**
    Answer: Cholera is caused by bacteria and mainly affects the intestine. Its major symptoms include diarrhoea and dehydration.
16. **Mention the cause and two symptoms of typhoid.**
    Answer: Typhoid is caused by bacteria and affects the intestine. Its symptoms include headache, abdominal discomfort, fever, and diarrhoea.

17. **What causes malaria? Mention two symptoms of malaria.**
Answer: Malaria is caused by a protozoan pathogen and is transmitted by mosquitoes. High fever, profuse sweating, and periodic chills are common symptoms of malaria.
18. **Mention any two measures to prevent dengue.**
Answer: Mosquito nets and repellents can be used to prevent mosquito bites. Mosquito breeding should be controlled by avoiding stagnant or still water around homes.
19. **What are deficiency diseases? Give two examples.**
Answer: Deficiency diseases are caused by the lack of specific nutrients in the diet and are non-communicable. Scurvy and anaemia are examples of deficiency diseases.
20. **What are chronic diseases? Give two examples.**
Answer: Diseases that persist for a long period, usually more than three months, are called chronic diseases. Diabetes and cancer are examples of diseases that may persist for a long time.
21. **Mention any two factors that may contribute to diabetes.**
Answer: Unhealthy eating habits and lack of physical activity can contribute to diabetes. Being overweight or obese and hormonal imbalances can also increase its occurrence.
22. **What is immunity? What is the role of the immune system?**
Answer: Immunity is the natural ability of our body to fight diseases. The immune system helps protect the body by fighting against disease-causing organisms.
23. **What is a vaccine? How does it protect our body?**
Answer: A vaccine is a preparation that helps protect us from certain infectious diseases. It trains the immune system to recognise and attack harmful pathogens, thereby developing acquired immunity.
24. **What is acquired immunity? How can it develop?**
Answer: Acquired immunity is protection developed by the body against a particular pathogen. It develops after exposure to a pathogen or through vaccination.
25. **Who was Edward Jenner? What was his contribution to medicine?**
Answer: Edward Jenner was an English doctor who observed that people who had cowpox did not get smallpox. His work led to the development of the first vaccine and helped protect people against smallpox.
26. **What was variolation? Who were teekedaars?**
Answer: Variolation was a traditional Indian practice in which material from a smallpox sore was used to create a mild infection and build immunity. People who performed this practice were known as **teekedaars**.
27. **State any two benefits of vaccination.**
Answer: Vaccination helps prevent serious illnesses and reduces the spread of infections. It protects vaccinated individuals as well as people around them.
28. **What are antibiotics? Against which type of infections do they work?**
Answer: Antibiotics are medicines that kill bacteria responsible for certain diseases. They work against bacterial infections but not against viruses or diseases caused by protozoa.
29. **Who discovered penicillin? How was it discovered?**
Answer: Penicillin was discovered by Alexander Fleming in 1928. He observed that a mould growing on a discarded petri dish stopped harmful bacteria from growing.
30. **What is antibiotic resistance? How can it be prevented?**
Answer: Antibiotic resistance occurs when bacteria survive and multiply despite treatment with an antibiotic that previously killed them. It can be reduced by using

antibiotics only when prescribed by a doctor and taking the correct dose for the prescribed duration.

3.8. Two-mark questions with Answers of HOTS Type: (25 Questions)

1. **A student eats nutritious food but sleeps very little and remains stressed. Can the student be considered completely healthy? Justify.**
   Answer: No, good health includes physical, mental, and social well-being, not merely proper nutrition or absence of disease. Lack of sleep and continuous stress can negatively affect both the body and mind.
2. **A child spends most of the free time on a mobile phone instead of playing outdoors. Predict two possible effects on the child's health.**
   Answer: Excessive screen time may reduce physical activity and interfere with adequate rest and sleep. It may also affect mental well-being by reducing interaction with family, friends, and nature.
3. **Two playgrounds are available—one is clean and well-maintained, while the other has garbage, flies, and mosquitoes. Which one should you choose and why?**
   Answer: I would choose the clean and well-maintained playground because it provides a healthier environment. The dirty playground may encourage flies and mosquitoes and increase the chances of illness.
4. **A person has no physical illness but constantly feels lonely and unhappy. Would you consider the person completely healthy? Give reasons.**
   Answer: No, complete health also requires mental and social well-being. Loneliness and unhappiness can affect mental health even when a person has no physical disease.
5. **Your friend has fever and headache. Explain why these observations alone may not be enough to identify the exact disease.**
   Answer: Similar signs and symptoms can occur in several different diseases, so they may not reveal the exact cause. A proper diagnosis is necessary to identify the disease and decide the appropriate treatment.
6. **Why is knowing whether a disease is communicable or non-communicable useful in preventing it?**
   Answer: Communicable diseases require measures that prevent pathogens from spreading between people. Non-communicable diseases are often better prevented or managed through healthy lifestyle, diet, exercise, and environmental changes.
7. **During a flu outbreak, a student continues to attend school while coughing and sneezing. What problems could this cause, and what should the student do?**
   Answer: The student may spread the virus through the air and infect classmates. The student should stay home, rest, cover the mouth and nose, and practise good hygiene to minimise transmission.
8. **A family drinks untreated water during a journey. Which type of diseases may they become more vulnerable to, and why?**
   Answer: They may become vulnerable to diseases such as cholera, typhoid, or Hepatitis A. These diseases can spread through contaminated food or drinking water.
9. **Your neighbourhood has many containers filled with stagnant rainwater. Why should they be emptied immediately?**
   Answer: Stagnant water can encourage mosquito breeding and thereby increase the risk of mosquito-borne diseases. Removing such breeding sites can help prevent diseases such as dengue and malaria.
10. **Malaria and dengue are both transmitted by mosquitoes. Does this mean that they are caused by the same pathogen? Explain.**

Answer: No, malaria is caused by a protozoan, whereas dengue is caused by a virus. Mosquitoes act as vectors that transmit these different pathogens.

11. **Why might a person who frequently eats processed food and does very little exercise be at greater risk of non-communicable diseases?**
    Answer: Unhealthy diet and lack of physical activity are lifestyle factors associated with diseases such as diabetes and obesity. Adopting a balanced diet and regular physical activity can help reduce such risks.
12. **A village improves sanitation and reduces open defecation. Predict how this could affect the health of the community.**
    Answer: Improved sanitation can reduce contamination and thereby decrease the spread of communicable diseases. The chapter's Odisha case study reports fewer cases of diarrhoea and infections following improved sanitation.
13. **Why may two people living in the same environment differ in how frequently they fall sick?**
    Answer: Their ability to fight disease may differ because immunity varies between individuals. A stronger or better-prepared immune system can provide greater protection against harmful pathogens.
14. **Why does vaccination before getting a disease help more than taking a vaccine after becoming sick?**
    Answer: Vaccines train the immune system to recognise and attack particular harmful germs before serious infection develops. They are primarily **preventive rather than curative** and do not treat an illness once a person is already sick.
15. **A vaccinated person says, "Vaccination protects only me, so my vaccination status does not matter to others." Evaluate this statement.**
    Answer: The statement is incorrect because vaccination helps reduce the spread of infections in addition to protecting the vaccinated person. Therefore, getting vaccinated can also contribute to protecting people around us.
16. **A student takes antibiotics whenever they develop a cold or flu. Why is this practice scientifically incorrect?**
    Answer: Cold and flu are viral infections, whereas antibiotics work only against bacterial infections. Unnecessary use of antibiotics can also contribute to antibiotic resistance.
17. **A patient stops taking prescribed antibiotics as soon as they start feeling better. Why can this be harmful?**
    Answer: Incorrect or incomplete antibiotic use can allow resistant bacteria to survive and multiply. Antibiotics should therefore be taken in the correct dose and for the duration prescribed by a doctor.
18. **Why is antibiotic resistance considered a threat not only to an individual but also to the community?**
    Answer: Resistant bacteria can spread from infected individuals to other people in the community. This makes common infections harder to treat and increases the risk of prolonged illness and complications.
19. **Alexander Fleming noticed that bacteria did not grow near a mould in a petri dish. Why was this observation scientifically important?**
    Answer: Fleming inferred that the mould was releasing a substance capable of killing or stopping the growth of bacteria. This observation eventually led to the discovery of penicillin, the first antibiotic used to treat bacterial infections.
20. **Edward Jenner observed that milkmaids who had cowpox did not develop smallpox. What conclusion could he draw from this observation?**
    Answer: Jenner hypothesised that exposure to cowpox could provide protection

against smallpox because the two viruses were related. His experiments supported this idea and contributed to the development of the smallpox vaccine.

21. **Why does the immune system respond more strongly when it encounters the same pathogen for a second time?**
    Answer: After the first exposure, the body develops acquired immunity and learns to recognise the particular pathogen. On later exposure, the immune system can recognise and attack it more effectively.
22. **Why can a community health campaign sometimes prevent more illnesses than treating individual patients after they become sick?**
    Answer: Community measures such as sanitation and hygiene can reduce exposure to pathogens and interrupt disease transmission before infection occurs. Thus, preventive action can protect many people simultaneously and reduce the number who require treatment.
23. **Dengue cases increase sharply during and after the rainy season. Suggest a possible reason for this pattern.**
    Answer: Rain can create collections of still water that provide suitable breeding places for mosquitoes. An increase in mosquito populations can consequently increase the transmission of dengue.
24. **Why is early diagnosis especially important for chronic non-communicable diseases?**
    Answer: Chronic diseases can continue for long periods and may require continuous management. Early diagnosis and regular care can help control disease progression and prevent complications.
25. **"Prevention is better than cure." Justify this statement using examples from the chapter.**
    Answer: Measures such as vaccination, sanitation, personal hygiene, safe drinking water, and mosquito control can prevent many communicable diseases before they occur. Healthy eating, regular exercise, and other lifestyle changes can also help reduce the risk of several non-communicable diseases.

3.9. Three-mark questions with Answers of LOTS Type: (22 Questions)

1. What are the three main aspects of health?
Answer:
1. **Physical health** refers to the proper functioning and well-being of our body.
2. **Mental health** refers to emotional well-being and maintaining a positive state of mind.
3. **Social health** refers to maintaining healthy relationships and adjusting well with others in society.

2. Mention any three healthy habits that help us maintain a healthy lifestyle.
Answer:
1. We should eat a balanced diet containing plenty of fruits, vegetables, and whole grains.
2. We should remain physically active through walking, running, cycling, outdoor games, or regular exercise.
3. We should get enough sleep and practise activities such as yoga or pranayama regularly.

3. Mention three unhealthy habits that should be avoided for good health.
Answer:
1. Spending too much time on mobile phones and other digital screens should be avoided.
2. Eating fast food and junk food every day is harmful to our health.
3. Sleeping very late, getting insufficient sleep, and skipping meals are unhealthy habits.

4. What are signs and symptoms of a disease? Give examples.

Answer:

1. A **symptom** is something that a sick person feels, such as pain, tiredness, or dizziness.
2. A **sign** is something that can be seen or measured, such as fever, rash, swelling, or high blood pressure.
3. Signs and symptoms help doctors understand what may be making a person unwell.

5. What are pathogens? Name the different types of pathogens mentioned in the chapter.

Answer:

1. Pathogens are disease-causing organisms that can cause communicable diseases.
2. Bacteria, viruses and fungi are some common types of pathogens.
3. Worms and protozoa can also act as disease-causing organisms.

6. What are communicable diseases? Give examples.

Answer:

1. Communicable diseases are diseases caused by pathogens.
2. They can spread from an infected person to another person through different modes of transmission.
3. Typhoid, dengue, flu, chickenpox and COVID-19 are examples of communicable diseases.

7. What are non-communicable diseases? Give examples.

Answer:

1. Non-communicable diseases are diseases that are not caused by pathogens and do not spread from one person to another.
2. They are usually associated with factors such as lifestyle, diet and environment.
3. Cancer, diabetes and asthma are examples of non-communicable diseases.

8. Mention three ways through which communicable diseases can spread.

Answer:

1. Some communicable diseases spread through air when an infected person coughs or sneezes.
2. They can spread through contaminated food or drinking water.
3. They can also spread through direct or indirect contact and through vectors such as mosquitoes and houseflies.

9. Mention three preventive measures against common cold and influenza.

Answer:

1. Wash hands frequently to reduce the transmission of pathogens.
2. Avoid sharing personal items with an infected person.
3. Cover the mouth and nose, including by using a mask when appropriate.

10. Describe three measures to prevent diseases spread through contaminated food and water.

Answer:

1. Maintain good personal hygiene and proper sanitary habits.
2. Consume properly cooked and hygienically prepared food.
3. Drink boiled or otherwise safe drinking water to reduce the risk of infection.

11. Mention three measures to prevent mosquito-borne diseases such as malaria and dengue.

Answer:

1. Use mosquito nets and mosquito repellents to prevent mosquito bites.
2. Wear long-sleeved clothes to reduce exposure to mosquitoes.
3. Control mosquito breeding around homes and avoid areas with stagnant or still water.

12. What are deficiency diseases? Explain with three points.

Answer:

1. Deficiency diseases are caused by the lack of specific nutrients in the diet.

2. They are classified as non-communicable diseases because they do not spread from one person to another.
3. The chapter mentions scurvy, anaemia and goitre as examples of diseases associated with nutritional deficiency.

13. What is diabetes? Mention some factors that may contribute to its development.

Answer:

1. Diabetes is a common non-communicable disease that is becoming more prevalent among both adults and children.
2. Hormonal imbalances and unhealthy eating habits can contribute to its development.
3. Lack of physical activity and being overweight or obese are also associated with the development of diabetes.

14. What is immunity? How does the immune system protect us?

Answer:

1. Immunity is the natural ability of our body to fight diseases.
2. The body has a special defence system called the **immune system**, which helps fight diseases.
3. Vaccines can train the immune system to recognise and attack particular harmful germs.

15. What are vaccines? How do they help us?

Answer:

1. Vaccines are preparations that help protect us from serious infections caused by viruses and bacteria.
2. They train the immune system to recognise and attack harmful germs and thereby provide acquired immunity.
3. Vaccines help prevent illness, reduce the spread of infections, and protect both vaccinated people and those around them.

16. Describe Edward Jenner's contribution to vaccination.

Answer:

1. Edward Jenner observed that people who had contracted cowpox did not develop smallpox.
2. His work showed that exposure to cowpox could provide protection against the deadly disease smallpox.
3. This discovery led to the development of the first vaccine and eventually contributed to the worldwide eradication of smallpox.

17. What are antibiotics? State their role in treating diseases.

Answer:

1. Antibiotics are medicines used to kill bacteria that cause certain infectious diseases.
2. They act on parts of bacterial cells that are different from human or other animal cells.
3. Antibiotics do not work against viruses or diseases caused by protozoa.

18. Describe the discovery of penicillin.

Answer:

1. Penicillin was discovered in **1928 by Alexander Fleming**, a bacteriologist from London.
2. He observed that a mould growing on a discarded petri dish stopped harmful bacteria from growing.
3. He realised that the mould released a bacteria-killing substance, leading to the discovery of penicillin, the first antibiotic used to treat bacterial infections.

19. What is antibiotic resistance? Why is it a concern?

Answer:

1. Antibiotic resistance occurs when bacteria that were earlier killed by an antibiotic survive and multiply despite treatment.

2. Indiscriminate or improper use of antibiotics contributes to the development of resistant bacteria.
3. Antibiotic resistance makes common infections harder to treat and can result in prolonged illness and serious complications.

20. State three precautions for the proper use of antibiotics.
Answer:
1. Antibiotics should be taken only when prescribed by a doctor.
2. They should be taken in the correct dose and for the prescribed duration.
3. Unnecessary use of antibiotics should be avoided to prevent the development of antibiotic-resistant bacteria.

21. How can we prevent the spread of communicable diseases? Mention three measures.
Answer:
1. Maintain personal hygiene and keep our surroundings clean.
2. Wash hands regularly with soap and water and cover the mouth and nose while coughing or sneezing.
3. Keep food and water clean and avoid sharing personal items such as towels and handkerchiefs.

22. How are non-communicable diseases managed?
Answer:
1. Treatment focuses on managing symptoms and improving the patient's quality of life.
2. Medication, healthy lifestyle changes and rehabilitation may be used for their management.
3. Early diagnosis and continuous care help control disease progression and prevent complications.

3.10. Three-mark questions with Answers of HOTS Type: (20 Questions)

1. Rohan eats nutritious food and exercises regularly, but he feels lonely and avoids interacting with others. Can he be considered completely healthy? Justify your answer.
Answer:
1. No, Rohan cannot be considered completely healthy because health includes **physical, mental, and social well-being**.
2. Although his physical health may be good, loneliness and lack of social interaction can affect his mental and social health.
3. He should maintain healthy relationships and spend time with family and friends along with following healthy physical habits.

2. Two children live in the same locality, but one falls sick more frequently than the other. What could explain this difference?
Answer:
1. Their immunity may differ because the body's natural ability to fight diseases varies among individuals.
2. Differences in food, hygiene, exercise, sleep and other lifestyle habits may also affect their health.
3. Therefore, living in the same environment does not necessarily mean that both children will have the same resistance to disease.

3. A student has fever and cough but continues to attend school. Explain how this behaviour could affect other students.
Answer:
1. If the illness is communicable, pathogens may spread through the air when the student coughs or sneezes.

2. Other students may become infected through close contact or contaminated personal items.
3. The sick student should stay home and rest, while following proper hygiene to minimise the spread of disease.

4. A family drinks clean water but regularly eats uncovered food exposed to houseflies. Are they completely protected from communicable diseases? Give reasons.

Answer:

1. No, drinking clean water alone cannot completely protect them from communicable diseases.
2. Houseflies can act as **vectors** and may carry pathogens that contaminate exposed food.
3. Therefore, both food and water should be kept clean, along with maintaining good personal and environmental hygiene.

5. During the rainy season, stagnant water collects around a neighbourhood. Predict its possible effect on community health and suggest preventive measures.

Answer:

1. Stagnant water can encourage mosquito breeding and increase the risk of diseases such as malaria and dengue.
2. People should prevent water from collecting around their homes and control mosquito-breeding sites.
3. Mosquito nets, repellents and long-sleeved clothing can provide additional protection against mosquito bites.

6. A person says, "If I do not have any disease, I am completely healthy." Do you agree? Give reasons.

Answer:

1. No, merely being free from disease does not mean that a person is completely healthy.
2. Health includes complete **physical, mental and social well-being**, not just the absence of illness.
3. A person should therefore care for the body, maintain a positive mind and develop healthy social relationships.

7. A child spends several hours every day using a mobile phone, sleeps late and skips breakfast. Predict how these habits may affect the child's health.

Answer:

1. Excessive screen time and insufficient sleep can prevent the body and mind from getting adequate rest and recovery.
2. Skipping meals may interfere with maintaining a healthy and balanced diet.
3. The child should limit screen time, get enough sleep, eat balanced meals and remain physically active.

8. Your friend wants to take antibiotics for flu because they helped him recover from a bacterial infection earlier. What would you advise him?

Answer:

1. I would advise him not to take antibiotics without a doctor's prescription.
2. Antibiotics act against **bacteria** and do not work against viruses; flu is listed in the chapter as a viral disease.
3. Unnecessary use of antibiotics can contribute to antibiotic resistance and make bacterial infections harder to treat in the future.

9. A patient stops taking antibiotics as soon as he starts feeling better instead of completing the prescribed duration. Why can this practice be harmful?

Answer:

1. Antibiotics should be taken in the correct dose and for the duration prescribed by the doctor.

2. Improper or incomplete use can contribute to the survival and multiplication of antibiotic-resistant bacteria.
3. Such resistance can make future bacterial infections more difficult to treat and increase the risk of complications.

10. Why can improving sanitation in an entire community be more effective than only asking individuals to take medicines after falling sick?

Answer:

1. Good sanitation can prevent pathogens from spreading and therefore reduce the number of people who become infected.
2. The Odisha community sanitation campaign described in the chapter reduced open defecation and was associated with fewer cases of diarrhoea and infections.
3. Thus, community-level prevention can protect many people before disease occurs rather than depending only on treatment after infection.

11. A vaccinated person says, "Now I can use this vaccine to cure the same disease whenever I fall sick." Is this reasoning correct? Explain.

Answer:

1. No, vaccines are mainly **preventive and not curative**.
2. They train the immune system to recognise and attack particular harmful germs before serious disease develops.
3. Therefore, vaccination helps prevent or minimise disease but does not serve as treatment once a person is already sick.

12. Why does vaccinating a large number of people help protect the community and not just vaccinated individuals?

Answer:

1. Vaccination protects individuals by preparing their immune systems to recognise and fight particular pathogens.
2. It also helps reduce the spread of infections from one person to another.
3. Therefore, widespread vaccination can indirectly protect other people in the community as well.

13. A person frequently eats processed food, rarely exercises and is overweight. Analyse why these habits may increase the risk of diabetes.

Answer:

1. Diabetes can develop due to a combination of factors including unhealthy eating habits and lack of physical activity.
2. Being overweight or obese is also identified as a factor associated with the development of diabetes.
3. Therefore, adopting a balanced diet and regular physical activity can help reduce lifestyle-related health risks.

14. Why might people living near heavily polluted roads or factories experience more respiratory health problems?

Answer:

1. Vehicles and factories can contribute to air pollution in the surrounding environment.
2. Polluted air containing smoke and dust can cause health problems such as coughing and asthma.
3. Therefore, cleaner air and a cleaner environment contribute to better health and well-being.

15. Suppose a doctor gives the same antibiotic to a patient suffering from typhoid and another suffering from dengue. Would you expect it to work equally well for both? Why?

Answer:

1. No, the antibiotic would not be expected to work equally well because typhoid is caused by **bacteria**, whereas dengue is caused by a **virus**.
2. Antibiotics work against bacterial infections because they target parts of bacterial cells.
3. They do not work against viral infections; therefore, antibiotics cannot treat dengue in the same way as a bacterial infection.

16. A town reports a sudden increase in cholera cases. What three actions would you recommend to control the outbreak?

Answer:

1. People should maintain good personal hygiene and proper sanitary practices.
2. They should consume properly cooked food and use boiled or otherwise safe drinking water.
3. Improving community sanitation and preventing contamination of food and water can help reduce further spread of the disease.

17. The number of dengue cases rises sharply during and after the rainy season. How would you explain this pattern?

Answer:

1. Rainy conditions can lead to the accumulation of still or stagnant water in the surroundings.
2. Such water provides breeding sites for mosquitoes, which can transmit dengue.
3. Controlling mosquito breeding before and during the rainy season can therefore help reduce dengue transmission.

18. Why is "prevention is better than cure" especially meaningful for both communicable and non-communicable diseases?

Answer:

1. Communicable diseases can often be reduced through hygiene, sanitation, vaccination and measures that prevent pathogen transmission.
2. Many non-communicable diseases can be prevented or better managed through healthy food, regular exercise and other lifestyle changes.
3. Preventive measures therefore reduce the chances of disease and can help avoid complications and prolonged treatment.

19. If antibiotics continue to be used unnecessarily, what consequences could society face in the future?

Answer:

1. More bacteria may develop resistance and survive medicines that previously killed them.
2. Common bacterial infections may become harder to treat, resulting in prolonged illness and serious complications.
3. Responsible antibiotic use is therefore necessary to keep these medicines effective for future generations.

20. A school wants to organise a "Healthy School Campaign." Suggest three important messages that should be included and justify them.

Answer:

1. **Eat healthy food and exercise regularly** because a balanced diet and physical activity support physical health and help reduce lifestyle-related risks.
2. **Maintain personal and environmental hygiene** because cleanliness and handwashing can reduce the transmission of pathogens.
3. **Care for mental and social well-being** by managing stress and maintaining positive relationships because complete health includes physical, mental and social well-being.

3.11 Five-mark questions with Answers of LOTS Type: (12 Questions)

1. What is health? Explain the different aspects of health.
Answer:
1. Health is a state of complete **physical, mental, and social well-being**, and not merely the absence of disease.
2. **Physical health** means keeping the body fit and functioning properly.
3. **Mental health** includes having a positive mindset and being able to cope with different situations.
4. **Social health** involves maintaining good relationships and adjusting well with other members of society.
5. A healthy person takes care of the body and mind and enjoys a healthy social life.

2. Describe five habits that help us maintain a healthy lifestyle.
Answer:
1. We should eat a **balanced diet** containing plenty of fruits, vegetables, and whole grains.
2. We should remain physically active through walking, running, cycling, outdoor games, or regular exercise.
3. We should get enough sleep so that our body and mind can rest and recover.
4. We should limit screen time and practise yoga, meditation, or breathing exercises such as pranayama.
5. We should avoid harmful substances such as tobacco, alcohol, and addictive drugs.

3. What are communicable diseases? Explain how they spread from one person to another.
Answer:
1. Communicable diseases are diseases caused by **pathogens** and can spread from one person to another.
2. They may spread through air when an infected person coughs or sneezes.
3. They can spread through direct contact or indirectly by sharing the personal belongings of an infected person.
4. Some communicable diseases spread through contaminated food and drinking water.
5. Certain pathogens are transmitted by vectors such as mosquitoes and houseflies.

4. Write five precautions that can help prevent the spread of communicable diseases.
Answer:
1. We should keep ourselves and our surroundings clean and practise good personal hygiene.
2. We should wash our hands regularly with soap and water to remove pathogens.
3. We should cover our mouth and nose while coughing or sneezing and wear a mask in crowded places when necessary.
4. We should avoid sharing personal items such as towels and handkerchiefs.
5. We should keep our food and water clean and stay at home and rest when we are unwell to avoid spreading disease to others.

5. What are non-communicable diseases? Describe their causes with suitable examples.
Answer:
1. Non-communicable diseases are diseases that **do not spread from one person to another**.
2. They are not caused by disease-causing pathogens.
3. Diseases such as **cancer, diabetes, and asthma** are examples of non-communicable diseases.
4. They are generally associated with factors such as lifestyle, diet, and environment.
5. Some non-communicable diseases, such as diabetes, may develop due to unhealthy eating, lack of physical activity, hormonal imbalance, and being overweight or obese.

6. What is immunity? Explain the role of vaccines in developing immunity.

Answer:

1. **Immunity** is the natural ability of our body to fight diseases.
2. Our body has an **immune system** that helps fight against disease-causing organisms.
3. Vaccines train the immune system to recognise and attack particular harmful germs.
4. Vaccines may be made from weakened or dead pathogens or from inactive or harmless parts of pathogens.
5. Vaccination provides acquired immunity and helps prevent serious infections caused by viruses and bacteria.

7. Explain the importance of vaccines in preventing diseases.

Answer:

1. Vaccines are one of the most effective methods of protecting people against many serious diseases.
2. They help prevent illnesses and reduce the spread of infections.
3. Vaccination protects people of different ages, from infants to the elderly.
4. Vaccines are **preventive and not curative**, which means they prevent or minimise diseases but do not treat an already sick person.
5. Vaccination protects not only the vaccinated individual but also people around them.

8. What are antibiotics? Explain their uses and limitations.

Answer:

1. **Antibiotics** are medicines used to kill bacteria that cause diseases.
2. They work against bacterial infections by targeting parts of bacterial cells.
3. Antibiotics have been effective in treating bacterial infections and have saved millions of lives.
4. They do not work against infections caused by viruses or protozoa.
5. Therefore, antibiotics should be used only when prescribed by a doctor, in the correct dose and for the prescribed duration.

9. What is antibiotic resistance? Explain it in five points.

Answer:

1. **Antibiotic resistance** occurs when bacteria that were earlier killed by an antibiotic survive and multiply despite treatment.
2. Indiscriminate or unnecessary use of antibiotics can contribute to the development of resistance.
3. Taking antibiotics when they are not required or taking an incomplete dose can encourage resistant bacteria.
4. Antibiotic resistance makes common infections harder to treat and may result in prolonged illness and complications.
5. Antibiotics should therefore be taken only on a doctor's prescription, in the correct dose and for the correct duration.

10. Describe malaria with reference to its causal agent, site of infection, symptoms, and prevention.

Answer:

1. Malaria is a communicable disease caused by a **protozoan** pathogen.
2. The sites of infection mentioned in the chapter are the **skin and blood**.
3. Its major symptoms include high fever, profuse sweating, and periodic chills.
4. Mosquito nets, mosquito repellents, and long-sleeved clothes can help prevent mosquito bites.
5. Mosquito breeding should be controlled in and around our homes to prevent the spread of malaria.

11. Describe dengue fever and the measures used to prevent it.

Answer:

1. Dengue fever, also called **break-bone fever**, is caused by a virus.
2. The sites of infection mentioned in the chapter are the skin and blood.
3. Its symptoms include fever, headache, muscle and joint pain, and nausea.
4. Mosquito nets, repellents, and long-sleeved clothes should be used to prevent mosquito bites.
5. Mosquito breeding should be controlled and areas with still water should be avoided.

12. Explain the difference between signs and symptoms of a disease with examples.

Answer:

1. Signs and symptoms indicate that a person may be unwell.
2. A **symptom** is something that the affected person feels.
3. Pain, tiredness, and dizziness are examples of symptoms.
4. A **sign** is something that can be seen or measured, such as fever, rash, high blood pressure, or swelling.
5. Signs and symptoms help doctors understand what may be causing a person's illness.

3.12 Five-mark questions with Answers of HOTS Type: (12 Questions)

1. A student eats healthy food and exercises regularly but spends most of the time alone and feels unhappy. Can the student be considered completely healthy? Justify your answer.

Answer:

1. The student cannot be considered completely healthy because health includes **physical, mental, and social well-being**.
2. Healthy food and exercise may help the student maintain good physical health.
3. Feeling unhappy for a long period can negatively affect mental well-being.
4. Spending most of the time alone may also affect social health because healthy relationships and interaction are important.
5. Therefore, the student should maintain healthy habits while also spending time with family and friends and taking care of emotional well-being.

2. During the rainy season, several dengue cases are reported in your locality. Analyse the possible reason and suggest measures to control the situation.

Answer:

1. Dengue is a communicable disease caused by a virus and is transmitted by mosquitoes.
2. During the rainy season, stagnant water may provide suitable places for mosquitoes to breed.
3. People should prevent water from remaining stagnant in and around their homes.
4. Mosquito nets, repellents, and long-sleeved clothes should be used to prevent mosquito bites.
5. Controlling mosquito breeding and avoiding areas with still water can reduce the spread of dengue.

3. Several students in a school have flu, but some infected students continue attending classes. What steps should the school take to control the spread of infection?

Answer:

1. Students who are unwell should be encouraged to stay at home and rest until they recover.
2. Students should cover their mouth and nose while coughing or sneezing because flu can spread through the air.
3. Everyone should wash their hands frequently and maintain good personal hygiene.
4. Students should avoid sharing personal items, and masks can be used in crowded situations for protection.

5. These measures can break the chain of transmission and protect both infected and healthy students.

4. A person says, "I am not sick, so I must be healthy." Evaluate this statement.

Answer:

1. The statement is incomplete because being healthy means more than simply being free from disease.
2. A person should have good **physical health** and be able to perform normal activities efficiently.
3. Good **mental health** includes a positive mindset and the ability to cope with difficult situations.
4. Good **social health** includes maintaining healthy relationships and adjusting well with others.
5. Therefore, complete health requires physical, mental, and social well-being, not merely the absence of illness.

5. A person suffering from a cold decides to take antibiotics without consulting a doctor. Why is this not advisable?

Answer:

1. A common cold is caused by a virus, while antibiotics work only against bacterial infections.
2. Therefore, taking antibiotics will not cure a viral infection such as the common cold.
3. Unnecessary use of antibiotics can encourage the development of antibiotic-resistant bacteria.
4. Resistant bacteria may survive and multiply, making future bacterial infections more difficult to treat.
5. Hence, antibiotics should be taken only when prescribed by a doctor, in the correct dose and for the correct duration.

6. Two children live in the same environment, but one falls sick more frequently than the other. How can you explain this difference?

Answer:

1. People may respond differently to pathogens because their body's ability to fight diseases can differ.
2. This natural ability of the body to fight diseases is called **immunity**.
3. The immune system protects the body against disease-causing organisms.
4. Vaccination can develop acquired immunity by training the immune system to recognise and attack particular harmful germs.
5. Therefore, differences in immune protection can help explain why some people become sick more frequently than others even in similar surroundings.

7. A family regularly eats processed and sugary foods, does little physical activity, and spends long hours watching screens. Predict the possible effects of this lifestyle and suggest improvements.

Answer:

1. Such habits may increase the risk of lifestyle-related non-communicable diseases such as obesity and diabetes.
2. The family should replace processed, fatty, and sugary foods with a balanced diet containing fruits, vegetables, and whole grains.
3. They should become physically active through walking, cycling, outdoor games, or regular exercise.
4. Screen time should be limited, and sufficient sleep should be made part of the daily routine.

5. Yoga, pranayama, relaxation, and spending time in nature can also support physical and mental well-being.

8. Explain why keeping only your own body clean may not be enough to protect you from communicable diseases.

Answer:

1. Personal hygiene is important, but pathogens can also be present in our surroundings.
2. Contaminated food and drinking water can spread communicable diseases.
3. Mosquitoes and houseflies can act as vectors and carry pathogens from one place or person to another.
4. Dirty and unhygienic surroundings may encourage flies and mosquitoes and increase the chances of illness.
5. Therefore, disease prevention requires both **personal hygiene and a clean environment**, including clean food, water, air, and surroundings.

9. "Vaccination protects not only an individual but also the community." Justify this statement.

Answer:

1. Vaccines train the immune system to recognise and fight harmful disease-causing germs.
2. A vaccinated person has protection against particular serious infections.
3. Vaccination also helps reduce the spread of infectious diseases from one person to another.
4. When infections spread less, people around vaccinated individuals also receive greater protection.
5. Therefore, vaccination contributes to both individual protection and the health of the wider community.

10. The number of dengue cases rises sharply during certain months of the year. What can a community do before the peak season to reduce the number of cases?

Answer:

1. The community should identify and remove places where stagnant water can collect before mosquito numbers increase.
2. People should control mosquito breeding in and around houses and public places.
3. Families should be encouraged to use mosquito nets and repellents and wear long-sleeved clothes.
4. Community awareness programmes can educate people about dengue symptoms and preventive practices.
5. Taking preventive action before the peak months can reduce mosquito breeding and consequently lower the risk of dengue transmission.

11. A patient stops taking antibiotics as soon as they start feeling better instead of completing the prescribed course. Analyse why this practice can be harmful.

Answer:

1. The prescribed duration of antibiotics should be followed even if the patient begins to feel better.
2. An incomplete dose can contribute to the development of antibiotic resistance.
3. Some bacteria may survive the incomplete treatment instead of being eliminated.
4. Resistant bacteria can multiply and make infections more difficult to treat in the future.
5. Therefore, antibiotics must be taken in the correct dose and for the duration prescribed by the doctor.

12. A village improves sanitation and reduces open defecation. Predict how this change can affect the health of the community.

Answer:

1. Better sanitation can reduce the contamination of the surroundings with disease-causing organisms.
2. This can lower people's exposure to pathogens responsible for communicable diseases.
3. Improved sanitation can particularly reduce diseases associated with contaminated food and water.
4. The chapter's Odisha case study reports that improved toilet use and reduced open defecation were associated with fewer cases of diarrhoea and infections.
5. Therefore, community-level sanitation measures can significantly improve public health and reduce the spread of disease.

3.13 Five-mark questions with Answers of Applied Type: (12 Questions)

1. A student eats healthy food and exercises regularly but spends most of the time alone and feels unhappy. Can the student be considered completely healthy? Justify your answer.

Answer:

1. The student cannot be considered completely healthy because health includes **physical, mental, and social well-being**.
2. Healthy food and exercise may help the student maintain good physical health.
3. Feeling unhappy for a long period can negatively affect mental well-being.
4. Spending most of the time alone may also affect social health because healthy relationships and interaction are important.
5. Therefore, the student should maintain healthy habits while also spending time with family and friends and taking care of emotional well-being.

2. During the rainy season, several dengue cases are reported in your locality. Analyse the possible reason and suggest measures to control the situation.

Answer:

1. Dengue is a communicable disease caused by a virus and is transmitted by mosquitoes.
2. During the rainy season, stagnant water may provide suitable places for mosquitoes to breed.
3. People should prevent water from remaining stagnant in and around their homes.
4. Mosquito nets, repellents, and long-sleeved clothes should be used to prevent mosquito bites.
5. Controlling mosquito breeding and avoiding areas with still water can reduce the spread of dengue.

3. Several students in a school have flu, but some infected students continue attending classes. What steps should the school take to control the spread of infection?

Answer:

1. Students who are unwell should be encouraged to stay at home and rest until they recover.
2. Students should cover their mouth and nose while coughing or sneezing because flu can spread through the air.
3. Everyone should wash their hands frequently and maintain good personal hygiene.
4. Students should avoid sharing personal items, and masks can be used in crowded situations for protection.
5. These measures can break the chain of transmission and protect both infected and healthy students.

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Answer:

1. The statement is incomplete because being healthy means more than simply being free from disease.
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3. The immune system protects the body against disease-causing organisms.
4. Vaccination can develop acquired immunity by training the immune system to recognise and attack particular harmful germs.
5. Therefore, differences in immune protection can help explain why some people become sick more frequently than others even in similar surroundings.

7. A family regularly eats processed and sugary foods, does little physical activity, and spends long hours watching screens. Predict the possible effects of this lifestyle and suggest improvements.

Answer:

1. Such habits may increase the risk of lifestyle-related non-communicable diseases such as obesity and diabetes.
2. The family should replace processed, fatty, and sugary foods with a balanced diet containing fruits, vegetables, and whole grains.
3. They should become physically active through walking, cycling, outdoor games, or regular exercise.
4. Screen time should be limited, and sufficient sleep should be made part of the daily routine.
5. Yoga, pranayama, relaxation, and spending time in nature can also support physical and mental well-being.

8. Explain why keeping only your own body clean may not be enough to protect you from communicable diseases.

Answer:

1. Personal hygiene is important, but pathogens can also be present in our surroundings.
2. Contaminated food and drinking water can spread communicable diseases.
3. Mosquitoes and houseflies can act as vectors and carry pathogens from one place or person to another.
4. Dirty and unhygienic surroundings may encourage flies and mosquitoes and increase the chances of illness.
5. Therefore, disease prevention requires both **personal hygiene and a clean environment**, including clean food, water, air, and surroundings.

9. "Vaccination protects not only an individual but also the community." Justify this statement.

Answer:

1. Vaccines train the immune system to recognise and fight harmful disease-causing germs.
2. A vaccinated person has protection against particular serious infections.
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4. When infections spread less, people around vaccinated individuals also receive greater protection.
5. Therefore, vaccination contributes to both individual protection and the health of the wider community.

10. The number of dengue cases rises sharply during certain months of the year. What can a community do before the peak season to reduce the number of cases?

Answer:

1. The community should identify and remove places where stagnant water can collect before mosquito numbers increase.
2. People should control mosquito breeding in and around houses and public places.
3. Families should be encouraged to use mosquito nets and repellents and wear long-sleeved clothes.
4. Community awareness programmes can educate people about dengue symptoms and preventive practices.
5. Taking preventive action before the peak months can reduce mosquito breeding and consequently lower the risk of dengue transmission.

11. A patient stops taking antibiotics as soon as they start feeling better instead of completing the prescribed course. Analyse why this practice can be harmful.

Answer:

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3. Improved sanitation can particularly reduce diseases associated with contaminated food and water.

4. The chapter's Odisha case study reports that improved toilet use and reduced open defecation were associated with fewer cases of diarrhoea and infections.
5. Therefore, community-level sanitation measures can significantly improve public health and reduce the spread of disease.

3.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

1. Aarav eats a balanced diet and exercises regularly, but he feels lonely, avoids friends, and remains anxious most of the time. Which conclusion is scientifically most appropriate?
A. Aarav is completely healthy because he has no physical disease.
B. Aarav may not be completely healthy because mental and social well-being are also components of health.
C. Aarav is unhealthy only if he develops fever.
D. Physical fitness automatically ensures mental well-being.
Answer: B

---

2. A student records the following observations about four people. Who best represents the chapter's concept of a healthy person?
A. A person who has no infection but is constantly stressed and isolated
B. A person who exercises daily but sleeps only four hours
C. A person who maintains physical fitness, a positive mindset, and healthy social relationships
D. A person who takes medicines regularly even without illness
Answer: C

---

3. Which combination contains only habits that promote a healthy lifestyle?
A. Regular exercise + balanced diet + adequate sleep + limited screen time
B. Regular exercise + skipping breakfast + adequate sleep + meditation
C. Balanced diet + excessive screen time + late-night sleep
D. Fast food + strenuous exercise + reduced sleep
Answer: A

---

4. Four students show the following conditions:
- P: Pain in the abdomen
- Q: Body temperature of 39°C
- R: Feeling tired
- S: Visible skin rash

Which correctly classifies them?
A. P and R are symptoms; Q and S are signs.
B. P and Q are symptoms; R and S are signs.
C. All four are symptoms.
D. All four are signs.
Answer: A
Explanation: A symptom is experienced or felt by the person, whereas a sign can be observed or measured.

---

5. Consider the following diseases:
1. Diabetes
2. Typhoid

3. Asthma
4. Measles
5. Cancer

Which group contains only non-communicable diseases?
A. 1, 2 and 3
B. 1, 3 and 5
C. 2, 4 and 5
D. 2, 3 and 4
Answer: B

---

6. A disease is found to be caused by a pathogen and can pass from an infected person to a healthy person. It should most appropriately be classified as:
A. Deficiency disease
B. Chronic disease only
C. Communicable disease
D. Lifestyle disease
Answer: C

---

7. Which of the following correctly matches the disease with its causal agent?
A. Malaria – Virus
B. Dengue – Protozoa
C. Tuberculosis – Bacteria
D. Ascariasis – Bacteria
Answer: C
Explanation: Malaria is caused by a protozoan, dengue by a virus, tuberculosis by bacteria, and ascariasis by worms.

---

8. Two diseases, X and Y, are transmitted by mosquitoes. X is caused by a protozoan, while Y is caused by a virus. X and Y are respectively:
A. Dengue and malaria
B. Malaria and dengue
C. Typhoid and dengue
D. Malaria and influenza
Answer: B

---

9. A community removes stagnant water, uses mosquito nets, and encourages people to wear long-sleeved clothes. These measures would most directly reduce the occurrence of:
A. Typhoid and cholera
B. Tuberculosis and influenza
C. Malaria and dengue
D. Hepatitis A and ascariasis
Answer: C

---

10. During an outbreak, a student frequently washes her hands, covers her mouth while coughing, avoids sharing towels, and wears a mask in crowded places. These measures primarily interrupt:
A. Lifestyle-related diseases
B. Transmission of communicable diseases
C. Deficiency diseases
D. Genetic disorders

Answer: B

---

11. A town improves sanitation, reduces open defecation, and ensures cleaner surroundings. Which outcome would be most consistent with the case study discussed in the chapter?
A. Increased incidence of diarrhoea
B. Reduction in diarrhoea and infections
C. Complete elimination of all non-communicable diseases
D. Increased antibiotic resistance
Answer: B

---

12. A person develops a disease because of prolonged unhealthy eating, lack of exercise, and obesity. Which type of disease is most strongly indicated?
A. Vector-borne communicable disease
B. Lifestyle-related non-communicable disease
C. Air-borne communicable disease
D. Water-borne communicable disease
Answer: B

---

13. Which sequence best represents the basic action of a vaccine described in the chapter?
A. Vaccine → kills all pathogens outside the body → prevents infection
B. Vaccine → trains immune system → acquired immunity → improved protection
C. Vaccine → causes disease → antibiotic treatment → immunity
D. Vaccine → destroys human cells → pathogens cannot reproduce
Answer: B

---

14. A child who has already developed influenza is given a vaccine against influenza with the expectation that it will immediately cure the existing illness. What is wrong with this reasoning?
A. Vaccines work only against bacteria.
B. Vaccines are primarily preventive rather than curative.
C. Vaccines destroy the immune system.
D. Vaccines work only in elderly people.
Answer: B

---

15. Edward Jenner's observation that milkmaids who had contracted cowpox did not catch smallpox led him to hypothesise that:
A. All viruses are harmless.
B. Cowpox exposure might provide protection against smallpox.
C. Smallpox was caused by bacteria.
D. Antibiotics could cure smallpox.
Answer: B

---

16. Which observation best illustrates *acquired immunity*?
A. A person's skin prevents germs from entering the body.
B. A vaccinated person's immune system develops protection against a particular disease.
C. A mosquito net prevents mosquitoes from biting.
D. Boiling water kills disease-causing organisms.
Answer: B

---

17. A doctor refuses to prescribe an antibiotic to a patient suffering from a viral cold. What is the best scientific explanation?
A. Antibiotics increase body temperature.
B. Antibiotics act only on worms.
C. Antibiotics target bacterial cells and do not work against viruses.
D. Viral infections never require treatment.
Answer: C

---

18. Alexander Fleming noticed that bacteria did not grow near a mould in a Petri dish. Which conclusion ultimately followed from this observation?
A. The mould released a substance capable of killing bacteria.
B. Bacteria caused the mould to grow.
C. The mould converted bacteria into viruses.
D. All fungi cause bacterial infections.
Answer: A

---

19. A patient stops taking a prescribed antibiotic as soon as he feels better. Some bacteria survive. What is the most serious possible consequence?
A. Surviving bacteria may contribute to antibiotic resistance.
B. The antibiotic will turn into a vaccine.
C. The bacteria will become viruses.
D. His immune system will permanently stop functioning.
Answer: A

---

20. Which practice would contribute MOST directly to reducing antibiotic resistance?
A. Taking antibiotics for every fever
B. Using antibiotics whenever a friend recommends them
C. Taking antibiotics only when prescribed and completing the correct dose and duration
D. Stopping antibiotics as soon as symptoms decrease
Answer: C

---

21. Study the following statements:
Statement I: Antibiotics can kill bacteria responsible for certain infections.
Statement II: Antibiotics can therefore cure influenza.
Which option is correct?
A. Both I and II are true.
B. Both I and II are false.
C. I is true, but II is false.
D. I is false, but II is true.
Answer: C

---

22. A patient has diarrhoea and severe dehydration. Another patient has periodic chills, high fever, and profuse sweating. The diseases most likely affecting them respectively are:
A. Cholera and malaria
B. Typhoid and dengue
C. Influenza and cholera
D. Malaria and tuberculosis
Answer: A

---

23. A patient shows frequent urination, excessive thirst, tiredness, weight loss, and slow healing. Based on the chapter's table of lifestyle-related diseases, the most likely condition is:
A. Malaria
B. Diabetes
C. Chickenpox
D. Tuberculosis
Answer: B

---

24. The chapter provides monthly dengue data for a hospital. Cases rise from 10 in January to 65 in July, August, and September, before declining. Which inference is most appropriate?
A. Dengue remains equally common throughout the year.
B. Dengue cases show a seasonal peak during July–September.
C. Dengue disappears after June.
D. Dengue is caused by low temperature.
Answer: B
The table on page 44 shows the maximum of **65 cases each in July, August, and September**, making these the peak months in the given data.

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25. Consider the following chain:
Excessive processed food → reduced physical activity → obesity → increased disease risk
Which disease discussed in the chapter is particularly associated with this combination of risk factors?
A. Chickenpox
B. Diabetes
C. Measles
D. Cholera
Answer: B

Answer Key

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.
1	**B**	6	**C**	11	**B**	16	**B**	21	**C**
2	**C**	7	**C**	12	**B**	17	**C**	22	**A**
3	**A**	8	**B**	13	**B**	18	**A**	23	**B**
4	**A**	9	**C**	14	**B**	19	**A**	24	**B**
5	**B**	10	**B**	15	**B**	20	**C**	25	**B**

3.15 Best Practices Opportunity List from the Chapter: (8 Ideas)

The chapter offers excellent scope for **experiential, inquiry-based, interdisciplinary, and life-skill-oriented teaching**, since it covers physical, mental and social health, healthy lifestyle, communicable and non-communicable diseases, immunity, vaccination, and responsible antibiotic use.

(1) **Personal Health Diary – "Know Your Habits":**
Students can maintain a **30-day health diary** recording food habits, water intake, physical activity, sleep, screen time, hygiene practices, and emotional well-being. At the end, they can identify one unhealthy habit and prepare a personal improvement plan. This is directly suggested as an extended activity in the chapter.

(2) **School Health & Hygiene Audit:**
Divide students into teams to inspect areas such as classrooms, playgrounds, drinking-water points, washrooms and waste-disposal facilities. They can prepare a simple **“Healthy School Scorecard”** and suggest practical improvements. This reinforces the chapter's connection between clean surroundings, sanitation and prevention of disease.

(3) **Disease Detective – Case-Based Learning:**
Give groups imaginary patient cases containing symptoms/signs such as fever, rash, diarrhoea, dehydration, cough or periodic chills. Students identify the probable disease, classify it as communicable/non-communicable, determine the possible causal agent and mode of transmission, and recommend preventive measures. The chapter's disease tables provide a strong basis for this activity.

(4) **“Doctor in the Classroom” Expert Interaction:**
Invite a **doctor, nurse or qualified health professional** for an interactive session on vaccination, nutrition, communicable diseases, lifestyle diseases and responsible medicine use. Students should prepare their questions beforehand and submit a short reflection afterwards. The chapter itself recommends interaction with health professionals.

(5) **Antibiotic Awareness Campaign – “Use Antibiotics Wisely”:**
Students can design posters, slogans, short videos or role-plays explaining why antibiotics should be taken **only when prescribed, in the correct dose and for the prescribed duration**. They can particularly address the misconception that antibiotics cure viral infections. This converts the chapter's antibiotic-resistance concept into responsible real-life behaviour.

(6) **Dengue Data Analysis – Integrating Science and Mathematics:**
Use the monthly dengue-case data provided in the chapter to ask students to construct a **bar graph**, identify peak and low-incidence months, analyse possible environmental reasons, and propose preventive action before the peak season. This is an excellent interdisciplinary **Science + Mathematics + Environmental Studies** activity.

(7) **“Healthy Me, Healthy School” Student Campaign:**
Each group can select one theme—**balanced diet, exercise, adequate sleep, reduced screen time, mental well-being, personal hygiene, clean surroundings, or prevention of mosquito breeding**—and conduct a week-long awareness campaign. Students become health ambassadors rather than merely learning health concepts from the textbook. The chapter explicitly connects these lifestyle practices with overall well-being.

(8) **Create a Personal Health Card:**
Students can design their own **“My Health Card”** containing healthy-habit goals, sleep and exercise records, hygiene checklist, screen-time goals and other age-appropriate health indicators. They can periodically review the card and reflect on improvements rather than treating it as a one-time assignment. The chapter specifically proposes creation and discussion of a health card.

Five strongest practices for school documentation
For a **lesson plan / academic audit / Best Practices record**, I would particularly recommend highlighting: **(1) 30-Day Personal Health Diary, (2) School Health & Hygiene Audit, (3) Disease Detective Case-Based Learning, (4) Doctor-in-the-Classroom Interaction, and (5) Student-led Health & Antibiotic Awareness Campaign.** These demonstrate experiential learning, community connection, interdisciplinary learning, critical thinking and behavioural change rather than conventional textbook teaching.

3.16 Innovations Opportunity List from the Chapter: (8 Ideas)

Chapter 3: ***Health: The Ultimate Treasure*** **– Grade 8**
The chapter is particularly suitable for innovative teaching because it connects health with lifestyle, environment, disease transmission, immunity, vaccination, antibiotics, data interpretation, and real-life decision-making. It also explicitly encourages students to **"discover, design and debate."**

(1) **Gamified "Disease Detective" Challenge:**
Convert the classroom into a diagnostic investigation centre. Students receive digital or printed "mystery patient cards" containing symptoms, signs, mode of transmission and environmental clues, and earn points by identifying the disease, causal agent, communicable/non-communicable category, and preventive measures. This innovatively transforms the chapter's disease-classification content into problem-solving and collaborative learning.

(2) **QR-Code Interactive Health Learning Stations:**
Set up different QR-code stations around the classroom on **healthy lifestyle, disease transmission, mosquito-borne diseases, immunity, vaccination and antibiotic resistance**. Scanning each QR code can lead students to a teacher-created micro-video, infographic, quiz or challenge. Students rotate through the stations in teams, making the lesson a **blended and self-paced learning experience**.

(3) **AI-Assisted "My Healthy Lifestyle Coach" Project:**
Students maintain anonymous/sample data on sleep, exercise, screen time, diet and hygiene and use an age-appropriate AI tool under teacher supervision to identify patterns and generate healthy-habit suggestions. They must then **critically verify the AI suggestions against the textbook**, learning both health science and responsible use of AI. The chapter itself asks students to maintain a month-long health diary covering these variables.

(4) **Digital Outbreak Simulation – "Stop the Epidemic":**
Conduct a classroom simulation in which an imaginary infectious disease begins with one student and spreads according to different modes—air, direct/indirect contact, contaminated food/water or vectors. Students introduce interventions such as handwashing, masks, isolation, sanitation and vector control and observe how the simulated outbreak changes. This makes the chapter's transmission pathways visually and experientially understandable.

(5) **Dengue Data Lab – From Numbers to Public-Health Decisions:**
Instead of merely drawing the textbook's bar graph, students can enter the monthly dengue data into a spreadsheet, create graphs, identify peak months and develop an **"Early Dengue Warning Plan"** for their locality. This integrates **Science + Mathematics + ICT + Environmental Education** and moves students from data interpretation to evidence-based decision-making. The chapter provides monthly dengue data and asks learners to analyse environmental causes and preventive measures.

(6) **AR/3D "Inside the Immune System" Learning Experience:**
Use simple augmented-reality resources, animations or student-created 3D models to visualise pathogens entering the body, immune responses and how vaccination prepares the immune system. Students can then explain the process through a "teach your partner" activity. This helps make the otherwise invisible concepts of **immunity and acquired immunity** concrete.

(7) **Interactive Antibiotic-Resistance Chain Simulation:**

Students create a physical or digital flow model showing how inappropriate/incomplete antibiotic use can select resistant bacteria and how those bacteria may spread through people, hospitals, animals, food and the environment. The textbook's detailed antibiotic-resistance infographic on pages 40–41 provides an excellent foundation for this innovation. Students can conclude by developing a digital message around **"Use antibiotics only when prescribed."**

(8) **Student-Created "Health Reels/Podcast" Studio:**
Teams produce 60–90 second educational videos, audio podcasts or digital posters on topics such as **screen-time balance, healthy diet, mosquito control, vaccination, hygiene, mental well-being or antibiotic misuse**. The best student productions can become QR-linked learning resources for other classes, turning Grade 8 students from **content consumers into content creators**.

Recommended 5 for an "Innovations" column:
For a school **lesson plan/academic documentation**, the strongest five could be written concisely as:
1. Gamified Disease Detective Challenge – Case-based gamification for identifying diseases, pathogens, transmission and prevention.
2. QR-Code Health Learning Stations – Self-paced blended learning through interactive digital stations.
3. AI-Assisted Healthy Lifestyle Coach – Responsible use of AI to analyse lifestyle patterns and critically verify health recommendations.
4. Digital Outbreak Simulation – Simulation-based learning to understand disease transmission and preventive interventions.
5. Dengue Data Lab – Spreadsheet-based analysis and visualisation of dengue data to develop evidence-based community prevention strategies.
These are distinctly **"innovations" rather than routine best practices**, because they introduce **gamification, AI, QR-enabled blended learning, simulation, digital data analytics and student-generated digital content** into the teaching-learning process.

3.17: Practicing Questions/Question Bank

The chapter covers physical, mental and social health; healthy lifestyles; signs and symptoms; communicable and non-communicable diseases; immunity and vaccination; and antibiotics and antibiotic resistance.

A. Fill in the Blanks — 1 Mark Each

1. The ability of the body to fight diseases is called __________.
   Answer: Immunity

2. Disease-causing organisms are called __________.
   Answer: Pathogens

3. Insects that transmit disease-causing pathogens are called __________.
   Answer: Vectors

4. Malaria is caused by a __________.
   Answer: Protozoan

5. Dengue fever is caused by a __________.
   Answer: Virus

6. Diseases that do not spread from one person to another are called __________ **diseases**.
   Answer: Non-communicable

7. Protection developed after exposure to a pathogen or vaccine is called __________ **immunity**.
   Answer: Acquired

8. The first antibiotic, penicillin, was discovered by __________.
   Answer: Alexander Fleming

9. The first vaccine was developed against __________.
   Answer: Smallpox

10. Antibiotics are effective against __________ **infections**.
    Answer: Bacterial

11. A disease that persists for more than three months may be referred to as a __________ **disease**.
    Answer: Chronic

12. Diseases caused by the lack of specific nutrients are called __________ **diseases**.
    Answer: Deficiency

13. The __________ helps us know how clean the air is.
    Answer: Air Quality Index (AQI)

14. Cholera mainly affects the __________.
    Answer: Intestine

15. The traditional Indian practice used to protect people against smallpox was called __________.
    Answer: Variolation

These concepts and terms are explicitly introduced throughout the chapter.

B. One-Mark Questions

1. **What is health?**
   Answer: Health is a state of complete physical, mental and social well-being, and not merely the absence of disease.

2. **What is a symptom?**
   Answer: A symptom is something a person feels when unwell, such as pain, tiredness or dizziness.

3. **What is a sign of disease? Give one example.**
   Answer: A sign is something that can be seen or measured, such as fever or high blood pressure.

4. **Define disease.**
   Answer: A disease is a condition that affects the normal working of the body or mind.

5. **What are pathogens?**
   Answer: Pathogens are disease-causing organisms.

6. **Give two examples of non-communicable diseases.**
   Answer: Diabetes and asthma.

7. **Name any two diseases transmitted by mosquitoes.**
   Answer: Malaria and dengue.

8. **What is immunity?**
   Answer: Immunity is the natural ability of our body to fight diseases.

9. **Who discovered penicillin?**
   Answer: Alexander Fleming.

10. **What is antibiotic resistance?**
    Answer: Antibiotic resistance is a phenomenon in which bacteria that were earlier killed by an antibiotic survive and multiply despite treatment.

The textbook clearly distinguishes symptoms from measurable signs and classifies diseases according to their causes and transmission.

C. Two-Mark Questions

1. Differentiate between a symptom and a sign.

Answer:

- A **symptom** is something that a person feels, such as pain or tiredness.
- A **sign** is something that can be observed or measured, such as fever, rash or high blood pressure.

2. Mention any two healthy lifestyle practices.

Answer:

- Eat a balanced diet containing fruits, vegetables and whole grains.
- Stay physically active through walking, running, cycling, outdoor games or exercise.

3. What are communicable diseases? Give two examples.

Answer:
Communicable diseases are diseases caused by pathogens that can spread from one person to another. Examples include **typhoid and chickenpox**.

4. What are non-communicable diseases? Give two examples.

Answer:
Non-communicable diseases are not caused by pathogens and do not spread from one person to another. **Diabetes and asthma** are examples.

5. Mention two ways in which communicable diseases can spread.

Answer:
Communicable diseases may spread:

- Through air when an infected person coughs or sneezes.
- Through contaminated food or drinking water.

6. Why are antibiotics not useful against viral infections?

Answer:
Antibiotics target parts of bacterial cells. Therefore, they work against bacterial infections but not against viruses.

7. Give two measures to prevent mosquito-borne diseases.

Answer:

- Use mosquito nets and repellents.
- Prevent mosquito breeding by avoiding stagnant water around homes.

8. What is acquired immunity? How can it develop?

Answer:
Acquired immunity is protection developed by the body against a disease. It can develop after exposure to a pathogen or through vaccination.

D. Three-Mark Descriptive Questions

1. Explain three dimensions of health.

Answer:

1. **Physical health** refers to the proper functioning and well-being of the body.
2. **Mental health** includes a positive mindset and emotional well-being.
3. **Social health** involves healthy relationships and the ability to adjust well with others.

The chapter emphasises that health is more than merely being free from disease.

2. Explain any three ways of preventing communicable diseases.

Answer:

1. Wash hands regularly with soap and water to remove pathogens.
2. Cover the mouth and nose while coughing or sneezing.
3. Keep food, drinking water, homes and surroundings clean.

3. Explain three factors that may contribute to diabetes.

Answer:

1. Unhealthy eating habits may increase the risk of diabetes.
2. Lack of physical activity is another contributing factor.
3. Being overweight or obese may also contribute to its development.

4. How do vaccines protect us from diseases?

Answer:

1. Vaccines train the immune system to recognise harmful germs.
2. They prepare the immune system to attack the pathogen.

3. This develops acquired immunity and helps prevent serious infections.

5. Explain three ways by which communicable diseases can spread.

Answer:

1. They can spread through air when an infected person coughs or sneezes.
2. They can spread through contaminated food or water.
3. They can also spread through direct/indirect contact or vectors such as mosquitoes and houseflies.

6. State three precautions that should be followed while using antibiotics.

Answer:

1. Antibiotics should be taken only when prescribed by a doctor.
2. They should be taken in the correct dose.
3. They should be taken for the prescribed duration to reduce the development of antibiotic resistance.

7. How does a clean environment help us remain healthy?

Answer:

1. Clean surroundings reduce the breeding of flies and mosquitoes.
2. Clean air reduces health problems associated with smoke, dust and pollution.
3. Clean water and sanitation reduce the risk of communicable diseases.

E. Five-Mark Descriptive Questions

1. Explain five important practices that help us maintain a healthy lifestyle.

Answer:

1. Eat a balanced diet containing plenty of fruits, vegetables and whole grains.
2. Avoid excessive processed, fatty and sugary foods and drinks.
3. Remain physically active through outdoor games, walking, running, cycling or exercise.
4. Get adequate sleep so that the body and mind can rest and recover.
5. Limit screen time, manage stress and practise activities such as yoga or pranayama.

2. Differentiate between communicable and non-communicable diseases in five points.

Answer:

Communicable Diseases	**Non-communicable Diseases**
Caused by pathogens.	Generally not caused by pathogens.
Can spread from one person to another.	Do not spread from person to person.

Communicable Diseases	Non-communicable Diseases
May spread through air, water, food, contact or vectors.	Often linked to lifestyle, diet and/or environment.
Examples include typhoid, dengue and flu.	Examples include diabetes, cancer and asthma.
Hygiene, vaccination and controlling transmission help prevent them.	Healthy lifestyle and regular exercise can help prevent or manage many of them.

The chapter identifies these as the two major groups of diseases based on their causes and spread.

3. Explain five measures that can prevent the spread of communicable diseases.

Answer:

1. Maintain personal hygiene and keep the surroundings clean.
2. Wash hands frequently with soap and water.
3. Cover the mouth and nose while coughing or sneezing.
4. Keep food and drinking water clean and safe.
5. Avoid sharing personal items and take appropriate preventive measures such as vaccination and protection against disease vectors.

4. Explain vaccination and its importance in five points.

Answer:

1. Vaccines help prevent serious infections caused by pathogens.
2. They train the immune system to recognise and attack harmful germs.
3. Vaccination provides acquired immunity against particular diseases.
4. Vaccines help prevent illness and reduce the spread of infections.
5. Vaccination protects not only the vaccinated person but also contributes to protecting people around them.

5. What is antibiotic resistance? Explain its causes, effects and prevention.

Answer:

1. Antibiotic resistance occurs when bacteria survive and multiply despite treatment with an antibiotic that previously killed them.
2. Indiscriminate and unnecessary use of antibiotics contributes to the development of resistance.
3. Taking an incomplete antibiotic dose can also encourage resistant bacteria to survive.
4. Resistance makes common infections harder to treat and may cause prolonged illness and complications.
5. Antibiotics should therefore be used only when prescribed by a doctor, in the correct dose and for the correct duration.

6. Describe five ways in which communicable diseases may be transmitted.

Answer:

1. **Through air** – pathogens may spread when an infected person coughs or sneezes.
2. **Through contaminated food or water** – diseases such as cholera and typhoid can spread this way.
3. **Through direct contact** – close physical contact with an infected person may transmit pathogens.
4. **Through indirect contact** – sharing personal items of an infected person can spread infection.
5. **Through vectors** – insects such as mosquitoes can transmit pathogens from one person to another.

7. "Health is more than the absence of disease." Explain this statement in five points.

Answer:

1. Good health includes **physical well-being** and proper functioning of the body.
2. It also includes **mental well-being**, such as maintaining a positive mindset.
3. **Social well-being** and healthy relationships are important components of health.
4. A healthy person is generally able to perform tasks efficiently and cope with difficult situations.
5. Healthy food, exercise, sleep, cleanliness, supportive relationships and practices such as yoga and meditation contribute to overall well-being.

Additional Higher-Order 5-Mark Question

A locality records a sharp increase in dengue cases during the rainy season. As a student health volunteer, prepare a five-point action plan to control the outbreak.

Expected Answer: Students should mention measures such as eliminating stagnant water, preventing mosquito breeding, keeping surroundings clean, using mosquito nets/repellents, wearing long-sleeved clothes, creating community awareness and taking preventive action before peak dengue season. This question directly builds on the chapter's dengue table and its data-analysis exercise, which shows the highest reported cases in July, August and September.

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8^{th} Standard Science Book Chapter 4

Chapter 4: Electricity: Magnetic and Heating Effects

4.1 Summary of the Chapter:

Summary – Chapter 4: *Electricity: Magnetic and Heating Effects*

(1) **Magnetic Effect of Electric Current:** When electric current flows through a conductor, it produces a **magnetic field** around it. This is called the *magnetic effect of electric current*. A nearby compass needle deflects when current flows and returns to its original position when the current stops.

(2) **Electromagnets:** A current-carrying coil behaves like a magnet and is called an **electromagnet**. Inserting an iron core inside the coil makes the electromagnet stronger. It loses its magnetic effect when the current is switched off.

(3) **Strength and Poles of an Electromagnet:** Like a bar magnet, an electromagnet has **North and South poles**. Its strength can be increased by increasing the current or the number of turns in the coil. Its poles can be reversed by reversing the direction of current.

(4) **Applications of Electromagnets:** Electromagnets are used in devices such as **electric bells, motors, fans and loudspeakers**. Powerful lifting electromagnets attached to cranes are used in factories and scrap yards to lift, move and sort heavy iron and steel objects.

(5) **Heating Effect of Electric Current:** When current passes through a conductor, resistance causes some electrical energy to be converted into **heat energy**. This phenomenon is known as the *heating effect of electric current*.

(6) **Factors Affecting Heating:** The amount of heat produced in a wire depends on factors such as the **magnitude of current, material, thickness and length of the wire, and the duration for which current flows**. Nichrome offers higher resistance than copper of the same size and length.

(7) **Applications of the Heating Effect:** Appliances such as **electric room heaters, stoves, kettles, irons, immersion rods and hair dryers** work using the heating effect of electric current. They contain a wire or coil called a **heating element**.

(8) **Generation of Electricity in a Cell:** A **Voltaic or Galvanic cell** contains two different metal electrodes and an electrolyte. Chemical reactions between the electrodes and electrolyte generate electricity. When the chemicals are used up, the cell becomes "dead."

(9) **Dry Cells and Rechargeable Batteries:** A dry cell contains a paste-like electrolyte, with a **zinc container as the negative terminal and a carbon rod as the positive terminal**. Unlike single-use dry cells, rechargeable batteries can be charged and reused many times, although they eventually wear out.

(10) **Battery Technology and Responsible Disposal: Lithium-ion batteries** are widely used rechargeable batteries, while newer technologies such as solid-state batteries are being developed. Used batteries should be sent to proper **e-waste recycling facilities** because they may contain harmful as well as valuable materials that can be recycled and reused.

4.2 Important Formulas:

Important Formulas / Quantitative Relationships – Chapter 4: *Electricity: Magnetic and Heating Effects*:

This chapter is **mainly conceptual and experimental**. It does **not explicitly introduce standard numerical formulas** such as Ohm's law or Joule's heating law. Instead, quantitative questions are mainly based on **relationships between current, number of coil turns, heating time, wire length and thickness**.

1. Strength of an Electromagnet:

The chapter establishes that electromagnet strength increases with both the **current through the coil** and the **number of turns of the coil**.

$$\boxed{\text{Strength of electromagnet} \propto \text{Current}}$$

$$\boxed{\text{Strength of electromagnet} \propto \text{Number of turns}}$$

For qualitative comparison:

$$\boxed{\text{Magnetic strength} \propto N \times I}$$

where
N= number of turns in the coil
I= current through the coil.
Thus, increasing either N or I generally produces a stronger electromagnet.

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2. Effect of Number of Cells:
The chapter explains:

$$\boxed{\text{More cells} \rightarrow \text{larger current} \rightarrow \text{stronger magnetic field}}$$

Hence:

$$\boxed{\text{More cells} \rightarrow \text{greater compass deflection}}$$

and

$$\boxed{\text{More cells} \rightarrow \text{more iron objects attracted}}$$

The textbook specifically compares a single cell with batteries containing more cells.

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3. Effect of an Iron Core:
For the same coil and current:

$$\boxed{\text{Electromagnet with iron core} > \text{coil without iron core}}$$

in terms of magnetic strength.
The chapter observes that inserting an iron nail into the coil produces a much greater compass deflection and enables it to attract iron clips.

---

4. Heating Effect and Current:
The amount of heat produced increases when the magnitude of electric current increases:

$$\boxed{\text{Heat generated increases as current increases}}$$

or, at the chapter's qualitative level,

$$\boxed{H \uparrow \text{ when } I \uparrow}$$

The experiment shows that two cells produce more heating than one cell for the same duration.

---

5. Heat and Time:
For otherwise similar conditions:

$$\boxed{\text{Heat generated increases with duration of current flow}}$$

Qualitatively,

$$\boxed{H \propto t}$$

where H= heat generated and t= duration of current flow.
The chapter specifically identifies duration as one of the factors affecting the heat generated in a wire.

---

6. Resistance and Heating:
The chapter explains that a conductor offers **resistance** to electric current and that this causes electrical energy to be converted into heat:

$$\boxed{\text{Electrical energy} \rightarrow \text{Heat energy}}$$

For wires of the same size and length:

$$\boxed{R_{\text{nichrome}} > R_{\text{copper}}}$$

Therefore, nichrome is particularly suitable for heating applications.

---

7. Factors Affecting Heat Produced:
A useful chapter-based relationship can be written as:

$$\boxed{H = f(I,\ \text{material}, L,\ \text{thickness}, t)}$$

where:

- I= current
- L= length of wire
- t= time
- material = type of conductor
- thickness = diameter/thickness of wire.

These are the factors explicitly identified in the chapter.

---

8. Comparing Wire Thickness:
The chapter proposes an experiment using nichrome wires of approximately **0.3 mm and 0.6 mm thickness** and asks students to compare their heating.
The thickness ratio can be calculated as:

$$\boxed{\text{Thickness ratio} = \frac{d_2}{d_1}}$$

Example:

$$\frac{0.6}{0.3} = 2$$

Hence, the second wire is **twice as thick** as the first.

---

9. Comparing Number of Coil Turns:
For experiments involving coils:

$$\boxed{\text{Turn ratio} = \frac{N_2}{N_1}}$$

For example, comparing 100 turns with 25 turns:

$$\frac{100}{25} = 4$$

Thus, the second coil has **four times as many turns**. The chapter specifically suggests experiments using **25, 50, 75 and 100 turns** to investigate electromagnet strength.

---

10. Percentage Increase/Decrease for Experimental Data:
If students record compass deflection, number of paper clips attracted, heating time, etc., percentage change can be calculated using:

$$\boxed{\%\ \text{Increase} = \frac{\text{New value} - \text{Original value}}{\text{Original value}} \times 100}$$

Similarly,

$$\boxed{\%\ \text{Decrease} = \frac{\text{Original value} - \text{New value}}{\text{Original value}} \times 100}$$

These formulas are **not stated in the textbook**, but they are useful mathematical tools for analysing data generated from the chapter's experiments.

Quick Formula Sheet

Concept	Formula / Relationship
Electromagnet strength vs current	$S \propto I$
Electromagnet strength vs turns	$S \propto N$
Combined qualitative relation	$S \propto NI$
Heating vs current	H increases as I increases
Heating vs time	$H \propto t$
Nichrome vs copper resistance	$R_N > R_C$ for same size/length
Turn ratio	N_2/N_1
Thickness ratio	d_2/d_1
Percentage increase	$\frac{New - Old}{Old} \times 100\%$
Percentage decrease	$\frac{Old - New}{Old} \times 100\%$

Important for Grade 8: The chapter expects students mainly to understand and apply these **cause-and-effect quantitative relationships**, rather than solve advanced numerical problems involving voltage, resistance, power, or Joule's law.

4.3 Fill-Up the Blank LOTS type questions with Answers: (40 Questions)

1. When electric current flows through a conductor, it produces a __________ around it.
   Answer: magnetic field
2. The phenomenon in which electric current produces a magnetic field is called the __________ of electric current.
   Answer: magnetic effect
3. The scientist who discovered the magnetic effect of electric current was __________.
   Answer: Hans Christian Oersted
4. Oersted discovered the connection between electricity and magnetism in the year __________.
   Answer: 1820
5. A current-carrying coil that behaves like a magnet is called an __________.
   Answer: electromagnet
6. An __________ core is generally used to make an electromagnet stronger.
   Answer: iron
7. Like an ordinary magnet, an electromagnet has __________ poles.
   Answer: two
8. The two poles of an electromagnet are called __________ and __________.
   Answer: North and South
9. Increasing the number of __________ in a coil makes the electromagnet stronger.
   Answer: turns
10. The poles of an electromagnet can be reversed by changing the __________ of the electric current.
    Answer: direction
11. Lifting electromagnets are commonly attached to __________ to lift heavy iron and steel objects.
    Answer: cranes

12. Lifting electromagnets are widely used in factories and __________ yards.
    Answer: scrap
13. When current through a lifting electromagnet is switched OFF, its __________ disappears.
    Answer: magnetic field
14. The special wire used in the experiment to demonstrate the heating effect is __________ wire.
    Answer: nichrome
15. The opposition offered by a conductor to the flow of electric current is called __________.
    Answer: resistance
16. Nichrome wire offers __________ resistance than a copper wire of the same size and length.
    Answer: higher
17. During the heating effect, some electrical energy is converted into __________ energy.
    Answer: heat
18. The warming of a conductor due to the flow of electric current is called the __________ effect of electric current.
    Answer: heating
19. The amount of heat generated depends on the __________ of the electric current.
    Answer: magnitude
20. The rod or coil of wire used to produce heat in an electrical appliance is called a __________.
    Answer: heating element
21. An electric iron works on the __________ effect of electric current.
    Answer: heating
22. A Voltaic cell is also known as a __________ cell.
    Answer: Galvanic
23. The two metal rods in a Voltaic cell are called __________.
    Answer: electrodes
24. The liquid present in a Voltaic cell is called an __________.
    Answer: electrolyte
25. The electrolyte in a Voltaic cell is usually a weak acid or __________ solution.
    Answer: salt
26. Electricity in a Voltaic cell is produced by a __________ reaction between the electrodes and electrolyte.
    Answer: chemical
27. In the lemon-cell experiment, __________ juice acts as the electrolyte.
    Answer: lemon
28. In the lemon cell, the metal electrodes used are copper wire and an __________ nail.
    Answer: iron
29. A glowing __________ indicates that the lemon cell is working.
    Answer: LED
30. A dry cell is called "dry" because its electrolyte is a thick moist __________ rather than a liquid.
    Answer: paste
31. The __________ container of a dry cell acts as its negative terminal.
    Answer: zinc
32. The __________ rod at the centre of a dry cell forms part of its positive terminal.
    Answer: carbon

33. A dry cell is a __________-use cell.
 Answer: single
34. Batteries that can be charged and used repeatedly are called __________ batteries.
 Answer: rechargeable
35. Rechargeable batteries can be reused __________ times.
 Answer: multiple
36. The most common type of rechargeable battery mentioned in the chapter is the __________ battery.
 Answer: lithium-ion (Li-ion)
37. Lithium-ion batteries use special metals such as lithium and __________.
 Answer: cobalt
38. __________-state batteries replace liquid or paste-like electrolytes with solid materials.
 Answer: Solid
39. Used batteries should preferably be disposed of at special __________ recycling facilities.
 Answer: e-waste
40. Recycling batteries helps recover valuable materials and is good for the __________ and people.
 Answer: planet

4.4 Fill-Up the Blank HOTS type questions with Answers: (35 Questions)

1. When a compass is placed near a current-carrying wire and its needle deflects, we can infer that the wire has produced a __________ around it.
 Answer: magnetic field
2. If the switch in a circuit is turned OFF and the compass needle returns to its original position, it shows that the magnetic effect exists only when __________ flows through the wire.
 Answer: electric current
3. If an iron nail is inserted into a current-carrying coil, the compass needle shows greater deflection because the electromagnet becomes __________.
 Answer: stronger
4. If the number of cells connected to the same electromagnet is increased, it can attract __________ iron clips because a larger current produces a stronger magnetic field.
 Answer: more
5. If the number of turns in a coil is increased while other conditions remain the same, the strength of the electromagnet will __________.
 Answer: increase
6. If the direction of current through an electromagnet is reversed, its North and South poles will be __________.
 Answer: reversed
7. A crane using an electromagnet can release the iron objects it carries simply by switching __________ the electric current.
 Answer: OFF
8. If the iron core is removed from a current-carrying coil, the coil will still behave as a magnet, but its magnetic effect will become __________.
 Answer: weaker
9. If a lifting electromagnet has to lift heavier iron objects, increasing both the current and the number of turns in its coil can make it __________.
 Answer: stronger

10. If a compass needle placed near a coil does not deflect when the switch is ON, one possible inference is that __________ is not flowing through the circuit.
Answer: electric current
11. A nichrome wire becomes warm when current flows because some of the __________ energy is converted into heat energy.
Answer: electrical
12. If identical nichrome wires are connected first to one cell and then to two cells for the same duration, the wire connected to two cells will produce __________ heat.
Answer: more
13. If copper and nichrome wires of the same size and length carry current, nichrome is more suitable as a heating element because it offers __________ resistance.
Answer: higher
14. If current is allowed to flow through a heating element for a longer duration, the amount of heat generated will generally __________.
Answer: increase
15. If an unsuitable wire, plug, or socket is used for a high-current appliance, excessive heating may lead to melting or even __________.
Answer: fire
16. If an electric heater is required to generate considerable heat, a material such as __________ is preferred over copper for its heating element.
Answer: nichrome
17. If the electrolyte is removed from a Voltaic cell, the cell will not generate electricity because the required __________ reaction cannot occur properly.
Answer: chemical
18. When the chemicals in a Voltaic cell are used up, the cell becomes __________ and can no longer supply electricity.
Answer: dead
19. In a lemon cell, replacing lemon juice with another suitable __________ solution may still allow the cell to generate electricity.
Answer: salt
20. If the LED in a properly assembled lemon battery does not glow because its terminals are connected in the wrong direction, the first corrective step should be to __________ the LED connections.
Answer: reverse
21. In the lemon-cell experiment, using copper and iron provides two __________ electrodes required for a Voltaic cell.
Answer: different metal
22. If lemon juice is replaced by pure water in the cell arrangement shown on page 60, the LED is less likely to glow because lemon juice serves as the __________.
Answer: electrolyte
23. If a student wants a battery that can be used repeatedly rather than discarded after one use, a __________ battery is the better choice.
Answer: rechargeable
24. If a mobile-phone battery needs charging more frequently after being used for many years, it indicates that the rechargeable battery has gradually __________.
Answer: worn out
25. Solid-state batteries may be safer than conventional rechargeable batteries because they replace liquid or paste-like electrolytes with __________ materials.
Answer: solid

26. If used batteries are thrown into ordinary garbage, metals and other materials present in them may harm the __________.
Answer: environment
27. Sending used batteries to e-waste recycling facilities allows valuable materials to be __________ and reused.
Answer: recycled
28. A wire carrying current may simultaneously become warm and deflect a nearby compass because electric current can produce both __________ and heating effects.
Answer: magnetic
29. If four similar coils made from iron, copper, aluminium, and nichrome all allow electric current to pass, a nearby compass can show __________ in all four cases.
Answer: deflection
30. In an experiment using coils of 25, 50, 75, and 100 turns with the same cell, the __________-turn coil is expected to produce the strongest electromagnet.
Answer: 100
31. If two nichrome wires have equal length but different thicknesses, comparing their heating under similar conditions helps investigate the effect of wire __________ on heat generation.
Answer: thickness
32. If two nichrome wires have the same thickness but different lengths, the experiment can be used to investigate how wire __________ affects heating.
Answer: length
33. A lifting electromagnet that stops attracting clips after its cell becomes weak demonstrates that electromagnet strength depends on the amount of __________ flowing through its coil.
Answer: electric current
34. Earth's magnetic field is linked to electric currents created by the movement of __________ in its core.
Answer: liquid iron
35. Migratory birds and some other animals can use Earth's __________ field to help navigate over long distances.
Answer: magnetic

4.5 One-mark questions with Answers of LOTS Type: (30 Questions)

The following **30 one-mark questions** are based directly on the uploaded Grade 8 Science chapter and focus on **LOTS (Remembering and Understanding)**.

1. **What happens to a compass needle when electric current flows through a nearby wire?**
Answer: The compass needle gets deflected from its original direction.
2. **What is meant by the magnetic effect of electric current?**
Answer: The production of a magnetic field around a conductor when electric current flows through it is called the magnetic effect of electric current.
3. **What is a magnetic field?**
Answer: A magnetic field is the region around a magnet or current-carrying wire where its magnetic effect can be felt.
4. **Who discovered the magnetic effect of electric current?**
Answer: Hans Christian Oersted discovered the magnetic effect of electric current in 1820.

5. **What happens to the magnetic field around a wire when current stops flowing?**
   Answer: The magnetic field around the wire disappears when the current stops flowing.
6. **What is an electromagnet?**
   Answer: A current-carrying coil that behaves like a magnet is called an electromagnet.
7. **Why is an iron core commonly used in an electromagnet?**
   Answer: An iron core is used to make an electromagnet stronger.
8. **How many poles does an electromagnet have?**
   Answer: An electromagnet has two poles, North and South.
9. **Name two factors that affect the strength of an electromagnet.**
   Answer: The amount of electric current and the number of turns in the coil affect the strength of an electromagnet.
10. **How can the poles of an electromagnet be reversed?**
    Answer: The poles of an electromagnet can be reversed by reversing the direction of electric current through the coil.
11. **What happens to the strength of an electromagnet when the number of turns in its coil is increased?**
    Answer: The electromagnet becomes stronger when the number of turns in its coil is increased.
12. **What are lifting electromagnets?**
    Answer: Lifting electromagnets are strong electromagnets used with cranes to lift iron and steel objects.
13. **Where are lifting electromagnets commonly used?**
    Answer: Lifting electromagnets are commonly used in factories and scrap yards to move, lift, and sort heavy metal objects.
14. **What is the heating effect of electric current?**
    Answer: The heating of a conductor due to the flow of electric current through it is called the heating effect of electric current.
15. **What happens to a nichrome wire when electric current passes through it?**
    Answer: A nichrome wire becomes warm when electric current passes through it.
16. **Why does a current-carrying conductor become hot?**
    Answer: Its resistance converts some of the electrical energy into heat energy.
17. **Which offers greater resistance for the same size and length—nichrome or copper?**
    Answer: Nichrome offers greater resistance than copper of the same size and length.
18. **Name any two factors on which the heat generated in a wire depends.**
    Answer: The heat generated depends on factors such as the material and thickness of the wire.
19. **What is a heating element?**
    Answer: A heating element is a rod or coil of wire in an electrical appliance that produces heat when current passes through it.
20. **Name any two appliances that work on the heating effect of electric current.**
    Answer: Electric irons and electric kettles work on the heating effect of electric current.
21. **What is a Voltaic cell also known as?**
    Answer: A Voltaic cell is also known as a Galvanic cell.
22. **What are electrodes in a Voltaic cell?**
    Answer: Electrodes are two metal rods made of different materials that are partly dipped in the electrolyte.

23. **What is an electrolyte?**
    Answer: An electrolyte is usually a weak acid or salt solution in which the electrodes of a Voltaic cell are partly dipped.
24. **How does a Voltaic cell produce electricity?**
    Answer: A Voltaic cell produces electricity through a chemical reaction between the electrodes and the electrolyte.
25. **When is an electric cell said to be 'dead'?**
    Answer: A cell is said to be dead when its chemicals are used up and it can no longer supply electricity.
26. **What acts as the electrolyte in the lemon-cell experiment?**
    Answer: Lemon juice acts as the electrolyte in the lemon-cell experiment.
27. **Which materials act as electrodes in the lemon cell described in the chapter?**
    Answer: Copper wire and an iron nail act as the electrodes in the lemon cell.
28. **Why is a dry cell called 'dry'?**
    Answer: A dry cell is called dry because its electrolyte is a thick moist paste rather than a liquid.
29. **What acts as the negative terminal of a dry cell?**
    Answer: The zinc container acts as the negative terminal of a dry cell.
30. **What is the main advantage of rechargeable batteries?**
    Answer: Rechargeable batteries can be recharged and reused multiple times, reducing wastage and saving money.

4.6 One-mark questions with Answers of HOTS Type: (35 Questions)

The following questions focus on **Higher-Order Thinking Skills (HOTS)** such as application, analysis, prediction, reasoning, and inference, while keeping each answer to **one sentence suitable for one mark**. The chapter establishes that current produces a magnetic field and that electromagnet strength can be altered by current and coil turns.

1. **A compass needle placed near a wire deflects only when the switch is ON; what can you infer?**
   Answer: The deflection shows that electric current flowing through the wire produces a magnetic field.
2. **Why does the compass needle return to its original position when the circuit is switched OFF?**
   Answer: It returns because the magnetic field produced by the current disappears when the current stops.
3. **If the number of cells connected to an electromagnet is increased, what change would you expect?**
   Answer: The electromagnet would become stronger because the increased current produces a stronger magnetic field.
4. **What would happen to an electromagnet if the number of turns in its coil were increased?**
   Answer: Its magnetic strength would increase and it would be able to attract more iron objects.
5. **A coil attracts only a few paper clips; suggest one way to make it attract more clips.**
   Answer: Increasing the number of turns in the coil or increasing the current would make it attract more clips.
6. **Why is an iron nail inserted inside the coil of a practical electromagnet?**
   Answer: The iron nail strengthens the magnetic effect of the current-carrying coil.

7. **What would happen to the poles of an electromagnet if the direction of current were reversed?**
   Answer: The North and South poles of the electromagnet would interchange.
8. **Why is an electromagnet more suitable than a permanent magnet for a scrap-yard crane?**
   Answer: An electromagnet can be switched ON to lift metal and switched OFF to release it.
9. **If a lifting electromagnet remains switched ON continuously, why might its wire become warm?**
   Answer: The wire becomes warm because electric current produces a heating effect while flowing through it.
10. **Why would removing the iron core from a current-carrying coil reduce compass deflection?**
    Answer: Removing the iron core weakens the electromagnet and therefore reduces its effect on the compass needle.
11. **Two identical nichrome wires are connected separately to one cell and two cells; which is expected to become hotter?**
    Answer: The wire connected to two cells is expected to become hotter because a larger current produces more heat.
12. **Why is nichrome preferred over copper for making heating elements?**
    Answer: Nichrome offers greater resistance than copper of the same size and length and therefore produces more heating.
13. **Why should a current-carrying nichrome wire not be held for a long time during an experiment?**
    Answer: It may become very hot due to the heating effect of current and cause injury.
14. **If current flows through a heating element for a longer time, what would you expect?**
    Answer: More heat would be generated because heating depends on the duration for which current flows.
15. **Why can an overloaded or unsuitable household wire become a fire hazard?**
    Answer: Excessive heating can damage insulation, plugs, or sockets and may cause a fire.
16. **An LED does not glow when connected to a lemon battery; what should be checked first?**
    Answer: The LED connections should be checked and reversed if its positive and negative terminals are connected incorrectly.
17. **Why can lemon juice be used as an electrolyte in a simple cell?**
    Answer: Lemon juice helps conduct electricity and allows the chemical process needed for the cell to work.
18. **Why are two different metals used as electrodes in a Voltaic cell?**
    Answer: Two different metals together with an electrolyte enable the chemical reaction that generates electricity.
19. **If all the chemicals in a Voltaic cell are used up, what will happen to the connected lamp?**
    Answer: The lamp will stop glowing because the cell can no longer supply electric current.
20. **Why would pure water be less suitable than lemon juice in the cell experiment shown in Fig. 4.12?**
    Answer: Lemon juice acts as a suitable electrolyte and supports the production and flow of electric current more effectively.

21. **A mobile phone battery needs charging more frequently after years of use; what can you infer?**
    Answer: The rechargeable battery has gradually worn out after repeated charging and use.
22. **Why are rechargeable batteries generally preferable to single-use dry cells for frequently used devices?**
    Answer: Rechargeable batteries can be reused many times, reducing waste and saving money.
23. **Why is a dry cell more convenient for portable devices than a traditional Voltaic cell?**
    Answer: A dry cell uses a moist paste electrolyte instead of a free-flowing liquid, making it more convenient for everyday use.
24. **Why should used batteries not be thrown into ordinary household garbage?**
    Answer: Used batteries may contain harmful acids and metals that can cause fires or damage the environment.
25. **Why is recycling used batteries beneficial even after they stop supplying electricity?**
    Answer: Recycling prevents harmful materials from entering the environment and allows valuable battery materials to be reused.
26. **A student uses coils of 25, 50, 75 and 100 turns with the same cell; which coil should show the greatest magnetic effect?**
    Answer: The 100-turn coil should show the greatest magnetic effect because increasing the number of turns strengthens the electromagnet.
27. **If an iron nail is removed from an electromagnet but current continues through the coil, will a nearby compass still deflect?**
    Answer: Yes, the compass will still deflect, but less strongly because the current-carrying coil itself produces a magnetic field.
28. **A nichrome wire becomes warm and also deflects a nearby compass; what does this demonstrate?**
    Answer: It demonstrates that the same electric current can produce both heating and magnetic effects.
29. **Why does switching OFF an electromagnet immediately release the iron objects being lifted?**
    Answer: Switching OFF stops the current, causing the electromagnet's magnetic field to disappear.
30. **How does the Earth illustrate the connection between electricity and magnetism described in the chapter?**
    Answer: Movement of liquid iron inside the Earth creates electric currents that generate the Earth's magnetic field.
31. **If an electromagnet attracts fewer clips after its battery has been used for a long time, what is a likely reason?**
    Answer: The weakened battery supplies less current, producing a weaker magnetic field.
32. **Why might future solid-state batteries be preferable to present batteries?**
    Answer: Solid-state batteries are expected to be safer, charge faster, and last longer.
33. **Why is the heating effect useful in an electric iron but undesirable in transmission wires?**
    Answer: Heating is intentionally used to warm the iron but represents unwanted energy loss in transmission wires.

34. **A crane operator wants to release a load of scrap iron without touching it; what should the operator do?**
    Answer: The operator should switch OFF the current so that the electromagnet loses its magnetic effect.
35. **Why can increasing both the current and number of coil turns make an electromagnet considerably stronger?**
    Answer: Both increased current and increased coil turns strengthen the magnetic effect produced by the electromagnet.

4.7 Two-mark questions with Answers of LOTS Type: (25 Questions)

1. **What is the magnetic effect of electric current? What happens when the current stops?**
   Answer:
   1. When electric current flows through a conductor, it produces a magnetic field around it.
   2. When the current stops flowing, the magnetic field disappears.
2. **What is a magnetic field? How can its presence near a current-carrying wire be detected?**
   Answer:
   1. The region around a magnet or current-carrying wire where its magnetic effect can be felt is called a magnetic field.
   2. Its presence can be detected by observing the deflection of a magnetic compass needle.
3. **What did Hans Christian Oersted discover?**
   Answer:
   1. Oersted discovered in 1820 that an electric current produces a magnetic field.
   2. His discovery established a connection between electricity and magnetism.
4. **What is an electromagnet? How can it be made stronger?**
   Answer:
   1. A current-carrying coil that behaves like a magnet is called an electromagnet.
   2. It can be made stronger by inserting an iron core inside the coil.
5. **What happens when an iron nail is inserted into a current-carrying coil?**
   Answer:
   1. The iron nail makes the current-carrying coil a stronger magnet.
   2. The stronger electromagnet produces greater compass deflection and can attract iron clips.
6. **Name the two poles of an electromagnet. How are they similar to those of an ordinary magnet?**
   Answer:
   1. An electromagnet has a North pole and a South pole.
   2. Like an ordinary magnet, its unlike poles attract each other.
7. **State two factors that affect the strength of an electromagnet.**
   Answer:
   1. The strength depends on the amount of electric current flowing through the coil.
   2. It also depends on the number of turns in the coil.
8. **What happens when the number of cells connected to an electromagnet is increased?**
   Answer:

   1. More cells provide a larger current and produce a stronger magnetic field.
   2. Therefore, the electromagnet can attract more iron clips.
9. **What happens when the number of turns in an electromagnet coil is increased?**
   Answer:
   1. Increasing the number of turns makes the coil a stronger magnet.
   2. Consequently, its magnetic effect becomes greater.
10. **What happens when the direction of current through an electromagnet is reversed?**
   Answer:
   1. Reversing the direction of current reverses the poles of the electromagnet.
   2. Its North pole becomes South and its South pole becomes North.
11. **What are lifting electromagnets? Where are they commonly used?**
   Answer:
   1. Lifting electromagnets are strong electromagnets attached to cranes for lifting iron and steel objects.
   2. They are widely used in factories and scrap yards to move, lift, and sort heavy metal items.
12. **How does a lifting electromagnet work?**
   Answer:
   1. When current is switched ON, the electromagnet develops a magnetic field and lifts iron or steel objects.
   2. When current is switched OFF, the magnetic field disappears and the objects are released.
13. **What is the heating effect of electric current? Why does a conductor become hot?**
   Answer:
   1. The generation of heat in a conductor due to the flow of electric current is called the heating effect of electric current.
   2. The resistance offered by the conductor causes some electrical energy to be converted into heat energy.
14. **Name any four factors on which the heat generated in a wire depends.**
   Answer:
   1. Heat generated depends on the material, thickness, and length of the wire.
   2. It also depends on the magnitude of current and the duration for which the current flows.
15. **What is a heating element? Name two appliances containing heating elements.**
   Answer:
   1. A heating element is a rod or coil of wire used to produce heat in an electrical appliance.
   2. Electric irons and electric kettles are examples of appliances containing heating elements.
16. **Name four appliances that work on the heating effect of electric current.**
   Answer:
   1. Electric room heaters and electric stoves work on the heating effect of electric current.
   2. Electric kettles and electric irons also work on the same principle.
17. **What is a Voltaic cell? What are its main components?**
   Answer:
   1. A Voltaic cell, also called a Galvanic cell, is an electric cell that produces electricity through chemical reactions.

2. It consists mainly of two different metal electrodes and an electrolyte.

18. **What is the role of an electrolyte in a Voltaic cell? What may be used as an electrolyte?**
Answer:
    1. The electrolyte participates in the chemical process that enables the cell to generate electricity.
    2. A weak acid or salt solution can be used as the electrolyte.
19. **Explain the electrodes and electrolyte used in a lemon cell.**
Answer:
    1. The copper wire and iron nail act as the two metal electrodes in a lemon cell.
    2. Lemon juice acts as the electrolyte and helps conduct electricity.
20. **What is a dry cell? Why is it called a 'dry' cell?**
Answer:
    1. A dry cell is a widely used electric cell containing a zinc container, carbon rod, and electrolyte.
    2. It is called a dry cell because its electrolyte is a thick moist paste rather than a liquid.
21. **State the functions of the zinc container and carbon rod in a dry cell.**
Answer:
    1. The zinc container acts as the negative terminal of the dry cell.
    2. The carbon rod with its metal cap acts as the positive terminal.
22. **What are rechargeable batteries? Give two advantages.**
Answer:
    1. Rechargeable batteries can be charged and reused multiple times.
    2. Their repeated use helps prevent wastage and saves money over time.
23. **Give four examples of devices that use rechargeable batteries.**
Answer:
    1. Mobile phones and laptops commonly use rechargeable batteries.
    2. Cameras, inverters, and electric vehicles also use rechargeable batteries.
24. **What are lithium-ion batteries? Mention one limitation associated with their materials.**
Answer:
    1. Lithium-ion batteries are the most common type of rechargeable batteries used in many modern devices.
    2. They depend on metals such as lithium and cobalt that are mined and processed in limited parts of the world.
25. **Why should used batteries be sent to e-waste recycling facilities?**
Answer:
    1. Used batteries may contain acids and metals such as lead, cadmium, nickel, or lithium that can harm the environment.
    2. E-waste recycling allows valuable battery materials to be recovered and reused.

4.8. Two-mark questions with Answers of HOTS Type: (20 Questions)

1. **A compass needle placed near a wire deflects when the switch is ON but returns to its original position when the switch is OFF. What can you infer?**
Answer:
    1. The deflection shows that the current-carrying wire produces a magnetic field around it.

   2. When the current stops, the magnetic field disappears, so the compass returns to its original position.

2. **A student inserts an iron nail inside a current-carrying coil. Predict what will happen to the compass deflection and explain why.**
   Answer:
   1. The compass needle will show a greater deflection after the iron nail is inserted.
   2. This happens because the iron core makes the electromagnet stronger.
3. **Two identical electromagnets use one cell and four cells respectively. Which one will attract more paper clips? Why?**
   Answer:
   1. The electromagnet connected to four cells will attract more paper clips.
   2. More cells produce a larger current and hence a stronger magnetic field.
4. **Two coils are connected to identical cells, but one has 25 turns and the other has 100 turns. Which is likely to produce a stronger magnetic effect?**
   Answer:
   1. The coil with 100 turns will produce a stronger magnetic effect.
   2. Increasing the number of turns increases the strength of an electromagnet.
5. **A student reverses the terminals of the battery connected to an electromagnet. Predict the effect on its poles.**
   Answer:
   1. Reversing the battery terminals reverses the direction of current through the coil.
   2. Therefore, the North and South poles of the electromagnet interchange.
6. **Why is an electromagnet more suitable than a permanent magnet for a crane in a scrap yard?**
   Answer:
   1. An electromagnet can be switched ON to attract and lift iron or steel objects.
   2. It can be switched OFF to release the objects whenever required.
7. **A crane's electromagnet suddenly stops attracting iron objects when its power supply fails. Explain the observation.**
   Answer:
   1. Without electric current, the coil cannot maintain its magnetic field.
   2. Therefore, the electromagnet loses its magnetic effect and releases the iron objects.
8. **A nichrome wire and a copper wire of the same size and length carry current. Which is expected to produce more heating? Why?**
   Answer:
   1. The nichrome wire is expected to produce more heating.
   2. Nichrome offers greater resistance than copper of the same size and length, causing more electrical energy to be converted into heat.
9. **A nichrome wire is connected first to one cell and then to two cells for the same duration. In which case will it become hotter? Explain.**
   Answer:
   1. The wire will heat up more when connected to two cells.
   2. The larger current supplied by two cells results in greater heat generation.
10. **Why can using an unsuitable wire in a household circuit become a fire hazard?**
    Answer:
    1. Excessive current may cause unsuitable wires, plugs, or sockets to overheat and damage or melt their parts.

2. Such overheating can lead to electrical fires, so components must be appropriately rated for the specified current.

11. **A current-carrying nichrome wire becomes warm and also deflects a nearby compass. What two conclusions can you draw?**
Answer:
    1. The warming of the wire demonstrates the heating effect of electric current.
    2. The compass deflection demonstrates the magnetic effect of the same electric current.
12. **A lemon cell has copper and iron electrodes, but the LED does not glow. What should the student check first? Why?**
Answer:
    1. The student should check whether the LED has been connected with the correct polarity and reverse its connections if necessary.
    2. Current passes through an LED only when its positive and negative terminals are connected to the corresponding battery terminals.
13. **Why would a lemon cell work better than a similar arrangement containing pure water?**
Answer:
    1. Lemon juice acts as an electrolyte and helps conduct electricity between the electrodes.
    2. Therefore, the lemon arrangement can function as a Voltaic cell, unlike the pure-water arrangement shown for comparison on page 60.
14. **A Voltaic cell stops supplying electricity after prolonged use. Why does this happen?**
Answer:
    1. Electricity in the cell is produced by chemical reactions involving its electrodes and electrolyte.
    2. As the chemicals become used up over time, the cell becomes 'dead' and can no longer supply electricity.
15. **Why are rechargeable batteries preferable to single-use dry cells for devices used frequently?**
Answer:
    1. Rechargeable batteries can be charged and reused many times instead of being discarded after one use.
    2. This reduces wastage and can save money over time.
16. **A mobile phone battery needs charging more frequently after being used for several years. What can you infer?**
Answer:
    1. Rechargeable batteries gradually wear out after repeated charging and use.
    2. Therefore, an older battery may need to be recharged more frequently than when it was new.
17. **A student removes the iron nail from an electromagnet but keeps current flowing through the coil. Will the compass still deflect? Compare the deflection.**
Answer:
    1. Yes, the compass will still deflect because a current-carrying coil itself produces a magnetic field.
    2. The deflection will be smaller because removing the iron core makes the electromagnet weaker.

18. **Why should the wire in an electromagnet experiment not remain connected to the cell for a long time?**
Answer:
    1. Keeping the circuit connected continuously causes current to flow and can weaken the cell quickly.
    2. The wire may also become warm because electric current produces a heating effect.
19. **A student wants to make an electromagnet stronger without changing the iron core. Suggest two changes.**
Answer:
    1. The student can increase the current flowing through the coil by using more cells.
    2. The student can also increase the number of turns in the coil.
20. **Why is throwing a 'dead' battery into ordinary household garbage environmentally unsafe?**
Answer:
    1. A used battery may still contain acids and metals such as lead, cadmium, nickel, or lithium that can cause fires or environmental harm.
    2. It should therefore be sent to an appropriate e-waste recycling facility where useful materials can be recovered and reused.

4.9. Three-mark questions with Answers of LOTS Type: (18 Questions)

1. What is the magnetic effect of electric current? Explain it in three points.
Answer:
1. When electric current flows through a conductor, it produces a magnetic field around it.
2. This phenomenon is called the **magnetic effect of electric current**.
3. When the current stops flowing, the magnetic field around the conductor disappears.

2. What is a magnetic field? How can it be detected around a current-carrying wire?
Answer:
1. The region around a magnet or current-carrying wire where its magnetic effect can be felt is called a **magnetic field**.
2. A magnetic compass can be placed near the current-carrying wire to detect this field.
3. The deflection of the compass needle when current flows indicates the presence of a magnetic field.

3. What is an electromagnet? Describe its basic features.
Answer:
1. A current-carrying coil that behaves like a magnet is called an **electromagnet**.
2. An iron core is generally placed inside the coil to make the electromagnet stronger.
3. The coil loses its magnetic effect when the electric current is stopped.

4. State three factors related to the strength and polarity of an electromagnet.
Answer:
1. Increasing the amount of current flowing through the coil increases the strength of the electromagnet.
2. Increasing the number of turns in the coil also makes the electromagnet stronger.
3. The poles of an electromagnet can be reversed by reversing the direction of electric current.

5. Describe the working of a lifting electromagnet.
Answer:

1. When the current is switched ON, the electromagnet develops a magnetic field and lifts iron or steel objects.
2. When the current is switched OFF, the magnetic field disappears and the objects are released.
3. Lifting electromagnets are commonly used in factories and scrap yards for moving, lifting and sorting heavy metal objects.

6. What is the heating effect of electric current?

Answer:

1. A conductor offers resistance or opposition to the flow of electric current.
2. Due to this resistance, some electrical energy is converted into heat energy.
3. The generation of heat in a conductor due to the flow of electric current is called the **heating effect of electric current**.

7. Mention three factors that affect the amount of heat generated in a wire.

Answer:

1. The heat generated depends on the magnitude of electric current flowing through the wire.
2. It also depends on the material, thickness and length of the wire.
3. The duration for which the electric current flows through the wire also affects the heat generated.

8. Explain the role of a heating element in electrical appliances.

Answer:

1. A heating element is a rod or coil of wire present in electrical heating appliances.
2. It becomes hot when electric current passes through it because of the heating effect of electric current.
3. Heating elements are used in appliances such as electric heaters, stoves, kettles, irons, immersion rods and hair dryers.

9. State three problems that may arise due to unwanted heating in electrical circuits.

Answer:

1. Heating of wires can result in the loss of electrical energy during transmission.
2. Excessive heating may damage plugs and sockets and can melt their plastic parts.
3. Severe overheating may even result in electrical fires.

10. Describe the basic construction and working of a Voltaic cell.

Answer:

1. A Voltaic cell contains two electrodes made of different metals partly dipped in an electrolyte.
2. The electrolyte is usually a weak acid or salt solution contained in a glass or plastic container.
3. Chemical reactions between the electrodes and electrolyte produce electricity.

11. Describe how a lemon can be used to make an electric cell.

Answer:

1. A copper wire and an iron nail are inserted into a juicy lemon at a small distance from each other.
2. The copper wire and iron nail act as electrodes, while lemon juice acts as the electrolyte.
3. Several such lemon cells can be connected to an LED, whose glow indicates that the cells are producing electricity.

12. Describe the main parts of a dry cell.

Answer:

1. A dry cell contains a thick, moist paste that acts as the electrolyte.
2. Its zinc container acts as the negative terminal.

3. A carbon rod at the centre, covered with a metal cap, acts as the positive terminal.

13. Write three points about rechargeable batteries.

Answer:

1. Rechargeable batteries can be charged and reused multiple times.
2. They are used in devices such as watches, mobile phones, laptops, inverters and electric vehicles.
3. Rechargeable batteries gradually wear out after being charged and used many times.

14. Write three points about lithium-ion batteries.

Answer:

1. Lithium-ion batteries are a common type of rechargeable battery used in many battery-powered devices.
2. They depend on special metals such as lithium and cobalt.
3. Recycling old batteries and developing new battery technologies are important because these metals are mined and processed in limited parts of the world.

15. Why should used batteries be recycled? Give three points.

Answer:

1. Used batteries may still contain acids and metals such as lead, cadmium, nickel or lithium.
2. These materials may cause fires or harm the environment when batteries are thrown into ordinary garbage.
3. Recycling allows valuable materials from batteries to be recovered and reused.

16. Describe Hans Christian Oersted's discovery regarding electricity and magnetism.

Answer:

1. In 1820, Hans Christian Oersted observed that a nearby magnetic compass needle deflected when an electrical circuit was closed or opened.
2. He investigated the observation and established that an electric current produces a magnetic field.
3. His discovery demonstrated an important connection between electricity and magnetism.

17. Explain three features of the poles of an electromagnet.

Answer:

1. Like an ordinary magnet, an electromagnet has two poles—North and South.
2. The two ends of an electromagnet have opposite polarities.
3. The polarity of its ends can be reversed by changing the direction of electric current through the coil.

18. State three points about Earth's magnetic field mentioned in the chapter.

Answer:

1. Movement of liquid iron deep inside Earth's core creates electric currents that generate a magnetic field.
2. Many migratory birds, fish and animals use Earth's magnetic field for navigation.
3. Earth's magnetic field also helps protect life by shielding the planet from harmful particles from space.

4.10. Three-mark questions with Answers of HOTS Type: (18 Questions)

1. A student makes an electromagnet using an iron nail and a coil connected to one cell. How can the student make the electromagnet stronger without changing the iron nail? Explain.

Answer:

1. The student can increase the number of turns of wire around the iron nail.

2. The student can also use more cells so that a larger current flows through the coil.
3. Both changes produce a stronger magnetic field, enabling the electromagnet to attract more iron objects.

2. An electromagnet attracts paper clips when connected to a battery but drops them immediately when disconnected. Explain why.

Answer:

1. When current flows through the coil, it produces a magnetic field and the coil behaves like a magnet.
2. The iron core strengthens this magnetic effect and therefore attracts the paper clips.
3. When the current stops, the magnetic effect disappears and the paper clips fall.

3. A student removes the iron nail from the centre of a current-carrying coil. Predict what will happen to a nearby compass needle and explain why.

Answer:

1. The compass needle will still deflect because a current-carrying coil itself produces a magnetic field.
2. However, the deflection will be less because the iron core is no longer present.
3. This shows that an iron core strengthens an electromagnet but is not essential for producing the magnetic effect.

4. Two identical electromagnets have 25 and 100 turns respectively and are connected to the same cell. Which one is likely to attract more paper clips? Why?

Answer:

1. The electromagnet having 100 turns is expected to attract more paper clips.
2. Increasing the number of turns of the coil increases the strength of the electromagnet.
3. Therefore, with the same cell, the 100-turn coil should produce a stronger magnetic effect than the 25-turn coil.

5. A crane operator needs to lift a pile of iron objects and then release them at another place. Why is an electromagnet more suitable than a permanent magnet?

Answer:

1. An electromagnet can be switched ON to produce a magnetic field and lift the iron objects.
2. It can be switched OFF at the required location so that the magnetic field disappears and the objects are released.
3. This controllability makes electromagnets especially suitable for cranes used in factories and scrap yards.

6. A student reverses the terminals of the battery connected to an electromagnet. Predict the effect on its strength and poles.

Answer:

1. Reversing the battery terminals reverses the direction of current through the coil.
2. As a result, the North and South poles of the electromagnet interchange.
3. If the amount of current and number of turns remain unchanged, the main change is in polarity rather than the strength of the electromagnet.

7. A nichrome wire and a copper wire of the same size and length carry electric current. Which is more suitable as a heating element? Justify your answer.

Answer:

1. Nichrome is more suitable because it offers higher resistance than copper of the same size and length.
2. Resistance causes some electrical energy to be converted into heat energy.
3. Therefore, nichrome can generate more heat and is suitable for electrical heating devices.

8. A student connects a nichrome wire first to one cell and then to two cells for the same duration. Predict and explain the observation.
Answer:
1. The nichrome wire will heat up more when connected to two cells.
2. A battery of two cells can result in a greater current than a single cell in the chapter's activity.
3. Since the heat generated depends on the magnitude of current, more heat is produced in the two-cell experiment.

9. Why can the heating effect of electric current be considered both useful and harmful?
Answer:
1. It is useful because appliances such as electric irons, kettles, heaters and stoves use it to produce heat.
2. It can be harmful because unwanted heating may waste energy, melt plastic parts of plugs and sockets, and cause fires.
3. Therefore, heating is beneficial when controlled but potentially dangerous when excessive or unintended.

10. Sumana leaves her lifting electromagnet switched ON for a long time. Later, it stops lifting paper clips although the wire remains warm. Give possible reasons.
Answer:
1. Keeping the electromagnet connected continuously may weaken the cell as its chemicals are gradually used up.
2. The weakened cell may no longer provide enough current to produce a sufficiently strong magnetic field to lift the clips.
3. The wire can still remain warm because the current flowing through it produces a heating effect.

11. A student makes two cells—one using lemon juice and another using pure water—with copper and iron electrodes. Which arrangement is more likely to light an LED? Explain.
Answer:
1. The cell containing lemon juice is more likely to make the LED glow.
2. Lemon juice acts as an electrolyte and helps the cell generate and conduct electric current between the electrodes.
3. Thus, the copper and iron electrodes together with lemon juice can form a working simple Voltaic cell.

12. An LED does not glow when connected to a set of lemon cells, although the cells have been connected correctly. What should the student check first? Explain.
Answer:
1. The student should first check whether the LED has been connected with the correct polarity.
2. Current passes through the LED when its longer wire is connected to the positive terminal and its shorter wire to the negative terminal.
3. Reversing the LED connections may therefore make it glow if incorrect polarity was the problem.

13. Why are rechargeable batteries environmentally preferable to single-use dry cells, although rechargeable batteries also eventually wear out?
Answer:
1. Rechargeable batteries can be charged and reused many times, reducing the number of batteries that need to be discarded.
2. This helps prevent wastage and can save money over time compared with repeatedly using single-use cells.

3. However, worn-out rechargeable batteries must still be properly recycled because they may contain materials harmful to the environment.

14. A used battery can no longer operate a device. Why should it not simply be thrown into household garbage?

Answer:

1. A battery that no longer supplies useful electricity may still contain acids and metals such as lead, cadmium, nickel or lithium.
2. These materials can cause fires or harm the environment if discarded with ordinary garbage.
3. Therefore, used batteries should be sent to suitable e-waste recycling facilities so valuable materials can also be recovered.

15. A compass needle placed below a nichrome wire deflects, and after some time the wire also becomes warm. What two effects of electric current does this demonstrate?

Answer:

1. The compass deflection demonstrates the **magnetic effect of electric current**, because current produces a magnetic field around the wire.
2. The warming of the nichrome wire demonstrates the **heating effect of electric current**, caused by resistance to current flow.
3. Thus, the same current-carrying conductor can simultaneously exhibit both magnetic and heating effects.

16. A factory wants to design a powerful lifting electromagnet. Suggest three changes or features that would improve its performance.

Answer:

1. An iron core should be placed inside the coil because it strengthens the electromagnet.
2. The coil can be made with a larger number of turns to increase its magnetic strength.
3. A suitable source providing greater current can also strengthen the magnetic field and allow heavier iron or steel objects to be lifted.

17. Scientists are developing solid-state batteries to replace some present rechargeable batteries. What advantages does the chapter predict for this technology?

Answer:

1. Solid-state batteries replace liquid or paste-like electrolytes with solid materials.
2. The chapter states that such batteries could be safer, charge faster and last longer.
3. Hence, their development could contribute to improved rechargeable batteries and more environmentally friendly electrical power technologies.

18. A student observes that increasing the number of turns of a coil increases compass deflection. What conclusion can be drawn from this experiment?

Answer:

1. Greater compass deflection indicates that the magnetic effect of the coil has become stronger.
2. Since the cell and other conditions are kept the same, the increased strength is associated with the greater number of coil turns.
3. Therefore, the experiment supports the conclusion that increasing the number of turns can strengthen an electromagnet.

4.11 Five-mark questions with Answers of LOTS Type: (12 Questions)

1. What is the magnetic effect of electric current? Explain it with the help of a magnetic compass.

Answer:

1. When electric current flows through a conductor, it produces a **magnetic field** around it.
2. This phenomenon is called the **magnetic effect of electric current**.
3. When a magnetic compass is placed near a current-carrying wire, its needle gets deflected.
4. When the current is stopped, the magnetic effect disappears and the compass needle returns to its original direction.
5. Thus, the deflection of the compass needle shows that a current-carrying conductor produces a magnetic field.

2. What is an electromagnet? Describe how an electromagnet can be made using an iron nail.

Answer:

1. An **electromagnet** is a current-carrying coil that behaves like a magnet.
2. Take an iron nail and tightly wind an insulated wire around it in the form of a coil.
3. Connect the two ends of the wire to an electric cell so that current flows through the coil.
4. The iron nail then behaves like a magnet and attracts iron objects such as paper clips.
5. When the current is switched off, the coil loses its magnetic effect and the paper clips are no longer attracted.

3. Describe five important properties of an electromagnet.

Answer:

1. An electromagnet behaves like a magnet only when electric current flows through its coil.
2. Like a bar magnet, an electromagnet has two poles—**North and South**.
3. An iron core placed inside the coil makes the electromagnet stronger.
4. Its strength can be increased by increasing the current or the number of turns of the coil.
5. Its North and South poles can be reversed by reversing the direction of electric current.

4. Explain the working and uses of a lifting electromagnet.

Answer:

1. A lifting electromagnet is a strong electromagnet that can be attached to a crane.
2. When the electric current is switched ON, the electromagnet produces a magnetic field.
3. It then attracts and lifts objects made of iron or steel.
4. When the current is switched OFF, the magnetic field disappears and the objects are released.
5. Lifting electromagnets are commonly used in factories and scrap yards to move, lift and sort heavy metal objects.

5. What is the heating effect of electric current? Explain how it occurs.

Answer:

1. When electric current passes through a conductor, the conductor becomes heated.
2. This phenomenon is known as the **heating effect of electric current**.
3. A conductor offers some opposition or **resistance** to the flow of electric current.
4. Due to this resistance, some electrical energy is converted into heat energy.
5. The heat generated depends on factors such as the material, thickness and length of the wire, the magnitude of current, and the duration for which current flows.

6. Explain the applications of the heating effect of electric current in everyday life.

Answer:

1. The heating effect of electric current is used in many household electrical appliances.
2. An electric room heater uses this effect to produce heat for warming a room.
3. Electric stoves and kettles use it for cooking and heating water.

4. Electric irons and immersion rods use the heat generated by electric current for ironing clothes and heating water respectively.
5. Hair dryers also use the heating effect, and these appliances contain a rod or coil of wire called a **heating element**.

7. What are the harmful effects of unwanted electrical heating? Mention the necessary precautions.

Answer:

1. Unwanted heating can cause loss of electrical energy in wires during transmission.
2. Excessive heating may damage electrical appliances, plugs and sockets.
3. Plastic parts of plugs and sockets may melt due to overheating.
4. Severe overheating may even cause electrical fires.
5. Appropriate wires, plugs and sockets rated for the specified electric current should therefore be used to prevent unnecessary heating.

8. Describe the construction and working of a Voltaic cell.

Answer:

1. A **Voltaic cell**, also called a Galvanic cell, contains two metal rods made of different materials.
2. These rods are called **electrodes** and are partly dipped in a liquid called an **electrolyte**.
3. The electrolyte is usually a weak acid or salt solution contained in a glass or plastic container.
4. A chemical reaction between the electrodes and electrolyte produces electricity.
5. When the circuit is connected, electric current flows from the positive terminal through the external circuit towards the negative terminal.

9. Describe how a simple electric cell can be made using lemons.

Answer:

1. Take five or six juicy lemons, copper wires or strips, iron nails, an LED and connecting wires.
2. Insert one copper wire and one iron nail into each lemon, keeping them a small distance apart.
3. Connect the copper wires and iron nails of the lemons in the arrangement shown in the chapter.
4. Connect the LED between the copper wire of the first lemon and the iron nail of the last lemon; reverse the LED connections if necessary.
5. Here, the copper wires and iron nails act as **electrodes**, while the lemon juice acts as the **electrolyte**.

10. Describe the structure and important features of a dry cell.

Answer:

1. A dry cell is widely used because it is more convenient for everyday use than a Voltaic cell.
2. It is called a **dry cell** because its electrolyte is a thick moist paste rather than a liquid.
3. The zinc container of the dry cell acts as its **negative terminal**.
4. The carbon rod at the centre, covered with a metal cap, acts as its **positive terminal** and is surrounded by the paste-like electrolyte.
5. A dry cell is a **single-use cell**, so once it is used up, it has to be disposed of.

11. Write five points about rechargeable batteries.

Answer:

1. Rechargeable batteries can be **recharged and reused multiple times**.
2. Their repeated use helps prevent wastage and can save money over time.
3. They are used in devices such as watches, mobile phones, cameras, laptops and tablets.
4. Larger rechargeable batteries are also used in inverters and electric vehicles.

5. Rechargeable batteries do not last forever and gradually wear out after being charged and used many times.

12. Explain why used batteries should be disposed of properly.

Answer:

1. A battery that stops working may still contain potentially harmful materials.
2. These may include acids and metals such as lead, cadmium, nickel or lithium.
3. Throwing such batteries into ordinary garbage may harm the environment or create a fire risk.
4. Many materials present in batteries are valuable and can be recycled and reused.
5. Therefore, used batteries should preferably be disposed of through special **e-waste recycling facilities**.

4.12 Five-mark questions with Answers of HOTS Type: (10 Questions)

1. A student makes an electromagnet using an iron nail, a coil of wire and one cell. It can lift only a few paper clips. Suggest ways to make the electromagnet stronger and justify your suggestions.

Answer:

1. The student can increase the **number of turns of wire** around the iron nail because more turns make the electromagnet stronger.
2. More cells can be used so that a larger electric current flows through the coil.
3. A larger current produces a **stronger magnetic field** around the coil.
4. The iron nail should remain inside the coil because the iron core considerably strengthens the electromagnet.
5. Therefore, increasing the current and number of turns while using an iron core will enable the electromagnet to attract more paper clips.

2. A compass needle placed near a coil deflects when current flows. Predict and explain what will happen if (a) the current is switched off, (b) the direction of current is reversed, and (c) an iron nail is inserted into the coil.

Answer:

1. When current flows through the coil, it produces a magnetic field and hence deflects the compass needle.
2. When the current is switched off, the magnetic effect disappears and the compass needle returns to its original position.
3. If the direction of current is reversed, the **North and South poles of the electromagnet are reversed**.
4. If an iron nail is inserted into the coil, the electromagnet becomes stronger.
5. Therefore, the compass shows a greater deflection with the iron core, while reversing the current changes the polarity of the electromagnet.

3. Sumana leaves her lifting electromagnet switched ON for a long time. Later, the nail stops picking up paper clips although the wire is still warm. Analyse the possible reasons.

Answer:

1. Keeping the circuit ON continuously causes electric current to flow through the coil for a long time.
2. The resistance of the wire converts some electrical energy into **heat**, making the wire warm.
3. Continuous use may weaken the cell because its chemicals gradually get used up.
4. A weakened cell supplies less current, resulting in a weaker magnetic field around the electromagnet.

5. Eventually, the magnetic field may become too weak to lift the paper clips even though some current still flows and produces heat.

4. Two identical nichrome wires are connected separately to one cell and two cells for the same duration. Predict which wire will become hotter and explain your reasoning.

Answer:

1. The nichrome wire connected to **two cells** will become hotter.
2. A battery with more cells can provide a larger electric current than a single cell in the chapter's experiment.
3. The amount of heat generated in the wire depends on the magnitude of electric current.
4. Therefore, the greater current produced using two cells causes more heating during the same duration.
5. This demonstrates that changing the magnitude of current can change the amount of heat generated in a conductor.

5. Why would nichrome be more suitable than a copper wire of the same size and length for the heating element of an electric heater?

Answer:

1. Different conducting materials offer different amounts of resistance to electric current.
2. Nichrome offers **higher resistance** than copper of the same size and length.
3. Resistance causes part of the electrical energy to be converted into heat energy.
4. Therefore, nichrome generates more useful heat for heating purposes than copper under the conditions discussed in the chapter.
5. Hence, nichrome is better suited for heating devices such as electric heaters and stoves.

6. A student removes the iron nail from an electromagnet but leaves the coil connected to the cell. Will the compass needle still deflect? Analyse what will happen and why.

Answer:

1. The compass needle will **still deflect** because current continues to flow through the coil.
2. A current-carrying coil itself behaves like a magnet and produces a magnetic field.
3. However, the compass deflection will be smaller after the iron nail is removed.
4. This is because inserting an iron core makes the magnetic effect of the coil much stronger.
5. Thus, the iron nail is not necessary for producing magnetism, but it greatly increases the strength of the electromagnet.

7. A student prepares two containers: one with lemon juice and another with pure water. An iron nail and copper strip are inserted into each. Predict which arrangement is more likely to make an LED glow and explain why.

Answer:

1. The arrangement containing **lemon juice** is expected to make the LED glow.
2. The iron nail and copper strip act as two different metal electrodes.
3. Lemon juice acts as an **electrolyte** and helps the cell generate/conduct electric current.
4. The chapter's lemon-cell activity shows that a combination of suitable electrodes and an electrolyte can form an electric cell.
5. Therefore, the lemon-juice arrangement provides the conditions described for a Voltaic cell, unlike the pure-water arrangement shown for comparison in the exercise.

8. Analyse why lifting electromagnets are more useful than permanent magnets for handling heavy iron and steel objects in a scrap yard.

Answer:

1. A lifting electromagnet can be controlled simply by switching electric current **ON or OFF**.

2. When current is switched ON, the electromagnet develops a magnetic field and attracts iron or steel objects.
3. The electromagnet can therefore lift and transport heavy metal objects efficiently.
4. When the current is switched OFF, the magnetic field disappears and the objects are released at the required place.
5. This controllability makes electromagnets particularly suitable for moving, lifting and sorting metal objects in factories and scrap yards.

9. Rechargeable batteries cost more initially than ordinary single-use dry cells. Why can they still be considered a better choice for frequently used devices?

Answer:

1. A dry cell is a **single-use cell** and must be disposed of after it is used up.
2. Rechargeable batteries can be charged and reused many times.
3. Repeated use can save money over time despite the need for recharging.
4. Reuse also reduces the number of batteries that need to be discarded.
5. Hence, rechargeable batteries can be a more economical and waste-reducing choice for devices that require frequent battery replacement.

10. A person throws used rechargeable batteries into ordinary household garbage. Evaluate this practice and suggest a better alternative.

Answer:

1. Throwing used batteries into ordinary garbage is **not a safe disposal practice**.
2. Even a battery that no longer works may contain acids and metals such as lead, cadmium, nickel or lithium.
3. These materials may create fire hazards or cause environmental harm if discarded improperly.
4. Many battery materials are valuable and can be recovered through recycling.
5. Therefore, used batteries should be taken to appropriate **e-waste recycling facilities** so that they can be handled and recycled safely.

4.13 Five-mark questions with Answers of Applied Type: (10 Questions)

1. A scrap-yard owner wants a device that can pick up a large quantity of iron pieces, move them to another location, and release them whenever required. Explain how an electromagnet can be used for this purpose.

Answer:

1. A strong electromagnet can be attached to the end of a crane for lifting the iron pieces.
2. When electric current is switched **ON**, the electromagnet produces a magnetic field and attracts the iron or steel objects.
3. The crane can then move the attracted objects to the required location.
4. When the current is switched **OFF**, the magnetic field disappears and the objects are released.
5. Thus, lifting electromagnets provide a convenient way to lift, move and sort heavy metal objects in scrap yards and factories.

2. You are asked to design a strong electromagnet for a school science exhibition using an iron nail, insulated wire and cells. Explain how you would construct it and improve its strength.

Answer:

1. Wind insulated wire tightly around an iron nail to form a coil and connect its ends to an electric cell.
2. When current passes through the coil, the iron nail behaves as a strong electromagnet.

3. Increase the **number of turns** of the wire around the nail to increase its magnetic strength.
4. Using more cells can provide a larger current and hence produce a stronger magnetic field.
5. The strength can therefore be controlled by changing the current, number of turns, or both.

3. During winter, a family uses an electric room heater. Explain how the heater produces heat and mention precautions that should be taken to prevent electrical overheating.

Answer:

1. An electric heater works on the **heating effect of electric current**.
2. When current passes through its heating element, resistance causes some electrical energy to be converted into heat energy.
3. Materials such as nichrome are suitable because nichrome offers higher resistance than copper of the same size and length.
4. Overheating may damage plugs and sockets, melt plastic parts or even cause fires.
5. Therefore, appropriate wires, plugs and sockets rated for the specified electric current should be used.

4. Your science teacher asks you to demonstrate that electric current has a magnetic effect without using an electric lamp. Describe an experiment you could perform.

Answer:

1. Make a simple circuit using an electric cell, connecting wires and a switch, and place a magnetic compass beneath a conducting wire.
2. Keep the switch OFF initially and observe the position of the compass needle.
3. Switch the circuit ON; the compass needle will deflect from its original direction.
4. Switch the circuit OFF again; the compass needle will return to its original position.
5. This shows that a current-carrying conductor produces a **magnetic field**, demonstrating the magnetic effect of electric current.

5. Suppose you have lemons, copper wires, iron nails, an LED and connecting wires. Explain how you could use these materials to make a simple battery and test whether it works.

Answer:

1. Insert a copper wire and an iron nail into each lemon, keeping them slightly apart.
2. Repeat the arrangement with several lemons and connect the copper wires and iron nails in the sequence shown in the chapter.
3. Connect the LED between the copper wire of the first lemon and the iron nail of the last lemon.
4. The copper and iron act as **electrodes**, while the lemon juice acts as the electrolyte.
5. If the LED glows, the arrangement is producing electric current; if it does not, reverse the LED connections and test again.

6. A student wants to determine how the number of turns in a coil affects the strength of an electromagnet. Design an investigation for the student.

Answer:

1. Prepare coils having **25, 50, 75 and 100 turns** of wire.
2. Connect each coil separately to the same electric cell so that the source remains unchanged.
3. Place a magnetic compass at the same position near each coil and observe its deflection.
4. Record and compare the compass deflection produced by the different coils.
5. The observations can be used to conclude that increasing the number of turns increases the strength of the electromagnet.

7. Your friend says that a coil cannot behave like a magnet unless an iron nail is placed inside it. How would you experimentally show that this statement is incorrect?
Answer:
1. Make a cylindrical coil of insulated wire and place magnetic compasses near its two ends.
2. Connect the coil to an electric cell without placing an iron nail inside it.
3. The compass needles will deflect, showing that the current-carrying coil itself produces a magnetic field.
4. Now insert an iron nail into the coil; the compass deflection becomes greater and the arrangement can attract iron clips.
5. Thus, the coil itself behaves as an electromagnet when current flows, while the iron core only makes it **stronger**.

8. A mobile phone battery that initially lasted the whole day now needs charging several times a day after years of use. Apply your knowledge of rechargeable batteries to explain this situation.
Answer:
1. Mobile phones commonly use rechargeable batteries that can be charged and reused many times.
2. However, rechargeable batteries do not last forever.
3. Repeated charging and use gradually cause the battery to wear out.
4. As the battery ages, it may need to be charged more frequently to continue operating the device.
5. Therefore, an old battery showing greatly reduced useful performance may eventually need appropriate replacement and recycling.

9. Your school collects a large number of used batteries from electronic devices. Suggest an environmentally responsible method of handling these batteries and explain its importance.
Answer:
1. Used batteries should **not be thrown into ordinary garbage**.
2. Even batteries that no longer work may contain acids and metals such as lead, cadmium, nickel or lithium.
3. Such substances may cause fires or harm the environment when improperly discarded.
4. Many materials present in batteries are valuable and can be recycled and reused.
5. Therefore, the school should collect used batteries separately and send them to suitable **e-waste recycling facilities**.

10. A student wants to investigate which factors affect the amount of heat produced in a wire carrying electric current. Suggest an experimental plan based on the chapter.
Answer:
1. The student can first compare the heating of a nichrome wire using one cell and then two cells for the same duration.
2. Two nichrome wires of equal length but different thicknesses can then be tested under similar conditions.
3. Wires of the same thickness but different lengths can also be compared.
4. The duration for which current flows can be varied carefully to observe its effect on heating.
5. The observations demonstrate that heating depends on factors including the **magnitude of current, material, thickness and length of the wire, and duration of current flow**.

4.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

Questions

1. A compass is placed just below a straight wire connected to a cell. When the switch is closed, the compass needle deflects. Which conclusion is most appropriate?
A. The wire becomes a permanent magnet.
B. The electric current produces a magnetic field around the wire.
C. The compass produces electricity in the wire.
D. The cell directly attracts the compass needle.
Answer: B. The electric current produces a magnetic field around the wire.

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2. A student switches OFF the current flowing through a wire placed above a compass. What should happen?
A. The compass needle continues to remain deflected permanently.
B. The compass needle rotates continuously.
C. The compass needle returns to its original direction.
D. The compass loses its magnetism.
Answer: C. The compass needle returns to its original direction.

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3. Which observation provides the strongest evidence that a current-carrying coil behaves like a magnet?
A. The coil becomes longer.
B. The coil changes colour.
C. The coil deflects a nearby compass needle.
D. The coil becomes transparent.
Answer: C. The coil deflects a nearby compass needle.

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4. Four identical coils have 25, 50, 75 and 100 turns respectively and are connected one at a time to the same cell. Which coil should produce the strongest magnetic effect?
A. 25 turns
B. 50 turns
C. 75 turns
D. 100 turns
Answer: D. 100 turns.
Increasing the number of turns makes the coil a stronger electromagnet.

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5. A student wants to increase the strength of an electromagnet without changing its iron core. Which change would be most suitable?
A. Reduce the number of turns of the coil.
B. Increase the number of turns of the coil.
C. Remove the electric cell.
D. Open the circuit.
Answer: B. Increase the number of turns of the coil.

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6. An electromagnet connected to one cell attracts five paper clips. Which arrangement is most likely to attract more paper clips?
A. The same electromagnet with more cells
B. The same electromagnet with the switch OFF
C. The coil without current
D. The iron nail without the coil
Answer: A. The same electromagnet with more cells.
More cells can provide a larger current, producing a stronger magnetic field.

7. An iron nail is inserted into the centre of a current-carrying coil. What is the most likely result?
A. Magnetic effect decreases.
B. Magnetic effect disappears.
C. Magnetic effect becomes stronger.
D. The current immediately stops.
Answer: C. Magnetic effect becomes stronger.

8. Suppose the north pole of a compass needle is attracted towards end P of an electromagnet. End P must be its:
A. north pole
B. south pole
C. neutral point
D. positive terminal
Answer: B. South pole.
Unlike magnetic poles attract each other.

9. What happens to the poles of an electromagnet if the direction of current through its coil is reversed?
A. Both poles disappear.
B. The poles interchange.
C. Only the north pole changes.
D. Nothing happens.
Answer: B. The poles interchange.

10. A lifting electromagnet attached to a crane is carrying an iron object. The operator switches OFF the current. What happens next?
A. The iron object remains permanently attached.
B. The electromagnet becomes stronger.
C. The magnetic field disappears and the object is released.
D. The iron object becomes electrically charged.
Answer: C. The magnetic field disappears and the object is released.

11. A nichrome wire and a copper wire have the same dimensions. According to the chapter, nichrome offers greater resistance. If they are considered for producing heat, which is more suitable?
A. Copper
B. Nichrome
C. Both must behave identically
D. Neither can produce heat
Answer: B. Nichrome.
Nichrome has higher resistance than copper of the same size and length and is suitable for heating applications.

12. Which energy transformation primarily occurs in the heating element of an electric iron?
A. Heat → electrical energy
B. Electrical → heat energy
C. Magnetic → chemical energy
D. Chemical → light energy

Answer: B. Electrical → heat energy.

---

13. A nichrome wire is connected first to one cell and then to two cells for the same duration. According to the experiment in the chapter, in which case will more heat be generated?
A. One cell
B. Two cells
C. Same in both cases
D. No heat in either case
Answer: B. Two cells.
The chapter states that the amount of heat generated depends on the magnitude of current.

---

14. Which combination contains only appliances mainly using the heating effect of electric current?
A. Electric iron, kettle and room heater
B. Compass, electromagnet and electric iron
C. Lifting crane, compass and kettle
D. Electromagnet, motor and compass
Answer: A. Electric iron, kettle and room heater.

---

15. Which of the following does **NOT** affect the heat generated in a wire according to the chapter?
A. Material of the wire
B. Thickness of the wire
C. Length of the wire
D. Colour of the wire
Answer: D. Colour of the wire.

---

16. Excessive heating in household circuits can be dangerous mainly because it may:
A. convert the wires into permanent magnets
B. melt plastic parts and possibly cause fires
C. turn all conductors into insulators
D. recharge dry cells automatically
Answer: B. Melt plastic parts and possibly cause fires.

---

17. A simple Voltaic cell requires:
A. two identical plastic rods and pure water
B. two electrodes of different metals and an electrolyte
C. only one metal electrode
D. an electromagnet and an electrolyte
Answer: B. Two electrodes of different metals and an electrolyte.

---

18. In a Voltaic cell, electricity is generated mainly because of:
A. gravitational force
B. friction between the electrodes
C. chemical reactions involving the electrodes and electrolyte
D. heating of the electrolyte
Answer: C. Chemical reactions involving the electrodes and electrolyte.

---

19. A student makes a lemon cell using an iron nail and copper wire. What role does the lemon juice perform?

A. Magnetic core
B. Electrolyte
C. Insulator
D. Heating element
Answer: B. Electrolyte.

---

20. A correctly constructed lemon battery is connected to an LED, but the LED does not glow. What should the student try first?
A. Remove all the lemons.
B. Reverse the LED connections.
C. Replace the metal electrodes with plastic.
D. Connect both LED terminals to the same electrode.
Answer: B. Reverse the LED connections.
An LED allows current through it only when connected with the correct polarity.

---

21. Which statement correctly distinguishes a dry cell from a Voltaic cell described in the chapter?
A. A dry cell contains no electrolyte.
B. A dry cell uses a thick moist paste as its electrolyte.
C. A dry cell has no terminals.
D. A dry cell produces electricity without chemical reactions.
Answer: B. A dry cell uses a thick moist paste as its electrolyte.

---

22. Which correctly represents the terminals of the dry cell described in the chapter?
A. Zinc container — positive; carbon rod — negative
B. Zinc container — negative; carbon rod with metal cap — positive
C. Both are positive
D. Both are negative
Answer: B. Zinc container — negative; carbon rod with metal cap — positive.

---

23. Consider the statements:
I. Rechargeable batteries can be used multiple times.
II. Rechargeable batteries last forever.
III. Rechargeable batteries reduce wastage compared with single-use cells.
Which is correct?
A. I only
B. I and II only
C. I and III only
D. I, II and III
Answer: C. I and III only.
Rechargeable batteries can be reused, but they gradually wear out after repeated charging and use.

---

24. A current-carrying nichrome wire is placed near a compass. Which pair of observations can occur simultaneously?
A. Wire becomes warm and compass needle deflects.
B. Wire becomes cold and compass loses magnetism.
C. Wire produces no magnetic field but becomes warm.
D. Compass deflects only if the wire remains cold.

Answer: A. Wire becomes warm and compass needle deflects.
The same electric current can demonstrate both the heating and magnetic effects.

---

25. Neha removes the iron nail from the centre of an electromagnet but keeps the coil connected to the same cell. What should happen?
A. The coil completely loses its magnetic effect.
B. The coil still has a magnetic effect, but it is weaker.
C. The coil becomes a permanent magnet.
D. The magnetic effect becomes stronger.
Answer: B. The coil still has a magnetic effect, but it is weaker.
A current-carrying coil itself behaves like a magnet, while inserting an iron core makes it stronger.

Answer Key

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.
1	B	6	A	11	B	16	B	21	B
2	C	7	C	12	B	17	B	22	B
3	C	8	B	13	B	18	C	23	C
4	D	9	B	14	A	19	B	24	A
5	B	10	C	15	D	20	B	25	B

4.15 Best Practices Opportunity List from the Chapter: (8 Ideas)

Best Practices Opportunities while Teaching Chapter 4: ***Electricity – Magnetic and Heating Effects***
The chapter provides excellent opportunities for **experiential, inquiry-based and interdisciplinary learning**, since it includes experiments on electromagnets, heating effects, cells, batteries and environmental concerns.

(1) **Learning by Doing – "Build Your Own Electromagnet":**
Students can construct an electromagnet using an iron nail, insulated wire and a cell, and test it by lifting paper clips. They can further compare coils with different numbers of turns and cells to discover how electromagnet strength changes. This converts an abstract concept into observable evidence.

(2) **Inquiry-Based Experimental Learning – "Predict, Experiment, Explain":**
Before each activity, students first **predict** the outcome, then **perform** the experiment, record observations and finally **explain** the result. For example, they can predict what will happen to a compass when current is switched ON/OFF or when the direction of current is reversed.

(3) **STEM Challenge – "Design a Mini Electromagnetic Crane":**
Small groups can design a working model of a crane capable of picking up and releasing iron objects. Students may compete to design an electromagnet that lifts the greatest number of paper clips using limited materials. This integrates **Science, Technology, Engineering and Mathematics (STEM)** with problem-solving and teamwork. The chapter itself connects electromagnets with cranes used in factories and scrap yards.

(4) **Home Appliance Science Audit – "Science Around Us":**
Students can identify electrical appliances at home that use the heating effect—such as irons, kettles, heaters, hair dryers and immersion rods—and prepare a table showing their purpose and heating element. The activity can be extended to discuss overheating, suitable wires/plugs and electrical safety.

(5) **Low-Cost Innovation – "Make Electricity from Fruits and Vegetables"**
Students can construct simple cells using lemons or other fruits/vegetables and different metal electrodes, then test whether they can light an LED. Groups can compare different combinations and prepare a short experimental report. This is particularly suitable as a **Science Society or interdisciplinary project**, as suggested at the end of the chapter.

(6) **Green Practice – "Battery to E-Waste" Campaign:**
Students can conduct a school-level awareness activity on why used batteries should not be thrown into ordinary garbage. They may design posters, identify appropriate e-waste collection practices and organise a supervised **used-battery collection awareness drive**. This connects classroom science with environmental responsibility, as the chapter highlights potentially harmful battery materials and the importance of recycling.

(7) **Collaborative Experimental Stations:**
The classroom can be organised into stations—**Magnetic Effect Station, Electromagnet Station, Heating Effect Station, Lemon Cell Station, and Battery Station**. Student groups rotate between stations, conduct/observe activities and maintain an observation sheet. This allows almost the entire chapter to be taught through active participation rather than lecture alone.

(8) **"Think Like a Scientist" Investigation Notebook:**
Each student can maintain a small **Science Investigation Journal** with four headings: *Prediction – Experiment – Observation – Conclusion*. For example, students can investigate coils of 25, 50, 75 and 100 turns and record how compass deflection changes. This directly develops scientific reasoning, data recording and evidence-based conclusion skills.

Five strongest practices for school documentation
If these are to be entered specifically under **"Best Practices/Innovative Practices Adopted by the Teacher,"** I would recommend highlighting: **Hands-on Electromagnet Construction; Predict–Experiment–Explain Inquiry Method; STEM Mini Electromagnetic Crane Challenge; Fruit/Vegetable Cell Innovation Lab; and Battery E-Waste Awareness & Sustainability Project.** These are measurable, activity-oriented and directly connected to the learning outcomes of the uploaded chapter.

4.16 Innovations Opportunity List from the Chapter: (8 Ideas)

"Innovations" Opportunities while Teaching-Learning Chapter 4: *Electricity – Magnetic and Heating Effects*
The following innovations are suitable for **Grade 8 students** and closely aligned with the experiments and concepts presented in the uploaded chapter.

(1) **Electromagnet Strength Challenge:**
Convert the electromagnet experiment into a design challenge. Student teams can make coils with **25, 50, 75 and 100 turns**, predict which will be strongest, test them using paper clips or compass deflection, record the results and identify the best design. This develops experimentation, measurement and analytical thinking.

(2) **Virtual Electricity & Magnetism Laboratory:**
Use interactive simulations or teacher-created digital demonstrations in which students can virtually change the **current, number of coil turns, core material and direction of current** and predict the resulting magnetic effect. This can complement the chapter's finding that electromagnet strength depends on current and number of turns, while reversing current reverses its poles.

(3) **"Fruit Battery Innovation Lab":**
Move beyond the prescribed lemon-cell activity by asking groups to test different fruits or vegetables and different electrode combinations. Students can compare which combination successfully lights an LED and present their findings as young researchers. The chapter itself encourages experimenting with various fruits, vegetables and electrode metals.

(4) **Design-a-Device Innovation Challenge:**
Ask students to design a simple useful device based on the **magnetic or heating effect of electric current**—for example, a miniature electromagnetic crane, magnetic waste sorter or model lifting device. The chapter shows how controllable lifting electromagnets are used to move and sort heavy iron/steel materials.

(5) **Smart Electrical Safety Detective:**
Present students with simulated household situations involving an overheated plug, inappropriate wire, damaged socket or continuously operating appliance. Teams act as **"Electrical Safety Detectives"** to identify the problem, explain the science behind it and recommend a safe solution. This directly applies the chapter's discussion of overheating, melting sockets and appropriate current-rated electrical components.

(6) **Student-Generated QR Learning Stations:**
Divide the chapter into topics such as **Magnetic Effect, Electromagnets, Heating Effect, Voltaic Cells, Dry Cells and Rechargeable Batteries**. Groups prepare short digital explanations, diagrams or experiment videos and link them through QR codes displayed around the classroom. The classroom thereby becomes a student-created interactive science gallery.

(7) **Battery Innovation & Sustainability Design Thinking:**
Give students the problem: **"How can we make battery use in our school more environmentally responsible?"** Students investigate rechargeable batteries, battery lifespan, collection of used cells and e-waste disposal before proposing solutions such as a school battery collection point or awareness campaign. The chapter explicitly connects battery disposal with hazardous materials, recycling and environmental protection.

(8) **Future Battery Research Corner:**
Introduce a small **"Future Scientist"** task in which students compare conventional dry cells, rechargeable Li-ion batteries and emerging solid-state batteries using a poster, infographic or model. This extends learning from today's technology to future innovation; the chapter notes that solid-state batteries are being developed with the potential to be safer, faster-charging and longer-lasting.

Recommended 5 for the "Innovations" column:
For a lesson plan or academic documentation, the strongest five can be stated briefly as: **Virtual Electricity & Magnetism Lab; Electromagnet Strength Design Challenge; Fruit Battery Innovation Lab; Smart Electrical Safety Detective; and Battery Sustainability & E-Waste Design Thinking Project.**

4.17: Practicing Questions/Question Bank

Chapter 4: ***Electricity: Magnetic and Heating Effects:***

The following is a **balanced question-bank set** based specifically on the uploaded chapter, covering the magnetic effect of electric current, electromagnets, heating effect, Voltaic cells, dry cells, rechargeable batteries, applications, safety and environmental aspects.

A. Fill in the Blanks

1. The region around a magnet or current-carrying wire where its magnetic effect can be felt is called a ________.
   Answer: Magnetic field
2. The magnetic effect of a current-carrying wire disappears when the ________ stops flowing.
   Answer: Electric current
3. A current-carrying coil that behaves like a magnet is called an ________.
   Answer: Electromagnet
4. Most electromagnets have an ________ core to make them stronger.
   Answer: Iron
5. An electromagnet has two poles called ________ and ________.
   Answer: North; South
6. Increasing the number of turns in a coil makes an electromagnet ________.
   Answer: Stronger
7. The poles of an electromagnet can be reversed by reversing the direction of ________.
   Answer: Electric current
8. ________ wire is commonly used as a heating element because it offers comparatively high resistance.
   Answer: Nichrome
9. Conversion of electrical energy into heat in a conductor is called the ________ **effect** of electric current.
   Answer: Heating
10. The liquid used in a Voltaic cell is called an ________.
    Answer: Electrolyte
11. The two metal rods partly dipped in the electrolyte of a Voltaic cell are called ________.
    Answer: Electrodes
12. In a dry cell, the ________ **container** acts as the negative terminal.
    Answer: Zinc
13. The carbon rod of a dry cell is associated with its ________ **terminal**.
    Answer: Positive
14. The electrolyte of a dry cell is in the form of a thick moist ________.
    Answer: Paste
15. Batteries that can be charged and used multiple times are called ________ **batteries**.
    Answer: Rechargeable

B. One-Mark Descriptive Questions

1. **What is the magnetic effect of electric current?**
   Answer: The production of a magnetic field around a conductor when electric current flows through it is called the magnetic effect of electric current.

2. **What observation shows that a current-carrying wire produces a magnetic field?**
   Answer: A magnetic compass needle placed near the wire gets deflected when current flows through it.

3. **Who discovered the magnetic effect of electric current?**
   Answer: Hans Christian Oersted discovered the link between electricity and magnetism in 1820.

4. **Define an electromagnet.**
   Answer: A current-carrying coil that behaves as a magnet is called an electromagnet.

5. **Why is an iron core placed inside an electromagnet?**
   Answer: An iron core is inserted to make the electromagnet stronger.

6. **Name two factors that affect the strength of an electromagnet.**
   Answer: The amount of current and the number of turns in the coil affect its strength.

7. **What happens to an electromagnet when the current is switched off?**
   Answer: It loses its magnetic effect.

8. **Mention one use of a lifting electromagnet.**
   Answer: It is used in scrap yards to lift and sort heavy iron or steel objects.

9. **What is the heating effect of electric current?**
   Answer: Heating of a conductor due to the flow of electric current through it is called the heating effect of electric current.

10. **Why does nichrome wire become warm when current passes through it?**
    Answer: Its resistance causes some electrical energy to be converted into heat energy.

11. **Name any two appliances that work on the heating effect of electric current.**
    Answer: Electric iron and electric kettle.

12. **What is an electrolyte?**
    Answer: An electrolyte is the liquid or paste-like conducting material used in an electric cell.

13. **What is a Voltaic cell?**
    Answer: A Voltaic or Galvanic cell produces electricity through chemical reactions involving two different metal electrodes and an electrolyte.

14. **Why is a dry cell called “dry”?**
    Answer: It is called dry because its electrolyte is a thick moist paste rather than a liquid.

15. **What is the advantage of rechargeable batteries?**
    Answer: They can be recharged and reused many times.

C. Two-Mark Descriptive Questions

1. **How can you demonstrate the magnetic effect of electric current using a compass?**
   Answer: Place a compass near a wire connected to an electric cell. When the circuit is switched ON, the compass needle deflects, showing that the current-carrying wire produces a magnetic field.

2. **State two ways of increasing the strength of an electromagnet.**
   Answer:

- Increase the current flowing through the coil.
- Increase the number of turns in the coil.

3. **What happens when the direction of current through an electromagnet is reversed?**
   Answer: The direction of its magnetic field changes. Therefore, the North and South poles of the electromagnet get reversed.
4. **Why are lifting electromagnets useful in scrap yards?**
   Answer: They can attract and lift heavy iron and steel objects when current is ON. The objects can be released easily by switching the current OFF.
5. **Why is nichrome preferred over copper in heating appliances?**
   Answer: Nichrome offers higher resistance than copper of the same size and length. Hence, it produces more heat when current passes through it.
6. **State any two factors affecting the heat generated in a wire.**
   Answer: Heat generated depends on factors such as the material and thickness of the wire. It also depends on its length, current and duration of current flow.
7. **Why can overheating in electrical circuits be dangerous?**
   Answer: Overheating can melt plastic parts of plugs and sockets. It may also damage appliances or cause fires.
8. **How does a Voltaic cell produce electricity?**
   Answer: Two different metal electrodes are partly dipped in an electrolyte. Chemical reactions between the electrodes and electrolyte produce electricity.
9. **Distinguish between a dry cell and a rechargeable battery.**
   Answer: A dry cell is a single-use cell that must be disposed of after it is used up. A rechargeable battery can be charged and reused multiple times.
10. **Why should used batteries not be thrown into regular garbage?**
    Answer: They may contain acids and metals such as lead, cadmium, nickel or lithium that can harm the environment or cause fires. Many battery materials can also be recovered through recycling.

D. Three-Mark Descriptive Questions

1. **Explain an experiment to demonstrate the magnetic effect of electric current.**
   Answer:
   - Place a magnetic compass below a wire connected to a cell through a switch.
   - When the switch is turned ON, the compass needle gets deflected.
   - When the switch is turned OFF, the needle returns to its original direction, showing that current produces a magnetic field.
2. **Explain how an electromagnet can be made using an iron nail.**
   Answer:
   - Wind insulated wire tightly around an iron nail to form a coil.
   - Connect the ends of the wire to an electric cell.

- When current flows, the nail behaves like a magnet and attracts iron objects.

3. **Explain three factors that influence the strength of an electromagnet.**
   Answer:
   - Increasing electric current strengthens its magnetic field.
   - Increasing the number of turns in the coil makes it stronger.
   - Introducing an iron core into the coil greatly increases its magnetic effect.
4. **Explain the working of a lifting electromagnet.**
   Answer:
   - Current flowing through its coil produces a strong magnetic field.
   - When switched ON, it attracts and lifts iron or steel objects.
   - When switched OFF, the magnetic field disappears and the objects are released.
5. **Explain the heating effect of electric current.**
   Answer:
   - A conductor offers resistance to the flow of electric current.
   - Due to this resistance, some electrical energy is converted into heat energy.
   - This generation of heat in a conductor is called the heating effect of electric current.
6. **Give three factors on which heating of a wire depends.**
   Answer:
   - The material, length and thickness of the wire affect heating.
   - Heating also depends on the magnitude of electric current.
   - It further depends on the duration for which current flows.
7. **Describe the main parts of a Voltaic cell.**
   Answer:
   - It contains two electrodes made of different metals.
   - The electrodes are partly immersed in an electrolyte, usually a weak acid or salt solution.
   - Chemical reactions between the electrodes and electrolyte produce electricity.
8. **Describe the internal structure of a dry cell.**
   Answer:
   - A zinc container acts as the negative terminal.
   - A carbon rod with a metal cap acts as the positive terminal.
   - The carbon rod is surrounded by a thick, moist, paste-like electrolyte.

E. Five-Mark Descriptive Questions

1. **Explain the magnetic effect of electric current and the formation and strengthening of an electromagnet.**

Answer:

- Electric current flowing through a conductor produces a magnetic field around it.
- A current-carrying coil therefore behaves like a magnet and is called an electromagnet.
- An iron core inserted inside the coil makes the electromagnet much stronger.
- Its strength can also be increased by increasing the current or the number of turns in the coil.
- Reversing the direction of current reverses the North and South poles of the electromagnet.

2. **Explain the heating effect of electric current, the factors affecting it and its applications.**

Answer:

- A conductor offers resistance to the flow of electric current.
- Due to resistance, some electrical energy gets converted into heat energy.
- Heat generated depends on the material, thickness and length of the wire, magnitude of current and duration of current flow.
- Heating elements are used in electric irons, kettles, heaters, stoves, immersion rods and hair dryers.
- Excessive heating can damage electrical components and may cause fires.

3. **Describe the construction and working of a Voltaic cell.**

Answer:

- A Voltaic or Galvanic cell contains two electrodes made of different metals.
- The electrodes are partly immersed in an electrolyte such as a weak acid or salt solution.
- Chemical reactions between the electrodes and electrolyte produce electricity.
- When the circuit is completed, electric current flows through the external circuit.
- Eventually the chemicals get used up and the cell becomes “dead” and can no longer supply electricity.

4. **Explain how a lemon battery can be constructed and tested.**

Answer:

- Insert a copper wire/strip and an iron nail into each juicy lemon without allowing them to touch.
- Prepare several such lemon cells and connect them in the manner shown in the chapter.

- Connect an LED between the copper wire of the first lemon and the iron nail of the last lemon.
- The copper and iron act as electrodes, while lemon juice acts as the electrolyte.
- If correctly connected, the LED glows, showing that the lemon cells are producing electricity.

5. **Compare dry cells and rechargeable batteries and explain the environmental importance of proper battery disposal.**

Answer:

- A dry cell contains a paste-like electrolyte and is generally a single-use cell.
- Rechargeable batteries can be charged and reused multiple times, reducing wastage and saving money.
- Rechargeable batteries are used in devices such as phones, laptops, cameras, inverters and electric vehicles.
- Used batteries may contain acids and metals that can harm the environment or create fire hazards.
- Batteries should therefore be sent to appropriate e-waste recycling facilities rather than thrown into ordinary garbage.

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8th Standard Science Book Chapter 5

Chapter 5: Exploring Forces

5.1 Summary of the Chapter:

Summary – Chapter 5: Exploring Forces

(1) **Force is a push or pull** on an object resulting from its interaction with another object. The SI unit of force is **newton (N)**.

(2) **A force can produce different effects** on an object. It can make a stationary object move, change the speed or direction of a moving object, stop it, or change its shape.

(3) Forces are broadly classified as **contact forces and non-contact forces**. Contact forces require physical contact between objects, whereas non-contact forces can act from a distance.

(4) **Muscular force and frictional force are contact forces.** Muscular force is produced by the action of muscles, while friction acts between surfaces in contact and opposes their relative motion.

(5) **Friction always acts opposite to the direction of motion or attempted motion.** It arises due to irregularities in surfaces and is generally greater on rough surfaces than on smooth surfaces. Air and water can also exert friction on moving objects.

(6) **Magnetic, electrostatic and gravitational forces are non-contact forces.** Magnetic force acts between magnets or magnetic materials, while electrostatic force is exerted by charged objects. Like electric charges repel and unlike charges attract.

(7) **Gravitational force** is the force with which the Earth attracts objects towards itself. It is always attractive and causes objects to fall towards the Earth.

(8) **Weight is the gravitational force exerted by the Earth on an object** and is measured in newtons (N). A **spring balance** can be used to measure weight. Mass, however, is the amount of matter in an object and is measured in grams or kilograms.

(9) **Mass remains the same wherever an object is taken, but its weight can change** because gravitational force varies from place to place and from one planet or celestial body to another. For example, the chapter shows that a 1 kg object weighs about **10 N on Earth but only 1.6 N on the Moon**.

(10) Liquids exert an upward force called **upthrust or buoyant force** on immersed objects. An object sinks if its gravitational force is greater than the buoyant force and floats when the two forces are equal. **Archimedes' Principle** states that the upward force on an immersed object equals the weight of the liquid displaced by it.

5.2 Important Formulas:

In **Chapter 5 – "Exploring Forces"**, the quantitative portion is mainly concerned with **force/weight, mass, spring-balance readings, gravity, and buoyancy**. The chapter itself does **not introduce mathematical formulas for friction, magnetic force, or electrostatic force**, so I would not add higher-level formulas for those topics.

Important Formulas for Quantitative Problems

No.	Concept	Formula	Meaning / Use
1	**Weight**	**$W = m \times g$**	Calculates the weight (gravitational force) acting on an object

No.	Concept	Formula	Meaning / Use
2	**Mass from weight**	**m = W ÷ g**	Calculates mass when weight and gravitational field strength are known
3	**Gravitational field strength**	**g = W ÷ m**	Calculates gravitational force per unit mass
4	**Approximate weight on Earth**	**W ≈ m × 10**	For school-level calculations on Earth, **g ≈ 10 N/kg**
5	**Weight on Moon**	$\mathbf{W_{moon} = W_{earth} \div 6}$	The chapter states that an object's weight on the Moon is approximately one-sixth of its weight on Earth
6	**Smallest division / Least count**	**Least count = Difference between two consecutive numbered marks ÷ Number of divisions**	Used to determine the smallest measurement that a spring balance can read
7	**Buoyant force / Upthrust**	$\mathbf{F_\beta}$ **= Weight of liquid displaced**	Based on Archimedes' Principle
8	**Apparent weight in liquid**	**Apparent weight = Actual weight − Buoyant force**	Useful for understanding why an object feels lighter when immersed in a liquid
9	**Buoyant force from weights**	$\mathbf{F_\beta}$ **= Weight in air − Apparent weight in liquid**	Used when spring-balance readings in air and liquid are given
10	**Weight–mass ratio**	**W/m = g**	Shows the relationship between weight and mass at a particular place

1. Weight and Mass
The most important relationship for numerical problems is:

$$\boxed{W = mg}$$

where **W = weight in newtons (N)**, **m = mass in kilograms (kg)** and **g = gravitational field strength in N/kg**.
The chapter gives the example that a **1 kg object weighs approximately 10 N on Earth**, while the same 1 kg mass weighs 1.6 N on the Moon, 3.8 N on Mars, 9 N on Venus and 25.4 N on Jupiter.
Therefore, for Earth:

$$\boxed{g \approx 10\ N/kg}$$

and hence:

$$\boxed{W \approx 10m}$$

Example: Mass = 5 kg

$$W = 5 \times 10 = \boxed{50\ N}$$

2. Finding Mass from Weight
Rearranging $W = mg$:

$$\boxed{m = \frac{W}{g}}$$

Example: An object's weight on Earth is 80 N.

$$m = \frac{80}{10} = \boxed{8\ kg}$$

Remember that **mass is measured in g or kg, whereas weight is a force and is measured in N**. The chapter emphasizes that mass remains unchanged while weight can change from place to place.

3. Weight on the Moon

The exercise explicitly states that an object's weight on the Moon becomes **one-sixth of its weight on Earth**.

Therefore:

$$\boxed{W_{\text{Moon}} = \frac{W_{\text{Earth}}}{6}}$$

Conversely,

$$\boxed{W_{\text{Earth}} = 6W_{\text{Moon}}}$$

Example: If Earth weight = 60 N,

$$W_{\text{Moon}} = \frac{60}{6} = \boxed{10\ N}$$

Importantly, the **mass does not become one-sixth**; mass remains unchanged.

4. Least Count of a Spring Balance

For quantitative questions involving the scale of a spring balance:

$$\boxed{\text{Least Count} = \frac{\text{Difference between two consecutive major readings}}{\text{Number of divisions}}}$$

The chapter's spring balance has **5 divisions between 0 N and 1 N**. Therefore:

$$LC = \frac{1N}{5} = \boxed{0.2N}$$

Thus, the smallest weight that this spring balance can measure is **0.2 N**.

5. Archimedes' Principle / Buoyant Force

The chapter states that an object fully or partially immersed in a liquid experiences an upward force equal to the **weight of the liquid displaced**.

Hence:

$$\boxed{\text{Buoyant Force} = \text{Weight of liquid displaced}}$$

or

$$\boxed{F_B = W_{\text{liquid displaced}}}$$

For problems involving apparent weight, this can be expressed as:

$$\boxed{F_B = W_{\text{air}} - W_{\text{liquid}}}$$

and therefore:

$$\boxed{W_{\text{apparent}} = W_{\text{actual}} - F_B}$$

6. Condition for Floating and Sinking

This is particularly important for conceptual numerical questions:

$$\boxed{W > F_B \Rightarrow \text{Object sinks}}$$

$$\boxed{W = F_B \Rightarrow \text{Object floats}}$$

The chapter explicitly explains that an object sinks when gravitational force is greater than buoyant force and floats when the two forces are equal.

Quick Formula Sheet

$$\boxed{W = mg}$$

$$\boxed{m = \frac{W}{g}}$$

$$\boxed{g = \frac{W}{m}}$$

$$\boxed{g_{\text{Earth}} \approx 10\ N/kg}$$

$$\boxed{W_{\text{Moon}} \approx \frac{W_{\text{Earth}}}{6}}$$

$$\boxed{\text{Least Count} = \frac{\text{Difference between consecutive major readings}}{\text{Number of divisions}}}$$

$$\boxed{F_B = \text{Weight of liquid displaced}}$$

$$\boxed{F_B = W_{\text{air}} - W_{\text{liquid}}}$$

$$\boxed{W_{\text{apparent}} = W_{\text{actual}} - F_B}$$

These formulas are sufficient for the **quantitative/numerical problems appropriate to the level and scope of this chapter**. The chapter begins by connecting everyday observations such as cycling uphill and slipping on wet surfaces to the study of forces.

5.3 Fill-Up the Blank LOTS type questions with Answers: (20 Questions)

The following questions focus on **LOTS (Lower Order Thinking Skills)**—mainly remembering, identifying, and recalling definitions and basic facts. The chapter defines force as a push or pull and classifies forces into contact and non-contact forces.

1. A push or pull applied on an object is called __________.
   Answer: Force
2. The SI unit of force is __________.
   Answer: Newton
3. The symbol used for newton is __________.
   Answer: N
4. At least __________ objects must interact for a force to come into play.
   Answer: Two
5. A force can change the __________ of a moving object.
   Answer: Speed
6. A force can change the __________ of motion of an object.
   Answer: Direction
7. A force can also change the __________ of an object.
   Answer: Shape
8. Forces that act only when there is physical contact between objects are called __________ **forces**.
   Answer: Contact
9. The force resulting from the action of muscles is known as __________ **force**.
   Answer: Muscular
10. Walking, running, lifting and pushing involve the use of __________ **force**.
    Answer: Muscular
11. The force that opposes the motion of an object over another surface is called __________.
    Answer: Friction
12. Friction acts in a direction __________ to the direction of motion.
    Answer: Opposite
13. Friction arises due to the __________ present on the two surfaces in contact.
    Answer: Irregularities

14. Friction is greater on __________ surfaces.
    Answer: Rough
15. Frictional force is an example of a __________ **force**.
    Answer: Contact
16. Forces that can act even when objects are not in contact are called __________ **forces**.
    Answer: Non-contact
17. Like poles of two magnets __________ each other.
    Answer: Repel
18. Unlike poles of two magnets __________ each other.
    Answer: Attract
19. The force exerted by a magnet on another magnet or magnetic material is called __________ **force**.
    Answer: Magnetic
20. Magnetic force is a __________ **force**.
    Answer: Non-contact
21. Electrical charges that do not move by themselves are called __________ **charges**.
    Answer: Static
22. An object that acquires static charges is called a __________ **object**.
    Answer: Charged
23. Similar or like electrical charges __________ each other.
    Answer: Repel
24. Opposite or unlike electrical charges __________ each other.
    Answer: Attract
25. The two kinds of static charges are called __________ and __________ charges.
    Answer: Positive and negative
26. The force exerted by a charged body on another charged or uncharged body is called __________ **force**.
    Answer: Electrostatic
27. Electrostatic force is a __________ **force**.
    Answer: Non-contact
28. The force with which the Earth attracts objects towards itself is called __________ **force**.
    Answer: Gravitational
29. The gravitational force exerted by the Earth is also called __________.
    Answer: Gravity
30. Gravitational force is always an __________ **force**.
    Answer: Attractive
31. Gravitational force is classified as a __________ **force**.
    Answer: Non-contact
32. The force with which the Earth pulls an object towards itself is called the __________ **of the object**.
    Answer: Weight
33. The SI unit of weight is __________.
    Answer: Newton (N)
34. A __________ **balance** is used to measure the weight of an object.
    Answer: Spring
35. The scale of a spring balance is marked to show force in __________.
    Answer: Newton

36. The spring balance shown in the chapter has a range from 0 N to __________ **N**.
    Answer: 10
37. The smallest value that the spring balance shown in Fig. 5.13 can read is __________ **N**.
    Answer: 0.2
38. Mass is the amount of __________ in an object.
    Answer: Matter
39. Mass is measured in grams or __________.
    Answer: Kilograms
40. The mass of an object remains __________ at every place.
    Answer: Same
41. Unlike mass, the __________ of an object can change from place to place.
    Answer: Weight
42. A 1 kg object weighs approximately __________ **N** on Earth.
    Answer: 10
43. A 1 kg object weighs approximately __________ **N** on the Moon.
    Answer: 1.6
44. The upward force applied by a liquid on an object is called __________ or buoyant force.
    Answer: Upthrust
45. Buoyant force acts in the __________ **direction**.
    Answer: Upward
46. Gravitational force acting on an object placed in a liquid acts in the __________ **direction**.
    Answer: Downward
47. If gravitational force is greater than buoyant force, the object __________.
    Answer: Sinks
48. If gravitational force and buoyant force are equal, the object __________.
    Answer: Floats
49. One factor on which buoyant force depends is the __________ **of the liquid.**
    Answer: Density
50. According to Archimedes' Principle, the upward force on an immersed object is equal to the __________ **of the liquid displaced.**
    Answer: Weight

Answer Key – Quick Reference:

1. Force | **2.** Newton | **3.** N | **4.** Two | **5.** Speed | **6.** Direction | **7.** Shape | **8.** Contact | **9.** Muscular | **10.** Muscular | **11.** Friction | **12.** Opposite | **13.** Irregularities | **14.** Rough | **15.** Contact | **16.** Non-contact | **17.** Repel | **18.** Attract | **19.** Magnetic | **20.** Non-contact | **21.** Static | **22.** Charged | **23.** Repel | **24.** Attract | **25.** Positive and negative | **26.** Electrostatic | **27.** Non-contact | **28.** Gravitational | **29.** Gravity | **30.** Attractive | **31.** Non-contact | **32.** Weight | **33.** Newton | **34.** Spring | **35.** Newton | **36.** 10 | **37.** 0.2 | **38.** Matter | **39.** Kilograms | **40.** Same | **41.** Weight | **42.** 10 | **43.** 1.6 | **44.** Upthrust | **45.** Upward | **46.** Downward | **47.** Sinks | **48.** Floats | **49.** Density | **50.** Weight.

5.4 Fill-Up the Blank HOTS type questions with Answers: (20 Questions)

These questions require students to **apply, analyse, compare, predict, and infer** using the concepts in the uploaded chapter rather than merely recall definitions. The chapter explains how forces affect motion and shape, and distinguishes contact and non-contact forces.

1. A cyclist stops pedalling on a rough road and slows down quickly. The force mainly responsible is __________.
   Answer: Frictional force
2. If the same object is pushed with equal force on a smooth floor and a rough floor, it will travel farther on the __________ floor.
   Answer: Smooth
3. A ball rolling on sand stops sooner than the same ball rolling on a tiled floor because friction is __________ on sand.
   Answer: Greater
4. If the irregularities between two surfaces increase, the friction between them is likely to __________.
   Answer: Increase
5. Aeroplanes and high-speed trains are given special shapes mainly to __________ friction caused by air.
   Answer: Reduce
6. When a moving football is kicked sideways, the force applied mainly changes its __________.
   Answer: Direction of motion
7. When brakes are applied to a moving bicycle, the force causes its speed to __________.
   Answer: Decrease
8. If an inflated balloon is squeezed between the hands, the applied force produces a change in its __________.
   Answer: Shape
9. An object remains at rest even though forces are acting on it. This suggests that the forces are __________ one another.
   Answer: Balancing
10. If an object changes its speed, direction, or shape, we can infer that a __________ has acted on it.
    Answer: Force
11. Two ring magnets are arranged with their north poles facing each other. The upper magnet may appear to float because of magnetic __________.
    Answer: Repulsion
12. If the upper ring magnet is reversed so that unlike poles face each other, the magnets will __________ each other.
    Answer: Attract
13. A magnet attracts an iron object without touching it. This demonstrates that magnetic force is a __________ force.
    Answer: Non-contact
14. Two balloons rubbed in the same way with wool move apart because they acquire __________ charges.
    Answer: Similar / like
15. A rubbed balloon moves towards the woollen cloth because the balloon and cloth acquire __________ charges.
    Answer: Opposite / unlike
16. A rubbed plastic scale attracts small pieces of uncharged paper without touching them. The force involved is __________ force.
    Answer: Electrostatic

17. If two charged objects repel each other, we can infer that they most likely carry __________ charges.
Answer: Similar / like
18. A ball thrown vertically upwards gradually slows down because the Earth's gravitational force acts in the __________ direction.
Answer: Downward
19. At the highest point of a vertically thrown ball, gravity continues to act __________.
Answer: Downwards
20. As a ball falls towards Earth, its speed increases because gravitational force acts in the __________ direction as its motion.
Answer: Same
21. If Earth's gravitational attraction suddenly became weaker, the weight of an object would __________.
Answer: Decrease
22. If the same object is taken from Earth to the Moon, its mass remains the same but its weight __________.
Answer: Decreases
23. An object weighs 10 N on Earth but only 1.6 N on the Moon because gravitational force on the Moon is __________.
Answer: Weaker
24. A 1 kg object would weigh the most on __________ among Earth, Moon, Mars, Venus, and Jupiter.
Answer: Jupiter
25. If two objects of different masses produce different extensions in the same spring, the object producing the greater extension has the __________ weight.
Answer: Greater
26. A spring balance has five equal divisions between 2 N and 3 N. Therefore, each small division represents __________ **N**.
Answer: 0.2 N
27. A spring balance with a maximum reading of 10 N should not be used for an object weighing 12 N because the balance may get __________.
Answer: Damaged
28. An empty closed bottle pushed under water rises back to the surface because water exerts an __________ force on it.
Answer: Upward / buoyant
29. If the gravitational force acting on an object in water is greater than the buoyant force, the object will __________.
Answer: Sink
30. If the buoyant force balances the gravitational force acting on an object, the object will __________.
Answer: Float
31. A mug feels lighter when immersed in water because water applies an upward __________ on it.
Answer: Upthrust / buoyant force
32. According to Archimedes' Principle, if the weight of displaced liquid equals the weight of the object, the object will __________.
Answer: Float
33. If the weight of liquid displaced by an object is less than the object's weight, the object will __________.
Answer: Sink

34. An object experiences greater buoyant force when it displaces a liquid of greater __________, other relevant conditions being comparable.
    Answer: Density
35. A pumice rock can float on water despite being a rock because its air pockets make it __________ dense than water.
    Answer: Less
36. A coin sinks while a larger wooden block can float, showing that floating and sinking do not depend simply on the __________ of an object.
    Answer: Size
37. If friction between our shoes and the floor becomes very small, we are more likely to __________.
    Answer: Slip
38. A cricket ball stops before reaching the boundary even when no player touches it because __________ acts against its motion.
    Answer: Friction
39. If gravity disappeared completely, an object released from a height would no longer be pulled __________ the Earth.
    Answer: Towards
40. A moving object whose speed or direction keeps changing is undergoing non-uniform motion; therefore, we can infer that a __________ is acting on it.
    Answer: Force

Answer Key – Quick Reference:
1. Frictional force | **2.** Smooth | **3.** Greater | **4.** Increase | **5.** Reduce | **6.** Direction of motion | **7.** Decrease | **8.** Shape | **9.** Balancing | **10.** Force | **11.** Repulsion | **12.** Attract | **13.** Non-contact | **14.** Similar/like | **15.** Opposite/unlike | **16.** Electrostatic | **17.** Similar/like | **18.** Downward | **19.** Downwards | **20.** Same | **21.** Decrease | **22.** Decreases | **23.** Weaker | **24.** Jupiter | **25.** Greater | **26.** 0.2 N | **27.** Damaged | **28.** Upward/buoyant | **29.** Sink | **30.** Float | **31.** Upthrust/buoyant force | **32.** Float | **33.** Sink | **34.** Density | **35.** Less | **36.** Size | **37.** Slip | **38.** Friction | **39.** Towards | **40.** Force.

5.5 One-mark questions with Answers of LOTS Type: (20 Questions)

Each answer is limited to one sentence.

1. **What is a force?**
   Answer: A force is a push or pull on an object resulting from its interaction with another object.
2. **What is the SI unit of force?**
   Answer: The SI unit of force is newton (N).
3. **Mention any two effects of force on an object.**
   Answer: A force can change the speed and direction of motion of an object.
4. **How can force affect the shape of an object?**
   Answer: A force can change the shape of an object by pushing, pulling, pressing, or stretching it.
5. **How many objects must interact for a force to come into play?**
   Answer: At least two objects must interact for a force to come into play.
6. **What are contact forces?**
   Answer: Forces that act only when there is physical contact between objects are called contact forces.
7. **What is muscular force?**
   Answer: The force resulting from the action of muscles is called muscular force.

8. **Give two examples of activities involving muscular force.**
   Answer: Walking and lifting an object are two activities involving muscular force.
9. **What is friction?**
   Answer: Friction is the force that comes into play when an object moves or tries to move over another surface.
10. **In which direction does friction act?**
    Answer: Friction acts opposite to the direction in which an object is moving or trying to move.
11. **Why does friction arise between two surfaces?**
    Answer: Friction arises due to the irregularities present on the two surfaces in contact.
12. **On which type of surface is friction greater?**
    Answer: Friction is greater on rough surfaces.
13. **Why is friction called a contact force?**
    Answer: Friction is called a contact force because it arises between two surfaces that are in contact.
14. **What are non-contact forces?**
    Answer: Forces that can act between objects without physical contact are called non-contact forces.
15. **Name three non-contact forces.**
    Answer: Magnetic force, electrostatic force, and gravitational force are three non-contact forces.
16. **What is magnetic force?**
    Answer: The force exerted by a magnet on another magnet or a magnetic material is called magnetic force.
17. **What happens when like poles of two magnets are brought near each other?**
    Answer: Like poles of two magnets repel each other.
18. **What happens when unlike poles of two magnets are brought near each other?**
    Answer: Unlike poles of two magnets attract each other.
19. **What are static charges?**
    Answer: Electrical charges that build up on the surfaces of certain materials and do not move by themselves are called static charges.
20. **What happens when two like electric charges are brought near each other?**
    Answer: Two like electric charges repel each other.
21. **What happens when two unlike electric charges are brought near each other?**
    Answer: Two unlike electric charges attract each other.
22. **What are the two kinds of static charges?**
    Answer: The two kinds of static charges are positive and negative charges.
23. **What is electrostatic force?**
    Answer: The force exerted by a charged body on another charged or uncharged body is called electrostatic force.
24. **What is gravitational force?**
    Answer: The force with which the Earth attracts objects towards itself is called gravitational force.
25. **Why is gravitational force called a non-contact force?**
    Answer: Gravitational force is a non-contact force because it acts on objects without physical contact.
26. **Is gravitational force attractive or repulsive?**
    Answer: Gravitational force is always attractive.

27. **What is vertical motion?**
Answer: The motion of an object in a vertical direction under the influence of gravitational force is called vertical motion.
28. **What is the weight of an object?**
Answer: Weight is the force with which the Earth pulls an object towards itself.
29. **What is the SI unit of weight?**
Answer: The SI unit of weight is newton (N).
30. **Which instrument is used to measure weight?**
Answer: A spring balance is used to measure the weight of an object.
31. **How does a spring balance measure weight?**
Answer: A spring balance measures weight from the amount by which its spring stretches when an object is suspended from it.
32. **What is mass?**
Answer: Mass is the amount of matter present in an object.
33. **What are the common units used to measure mass?**
Answer: Mass is commonly measured in grams (g) or kilograms (kg).
34. **Does the mass of an object change from place to place?**
Answer: No, the mass of an object remains the same at every place.
35. **Can the weight of an object change from place to place?**
Answer: Yes, the weight of an object can change because gravitational force varies from place to place.
36. **What is the weight of a 1 kg object on Earth according to the chapter?**
Answer: A 1 kg object weighs approximately 10 N on Earth.
37. **What is the weight of a 1 kg object on the Moon according to the chapter?**
Answer: A 1 kg object weighs approximately 1.6 N on the Moon.
38. **What is buoyant force?**
Answer: The upward force exerted by a liquid on an object placed in it is called buoyant force or upthrust.
39. **When does an object sink in a liquid?**
Answer: An object sinks when the gravitational force acting on it is greater than the buoyant force.
40. **When does an object float in a liquid?**
Answer: An object floats when the buoyant force and gravitational force acting on it are equal.
41. **State Archimedes' Principle.**
Answer: An object fully or partially immersed in a liquid experiences an upward force equal to the weight of the liquid displaced by it.
42. **Name one factor on which buoyant force depends.**
Answer: Buoyant force depends on the density of the liquid.
43. **Why can pumice rock float on water?**
Answer: Pumice floats because its air-filled porous structure makes it less dense than water.
44. **Give one example of frictional force from daily life.**
Answer: A rolling ball gradually stopping on the ground is an example of frictional force.
45. **Give one example of gravitational force from daily life.**
Answer: A fruit falling from a tree is an example of gravitational force.
46. **Give one example of electrostatic force.**
Answer: A balloon rubbed with wool attracting hair strands is an example of electrostatic force.

47. **Give one example of magnetic force.**
Answer: A compass needle pointing north is an example of magnetic force.

5.6 One-mark questions with Answers of HOTS Type: (20 Questions)

Application, analysis and reasoning-based; each answer is one sentence.

1. **Why does a bicycle slow down when we stop pedalling on a flat road?**
Answer: The bicycle slows down because friction acts opposite to its motion and gradually reduces its speed.
2. **Why does a bicycle stop sooner on a rough road than on a smooth road?**
Answer: A rough road produces greater friction and therefore brings the bicycle to rest sooner.
3. **Why is it harder to push a box on a rough floor than on a smooth floor?**
Answer: A rough floor offers greater friction because its surface irregularities oppose the motion more strongly.
4. **Why are aeroplanes and high-speed trains given special streamlined shapes?**
Answer: They are given special shapes to reduce the friction exerted by air during motion.
5. **Why does a moving ball change direction when it is hit with a bat?**
Answer: The force exerted by the bat changes the direction of motion of the ball.
6. **A balloon changes shape when pressed; what does this demonstrate about force?**
Answer: It demonstrates that an applied force can change the shape of an object.
7. **An object is at rest on a table; can we conclude that no force acts on it? Why?**
Answer: No, forces may be acting on the object but balancing one another, keeping it at rest.
8. **Why does a person feel a force on the hand while pushing a table?**
Answer: The person feels a force because during interaction both the hand and the table experience force from each other.
9. **Why can a magnet attract an iron object without touching it?**
Answer: Magnetic force is a non-contact force and can therefore act on a magnetic material from a distance.
10. **Why does the upper ring magnet appear to float when like poles of two ring magnets face each other?**
Answer: The upper magnet appears to float because the like poles repel each other through magnetic force.
11. **Why do two balloons rubbed with the same woollen cloth move away from each other?**
Answer: The balloons acquire similar charges, and like charges repel each other.
12. **Why does a rubbed plastic scale attract small pieces of paper without touching them?**
Answer: The charged scale exerts an electrostatic force on the uncharged paper pieces from a distance.
13. **Why does a ball thrown vertically upward eventually return to the ground?**
Answer: It returns to the ground because Earth's gravitational force continuously attracts it downward.
14. **Why does the speed of a ball decrease while it moves vertically upward?**
Answer: Its speed decreases because gravitational force acts downward, opposite to its upward motion.

15. **Why does the speed of a falling ball increase as it moves downward?**
Answer: Its speed increases because gravitational force acts in the same downward direction as its motion.
16. **Can gravitational force ever repel an object from the Earth? Give a reason.**
Answer: No, gravitational force is always attractive and therefore pulls objects towards the Earth.
17. **Two objects stretch the same spring by different amounts; what can you infer?**
Answer: We can infer that the objects have different weights because the Earth pulls them with different forces.
18. **Why should an object heavier than the maximum range of a spring balance not be measured with it?**
Answer: An object beyond the maximum range may overstretch and damage the spring balance.
19. **A spring balance has five equal divisions between 1 N and 2 N; what is its smallest measurable value?**
Answer: Its smallest measurable value is $1 \div 5 = 0.2$N.
20. **Why does the mass of an object remain unchanged on the Earth and the Moon while its weight changes?**
Answer: Mass represents the amount of matter and remains unchanged, whereas weight depends on gravitational force.
21. **Why would the same 1 kg object weigh less on the Moon than on the Earth?**
Answer: It weighs less on the Moon because the Moon exerts a weaker gravitational force on it.
22. **A 1 kg object weighs 10 N on Earth but 25.4 N on Jupiter; what can you infer?**
Answer: We can infer that Jupiter exerts a stronger gravitational force on the object than the Earth does.
23. **Why is saying "the weight of this wheat bag is 10 kg" scientifically incorrect?**
Answer: It is scientifically incorrect because kilogram is a unit of mass, whereas weight is a force measured in newtons.
24. **Why does a tightly closed empty bottle bounce back to the surface when pushed under water and released?**
Answer: The bottle rises because water exerts an upward buoyant force on it.
25. **Why does a mug feel lighter when it is immersed in water?**
Answer: It feels lighter because the upward buoyant force of water acts against the downward gravitational force.
26. **What will happen if the gravitational force on an immersed object is greater than the buoyant force?**
Answer: The object will sink because the downward gravitational force is greater than the upward buoyant force.
27. **Under what condition will an object float in a liquid?**
Answer: An object will float when the buoyant force acting on it equals the gravitational force acting on it.
28. **A coin sinks in water while a larger wooden block floats; why does size alone not decide floating or sinking?**
Answer: Floating or sinking depends on the balance between the object's weight and the buoyant force rather than simply its size.
29. **Why can pumice rock float on water even though it is a rock?**
Answer: Pumice floats because its many trapped air pockets make it less dense than water.

30. **Why is it easier to slip on a smooth or wet surface?**
    Answer: It is easier to slip because such a surface provides less friction to oppose slipping.
31. **If the same object is pushed with equal force on sand and glass, on which surface will it travel farther and why?**
    Answer: It will travel farther on glass because the smoother surface generally offers less friction than sand.
32. **Why does turning the handle of a moving bicycle change its path?**
    Answer: The applied force changes the direction of motion of the bicycle.
33. **If two oppositely charged objects are brought close without touching, what will happen?**
    Answer: They will move towards each other because unlike electric charges attract.
34. **How can you prove that electrostatic force is a non-contact force using a charged scale and paper pieces?**
    Answer: Bringing the charged scale near the paper without touching it causes the paper pieces to move towards the scale.
35. **If friction suddenly disappeared, why would walking become difficult?**
    Answer: Walking would become difficult because there would be no friction between our feet and the ground to provide the required grip.
36. **A ball moving on a horizontal surface eventually stops; what does this tell you about the forces acting on it?**
    Answer: It shows that friction is acting opposite to the ball's motion and reducing its speed.
37. **If an object's direction changes while its speed remains the same, has a force acted on it? Why?**
    Answer: Yes, a force has acted because force can change the direction of motion even without changing the speed.
38. **Why are magnetic force and electrostatic force different from muscular force?**
    Answer: Magnetic and electrostatic forces can act without physical contact, whereas muscular force requires contact.
39. **A floating object is pushed deeper into water; which force from the water can be felt?**
    Answer: An upward buoyant force or upthrust exerted by the water can be felt.
40. **According to Archimedes' Principle, why does an object float when the weight of displaced liquid equals its own weight?**
    Answer: It floats because the upward buoyant force equals its downward weight, balancing the two forces.

5.7 Two-mark questions with Answers of LOTS Type: (15 Questions)

Each answer is given in two simple sentences/points, suitable for 2 marks.

1. **What is force? State its SI unit.**
   Answer:
    1. A force is a push or pull on an object resulting from its interaction with another object.
    2. The SI unit of force is **newton (N)**.
2. **Mention any two effects that a force can have on an object.**
   Answer:
    1. A force can make an object move from rest or change the speed of a moving object.

   2. It can also change the direction of motion or the shape of an object.
3. **What are contact forces? Give one example.**
   Answer:
   1. Forces that act only when there is physical contact between objects are called contact forces.
   2. Muscular force is an example of a contact force.
4. **What is muscular force? Give one example of its use.**
   Answer:
   1. The force resulting from the action of muscles is called muscular force.
   2. Activities such as walking, lifting, pushing and jumping involve muscular force.
5. **What is friction? In which direction does it act?**
   Answer:
   1. Friction is the force that comes into play when an object moves or tries to move over another surface.
   2. It acts in a direction opposite to the direction of motion or attempted motion.
6. **How does the nature of a surface affect friction?**
   Answer:
   1. The force of friction depends on the nature of the surfaces in contact.
   2. Friction is greater on rough surfaces than on smooth surfaces.
7. **Why does friction occur between two surfaces?**
   Answer:
   1. Friction arises because of minute irregularities present on the surfaces in contact.
   2. These irregularities lock into each other and oppose the movement of one surface over another.
8. **What are non-contact forces? Name any two examples.**
   Answer:
   1. Forces that can act between objects even when they are not in physical contact are called non-contact forces.
   2. Magnetic force and gravitational force are examples of non-contact forces.
9. **What is magnetic force? Why is it called a non-contact force?**
   Answer:
   1. The force exerted by a magnet on another magnet or magnetic material is called magnetic force.
   2. It is a non-contact force because a magnet can exert force from a distance without touching the object.
10. **State the behaviour of like and unlike poles of magnets.**
    Answer:
    1. Like poles of magnets, such as North–North or South–South, repel each other.
    2. Unlike poles, such as North–South, attract each other.
11. **What are static charges? How are they produced?**
    Answer:
    1. Electrical charges that build up on the surfaces of objects and do not move by themselves are called static charges.
    2. They can be produced when objects made of certain materials are rubbed together.
12. **What is electrostatic force? State whether it is a contact or non-contact force.**
    Answer:

1. The force exerted by a charged body on another charged or uncharged body is called electrostatic force.
2. Electrostatic force is a **non-contact force**.

13. **How do like and unlike electrical charges behave?**
Answer:
1. Similar or like electrical charges repel each other.
2. Opposite or unlike electrical charges attract each other.

14. **What is gravitational force? What type of force is it?**
Answer:
1. The force with which the Earth attracts objects towards itself is called gravitational force or gravity.
2. It is a non-contact force and is always attractive.

15. **Describe the motion of an object thrown vertically upwards.**
Answer:
1. As the object moves upwards, its speed gradually decreases until it stops momentarily at the top.
2. It then changes direction and falls downwards with increasing speed.

16. **What is the weight of an object? State its SI unit.**
Answer:
1. The force with which the Earth pulls an object towards itself is called the weight of the object.
2. Since weight is a force, its SI unit is **newton (N)**.

17. **What is a spring balance? How does it measure weight?**
Answer:
1. A spring balance is a simple device used to measure the weight or force acting on an object.
2. When an object is hung from its hook, the spring stretches and the amount of stretching indicates its weight.

18. **What are the range and smallest division of the spring balance shown in the chapter?**
Answer:
1. The spring balance shown has a measuring range of **0 to 10 N**.
2. Its smallest division represents **0.2 N**.

19. **Differentiate between mass and weight.**
Answer:
1. Mass is the amount of matter in an object and is measured in grams or kilograms.
2. Weight is the gravitational force acting on an object and is measured in newtons.

20. **How do mass and weight change from one planet to another?**
Answer:
1. The mass of an object remains the same wherever the object is taken.
2. Its weight can change because gravitational force is different on different planets.

21. **What is upthrust or buoyant force? In which direction does it act?**
Answer:
1. The force applied by a liquid on an object placed in it is called upthrust or buoyant force.
2. Buoyant force acts in the **upward direction**.

22. **State the conditions under which an object sinks or floats in a liquid.**
    Answer:
    1. An object sinks when the gravitational force acting on it is greater than the buoyant force.
    2. It floats when the gravitational force and buoyant force are equal.
23. **State Archimedes' Principle.**
    Answer:
    1. An object fully or partially immersed in a liquid experiences an upward force.
    2. This upward force is equal to the weight of the liquid displaced by the object.
24. **What happens when a tightly closed empty bottle is pushed into water and released? Why?**
    Answer:
    1. The bottle experiences an upward push and bounces back to the surface when released.
    2. This happens because water exerts an upward buoyant force on the bottle.
25. **Why can a pumice rock float on water?**
    Answer:
    1. Pumice contains many tiny air pockets formed when gas-rich lava cools quickly.
    2. These air pockets make pumice less dense than water, enabling it to float.
26. **Name two contact forces and two non-contact forces discussed in the chapter.**
    Answer:
    1. **Muscular force and frictional force** are contact forces.
    2. **Magnetic force and gravitational force** are non-contact forces.
27. **What happens when a ball rolls on flat ground? Name the force responsible.**
    Answer:
    1. A ball rolling on flat ground gradually slows down and finally comes to rest.
    2. The **force of friction** acting opposite to its motion is responsible for stopping it.
28. **How is muscular force useful inside the human body?**
    Answer:
    1. Muscular force helps us chew food and move it through the alimentary canal during digestion.
    2. The contraction and expansion of heart muscles help circulate blood throughout the body.
29. **Why are aeroplanes, ships and high-speed trains designed with special shapes?**
    Answer:
    1. Air and water exert frictional force on objects moving through them.
    2. Aeroplanes, ships and high-speed trains have special shapes to reduce this friction.
30. **What happens to the weight and mass of an object when it is taken from the Earth to the Moon?**
    Answer:
    1. Its weight decreases because the gravitational force on the Moon is weaker than on the Earth.
    2. Its mass remains unchanged because the amount of matter in the object does not change.

5.8. Two-mark questions with Answers of HOTS Type: (15 Questions)

The following questions focus on **application, analysis, reasoning, prediction, and cause–effect relationships**, rather than simple recall. Each answer is limited to **two points/sentences**, making it suitable for **2 marks**.

1. **A cyclist stops pedalling on a rough road and comes to rest sooner than on a smooth road. Why?**
   Answer:
   1. A rough road produces greater friction because its surface has more irregularities that oppose motion.
   2. Therefore, the bicycle loses speed and comes to rest sooner on the rough road.
2. **Why does a person have a greater chance of slipping on a wet or highly polished floor?**
   Answer:
   1. A wet or highly polished surface offers less friction between the feet and the floor.
   2. With insufficient friction to provide grip, the feet can slide and cause the person to slip.
3. **A moving football changes direction when a player kicks it from the side. What does this demonstrate about force?**
   Answer:
   1. The player's kick applies a force to the moving football.
   2. This demonstrates that force can change the direction of motion of an object.
4. **A student pushes a heavy table but it does not move. Can we conclude that no force is acting on the table? Justify.**
   Answer:
   1. No, the table remaining at rest does not necessarily mean that no forces are acting on it.
   2. The forces acting on the table may be balancing one another, so its state of rest does not change.
5. **A rolling ball eventually stops even though nobody touches it. Which force causes this and how?**
   Answer:
   1. Friction acts between the ball and the surface in a direction opposite to the ball's motion.
   2. This opposing force gradually reduces the ball's speed until it comes to rest.
6. **Why are aeroplanes and high-speed trains given specially designed shapes?**
   Answer:
   1. Air exerts frictional force on objects moving through it and opposes their motion.
   2. Special shapes help reduce this friction, allowing aeroplanes and high-speed trains to move more efficiently.
7. **Two ring magnets are arranged with their like poles facing each other. Why can the upper magnet appear to float?**
   Answer:
   1. Like poles of the two magnets repel each other and produce a magnetic force.
   2. Since magnetic force can act without physical contact, the upper magnet can remain separated from the lower one.
8. **A plastic scale rubbed with polythene attracts small pieces of paper without touching them. Explain why.**
   Answer:
   1. Rubbing causes static electrical charges to build up on the plastic scale.

   2. The charged scale exerts an electrostatic force on the uncharged paper pieces from a distance.

9. **Two balloons rubbed with the same woollen cloth move away from each other when brought close. Why?**
   Answer:
   1. Both balloons acquire similar electrical charges when rubbed in the same way.
   2. Since like charges repel each other, the balloons move away from one another.
10. **A ball is thrown vertically upwards with greater force. Will it escape Earth's gravitational pull? Explain based on the chapter.**
    Answer:
    1. The ball still experiences Earth's gravitational force pulling it downwards while it moves upwards.
    2. Therefore, it slows down, stops momentarily at its highest point and then falls back towards the Earth.
11. **Why does the speed of a vertically thrown ball decrease while going up but increase while coming down?**
    Answer:
    1. While the ball moves upwards, gravity acts downwards and causes its speed to decrease.
    2. While it falls downwards, gravity acts in the direction of its motion and its speed increases.
12. **An object weighs 10 N on Earth but only 1.6 N on the Moon. Has the amount of matter in the object changed? Explain.**
    Answer:
    1. No, its mass remains unchanged because the amount of matter in the object remains the same.
    2. Its weight changes because the gravitational force acting on it is different on the Earth and the Moon.
13. **A 1 kg object weighs 10 N on Earth and 25.4 N on Jupiter. What can you infer from this observation?**
    Answer:
    1. The object's mass remains 1 kg on both planets, showing that mass does not change with location.
    2. Its greater weight on Jupiter shows that the gravitational pull acting on it is stronger there.
14. **Why should an object heavier than the maximum capacity of a spring balance not be measured with it?**
    Answer:
    1. A spring balance has a fixed maximum range of weight that it can measure.
    2. Hanging an object heavier than this maximum value may overstretch and damage the spring balance.
15. **A spring balance has five equal divisions between 2 N and 3 N. What is the value of each division? Explain your calculation.**
    Answer:
    1. The difference between the two markings is $3 - 2 = 1$N.
    2. Therefore, each of the five divisions represents $1 \div 5 = 0.2$N.
16. **An empty closed bottle pushed under water rises to the surface when released. Why?**
    Answer:
    1. Water exerts an upward force called buoyant force or upthrust on the bottle.

    2. The upward effect causes the bottle to rise and bounce back to the water's surface.
17. **A coin sinks in water, whereas a much larger wooden block may float. What does this show about floating and sinking?**
    Answer:
    1. An object's size alone does not determine whether it will float or sink; the downward gravitational force and upward buoyant force must be considered.
    2. An object sinks when gravitational force is greater than buoyant force and floats when the two forces are equal.
18. **Why does a mug filled with water feel lighter while it is still inside a bucket of water?**
    Answer:
    1. The water in the bucket exerts an upward buoyant force on the immersed mug.
    2. This upward force opposes the downward gravitational force, making the mug feel lighter while it is in water.
19. **A stone sinks in water. Using Archimedes' Principle, explain why.**
    Answer:
    1. The immersed stone experiences an upward force equal to the weight of the water it displaces.
    2. If the weight of the displaced water is less than the weight of the stone, the stone sinks.
20. **Pumice is a rock, yet it can float on water. How is this possible?**
    Answer:
    1. Pumice contains many tiny air pockets formed when gas-rich lava cools quickly.
    2. These air pockets make pumice less dense than water, enabling the rock to float.
21. **Suppose friction suddenly disappeared from a road. Predict what would happen when a cyclist tried to apply the brakes.**
    Answer:
    1. Without sufficient friction, the bicycle would not slow down effectively when the brakes were applied.
    2. The cyclist would also have difficulty maintaining grip and controlling the bicycle because friction opposes sliding motion.
22. **A ball released from an inclined plane stops at point A on a horizontal surface. How can you make it stop before point A?**
    Answer:
    1. The horizontal surface can be made rougher so that the frictional force acting on the ball increases.
    2. Greater friction will reduce its speed more quickly and make the ball stop before point A.
23. **How can the same ball be made to travel beyond point A before stopping?**
    Answer:
    1. The horizontal surface can be made smoother so that the frictional force acting on the ball decreases.
    2. With less friction opposing its motion, the ball will travel a greater distance before coming to rest.
24. **A charged object attracts an uncharged piece of paper. Does this prove that only charged objects can experience electrostatic force? Explain.**
    Answer:

1. No, electrostatic force can act between a charged object and another charged or uncharged object.
2. Therefore, an uncharged paper piece can also experience attraction when a charged object is brought near it.

25. **Why can gravitational force not be classified as a contact force even though objects finally touch the ground?**
Answer:
    1. The Earth begins attracting an object even when the object is at a distance and not touching the ground.
    2. Hence, gravitational force acts without physical contact and is classified as a non-contact force.
26. **Magnetic and gravitational forces are both non-contact forces. How can their effects differ?**
Answer:
    1. Magnetic force can produce either attraction or repulsion depending on the poles involved.
    2. Gravitational force, in contrast, is always attractive.
27. **A student says, "If an object is not moving, no force is acting on it." Do you agree? Give a reason.**
Answer:
    1. No, an object can remain at rest even when forces are acting on it.
    2. This can happen when the forces acting on the object balance one another.
28. **Why is it scientifically incorrect to say that a bag has a "weight of 10 kg"?**
Answer:
    1. Kilogram is a unit of **mass**, whereas weight is a gravitational force measured in **newtons**.
    2. Therefore, "10 kg" describes the mass of the bag and not its scientific weight.
29. **If gravity on a planet is stronger than on Earth, what would happen to your mass and weight there?**
Answer:
    1. Your mass would remain unchanged because the amount of matter in your body would remain the same.
    2. Your weight would increase because a stronger gravitational force would pull you more strongly.
30. **Why can friction be considered both useful and opposing in our daily life?**
Answer:
    1. Friction opposes motion and can slow down moving objects, such as a rolling ball or bicycle.
    2. At the same time, sufficient friction provides grip, which helps prevent slipping on surfaces.

5.9. Three-mark questions with Answers of LOTS Type: (10 Questions)

Below are **15 LOTS (Lower Order Thinking Skills) questions**, focusing mainly on **remembering, understanding, describing, explaining, listing, and differentiating**. Each answer contains **exactly three points/sentences** suitable for **3 marks**.

1. What is force? Mention any two effects of force.
Answer:
1. A force is a **push or pull** on an object resulting from its interaction with another object.
2. A force can change the **speed or direction of motion** of an object.

3. A force can also change the **shape** of an object.

2. Explain why force is considered an interaction between two objects.

Answer:

1. A force comes into play when at least **two objects interact** with each other.
2. For example, when a person pushes a table, the hand and the table interact with each other.
3. When the interaction stops, the objects no longer experience the force due to that interaction.

3. What are contact forces? Explain muscular force with examples.

Answer:

1. Forces that act only when there is **physical contact between objects** are called contact forces.
2. Muscular force is the force produced by the action of muscles in our body.
3. Activities such as walking, running, lifting, pushing and jumping involve muscular force.

4. State three important functions of muscular force in living beings.

Answer:

1. Muscular force helps humans and animals in movements such as walking, running, jumping and lifting.
2. It helps us to **chew food and push it through the alimentary canal** during digestion.
3. The expansion and contraction of heart muscles help in the **circulation of blood** throughout the body.

5. What is friction? State two characteristics of frictional force.

Answer:

1. The force that comes into play when an object moves or tries to move over another surface is called **friction**.
2. Friction always acts in a direction **opposite to the direction of motion or attempted motion**.
3. Friction is a **contact force** because it arises between two surfaces that are in contact.

6. How is friction produced between two surfaces?

Answer:

1. Friction arises because of the **irregularities present on the surfaces** in contact.
2. Even surfaces that appear smooth contain a large number of minute irregularities.
3. These irregularities lock into one another and oppose the movement of one surface over the other.

7. What are non-contact forces? Name and describe three examples.

Answer:

1. Forces that can act on objects **without physical contact** are called non-contact forces.
2. **Magnetic force** and **electrostatic force** can produce attraction or repulsion without direct contact.
3. **Gravitational force** is a non-contact force by which the Earth attracts objects towards itself.

8. What is magnetic force? Explain the attraction and repulsion between magnets.

Answer:

1. The force exerted by a magnet on another magnet or magnetic material is called **magnetic force**.
2. Like poles of magnets, such as North–North or South–South, **repel each other**.
3. Unlike poles, such as North–South, **attract each other**.

9. What are static charges? Explain how an object can acquire them.

Answer:

1. When objects made of certain materials are rubbed together, **electrical charges build up on their surfaces**.
2. These charges are called **static charges** because they do not move by themselves.
3. An object that acquires static charges is called a **charged object**.

10. Explain the attraction and repulsion between electrically charged objects.
Answer:
1. There are two kinds of static electrical charges called **positive and negative charges**.
2. Similar or like charges **repel each other**.
3. Opposite or unlike charges **attract each other**.

11. What is electrostatic force? Give an example and state its type.
Answer:
1. The force exerted by a charged body on another charged or uncharged body is called **electrostatic force**.
2. For example, a rubbed plastic scale can attract small pieces of paper towards it.
3. Electrostatic force is a **non-contact force** because it can act without physical contact between the objects.

12. What is gravitational force? State its important characteristics.
Answer:
1. The force with which the Earth attracts objects towards itself is called **gravitational force or gravity**.
2. It is a **non-contact force** because it can act on an object without physical contact.
3. Gravitational force is **always attractive**, unlike magnetic and electrostatic forces, which may be attractive or repulsive.

13. Describe the motion of an object thrown vertically upwards.
Answer:
1. When an object is thrown vertically upwards, it moves upward while its **speed gradually decreases**.
2. It stops momentarily when it reaches its **highest point**.
3. It then changes its direction and falls downward with **increasing speed** under the influence of gravitational force.

14. What is weight? How is it measured?
Answer:
1. The force with which the Earth pulls an object towards itself is called the **weight of the object**.
2. Since weight is a force, its SI unit is the **newton (N)**.
3. The weight of an object can be measured using a **spring balance**.

15. Differentiate between mass and weight.
Answer:
1. **Mass** is the amount of matter present in an object, whereas **weight** is the gravitational force acting on the object.
2. Mass is measured in **grams (g) or kilograms (kg)**, whereas weight is measured in **newtons (N)**.
3. The mass of an object remains the same at every place, whereas its weight can change because gravitational force varies from place to place.

16. What is buoyant force? Explain its effect on an object placed in a liquid.
Answer:
1. The upward force exerted by a liquid on an object placed in it is called **upthrust or buoyant force**.
2. When an object is placed in a liquid, gravitational force acts downward while buoyant force acts upward.

3. The object sinks if gravitational force is greater than buoyant force and floats if the two forces are equal.

17. State Archimedes' Principle and explain its relation to floating and sinking.

Answer:

1. According to **Archimedes' Principle**, an object fully or partially immersed in a liquid experiences an upward force equal to the weight of the liquid displaced by it.
2. If the weight of the displaced liquid is less than the weight of the object, the object **sinks**.
3. If the weight of the displaced liquid is equal to the weight of the object, the object **floats**.

18. Describe the construction and working of a spring balance.

Answer:

1. A spring balance consists of a **spring fixed at one end and a hook attached at the other end**.
2. When an object is hung from the hook, its weight causes the spring to stretch.
3. The amount of stretching is shown on a calibrated scale and gives the **weight of the object in newtons**.

19. Explain why different objects produce different stretches in a spring.

Answer:

1. When an object is suspended from a spring, the Earth pulls it downward due to gravitational force.
2. Different objects may experience different gravitational forces and therefore have different weights.
3. Hence, different objects can produce different amounts of stretch in the spring.

20. Explain the floating and sinking of objects in a liquid.

Answer:

1. An object placed in a liquid experiences **gravitational force downward** and **buoyant force upward**.
2. If the gravitational force is greater than the buoyant force, the object **sinks**.
3. If the gravitational force and buoyant force are equal, the object **floats**.

5.10. Three-mark questions with Answers of HOTS Type: (10 Questions)

The following questions are based on **application, analysis, reasoning, prediction and comparison**, rather than direct recall. Each answer has **three clear points/sentences for 3 marks**. The chapter itself encourages this kind of reasoning through questions involving friction, gravity, electrostatic force, and floating and sinking.

1. A cyclist finds it more difficult to ride on a rough road than on a smooth road. Explain why.

Answer:

1. A rough road has more surface irregularities, which produce greater **friction** between the tyres and the road.
2. Friction acts opposite to the direction of motion and therefore opposes the movement of the bicycle.
3. Hence, the cyclist has to apply greater muscular force to keep the bicycle moving.

2. A ball rolled with the same force travels farther on a smooth floor than on a rough floor. Give reasons.

Answer:

1. The force of friction depends on the **nature of the surfaces in contact**.
2. A rough floor produces greater friction and therefore slows down the ball more quickly.

3. A smooth floor produces less friction, so the ball travels a greater distance before stopping.

3. Why is it easier for a person to slip on a wet or highly polished floor?

Answer:

1. We need sufficient friction between our feet and the floor to walk without slipping.
2. On a wet or highly smooth surface, the friction available between the feet and the surface is reduced.
3. Therefore, the feet can slide more easily, causing the person to slip.

4. Two balloons are rubbed with the same woollen cloth and then brought close to each other. Predict what will happen and explain why.

Answer:

1. Both balloons acquire **similar electrical charges** because they are charged in the same way.
2. Like or similar charges repel each other.
3. Therefore, the two balloons move away from each other due to **electrostatic force**.

5. A plastic scale rubbed with polythene attracts small pieces of paper even without touching them. How can you explain this observation?

Answer:

1. Rubbing the plastic scale with polythene causes **static charges** to build up on its surface.
2. The charged scale exerts an electrostatic force on the uncharged pieces of paper.
3. Since this force acts without direct physical contact, electrostatic force is classified as a **non-contact force**.

6. A ball is thrown vertically upwards. Explain why it slows down, stops momentarily and then falls back.

Answer:

1. During upward motion, Earth's gravitational force acts downward, opposite to the motion of the ball, so its speed decreases.
2. At the highest point, the ball stops momentarily before changing its direction of motion.
3. It then falls towards the Earth with increasing speed under the influence of **gravitational force**.

7. A student says, "An object at rest has no force acting on it." Do you agree? Justify your answer.

Answer:

1. No, an object can remain at rest even when forces are acting on it.
2. This happens when the forces acting on the object **balance one another**.
3. Therefore, being at rest does not necessarily mean that no force is acting on the object.

8. A coin sinks in water, but a much bigger wooden block floats. How can a bigger object float while a smaller object sinks?

Answer:

1. Floating or sinking is determined by the relationship between the object's weight and the **buoyant force** acting on it, not simply by its size.
2. The coin sinks when its gravitational force is greater than the upward buoyant force acting on it.
3. The wooden block floats when the upward buoyant force balances its weight.

9. An empty closed bottle pushed under water immediately rises when released. Explain this observation.

Answer:

1. Water exerts an upward force called **buoyant force or upthrust** on the bottle.
2. The bottle also experiences gravitational force acting vertically downward.

3. The upward effect causes the bottle to rise towards the surface when it is released.

10. A student's mass is 40 kg on Earth. If the student goes to the Moon, will both mass and weight remain the same? Explain.

Answer:

1. The student's **mass remains 40 kg** because mass is the amount of matter in an object and does not change with location.
2. The student's weight decreases on the Moon because the Moon's gravitational pull is weaker than Earth's.
3. Thus, **mass remains constant while weight changes** when gravitational force changes.

11. A spring balance stretches more when object A is suspended from it than when object B is suspended. What can you infer?

Answer:

1. The stretching of the spring is caused by the weight of the object suspended from it.
2. Greater stretching indicates that a greater gravitational force is acting on object A.
3. Therefore, object A has a **greater weight** than object B.

12. A spring balance has a range of 0–10 N. A student tries to measure an object weighing 15 N. Why should this be avoided?

Answer:

1. The maximum weight that this spring balance can measure is **10 N**.
2. A 15 N object exceeds the measuring range of the instrument and may stretch the spring beyond its intended limit.
3. Therefore, using such an object may **damage the spring balance** and prevent reliable measurement.

13. A ball released down a slope stops at point A on a horizontal rough surface. How could you make it stop before point A or after point A?

Answer:

1. To make the ball stop **before point A**, the friction can be increased by making the horizontal surface rougher.
2. To make it stop **after point A**, friction can be reduced by making the surface smoother.
3. This works because greater friction stops a moving object sooner, while smaller friction allows it to travel farther.

14. Aeroplanes, ships and high-speed trains are given special shapes. Explain this design using the concept of friction.

Answer:

1. Air and water exert frictional forces on objects moving through them.
2. Special shapes are designed to reduce the friction caused by the surrounding air or water.
3. Reduced friction allows aeroplanes, ships and high-speed trains to move more easily through their respective surroundings.

15. A magnet is held above another magnet with like poles facing each other. The upper magnet appears to float. Explain.

Answer:

1. Like poles of two magnets **repel each other**.
2. The lower magnet exerts an upward magnetic force on the upper magnet even though they are not touching.
3. This demonstrates that magnetic force can act from a distance and is therefore a **non-contact force**.

16. A child pushes a heavy table, but the table does not move. Can we say that no force is being applied? Give reasons.

Answer:

1. No, the child is applying **muscular force** on the table even though it does not move.
2. A force does not necessarily produce visible motion because other opposing forces may balance the applied force.
3. Therefore, the absence of movement does not prove the absence of force.

17. Why does a mug feel lighter while it is inside water than when it is lifted out of the water?

Answer:

1. When the mug is inside water, water exerts an **upward buoyant force** on it.
2. This upward force acts opposite to the downward gravitational force or weight of the mug.
3. Therefore, the mug appears to require less upward force to support or lift while it is in water.

18. Suppose gravity suddenly disappeared from the Earth. Predict three immediate effects based on the concepts in this chapter.

Answer:

1. Objects released from a height would no longer be pulled downward towards the Earth.
2. Objects would no longer have **weight due to Earth's gravitational pull**, although their mass would remain unchanged.
3. The familiar behaviour of falling objects and the balance between gravitational and buoyant forces would therefore be drastically altered.

19. Friction is sometimes called both "useful" and "undesirable." Justify this statement.

Answer:

1. Friction is useful because it provides the grip required for activities such as walking and controlling movement.
2. However, friction also opposes motion and can make moving an object more difficult.
3. Therefore, friction is necessary in some situations but needs to be reduced in situations where it unnecessarily resists motion.

20. Two objects have the same mass but are taken to two planets having different gravitational forces. Compare their mass and weight.

Answer:

1. The **mass of both objects remains unchanged** because mass does not depend on the gravitational force of a planet.
2. Their weights will be different because weight depends on the gravitational pull exerted by the planet.
3. Therefore, the same object can have the **same mass but different weights** at different places.

5.11 Five-mark questions with Answers of LOTS Type: (5 Questions)

Below are **10 five-mark descriptive questions** based directly on the uploaded Grade 8 chapter. These are **LOTS (Lower Order Thinking Skills)** questions focusing mainly on remembering, understanding, describing, listing and explaining concepts.

1. What is force? Explain any four effects that a force can have on an object.

Answer:

1. A **force** is a push or pull on an object resulting from its interaction with another object.
2. A force can make an object at rest **start moving**.
3. It can **change the speed** of a moving object.
4. It can **change the direction of motion** of an object.
5. It can also **change the shape** of an object.

2. What are contact forces? Explain muscular force with suitable examples.

Answer:

1. Forces that act only when there is physical contact between objects are called **contact forces**.
2. **Muscular force** is a contact force produced by the action of muscles.
3. Activities such as walking, running, lifting, pushing, jumping and stretching involve muscular force.
4. Animals, birds, fish and insects also use muscular force for their movement and survival.
5. Muscular force is also involved in internal body functions such as chewing food and the contraction and expansion of the heart.

3. Define friction and explain its main characteristics.

Answer:

1. **Friction** is the force that comes into play when an object moves or tries to move over another surface.
2. It always acts in a direction **opposite to the direction of motion** or attempted motion.
3. Friction is a **contact force** because it arises between two surfaces that are in contact.
4. It arises due to the minute irregularities present on the surfaces, which lock with one another.
5. Friction depends on the nature of the surfaces in contact and is generally greater on **rough surfaces**.

4. What is magnetic force? Explain the attraction and repulsion between magnets.

Answer:

1. The force exerted by a magnet on another magnet or a magnetic material is called **magnetic force**.
2. A magnet can exert force on another object even when the two objects are not touching.
3. Like magnetic poles, such as North–North or South–South, **repel each other**.
4. Unlike magnetic poles, such as North–South, **attract each other**.
5. Since magnetic force can act from a distance without physical contact, it is called a **non-contact force**.

5. What is electrostatic force? Describe how static charges are produced and interact.

Answer:

1. When objects made of certain materials are rubbed together, **electrical charges** build up on their surfaces.
2. These charges are called **static charges**, and an object possessing them is called a charged object.
3. The two kinds of static charges are called **positive and negative charges**.
4. Similar or like charges repel each other, while opposite or unlike charges attract each other.
5. The force exerted by a charged body on another charged or uncharged body is called **electrostatic force**, and it is a non-contact force.

6. What is gravitational force? Describe its important features.

Answer:

1. The force with which the Earth attracts objects towards itself is called **gravitational force**.
2. The gravitational force exerted by the Earth is also called the **force of gravity or gravity**.
3. It acts without physical contact between the Earth and the object and is therefore a **non-contact force**.
4. Gravitational force is **always attractive**, unlike magnetic and electrostatic forces, which may be attractive or repulsive.

5. Due to gravitational force, objects thrown upwards eventually fall back towards the Earth.

7. Define weight. Explain how the weight of an object can be measured using a spring balance.

Answer:

1. The force with which the Earth pulls an object towards itself is called the **weight of the object**.
2. Since weight is a force, its SI unit is **newton (N)**.
3. A **spring balance** is a simple device used to measure the weight of an object.
4. When an object is suspended from its hook, the spring stretches, and the amount of stretching indicates the object's weight.
5. The weight is read from the scale marked in newtons on the spring balance.

8. Differentiate between mass and weight.

Answer:

1. **Mass** is the amount of matter present in an object, whereas **weight** is the gravitational force acting on the object.
2. Mass is measured in **grams (g) or kilograms (kg)**, whereas weight is measured in **newtons (N)**.
3. The mass of an object remains the **same at every place**.
4. The weight of an object may change because gravitational force varies from place to place and from one planet to another.
5. Thus, an object has the same mass on the Earth, Moon and other planets but can have **different weights** on them.

9. What is buoyant force? Explain how it determines whether an object floats or sinks.

Answer:

1. The upward force applied by a liquid on an object placed in it is called **upthrust or buoyant force**.
2. When an object is placed in a liquid, gravitational force acts on it in the **downward direction**.
3. At the same time, the liquid applies buoyant force on the object in the **upward direction**.
4. If the gravitational force is greater than the buoyant force, the object **sinks**.
5. If the gravitational force and buoyant force are equal, the object **floats**.

10. State Archimedes' Principle and explain floating and sinking based on it.

Answer:

1. Archimedes' Principle states that an object fully or partially immersed in a liquid experiences an **upward force**.
2. This upward force is equal to the **weight of the liquid displaced** by the object.
3. The upward force exerted by the liquid is called **buoyant force or upthrust**.
4. If the weight of the displaced liquid is smaller than the weight of the object, the object **sinks**.
5. If the weight of the displaced liquid is equal to the weight of the object, the object **floats**.

5.12 Five-mark questions with Answers of HOTS Type: (5 Questions)

The following questions emphasize **analysis, reasoning, comparison, prediction, and cause–effect relationships**. Each answer contains **five sentences/points**, suitable for **5 marks**.

1. A ball rolled with the same push travels different distances on glass, wood, cloth and sand. Explain why and predict where it would stop sooner.

Answer:

1. The ball experiences **frictional force** between its surface and the surface over which it rolls.
2. Friction acts opposite to the direction of motion and gradually reduces the speed of the ball.
3. The amount of friction depends on the **nature of the surfaces in contact**.
4. Rough surfaces generally produce greater friction than smoother surfaces.
5. Therefore, the ball would stop sooner on a rough surface such as sand and travel farther on a smoother surface.

2. A student says, "If an object is at rest, no force can be acting on it." Analyse this statement with suitable reasoning.

Answer:

1. The statement is **not always correct**, because an object may remain at rest even when forces are acting on it.
2. An object at rest can have forces acting on it that **balance one another**.
3. Since the forces balance, they do not produce a change in the object's state of rest.
4. Thus, observing that an object is stationary is not enough to conclude that no force is acting on it.
5. Hence, an object can remain at rest while experiencing **balanced forces**.

3. A ball is thrown vertically upwards. Analyse its motion from the moment it leaves the hand until it returns to the ground.

Answer:

1. After the ball leaves the hand, Earth's **gravitational force acts downward** on it.
2. While the ball moves upwards, its speed continuously decreases because gravity acts opposite to its direction of motion.
3. At its highest point, the ball **stops momentarily** before changing its direction.
4. During its downward journey, gravity acts in the direction of its motion, and its speed increases.
5. Thus, gravitational force is responsible for the changes in the speed and direction of the ball during its vertical motion.

4. An object has a mass of 1 kg on Earth and weighs 10 N. On the Moon, it weighs only 1.6 N. Explain what this tells us about mass and weight.

Answer:

1. **Mass** represents the amount of matter in an object and remains unchanged from place to place.
2. Therefore, the object's mass remains **1 kg** on both the Earth and the Moon.
3. **Weight** is the gravitational force with which a planet or other celestial body pulls an object.
4. The lower weight of 1.6 N on the Moon indicates that the gravitational pull there is weaker than on Earth.
5. Hence, an object's **mass remains constant while its weight can change** depending on gravitational force.

5. A coin sinks in water, whereas a much larger wooden block floats. Explain why size alone cannot determine whether an object will float or sink.

Answer:

1. Every object placed in water experiences its **weight downward** and a **buoyant force upward**.
2. Whether an object floats or sinks depends on the relationship between these two opposing forces rather than simply on its size.
3. If the gravitational force acting on an object is greater than the buoyant force, the object sinks.

4. If the buoyant force balances the gravitational force, the object floats.
5. Therefore, a small coin may sink while a larger wooden block may float because size alone does not determine the balance between these forces.

6. Two balloons are rubbed with the same woollen cloth and brought near each other. Explain what happens and what conclusions can be drawn.

Answer:

1. Rubbing causes **static electrical charges** to develop on the surfaces of the balloons.
2. Since both balloons are rubbed in the same way, they acquire **similar charges**.
3. When the balloons are brought near each other, they move apart because **like charges repel**.
4. The force causing this repulsion is called **electrostatic force**.
5. Since the balloons repel without touching each other, electrostatic force is classified as a **non-contact force**.

7. In an experiment, two ring magnets are placed on a vertical wooden stick with like poles facing each other. Explain why the upper magnet appears to float and what happens if one magnet is reversed.

Answer:

1. Like poles of magnets **repel each other**, producing a repulsive magnetic force.
2. When like poles face each other, the lower magnet exerts a force on the upper magnet without touching it.
3. This repulsive effect can keep the upper magnet separated from the lower magnet, making it appear to float.
4. If one magnet is reversed, unlike poles face each other and the magnets **attract** instead of repel.
5. The experiment demonstrates that magnetic force can produce attraction or repulsion and can act as a **non-contact force**.

8. An empty bottle with its lid tightly closed is pushed below the surface of water and then released. Explain what happens using the concept of forces.

Answer:

1. When the bottle is pushed into water, the water applies an **upward buoyant force** on it.
2. At the same time, Earth's gravitational force acts on the bottle in the downward direction.
3. On releasing the bottle, it moves upwards and bounces back towards the water surface.
4. This shows that a liquid can exert an upward force on an immersed object.
5. The behaviour of the bottle can therefore be understood by comparing the downward gravitational force with the upward **buoyant force or upthrust**.

9. A ball released from point P on an inclined plane stops at point A on a horizontal surface. Suggest how you could make it stop before A and after A, giving reasons.

Answer:

1. The ball eventually stops because **friction acts opposite to its motion** on the horizontal surface.
2. To make the ball stop **before point A**, the horizontal surface can be made rougher.
3. A rougher surface produces greater friction and therefore slows the ball more quickly.
4. To make the ball stop **after crossing point A**, the surface can be made smoother so that friction is reduced.
5. Thus, changing the nature of the surface changes the frictional force and consequently the distance travelled by the ball.

10. A student notices that a mug full of water feels lighter while it is still inside a bucket of water than after it is lifted out. Explain this observation.

Answer:
1. While the mug is inside water, it experiences a **buoyant force in the upward direction**.
2. Earth's gravitational force simultaneously pulls the mug downward.
3. The upward buoyant force opposes the downward gravitational force.
4. Therefore, the student experiences less downward effect while holding the mug inside water, making it feel lighter.
5. Once the mug is lifted out of the water, the upward buoyant force from the surrounding water no longer acts on it in the same way.

11. Why can a pumice rock float on water even though we normally expect rocks to sink?
Answer:
1. Pumice is formed when lava containing large amounts of gas and water vapour cools quickly.
2. During cooling, tiny bubbles of gas become trapped inside the rock.
3. These bubbles create numerous **air pockets**, making pumice light and porous.
4. As a result, pumice can be **less dense than water**.
5. Therefore, unlike many ordinary rocks, pumice can float on the surface of water.

12. Compare magnetic, electrostatic and gravitational forces on the basis of contact, attraction and repulsion.
Answer:
1. Magnetic, electrostatic and gravitational forces are all **non-contact forces** because they can act without objects physically touching.
2. Magnetic force can cause **attraction between unlike poles and repulsion between like poles**.
3. Electrostatic force can cause **attraction between unlike charges and repulsion between like charges**.
4. Gravitational force differs from both because it is **always attractive**.
5. Thus, although all three can act from a distance, their attractive and repulsive behaviours are not identical.

5.13 Five-mark questions with Answers of Applied Type: (5 Questions)

The following questions require students to **apply the concepts of force, friction, gravity, electrostatic and magnetic forces, weight, buoyancy, and floating/sinking to real-life situations**. The chapter itself emphasizes applying these ideas through experiments and everyday observations.

1. A cyclist is travelling on a smooth road and suddenly enters a rough, sandy road. Explain what the cyclist will experience and how the concept of friction applies.
Answer:
1. On entering the rough road, the cyclist will find it more difficult to maintain the same speed.
2. Friction acts between the bicycle tyres and the road in a direction opposite to motion.
3. A rough surface produces greater friction because of greater interaction between surface irregularities.
4. Therefore, the bicycle slows down more quickly on the rough road than on the smooth road.
5. The cyclist must apply greater muscular force through pedalling to overcome the increased friction and continue moving.

2. During the rainy season, a school corridor becomes wet and students tend to slip while walking. Apply your knowledge of friction to explain the situation and suggest a solution.
Answer:

1. Walking requires sufficient friction between our footwear and the floor to provide grip.
2. A wet or very smooth floor provides less effective grip, making slipping more likely.
3. Students should therefore walk carefully and avoid running on such surfaces.
4. Increasing the roughness or grip of the walking surface can help prevent slipping.
5. Thus, this situation demonstrates that friction, although it opposes motion, is also necessary for safe movement.

3. A child throws a ball vertically upwards during a game. Explain what happens to the ball from the moment it leaves the child's hand until it returns.

Answer:

1. After leaving the child's hand, the ball continues moving upward while Earth's gravitational force acts downward.
2. Since gravity acts opposite to its upward motion, the speed of the ball gradually decreases.
3. At its highest position, the ball stops momentarily before changing its direction.
4. It then moves downward, and its speed increases as it falls towards the Earth.
5. Thus, the entire change in the ball's vertical motion after release occurs under the influence of Earth's gravitational force.

4. An astronaut carries an object of mass 1 kg from Earth to the Moon. Explain what happens to its mass and weight.

Answer:

1. The amount of matter in the object does not change, so its mass remains **1 kg**.
2. On Earth, according to the chapter's table, the 1 kg object weighs approximately **10 N**.
3. On the Moon, the same object weighs approximately **1.6 N** because the Moon's gravitational pull is weaker.
4. Therefore, changing location can change an object's weight without changing its mass.
5. This application demonstrates that **mass is constant while weight depends on gravitational force**.

5. You are given a spring balance with a range of 0–10 N and five small divisions between every two consecutive newton marks. Explain how you would use it to measure an object's weight.

Answer:

1. First, I would identify the range of the spring balance, which is **0–10 N**.
2. Since five divisions represent 1 N, each small division represents **1 ÷ 5 = 0.2 N**.
3. I would ensure that the object's weight does not exceed 10 N, because excessive weight may damage the balance.
4. I would suspend the object carefully from the hook and allow the spring to stretch.
5. I would then read the position of the indicator on the scale and record the object's weight in **newtons (N)**.

6. You are given an empty plastic bottle with its lid tightly closed and a bucket of water. Predict what will happen when you push the bottle completely under water and release it.

Answer:

1. While pushing the bottle underwater, an upward force from the water can be felt.
2. This upward force exerted by the liquid is called **upthrust or buoyant force**.
3. At the same time, gravitational force acts on the bottle vertically downward.
4. When the bottle is released, the upward effect causes it to move back towards the surface.
5. This activity demonstrates that objects immersed in liquids experience an upward **buoyant force**.

7. A coin sinks when dropped into water, whereas a larger wooden block floats. Apply the concepts of gravity and buoyancy to explain this observation.
Answer:
1. Both the coin and wooden block experience gravitational force downward and buoyant force upward.
2. An object's size alone does not determine whether it will float or sink.
3. The coin sinks because the downward gravitational force on it is greater than the buoyant force supporting it.
4. The wooden block floats when the upward buoyant force balances its weight.
5. Therefore, floating and sinking depend on the relationship between the object's weight and the buoyant force acting on it.

8. Two balloons are rubbed with a woollen cloth and suspended close to each other. Predict the observation and explain its practical scientific basis.
Answer:
1. Rubbing the balloons with wool causes **static electrical charges** to develop on their surfaces.
2. Since both balloons are rubbed similarly, they acquire similar charges.
3. Similar electrical charges repel each other, so the balloons move apart when released.
4. If the woollen cloth used for rubbing is brought near a rubbed balloon, they attract because they have acquired opposite kinds of charges.
5. This experiment demonstrates the application of **electrostatic force**, which acts without physical contact.

9. A student wants a ball released from the same point on an inclined plane to stop at different positions on the horizontal surface. How can this be achieved?
Answer:
1. The ball stops on the horizontal surface because friction acts opposite to its direction of motion.
2. To make the ball stop **sooner**, the student can use a rougher horizontal surface.
3. Greater friction on the rough surface will reduce the ball's speed more quickly.
4. To make the ball travel **farther**, the student can use a smoother horizontal surface that provides less friction.
5. Thus, the stopping distance of the ball can be changed by changing the nature of the surface and consequently the amount of friction.

10. You are asked to demonstrate a non-contact force in the classroom using two ring magnets. Describe how you would perform the activity and explain the result.
Answer:
1. I would place one ring magnet on a vertical wooden stick and then place another ring magnet above it with **like poles facing each other**.
2. The upper magnet would remain separated from the lower magnet because like magnetic poles repel each other.
3. If I gently pushed the upper magnet downward, I would feel the repulsive force acting against the push.
4. If the orientation were changed so that unlike poles faced each other, the magnets would attract instead.
5. The experiment proves that **magnetic force can act from a distance without physical contact**, so it is a non-contact force.

11. A student notices that a mug filled with water feels lighter while it is still inside a bucket of water than when it is lifted out. Apply the concept of buoyancy to explain.
Answer:

1. While the mug is inside the water, it experiences its weight due to gravitational force in the downward direction.
2. The surrounding water simultaneously exerts an **upward buoyant force** on the mug.
3. This upward force opposes the downward gravitational force acting on the mug.
4. Consequently, the mug feels lighter while it is immersed in water.
5. When the mug is taken out, the buoyant support provided by the surrounding water is removed, so it feels heavier.

12. A company wants to design a high-speed train that can travel efficiently through air. How can the concept of friction be applied to its design?

Answer:

1. Air exerts frictional force on objects moving through it.
2. This friction acts against the motion of a high-speed train and can make its movement more difficult.
3. The train should therefore be given a suitable shape that reduces the friction caused by the surrounding air.
4. Reduced air friction allows the train to move more efficiently at high speeds.
5. This is why high-speed trains, aeroplanes, ships and boats are designed with **specific shapes to reduce friction** from air or water.

5.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

The chapter covers effects and types of forces, friction, magnetic/electrostatic/gravitational forces, weight, spring balance, buoyancy, and floating and sinking.

1. A football moving towards the east is kicked so that it starts moving towards the north. The force applied by the player has primarily changed the:

A. mass of the football
B. shape of the football permanently
C. direction of motion of the football
D. gravitational force on the football

Answer: C. Direction of motion of the football

Explanation: A force can change the speed or direction of motion of an object, as well as its shape.

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2. A wooden block is pushed with the same initial effort over four surfaces. It travels the following distances:

Surface	Distance travelled
P	80 cm
Q	25 cm
R	120 cm
S	50 cm

On which surface is friction most likely to be greatest?

A. P
B. Q
C. R
D. S

Answer: B. Q

Explanation: Greater friction causes the moving object to stop sooner. Therefore, the surface on which it travels the shortest distance offers the greatest friction.

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3. Which pair contains only non-contact forces?
A. Muscular force and friction
B. Friction and magnetic force
C. Magnetic force and gravitational force
D. Muscular force and electrostatic force
Answer: C. Magnetic force and gravitational force
Explanation: Magnetic, gravitational and electrostatic forces are non-contact forces, whereas muscular force and friction are contact forces.

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4. Two identical balloons are rubbed in the same way with a woollen cloth. When brought close together without touching, they move apart. The best explanation is:
A. both balloons have become heavier
B. the balloons acquire similar charges and repel
C. the balloons acquire opposite charges and repel
D. gravitational force between them increases
Answer: B. The balloons acquire similar charges and repel
Explanation: Similarly charged objects repel, whereas unlike charges attract.

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5. A ball is thrown vertically upwards. At its highest point, which statement is correct according to the chapter?
A. Its speed is momentarily zero, but gravitational force still acts on it.
B. Its speed and gravitational force are both zero.
C. Gravity acts upward.
D. The ball loses its mass momentarily.
Answer: A. Its speed is momentarily zero, but gravitational force still acts on it.
Explanation: The ball slows down, stops momentarily at the highest point and then falls. Earth's gravitational force continues to act downward.

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6. A spring balance has a range of 0–10 N. There are five equal small divisions between two consecutive 1 N markings. Its smallest measurable value is:
A. 0.1 N
B. 0.2 N
C. 0.5 N
D. 2 N
Answer: B. 0.2 N
Explanation:
Smallest division = $1N \div 5 = 0.2N$.

---

7. A student says, "An object at rest has no force acting on it." Which response is most appropriate?
A. Always correct
B. Correct only for very light objects
C. Incorrect; forces acting on it may be balancing one another
D. Incorrect because only gravity acts on every stationary object
Answer: C. Forces acting on it may be balancing one another
Explanation: The chapter specifically points out that an object can remain at rest when the forces acting on it balance one another.

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8. An object has a mass of 1 kg. According to the table in the chapter, where would it have the greatest weight?

A. Moon
B. Mars
C. Earth
D. Jupiter
Answer: D. Jupiter
Explanation: The table gives the weights as Earth = 10 N, Moon = 1.6 N, Mars = 3.8 N, Venus = 9 N and Jupiter = 25.4 N.

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9. The same 1 kg object is taken from Earth to the Moon. Which combination is correct?
A. Mass decreases; weight remains unchanged
B. Mass remains unchanged; weight decreases
C. Both mass and weight decrease
D. Both remain unchanged
Answer: B. Mass remains unchanged; weight decreases
Explanation: Mass remains the same at every place, whereas weight depends on gravitational force and can change.

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10. A plastic bottle with its lid tightly closed is pushed completely underwater and released. It moves towards the surface mainly because:
A. water exerts an upward buoyant force
B. gravity disappears underwater
C. its mass becomes zero
D. friction pulls it upwards
Answer: A. Water exerts an upward buoyant force
Explanation: A liquid applies an upward force called **upthrust or buoyant force** on an immersed object.

---

11. An object placed in a liquid will sink if:
A. buoyant force is greater than gravitational force
B. gravitational force is greater than buoyant force
C. gravitational force equals buoyant force
D. no gravitational force acts on it
Answer: B. Gravitational force is greater than buoyant force
Explanation: The chapter states that an object sinks when gravitational force exceeds buoyant force; it floats when the two are equal.

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12. According to Archimedes' Principle, the upward force on a fully or partially immersed object equals:
A. the mass of the object
B. the volume of the object
C. the weight of liquid displaced by the object
D. the total weight of liquid in the container
Answer: C. The weight of liquid displaced by the object

---

13. A compass needle points approximately north because of:
A. electrostatic force
B. magnetic force
C. frictional force
D. muscular force
Answer: B. Magnetic force

This example also appears in the chapter's force-matching exercise.

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14. Which statement correctly compares gravitational force with magnetic and electrostatic forces?
A. All three forces can only attract.
B. Gravity can repel, but the other two cannot.
C. Gravity is always attractive, while magnetic and electrostatic forces can attract or repel.
D. Gravity is a contact force, whereas the others are non-contact forces.
Answer: C.
Explanation: Gravitational force is always attractive. Magnetic and electrostatic forces can produce attraction as well as repulsion.

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15. A student rubs a plastic scale with polythene and brings it near tiny pieces of paper without touching them. The paper pieces move towards the scale. This demonstrates:
A. muscular force
B. gravitational force only
C. electrostatic force
D. frictional force between scale and paper
Answer: C. Electrostatic force
Explanation: Rubbing can produce static charges, and the charged scale can attract uncharged paper pieces without contact.

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16. Why are high-speed trains and aeroplanes designed with specific shapes?
A. To completely eliminate gravity
B. To increase their mass
C. To reduce friction due to air
D. To increase electrostatic force
Answer: C. To reduce friction due to air
Explanation: Gases and liquids exert friction on moving objects; suitable shapes help reduce this resistance.

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17. A moving ball rolls farther on a polished floor than on a rough floor when given similar pushes. Which conclusion is best supported?
A. Gravity is absent on the polished floor.
B. Friction is greater on the polished floor.
C. Friction is greater on the rough floor.
D. The mass of the ball changes with the surface.
Answer: C. Friction is greater on the rough floor
Explanation: Friction depends on the nature of the surfaces and is greater on rough surfaces.

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18. Two ring magnets are placed on a vertical wooden stick with like poles facing each other. The upper magnet appears to remain above the lower one. Which force is responsible?
A. Frictional attraction
B. Magnetic repulsion
C. Electrostatic attraction
D. Muscular force
Answer: B. Magnetic repulsion
Explanation: Like magnetic poles repel each other, and magnetic force can act without physical contact.

19. Which of the following is scientifically incorrect?
A. The weight of a bag is 50 N.
B. The mass of a bag is 5 kg.
C. The mass of an object remains unchanged when taken to the Moon.
D. The weight of a wheat bag is 10 kg.
Answer: D. The weight of a wheat bag is 10 kg
Explanation: Kilogram is a unit of **mass**, whereas weight is a force measured in newtons. The chapter specifically highlights this common everyday misuse.

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20. Consider the following statements:
I. Friction acts opposite to the direction in which an object moves or tries to move.
II. Friction is a non-contact force.
III. Friction can act between an object and air or water.
Which are correct?
A. I only
B. I and II only
C. I and III only
D. I, II and III
Answer: C. I and III only
Explanation: Friction opposes motion and can arise in air and water, but it is classified as a **contact force**.

---

21. Three objects P, Q and R are placed in the same liquid. P sinks, Q floats, and R is just floating with its weight balanced by the liquid. Which statement must be true according to the chapter?
A. For P, buoyant force is greater than gravitational force.
B. For P, gravitational force is greater than buoyant force.
C. For Q, gravitational force must always be zero.
D. For R, buoyant force is smaller than gravitational force.
Answer: B. For P, gravitational force is greater than buoyant force
Explanation: An object sinks when gravitational force exceeds buoyant force.

---

22. A 1 kg object weighs 10 N on Earth and 25.4 N on Jupiter according to the chapter. What is the approximate ratio of its weight on Jupiter to its weight on Earth?
A. 0.254
B. 1.54
C. 2.54
D. 25.4
Answer: C. 2.54
Calculation:

$$25.4 \div 10 = 2.54$$

Thus, the object weighs about **2.54 times as much on Jupiter as on Earth**, while its mass remains 1 kg.

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23. Assertion–Reason
Assertion (A): A ball rolling on a rough road stops sooner than the same ball rolling on a smoother road.
Reason (R): Friction is generally greater on rough surfaces.
Choose the correct option:

A. Both A and R are true, and R correctly explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.
Answer: A. Both A and R are true, and R correctly explains A.

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24. Assertion–Reason
Assertion (A): The mass of an astronaut's equipment remains the same when taken from Earth to the Moon.
Reason (R): Mass is the amount of matter in an object and does not depend on the gravitational pull at its location.
A. Both A and R are true, and R correctly explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. Both A and R are false.
Answer: A. Both A and R are true, and R correctly explains A.

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25. Olympiad Challenge
An object weighs **10 N on Earth**. Using the values given in the chapter, approximately what would it weigh on the Moon, Mars and Jupiter respectively?
A. 1.6 N, 3.8 N, 25.4 N
B. 3.8 N, 1.6 N, 25.4 N
C. 1.6 N, 9 N, 10 N
D. 10 N, 10 N, 10 N
Answer: A. 1.6 N, 3.8 N, 25.4 N
Explanation: The chapter's comparison table shows that a 1 kg object has the same mass at all these locations but different weights: **10 N on Earth, 1.6 N on Moon, 3.8 N on Mars, 9 N on Venus and 25.4 N on Jupiter**.

Answer Key:
1-C | 2-B | 3-C | 4-B | 5-A | 6-B | 7-C | 8-D | 9-B | 10-A | 11-B | 12-C | 13-B | 14-C | 15-C | 16-C | 17-C | 18-B | 19-D | 20-C | 21-B | 22-C | 23-A | 24-A | 25-A

5.15 Best Practices Opportunity List from the Chapter:

The chapter **"Exploring Forces"** is particularly suitable for activity-based and inquiry-oriented teaching because it already encourages students to explore force through observation, experimentation, discussion, design and debate. The chapter begins with real-life questions such as why cycling uphill is harder and why wet surfaces are slippery.

Suggested "Best Practices" Opportunities:

No.	Best Practice	Suggested Classroom Implementation
1	**Learning by Doing – Force Exploration Stations**	Set up different activity stations where students **push/pull objects, stretch rubber bands, roll balls and change the direction of moving objects**. Students record whether the force changes **speed, direction, state of motion or shape**. This directly reinforces the effects of force described in the chapter.
2	**Friction Investigation Challenge**	Let groups slide the **same object over glass, cloth, wood, tile and sand** and measure the distance travelled. Students rank the surfaces according to friction and explain why rough surfaces produce

No.	Best Practice	Suggested Classroom Implementation
		greater friction. This converts the chapter's friction activity into a small comparative investigation.
3	**Student-Made Science Models**	Organise a **"Build Your Own Scientific Instrument"** activity in which students construct and calibrate a simple **spring balance** using standard weights. They can then measure different classroom objects and compare mass and weight. The chapter itself recommends making and calibrating a spring balance.
4	**Predict–Observe–Explain (POE) Experiments**	Before demonstrating **magnetic force, electrostatic force or buoyancy**, ask students to predict what will happen and justify their prediction. Conduct the experiment, record the observation, and finally ask them to explain any difference between their prediction and the result. For example, two similarly charged balloons repel whereas unlike charges attract.
5	**Science Debate – "Friction: Friend or Foe?"**	Divide the class into groups to debate **"Friction—a necessity or a problem?"** Students identify situations where friction is useful—walking, braking, writing—and where it causes difficulty or energy loss. This is directly suggested as a discussion opportunity in the chapter.
6	**Mini Research Project on Static Electricity**	Give students different materials such as **plastic, wool, silk, rubber, polythene, paper and metals**. They rub different combinations, test whether they attract paper pieces, tabulate observations and prepare a **mini research report**. This develops experimentation, data recording and scientific communication.
7	**STEM Design Challenge – Make an Electroscope**	Students construct a simple **electroscope using a jar, straw, copper wire and aluminium foil**, as illustrated on page 79. After testing charged objects, groups can suggest other possible applications of their device.
8	**Creative Science – "A World Without Gravity"**	Ask students to imagine that **gravity suddenly disappears**. Instead of writing an ordinary answer, they create a **comic strip/storyboard** showing what would happen to people, water, vehicles and everyday objects. The chapter itself proposes this creative activity.
9	**Buoyancy Prediction Lab – Float or Sink?**	Display several objects and ask students to first **predict whether each will float or sink**. They then test the objects in water and explain the observations in terms of **gravitational force and buoyant force**. The chapter explains that an object sinks when gravitational force exceeds buoyant force and floats when the forces balance.
10	**Olympiad Corner – Concept of the Day**	At the end of every class, give one **HOTS/Olympiad-style question** involving a new situation rather than direct recall—for example, *"Why does a parachute slow a falling person?"*, *"Why do tyres have grooves?"* or *"Would your mass and weight change on Jupiter?"* Students discuss the reasoning in pairs before answering. This develops the application-oriented thinking required in competitive examinations.

Five strongest practices to formally document:

If these are required for a **lesson plan/teacher diary under the heading "Best Practices Opportunity,"** I would recommend recording these five in concise form:

1. **Experiential Learning:** Hands-on experiments to explore contact and non-contact forces.
2. **Inquiry-Based Learning:** Predict–Observe–Explain strategy for friction, magnetism, electrostatic force and buoyancy.
3. **Collaborative Learning:** Group investigation comparing friction on different surfaces and presenting findings.
4. **STEM/Design Thinking:** Construction and calibration of a simple spring balance/electroscope.
5. **Critical Thinking & Scientific Argumentation:** Debate on **"Friction – A Necessity or a Problem?"** supported by real-life examples.

These fit especially well with the chapter because its concluding **"Discover, design, and debate"** section explicitly moves students beyond textbook recall into investigation, model-making, research, creativity and classroom discussion.

5.16 Innovations Opportunity List from the Chapter:

For the Grade 8 Science chapter **"Exploring Forces,"** the "Innovations" opportunity can go beyond ordinary experiments by introducing technology, student-created models, simulations, gamification, and design challenges. The chapter itself begins with inquiry-provoking situations such as cycling uphill and slipping on wet surfaces, making it well suited for innovative learning.

Suggested "Innovations" Opportunities

No.	Innovative Practice	How it can be implemented
1.	**Force Detective – QR Code Learning Trail**	Place QR codes at different locations in the classroom/school. Each code presents a real-life situation—opening a door, cycling, kicking a ball, using a magnet, slipping on a floor, etc. Students scan the code and identify the **type, direction and effect of force** involved. This reinforces the chapter's explanation that force can change motion, speed, direction or shape.
2.	**Virtual Force Laboratory using Simulations**	Use interactive digital simulations to allow students to change **force, friction, mass and gravity** and observe the results immediately. Students can compare virtual results with simple classroom experiments and explain differences.
3.	**Design-a-Vehicle Friction Challenge**	Teams construct a small vehicle using waste materials, bottle caps, cardboard, straws, etc. They modify wheel/surface design to make it travel the **maximum distance with minimum friction**. This directly applies the chapter's concept that friction varies with the nature of surfaces.
4.	**"Gravity on Another Planet" Digital Mission**	Students become imaginary space scientists and prepare a digital **"Mission to Moon/Mars/Jupiter"** presentation showing what happens to the weight of the same object on different celestial bodies. The chapter specifically distinguishes mass from weight and provides comparative weights on Earth, Moon, Mars, Venus and Jupiter.

No.	Innovative Practice	How it can be implemented
5.	**Student Innovation Lab – Build a Scientific Device**	Students design and construct their own **spring balance or electroscope** using inexpensive/recycled materials. Instead of merely copying the textbook model, challenge them to improve its accuracy, usability or appearance. The chapter explicitly proposes constructing and calibrating a spring balance and making an electroscope.
6.	**Slow-Motion Science using Smartphones**	Record a **bouncing ball, falling object, rolling ball or balloon** using slow-motion video. Students replay the video and identify when the object's **speed/direction changes and which force causes the change**. This makes otherwise rapid changes in motion visually observable.
7.	**Gamified "Force Escape Room"**	Create teams and give sequential puzzles on **muscular, frictional, magnetic, electrostatic and gravitational forces**. Correct answers reveal clues/codes needed to unlock the next challenge. The chapter categorises muscular and frictional forces as contact forces and magnetic, gravitational and electrostatic forces as non-contact forces.
8.	**Engineering Challenge – Build a Floating Boat**	Give every team the **same quantity of aluminium foil/clay** and challenge them to design a boat capable of carrying the greatest number of coins without sinking. Students redesign their prototypes after each trial and relate their observations to **buoyant force, gravity and floating/sinking**. The chapter explains buoyant force and the conditions for floating and sinking.
9.	**AI-Assisted "Ask a Force" Activity**	Students formulate questions such as *"Why do sports shoes have rough soles?"*, *"Why are racing cars streamlined?"* or *"Why would I weigh less on the Moon?"* They obtain an AI-generated explanation, but must **verify it using the textbook**, identify inaccuracies if any, and rewrite the explanation scientifically. This introduces **AI literacy along with scientific verification** rather than simply using AI to obtain answers.
10.	**Innovators' Pitch – Solve a Real-Life Force Problem**	Teams identify a real problem involving force—for example, slippery school floors, difficulty moving heavy objects, excessive friction, or objects sinking—and propose an innovative solution. Each group presents a **2-minute prototype/product pitch** explaining the scientific principle behind its design.

Best 5 to enter in the Lesson Plan under "Innovations":
For a formal **Teaching–Learning Plan**, I suggest these concise entries:

1. **QR-Code Force Detective Trail** – technology-enabled exploration of forces in real-life situations.
2. **Virtual Force Laboratory** – simulation-based investigation of force, friction and gravity.
3. **STEM Design Challenge** – designing a low-friction vehicle or high-load floating boat.
4. **Student Innovation Lab** – designing and constructing a spring balance/electroscope using low-cost materials.
5. **AI-Assisted Scientific Inquiry** – using AI-generated explanations followed by textbook-based verification and correction.

The last one can be particularly valuable as an **innovation** because students are not merely "using AI"; they learn to **question, verify and scientifically validate AI-generated information**, which develops scientific temper alongside digital literacy.

5.17: Practicing Questions/Question Bank

A. Fill in the Blanks — 1 Mark Each

1. A push or pull applied on an object is called a __________.
2. The SI unit of force is __________.
3. The symbol used for newton is __________.
4. At least __________ objects must interact for a force to come into play.
5. The force resulting from the action of muscles is called __________ force.
6. The force that opposes the motion of an object over a surface is called __________.
7. Friction always acts in a direction __________ to the direction of motion.
8. Friction is generally greater on __________ surfaces.
9. Muscular force and frictional force are examples of __________ forces.
10. Magnetic force is a __________ force.
11. Like poles of two magnets __________ each other.
12. Unlike poles of two magnets __________ each other.
13. Electrical charges that do not move by themselves are called __________ charges.
14. Like electrical charges __________ each other.
15. Unlike electrical charges __________ each other.
16. The force exerted by a charged body on another charged or uncharged body is called __________ force.
17. The force with which the Earth attracts objects towards itself is called __________ force.
18. Gravitational force is always an __________ force.
19. The force with which the Earth pulls an object towards itself is called its __________.
20. The SI unit of weight is __________.
21. A __________ balance can be used to measure weight.
22. Mass is commonly measured in __________ or __________.
23. The mass of an object remains __________ from place to place.
24. The upward force exerted by a liquid on an object is called __________ or buoyant force.
25. An object floats when its gravitational force and buoyant force are __________.

These questions reflect the chapter's definitions and summary concepts.

B. One-Mark Questions

1. What is force?
2. State the SI unit of force.
3. Name any two effects that force can produce on an object.
4. What is a contact force?
5. Give one example of a contact force.
6. Define muscular force.
7. What is friction?
8. In which direction does friction act?
9. Give one example where friction slows down a moving object.
10. What is a non-contact force?
11. Name the three non-contact forces discussed in the chapter.
12. Define magnetic force.
13. What happens when like poles of two magnets are brought close together?
14. What are static charges?
15. Name the two kinds of static charges.
16. What is electrostatic force?
17. What happens when two similarly charged objects are brought close together?
18. Define gravitational force.
19. Why is gravitational force called a non-contact force?
20. Define weight.
21. What is the SI unit of weight?
22. Name the instrument used to measure weight.
23. Define mass.
24. What is buoyant force?
25. State one condition under which an object floats in a liquid.

The textbook specifically distinguishes contact forces from non-contact forces and identifies muscular/frictional forces in the former category and magnetic, electrostatic and gravitational forces in the latter.

C. Two-Mark Questions

1. Mention any four effects that a force can have on an object.
2. Differentiate between push and pull with one example each.
3. Why is interaction between two objects necessary for a force to come into play?
4. Distinguish between contact and non-contact forces with one example each.

5. Explain muscular force with two examples.
6. Why does a rolling ball eventually stop on a flat surface?
7. Why is it more difficult to move an object on a rough surface than on a smooth surface?
8. Explain how irregularities on two surfaces cause friction.
9. Why are aeroplanes, ships and high-speed trains designed with specific shapes?
10. State the behaviour of like and unlike poles of magnets.
11. How can you demonstrate that magnetic force can act without physical contact?
12. How can a plastic scale be electrically charged and used to attract small pieces of paper?
13. What happens when two balloons rubbed with the same woollen cloth are brought close together? Why?
14. Differentiate between like and unlike electrical charges in terms of attraction and repulsion.
15. Why does a ball thrown vertically upwards return to the ground?
16. Why is gravitational force different from magnetic and electrostatic forces in terms of attraction and repulsion?
17. Differentiate between mass and weight on the basis of meaning and unit.
18. Why does an object weigh differently on the Earth and Moon while its mass remains unchanged?
19. What happens when an empty closed bottle is pushed into water and released? Why?
20. State the conditions under which an object sinks or floats in a liquid.

The mass–weight distinction is particularly important: the chapter states that mass remains unchanged, whereas weight depends upon gravitational force and can vary from place to place.

D. Three-Mark Descriptive Questions

1. **Explain any three effects of force on an object with suitable examples.**
2. **What is friction? Explain its direction and how the nature of surfaces affects friction.**
3. **Classify forces into contact and non-contact forces. Give suitable examples of each category.**
4. **Explain how friction arises between two surfaces. Why is friction greater on rough surfaces?**
5. **Describe an activity to show that the force of friction depends on the nature of the surfaces in contact.**
6. **Describe an experiment using two ring magnets to demonstrate magnetic force as a non-contact force.**
7. **Explain with an activity how a charged plastic scale can attract small pieces of paper without touching them.**
8. **Describe the balloon experiment that demonstrates attraction and repulsion between electrical charges. What conclusions can you draw from it?**

9. **What is gravitational force? Explain what happens to the speed and direction of a ball when it is thrown vertically upwards.**
10. **Explain the working of a spring balance and how it is used to measure weight.**
11. **Distinguish between mass and weight under any three appropriate headings.**
12. **A 1 kg object has different weights on the Earth and Moon but the same mass. Explain why.**
13. **What is buoyant force? Explain the forces acting on an object placed in water.**
14. **Explain why some objects float in water while others sink.**
15. **A large wooden block floats in water whereas a small coin sinks. Explain why size alone cannot determine whether an object floats or sinks.**

The chapter explains that liquids exert an upward buoyant force while gravity acts downward; an object sinks if gravitational force is greater than buoyant force and floats when the two are equal.

E. Five-Mark Descriptive / Long-Answer Questions

1. **What is force? Explain in detail the different effects that a force can produce on an object. Give suitable examples for each effect.**
2. **What are contact and non-contact forces? Classify muscular, frictional, magnetic, electrostatic and gravitational forces into these categories and explain each with an example.**
3. **Define friction. Explain its cause, direction and dependence on the nature of surfaces. Give examples to show where friction affects the motion of objects.**
4. **Explain electrostatic force. Describe suitable activities to demonstrate (a) attraction between a charged and an uncharged object and (b) attraction and repulsion between charged objects. State the conclusions obtained from these activities.**
5. **Explain gravitational force. Describe the motion of a ball thrown vertically upwards from the moment it leaves the hand until it returns to the ground. Discuss the changes in its speed and direction under gravity.**
6. **What is weight? Explain how a spring balance is used to measure the weight of an object. Also explain the terms range and smallest division of a spring balance.**
7. **Differentiate between mass and weight. Explain why the mass of an object remains unchanged while its weight varies on different celestial bodies.**
8. **Explain buoyant force and floating and sinking. What forces act on an object immersed in a liquid? State the conditions under which an object floats or sinks.**
9. **Describe an experiment using an empty closed bottle and water to demonstrate buoyant force. Explain the observation scientifically and relate it to floating and sinking.**
10. **"Friction can be both useful and troublesome." Explain the statement using suitable examples. Also suggest ways in which friction may be increased or reduced in practical situations.**
    Teacher's note: the first part is directly supported by the chapter's friction discussion and debate prompt; specific methods of increasing/reducing friction should be taught only to the extent covered in your classroom instruction.

F. Higher-Order / Application Questions

I would strongly recommend adding a small HOTS section rather than making the question bank entirely definition-based.

1. A cyclist stops pedalling on two roads—one rough and one smooth. On which road will the bicycle stop sooner? Explain.
2. Why are you more likely to slip on a wet or highly polished floor than on a rough floor?
3. A student says, **“If an object is at rest, no force is acting on it.”** Is the statement always correct? Explain.
4. Two identical balloons are rubbed with wool and suspended close to each other. Predict what happens and justify your answer.
5. A magnet attracts an iron nail without touching it. What does this demonstrate about the nature of force?
6. A ball thrown upwards slows down even though nobody is touching it. Identify the force responsible and explain.
7. An astronaut carries an object from the Earth to the Moon. What happens to its mass and weight? Explain.
8. A heavy ship floats, whereas a small metal coin sinks. Explain this using gravitational and buoyant forces.
9. A spring balance has **five equal divisions between 1 N and 2 N**. Calculate its smallest division.
10. Imagine that gravitational force suddenly disappeared. Mention three changes you would expect to observe in everyday life.

The spring-balance numerical is directly aligned with the textbook example, where five divisions over a 1 N interval give a smallest reading of **0.2 N**.

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8th Standard Science Book Chapter 6

Chapter 6: Pressure, Winds, Storms, and Cyclones

6.1 Summary of the Chapter:

Chapter 6: Pressure, Winds, Storms, and Cyclones — Summary

(1) **Pressure** is the force acting per unit area of a surface. It is calculated as **Pressure = Force ÷ Area**. Its SI unit is **newton per square metre (N/m²)**, also called **pascal (Pa)**.

(2) For the **same force**, pressure increases when the area of contact decreases and decreases when the area increases. Therefore, broad bag straps and broad bucket handles reduce pressure, while pointed nails and sharp knives produce greater pressure over a smaller area.

(3) **Liquids exert pressure**, and the pressure at the bottom of a liquid increases with the **height of the liquid column**. This is why overhead water tanks are placed at a height to provide a good stream of water through taps.

(4) Liquids exert pressure **in all directions**—not only at the bottom but also on the sides of their containers. Water pressure is greater at greater depths; therefore, dams are constructed with **broader bases** to withstand the large pressure near the bottom.

(5) The layer of air surrounding the Earth is called the **atmosphere**. Air exerts pressure on all objects, and the pressure exerted by the surrounding air is called **atmospheric pressure**.

(6) **Wind is produced by differences in air pressure.** Air moves from a region of **high pressure to a region of low pressure**, and greater pressure differences can produce faster-moving air.

(7) Unequal heating of land and water creates **sea breeze and land breeze**. During the day, warm air over the land rises and cooler air moves from sea to land. At night, wind moves from land towards the relatively warmer sea.

(8) **High-speed winds are accompanied by lower air pressure.** During storms, the pressure above a house roof may become lower than the pressure below it. A large pressure difference can cause weak roofs to be blown away.

(9) **Storms** form when warm, moist air rises, creating a low-pressure region. Cooler air rushes in, gets heated and rises, producing continuous air circulation. As the rising air cools, water vapour condenses into droplets, forming clouds and eventually rain, hail, or snow.

(10) In storm clouds, the movement and rubbing of water droplets and ice particles cause **separation of electric charges**. When the charge build-up becomes very large, a sudden flow of charges produces **lightning**. The rapid heating and expansion of air caused by lightning produces **thunder**. A storm accompanied by thunder and lightning is called a **thunderstorm**.

(11) During lightning, we should avoid tall objects, water and metallic umbrellas and should crouch in a low-lying area if caught outdoors. **Lightning conductors** installed on buildings provide a safe path for electric charges to pass into the ground.

(12) **Cyclones** are large storms formed over warm ocean waters. Warm, moist air rises and creates very low pressure; surrounding air rushes in, and the Earth's rotation causes the system to spin. The centre, called the **eye of the cyclone**, has the lowest pressure and relatively calm winds, while the surrounding region experiences strong winds and heavy rainfall. Cyclones can cause storm surges, floods, landslides and extensive damage, so weather warnings and timely movement to cyclone shelters are important safety measures.

6.2 Important Formulas:

Based specifically on **Chapter 6 – "Pressure, Winds, Storms, and Cyclones"**, the quantitative problems are mainly based on **pressure, force, area, weight, total force, and unit conversion**. The chapter explicitly defines pressure as force per unit area and uses pascal as its SI unit.

Important Formulas for Quantitative Problems

No.	Concept	Formula	Units / Notes
1	**Pressure**	**P = F/A**	P in Pa, F in N, A in m^2
2	**Force from pressure**	**P = P × A**	Used when pressure and area are given
3	**Area from pressure**	**A = F/P**	Used when force and pressure are given
4	**Weight**	**W = m × g**	W in N, mass in kg; use when mass rather than weight is given
5	**Total contact area**	**A_t = n × A**	n = number of identical contact surfaces
6	**Pressure with several contact surfaces**	**P = W/(nA)**	Particularly useful for feet/legs/supports
7	**Total force/weight of several identical persons or objects**	**F_t = n × F**	Useful in boat/load problems
8	**Pressure due to several persons/objects**	**P = nF/A**	Total force divided by base/contact area
9	**Pressure difference**	**$\Delta P = P_1 - P_2$**	Useful when comparing two pressures
10	**Pressure unit conversion**	**1 Pa = 1 N/m^2**	Fundamental SI relationship
11	**Millibar conversion**	**1 mb = 100 Pa**	Given in the chapter
12	**Hectopascal conversion**	**1 hPa = 100 Pa**	Given in the chapter

The chapter explicitly gives **1 millibar = 100 Pa** and **1 hectopascal = 100 Pa**.

Most Important Formula

The central formula for this chapter is:

$$\boxed{P = \frac{F}{A}}$$

Therefore,

$$\boxed{F = P \times A}$$

and

$$\boxed{A = \frac{F}{P}}$$

The textbook itself demonstrates this with **100 N acting on 2 m^2**:

$$P = \frac{100}{2} = 50\ N/m^2 = 50\ Pa$$

Formula Application in the Chapter's Exercise Problems

1. Elephant standing on four feet

The chapter gives the area of **one foot = 0.25 m^2** and weight = **20,000 N**.

First calculate total contact area:

$$A_T = 4 \times 0.25 = 1\, m^2$$

Then,

$$P = \frac{W}{A_T} = \frac{20{,}000}{1} = \boxed{20{,}000\ Pa}$$

2. Boat problems

The chapter asks students to compare two boats having different base areas and different numbers of passengers, with each passenger weighing **700 N**.

Use:

$$\boxed{F_T = n \times W}$$

followed by

$$\boxed{P = \frac{F_T}{A}}$$

Important Relationships to Remember

Not all quantitative ideas in this chapter are expressed through numerical formulas. Some are **relationships** students should remember for reasoning-based problems:

- For the **same force**: smaller area → **greater pressure**; larger area → **smaller pressure**.
- Greater **height of a water column** → greater pressure at the bottom.
- Air moves from **higher pressure** → **lower pressure**.
- Greater air-pressure difference → **higher wind speed**.
- High-speed winds are associated with **lower air pressure**.

Note: The chapter does **not introduce** $P = \rho g h$ as a formula for liquid pressure. It only establishes qualitatively that liquid pressure increases with the height of the liquid column. Therefore, for questions strictly based on this Grade 8 chapter 6, I would **not include** $P = \rho g h$ **as a required formula**.

6.3 Fill-Up the Blank LOTS type questions with Answers: (20 Questions)

The following questions are based directly on the concepts and terminology:

1. Pressure is defined as the force acting per unit ________.
   Answer: area
2. The SI unit of pressure is ________.
   Answer: pascal (Pa)
3. The SI unit of force is ________.
   Answer: newton (N)
4. One pascal is equal to one ________ per square metre.
   Answer: newton
5. Broad straps of a school bag exert ________ pressure on the shoulders than narrow straps.
   Answer: less
6. When the area over which a force acts decreases, the pressure ________.
   Answer: increases
7. Liquids exert pressure at the bottom as well as on the ________ of a container.
   Answer: sides
8. Liquids exert pressure in ________ directions.
   Answer: all
9. The pressure exerted by a liquid increases with the ________ of its liquid column.
   Answer: height

10. Overhead water tanks are placed at a height to ________ the pressure of water at the taps.
Answer: increase
11. The envelope of air surrounding the Earth is called the ________.
Answer: atmosphere
12. The pressure exerted by the air around us is called ________ pressure.
Answer: atmospheric
13. Air exerts pressure in ________ directions.
Answer: all
14. The practical unit of air pressure is ________.
Answer: millibar (mb)
15. One millibar is equal to ________ pascals.
Answer: 100
16. One hectopascal is equal to ________ pascals.
Answer: 100
17. Air moves from a region of ________ pressure to a region of low pressure.
Answer: high
18. The flow of air stops when the pressure in both regions becomes ________.
Answer: equal
19. During the day, land gets heated ________ than water.
Answer: faster
20. During the daytime, air above the heated land rises and creates an area of ________ pressure.
Answer: low
21. During the day, air blowing from the sea towards the land is called ________.
Answer: sea breeze
22. At night, wind blowing from the land towards the sea is called ________.
Answer: land breeze
23. Differences in air ________ cause winds to blow.
Answer: pressure
24. High-speed winds are accompanied by ________ air pressure.
Answer: reduced
25. Warm and moist air is ________ than the surrounding cooler air and therefore rises.
Answer: lighter
26. As rising moist air cools, its moisture condenses to form water ________.
Answer: droplets
27. Strong winds accompanied by rain are called a ________.
Answer: storm
28. Strong winds moving upwards and downwards cause electric ________ to develop within clouds.
Answer: charges
29. Positively charged lighter ice particles occupy the ________ part of clouds.
Answer: upper
30. Negatively charged heavier water droplets occupy the ________ part of clouds.
Answer: lower
31. Normally, air acts as an electrical ________.
Answer: insulator
32. A sudden flow of electric charges produces a bright flash of light called ________.
Answer: lightning

33. Lightning rapidly heats the surrounding air, producing a loud sound called ________.
    Answer: thunder
34. A storm accompanied by lightning and thunder is called a ________.
    Answer: thunderstorm
35. A metallic rod used to protect buildings from lightning is called a lightning ________.
    Answer: conductor
36. The lower end of a lightning conductor is buried deep in the ________.
    Answer: ground
37. Cyclones are large storms that form over warm ________ waters.
    Answer: ocean
38. The rotation of the ________ causes moving air in a cyclone to spin.
    Answer: Earth
39. The spinning system of clouds, winds, and rain is called a ________.
    Answer: cyclone
40. The region of lowest pressure at the centre of a cyclone is called its ________.
    Answer: eye
41. At the eye of a cyclone, the wind is generally ________.
    Answer: calm
42. The region surrounding the eye of a cyclone experiences strong winds and heavy ________.
    Answer: rainfall
43. A cyclone gradually loses its strength after reaching ________.
    Answer: land
44. Strong cyclone winds can push ocean water towards the ________.
    Answer: shore
45. Cyclone-related weather alerts and warnings in India are issued by the ________.
    Answer: India Meteorological Department (IMD)
46. Weather-monitoring ________ help track cyclones and predict their paths.
    Answer: satellites
47. During a cyclone, people in cyclone-prone areas should move to a designated cyclone ________.
    Answer: shelter
48. During lightning, a person should stay away from ________ objects.
    Answer: tall
49. During lightning, one should avoid using an umbrella with a ________ rod.
    Answer: metallic
50. During a thunderstorm, being inside a bus or car is comparatively ________.
    Answer: safer

These LOTS questions primarily test **Remembering and basic Understanding**, covering pressure, liquid and atmospheric pressure, formation of winds, storms, thunderstorms, lightning, cyclones, and safety measures as presented in Chapter 6. The chapter summary likewise identifies pressure, atmospheric pressure, winds, thunderstorms, lightning conductors, and cyclone monitoring as its core recall concepts.

6.4 Fill-Up the Blank HOTS type questions with Answers: (20 Questions)

These questions require students to **apply, analyse, predict, and reason** using the concepts in the uploaded chapter rather than merely recall definitions. The chapter itself includes application-oriented situations involving water tanks, pressure differences, roofs during storms, lightning, and cyclone formation.

1. Two school bags have equal weight, but the bag with narrower straps causes greater discomfort because it exerts ________ pressure on the shoulders.
   Answer: greater
2. A sharp knife cuts an apple more easily than a blunt knife because its edge has a ________ area of contact, producing greater pressure.
   Answer: smaller
3. If the same force is applied over twice the area, the pressure exerted will become ________ of its original value.
   Answer: half
4. A person lying on loose sand sinks less than when standing because lying down ________ the area over which the body weight acts.
   Answer: increases
5. If the height of water in an overhead tank is increased, the pressure of water at the tap will ________.
   Answer: increase
6. Two pipes of different diameters contain water columns of equal height. The pressure at their bottoms will be ________.
   Answer: equal
7. If two holes are made at different heights on the side of a water-filled bottle, water from the ________ hole will generally spurt farther.
   Answer: lower
8. The base of a dam is made broader because water pressure is ________ near the bottom.
   Answer: greater
9. If an overhead tank is shifted to a lower position without changing the amount of water, the water pressure at the ground-floor tap will ________.
   Answer: decrease
10. When a rubber sucker is pressed against a smooth surface, the air pressure inside it becomes ________ than the atmospheric pressure outside.
    Answer: lower
11. If the pressure inside a rubber sucker becomes equal to the atmospheric pressure outside, the sucker will ________ its strong grip on the surface.
    Answer: lose
12. When an inflated and an uninflated balloon are connected by a straw, air moves towards the ________ balloon because its air pressure is lower.
    Answer: uninflated
13. Air stops flowing between two connected balloons when the pressure inside them becomes ________.
    Answer: equal
14. If the pressure difference between two regions increases, the speed of air flowing between them will ________.
    Answer: increase
15. On a hot afternoon near the coast, the land heats faster than the sea. Therefore, air above the land rises and creates a ________ pressure region.
    Answer: low
16. During the daytime, wind blows from the sea towards the land because the sea has relatively ________ air pressure than the heated land.
    Answer: higher

17. At night, if the sea remains warmer than the land, a low-pressure region develops over the ________.
    Answer: sea
18. When air is blown rapidly between two hanging balloons, they move ________ each other because the pressure between them decreases.
    Answer: towards
19. If the speed of wind over the roof of a house increases greatly, the air pressure above the roof will ________.
    Answer: decrease
20. During strong winds, keeping doors and windows open can reduce the pressure ________ between the inside of the house and the region above its roof.
    Answer: difference
21. Warm and moist air rises during storm formation because it is ________ than the surrounding cooler air.
    Answer: lighter
22. If rising moist air cools sufficiently, its water vapour ________ to form water droplets and clouds.
    Answer: condenses
23. If strong upward and downward movement of air inside clouds did not occur, the rubbing responsible for producing electric ________ would be reduced.
    Answer: charges
24. If air were a good conductor of electricity, large separated charges in clouds would be less likely to ________ before flowing between regions.
    Answer: accumulate
25. A person caught outdoors during lightning should crouch down rather than lie flat because this helps ________ contact with the ground.
    Answer: minimise
26. A lightning conductor protects a building by providing an easy path for electric charges to flow into the ________.
    Answer: ground
27. In cyclone formation, condensation releases heat into the atmosphere, causing the ascending air to become warmer and rise ________.
    Answer: further
28. If the Earth did not rotate, the moving air associated with cyclone formation would not ________ in the manner described in the chapter.
    Answer: spin
29. The centre of a cyclone has the lowest pressure but relatively ________ winds compared with the surrounding region.
    Answer: calm
30. When a cyclone moves over land, it gradually weakens because its supply of warm, ________ air is cut off.
    Answer: moist
31. If a cyclone remains over warm ocean water for longer, it continues to receive the heat and moisture needed to maintain its ________.
    Answer: strength
32. Strong cyclone winds pushing seawater towards the coast can produce a destructive wall of water called a ________.
    Answer: surge

33. Farmland flooded by seawater after a cyclone may become less fertile because of the presence of ________ in seawater.
    Answer: salt
34. If fallen trees and debris block roads after a cyclone, emergency assistance may take ________ to reach affected areas.
    Answer: longer
35. Weather-monitoring satellites help reduce cyclone-related losses because they allow scientists to track cyclones and predict their ________.
    Answer: path
36. If people in a cyclone-prone coastal area receive an official warning in advance, moving to a designated cyclone ________ can reduce the risk to life.
    Answer: shelter
37. Two vessels contain water to the same height but have differently shaped bases. The pressure at the same depth depends primarily on the ________ of the water column.
    Answer: height
38. A banner with several holes is less likely to be damaged by strong wind because the holes allow some ________ to pass through it.
    Answer: air
39. If high-speed wind creates lower pressure on one side of an object while the other side remains at higher pressure, a net ________ acts on the object.
    Answer: force
40. A cyclone becomes weaker after landfall, showing that warm ocean water is an important source of ________ and moisture for sustaining it.
    Answer: heat

These HOTS questions closely reflect the chapter's own higher-order exercises, which ask students to reason about lightning, balloon pressure, storm-to-cyclone development, sea breeze, air-pressure movement, and holes in banners.

6.5 One-mark questions with Answers of LOTS Type: (20 Questions)

The following questions focus mainly on **Remembering and Understanding** and are based directly on the uploaded Grade 8 chapter.

1. **What is pressure?**
   Answer: Pressure is the force acting per unit area of a surface.
2. **What is the SI unit of pressure?**
   Answer: The SI unit of pressure is newton per square metre (N/m^2), also called pascal (Pa).
3. **Why are broad straps more comfortable than narrow straps?**
   Answer: Broad straps spread the force over a larger area and therefore exert less pressure on the shoulders.
4. **Why is it easier to cut an apple with the sharp edge of a knife?**
   Answer: A sharp edge has a smaller area and therefore produces greater pressure for the same force.
5. **Do liquids exert pressure?**
   Answer: Yes, liquids exert pressure on the bottom as well as the sides of their containers.
6. **In which directions do liquids exert pressure?**
   Answer: Liquids exert pressure in all directions.
7. **On what factor does the pressure exerted by a liquid column depend?**
   Answer: The pressure exerted by a liquid column depends on the height of the liquid column.

8. **Why are overhead water tanks placed at a height?**
   Answer: Overhead water tanks are placed at a height to increase water pressure and provide a good stream of water from taps.
9. **Why is the base of a dam made broader than its top?**
   Answer: The base of a dam is made broader to withstand the greater water pressure near the bottom.
10. **What is the atmosphere?**
    Answer: The envelope of air surrounding the Earth is called the atmosphere.
11. **What is atmospheric pressure?**
    Answer: The pressure exerted by the air around us is called atmospheric pressure.
12. **Why does a balloon expand when air is blown into it?**
    Answer: A balloon expands because the air filled inside it exerts pressure on its walls in all directions.
13. **Why does a rubber sucker stick to a smooth surface?**
    Answer: A rubber sucker sticks because the air pressure outside it is greater than the air pressure inside it.
14. **In which direction does air move when there is a difference in air pressure?**
    Answer: Air moves from a region of high pressure to a region of low pressure.
15. **What causes winds to blow?**
    Answer: Winds blow because of differences in air pressure between different regions.
16. **How is a sea breeze formed?**
    Answer: A sea breeze forms when air moves from the high-pressure region over the sea towards the low-pressure region over the warmer land.
17. **How is a land breeze formed?**
    Answer: A land breeze forms at night when air moves from the land towards the low-pressure region over the warmer sea.
18. **What happens to air pressure when the speed of wind increases?**
    Answer: Air pressure decreases when the speed of wind increases.
19. **What is a storm?**
    Answer: Strong winds accompanied by rain are called a storm.
20. **How are clouds formed during a storm?**
    Answer: Clouds form when rising warm air cools and its moisture condenses into water droplets.
21. **What causes electric charges to develop inside clouds?**
    Answer: Strong upward and downward winds cause water droplets and ice particles to rub against each other and develop electric charges.
22. **What is lightning?**
    Answer: Lightning is a bright flash produced by a sudden flow of electric charges.
23. **What causes thunder?**
    Answer: Thunder is caused when lightning rapidly heats the surrounding air, making it expand and produce a loud sound.
24. **What is a thunderstorm?**
    Answer: A storm accompanied by lightning and thunder is called a thunderstorm.
25. **What safety position should a person take outdoors during lightning?**
    Answer: A person should crouch down in a low-lying open area and minimise contact with the ground.
26. **Why should we not lie flat on the ground during lightning?**
    Answer: We should not lie flat because we need to minimise our contact with the ground during lightning.

27. **What is a lightning conductor?**
 Answer: A lightning conductor is a metallic rod installed on a building to provide an easy path for electric charges to reach the ground.
28. **What is a cyclone?**
 Answer: A cyclone is a spinning system of clouds, high-speed winds, and rain formed around a very low-pressure region.
29. **Where do cyclones generally form?**
 Answer: Cyclones generally form over warm ocean waters.
30. **What is the eye of a cyclone?**
 Answer: The eye is the central region of a cyclone where the pressure is lowest and the wind is calm.
31. **Why does a cyclone gradually weaken after reaching land?**
 Answer: A cyclone weakens over land because its supply of moist air from the ocean is cut off.
32. **How does the Earth's rotation contribute to cyclone formation?**
 Answer: The Earth's rotation causes the moving air in a developing cyclone to spin.
33. **What is a storm surge?**
 Answer: A storm surge is a wall of seawater pushed towards the shore by the strong winds of a cyclone.
34. **How can seawater brought inland by a cyclone affect farmland?**
 Answer: Salt in seawater can make the soil less fertile and damage crops.
35. **Which organisation issues cyclone warnings in India?**
 Answer: The India Meteorological Department (IMD) issues alerts and warnings about cyclones in India.
36. **How do weather-monitoring satellites help during cyclones?**
 Answer: Weather-monitoring satellites help track cyclones and predict their paths.
37. **What should people in cyclone-prone areas keep ready?**
 Answer: People in cyclone-prone areas should keep an emergency kit containing essential items ready.
38. **Where should people move during a cyclone?**
 Answer: People should quickly move to a nearby designated cyclone shelter.
39. **What are the two important requirements for the formation of thunderstorms?**
 Answer: Moisture and strong winds are important requirements for the formation of thunderstorms.
40. **How do lightning conductors protect buildings?**
 Answer: Lightning conductors protect buildings by providing an easy path for electric charges to pass safely into the ground.

6.6 One-mark questions with Answers of HOTS Type: (20 Questions)

The following are **Higher Order Thinking Skills (HOTS)** questions requiring application, reasoning, prediction, or analysis, while keeping each answer to **one sentence**.

1. **Why does a school bag with broad straps feel more comfortable than one with narrow straps of the same weight?**
 Answer: Broad straps distribute the same force over a larger area and therefore exert less pressure on the shoulders.
2. **Why does a sharp knife cut a fruit more easily than a blunt knife?**
 Answer: A sharp knife applies the force over a smaller area and hence produces greater pressure.

3. **Why is the pointed end of a nail driven into wood instead of its flat head?**
   Answer: The pointed end has a smaller area and therefore produces greater pressure for the same applied force.
4. **A person has to carry a heavy basket on the head; why would placing a folded cloth beneath it help?**
   Answer: The folded cloth increases the area over which the force acts and thereby reduces pressure on the head.
5. **Two water columns have equal heights but different widths; how will their pressure at the bottom compare?**
   Answer: They will exert equal pressure at the bottom because liquid pressure depends on the height of the liquid column.
6. **Two students live on the first and second floors of the same building supplied by a rooftop water tank; who will receive water with greater pressure?**
   Answer: The student on the first floor will receive water with greater pressure because the height of the water column above the tap is greater.
7. **Why would raising an overhead water tank improve the flow of water from taps?**
   Answer: Raising the tank increases the height of the water column and hence increases the pressure at the taps.
8. **Why does water spurt out from a hole in the side of a water pipe?**
   Answer: Water spurts out because liquids exert pressure on the walls of their containers.
9. **Why is the bottom of a dam constructed much broader than its top?**
   Answer: The bottom is made broader because water pressure is much greater near the bottom and the dam must withstand this pressure.
10. **Why does an inflated balloon expand in all directions rather than only in one direction?**
    Answer: The balloon expands in all directions because the air inside it exerts pressure in all directions.
11. **Why does air rush out when the mouth of an inflated balloon is released?**
    Answer: Air rushes out because it moves from the higher-pressure region inside the balloon to the lower-pressure region outside.
12. **Why does a rubber sucker stick better to a smooth surface than to a rough surface?**
    Answer: A smooth surface allows a better seal and maintains the pressure difference needed for atmospheric pressure to hold the sucker firmly.
13. **If atmospheric pressure is very large, why are human beings not crushed by it?**
    Answer: We are not crushed because the pressure inside our bodies balances the atmospheric pressure acting from outside.
14. **If the pressure difference between two regions increases, what change would you expect in wind speed?**
    Answer: Wind speed would increase because a greater pressure difference causes air to move faster.
15. **Why does a sea breeze usually blow from the sea towards the land during the daytime?**
    Answer: The warmer land develops lower air pressure, causing air to move from the higher-pressure region over the sea towards the land.
16. **Why does the direction of the breeze near the coast reverse at night?**
    Answer: At night the sea remains warmer than the land and develops lower pressure, causing air to move from land towards the sea.

17. **Two balloons are hanging close together; what will happen if you blow rapidly between them?**
    Answer: The balloons will move towards each other because the fast-moving air between them creates a region of lower pressure.
18. **Why can the roof of a weak house be blown away during a high-speed storm?**
    Answer: High-speed wind lowers the pressure above the roof, so the greater pressure below it can push the roof upwards.
19. **Why can keeping doors and windows open reduce the chance of a roof being blown away during high-speed winds?**
    Answer: Open doors and windows allow air to pass through and reduce the pressure difference between the inside and outside of the house.
20. **Why does warm air rise during the formation of a storm?**
    Answer: Warm air rises because it becomes lighter than the surrounding cooler air and creates a low-pressure region.
21. **Why are thunderstorms more frequent in hot and humid regions?**
    Answer: Hot and humid regions provide abundant warm moist air that can rise, cool, condense, and contribute to storm formation.
22. **Why should a person avoid standing under a tall tree during lightning?**
    Answer: A tall tree can become a target for lightning and may conduct the electric charge towards a person nearby.
23. **Why should a person not lie flat on the ground during lightning?**
    Answer: Lying flat increases contact with the ground and therefore increases the risk from electric charges spreading through the ground.
24. **Why is a person comparatively safer inside a car during lightning?**
    Answer: A person inside a car is comparatively safer because the vehicle provides protection from direct exposure to lightning.
25. **Why is the lower end of a lightning conductor buried deep in the ground?**
    Answer: It is buried deep so that electric charges can pass through the conductor safely into the ground.
26. **If air were a good conductor of electricity, would charges build up in clouds as they normally do before lightning?**
    Answer: No, charges would flow through the conducting air instead of building up sufficiently to produce the usual sudden electrical discharge.
27. **Why do cyclones generally develop over warm ocean waters?**
    Answer: Warm ocean water supplies warm moist air whose rising and condensation help create and strengthen the low-pressure system.
28. **Why does the pressure at the centre of a cyclone become very low?**
    Answer: Continuously rising warm moist air and the heat released during condensation further strengthen the rising air and lower the pressure.
29. **Why can the eye of a cyclone be calm even though destructive winds occur around it?**
    Answer: The eye is the central lowest-pressure region where winds are calm, while the surrounding region experiences strong winds and heavy rainfall.
30. **What would happen to cyclone formation if the Earth did not rotate?**
    Answer: The moving air would not acquire the spinning motion caused by Earth's rotation, so cyclones would not form in the described rotating manner.
31. **Why does a cyclone gradually become weaker after reaching land?**
    Answer: A cyclone weakens after reaching land because its continuous supply of moist air from the ocean is cut off.

32. **Why can a cyclone damage farmland even after floodwater has disappeared?**
Answer: Seawater brought inland can leave salt in the soil, reducing its fertility and affecting crops.
33. **Why can cyclone damage make rescue operations difficult even after the strongest winds have stopped?**
Answer: Fallen trees and debris can block roads while power outages can disrupt emergency services and communication.
34. **How can weather-monitoring satellites reduce loss of life during a cyclone?**
Answer: Satellites help track cyclones and predict their paths so that warnings and evacuation measures can be taken in advance.
35. **Why should people in cyclone-prone regions keep an emergency kit ready even when no cyclone is present?**
Answer: An emergency kit ensures that essential supplies are immediately available when a cyclone warning requires rapid evacuation.
36. **Why are holes sometimes made in large outdoor banners and hoardings?**
Answer: Holes allow wind to pass through and reduce the pressure exerted by high-speed winds on the banner.
37. **A boy stands and then lies down on loose sand; in which position will he sink less and why?**
Answer: He will sink less while lying down because his weight acts over a larger area and therefore exerts less pressure on the sand.
38. **If two vessels contain water to the same height but have different base areas, will the pressure at their bottoms be different?**
Answer: No, the pressure at their bottoms will be the same because the water columns have the same height.
39. **Why does air stop flowing between two connected balloons after some time?**
Answer: Air stops flowing when the pressure in both balloons becomes equal and there is no pressure difference to drive the flow.
40. **If the height of water in a bottle is increased, what would you predict about the force of water coming from a hole near its bottom?**
Answer: The water would come out more forcefully because increasing the height of the water column increases the pressure near the bottom.

6.7 Two-mark questions with Answers of LOTS Type: (15 Questions)

Below are **20 two-mark questions** based directly on chapter 6. Each answer is given in **exactly two simple points/sentences**, focusing mainly on **Remembering and Understanding (LOTS)**.

1. What is pressure? State its SI unit.

Answer:
1. Pressure is defined as the force acting per unit area.
2. Its SI unit is newton per square metre (N/m^2), also called pascal (Pa).

2. How do broad straps of a school bag reduce discomfort?

Answer:
1. Broad straps spread the weight of the bag over a larger area of the shoulders.
2. This reduces the pressure exerted on the shoulders and makes the bag more comfortable to carry.

3. What happens to pressure when the area of application of force decreases? Give one example.

Answer:

1. Pressure increases when the same force acts over a smaller area.
2. Therefore, the pointed end of a nail can be driven into a surface more easily.

4. How does the height of a liquid column affect the pressure exerted by it?
Answer:
1. The pressure exerted by a liquid increases as the height of its column increases.
2. Therefore, a taller water column produces greater pressure at the bottom.

5. Why are overhead water tanks placed at a height?
Answer:
1. Increasing the height of the water column increases the pressure of water.
2. This increased pressure provides a good stream of water from the taps.

6. What does Activity 6.2 demonstrate about pressure exerted by liquids?
Answer:
1. Water flowing out through holes on the sides of a bottle shows that liquids exert pressure on the walls of a container.
2. Liquids exert pressure not only at the bottom but in all directions.

7. Why is the base of a dam broader than its top?
Answer:
1. Water pressure near the bottom of a dam is much greater than near the top.
2. Therefore, the base is made broader to withstand the large pressure exerted by water.

8. What is atmosphere? What is atmospheric pressure?
Answer:
1. The envelope of air surrounding the Earth is called the atmosphere.
2. The pressure exerted by the air around us is called atmospheric pressure.

9. How does an inflated balloon show that air exerts pressure?
Answer:
1. Air filled inside a balloon exerts pressure on the walls of the balloon.
2. Since air exerts pressure in all directions, the balloon expands in all directions.

10. Why does a rubber sucker stick to a smooth surface?
Answer:
1. Pressing the sucker pushes out most of the air beneath it and reduces the air pressure inside.
2. The higher atmospheric pressure outside then presses the sucker firmly against the surface.

11. In which direction does air move when there is a difference in air pressure?
Answer:
1. Air moves from a region of high air pressure to a region of low air pressure.
2. The movement continues until the pressure difference is reduced or the pressures become equal.

12. Explain the formation of sea breeze during the daytime.
Answer:
1. During the day, land heats faster than water, so warm air above the land rises and creates a low-pressure area.
2. Air from the high-pressure region over the sea moves towards the land, producing a sea breeze.

13. Explain the formation of land breeze at night.
Answer:
1. At night, the sea remains warmer than the land, producing a low-pressure area above the sea.
2. Air moves from the land towards the sea, resulting in a land breeze.

14. What happens to air pressure when wind speed increases?
Answer:
1. High-speed winds are accompanied by reduced air pressure.
2. Thus, an area through which air moves rapidly has lower pressure than the surrounding region.

15. What is a storm? How are clouds formed during a storm?
Answer:
1. Strong winds accompanied by rain are called a storm.
2. Rising warm moist air expands and cools, causing its moisture to condense into water droplets and form clouds.

16. What is lightning and how is it produced?
Answer:
1. Lightning is a bright flash of light produced by a sudden flow of electric charges.
2. It occurs when the build-up of charges becomes very large and the insulating property of air breaks down.

17. What are thunder and thunderstorm?
Answer:
1. Lightning rapidly heats and expands the surrounding air, producing a loud sound called thunder.
2. A storm accompanied by lightning and thunder is called a thunderstorm.

18. Mention two safety precautions to be followed during lightning.
Answer:
1. Stay away from tall objects and crouch down in a low-lying open area while minimising contact with the ground.
2. Do not lie flat on the ground or use an umbrella with a metallic rod.

19. What is a lightning conductor? How does it protect a building?
Answer:
1. A lightning conductor is a metallic rod installed along the walls of a building, with its upper end above the highest point of the building.
2. Its lower end is buried deep in the ground, providing an easy path for electric charges to pass safely into the ground.

20. What is a cyclone? What is the eye of a cyclone?
Answer:
1. A cyclone is a spinning system of clouds, high-speed winds, and rain formed around a very low-pressure area.
2. The region of lowest pressure at the centre of a cyclone is called its eye, where the wind is calm.

6.8. Two-mark questions with Answers of HOTS Type: (15 Questions)

The following questions are designed as **Higher Order Thinking Skills (HOTS)** questions requiring students to **apply, analyse, predict, infer, or reason** using the concepts in the chapter. Each answer is restricted to **two points/sentences**, suitable for **2 marks**. The chapter itself encourages application through situations involving pressure, wind, lightning, storms, and cyclones.

1. A student carries two bags of equal weight, one with broad straps and another with narrow straps. Which one will feel more comfortable and why?
Answer:
1. The bag with broad straps will be more comfortable because its weight acts over a larger area of the shoulders.

2. Since pressure decreases when the area of contact increases for the same force, broad straps exert less pressure.

2. Why can a sharp knife cut a fruit more easily than a blunt knife even when the same force is applied?
Answer:
1. The sharp edge has a smaller area of contact and therefore produces greater pressure for the same force.
2. The greater pressure makes it easier for the sharp edge to penetrate and cut the fruit.

3. A boy first lies flat and then stands on loose sand. In which position will he sink more? Explain.
Answer:
1. He will sink more while standing because his weight acts over the smaller area of his feet.
2. When lying flat, his weight is distributed over a larger area and therefore exerts less pressure on the sand.

4. Two water tanks of different capacities are placed at the same height and filled to the same water level. Will one necessarily supply water at greater pressure? Why?
Answer:
1. No, their different capacities alone will not produce different water pressures if the heights of the water columns are the same.
2. Liquid pressure depends on the height of the liquid column, as demonstrated by the equal bulging of balloons below water columns of equal height.

5. In a three-storeyed building, will the first-floor or second-floor tap receive water with greater pressure from the same rooftop tank? Justify.
Answer:
1. The first-floor tap will receive water with greater pressure because the height of the water column above it is greater.
2. Liquid pressure increases with an increase in the height of the liquid column.

6. A dam is made equally thick from top to bottom. What problem could arise, and why?
Answer:
1. The lower part of the dam may not safely withstand the very large horizontal pressure exerted by water near the bottom.
2. Hence, dams are constructed with broader bases to withstand the greater pressure at greater water depths.

7. A rubber sucker sticks well to glass but not to a rough wall. Explain why.
Answer:
1. A smooth glass surface allows most of the air beneath the sucker to be pushed out, producing a pressure difference that holds it firmly.
2. On a rough surface, air can enter beneath the sucker, reducing this pressure difference and preventing firm attachment.

8. Two balloons, one inflated and the other uninflated, are connected by a straw. Predict what happens when air is allowed to flow between them.
Answer:
1. Air moves from the inflated balloon, where pressure is higher, towards the uninflated balloon, where pressure is lower.
2. The flow continues until the air pressures in the two balloons become nearly equal.

9. Why does a stronger pressure difference generally produce faster-moving air?
Answer:

1. Air naturally moves from a region of higher pressure towards a region of lower pressure.
2. The chapter explains that the speed of moving air is higher when the pressure difference is greater.

10. During daytime, why does wind generally blow from the sea towards the land in coastal areas?
Answer:
1. Land heats faster than water, so the warm air above the land rises and creates a low-pressure region.
2. Air therefore moves from the higher-pressure region over the sea towards the lower-pressure region over the land.

11. Two hanging balloons move towards each other when air is blown rapidly between them. Why do they not move apart?
Answer:
1. Fast-moving air between the balloons creates a region of lower air pressure between them.
2. The higher air pressure outside the balloons pushes them towards each other.

12. Why may the roof of a weak house be blown away during a high-speed storm?
Answer:
1. High-speed wind above the roof creates lower pressure compared with the air pressure below the roof.
2. If this pressure difference becomes sufficiently large, the higher pressure from below can push the weak roof upwards and blow it away.

13. Why can keeping doors and windows open during high-speed winds help prevent a roof from being blown off?
Answer:
1. Open doors and windows allow the wind to move through the house as well as over its roof.
2. This reduces the pressure difference between the inside of the house and the region above the roof, helping the roof remain intact.

14. Why are holes often made in large banners and hoardings displayed outdoors?
Answer:
1. The holes allow some of the moving air to pass through the banner instead of exerting its full force on it.
2. This reduces the pressure effect of strong winds and lowers the chance of the banner being torn or blown away.

15. A person is caught outdoors during lightning. Why should the person crouch instead of lying flat on the ground?
Answer:
1. Crouching in a low-lying area helps minimise the person's contact with the ground during lightning.
2. Lying flat increases contact with the ground and is specifically advised against as a lightning-safety measure.

16. Would lightning occur in the same way if air were a good conductor of electricity? Give reasons.
Answer:
1. No, charges would be able to flow through the air more easily instead of accumulating to very high levels.
2. Lightning occurs when the accumulated charges become large enough to break down the normally insulating air and produce a sudden discharge.

17. Why is the top of a lightning conductor placed higher than the highest point of a building while its other end is buried in the ground?
Answer:
1. The conductor is positioned to provide an easy conducting path for electric charges associated with lightning.
2. Its lower end is buried deep in the ground so that the electric charges can be transferred safely into the ground.

18. Why do cyclones become stronger over warm ocean water but gradually weaken after reaching land?
Answer:
1. Warm ocean water continuously supplies warm, moist air whose condensation releases heat and supports further rising air and lower pressure.
2. After reaching land, the cyclone loses this source of moist air and therefore gradually loses its strength.

19. The eye of a cyclone is calm, but areas immediately surrounding it experience destructive weather. Explain this contrast.
Answer:
1. The eye is the region of lowest pressure at the centre of the cyclone, where the wind is calm.
2. The surrounding region experiences strong revolving winds and heavy rainfall.

20. Why can a cyclone cause flooding even in places some distance away from the seashore?
Answer:
1. Strong cyclone winds can push ocean water towards the shore, producing a storm surge that may travel inland and flood coastal regions.
2. Heavy cyclone rainfall can also cause rivers to overflow, extending flooding beyond the immediate coastline.

21. If the Earth did not rotate, how would the formation of a cyclone be affected according to the mechanism described in the chapter?
Answer:
1. Warm moist air could still rise over warm oceans and create a low-pressure region into which surrounding air would rush.
2. However, the chapter attributes the spinning of this moving air to Earth's rotation, so the characteristic rotating cyclone system would not form in the same way.

22. Why can seawater brought inland by a cyclone affect farming even after the floodwater disappears?
Answer:
1. Seawater entering farmland introduces salt into the soil.
2. The salt can make the soil less fertile and consequently affect the growth of crops.

6.9. Three-mark questions with Answers of LOTS Type: (10 Questions)

The following are **LOTS (Lower Order Thinking Skills)** questions based on the chapter 6. They focus mainly on **remembering, understanding, describing, stating, and explaining basic concepts**. Each answer contains **exactly three points/sentences**, suitable for **3 marks**.

1. What is pressure? State its formula and SI unit.
Answer:
1. Pressure is defined as the **force acting per unit area**.
2. It is calculated using the formula **Pressure = Force ÷ Area**.
3. The SI unit of pressure is **newton per square metre (N/m^2)**, also called **pascal (Pa)**.

2. Explain how the area over which a force acts affects pressure.
Answer:
1. For the same force, pressure depends on the area over which the force acts.
2. A smaller area of contact produces greater pressure.
3. A larger area of contact produces less pressure, which is why broad bag straps are more comfortable than narrow straps.

3. Describe how the height of a liquid column affects liquid pressure.
Answer:
1. A liquid exerts pressure at the bottom of its container.
2. As the height of the liquid column increases, the pressure at the bottom also increases.
3. Therefore, overhead water tanks are placed at a height to provide a good stream of water from taps.

4. What does Activity 6.2 show about the pressure exerted by liquids?
Answer:
1. When holes at the same height are made around a water-filled bottle, water flows out through all the holes.
2. This shows that water exerts pressure on the sides of its container.
3. Thus, liquids exert pressure not only at the bottom but **in all directions**.

5. Why is the base of a dam made broader than its top?
Answer:
1. Water stored in a dam exerts pressure horizontally on its walls and vertically on its floor.
2. The horizontal water pressure is very large near the bottom because of the greater height of water above it.
3. Therefore, the base of the dam is made broader to withstand this greater pressure.

6. What is atmospheric pressure? Explain how air exerts pressure.
Answer:
1. The envelope of air surrounding the Earth is called the **atmosphere**.
2. Air exerts force on objects, and this force per unit area produces pressure.
3. The pressure exerted by the air around us is called **atmospheric pressure**.

7. Explain how a rubber sucker sticks to a smooth surface.
Answer:
1. When a rubber sucker is pressed against a smooth surface, most of the air beneath it is pushed out.
2. As a result, the air pressure inside the sucker becomes lower than the atmospheric pressure outside it.
3. The higher outside air pressure pushes the sucker against the surface and keeps it attached.

8. Why are human beings not crushed by atmospheric pressure?
Answer:
1. The atmosphere exerts a very large pressure on our bodies from outside.
2. The fluids and gases present in our tissues and organs produce pressure inside our bodies.
3. This internal pressure balances the atmospheric pressure outside, preventing us from being crushed.

9. Explain how differences in air pressure cause the movement of air.
Answer:
1. Air moves from a region of **higher air pressure to a region of lower air pressure**.
2. The movement continues as long as a pressure difference exists between the two regions.

3. When the pressure becomes equal, the flow of air stops.

10. Explain the formation of sea breeze during the daytime.

Answer:

1. During the day, land heats up faster than water, making the air above the land warmer and lighter.
2. The warm air rises and creates a low-pressure area over the land.
3. Cooler air from the high-pressure region over the sea moves towards the land, producing a **sea breeze**.

11. Explain the formation of land breeze at night.

Answer:

1. At night, water remains warmer than the land, so a low-pressure area develops above the sea.
2. The comparatively cooler land has higher air pressure than the region over the sea.
3. Air therefore blows from the land towards the sea, producing a **land breeze**.

12. State the relationship between high-speed winds and air pressure.

Answer:

1. High-speed winds are accompanied by reduced air pressure.
2. When air is blown rapidly between two hanging balloons, a low-pressure region develops between them.
3. The higher pressure surrounding the balloons pushes them towards each other.

13. Describe the formation of a storm.

Answer:

1. When land gets heated, warm and moist air rises and creates a low-pressure area, while cooler surrounding air moves in to replace it.
2. The rising air expands and cools, causing its moisture to condense and form clouds and larger water droplets.
3. The strong winds accompanied by rain are called a **storm**.

14. How are electric charges formed and separated inside storm clouds?

Answer:

1. Strong upward and downward winds cause water droplets and ice particles to rub against each other and develop electric charges.
2. Positively charged lighter ice particles move upwards and occupy the upper part of the clouds.
3. Negatively charged heavier water droplets remain in the lower part, resulting in charge separation within the cloud.

15. Explain how lightning and thunder are produced.

Answer:

1. When the accumulation of electric charges becomes very large, the insulating property of air breaks down and a sudden flow of charges occurs.
2. This electric discharge produces a bright flash of light called **lightning**.
3. Lightning rapidly heats the surrounding air, causing it to expand and produce the loud sound called **thunder**.

16. State three safety precautions to be followed during lightning.

Answer:

1. Stay away from tall objects and move to a low-lying open area where you should crouch down.
2. Minimise contact with the ground and never lie flat on the ground.
3. Avoid umbrellas with metallic rods, get out of water, and remember that being inside a bus or car is comparatively safer.

17. What is a lightning conductor and how does it protect a building?

Answer:
1. A lightning conductor is a metallic rod installed along the walls of a building.
2. Its pointed end is kept above the highest point of the building, while its other end is buried deep in the ground.
3. It provides an easy path for electric charges to pass safely into the ground.

18. Describe the formation of a cyclone.
Answer:
1. Over warm ocean water, warm and moist air rises, and the water vapour condenses into raindrops, releasing heat into the atmosphere.
2. This causes further rising of air and creates a very low-pressure region into which surrounding air rushes.
3. Earth's rotation makes the moving air spin, eventually forming a rotating system of clouds, winds, and rain called a **cyclone**.

19. What is the eye of a cyclone? Describe the conditions in and around it.
Answer:
1. The region of lowest pressure at the centre of a cyclone is called the **eye of the cyclone**.
2. The wind at the eye of the cyclone is calm.
3. The region surrounding the eye experiences strong winds and heavy rainfall.

20. Mention three major destructive effects of cyclones.
Answer:
1. Strong cyclone winds push seawater towards the shore, causing storm surges and severe coastal flooding.
2. Heavy rainfall may cause rivers to overflow and can also trigger landslides.
3. Cyclones can contaminate drinking water, damage farmland, block roads, and cause prolonged power outages.

21. State three measures that help protect people during cyclones.
Answer:
1. People should regularly follow weather reports, alerts, and warnings issued by the **India Meteorological Department (IMD)**.
2. Families living in cyclone-prone areas should keep an emergency kit containing essential items ready.
3. During a cyclone, people should quickly move to a nearby designated cyclone shelter.

22. What is a thunderstorm? Mention the important processes involved in its formation.
Answer:
1. A storm accompanied by lightning and thunder is called a **thunderstorm**.
2. Warm moist air rises, cools, and condenses to form clouds, while strong upward and downward winds develop within them.
3. These winds facilitate the formation and separation of electric charges, which can produce lightning and thunder.

6.10. Three-mark questions with Answers of HOTS Type: (10 Questions)

Below are **HOTS (Higher Order Thinking Skills)** questions requiring students to **apply, analyse, predict, reason, and infer** using concepts from the chapter 6. Each answer is given in **exactly three points/sentences**, making it suitable for **3 marks**. The chapter itself encourages such reasoning through application-based questions involving pressure, lightning, winds, storms, and cyclones.

1. A student carries two bags of equal weight, one with broad straps and the other with narrow straps. Which one will feel more comfortable and why?

Answer:

1. The bag with broad straps will feel more comfortable because its weight acts over a larger area of the shoulder.
2. Since pressure is force per unit area, increasing the area decreases the pressure for the same weight.
3. Therefore, broad straps exert less pressure on the shoulders than narrow straps.

2. A sharp knife cuts an apple more easily than a blunt knife even when the same force is applied. Explain why.

Answer:

1. The sharp edge of a knife has a smaller area of contact with the apple than the blunt edge.
2. For the same applied force, a smaller area produces greater pressure.
3. Therefore, the sharp knife produces greater pressure on the apple and cuts it more easily.

3. Two identical taps are connected to the same overhead water tank, one on the first floor and another on the second floor. Which tap will give a stronger stream of water? Why?

Answer:

1. The tap on the first floor will generally receive a stronger stream because the height of the water column above it is greater.
2. Liquid pressure increases as the height of the liquid column increases.
3. Therefore, the water pressure at the first-floor tap will be greater than at the second-floor tap.

4. Two pipes of different diameters contain water up to the same height. Identical balloons are attached at their lower ends. Predict how the balloons will bulge and justify your answer.

Answer:

1. Both balloons will bulge to the same extent even though the pipes have different diameters.
2. The pressure at the bottom depends on the height of the water column, and the water level is the same in both pipes.
3. Therefore, equal-height water columns produce equal pressure and hence equal bulging of the balloons.

5. Why are the walls of a dam made much thicker at the bottom than at the top?

Answer:

1. The water near the bottom of a dam has a greater height of water above it and therefore exerts greater pressure.
2. Hence, the horizontal pressure exerted on the dam wall is much larger near the bottom.
3. The dam is therefore constructed with a broader and stronger base to withstand this greater pressure.

6. A rubber sucker sticks firmly to a smooth glass surface but may not stick properly to a rough wall. Give reasons.

Answer:

1. On a smooth surface, pressing the sucker pushes out most of the air beneath it and reduces the pressure inside.
2. Atmospheric pressure outside then pushes the sucker firmly against the surface.
3. On a rough surface, air can enter through small gaps, reducing the pressure difference required to keep the sucker attached.

7. An inflated balloon is connected to an uninflated balloon through a straw. Predict what will happen and explain why.

Answer:

1. Air will initially move from the inflated balloon to the uninflated balloon because the inflated balloon has higher air pressure.
2. As air moves, the inflated balloon becomes smaller while the other balloon becomes larger.
3. The flow eventually stops when the air pressure in the two balloons becomes equal.

8. On a hot afternoon at the seashore, in which direction will the wind blow? Explain your reasoning.

Answer:

1. During the day, land heats faster than seawater, causing the warm air above the land to rise and create a low-pressure region.
2. The relatively cooler air above the sea forms a higher-pressure region.
3. Air therefore moves from the sea towards the land, producing a sea breeze.

9. When air is blown rapidly between two hanging balloons, they move towards each other instead of moving apart. Why?

Answer:

1. Fast-moving air between the balloons creates a region of lower air pressure.
2. The air pressure on the outer sides of the balloons is comparatively higher.
3. This higher surrounding pressure pushes both balloons towards the low-pressure region between them.

10. During a severe storm, why can the roof of a weak house be blown away by high-speed winds?

Answer:

1. High-speed winds moving over the roof create a region of low air pressure above it.
2. The air pressure inside the house can then become greater than the pressure above the roof.
3. If this pressure difference is sufficiently large, the upward force can blow a weak roof away.

11. Why may keeping doors and windows open during certain high-speed wind conditions help prevent a roof from being blown away?

Answer:

1. High-speed winds above a roof reduce the air pressure outside and can create a pressure difference between the inside and outside of the house.
2. Allowing the same wind to move through the house reduces this pressure difference to a large extent.
3. A smaller pressure difference reduces the possibility of the roof being blown away.

12. Suppose air were a good conductor of electricity. How would this affect the occurrence of lightning?

Answer:

1. Normally, air acts as an electrical insulator and prevents opposite charges from meeting easily.
2. If air were a good conductor, accumulated charges could flow through it more readily instead of building up greatly.
3. Therefore, the sudden large electrical discharge responsible for lightning would not occur in the same manner described in the chapter.

13. A person is caught in an open field during lightning. Why is crouching safer than lying flat on the ground?

Answer:

1. During lightning, a person should minimise contact with the ground and stay away from tall objects.
2. Crouching makes the person low while reducing the area of the body in contact with the ground.
3. Therefore, crouching is recommended, whereas lying flat on the ground increases contact with the ground and should be avoided.

14. A cyclone becomes weaker after moving from the ocean onto land. Analyse why this happens.

Answer:

1. Cyclones obtain the warm and moist air needed for their development from warm ocean water.
2. After reaching land, this continuous supply of moist air is cut off.
3. Therefore, the cyclone gradually loses its strength as it travels over land.

15. If the Earth did not rotate, how would the formation of a cyclone be affected?

Answer:

1. Warm ocean water could still cause moist air to rise and produce a low-pressure region.
2. However, the chapter states that Earth's rotation causes the moving air to spin around the low-pressure region.
3. Without Earth's rotation, the characteristic spinning system of clouds, winds, and rain described as a cyclone would therefore not form in the same way.

16. The eye of a cyclone is calm, yet the cyclone itself is extremely destructive. Explain this apparent contradiction.

Answer:

1. The eye is the central region of lowest pressure where the wind is comparatively calm.
2. The region surrounding the eye experiences strong winds and heavy rainfall.
3. Therefore, calm conditions at the eye do not mean the whole cyclone is calm, because the surrounding regions can be highly destructive.

17. Why can a cyclone affect agriculture even after the floodwater has disappeared?

Answer:

1. A cyclone can push seawater inland and flood agricultural land.
2. The salt present in seawater can remain in the soil and make it less fertile.
3. Therefore, crop production may continue to be affected even after the floodwater has receded.

18. Why can early cyclone warnings significantly reduce the loss of life even though they cannot stop the cyclone?

Answer:

1. Weather-monitoring satellites help track cyclones and predict their likely paths before they reach affected areas.
2. Early warnings give people time to prepare emergency supplies and move to designated cyclone shelters.
3. Thus, although the cyclone cannot be prevented, timely preparation and evacuation can reduce its impact on human life and property.

19. A boy first lies flat on loose sand and then stands on it. In which position will he sink more? Explain.

Answer:

1. The boy will sink more when standing because his weight acts over the relatively small area of his feet.

2. When he lies down, the same weight is distributed over a much larger area of his body.
3. Since a smaller area produces greater pressure for the same force, he sinks more while standing.

20. Large banners displayed outdoors often have several holes in them. Explain the scientific reason for this design.

Answer:

1. Strong winds exert pressure on a banner and may tear it or pull down its supports.
2. Holes allow some of the moving air to pass through the banner instead of the entire wind force acting against it.
3. This reduces the pressure difference across the banner and decreases the chance of damage during strong winds.

6.11 Five-mark questions with Answers of LOTS Type: (5 Questions)

These questions focus mainly on **Remembering and Understanding (LOTS)**. Each answer contains **exactly five sentences/points**, suitable for a **5-mark descriptive question**.

1. What is pressure? Explain the relationship between force, area, and pressure with examples.

Answer:

1. Pressure is defined as the **force acting per unit area** of a surface.
2. It is expressed as **Pressure = Force ÷ Area**.
3. The SI unit of pressure is **newton per square metre (N/m^2)**, also called **pascal (Pa)**.
4. For the same force, pressure increases when the area over which the force acts decreases.
5. Therefore, a sharp knife cuts more easily and broad bag straps feel more comfortable because of differences in the area over which force acts.

2. Explain how liquids exert pressure and how liquid pressure depends on the height of the liquid column.

Answer:

1. Liquids exert pressure on the bottom as well as on the walls of their containers.
2. In fact, liquids exert pressure in **all directions**.
3. The pressure exerted by a liquid depends on the height of the liquid column.
4. As the height of the liquid column increases, the pressure at the bottom also increases.
5. Therefore, overhead water tanks are placed at a height to increase water pressure and provide a good stream of water through taps.

3. What is atmospheric pressure? Explain how a rubber sucker demonstrates atmospheric pressure.

Answer:

1. The envelope of air surrounding the Earth is called the **atmosphere**.
2. Air exerts pressure on all objects, and this pressure is called **atmospheric pressure**.
3. When a rubber sucker is pressed against a smooth surface, most of the air between the sucker and the surface is pushed out.
4. The air pressure inside the sucker becomes lower than the atmospheric pressure outside it.
5. The greater pressure of the surrounding air pushes the sucker firmly against the surface, making it difficult to pull off.

4. Explain the formation of sea breeze and land breeze.

Answer:

1. During the day, land gets heated faster than water, making the air above the land warmer and lighter.
2. The warm air rises and creates a low-pressure region over the land.
3. Air from the high-pressure region over the sea moves towards the land, producing a **sea breeze**.
4. At night, water remains warmer than the land, so a low-pressure region develops above the sea.
5. Air then moves from the land towards the sea, producing a **land breeze**.

5. Describe the formation of a storm.

Answer:

1. When land gets heated, warm and moist air becomes lighter and rises, creating a low-pressure area.
2. Cooler air from the surrounding high-pressure regions flows towards this low-pressure area and replaces the rising air.
3. The rising warm air expands, cools, and its moisture condenses to form water droplets and clouds.
4. The water droplets combine to form heavier drops that fall as rain, hail, or snow.
5. The strong winds accompanying such precipitation form a **storm**.

6. Explain how lightning is produced during a thunderstorm.

Answer:

1. Strong upward and downward winds cause water droplets and ice particles inside clouds to rub against one another and develop electric charges.
2. Positively charged lighter ice particles move upwards, while negatively charged heavier water droplets occupy the lower part of the cloud.
3. Normally, air acts as an electrical insulator and prevents opposite charges from meeting.
4. When the accumulation of charges becomes very large, the insulating property of air breaks down and a sudden flow of electric charges occurs.
5. This sudden electrical discharge produces a bright flash called **lightning**, while the rapid expansion of heated air produces **thunder**.

7. Describe five safety precautions that should be followed during lightning.

Answer:

1. Stay away from tall objects such as trees, poles, and buildings during lightning.
2. If caught in an open area, find a low-lying place, crouch down, and minimise contact with the ground.
3. Never lie flat on the ground during lightning.
4. Avoid using umbrellas with metallic rods and get out of water immediately if you are swimming or standing in water.
5. If you are inside a bus or car, remain inside because it is comparatively safer.

8. Explain the formation of a cyclone.

Answer:

1. Cyclones are large storms that form over **warm ocean waters**, where warm and moist air rises.
2. As the moist air rises, water vapour condenses into raindrops and releases heat into the atmosphere.
3. This heat further warms the rising air, causing it to rise higher and creating an even lower-pressure region.
4. Air from surrounding regions rushes towards the low-pressure area, and Earth's rotation causes the moving air to spin.

5. The repeated process creates a very low-pressure region surrounded by high-speed rotating winds, clouds, and rain, forming a **cyclone**.

9. Describe the eye of a cyclone and the conditions in and around it.

Answer:

1. The centre of a cyclone is called the **eye of the cyclone**.
2. The eye is the region of **lowest air pressure** in the cyclone.
3. The wind at the eye of the cyclone is comparatively calm.
4. The region surrounding the eye experiences very strong winds and heavy rainfall.
5. After a cyclone reaches land, its supply of moist air is cut off and it gradually loses its strength.

10. Describe the major destructive effects of cyclones.

Answer:

1. Strong cyclone winds push ocean water towards the shore, producing a large surge of water that can flood coastal areas.
2. Heavy rainfall associated with cyclones can cause rivers to overflow and may also trigger landslides.
3. Seawater entering inland areas can contaminate drinking-water sources and damage farmland.
4. Fallen trees and debris can block roads, making it difficult for rescue teams and emergency services to reach affected areas.
5. Cyclones can also cause prolonged power outages and severe damage to life, property, agriculture, and daily activities.

6.12 Five-mark questions with Answers of HOTS Type: (5 Questions)

The following questions are designed to test **application, analysis, reasoning, prediction, and evaluation**. Each answer contains **five clear points/sentences**, suitable for **5 marks**. The questions are based on the concepts and application-oriented exercises in the chapter 6.

1. A school bag with narrow straps feels more painful than an equally heavy bag with broad straps. Analyse the reason and suggest a suitable design for a comfortable school bag.

Answer:

1. Both bags may exert the same force on the shoulders because their weights are equal.
2. Pressure depends on both force and the area over which the force acts.
3. Narrow straps act over a smaller area and therefore produce greater pressure on the shoulders.
4. Broad straps distribute the same force over a larger area and hence reduce the pressure.
5. Therefore, a comfortable school bag should have **broad, preferably padded straps** to distribute its weight over a larger area.

2. A student living on the first floor gets a stronger stream of water from a tap than a student living on the second floor of the same building. Explain why.

Answer:

1. The pressure exerted by water depends on the height of the water column above the point where pressure is measured.
2. The first-floor tap has a greater height of water column above it than the second-floor tap.
3. Therefore, water exerts greater pressure at the first-floor tap.
4. Greater water pressure produces a stronger stream of water from the tap.

5. This also explains why overhead water tanks are placed at a considerable height above the taps.

3. The base of a dam is made much broader and stronger than its upper portion. Analyse the scientific reason behind this design.

Answer:

1. Water stored in a dam exerts pressure on the walls of the dam.
2. Liquid pressure increases as the height or depth of the water column increases.
3. Therefore, the horizontal pressure exerted by water is much greater near the bottom of the dam.
4. A thin or weak base may not be able to withstand this large pressure and could get damaged.
5. Hence, dams are constructed with **broad and strong bases** to withstand the greater water pressure near the bottom.

4. During a storm, high-speed winds blow over the roof of a house. Predict what may happen if all the doors and windows are tightly closed, and explain why.

Answer:

1. High-speed winds blowing over the roof create a region of lower air pressure above the roof.
2. If the doors and windows are closed, the air pressure inside the house may remain higher than the pressure above the roof.
3. This creates a large pressure difference between the inside and outside of the house.
4. If the roof is weak, the higher pressure from below may push it upwards and cause it to be blown away.
5. The chapter explains that keeping doors and windows open during such high-speed winds can reduce this pressure difference and help protect the roof.

5. Two balloons, one inflated and the other uninflated, are connected using a straw. Predict what will happen and justify your answer.

Answer:

1. Initially, the air pressure inside the inflated balloon is higher than that inside the uninflated balloon.
2. Air therefore moves through the straw from the inflated balloon towards the uninflated balloon.
3. As a result, the inflated balloon becomes smaller while the other balloon becomes larger.
4. Air continues to flow until the pressure in the two balloons becomes nearly equal.
5. This experiment demonstrates that **air moves from a region of high pressure to a region of low pressure**.

6. Two identical balloons are suspended close to each other. A student predicts that blowing strongly between them will push them apart. Is the prediction correct? Justify your answer.

Answer:

1. The student's prediction is incorrect because the balloons will move **towards each other**.
2. Blowing air rapidly between them increases the speed of air in the space separating the balloons.
3. High-speed moving air is accompanied by reduced air pressure.
4. The comparatively higher pressure of the surrounding air then pushes the balloons towards each other.
5. Blowing harder makes them approach each other faster because high-speed winds produce a greater lowering of pressure between them.

7. A person is caught in an open field during lightning. Evaluate what the person should and should not do to remain safe.
Answer:
1. The person should move away from tall objects such as trees because lightning may strike them.
2. The person should find a low-lying open area and crouch down while minimising contact with the ground.
3. The person should **not lie flat on the ground**, as this increases contact with the ground.
4. Metallic objects such as umbrellas with metal rods should be avoided, and the person should immediately get out of water if nearby.
5. If a car or bus is available, moving inside it would be comparatively safer during lightning.

8. Suppose air and clouds were good conductors of electricity. Would lightning occur in the same way as it does now? Analyse.
Answer:
1. Normally, air acts as an electrical insulator and prevents opposite electric charges from meeting easily.
2. This allows positive and negative charges to accumulate and separate within clouds.
3. When the accumulated charge becomes sufficiently large, the insulating property of air breaks down suddenly.
4. This sudden flow of electric charges produces the bright flash that we call lightning.
5. Therefore, if air and clouds were good conductors, charges would flow more easily instead of building up for a sudden discharge, so lightning would **not occur in the same way**.

9. A cyclone becomes weaker after reaching land even though it may still have very strong winds. Analyse the reason.
Answer:
1. Cyclones develop over warm ocean waters where they continuously receive warm and moist air.
2. Water vapour in the rising air condenses and releases heat into the atmosphere.
3. This heat supports further rising of air and helps maintain the very low-pressure region of the cyclone.
4. When the cyclone reaches land, its continuous supply of warm and moist ocean air is cut off.
5. Therefore, the cyclone gradually loses the source of energy that sustains it and becomes weaker as it moves further over land.

10. A coastal village receives a cyclone warning from the India Meteorological Department. Suggest five actions that can reduce loss of life and property.
Answer:
1. People should continuously follow reliable weather reports, alerts, and warnings issued by the **India Meteorological Department (IMD)**.
2. Families should prepare an emergency kit containing essential items required during the disaster.
3. People living in vulnerable areas should quickly move to designated cyclone shelters when instructed.
4. Residents should avoid unnecessary travel because fallen trees, debris, flooding, and landslides may make roads dangerous.
5. Early warning, timely evacuation, and preparedness can considerably reduce the impact of cyclones on life and property.

11. During a summer afternoon at the seashore, trees are seen bending towards the land. Use this observation to identify the direction of the wind and explain how it develops.
Answer:
1. During the day, land gets heated faster than seawater.
2. The air above the land becomes warm and lighter and rises, producing a low-pressure region.
3. The air over the comparatively cooler sea remains at a relatively higher pressure.
4. Air therefore moves from the sea towards the low-pressure region over the land.
5. Hence, trees bending towards the land indicate a **sea breeze**, caused by the pressure difference between the sea and the land.

12. Large banners and hoardings often have several holes in them. Apply your knowledge of air pressure to explain why these holes are necessary.
Answer:
1. Strong winds exert force and pressure on large banners and hoardings.
2. A large continuous surface receives considerable force from the moving air.
3. If the pressure becomes too great, the banner may tear or the supporting structure may get damaged.
4. Holes allow some of the moving air to pass through instead of exerting its entire force on the surface.
5. Therefore, making holes in banners and hoardings reduces the effect of wind pressure and decreases the possibility of damage.

6.13 Five-mark questions with Answers of Applied Type: (5 Questions)

Below are **application-based questions** in which students use the concepts learned in the chapter in practical or real-life situations. Each answer has **five points/sentences for 5 marks**. The chapter focuses on applying the concepts of pressure, atmospheric pressure, wind formation, thunderstorms, lightning and cyclones.

1. A vegetable vendor carries a heavy basket on her head by placing a folded cloth between the basket and her head. Explain how this helps her.
Answer:
1. The heavy basket exerts a downward force due to its weight.
2. If the basket is placed directly on the head, the force acts over a smaller area.
3. The folded cloth increases the area over which the force acts.
4. Since pressure is force per unit area, increasing the area reduces the pressure on the head.
5. Therefore, the folded cloth makes carrying the heavy basket more comfortable.

2. A carpenter finds it difficult to drive a blunt nail into a wooden plank. What should the carpenter do? Explain using the concept of pressure.
Answer:
1. The carpenter should use a nail with a sharp, pointed end.
2. The pointed end has a much smaller area than a blunt end.
3. When the same force is applied over a smaller area, greater pressure is produced.
4. The greater pressure allows the pointed end to penetrate the wooden plank more easily.
5. Thus, sharp nails are more effective because they produce greater pressure for the same applied force.

3. A family living on the top floor of a building complains that water comes slowly from their taps, while the ground-floor taps have a stronger flow. Apply the concept of liquid pressure to explain this situation.

Answer:
1. The pressure exerted by water depends on the height of the water column above the tap.
2. The ground-floor tap has a greater height of water column above it.
3. Therefore, the water pressure at the ground-floor tap is greater.
4. The top-floor tap has a smaller water column above it and therefore receives water at lower pressure.
5. Increasing the height of the overhead tank can increase the water pressure available at the taps.

4. A large water-storage dam is being designed. Why should engineers construct its base thicker and broader than its top?

Answer:
1. Water exerts pressure on both the bottom and sides of its container.
2. The pressure exerted by water increases with the height of the water column.
3. Therefore, the horizontal water pressure is very large near the bottom of a dam.
4. A broader and stronger base can withstand this greater pressure and also support the structure.
5. Hence, engineers construct dams with a much broader base than the top for strength and safety.

5. A rubber sucker is used to hang a lightweight object on a smooth glass wall. Explain how the sucker remains attached to the wall.

Answer:
1. When the rubber sucker is pressed firmly against the glass, most of the air trapped beneath it is pushed out.
2. This reduces the air pressure between the sucker and the glass surface.
3. The atmospheric pressure outside the sucker is now greater than the pressure beneath it.
4. The greater outside pressure pushes the sucker firmly against the glass.
5. Therefore, a sufficient force is required to overcome this pressure difference and remove the sucker.

6. You are at a beach during a hot summer afternoon and feel wind blowing from the sea towards the land. Apply your knowledge of pressure to explain this observation.

Answer:
1. During the day, land gets heated faster than seawater.
2. The air above the land becomes warmer and lighter and rises.
3. This creates a region of low pressure over the land.
4. The air over the comparatively cooler sea is at higher pressure and moves towards the low-pressure region over the land.
5. This movement of air from the sea towards the land produces a **sea breeze**.

7. During a severe storm, high-speed winds are blowing over a house with a weak roof. Explain why the roof may be blown away.

Answer:
1. High-speed winds blowing over the roof create a region of lower air pressure above it.
2. The air pressure below the roof may remain comparatively higher.
3. This creates a pressure difference between the air inside the house and the air above the roof.
4. If this difference becomes large, the higher pressure below the roof can push it upwards.
5. Therefore, a weak roof may be blown away during a storm with high-speed winds.

8. A farmer working in an open field suddenly notices lightning and hears thunder. What safety measures should the farmer immediately follow?

Answer:

1. The farmer should move away from tall objects such as trees.
2. The farmer should find a low-lying open area and crouch down.
3. Contact with the ground should be minimised, and the farmer should not lie flat on the ground.
4. Metallic objects, including umbrellas with metallic rods, should be avoided.
5. If a car or bus is nearby, the farmer should get inside it because being inside such a vehicle is comparatively safer.

9. A new multi-storeyed school building is being constructed in an area where thunderstorms are common. What device should be installed to protect the building from lightning? Explain how it works.

Answer:

1. A **lightning conductor** should be installed on the school building.
2. It consists of a metallic rod placed along the wall of the building.
3. Its pointed upper end is kept higher than the highest point of the building.
4. The other end of the metallic rod is buried deep in the ground.
5. It provides an easy path for electric charges to pass safely into the ground, thereby protecting the building.

10. A cyclone warning has been issued for your coastal town. As a responsible student, suggest five actions that your family should take.

Answer:

1. The family should regularly follow weather reports, alerts and warnings issued by the **India Meteorological Department (IMD)**.
2. An emergency kit containing essential items should be kept ready.
3. Family members should follow evacuation instructions issued by the authorities.
4. If instructed, everyone should quickly move to a nearby designated cyclone shelter.
5. Early warning, preparedness and timely evacuation can help reduce the loss of life and property during a cyclone.

11. A coastal farmer finds that his field has become less fertile after a severe cyclone. Apply your knowledge of cyclones to explain the possible reason.

Answer:

1. Strong cyclone winds can push large amounts of seawater towards the shore.
2. This produces a storm surge that may flood coastal areas and agricultural fields.
3. The seawater entering the fields contains a large amount of salt.
4. The salt deposited in the soil can make the soil less fertile.
5. Therefore, crops may grow poorly in farmland affected by seawater during a cyclone.

12. Large banners displayed across roads often have several holes in them. Explain the practical purpose of these holes.

Answer:

1. Moving air exerts pressure on banners and hoardings.
2. During strong winds, a large banner without holes experiences considerable wind force.
3. The holes provide passages through which some of the moving air can flow.
4. This reduces the effect of wind pressure on the banner.
5. Therefore, holes help prevent large banners and hoardings from tearing or being damaged during strong winds.

6.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

Olympiad / Competitive Exam–Type Multiple Choice Questions:

The following questions are designed to be more **conceptual, application-oriented, numerical and reasoning-based** than ordinary textbook MCQs, while remaining grounded in the chapter 6. The chapter establishes that pressure is force per unit area and develops this concept through liquids, atmospheric pressure, winds, thunderstorms and cyclones.

1. Three identical bricks P, Q and R are placed on sand. P rests on its largest face, Q on its medium face and R on its smallest face. Which brick will sink deepest?
A. P
B. Q
C. R
D. All will sink equally
Answer: C. R
Explanation: All have the same weight, but R has the smallest contact area. Hence, it exerts the greatest pressure.

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2. A force of 240 N acts normally on an area of 0.8 m². If the same force is applied over an area of 0.2 m², the pressure becomes:
A. 75 Pa
B. 300 Pa
C. 600 Pa
D. 1200 Pa
Answer: D. 1200 Pa
Explanation: $P = F/A = 240/0.2 = 1200$Pa. Pressure increases when the same force acts over a smaller area.

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3. A school bag with narrow straps feels more painful than an equally heavy bag with broad straps because the narrow straps:
A. exert less force on the shoulders
B. exert greater pressure due to smaller contact area
C. increase the weight of the bag
D. decrease gravitational force
Answer: B. exert greater pressure due to smaller contact area

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4. Two vertical pipes have different diameters but contain water columns of exactly the same height. Identical balloons are attached at their bottoms. Which observation is expected?
A. Balloon under the wider pipe bulges more.
B. Balloon under the narrower pipe bulges more.
C. Both balloons bulge approximately equally.
D. Neither balloon bulges.
Answer: C. Both balloons bulge approximately equally.
Explanation: In the chapter's experiment, liquid pressure at the bottom depends on the height of the water column; equal heights produced equal balloon bulges despite different pipe diameters.

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5. An overhead tank supplies water to taps on the first and second floors. Assuming everything else is identical, which tap should normally receive water at greater pressure?
A. Second-floor tap
B. First-floor tap
C. Both receive exactly the same pressure
D. Pressure depends only on the tank's capacity
Answer: B. First-floor tap
Explanation: The water column above the lower tap is greater, resulting in greater pressure.

6. Four holes are made around a water-filled bottle at the same horizontal level. Water emerging from them demonstrates most directly that:
A. water exerts pressure only downward
B. water pressure depends only on container shape
C. liquids exert pressure on the sides of their containers
D. water has no pressure at equal depths
Answer: C. liquids exert pressure on the sides of their containers.

7. Why is the base of a dam made much broader than its top?
A. Water pressure is maximum at the surface.
B. Water pressure near the bottom is very large.
C. Atmospheric pressure exists only near the bottom.
D. Water has greater density at the bottom.
Answer: B. Water pressure near the bottom is very large.

8. A rubber sucker sticks strongly to a smooth wall mainly because:
A. the sucker produces gravitational attraction
B. air pressure inside becomes greater than outside
C. outside atmospheric pressure is greater than the reduced pressure beneath the sucker
D. the rubber chemically bonds with the wall
Answer: C. outside atmospheric pressure is greater than the reduced pressure beneath the sucker.

9. Atmospheric pressure does not normally crush the human body because:
A. atmospheric pressure is actually negligible
B. bones completely block atmospheric pressure
C. pressure inside the body balances atmospheric pressure outside
D. atmospheric pressure acts only upward
Answer: C. pressure inside the body balances atmospheric pressure outside.

10. Two balloons are connected by a straw. Balloon X initially has higher air pressure than balloon Y. What will happen?
A. Air flows Y → X continuously.
B. Air flows X → Y until their pressures become approximately equal.
C. No air flows because both contain air.
D. Air flows in both directions simultaneously at different speeds.
Answer: B. Air flows X → Y until their pressures become approximately equal.

11. If the pressure difference between two regions increases considerably, the chapter predicts that the speed of air moving between them will generally:
A. increase
B. decrease
C. remain unchanged
D. become zero
Answer: A. increase
Explanation: The chapter states that the speed of escaping air is higher when the pressure difference is higher.

12. During a hot summer afternoon near a coast, the land becomes hotter than the sea. Which sequence correctly explains sea breeze?
A. Land heats → air above land rises → low pressure over land → air moves sea to land
B. Sea heats → air above sea sinks → low pressure over sea → air moves land to sea
C. Land heats → high pressure over land → air moves land to sea
D. Sea cools → high pressure over land → air moves sea to land
Answer: A. Land heats → air above land rises → low pressure over land → air moves sea to land

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13. At night, land breeze generally blows:
A. sea → land
B. land → sea
C. vertically upward only
D. from low pressure to high pressure
Answer: B. land → sea
Explanation: At night, water is warmer than land, producing relatively lower pressure above the sea. Air therefore moves from land towards sea.

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14. Two inflated balloons are suspended close together. When a student blows rapidly between them, they:
A. move apart because the blown air pushes them outward
B. move towards each other because pressure between them decreases
C. remain stationary
D. burst immediately
Answer: B. move towards each other because pressure between them decreases.

---

15. Consider the following statements:
I. High-speed winds are accompanied by reduced air pressure.
II. High-speed wind above a weak roof can create lower pressure above it than below it.
III. A sufficiently large pressure difference can cause the roof to be blown away.
Which is correct?
A. I only
B. I and II only
C. II and III only
D. I, II and III
Answer: D. I, II and III

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16. Warm, moist air rises during the development of a storm. What happens next according to the chapter?
A. It gets compressed and becomes hotter indefinitely.
B. It expands, cools and its moisture condenses into water droplets.
C. It immediately becomes dry air.
D. It creates high pressure at the surface.
Answer: B. It expands, cools and its moisture condenses into water droplets.

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17. In a thundercloud, the chapter describes the upper and lower regions as predominantly:
A. upper negative; lower positive
B. upper positive; lower negative
C. both positive
D. both electrically neutral

Answer: B. upper positive; lower negative
Explanation: Positively charged lighter ice particles move upward, while negatively charged heavier water droplets occupy the lower region.

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18. Lightning occurs when:
A. air permanently remains a perfect insulator
B. accumulated charges become large enough for the insulating property of air to break down
C. all charges inside a cloud disappear
D. clouds stop containing water droplets
Answer: B. accumulated charges become large enough for the insulating property of air to break down.

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19. Thunder is produced mainly because lightning:
A. cools the surrounding air suddenly
B. rapidly heats the surrounding air, causing it to expand
C. causes clouds to collide physically
D. produces rain that strikes the ground
Answer: B. rapidly heats the surrounding air, causing it to expand.

---

20. A student is caught outdoors during lightning. Which is the **safest** action among the following?
A. Stand under the tallest tree.
B. Lie flat on the ground.
C. Hold a metal umbrella above the head.
D. Find a low-lying open area, crouch and minimise contact with the ground.
Answer: D. Find a low-lying open area, crouch and minimise contact with the ground.

---

21. Which arrangement correctly describes a lightning conductor?
A. Both ends remain above the building.
B. One pointed end extends above the building and the other end is buried deep in the ground.
C. The entire rod is buried underground.
D. It is made from an electrical insulator.
Answer: B. One pointed end extends above the building and the other end is buried deep in the ground.
Explanation: It provides an easy path for electric charges to reach the ground.

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22. Which sequence best represents the formation of a cyclone?
A. Warm ocean → moist air rises → condensation releases heat → air rises further → pressure falls → surrounding air rushes in → rotating system develops
B. Cold ocean → dry air sinks → pressure falls → cyclone forms
C. Warm ocean → air sinks → pressure rises → surrounding air moves away → cyclone forms
D. Warm land → air stops moving → pressure becomes uniform → cyclone forms
Answer: A. Warm ocean → moist air rises → condensation releases heat → air rises further → pressure falls → surrounding air rushes in → rotating system develops

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23. Why is condensation particularly important in strengthening the rising air involved in cyclone formation?

A. Condensation absorbs all atmospheric heat.
B. Condensation releases heat into the atmosphere, causing further warming and ascent of air.
C. Condensation stops air movement.
D. Condensation increases pressure at the cyclone centre.
Answer: B. Condensation releases heat into the atmosphere, causing further warming and ascent of air.

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24. The pressure readings at four locations around a developing cyclone are 1008 mb, 998 mb, 996 mb and 994 mb. Which location is most likely closest to the cyclone's centre?
A. 1008 mb
B. 998 mb
C. 996 mb
D. 994 mb
Answer: D. 994 mb
Explanation: The cyclone's centre or eye is the region of lowest pressure. The pressure pattern illustrated in the chapter also decreases towards the low-pressure centre.

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25. Which statement about the **eye of a cyclone** is correct?
A. It has the highest wind speed in the cyclone.
B. It is the region of lowest pressure, but winds there are calm.
C. It has the highest atmospheric pressure.
D. It exists only after the cyclone reaches land.
Answer: B. It is the region of lowest pressure, but winds there are calm.

---

26. A cyclone generally weakens after reaching land mainly because:
A. Earth's rotation stops affecting it
B. atmospheric pressure completely disappears
C. its supply of moist air from the ocean is cut off
D. land has no air above it
Answer: C. its supply of moist air from the ocean is cut off.

---

27. Which of the following is **NOT** identified in the chapter as a possible consequence of a cyclone?
A. Storm surge flooding coastal regions
B. Seawater contamination of drinking-water sources
C. Increased soil fertility due to seawater salt
D. Power outages and blocked roads
Answer: C. Increased soil fertility due to seawater salt
Explanation: The chapter states the opposite: salt from seawater can make soil **less fertile**.

---

28. Strong cyclone winds push seawater towards the shore, forming a wall of water. According to the chapter, this wall can be approximately:
A. 3–12 cm high
B. 3–12 m high
C. 30–120 m high
D. exactly 3 m high in every cyclone
Answer: B. 3–12 m high

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29. A 20,000 N elephant stands evenly on four feet. If each foot covers 0.25 m^2, what pressure does it exert on the ground?

A. 5,000 Pa
B. 10,000 Pa
C. 20,000 Pa
D. 80,000 Pa
Answer: C. 20,000 Pa
Calculation:
Total area = $4 \times 0.25 = 1\ m^2$

$$P = \frac{20{,}000}{1} = 20{,}000\ Pa$$

This numerical situation is also posed in the chapter exercises.

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30. Boat A has a base area of 7 m² and carries 5 people. Boat B has a base area of 3.5 m² and carries 3 people. Each person weighs 700 N. Considering only the people's weight, which statement is correct?
A. Boat A produces greater pressure.
B. Boat B produces greater pressure.
C. Both produce equal pressure.
D. There is insufficient information.
Answer: B. Boat B produces greater pressure.
Calculation:
Boat A: $P = (5 \times 700)/7 = 500\ Pa$
Boat B: $P = (3 \times 700)/3.5 = 600\ Pa$
Therefore, Boat B produces **100 Pa more pressure**. The numerical data are taken from the chapter exercise.

Answer Key

Q	Ans.	Q	Ans.	Q	Ans.
1	C	11	A	21	B
2	D	12	A	22	A
3	B	13	B	23	B
4	C	14	B	24	D
5	B	15	D	25	B
6	C	16	B	26	C
7	B	17	B	27	C
8	C	18	B	28	B
9	C	19	B	29	C
10	B	20	D	30	B

6.15 Best Practices Opportunity List from the Chapter:

For the chapter **"Pressure, Winds, Storms, and Cyclones"**, the "Best Practices" can focus on **experiential learning, inquiry, real-life application, safety awareness, and student-led exploration**. This fits the chapter particularly well because it begins with everyday questions such as why winds vary in strength, why water tanks are placed at a height, and what causes storms and cyclones.

Suggested Best Practices:

1. **Learning Science through Hands-on Experiments:**

Adopt an **"Experiment First – Concept Next"** approach. Students can perform simple activities using balloons, bottles, straws, paper, water and rubber suckers to discover pressure concepts themselves rather than merely learning definitions. The chapter itself uses experiments to establish that liquid pressure increases with the height of the water column.

2. **Predict–Observe–Explain (POE) Method:**
   Before every demonstration, ask students to **predict the outcome**, observe the experiment and then scientifically explain what happened. For example, students can predict what happens when air is blown between two suspended balloons and then relate the observation to reduced air pressure associated with high-speed winds.
3. **Real-Life Science Problem Solving:**
   Connect each concept to a familiar situation—**broad school-bag straps, sharp knives, overhead water tanks, dams, leaking water pipes, roofs during storms and coastal winds**. Students may be asked not just *what happens*, but *why*, encouraging application of scientific principles to everyday life.
4. **Weather Watch – Student Meteorologist Activity:**
   Create a **"Young Meteorologist" classroom project** in which students record daily weather conditions, wind direction, rainfall and weather warnings for a week. They can relate their observations to pressure differences, wind formation, thunderstorms and cyclones. This can culminate in students presenting a short classroom "weather bulletin."
5. **Disaster Preparedness through Role Play and Simulation:**
   Conduct a **mock cyclone/thunderstorm preparedness drill**. Groups can act as the IMD, disaster-management team, school authorities, media, rescue workers and local residents. Students prepare emergency kits, interpret warnings and decide appropriate safety actions. The chapter specifically stresses weather alerts, emergency kits and moving to designated cyclone shelters.
6. **Local Context and Community-Based Learning:**
   Since the students are in **coastal Karnataka**, connect the chapter to locally experienced heavy rainfall, strong coastal winds, thunderstorms and cyclone alerts. Students can interview parents/grandparents about major storms they remember and compare traditional observations with modern scientific weather forecasting. The chapter itself specifically mentions Karnataka's local thunderstorms and their role in coffee cultivation.
7. **Student Research – "Cyclone Case Study":**
   Divide the class into groups and assign each group a major cyclone affecting India. Students investigate its path, wind speed, rainfall, destruction, government response and lessons learned, and present their findings through posters or PPTs. This directly extends the chapter's suggested interdisciplinary project on major Indian cyclones and disaster-management measures.
8. **Concept-to-Model STEM Challenge:**
   Students can build simple working models such as an **overhead water-tank pressure model, dam model, lightning conductor model, wind-pressure demonstration or cyclone formation model**. Rather than judging only appearance, assess whether students can explain the scientific principle represented by their model.
9. **Peer Teaching – "Become the Science Teacher":**
   Assign small groups one concept each—pressure, atmospheric pressure, wind formation, sea/land breeze, lightning or cyclones. Each group gets **3–5 minutes to teach the concept** using an experiment, diagram or everyday example. This promotes communication, teamwork and conceptual clarity.

10. **HOTS & Olympiad Question of the Day:**
    End each lesson with one **Higher-Order Thinking/Olympiad Challenge** rather than a direct recall question—for example, *"If Earth stopped rotating, how would cyclone formation be affected?"* or *"Why does a person sink deeper into loose sand while standing than while lying down?"* The chapter itself encourages students to frame "Why?", "When?", "How long?" and "Why not?" questions.

For a school **Best Practices record/report**, I would especially recommend highlighting **#1 Hands-on Experiments, #2 Predict–Observe–Explain, #4 Young Meteorologist, #5 Disaster Preparedness Simulation, and #6 Local Context-Based Learning**. These five are distinctive, observable in the classroom, and easy to document with photographs and student work.

6.16 Innovations Opportunity List from the Chapter:

For the Grade 8 chapter 6 **"Pressure, Winds, Storms, and Cyclones"**, the textbook itself encourages students to begin with curiosity-driven questions such as why winds differ in strength, why water tanks are placed at a height, and how storms and cyclones form. This creates excellent scope for **innovative teaching-learning practices** beyond conventional experiments.

Innovations in Teaching–Learning:

(1) **Digital Cyclone Simulation – "Create Your Own Cyclone":**
Use an interactive digital simulation in which students vary **ocean temperature, air pressure, moisture and wind conditions** and observe how these changes influence cyclone formation. Students can then explain why warm ocean water, rising moist air, low pressure and Earth's rotation contribute to cyclone development.

(2) **AI as a Science Learning Partner:**
Introduce age-appropriate use of **Generative AI** by asking students to frame scientific questions and critically evaluate the answers. For example: *"What would happen to cyclones if Earth stopped rotating?"* Students should verify AI-generated explanations against the textbook and classroom experiments rather than simply accepting the response.

(3) **DIY Smart Weather Station:**
Create a small **"Weather Innovation Corner"** in the school. Students can measure or record temperature, rainfall, wind direction and atmospheric pressure using simple instruments or low-cost digital sensors. Teams maintain weekly data and attempt to relate changing weather conditions to the chapter's concepts of pressure and wind.

(4) **AR/3D Cyclone and Thunderstorm Learning:**
Use **Augmented Reality, 3D animation or interactive digital models** to allow students to visualise what cannot easily be demonstrated in the classroom—the eye of a cyclone, rotating winds, rising warm moist air, cloud formation and charge separation during lightning. The textbook explains that the cyclone's lowest-pressure region is its eye, surrounded by strong winds and heavy rainfall.

(5) **"Cyclone Control Room" – Classroom Transformation:**
Convert the classroom temporarily into a **mock meteorological control room**. Students take roles such as meteorologists, satellite analysts, disaster-management officers, journalists and district administrators. Give them simulated cyclone data and ask each team to interpret it and issue appropriate warnings and safety instructions. This connects directly with the textbook's discussion of IMD alerts, satellite monitoring and cyclone preparedness.

(6) **QR-Code Science Trail Around the School:**
Create QR codes at relevant locations around the campus. For example, a QR code near the **overhead water tank** could ask *"Why is this tank placed so high?"*; near a broad pillar or foundation, students could explore pressure; near an open field, wind; and near the building's lightning conductor, lightning safety. Scanning each code reveals a challenge, video, question or experiment. This turns the **whole school campus into a science laboratory**.

(7) **Student-Made Slow-Motion Science Videos:**
Students use a mobile/tablet camera to record experiments such as **water emerging from holes in a bottle, movement of balloons under fast-moving air, or pressure demonstrations**. They replay the experiment in slow motion, annotate what they observe and provide a voice-over explaining the scientific principle. The chapter establishes experimentally that liquids exert pressure on the sides of containers and in all directions.

(8) **Design Thinking Challenge – "Cyclone-Resistant House":**
Give teams paper, cardboard, straws and other simple materials and ask them to **design a model house capable of withstanding strong winds**. Test each model using a fan. Students redesign their models based on the results. This turns the textbook concept that high-speed winds create pressure differences capable of lifting roofs into an engineering-design challenge.

(9) **Student-Generated Digital Weather Bulletin:**
Students create a 2–3 minute **"Poornaprajna Weather News"** programme. One student becomes the weather presenter while others prepare maps, cyclone symbols, pressure readings, safety alerts and explanations. Instead of merely memorising terminology, students learn to **communicate scientific information to the public**.

(10) **Innovation Lab: From Problem to Prototype:**
Challenge students to identify one problem related to storms/cyclones and invent a simple solution—for example, a **low-cost wind-speed indicator, emergency cyclone kit, roof-protection model, rain gauge, flood-level warning device or wind-direction indicator**. They should follow the cycle: **Identify** → **Imagine** → **Design** → **Build** → **Test** → **Improve** → **Present**.

Five strongest ideas for the "Innovations" column
If this is being prepared for a **lesson plan/academic observation record**, we suggest recording these five in particular:

Innovation	Teaching–Learning Opportunity
Digital Cyclone Simulation	Visualising and manipulating conditions responsible for cyclone formation
DIY Smart Weather Station	Real-time data collection and experiential learning
Cyclone Control Room	Simulation, collaboration and disaster-management learning
QR-Code Science Trail	Extending learning beyond the classroom
Cyclone-Resistant House STEM Challenge	Design thinking, problem-solving and application of pressure concepts

These are more appropriately described as **"Innovations"** than ordinary classroom activities because they introduce **technology integration, simulation, interdisciplinary STEM, design thinking, authentic problem-solving and student-created learning experiences**.

6.17: Practicing Questions/Question Bank

A. Fill in the Blanks — 1 Mark Each:

1. Pressure is defined as ________ per unit area.
2. The SI unit of pressure is ________.
3. One pascal is equal to one ________ per square metre.
4. Liquids exert pressure in ________ directions.
5. The pressure exerted by a liquid increases with the ________ of its column.
6. The envelope of air surrounding the Earth is called the ________.
7. The pressure exerted by the air around us is called ________ pressure.
8. Air moves from a region of ________ pressure to a region of ________ pressure.
9. During the daytime, air generally moves from the ________ towards the land, producing a sea breeze.
10. High-speed winds are accompanied by ________ air pressure.
11. A storm accompanied by lightning and thunder is called a ________.
12. The sudden flow of electric charges produces a bright flash of light called ________.
13. The loud sound produced due to rapid expansion of air during lightning is called ________.
14. A metallic rod used to protect buildings from lightning is called a ________.
15. Cyclones generally form over ________ ocean waters.
16. The lowest-pressure region at the centre of a cyclone is called its ________.
17. The wind at the eye of a cyclone is generally ________.
18. The rotation of the ________ causes moving air in a cyclone to spin.
19. Cyclones gradually lose their strength after reaching ________.
20. In India, cyclones and thunderstorms are monitored by the ________.

Answer Key:

1. force 2. pascal (Pa) 3. newton 4. all 5. height 6. atmosphere 7. atmospheric 8. high, low 9. sea 10. reduced/lower 11. thunderstorm 12. lightning 13. thunder 14. lightning conductor 15. warm 16. eye 17. calm 18. Earth 19. land 20. India Meteorological Department (IMD)

The chapter specifically establishes that pressure is force per unit area, with pascal as its SI unit, and demonstrates that liquid pressure increases with the height of the water column.

B. One-Mark Questions

1. Define pressure.
2. Write the formula for calculating pressure.
3. State the SI unit of pressure.
4. What is one pascal?
5. Why are broad straps preferred for school bags?

6. Why does a sharp knife cut better than a blunt knife?
7. Why is the pointed end of a nail easier to drive into a wall?
8. Do liquids exert pressure only at the bottom of a container?
9. What happens to liquid pressure when the height of the liquid column increases?
10. Why are overhead water tanks placed at a height?
11. Define atmosphere.
12. What is atmospheric pressure?
13. In which direction does air move when there is a difference in pressure?
14. What is a sea breeze?
15. What is a land breeze?
16. What happens to air pressure when wind speed increases?
17. Define a storm.
18. What is lightning?
19. What is thunder?
20. Define a thunderstorm.
21. What is the function of a lightning conductor?
22. What is a cyclone?
23. What is meant by the eye of a cyclone?
24. What are the wind conditions at the eye of a cyclone?
25. Why does a cyclone lose strength after reaching land?
26. Name the organisation that monitors cyclones and thunderstorms in India.

These concepts are directly summarised in the chapter's “Snapshots” section.

C. Two-Mark Questions

1. Explain why a school bag with broad straps is more comfortable than one with narrow straps.
2. Why is it easier to cut an apple using the sharp edge of a knife than its blunt edge?
3. Why do people carrying heavy loads on their heads place a round piece of cloth under the load?
4. State any **two conclusions** about the pressure exerted by liquids.
5. Why are overhead water tanks placed at a considerable height?
6. Why is the base of a dam made broader than its top?
7. Give **two examples** to show that air exerts pressure.
8. Why does a rubber sucker stick firmly to a smooth surface?

9. Why are we not crushed by the enormous atmospheric pressure acting on our bodies?
10. Explain why air escapes from an inflated balloon when its mouth is left open.
11. What causes the formation of wind?
12. Differentiate between **sea breeze and land breeze**.
13. What happens when high-speed air is blown between two hanging balloons? Give a reason.
14. Why can high-speed winds blow away weak roofs?
15. Mention any **two precautions** to be followed during lightning.
16. What is a lightning conductor? How does it protect a building?
17. Differentiate between a **storm and a thunderstorm**.
18. State any two conditions/processes involved in the formation of a cyclone.
19. Why is the eye of a cyclone different from its surrounding region?
20. Mention any **two harmful effects** of cyclones.
21. Mention any **two precautions** that should be taken in a cyclone-prone area.

The chapter explains, for example, that high-speed winds create lower pressure above roofs; a sufficiently large pressure difference can therefore blow weak roofs away.

D. Three-Mark Descriptive Questions

1. **Explain the relationship between force, area and pressure. Give two examples from daily life.**
2. **Describe an activity to demonstrate that the pressure exerted by a liquid depends on the height of its column.**
3. **Describe an experiment to show that liquids exert pressure on the walls of their containers. What conclusion can you draw?**
4. Explain why the base of a dam is constructed much broader than its top.
5. Describe an activity using a paper plate and chart paper to demonstrate that atmospheric air exerts pressure.
6. Explain the working of a rubber sucker using the concept of atmospheric pressure.
7. **Explain how differences in air pressure cause the formation of winds.**
8. Explain the formation of sea breeze during the daytime.
9. Explain the formation of land breeze during the night.
10. Describe the two-balloon experiment that demonstrates that air moves from a region of high pressure to a region of low pressure.
11. **Describe an activity to demonstrate that high-speed winds are accompanied by reduced air pressure.**
12. Explain how high-speed winds can blow away the roofs of houses.
13. Explain briefly how clouds and rain are formed during a storm.

14. Explain how electric charges become separated inside thunderclouds.
15. **Explain the formation of lightning.**
16. Write any three safety precautions that should be followed during lightning.
17. Explain the construction and function of a lightning conductor.
18. **Explain the role of warm ocean water, moist air and low pressure in the formation of a cyclone.**
19. Describe the conditions at the eye and around the eye of a cyclone.
20. Explain any three ways in which cyclones cause damage to life, property and the environment.

The textbook describes charge separation in clouds and explains that when the insulating property of air brakes down, a sudden flow of charges produces lightning; the rapid heating and expansion of surrounding air produce thunder.

E. Five-Mark Descriptive / Long-Answer Questions

1. **What is pressure? Explain the relationship between force, area and pressure with suitable examples from everyday life.**
2. **Explain liquid pressure in detail. Describe suitable activities to demonstrate that:**
   (a) liquids exert pressure,
   (b) liquid pressure increases with the height of the liquid column, and
   (c) liquids exert pressure on the sides of containers.
3. **What is atmospheric pressure? Describe an activity to demonstrate atmospheric pressure and explain why atmospheric pressure does not crush our bodies.**
4. **Explain the formation of winds. Using the concept of pressure differences, explain the formation of both sea breeze and land breeze.**
5. **"High-speed winds are accompanied by reduced air pressure." Explain this statement with an experiment. How can this phenomenon result in roofs being blown away during storms?**
6. **Explain the complete process of formation of a thunderstorm**, beginning with the heating of land and ending with rain, lightning and thunder.
7. **Explain the process of lightning formation in detail.** Include charge separation in clouds, breakdown of the insulating property of air, formation of lightning and thunder.
8. **What precautions should be taken during lightning? Explain the role of a lightning conductor in protecting buildings.**
9. **Explain the formation of a cyclone step by step.** Include the roles of warm ocean water, rising moist air, condensation, heat release, low pressure and Earth's rotation.
10. **Describe the structure and behaviour of a cyclone.** Explain the eye of a cyclone, surrounding winds and rainfall, movement towards land and why a cyclone weakens after landfall.
11. **Cyclones can cause widespread destruction. Explain any five major effects of cyclones on coastal regions, people, agriculture and infrastructure.**

12. **Explain how people and authorities can reduce the loss of life and property during cyclones.** Discuss weather forecasts, IMD warnings, satellites, emergency kits and cyclone shelters.

13. **Compare a storm, thunderstorm and cyclone.** Explain their important features and the conditions responsible for their formation.

14. **“Differences in pressure are responsible for many phenomena discussed in this chapter.” Justify the statement** with examples involving liquid pressure, wind formation, sea/land breeze and high-speed winds.

15. **From warm ocean water to landfall, describe the life cycle of a cyclone. What happens to the cyclone after it reaches land, and why?**

For the 5-mark section, cyclone formation is particularly suitable for a **diagram-based long answer**. The chapter's illustration on page 92 shows winds moving from high-pressure regions toward the low-pressure centre, while the accompanying cyclone diagram identifies the eye.

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8th Standard Science Book Chapter 7

Chapter 7: Particulate Nature of Matter:

7.1 Summary of the Chapter:

Chapter 7: Particulate Nature of Matter — Summary

(1) **Matter is made up of extremely small particles** called constituent particles. These particles are so tiny that they cannot be seen even with an ordinary microscope.

(2) **There are spaces between the particles of matter**, known as **interparticle spaces**. When sugar dissolves in water, its particles occupy the available spaces between water particles.

(3) Particles of matter attract one another through **interparticle forces of attraction**. The strength of these forces depends on the nature of the substance and the distance between its particles.

(4) Matter commonly exists in **three physical states—solid, liquid, and gas**. Their different properties arise mainly from differences in interparticle spacing, attraction, and movement of particles.

(5) In **solids**, particles are closely packed and have very strong interparticle attraction. Therefore, solids have a **definite shape and definite volume**. Their particles cannot move freely but can vibrate about their fixed positions.

(6) When a solid is heated, its particles vibrate more vigorously. At its **melting point**, the attractive forces weaken sufficiently for the solid to change into a liquid. The melting point is the minimum temperature at which a solid melts at atmospheric pressure.

(7) In **liquids**, particles are slightly farther apart and the forces of attraction are weaker than in solids. Hence, liquids have a **definite volume but no fixed shape** and take the shape of their container.

(8) When a liquid is heated to its **boiling point**, its particles gain enough energy to move apart and escape into the gaseous state. **Evaporation**, unlike boiling, can occur slowly at the surface even below the boiling point.

(9) In **gases**, particles are far apart, move freely in all directions, and have negligible interparticle attraction. Therefore, gases have **neither a fixed shape nor a fixed volume** and occupy all the available space. Both liquids and gases are called **fluids** because they can flow.

(10) **Interparticle spacing is maximum in gases, less in liquids, and minimum in solids.** Hence, gases can be compressed considerably, while liquids are practically incompressible.

(11) **Particles of matter are constantly moving.** Their movement becomes faster when heat is supplied. For example, potassium permanganate spreads faster in hot water than in room-temperature or ice-cold water. Similarly, the fragrance of an incense stick spreads throughout a room because gas particles are continuously moving.

(12) **Thermal energy influences the physical state of matter.** As particles gain heat energy, their movement and spacing increase and the attractive forces become less effective, enabling changes from solid to liquid and ultimately to gas. Thus, the three states differ mainly in the **arrangement, spacing, attraction, and movement of their particles**.

7.2 Important Formulas:

The chapter 7 is **primarily conceptual and activity-based**. It does **not prescribe many mathematical formulae** for numerical problem-solving. Its quantitative elements mainly concern **temperature, volume, change in volume, and comparison of particle spacing/movement**. For a Grade 8 question bank, the following formulae and relationships are useful and remain closely aligned with the chapter.

No.	Concept	Formula / Relationship	Use
1	**Change in Volume**	$\Delta V = V_2 - V_1$	To calculate increase/decrease in volume
2	**Volume after change**	$V_2 = V_1 + \Delta V$	Finding final volume when volume increases
3	**Decrease in Volume**	Decrease $= V_1 - V_2$	Useful in compression/dissolution problems
4	**Percentage change in volume**	% Change $= [(V_2 - V_1)/V_1] \times 100$	Applied numerical questions involving compression
5	**Percentage decrease in volume**	% Decrease $= [(V_1 - V_2)/V_1] \times 100$	Gas-compression problems
6	**Combined volume before mixing**	$V_{total} = V_1 + V_2$	Comparing expected and actual volume after mixing
7	**Volume contraction on dissolution**	Contraction $= (V_{water} + V_{solute}) - V_{solution}$	Demonstrating interparticle spaces
8	**Temperature difference**	$\Delta T = T_2 - T_1$	Comparing heating/cooling conditions
9	**Celsius to Kelvin***	$K = °C + 273$	Extension/application questions
10	**Kelvin to Celsius***	$°C = K - 273$	Extension/application questions

*Kelvin conversion is **not explicitly taught as a formula in this chapter**, so it is better treated as an enrichment formula rather than a required textbook formula.

Important numerical values from the chapter
The chapter specifically gives the following melting points: **Ice = 0°C, Urea = 133°C, Iron = 1538°C**. These can be used to construct comparison, difference-in-temperature, and reasoning-based quantitative questions.
For example:
Temperature difference between melting points of iron and urea

$$\Delta T = 1538 - 133 = 1405°C$$

Quantitative relationship involving dissolution
An especially important relationship arises from the sugar-and-water experiment:

$$\boxed{V_{\text{solution}} < V_{\text{water}} + V_{\text{sugar}}}$$

This occurs because dissolved sugar particles occupy some of the **interparticle spaces between water particles**. The textbook explicitly observes that the solution's volume is less than the sum of the separate volumes of water and sugar.
Thus,

$$\boxed{\text{Volume contraction} = \left(V_{\text{water}} + V_{\text{sugar}}\right) - V_{\text{solution}}}$$

Quantitative relationship involving compression of gases
The syringe experiment demonstrates:

$$\boxed{\text{Compression} = V_{\text{initial}} - V_{\text{final}}}$$

and

$$\boxed{\%\ \text{Compression} = \frac{V_{\text{initial}} - V_{\text{final}}}{V_{\text{initial}}} \times 100}$$

The chapter itself does not state this percentage formula, but it can be used to create **applied/Olympiad-type numerical problems** based directly on the experiment. The experiment establishes that the volume of trapped air decreases under pressure because gas particles have large interparticle spaces, whereas water is practically incompressible.

Important relationships to remember

Although these are **not mathematical formulae**, they are important for solving application and reasoning problems:

Interparticle spacing:

$$\boxed{\text{Gas} > \text{Liquid} > \text{Solid}}$$

Interparticle attraction:

$$\boxed{\text{Solid} > \text{Liquid} > \text{Gas}}$$

Freedom of particle movement:

$$\boxed{\text{Gas} > \text{Liquid} > \text{Solid}}$$

The chapter summarizes solids as having minimum spacing and maximum attraction, liquids as intermediate, and gases as having maximum spacing and negligible attraction.

Effect of heating:

$$\boxed{\text{Increase in heat energy} \rightarrow \text{faster particle movement} \rightarrow \text{greater separation}}$$

The potassium permanganate experiment shows that particles spread fastest in hot water and slowest in ice-cold water.

Most important formula box for Grade 8

$$\boxed{\Delta V = V_2 - V_1}$$

$$\boxed{\Delta T = T_2 - T_1}$$

$$\boxed{\%\ \text{Change in Volume} = \frac{V_2 - V_1}{V_1} \times 100}$$

$$\boxed{\text{Volume Contraction} = (V_1 + V_2) - V_{\text{final}}}$$

$$\boxed{K = \ \ ^{\circ}C + 273} \text{ (Enrichment only)}$$

For this particular chapter, I would **not overload students with additional formulas**, because the textbook's learning focus is understanding the **particulate nature of matter, interparticle spacing and attraction, particle motion, and changes of state**, rather than mathematical calculation.

7.3 Fill-Up the Blank LOTS type questions with Answers: (40 Questions)

The following questions are based directly on the chapter 7 and focus on **LOTS (Lower Order Thinking Skills)**—mainly remembering, identifying, and recalling concepts and facts. The chapter establishes that matter consists of extremely small particles held together by interparticle forces of attraction.

1. Matter is composed of a large number of extremely small ___________.
   Answer: particles
2. The basic unit that makes up a larger piece of a substance is called a ___________ particle.
   Answer: constituent
3. Grinding chalk into fine powder is a ___________ change.
   Answer: physical

4. The spaces present between the constituent particles of matter are called __________ spaces.
   Answer: interparticle
5. The attractive forces that hold the constituent particles of matter together are called __________ attractions.
   Answer: interparticle
6. Acharya Kanad used the term __________ for tiny, indivisible and eternal particles of matter.
   Answer: Parmanu
7. Acharya Kanad's idea of Parmanu was written in the __________ Sutras.
   Answer: Vaisheshika
8. In solids, particles are __________ packed.
   Answer: tightly
9. Solids have a definite shape and definite __________.
   Answer: volume
10. Particles in a solid can only __________ or oscillate about their fixed positions.
    Answer: vibrate
11. The minimum temperature at which a solid melts into a liquid at atmospheric pressure is called its __________.
    Answer: melting point
12. The melting point of ice is __________ °C.
    Answer: 0
13. The melting point of urea is __________ °C.
    Answer: 133
14. The melting point of iron is __________ °C.
    Answer: 1538
15. Liquids have a definite __________ but no fixed shape.
    Answer: volume
16. A liquid takes the shape of the __________ in which it is kept.
    Answer: container
17. The interparticle attractions in liquids are slightly __________ than those in solids.
    Answer: weaker
18. The temperature at which a liquid boils and changes into vapour at atmospheric pressure is called its __________ point.
    Answer: boiling
19. The slow formation of vapour from the surface of a liquid below its boiling point is called __________.
    Answer: evaporation
20. Gases have neither a fixed shape nor a fixed __________.
    Answer: volume
21. Gas particles move freely in __________ directions.
    Answer: all
22. The interparticle attractions in gases are __________.
    Answer: negligible
23. Liquids and gases are collectively classified as __________ because both can flow.
    Answer: fluids
24. Gas particles have a __________ amount of space between them compared with particles of solids and liquids.
    Answer: large

25. Water is practically __________ when pressure is applied to it.
    Answer: incompressible
26. When sugar dissolves in water, its particles occupy the __________ between the water particles.
    Answer: spaces
27. Sand is __________ in water.
    Answer: insoluble
28. A few grains of potassium permanganate added to water eventually give the water a uniform __________ colour.
    Answer: pink
29. Potassium permanganate spreads fastest in __________ water.
    Answer: hot
30. The movement of particles __________ when heat is provided.
    Answer: increases
31. The fragrance of an incense stick spreads throughout a room because air particles are moving __________.
    Answer: constantly
32. Interparticle spacing is __________ in solids.
    Answer: minimum
33. Interparticle spacing is __________ in gases.
    Answer: maximum
34. Interparticle attraction is __________ in solids.
    Answer: maximum
35. Interparticle attraction is minimum or __________ in gases.
    Answer: negligible
36. The physical state of matter is influenced by the __________ energy of its particles.
    Answer: thermal
37. At the melting point, thermal energy helps overcome the __________ forces between particles.
    Answer: attractive
38. The tiny particles that make up all matter are atoms and __________.
    Answer: molecules
39. Two atoms of hydrogen combine to form a molecule of __________.
    Answer: hydrogen
40. A water molecule consists of two hydrogen atoms and __________ oxygen atom.
    Answer: one

These **40 LOTS fill-in-the-blank questions** cover the chapter's key terminology, properties of solids/liquids/gases, interparticle attraction and spacing, particle movement, melting and boiling, and basic atoms and molecules.

7.4 Fill-Up the Blank HOTS type questions with Answers: (35 Questions)

The following questions require students to **analyse situations, predict outcomes, compare particle behaviour, and apply concepts**, rather than merely recall definitions.

1. When sugar dissolves completely in water but the solution still tastes sweet, we can infer that sugar is present in the form of __________.
   Answer: constituent particles
2. If the total volume after dissolving sugar in water is less than the sum of their separate volumes, it provides evidence for the existence of __________ between water

particles.
Answer: interparticle spaces
3. If sand is added instead of sugar to water, the total volume increases because sand particles __________ rather than dissolve in water.
Answer: settle down
4. A student can easily push a syringe containing trapped air but finds it difficult to push one containing water. This indicates that the interparticle spacing is much __________ in gases than in liquids.
Answer: greater
5. When the pressure on compressed air in a syringe is released, the plunger tends to move back because the gas particles __________ again.
Answer: spread out
6. If two substances have different melting points, the one with the higher melting point generally has __________ interparticle forces of attraction.
Answer: stronger
7. Iron has a much higher melting point than ice; therefore, the attractive forces between the particles of iron can be inferred to be __________ than those in ice.
Answer: stronger
8. When a solid is heated until it melts, its particles gain enough thermal energy to overcome some of the __________ between them.
Answer: interparticle attractions
9. A liquid changes its shape when transferred from a bottle to a bowl because its particles can __________ within a limited space.
Answer: move
10. A solid retains its shape when transferred from one container to another because its particles remain in relatively __________ positions.
Answer: fixed
11. If a substance has a definite volume but takes the shape of whatever container it is placed in, its physical state is most likely __________.
Answer: liquid
12. If a substance occupies the entire available space of a closed container, it is most likely in the __________ state.
Answer: gaseous
13. When smoke introduced into one connected gas jar eventually spreads into another jar, it demonstrates that gas particles move freely in __________.
Answer: all directions
14. A student smells an incense stick from the opposite side of a room because fragrance particles are helped to spread by the constant motion of __________ particles.
Answer: air
15. If an incense stick is lit in a larger room, its fragrance can eventually spread through the available space because gas particles are in __________ motion.
Answer: constant
16. Potassium permanganate spreads faster in hot water than in cold water because particles move __________ when their thermal energy increases.
Answer: faster
17. If identical grains of potassium permanganate are placed in hot, room-temperature and ice-cold water, the colour will spread slowest in the __________ water.
Answer: ice-cold

18. Increasing the temperature of matter generally __________ the movement of its constituent particles.
Answer: increases
19. When a liquid reaches its boiling point, its particles acquire sufficient energy to move __________ from one another and escape into the gaseous state.
Answer: apart
20. Vapour formation throughout the liquid accompanied by bubble formation indicates __________ rather than evaporation.
Answer: boiling
21. If vapour is forming slowly only from the surface of a liquid below its boiling point, the process is __________.
Answer: evaporation
22. If the distance between constituent particles increases, the interparticle forces of attraction generally __________.
Answer: decrease
23. Of solid, liquid and gas, a substance that is easiest to compress would normally be a __________ because it has maximum interparticle spacing.
Answer: gas
24. If particles are closely packed, experience strong attraction, and only vibrate about their positions, the substance must be in the __________ state.
Answer: solid
25. If particles have negligible attraction and can move throughout all available space, the substance is in the __________ state.
Answer: gaseous
26. Milk spreads over a table when spilled, while the glass tumbler containing it retains its shape, because milk is a __________ whereas the tumbler is a solid.
Answer: liquid
27. Although rice flour takes the shape of its container, each individual grain retains its own shape; therefore, rice flour should be classified as a __________.
Answer: solid
28. If all the constituent particles of a chair could somehow be removed, __________ of the chair would remain.
Answer: nothing
29. When a balloon fixed over the mouth of a bottle expands after the bottle is placed in hot water, it can be inferred that heating causes the air particles inside to move more __________.
Answer: vigorously
30. As a solid changes into a liquid and then into a gas on continued heating, its interparticle spacing generally __________.
Answer: increases
31. As matter changes from solid → liquid → gas, the freedom of movement of its constituent particles generally __________.
Answer: increases
32. A substance whose particles possess sufficient energy to overcome interparticle attractions and move freely in all directions is in the __________ state.
Answer: gaseous
33. If thermal energy of particles decreases sufficiently, their movement would be expected to become __________.
Answer: slower

34. When a solid melts, its particles leave their fixed positions because their vibrations become increasingly __________.
Answer: vigorous
35. If interparticle attraction is maximum and interparticle spacing is minimum, the substance is most likely a __________.
Answer: solid

7.5 One-mark questions with Answers of LOTS Type: (40 Questions)

1. **What is matter composed of?**
Answer: Matter is composed of a large number of extremely small particles.
2. **What is a constituent particle?**
Answer: A constituent particle is the basic unit that makes up a larger piece of a substance or material.
3. **What are interparticle spaces?**
Answer: The spaces present between the constituent particles of matter are called interparticle spaces.
4. **What are interparticle attractions?**
Answer: The attractive forces that hold the constituent particles of matter together are called interparticle attractions.
5. **What determines the strength of interparticle attraction?**
Answer: The strength of interparticle attraction depends on the nature of the substance and the distance between its particles.
6. **What did Acharya Kanad call the tiny, indivisible particles of matter?**
Answer: Acharya Kanad called the tiny, indivisible particles of matter *Parmanu*.
7. **Name the work in which Acharya Kanad described the idea of Parmanu.**
Answer: Acharya Kanad described the idea of Parmanu in the *Vaisheshika Sutras*.
8. **State one characteristic of the shape of solids.**
Answer: Solids have a definite shape.
9. **How are the particles arranged in solids?**
Answer: The particles in solids are tightly packed and held in fixed positions.
10. **How do particles move in a solid?**
Answer: Particles in a solid vibrate or oscillate to and fro about their fixed positions.
11. **What happens to the particles of a solid when it is heated?**
Answer: The particles of a solid vibrate more vigorously when it is heated.
12. **What is the melting point of a solid?**
Answer: The melting point is the minimum temperature at which a solid melts into a liquid at atmospheric pressure.
13. **What is the melting point of ice?**
Answer: The melting point of ice is 0 °C.
14. **What is the melting point of iron?**
Answer: The melting point of iron is 1538 °C.
15. **Do liquids have a fixed shape?**
Answer: No, liquids do not have a fixed shape and take the shape of their container.
16. **Do liquids have a definite volume?**
Answer: Yes, liquids have a definite volume.
17. **How do the particles of a liquid move?**
Answer: The particles of a liquid can move freely within a limited space.
18. **How do the interparticle attractions in liquids compare with those in solids?**
Answer: Interparticle attractions in liquids are slightly weaker than those in solids.

19. **What is the boiling point of a liquid?**
    Answer: The boiling point is the temperature at which a liquid boils and turns into vapour at atmospheric pressure.
20. **Where does vapour formation occur during boiling?**
    Answer: During boiling, vapour formation occurs both at the surface and within the liquid.
21. **What is evaporation?**
    Answer: Evaporation is the slow formation of vapour from the surface of a liquid at temperatures below its boiling point.
22. **Do gases have a fixed shape?**
    Answer: No, gases do not have a fixed shape.
23. **Do gases have a fixed volume?**
    Answer: No, gases do not have a fixed volume.
24. **How do particles move in gases?**
    Answer: Gas particles move freely in all directions.
25. **How strong are the interparticle attractions in gases?**
    Answer: The interparticle attractions in gases are negligible.
26. **Why are liquids and gases called fluids?**
    Answer: Liquids and gases are called fluids because they can flow and do not retain a fixed shape.
27. **Which state of matter has the minimum interparticle spacing?**
    Answer: The solid state has the minimum interparticle spacing.
28. **Which state of matter has the maximum interparticle spacing?**
    Answer: The gaseous state has the maximum interparticle spacing.
29. **Which state of matter has the strongest interparticle attraction?**
    Answer: Solids have the strongest interparticle attraction.
30. **Which state of matter has negligible interparticle attraction?**
    Answer: Gases have negligible interparticle attraction.
31. **Why can gases be compressed easily?**
    Answer: Gases can be compressed easily because there is a large amount of space between their particles.
32. **Is water easily compressible?**
    Answer: No, water is practically incompressible.
33. **What happens to potassium permanganate when added to water?**
    Answer: Potassium permanganate gradually spreads throughout the water and gives it a uniform pink colour.
34. **In which type of water does potassium permanganate spread fastest?**
    Answer: Potassium permanganate spreads fastest in hot water.
35. **What happens to the movement of particles when heat is provided?**
    Answer: The movement of particles increases when heat is provided.
36. **Why can the fragrance of an incense stick be smelled throughout a room?**
    Answer: The fragrance spreads throughout the room because air particles are constantly moving and help the fragrance particles spread.
37. **What is Suspended Particulate Matter (SPM)?**
    Answer: Suspended Particulate Matter refers to tiny dust particles suspended in air.
38. **What are the tiny particles that make up all matter?**
    Answer: The tiny particles that make up all matter are atoms and molecules.
39. **How many hydrogen atoms combine to form a molecule of hydrogen?**
    Answer: Two hydrogen atoms combine to form a molecule of hydrogen.

40. **What is a water molecule made up of?**
Answer: A water molecule is made up of two hydrogen atoms and one oxygen atom.

7.6 One-mark questions with Answers of HOTS Type: (40 Questions)

1. **Why does water take the shape of a glass while the glass retains its own shape?**
Answer: Water particles can move past one another, whereas the strongly attracted particles of the solid glass remain in fixed positions.
2. **Why can a gas be compressed more easily than a liquid?**
Answer: A gas has much larger interparticle spaces than a liquid, so its particles can be pushed closer together.
3. **Why does sugar seem to disappear when dissolved in water?**
Answer: Sugar breaks into tiny constituent particles that occupy the spaces between water particles and are no longer visible.
4. **Why does the water level not increase greatly after sugar dissolves in it?**
Answer: The dissolved sugar particles occupy the available interparticle spaces between water particles.
5. **Why does sand increase the volume of water instead of disappearing in it like sugar?**
Answer: Sand is insoluble in water, so its particles settle and occupy additional space in the container.
6. **Why can you move your finger through water but not through a wooden block?**
Answer: Liquid particles have weaker interparticle attractions and can move aside, while solid particles are strongly held in fixed positions.
7. **Why does water regain its position after you remove your finger from it?**
Answer: The attractive forces between water particles keep them together and allow them to occupy the displaced space again.
8. **A solid has a very high melting point; what can you infer about its interparticle attraction?**
Answer: Its particles have strong interparticle attraction and therefore require more thermal energy to separate.
9. **Why does iron have a much higher melting point than ice?**
Answer: Iron has stronger interparticle forces of attraction than ice and therefore requires much more heat to melt.
10. **Why do the particles of a solid vibrate faster when the solid is heated?**
Answer: Heating increases the thermal energy of the particles, causing them to vibrate more vigorously.
11. **What happens to the interparticle attraction when a solid melts?**
Answer: The interparticle attraction weakens as the particles gain enough energy to move away from their fixed positions.
12. **Why does a liquid flow but a solid normally does not?**
Answer: Liquid particles can move past one another, whereas solid particles are held in fixed positions by strong attractive forces.
13. **Why does smoke spread throughout a gas jar when the separating glass plate is removed?**
Answer: Gas particles move freely in all directions and spread to occupy all the available space.
14. **Why does a gas not have a definite volume?**
Answer: Gas particles have negligible attraction and move freely to occupy the entire available space.

15. **Why are both liquids and gases classified as fluids?**
    Answer: Both liquids and gases can flow because their particles are able to move from one position to another.
16. **Why does the fragrance of an incense stick eventually reach all corners of a room?**
    Answer: Constantly moving air particles help the fragrance particles spread throughout the room.
17. **If an incense stick is lit in a larger room, why may its fragrance take longer to reach the far end?**
    Answer: The fragrance particles must spread through a greater volume of air before reaching the far end.
18. **Why does potassium permanganate eventually colour the entire water pink even without continuous stirring?**
    Answer: The constant movement of water particles causes the potassium permanganate particles to spread throughout the water.
19. **Why does potassium permanganate spread faster in hot water than in cold water?**
    Answer: Particles move faster in hot water because they possess greater thermal energy.
20. **If potassium permanganate is added to ice-cold water, what would you predict about the rate at which its colour spreads?**
    Answer: Its colour would spread slowly because particles move more slowly at a lower temperature.
21. **Why does a syringe containing trapped air allow its plunger to be pushed inward?**
    Answer: Air contains large interparticle spaces that can be reduced by applying pressure.
22. **Why does the plunger of a syringe move back when the pressure on compressed air is released?**
    Answer: The compressed gas particles spread apart again and push the plunger towards its original position.
23. **Why is it difficult to push the plunger of a syringe filled completely with water?**
    Answer: Water is practically incompressible because its particles have much less interparticle space than gases.
24. **A substance has a fixed volume but takes the shape of its container; which state is it most likely in and why?**
    Answer: It is a liquid because liquid particles can move while remaining sufficiently close together to maintain a definite volume.
25. **A substance fills every part of a closed container; what can you infer about its particles?**
    Answer: Its particles move freely in all directions with negligible interparticle attraction, indicating that it is a gas.
26. **Why does boiling occur throughout a liquid while evaporation occurs only at its surface?**
    Answer: At the boiling point particles throughout the liquid can escape as vapour, whereas below it vapour formation occurs slowly only at the surface.
27. **Why does spilled water disappear even when its temperature is below its boiling point?**
    Answer: Water undergoes evaporation from its surface even at temperatures below its boiling point.

28. **Why are solid particles unable to move freely despite having some interparticle space?**
Answer: Strong interparticle attractions hold solid particles in fixed positions despite the small spaces between them.
29. **If all constituent particles were removed from a chair, what would remain of the chair?**
Answer: Nothing of the chair would remain because matter is made entirely of constituent particles.
30. **Why can gases mix with one another more easily than solids?**
Answer: Gas particles move freely through large interparticle spaces, whereas solid particles are strongly held in fixed positions.
31. **Rice flour takes the shape of its container; why is it still classified as a solid rather than a liquid?**
Answer: Each individual grain of rice flour has a definite shape and volume even though the collection can be poured.
32. **Why does ocean water taste salty even though individual salt particles cannot be seen?**
Answer: Dissolved salt exists as extremely small constituent particles distributed throughout the water.
33. **What would happen to the movement of particles if the thermal energy of matter increased?**
Answer: The particles would move more vigorously as their thermal energy increased.
34. **Why does increasing the distance between particles weaken their attractive forces?**
Answer: Interparticle forces decrease drastically when the distance between constituent particles increases.
35. **If the attractive forces between the particles of a liquid become sufficiently weak on heating, what change would occur?**
Answer: The liquid would change into vapour as its particles gain enough energy to escape from the liquid state.
36. **Why does soap help remove an oily stain from cloth?**
Answer: Soap particles surround the oil, with one end attaching to the oil and the other mixing with water so that the oil can be washed away.
37. **A balloon fixed over a bottle expands when the bottle is placed in hot water; what does this indicate about the air inside?**
Answer: Heating makes the air particles move more vigorously and spread out, causing the balloon to expand.
38. **If the interparticle attraction of a substance is negligible and its interparticle spacing is maximum, what state would you predict?**
Answer: The substance would be in the gaseous state because these are characteristic properties of gases.
39. **Why does melting change the shape-related behaviour of a substance?**
Answer: Melting weakens interparticle attraction enough for particles to leave their fixed positions and move around.
40. **Why can thermal energy determine the physical state of matter?**
Answer: Thermal energy affects particle movement, interparticle distance, and the ability of particles to overcome attractive forces.

7.7 Two-mark questions with Answers of LOTS Type: (25 Questions)

These questions focus mainly on **Remembering and Understanding (LOTS)**, with each answer given in **two clear sentences/points**, based strictly on the chapter 7.

1. **What are constituent particles of matter?**
   Answer:
    1. Constituent particles are the basic units that make up a substance or material.
    2. Matter is composed of a very large number of such extremely small particles.
2. **What are interparticle spaces? Explain briefly.**
   Answer:
    1. The spaces present between the constituent particles of matter are called interparticle spaces.
    2. Dissolved sugar particles can occupy the available spaces between water particles.
3. **What are interparticle attractions? What determines their strength?**
   Answer:
    1. The attractive forces that hold constituent particles of matter together are called interparticle attractions.
    2. Their strength depends on the nature of the substance and the distance between its particles.
4. **State any two characteristics of particles in solids.**
   Answer:
    1. The particles in solids are tightly packed and have very strong interparticle attractions.
    2. They remain in fixed positions and can only vibrate or oscillate about these positions.
5. **Why do solids have a definite shape and volume?**
   Answer:
    1. The particles of solids are tightly packed and held together by very strong forces of attraction.
    2. These forces keep the particles in fixed positions and prevent them from moving freely.
6. **What happens to the particles of a solid when it is heated?**
   Answer:
    1. The particles gain thermal energy and begin to vibrate more vigorously.
    2. On sufficient heating, the forces of attraction weaken and the particles start leaving their fixed positions.
7. **Define melting point and give one example.**
   Answer:
    1. Melting point is the minimum temperature at which a solid melts to become a liquid at atmospheric pressure.
    2. The melting point of ice is **0°C**, while that of iron is **1538°C**.
8. **State any two properties of liquids.**
   Answer:
    1. Liquids do not have a fixed shape and take the shape of the container in which they are kept.
    2. Liquids have a definite volume because their particles can move only within a limited space.
9. **How are particles arranged in liquids?**
   Answer:
    1. The particles in liquids are somewhat farther apart than those in solids.

2. Their interparticle attractions are weaker than in solids, allowing them to move past one another.

10. **Define boiling point and explain what happens at this temperature.**
Answer:
    1. The temperature at which a liquid boils and changes into vapour at atmospheric pressure is called its boiling point.
    2. At this temperature, particles move vigorously, overcome attractive forces and escape from the liquid.
11. **What is evaporation? How is it different from boiling?**
Answer:
    1. Evaporation is the slow formation of vapour from the surface of a liquid at temperatures below its boiling point.
    2. Boiling involves rapid vapour formation both at the surface and within the liquid.
12. **State any two properties of gases.**
Answer:
    1. Gases have neither a fixed shape nor a fixed volume and occupy all the available space.
    2. Their particles move freely in all directions because interparticle attractions are negligible.
13. **Why are liquids and gases called fluids?**
Answer:
    1. Both liquids and gases can flow from one place to another.
    2. They do not retain a fixed shape and take the shape of the container in which they are kept.
14. **Describe the interparticle spacing in solids, liquids and gases.**
Answer:
    1. Interparticle spacing is minimum in solids and slightly greater in liquids.
    2. Gases have the maximum interparticle spacing among the three states of matter.
15. **Describe the interparticle attraction in the three states of matter.**
Answer:
    1. Interparticle attraction is strongest in solids and slightly weaker in liquids.
    2. In gases, interparticle attraction is minimum or negligible.
16. **What does the syringe experiment show about gases?**
Answer:
    1. When the plunger is pushed, the volume of trapped air decreases because gas particles are forced closer together.
    2. This shows that gases have large interparticle spaces and can be compressed by applying pressure.
17. **What happens when sugar is dissolved in water?**
Answer:
    1. Sugar breaks into its constituent particles and spreads through the water.
    2. The sugar particles occupy the available interparticle spaces between the water particles.
18. **What happens when sand is added to water?**
Answer:
    1. Sand does not dissolve in water and its particles settle at the bottom.
    2. The sand particles occupy space in the container and cause the total volume to increase.

19. **What happens when potassium permanganate is added to water?**
    Answer:
    1. Initially, streaks of pink colour spread from the potassium permanganate grain.
    2. After some time, the particles spread throughout the water and give it a uniform pink colour.
20. **How does temperature affect the movement of particles in water?**
    Answer:
    1. Water particles move faster in hot water and more slowly in cold water.
    2. Thus, the movement of particles increases when heat is provided.
21. **How does the incense-stick activity demonstrate the movement of gas particles?**
    Answer:
    1. The fragrance of an incense stick gradually spreads from one corner throughout the room.
    2. This happens because constantly moving air particles hit the fragrance particles and help them spread.
22. **How does thermal energy affect the physical state of matter?**
    Answer:
    1. Thermal energy affects the movement and distance between the constituent particles of matter.
    2. Increasing thermal energy enables particles to overcome attractive forces and can cause a change of state.
23. **Give two differences between solids and liquids based on their particles.**
    Answer:
    1. Solid particles are closely packed and have stronger interparticle attractions, while liquid particles are comparatively farther apart with weaker attractions.
    2. Solid particles remain in fixed positions, whereas liquid particles can move past one another.
24. **Give two differences between liquids and gases.**
    Answer:
    1. Liquids have a definite volume, whereas gases have no definite volume.
    2. Liquid particles have limited movement, whereas gas particles move freely throughout the available space.
25. **How does soap help in removing oil from clothes?**
    Answer:
    1. Soap particles surround the oil particles present on the fabric, with one end of the soap particle attaching to the oil.
    2. The other end mixes with water, helping to lift the oil from the fabric and wash it away.

7.8. Two-mark questions with Answers of HOTS Type: (25 Questions)

The following questions are designed to test **application, analysis, reasoning, prediction and inference**, rather than simple recall. They are based on the concepts and activities in the chapter 7, especially interparticle spacing, attraction, particle movement and changes of state.

1. **A student says, "Sugar disappears when it is dissolved in water." Do you agree? Justify your answer.**
   Answer:
   1. No, sugar does not disappear; it breaks into extremely small constituent particles that spread throughout the water.

    2. These particles occupy the interparticle spaces between water particles, and their presence can still be detected by taste.

2. **Why can you move your finger through water but not through a wooden block?**
   Answer:
    1. In water, the interparticle attractions are weaker, allowing particles to move aside when the finger passes through.
    2. In wood, the particles are tightly packed with strong attractions and remain in fixed positions.
3. **Two identical grains of potassium permanganate are placed separately in hot and cold water. Predict which will spread faster and explain why.**
   Answer:
    1. Potassium permanganate will spread faster in hot water.
    2. Heating increases the movement of water particles, causing them to spread the potassium permanganate particles more rapidly.
4. **Why does the smell of perfume spread throughout a room even if perfume is sprayed only in one corner?**
   Answer:
    1. Air particles are constantly moving and collide with the fragrance particles.
    2. These collisions help the fragrance particles spread throughout the available space in the room.
5. **A student transfers 200 mL of water from a tall bottle to a wide bowl. Predict what will happen to its shape and volume.**
   Answer:
    1. The water will change its shape and take the shape of the wide bowl because liquid particles can move past one another.
    2. Its volume will remain 200 mL because liquids have a definite volume.
6. **Air and water are separately trapped in two syringes. Which syringe can be compressed more easily? Why?**
   Answer:
    1. The syringe containing air can be compressed more easily because gas particles have large spaces between them.
    2. Water is practically incompressible because its particles have much less interparticle space.
7. **Why does the plunger of an air-filled syringe move back when the pressure on it is released?**
   Answer:
    1. Compression forces the gas particles closer together by reducing the spaces between them.
    2. When pressure is released, the particles spread out again and push the plunger towards its original position.
8. **Ice, urea and iron have melting points of 0°C, 133°C and 1538°C respectively. What can you infer about their interparticle attractions?**
   Answer:
    1. Iron has the strongest interparticle attractions among the three because it requires the highest temperature to melt.
    2. Ice has comparatively weaker attractions because it melts at a much lower temperature.
9. **Why does smoke eventually fill both gas jars when the glass plate separating them is removed?**
   Answer:

1. Gas particles move freely in all directions because their interparticle attractions are negligible.
2. Therefore, the smoke spreads through the available space instead of remaining confined to one jar.

10. **A student says that the empty spaces between particles of a solid must contain air. Is this reasoning correct? Explain.**
    Answer:
    1. No, the interparticle spaces in a solid are not filled with air.
    2. The chapter explains that although some space exists even between closely packed solid particles, these spaces contain nothing.
11. **Rice flour takes the shape of the container in which it is kept. Does this mean rice flour is a liquid? Justify.**
    Answer:
    1. No, rice flour consists of many tiny solid grains, and each individual grain has its own definite shape and volume.
    2. The collection appears to take the container's shape because the separate solid grains can rearrange themselves.
12. **A glass of milk falls on the floor. The milk spreads, but the glass pieces retain their shapes. Explain this using the particle model.**
    Answer:
    1. Milk is a liquid whose particles can move past one another, so it flows and spreads over the floor.
    2. Glass is a solid with strongly held particles in fixed positions, so its broken pieces retain definite shapes.
13. **Why does adding sugar to water not increase the final volume by an amount equal to the volume of sugar added?**
    Answer:
    1. When sugar dissolves, its constituent particles occupy some of the available spaces between water particles.
    2. Therefore, the volume of the solution can be less than the sum of the separate volumes of sugar and water.
14. **Sand and sugar are both solids, yet sugar dissolves in water while sand does not. What does this suggest about their particles?**
    Answer:
    1. Water particles can pull out and spread the constituent particles of sugar through the water.
    2. In substances such as sand, the constituent particles are held together strongly enough that water particles cannot pull them out.
15. **Why does ocean water taste salty even though individual salt particles cannot be seen?**
    Answer:
    1. Dissolved salt is broken into extremely small constituent particles that spread throughout the water.
    2. These particles are too small to be seen individually but can still be detected through the salty taste.
16. **A student heats a solid continuously until it becomes a liquid. Explain what happens to its particles during this process.**
    Answer:
    1. Heating increases the thermal energy of the particles, making them vibrate more vigorously.

2. Eventually, they overcome some of the attractive forces and leave their fixed positions, converting the solid into a liquid.

17. **Why are gases much more compressible than liquids?**
Answer:
    1. Gas particles have maximum interparticle spacing, so external pressure can force them much closer together.
    2. Liquid particles are already relatively close together and therefore have much less space available for compression.
18. **If the attractive forces between the particles of a gas suddenly became very strong, predict how its properties would change.**
Answer:
    1. The particles would come closer together and their free movement would become restricted.
    2. Consequently, the substance would no longer show the typical properties of a gas, such as freely filling all available space.
19. **Why does boiling occur throughout a liquid, whereas evaporation occurs only at its surface?**
Answer:
    1. At the boiling point, particles throughout the liquid have sufficient energy to escape, resulting in rapid vapour formation and bubbles.
    2. Below the boiling point, vapour formation is slower and occurs only from particles at the liquid surface.
20. **Suppose all the constituent particles were removed from a wooden chair. What would remain? Give a reason.**
Answer:
    1. Nothing of the chair would remain because the chair itself is made up entirely of constituent particles.
    2. Removing all those particles means removing all the matter that forms the chair.
21. **Why does a liquid regain its position after you remove your finger from it?**
Answer:
    1. The finger only temporarily displaces the liquid particles because they can move past one another.
    2. The attractive forces between the particles are still strong enough to keep them together, so the liquid occupies the space again.
22. **An inflated balloon is heavier than an empty balloon even though air cannot be seen. What does this indicate?**
Answer:
    1. Air is matter made up of extremely small particles even though these particles are invisible to our eyes.
    2. These particles contribute mass, so adding air can increase the weight of the balloon.
23. **A balloon is fixed over the mouth of a bottle and the bottle is placed in hot water. Predict what will happen and explain why.**
Answer:
    1. The balloon is expected to inflate as the air inside the bottle is heated.
    2. Heating increases the movement of air particles, causing them to spread and push against the balloon.

24. **Why can gases fill an entire room while liquids remain confined to the lower part of a container?**
    Answer:
    1. Gas particles have negligible attractions and move freely throughout all available space.
    2. Liquid particles have stronger attractions and their movement is restricted to a limited space, giving liquids a definite volume.
25. **Ice changes into water and then into water vapour on continuous heating. Relate these changes to interparticle attraction and movement.**
    Answer:
    1. During melting, particles gain energy, move away from fixed positions and experience reduced interparticle attraction.
       2. With further heating, they gain enough energy to overcome attractive forces and move freely as gas particles.

7.9. Three-mark questions with Answers of LOTS Type: (15 Questions)

1. What are constituent particles? Explain their role in matter.
Answer:
1. Matter is made up of a very large number of extremely small particles.
2. The basic units that make up a substance or material are called its **constituent particles**.
3. For example, a piece of chalk consists of a large number of constituent particles of chalk.

2. What are interparticle spaces? Explain with the example of sugar dissolving in water.
Answer:
1. The spaces present between the constituent particles of matter are called **interparticle spaces**.
2. When sugar dissolves in water, it breaks up into tiny constituent particles.
3. These sugar particles occupy the available spaces between the water particles.

3. What are interparticle attractions? State their importance.
Answer:
1. The attractive forces that hold the constituent particles of matter together are called **interparticle attractions**.
2. Their strength depends on the nature of the substance and the distance between its particles.
3. The strength of these attractions helps determine the physical state of a substance.

4. Describe three characteristics of particles in the solid state.
Answer:
1. In solids, particles are tightly packed and have very little interparticle space.
2. The interparticle forces of attraction are very strong and keep the particles in fixed positions.
3. The particles cannot move freely but can vibrate or oscillate about their fixed positions.

5. Explain what happens to the particles of a solid when it is heated.
Answer:
1. When a solid is heated, its particles begin to vibrate more vigorously.
2. With further heating, the interparticle forces become weaker and the particles begin to leave their fixed positions.
3. At the melting point, the solid changes into the liquid state.

6. What is melting point? How is it related to interparticle attraction?
Answer:

1. The minimum temperature at which a solid melts into a liquid at atmospheric pressure is called its **melting point**.
2. Solids having weak interparticle attractions generally have lower melting points.
3. Solids having strong interparticle attractions generally have higher melting points.

7. Describe three important properties of liquids.

Answer:

1. Liquids do not have a fixed shape and take the shape of the container in which they are kept.
2. Liquids have a definite volume.
3. Their particles can move freely, but only within a limited space.

8. What is boiling point? What happens to liquid particles during boiling?

Answer:

1. The temperature at which a liquid boils and changes into vapour at atmospheric pressure is called its **boiling point**.
2. During boiling, the movement of liquid particles becomes very vigorous and the particles move farther apart.
3. Eventually, the particles escape from the liquid and the substance changes into the gaseous state.

9. Differentiate between boiling and evaporation.

Answer:

1. Boiling occurs at the boiling point, whereas evaporation can occur at temperatures below the boiling point.
2. During boiling, vapour formation is very fast, whereas evaporation is a slower process.
3. Boiling occurs throughout the liquid, while evaporation takes place only at the surface.

10. Describe three characteristics of gases.

Answer:

1. Gases have neither a fixed shape nor a fixed volume.
2. Their particles move freely in all directions and occupy all the available space.
3. The interparticle forces of attraction between gas particles are negligible.

11. Why are liquids and gases called fluids?

Answer:

1. Both liquids and gases have particles that can move from one position to another.
2. Therefore, both liquids and gases can flow.
3. Since they flow and do not retain a fixed shape, liquids and gases are collectively called **fluids**.

12. Describe the compressibility of gases using the syringe experiment.

Answer:

1. When the plunger of an air-filled syringe is pushed while its opening is closed, the volume of air decreases.
2. The gas particles are forced closer together because there is a large amount of space between them.
3. Thus, gases can be compressed by applying external pressure.

13. Describe the interparticle spacing in solids, liquids and gases.

Answer:

1. In solids, interparticle spacing is minimum because the particles are closely packed.
2. In liquids, the spacing is slightly greater than in solids.
3. In gases, interparticle spacing is maximum because the particles are far apart and move freely.

14. Explain the movement of potassium permanganate particles in water.

Answer:

1. When potassium permanganate is added to water, pink streaks initially spread from its grains.
2. The constantly moving water particles pull out and hit the potassium permanganate particles, causing them to spread.
3. After some time, the particles spread throughout the water and give it a uniform pink colour.

15. How does temperature affect the movement of particles in water?
Answer:
1. Water particles move faster in hot water than in water at room temperature.
2. They move still more slowly in ice-cold water.
3. Therefore, the movement of particles increases when heat is provided.

7.10. Three-mark questions with Answers of HOTS Type: (18 Questions)

The following questions are designed as **Higher Order Thinking Skills (HOTS)** questions requiring students to **apply, analyse, compare, predict, infer and justify** using concepts from the 7th chapter. Each answer contains **three points/sentences suitable for 3 marks**. The chapter establishes that differences among solids, liquids and gases arise from interparticle spacing, attraction and particle movement.

1. A student adds sugar to water and observes that the sugar disappears, but the water tastes sweet. What can you infer from this observation?
Answer:
1. The sugar has not disappeared; it has broken into extremely small constituent particles that cannot be seen.
2. These sugar particles occupy the available interparticle spaces between the water particles.
3. The sweet taste proves that sugar particles are still present and distributed throughout the water.

2. A metal spoon keeps its shape when placed in different containers, whereas water changes its shape. Explain this difference using the particle model.
Answer:
1. In the metal spoon, particles are tightly packed and held in fixed positions by strong interparticle attractions.
2. In water, the attractive forces are weaker, allowing its particles to move past one another within a limited space.
3. Therefore, the spoon retains a fixed shape while water takes the shape of its container.

3. Air in a closed syringe can be compressed easily, but water cannot. What does this tell you about their particle arrangement?
Answer:
1. Gas particles have large interparticle spaces, so they can be pushed closer together when pressure is applied.
2. The particles of water are much closer together and have comparatively less interparticle space.
3. Hence, air can be compressed considerably, while water is practically incompressible.

4. Potassium permanganate spreads faster in hot water than in cold water. Why?
Answer:
1. Heating increases the movement of water particles.
2. Therefore, water particles move faster in hot water and spread the potassium permanganate particles more quickly.

3. This demonstrates that the movement of particles increases when heat is provided.

5. A student says, "Since rice flour takes the shape of its container, it must be a liquid." Do you agree? Justify your answer.

Answer:

1. No, rice flour is a collection of many tiny solid particles, and each individual particle has its own definite shape and volume.
2. The particles can move and rearrange themselves when the flour is transferred to another container.
3. Therefore, the bulk flour may take the container's shape, but this does not make rice flour a liquid.

6. A bottle filled with air is connected to a larger empty container. Predict what will happen to the air when it is allowed to enter the larger container.

Answer:

1. The air particles will move freely from the bottle into the larger container.
2. Since interparticle attractions in gases are negligible, the particles will spread throughout all the available space.
3. Therefore, the air will occupy the entire larger container rather than remaining confined to the original volume.

7. Why can you move your finger easily through water but not through a wooden block?

Answer:

1. In water, interparticle attractions are weaker, allowing the particles to move and be temporarily displaced by the finger.
2. In a wooden block, particles are strongly attracted and held in fixed positions.
3. Hence, the finger can pass through water by displacing its particles but cannot similarly pass through the solid block.

8. Iron melts at 1538 °C, while ice melts at 0 °C. What can you infer about the interparticle forces in these two substances?

Answer:

1. A higher melting point generally indicates that more thermal energy is required to overcome the interparticle attractions.
2. Iron's very high melting point indicates much stronger attractive forces than those associated with the much lower melting point of ice.
3. Thus, substances with stronger interparticle attractions generally have higher melting points.

9. A student lights an incense stick in one corner of a classroom. After some time, students sitting far away can smell it. What does this observation prove?

Answer:

1. The fragrance particles spread from the incense stick throughout the classroom.
2. Constantly moving air particles hit the fragrance particles and help them spread.
3. This observation provides evidence that gas particles are continuously moving and can spread throughout the available space.

10. Milk spills from a glass and spreads over a table, while the glass retains its shape. Explain using the particulate nature of matter.

Answer:

1. Milk is a liquid whose particles can move past one another because their interparticle attractions are weaker than those in solids.
2. The glass is a solid whose particles are strongly held in fixed positions.
3. Therefore, milk flows and spreads over the table, whereas the glass retains its definite shape.

11. When sugar is dissolved in water, the final volume may be less than the combined volumes of sugar and water. Why?

Answer:

1. Water contains spaces between its constituent particles.
2. When sugar dissolves, its particles enter and occupy some of these interparticle spaces.
3. Therefore, the volume of the solution can be less than the sum of the separate volumes of sugar and water.

12. Sugar dissolves in water, whereas sand settles at the bottom. Explain this difference based on the chapter.

Answer:

1. Water particles can pull constituent particles out of substances such as sugar and spread them throughout the liquid.
2. In substances such as sand, the constituent particles are held together so strongly that water particles cannot pull them out.
3. Hence, sugar dissolves in water, while sand remains insoluble and settles at the bottom.

13. Predict what will happen to a balloon fixed over the mouth of a bottle when the bottle is placed in hot water. Give reasons.

Answer:

1. The balloon is expected to expand when the bottle is placed in hot water.
2. Heating gives more thermal energy to the air particles inside the bottle, increasing their movement.
3. The faster-moving air particles spread and push into the balloon, causing it to inflate.

14. A solid is heated continuously until it becomes a liquid and then a gas. Explain the changes occurring in its particles.

Answer:

1. On heating the solid, its particles gain thermal energy, vibrate more vigorously and eventually overcome enough attraction to leave their fixed positions.
2. In the liquid state, particles have greater spacing and can move around within a limited space.
3. With further heating, they gain enough energy to overcome attractive forces and move freely in all directions as a gas.

15. If all the constituent particles of a chair could somehow be removed, would the chair merely become lighter? Justify your answer.

Answer:

1. No, the chair would not simply become lighter because matter itself is made up of constituent particles.
2. The chair exists because a large number of these particles together form its material.
3. If all its constituent particles were removed, **nothing of the chair would remain**.

16. Two students say: "Particles in a solid do not move at all." Is this statement correct? Explain.

Answer:

1. The statement is not correct because particles in solids are not completely motionless.
2. Strong interparticle attractions prevent them from moving freely, but they can vibrate or oscillate about their fixed positions.
3. When the solid is heated, these vibrations become more vigorous and may eventually lead to melting.

17. Why does adding sand to water increase the total volume, whereas dissolved sugar may not increase it by the same amount?

Answer:

1. Sugar dissolves and its tiny particles occupy some of the available spaces between water particles.
2. Sand does not dissolve; instead, its particles settle down and occupy additional space in the container.
3. Hence, adding sand increases the total volume more directly, while dissolved sugar occupies interparticle spaces in water.

18. A student claims that the empty spaces between particles of a solid must contain air. Is the claim correct? Justify.

Answer:

1. No, the claim is incorrect because even closely packed solid particles have small spaces between them.
2. According to the chapter, these interparticle spaces are **not filled with air**.
3. The spaces between the constituent particles contain nothing at all.

7.11 Five-mark questions with Answers of LOTS Type: (12 Questions)

The following are **LOTS (Lower Order Thinking Skills)** questions focusing mainly on **remembering, understanding, describing, explaining, and comparing** concepts directly presented in the chapter. The chapter summarises matter in terms of interparticle spacing, attraction, and particle movement in solids, liquids, and gases.

1. What are constituent particles of matter? Explain their important characteristics.

Answer:

1. Matter is made up of a very large number of extremely small particles.
2. These basic units that make up a substance or material are called **constituent particles**.
3. Constituent particles are extremely small and cannot be seen even through an ordinary microscope.
4. There are spaces between these particles called **interparticle spaces**.
5. The particles are held together by attractive forces called **interparticle attractions**.

2. Describe the main characteristics of the solid state of matter.

Answer:

1. Solids have a **definite shape and definite volume**.
2. The constituent particles in solids are **tightly packed** with minimum interparticle spacing.
3. The **interparticle forces of attraction are very strong** in solids.
4. These strong forces hold the particles in fixed positions and prevent them from moving freely.
5. The particles can only **vibrate or oscillate about their fixed positions** and cannot move past one another.

3. Describe the main characteristics of the liquid state of matter.

Answer:

1. Liquids have a **definite volume but no fixed shape**.
2. They take the shape of the container in which they are kept.
3. The particles of liquids can move freely, but only within a limited space.
4. The interparticle attractions in liquids are **slightly weaker than those in solids**.
5. The particles remain close together but can move past one another, which enables liquids to flow.

4. Describe the main characteristics of the gaseous state of matter.

Answer:

1. Gases have **neither a fixed shape nor a fixed volume**.
2. They take the shape of the container in which they are present.

3. Gas particles move freely in all directions and occupy the entire available space.
4. The interparticle spacing in gases is very large compared with solids and liquids.
5. The interparticle attractions between gas particles are **negligible**, allowing them to move freely.

5. Explain what happens when a solid is heated and changes into a liquid.
Answer:
1. In a solid, particles are held in fixed positions by strong interparticle attractions.
2. When the solid is heated, its particles begin to vibrate more vigorously.
3. With continued heating, the vibrations become strong enough for particles to start leaving their fixed positions.
4. The interparticle forces of attraction weaken, and the solid changes into a liquid.
5. The minimum temperature at which a solid changes into a liquid at atmospheric pressure is called its **melting point**.

6. What is boiling? Explain how a liquid changes into a gaseous state.
Answer:
1. When a liquid is heated, the movement of its particles becomes increasingly vigorous.
2. The particles begin to move farther apart, reducing the interparticle forces of attraction.
3. Eventually, the particles acquire enough energy to escape from the liquid and form vapour.
4. The temperature at which a liquid boils and changes into vapour at atmospheric pressure is called its **boiling point**.
5. At the boiling point, vapour formation occurs rapidly both at the surface and within the liquid, producing bubbles.

7. Compare the interparticle spacing and attraction in solids, liquids, and gases.
Answer:
1. In **solids**, interparticle spacing is minimum and the particles are closely packed.
2. In **liquids**, interparticle spacing is slightly greater than in solids and the particles are a little more loosely packed.
3. In **gases**, interparticle spacing is maximum and the particles are far apart and free to move.
4. Interparticle attraction is **maximum in solids, slightly weaker in liquids, and negligible in gases**.
5. These differences in spacing and attraction are responsible for the different properties of the three states of matter.

8. Describe Activity 7.7 that demonstrates the presence of spaces between water particles.
Answer:
1. Take a glass vessel half-filled with water, mark its level, and add two teaspoons of sugar.
2. Mark the new water level and then stir the mixture with a glass rod until the sugar dissolves completely.
3. Initially, the water level increases when sugar is added, but after dissolution it may decrease to some extent.
4. The volume of the resulting solution is less than the sum of the separate volumes of water and sugar.
5. This demonstrates that **spaces exist between water particles and dissolved sugar particles occupy these spaces**.

9. Describe the experiment using potassium permanganate that demonstrates the movement of particles in liquids.
Answer:
1. Take a glass tumbler containing water and add a few grains of potassium permanganate.
2. Initially, streaks of pink colour can be seen spreading from the grains.

3. After some time, the entire water in the tumbler becomes uniformly pink.
4. This happens because water particles are constantly moving and help spread the potassium permanganate particles throughout the liquid.
5. The experiment therefore demonstrates that **particles in liquids are in constant motion**.

10. Explain how the movement of particles is affected by temperature.

Answer:

1. The movement of particles increases when heat is supplied to a substance.
2. Water particles move faster in hot water than in water at room temperature.
3. They move still more slowly in ice-cold water.
4. Therefore, potassium permanganate spreads fastest in hot water, more slowly at room temperature, and slowest in ice-cold water.
5. This shows that **heating increases the movement of particles by increasing their thermal energy**.

11. Explain the syringe experiment used to study interparticle spacing in gases.

Answer:

1. Take a syringe without a needle, pull the plunger outward, and close its open end with your thumb.
2. When the plunger is pushed inward, the volume of the trapped air decreases.
3. The air particles are forced to come closer together because gases have large spaces between their particles.
4. When pressure on the plunger is removed, the gas particles spread again and the plunger moves back.
5. This experiment shows that **gases have large interparticle spaces and can be compressed by applying external pressure**.

12. Explain how an incense-stick activity demonstrates the movement of gas particles.

Answer:

1. An incense stick is lit in one corner of a room and allowed to burn for a few minutes.
2. Initially, its fragrance is experienced only near the burning incense stick.
3. After some time, the fragrance can be smelled throughout the room.
4. Constantly moving air particles hit the fragrance particles and help them spread throughout the room.
5. Therefore, the activity demonstrates that **particles of gases are constantly moving and spread through the available space**.

7.12 Five-mark questions with Answers of HOTS Type: (12 Questions)

The following questions require students to **apply, analyse, justify, predict, compare, and infer** using the concepts of interparticle spacing, attraction, movement, and thermal energy explained in the chapter.

1. A student says, "Rice flour takes the shape of a container, so it must be a liquid." Do you agree? Justify your answer.

Answer:

1. No, rice flour is not a liquid; each individual grain of rice flour is a **solid particle**.
2. Each grain has its own definite shape and volume, even though it is extremely small.
3. The grains are not joined together like the constituent particles of a single liquid.
4. When poured into a container, the individual grains rearrange themselves and collectively appear to take its shape.
5. Therefore, taking the shape of a container alone is **not sufficient to classify a substance as a liquid**.

2. Why can air in a syringe be compressed easily, whereas water in a syringe is practically incompressible? Analyse using the particle model.
Answer:
1. Gas particles have **large interparticle spaces** between them.
2. When the syringe plunger is pushed, these particles can be forced closer together.
3. Hence, the volume of trapped air decreases considerably under pressure.
4. In liquids, particles are already much closer together, leaving much less space for further compression.
5. Therefore, air is easily compressible, whereas water is **practically incompressible**.

3. Three students add potassium permanganate separately to hot, room-temperature, and ice-cold water. Predict the order in which the colour will spread and justify your prediction.
Answer:
1. The colour will spread **fastest in hot water**, followed by room-temperature water and slowest in ice-cold water.
2. Heating provides more thermal energy to the water particles.
3. Therefore, particles in hot water move faster and spread the potassium permanganate particles more quickly.
4. Particles in ice-cold water have less thermal energy and hence move more slowly.
5. Thus, the experiment shows that **particle movement increases with an increase in temperature**.

4. A student adds sugar to water and notices that the final volume is less than the combined volumes of sugar and water. What can be inferred from this observation?
Answer:
1. The observation indicates that water is made up of particles with **spaces between them**.
2. When sugar dissolves, it separates into very small constituent particles.
3. These sugar particles enter and occupy some of the available spaces between water particles.
4. Therefore, the final volume does not equal the simple sum of the separate volumes of sugar and water.
5. This provides evidence for the existence of **interparticle spaces in matter**.

5. A solid piece of iron requires a much higher temperature to melt than ice. What can you infer about the particles of iron and ice?
Answer:
1. Iron melts at about **1538°C**, whereas ice melts at **0°C**.
2. A higher melting point generally indicates stronger interparticle forces of attraction.
3. Therefore, considerably more thermal energy is required to overcome the attractive forces in iron.
4. Ice requires much less thermal energy to reach its melting point and change into liquid water.
5. Hence, we can infer that the forces holding particles together are **much stronger in iron than in ice**.

6. Milk spills and spreads across a table, but the glass tumbler from which it spills retains its shape. Explain this difference using the particulate nature of matter.
Answer:
1. The glass tumbler is a **solid**, while milk behaves as a **liquid**.
2. In solids, particles are tightly packed and held in fixed positions by strong interparticle attractions.
3. Therefore, the glass retains its definite shape and volume.

4. In liquids, interparticle attractions are weaker, allowing particles to move past one another within a limited space.
5. Hence, milk can flow and spread over the table, whereas the glass tumbler **retains its shape**.

7. If all the constituent particles of a wooden chair could somehow be removed, would the chair still exist? Give reasons.

Answer:

1. No, nothing of the chair would remain if all its constituent particles were removed.
2. Matter is composed of an extremely large number of very small constituent particles.
3. The chair exists because these particles together constitute its material.
4. Removing only some particles might reduce the amount of matter present, but removing **all** of them would remove the chair itself.
5. Therefore, the existence of an object depends on the **constituent particles that make up its matter**.

8. A bottle with a balloon fixed tightly over its mouth is placed in hot water. Predict what will happen to the balloon and explain why.

Answer:

1. The balloon is expected to **inflate or expand** when the bottle is placed in hot water.
2. The air inside the bottle gains thermal energy from the hot water.
3. As thermal energy increases, the movement of the air particles becomes more vigorous.
4. The gas tends to occupy more available space and pushes into the balloon.
5. Hence, the balloon expands, demonstrating the effect of **heat on the movement and behaviour of gas particles**. The chapter itself proposes this situation as an exploratory HOTS activity.

9. Why does the fragrance of an incense stick eventually reach a person sitting far away from it? Analyse the phenomenon using particle movement.

Answer:

1. When an incense stick burns, fragrance particles are released into the surrounding air.
2. The particles of air are in **constant motion**.
3. Moving air particles collide with the fragrance particles and help them spread throughout the room.
4. As a result, the fragrance gradually reaches places far away from the incense stick.
5. Therefore, this observation provides evidence that **gas particles move continuously and spread through available space**.

10. Sugar and sand are both solids, but sugar dissolves in water whereas sand does not. Explain this difference using the ideas given in the chapter.

Answer:

1. When sugar is mixed with water, water particles are able to separate sugar into its constituent particles.
2. The separated sugar particles then spread through and occupy spaces between the water particles.
3. In some substances, however, constituent particles are held together so strongly that water particles cannot pull them apart.
4. Sand behaves in this way and therefore remains insoluble and eventually settles down.
5. Thus, being a solid alone does not determine solubility; the ability of water particles to **pull out and disperse the constituent particles** is important.

11. Why do gases mix with each other more easily than solids? Explain using three properties of their particles.

Answer:

1. Gas particles have **maximum interparticle spacing**, whereas particles in solids are closely packed.
2. Interparticle attractions in gases are negligible, while they are very strong in solids.
3. Gas particles can move freely in all directions, whereas solid particles mainly vibrate around fixed positions.
4. Therefore, particles of one gas can easily move into the spaces occupied by particles of another gas.
5. Hence, gases mix readily, while solids do not mix in the same manner under ordinary conditions.

12. Ice, water, and water vapour are forms of the same substance. Why do they show very different physical properties?

Answer:

1. Their different properties arise from differences in **particle arrangement, spacing, attraction, and movement**.
2. In ice, particles are held strongly and their movement is largely restricted to vibrations.
3. In liquid water, particles have greater freedom to move because the attractive forces are weaker.
4. In water vapour, particles have enough energy to overcome attractive forces and move freely in all directions.
5. Thus, changes in thermal energy alter particle behaviour and consequently produce the different **physical states of the same substance**.

7.13 Five-mark questions with Answers of Applied Type: (12 Questions)

1. A student transfers 200 mL of water from a cylindrical container into containers of different shapes. Explain what changes and what remains unchanged.

Answer:

1. The **shape of the water changes** whenever it is transferred to a differently shaped container.
2. This is because liquid particles can move past one another within a limited space.
3. Therefore, liquids do not possess a definite or fixed shape.
4. If no water is spilled or left sticking to the container, its volume remains **200 mL** after each transfer.
5. Thus, this activity demonstrates that a liquid has **no fixed shape but has a definite volume**.

2. You are given two syringes without needles—one containing air and the other containing water. How can you use them to demonstrate the difference in interparticle spacing?

Answer:

1. Close the open ends of both syringes and try to push their plungers inward.
2. The plunger of the syringe containing air can be pushed considerably because gases have **large interparticle spaces**.
3. Pressure forces the air particles to come closer, thereby reducing the volume of air.
4. The plunger of the syringe containing water cannot be pushed significantly because water is practically incompressible.
5. Hence, the experiment demonstrates that **interparticle spacing is much greater in gases than in liquids**.

3. You accidentally spill some water on the floor. After some time, the water disappears even though the floor has not reached the boiling point. Apply your knowledge to explain this observation.

Answer:
1. The spilled water disappears because of a process called **evaporation**.
2. Vapour formation can occur at temperatures below the boiling point.
3. During evaporation, some water particles at the surface escape from the liquid into the surrounding air.
4. Unlike boiling, evaporation takes place **slowly and only at the surface** of the liquid.
5. Therefore, spilled water can gradually change into vapour and disappear without reaching its boiling point.

4. A student wants potassium permanganate to spread quickly through water without stirring it. Should the student use hot, room-temperature, or ice-cold water? Explain.
Answer:
1. The student should use **hot water** to make potassium permanganate spread fastest.
2. Water particles are in constant motion, and their movement increases when heat is provided.
3. Therefore, particles move faster in hot water than in water at room temperature.
4. Their movement is slowest in ice-cold water because the particles have less thermal energy.
5. Hence, potassium permanganate spreads **fastest in hot water, slower in room-temperature water, and slowest in ice-cold water**.

5. A person sprays perfume in one corner of a room, but after some time a person at the opposite corner can smell it. Apply the particle model to explain why.
Answer:
1. Perfume releases fragrance particles into the surrounding air.
2. The particles of air are **constantly moving in different directions**.
3. These moving air particles hit the fragrance particles and help them spread through the room.
4. Gas particles can move throughout all the available space because their interparticle attractions are negligible.
5. Therefore, the fragrance eventually reaches the opposite corner of the room even though the perfume was sprayed at only one place.

6. Sugar is added to water and stirred until it is no longer visible. How can you prove that the sugar is still present and explain where it has gone?
Answer:
1. The water can be tasted, under proper supervision, and it will taste sweet, showing that sugar is still present.
2. When sugar dissolves, it breaks into extremely small **constituent particles**.
3. These particles are too small to be seen with our eyes.
4. The sugar particles spread through the water and occupy the available **interparticle spaces between water particles**.
5. Therefore, sugar has not disappeared; it remains distributed throughout the solution in the form of tiny particles.

7. A student adds equal quantities of sugar and sand separately to two glasses of water and stirs them. Predict the observations and explain the difference.
Answer:
1. Sugar dissolves in water, whereas sand remains undissolved and eventually settles down.
2. Water particles are able to pull out the constituent particles from sugar and spread them throughout the liquid.
3. The dissolved sugar particles occupy some of the spaces between the water particles.

4. In sand, the constituent particles are held together strongly enough that water particles cannot pull them out in the same manner.
5. Therefore, sugar forms a solution with water, while sand remains **insoluble and occupies space in the container**.

8. Ice cubes are taken out of a freezer and left in a warm room. Explain the changes in their particles as the ice melts.

Answer:

1. Initially, the particles in ice have low thermal energy and are held in relatively fixed positions.
2. As the ice absorbs heat from the surroundings, its particles gain thermal energy and vibrate more vigorously.
3. At the melting point, the thermal energy helps overcome some of the attractive forces between the particles.
4. The particles can then move away from their fixed positions, and their freedom of movement increases.
5. As a result, solid ice changes into **liquid water**, whose particles can move around within a limited space.

9. Why is an LPG/cooking gas cylinder able to store a large quantity of gas in a comparatively small space? Explain using the concept demonstrated by the syringe activity.

Answer:

1. Gas particles naturally have **large spaces between them**.
2. When external pressure is applied, these particles can be forced closer together.
3. As the particles come closer, the same amount of gas can occupy a smaller volume.
4. The syringe experiment demonstrates this principle because pushing the plunger reduces the volume occupied by trapped air.
5. Thus, the compressibility of gases explains how a large amount of gas can be accommodated in a relatively small container.

10. A student has three unknown substances—one has a fixed shape, one flows but maintains its volume, and one spreads to fill its entire container. Identify their states and justify your answer.

Answer:

1. The substance with a **fixed shape** is a solid because its particles are tightly packed and strongly attracted to each other.
2. The substance that flows but maintains a definite volume is a liquid because its particles can move within a limited space.
3. The substance that spreads throughout the entire container is a gas because its particles move freely in all directions.
4. Solids have minimum interparticle spacing, liquids have slightly greater spacing, and gases have maximum spacing.
5. Hence, observable properties such as **shape, volume, flow, and spreading** can be applied to identify the three states of matter.

11. A student finds that an iron nail does not melt when heated to 200°C, whereas ice melts easily at room temperature. Explain the observation.

Answer:

1. Different solids have different **melting points** because their interparticle forces of attraction differ.
2. Ice has a melting point of **0°C**, while iron has a melting point of about **1538°C**.
3. Ice therefore melts easily when its temperature rises above 0°C.

4. Heating iron to 200°C does not provide sufficient thermal conditions for it to reach its melting point.
5. Thus, iron requires a much higher temperature to melt because its particles are held together by **strong attractive forces**.

12. While washing an oily cloth with soap and water, the oil gets removed from the fabric. Apply the particulate nature of matter to explain how soap helps.

Answer:

1. Oil particles sticking to the cloth do not get removed easily by water alone.
2. When soap is used, numerous **soap particles surround the oil particles** on the fabric.
3. One end of a soap particle attaches itself to the oil.
4. The other end of the soap particle mixes with water.
5. In this way, soap helps lift the oil from the fabric so that it can be **washed away with water**.

7.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

Olympiad-Type Multiple Choice Questions:

1. A student adds sugar to 100 mL of water. Before stirring, the level rises. After the sugar dissolves completely, the level falls slightly from this new level. Which explanation is most appropriate?

A. Sugar loses some of its mass during dissolution.
B. Sugar particles evaporate while stirring.
C. Sugar particles occupy some of the spaces between water particles.
D. Water particles are converted into sugar particles.

Answer: C

Explanation: The volume of the solution can be less than the sum of the separate volumes because dissolved sugar particles occupy interparticle spaces between water particles.

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2. Three identical grains of potassium permanganate are simultaneously placed in equal amounts of water at 10°C, 30°C and 70°C. In which order will the colour spread from fastest to slowest?

A. 10°C > 30°C > 70°C
B. 70°C > 30°C > 10°C
C. 30°C > 70°C > 10°C
D. The rate will be identical in all three.

Answer: B

Explanation: Increasing temperature increases particle movement; hence potassium permanganate spreads fastest in hot water.

---

3. A sealed syringe contains only air. Its nozzle is blocked and the plunger is pushed inward. Which statement best describes what happens?

A. The number of air particles decreases.
B. The size of each air particle decreases.
C. The spaces between air particles decrease.
D. Air particles change into liquid particles.

Answer: C

Explanation: Compression forces gas particles closer together by reducing the large spaces between them.

---

4. The experiment in Question 3 is repeated after filling the syringe completely with water. The plunger hardly moves. The best conclusion is:
A. Water has no particles.
B. Water is practically incompressible.
C. Water particles have no spaces whatsoever between them.
D. Water particles cannot move.
Answer: B

---

5. A solid P melts at 50°C and another solid Q melts at 900°C. Based only on the chapter, which inference is most reasonable?
A. P necessarily has larger particles than Q.
B. Q generally has stronger interparticle attractions than P.
C. P must be heavier than Q.
D. Q contains no interparticle spaces.
Answer: B
Explanation: Solids with stronger attractive forces generally have higher melting points.

---

6. Ice, urea and iron are heated separately. Their melting points are 0°C, 133°C and 1538°C respectively. At 150°C, which of the following is correct?
A. All three must remain solid.
B. Ice and urea have crossed their melting points, while iron has not.
C. Only iron has crossed its melting point.
D. Urea and iron have crossed their melting points.
Answer: B

---

7. Consider the following properties:
P — fixed shape
Q — definite volume
R — particles can move past one another
S — takes the shape of its container
Which combination correctly describes a liquid?
A. P and Q only
B. P, Q and R
C. Q, R and S
D. R and S only
Answer: **C**
Explanation: Liquids have definite volume but no fixed shape, and their particles can move within a limited space.

---

8. Two gas jars are arranged one above the other. The lower jar contains smoke and the upper jar initially contains ordinary air. When the separating plate is removed, smoke eventually spreads into the upper jar. This provides strongest evidence that:
A. gases have fixed volumes.
B. gas particles are stationary.
C. gas particles move freely and occupy available space.
D. smoke particles are attracted only upward.
Answer: C

---

9. Which arrangement correctly represents the **decreasing order of interparticle attraction**?

A. Gas > Liquid > Solid
B. Liquid > Solid > Gas
C. Solid > Liquid > Gas
D. Solid > Gas > Liquid
Answer: C
Explanation: Attraction is strongest in solids, slightly weaker in liquids, and negligible/minimum in gases.

---

10. Which arrangement correctly represents the **increasing order of interparticle spacing**?
A. Gas < Liquid < Solid
B. Solid < Liquid < Gas
C. Liquid < Solid < Gas
D. Solid < Gas < Liquid
Answer: B

---

11. A student says, "The empty spaces between the particles of a solid must be filled with air." According to the chapter, this statement is:
A. correct because air exists everywhere.
B. correct only in porous solids.
C. incorrect because the interparticle spaces contain nothing at all.
D. incorrect because solids have absolutely no interparticle spaces.
Answer: C
Explanation: Even closely packed solid particles have spaces between them, and the chapter specifically states that these spaces are not filled with air.

---

12. Why can you move your finger through water without permanently cutting the water into two parts?
A. Water has no interparticle attraction.
B. Liquid particles can be temporarily displaced and rearranged.
C. Water is a gas at room temperature.
D. Water particles disappear when touched.
Answer: B
Explanation: Liquid particles have weaker attractions than solids and can move; after the finger is removed, the water's position is restored.

---

13. Which pair is correctly classified as **fluids** according to the chapter?
A. Solids and liquids
B. Solids and gases
C. Liquids and gases
D. Only gases
Answer: C
Explanation: Both liquids and gases flow and do not retain a fixed shape; hence both are classified as fluids.

---

14. Water is transferred successively among three clean containers of different shapes without spilling. Which observation is expected?
A. Both shape and volume remain unchanged.
B. Shape changes but volume remains unchanged.
C. Volume changes but shape remains unchanged.
D. Both shape and volume change.

Answer: B

---

15. In Question 14, suppose a small amount of water sticks to the walls of each container during transfer. The measured volume in the next container may:
A. become slightly less.
B. become exactly double.
C. become greater because water expands.
D. become zero.
Answer: A
Explanation: The chapter specifically cautions that water sticking to an unclean container can produce a slightly lower subsequent reading.

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16. Which statement best distinguishes **boiling** from **evaporation**?
A. Boiling occurs only at the surface, whereas evaporation occurs throughout the liquid.
B. Evaporation occurs only at the boiling point.
C. At the boiling point, rapid vapour formation occurs at the surface and within the liquid; evaporation can occur slowly at the surface below the boiling point.
D. There is no difference between them.
Answer: C

---

17. A puddle slowly disappears on a day when its temperature never reaches the boiling point of water. The process responsible is:
A. melting
B. freezing
C. evaporation
D. compression
Answer: C

---

18. A student grinds a chalk stick repeatedly into an extremely fine powder. Which statement is correct according to the chapter?
A. Grinding converts chalk into a chemically different substance.
B. Grinding is a physical change and reduces the size of the chalk specks.
C. Each visible grain is necessarily one constituent particle of chalk.
D. Chalk ceases to be matter after sufficient grinding.
Answer: B
Explanation: Grinding changes the size but does not produce a new substance.

---

19. If hypothetically **all constituent particles** were removed from a wooden chair, what would remain of the chair?
A. A lighter chair
B. An invisible chair with the same shape
C. Nothing of the chair
D. Only the interparticle attractions
Answer: C
Explanation: Matter is made of constituent particles; removing all of them means nothing of the object remains. This reasoning is also tested in the chapter's end exercise.

---

20. Sugar dissolves in water, but sand generally settles at the bottom. Which explanation agrees best with the chapter?

A. Sand contains no constituent particles.
B. Sugar particles are larger than sand particles.
C. Water can pull out and spread the constituent particles of sugar, whereas it cannot similarly pull out the strongly held particles of sand.
D. Sand is a liquid.
Answer: C

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21. Assertion–Reason Question
Assertion (A): Gases can be compressed much more easily than liquids.
Reason (R): Gas particles naturally have much larger interparticle spaces than liquid particles.
Choose:
A. Both A and R are true, and R correctly explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.
Answer: A

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22. Assertion–Reason Question
Assertion (A): A liquid has a definite volume but no definite shape.
Reason (R): Liquid particles can move, but their movement is restricted to a limited space.
A. Both A and R are true, and R correctly explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. Both A and R are false.
Answer: A

---

23. Four students make the following statements about heating a solid:
P: Particle vibrations increase.
Q: Interparticle attractive forces can eventually be overcome sufficiently for melting.
R: Particles become completely motionless.
S: At the melting point, particles can begin leaving their fixed positions.
Which statements are correct?
A. P and R only
B. P, Q and S only
C. Q and R only
D. P, Q, R and S
Answer: B
Explanation: Heating increases vibrations; at melting, thermal energy helps overcome attractive forces so particles can leave fixed positions.

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24. An incense stick is lit in one corner of a large room. After some time, its fragrance is detected at the opposite corner. Which sequence best explains this?
A. Fragrance particles become solids → fall → spread along the floor.
B. Air particles remain stationary → fragrance pulls them towards itself.
C. Air particles move constantly → collide with fragrance particles → help spread them throughout the room.
D. Fragrance changes the entire air into perfume.
Answer: C

---

25. Consider the following particle diagrams:

P: particles very closely packed in fixed positions
Q: particles close together but able to move within a limited space
R: particles widely separated and free to move throughout available space
Which identification is correct?
A. P = Gas, Q = Liquid, R = Solid
B. P = Liquid, Q = Solid, R = Gas
C. P = Solid, Q = Liquid, R = Gas
D. P = Solid, Q = Gas, R = Liquid
Answer: C
Explanation: This corresponds to the particle-arrangement summary shown in the chapter: solids have minimum spacing, liquids somewhat greater spacing, and gases maximum spacing.

Additional Challenging Olympiad Questions
26. A gas is compressed in a closed syringe and then the force on the plunger is removed. The plunger tends to move back. Why?
A. New gas particles are created.
B. The compressed gas particles spread again when the external force is removed.
C. Gas particles become larger.
D. Atmospheric pressure converts the gas into a solid.
Answer: B

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27. Which of the following statements about particles is **incorrect**?
A. Matter is composed of extremely small particles.
B. Interparticle attraction depends partly on interparticle distance.
C. Increasing interparticle distance can greatly decrease attractive forces.
D. Gas particles remain in fixed positions and only vibrate.
Answer: D
Explanation: Gas particles move freely in all directions; particles in solids are restricted mainly to vibrations.

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28. A student observes that rice flour takes the shape of whichever jar it is poured into and concludes, “Rice flour is a liquid.” What is the flaw in the reasoning?
A. Anything that takes the shape of a container must be a gas.
B. Rice flour consists of many individual solid grains; the bulk may take the container's shape, but its constituent grains are solids.
C. Rice flour has no volume.
D. Rice flour is always gaseous at room temperature.
Answer: B
Explanation: The chapter itself challenges students to distinguish grains/rice flour from true liquids despite their bulk behaviour.

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29. Which statement about thermal energy and state of matter is most consistent with the chapter?
A. Greater thermal energy always makes interparticle attractions stronger.
B. Thermal energy has no connection with particle movement.
C. Increasing thermal energy can increase particle movement and help particles overcome attractive forces.
D. Only gases possess thermal energy.
Answer: C

30. A balloon is fixed tightly over the mouth of a bottle, and the bottle is placed in hot water. Based on the particle model developed in the chapter, which prediction is most reasonable?
A. The balloon is likely to expand as heating increases the movement of the gas particles inside.
B. The balloon must shrink because heated particles stop moving.
C. The air inside turns into a solid.
D. Nothing can happen because gases have no particles.
Answer: A
Explanation: The chapter proposes this as an exploratory application after establishing that particle movement increases when heat is supplied.

Quick Answer Key

Q	Ans.	Q	Ans.	Q	Ans.
1	C	11	C	21	A
2	B	12	B	22	A
3	C	13	C	23	B
4	B	14	B	24	C
5	B	15	A	25	C
6	B	16	C	26	B
7	C	17	C	27	D
8	C	18	B	28	B
9	C	19	C	29	C
10	B	20	C	30	A

7.15 Best Practices Opportunity List from the Chapter: (10 Ideas)

Suggested Best Practices:

(1) **Learning by Doing – Mini Laboratory Activities:**
Conduct simple hands-on experiments such as dissolving sugar in water, compressing air in a syringe, transferring water between differently shaped containers, and observing potassium permanganate spreading in water. Students should first **predict the outcome, perform the activity, record observations, and then explain the result using the particle model**. The chapter itself uses these activities to establish interparticle spaces and particle movement.

(2) **Student-Made 3D Particle Models:**
Ask students in small groups to construct models of **solids, liquids and gases** using clay balls, beads, thermocol balls or other low-cost/recycled materials. The models should demonstrate differences in **particle arrangement, interparticle spacing and freedom of movement**. This directly extends the model-building activity suggested in the chapter.

(3) **"Become a Particle" Role-Play / Kinesthetic Learning:**
Turn the classroom into a particle model. Students themselves represent particles—standing tightly packed and vibrating as a **solid**, moving around one another within a limited area as a **liquid**, and spreading throughout the available space as a **gas**. Repeat the activity at different imaginary temperatures so students physically demonstrate how increased thermal energy changes particle movement. The textbook specifically proposes particle role-play/dance as an extension activity.

(4) **Predict–Observe–Explain (POE) Challenge:**

Before every experiment, require students to write three things: **"I Predict…"** → **"I Observed…"** → **"I Explain…"**. For example, before putting potassium permanganate into hot, room-temperature and ice-cold water, students predict where it will spread fastest and subsequently explain their observations in terms of particle movement. The chapter establishes that the spreading is fastest in hot water because particle movement increases with heating.

(5) **Real-Life Science Detective Activity:**
Give students everyday situations such as **perfume spreading across a room, wet clothes drying, sugar disappearing in water, LPG being stored under pressure, steam formation, melting ice, or the smell of incense travelling across a room**. Students identify the relevant particle behaviour—movement, spacing, attraction, evaporation, compression or change of state. The chapter itself connects fragrance spreading through a room with the constant movement of air particles.

(6) **Olympiad/HOTS Question of the Day:**
End each lesson with one challenging **Higher Order Thinking Skills (HOTS)/Olympiad-style question** rather than a simple recall question. For example: *"Rice grains and rice flour take the shape of their container. Why are they still classified as solids rather than liquids?"* This type of reasoning question is also included in the chapter exercises.

(7) **Peer Teaching through a "States of Matter Expert Group":**
Divide the class into three expert groups—**Solid Experts, Liquid Experts and Gas Experts**. Each group studies particle spacing, attraction, movement, shape and volume and then teaches the other groups using a model, demonstration or poster. Finally, students collaboratively construct a comparison chart. The chapter's summary provides precisely these comparative parameters.

(8) **Concept Cartoon and Misconception Challenge:**
Present scientifically interesting statements such as *"There is no space between particles of a solid," "The space between particles contains air," "Sugar disappears when dissolved,"* or *"Particles in a solid do not move."* Students vote **Agree/Disagree**, discuss in teams and justify their answers experimentally. This is especially useful because the chapter explicitly clarifies that even closely packed solids have interparticle spaces and that those spaces are not filled with air.

(9) **Science Debate – Evidence-Based Argumentation:**
Conduct a short classroom debate on **"The ability of gases to spread and occupy all available space—beneficial or harmful?"** Teams should use scientific examples and particle theory to defend their positions. This debate is directly suggested under the chapter's "Discover, design, and debate" section.

(10) **Exit Ticket – 3–2–1 Reflection:**
At the end of the chapter, each student submits an exit ticket containing **3 concepts learned, 2 real-life applications, and 1 question they still have**. The unanswered questions can become the starting point for the next lesson or an inquiry project, supporting the textbook's emphasis on keeping students' curiosity alive.

For a school "Best Practices" record, the strongest five to highlight would be: Learning by Doing, Predict–Observe–Explain, Student-Made 3D Models, Particle Role-Play, and Olympiad/HOTS Question of the Day. Together, these provide a good combination of **experiential learning, inquiry-based learning, collaborative learning, competency-based assessment and competitive-exam readiness**.

7.16 Innovations Opportunity List from the Chapter: (5 Ideas)

The chapter offers excellent scope for innovative teaching because students must understand **invisible particles, interparticle spaces, attraction, particle motion and changes of state**. The textbook itself encourages model-making, role-play and experimentation.

(1) **Virtual Particle Simulation – "See the Invisible":**
Use digital animations or teacher-created simulations in which students can increase or decrease temperature and visually observe particles vibrating, moving apart and changing from solid → liquid → gas. Students can relate the animation to the chapter's explanation that increasing thermal energy increases particle movement and overcomes attractive forces.

(2) **Human Particle Laboratory – Classroom as Matter:**
Convert the classroom into a giant particle model. Students become particles: tightly packed and vibrating for solids, moving within a restricted area for liquids, and moving freely throughout the classroom for gases. A student acting as the **"Heat Controller"** can progressively increase or decrease the imaginary temperature, making the other students alter their movement accordingly.

(3) **Slow-Motion Diffusion Investigation:**
Students can record the potassium permanganate experiment using a mobile/tablet camera and create a **time-lapse video** comparing its spread in hot, room-temperature and ice-cold water. They can then analyse the videos and explain why diffusion occurs faster at higher temperatures. This directly builds upon the chapter's observation that potassium permanganate spreads fastest in hot water because particle movement increases with heat.

(4) **Augmented Particle Model using QR Codes:**
Create QR-code learning stations labelled **Solid, Liquid, Gas, Melting, Boiling and Diffusion** around the classroom. Scanning each QR code can reveal a short animation, diagram, challenge question or experiment. Students rotate through the stations in teams and complete a "Particle Investigator Sheet."

(5) **Gamification – "Escape from the Particle Lab":**
Design a classroom escape-room activity in which teams solve successive puzzles involving **particle spacing, forces of attraction, compressibility, melting point, boiling point and particle movement**. Each correct solution provides a clue or code needed to unlock the next challenge. This turns chapter revision into collaborative problem-solving rather than conventional question-answer practice.

(6) **Student Science Reel / One-Minute Video Challenge:**
Students create a **60–90 second science video** explaining one everyday phenomenon such as perfume spreading, sugar dissolving, evaporation, melting ice or air compression. The video must include a simple particle diagram and a scientifically correct explanation. For example, the chapter explains the spread of incense fragrance through the constant movement of air particles.

(7) **AI-Assisted "Ask a Particle" Activity:**
Students frame questions as though interviewing a particle: *"Why can't you move freely when you are in a solid?"*, *"What happens to you when heat is supplied?"* or *"Why are you easier to compress in a gas?"* With teacher supervision, an AI tool can generate a "particle's response," after which students must **verify and correct the response using the textbook**. This develops AI literacy along with scientific reasoning.

(8) **Design-Thinking Challenge – Build the Best Particle Model:**
Give groups the same low-cost materials—beads, clay balls, thread, cardboard, rubber bands, etc.—and ask them to invent a working model showing **interparticle spacing, attraction and movement** in all three states. Groups present their prototypes and

classmates evaluate which model communicates the scientific concept most effectively. The chapter itself recommends constructing particle models using clay balls and beads.

(9) **Particle Concept Comic Creation:**
Students create a short comic titled **"The Adventures of a Particle"** in which the main character travels through solid, liquid and gaseous states as temperature changes. Scientific concepts—spacing, attraction, movement, melting and boiling—must be incorporated into the storyline, combining science with art, language and creativity.

(10) **Student-Generated Digital Quiz / Olympiad Challenge:**
Instead of the teacher preparing all assessment questions, groups create **HOTS and Olympiad-style MCQs** based on real-life situations from the chapter. The best questions can be combined into a class digital quiz competition. This shifts students from merely *answering questions* to the higher cognitive task of *designing scientifically valid questions*.

Five strongest innovations for school documentation
For an **"Innovative Practices in Teaching–Learning"** record, we would particularly recommend highlighting **Virtual Particle Simulation, Human Particle Laboratory, Slow-Motion Diffusion Investigation, Particle-Lab Escape Room, and Student Science Reel**. These clearly demonstrate the integration of **experiential learning + technology + gamification + collaborative learning + competency-based education**.

7.17: Practicing Questions/Question Bank

The following questions are related to chapter 7 and cover matter and constituent particles, interparticle spaces and attractions, properties of solids/liquids/gases, melting and boiling, compressibility, dissolution, particle movement, and the effect of heat. The chapter summarizes that interparticle spacing increases from solid to gas, while interparticle attraction decreases.

A. Fill in the Blanks

1. Matter is composed of extremely small __________.
   Answer: particles

2. The basic units that make up a substance are called __________ particles.
   Answer: constituent

3. The spaces present between particles of matter are called __________ spaces.
   Answer: interparticle

4. The attractive forces between constituent particles are called __________.
   Answer: interparticle attractions

5. In solids, particles are __________ packed.
   Answer: closely/tightly

6. Solids have a definite __________ and volume.
   Answer: shape

7. The temperature at which a solid changes into a liquid at atmospheric pressure is called its __________.
   Answer: melting point

8. The melting point of ice is __________ °C.
   Answer: 0

9. Liquids have a definite volume but no fixed __________.
   Answer: shape

10. The temperature at which a liquid boils and changes into vapour at atmospheric pressure is called its __________.
    Answer: boiling point

11. The slow formation of vapour from the surface of a liquid below its boiling point is called __________.
    Answer: evaporation

12. In gases, interparticle attractions are __________.
    Answer: negligible

13. Gases occupy the entire __________ space.
    Answer: available

14. Liquids and gases are collectively classified as __________ because they can flow.
    Answer: fluids

15. Gas particles have __________ interparticle spacing among the three states of matter.
    Answer: maximum

16. Water is practically __________ compared with air.
    Answer: incompressible

17. Potassium permanganate spreads faster in __________ water than in cold water.
    Answer: hot

18. The movement of particles __________ when heat is provided.
    Answer: increases

19. Acharya Kanad described tiny indivisible particles of matter as __________.
    Answer: Parmanu

20. Acharya Kanad's ideas about matter were recorded in the __________.
    Answer: Vaisheshika Sutras

The textbook specifically defines interparticle spaces and attractions and explains how their strength influences the physical state of matter.

B. One-Mark Descriptive Questions

1. **What is a constituent particle?**
   Answer: A constituent particle is the basic unit that makes up a larger piece of a substance or material.

2. **What are interparticle spaces?**
   Answer: The spaces present between constituent particles of matter are called interparticle spaces.

3. **What are interparticle attractions?**
   Answer: Interparticle attractions are the attractive forces that hold the constituent particles of matter together.

4. **Why does a solid have a definite shape?**
   Answer: A solid has a definite shape because its tightly packed particles are held in fixed positions by strong interparticle attractions.

5. **How do particles move in a solid?**
   Answer: Particles in a solid vibrate or oscillate about their fixed positions.

6. **Define melting point.**
   Answer: Melting point is the minimum temperature at which a solid melts to become a liquid at atmospheric pressure.

7. **Why do liquids take the shape of their containers?**
   Answer: Liquid particles can move past one another, allowing the liquid to take the shape of its container.

8. **Define boiling point.**
   Answer: Boiling point is the temperature at which a liquid boils and changes into vapour at atmospheric pressure.

9. **What is evaporation?**
   Answer: Evaporation is the slow formation of vapour from the surface of a liquid, even below its boiling point.

10. **Why do gases have no fixed shape?**
    Answer: Gas particles move freely in all directions and therefore gases acquire the shape of their containers.

11. **Why are gases highly compressible?**
    Answer: Gases are highly compressible because there is a large amount of space between their particles.

12. **Why is water practically incompressible?**
    Answer: Water is practically incompressible because its particles have much less interparticle space than gases.

13. **Why does sugar disappear when dissolved in water?**
    Answer: Sugar breaks into constituent particles that occupy the available spaces between water particles.

14. **Why can we smell an incense stick from a distance?**
    Answer: Fragrance particles spread through the room due to the constant movement of air particles.

15. **What happens to particle movement when matter is heated?**
    Answer: The movement of particles increases when heat is supplied.

The syringe experiment in the chapter particularly demonstrates the difference between compressible air and practically incompressible water.

C. Two-Mark Descriptive Questions

1. State any two characteristics of particles in solids.

Answer:

- The particles are closely packed with very small interparticle spaces.

- Strong interparticle attractions keep them in fixed positions.

2. Give two properties of liquids based on their particle arrangement.

Answer:

- Liquids have a definite volume but no fixed shape.
- Their particles can move within a limited space because their interparticle attraction is weaker than in solids.

3. State two characteristics of gases.

Answer:

- Gases have neither a fixed shape nor a fixed volume.
- Their particles have maximum interparticle spacing and negligible interparticle attraction.

4. Differentiate between boiling and evaporation.

Answer:

- Boiling occurs at the boiling point and vapour formation occurs throughout the liquid.
- Evaporation can occur below the boiling point and takes place slowly only at the surface.

5. What happens to the particles of a solid when it is heated?

Answer:

- Its particles vibrate more vigorously as their thermal energy increases.
- Eventually, the attractions weaken sufficiently for particles to leave their fixed positions and the solid melts.

6. Why can you move your finger through water but not through a solid object?

Answer:

- Liquid particles have weaker interparticle attractions and can move past one another.
- Solid particles are strongly held in fixed positions and cannot move past one another.

7. Why does smoke spread throughout a gas jar?

Answer:

- Gas particles move freely and continuously in all directions.
- Their movement causes the smoke to spread throughout the available space.

8. Why does dissolving sugar in water indicate the presence of interparticle spaces?

Answer:

- Dissolved sugar particles occupy spaces between water particles.
- Therefore, the volume of the solution can be less than the sum of the separate volumes of sugar and water.

9. Why does potassium permanganate spread faster in hot water?

Answer:

- Water particles possess greater movement when heated.
- Their faster movement causes potassium permanganate particles to spread more quickly.

10. Why are liquids and gases called fluids?

Answer:

- Both liquids and gases can flow.
- Neither retains a fixed shape.

The chapter experimentally shows that heating increases particle movement: potassium permanganate spreads fastest in hot water and slowest in ice-cold water.

D. Three-Mark Descriptive Questions

1. Explain the arrangement and movement of particles in solids.

Answer:

1. Particles in solids are closely packed with minimum interparticle spacing.
2. Strong interparticle attractions hold them in fixed positions.
3. They cannot move freely and can only vibrate about their fixed positions.

2. Explain the particulate nature of liquids.

Answer:

1. Liquid particles are slightly farther apart than particles in solids.
2. Their interparticle attraction is weaker than that in solids.
3. They can move within a limited space, giving liquids a definite volume but no fixed shape.

3. Explain the particulate nature of gases.

Answer:

1. Gas particles have maximum interparticle spacing.
2. Interparticle attractions between them are negligible.
3. They move freely throughout the available space, so gases have neither fixed shape nor fixed volume.

4. Explain what happens when a solid melts.

Answer:

1. Heating increases the thermal energy and vibrations of solid particles.
2. At the melting point, the particles acquire sufficient energy to overcome some of their attractive forces.
3. They leave their fixed positions and can move around, converting the solid into a liquid.

5. Explain the syringe experiment used to demonstrate compressibility of gases.

Answer:

1. Air is trapped inside a syringe by closing its open end.
2. When the plunger is pushed, the air volume decreases because gas particles are forced closer together.
3. This demonstrates that gases contain large interparticle spaces and are compressible.

6. Explain what happens when sugar dissolves in water.

Answer:

1. Sugar separates into extremely small constituent particles.
2. These particles occupy the available spaces between water particles.
3. Thus, sugar is present throughout the solution even though individual sugar particles cannot be seen.

7. Explain the potassium permanganate experiment.

Answer:

1. A few grains of potassium permanganate placed in water initially produce streaks of pink colour.
2. The colour gradually spreads throughout the water because water particles are in constant motion.
3. Eventually, the entire water becomes uniformly coloured, demonstrating particle movement.

8. Compare the interparticle attractions in solids, liquids and gases.

Answer:

1. Solids have the strongest interparticle attractions.
2. Liquids have slightly weaker attractions than solids.
3. Gases have negligible interparticle attractions.

9. Explain why the fragrance of an incense stick reaches different parts of a room.

Answer:

1. Fragrance particles initially remain concentrated near the burning incense stick.
2. Constantly moving air particles hit the fragrance particles.
3. The fragrance particles consequently spread throughout the room.

10. How does thermal energy influence the physical state of matter?

Answer:

1. Thermal energy affects the movement and spacing of constituent particles.
2. Increasing thermal energy allows particles to overcome interparticle attractive forces.

3. Therefore, sufficient heating can cause a solid to become a liquid and a liquid to become a gas.

E. Five-Mark Descriptive Questions

1. Compare solids, liquids and gases on the basis of their particulate nature.

Answer:

Property	**Solid**	**Liquid**	**Gas**
Interparticle spacing	Minimum	More than solids	Maximum
Attraction	Strongest	Weaker than solids	Negligible
Particle movement	Vibrations only	Restricted movement	Free movement
Shape	Fixed	Not fixed	Not fixed
Volume	Fixed	Fixed	Not fixed

This comparison closely follows the chapter's summary diagram on page 112.

2. Explain how heating can change a solid into a liquid and then into a gas.

Answer:

1. In a solid, particles have low thermal energy and are held closely together by strong attractive forces.
2. Heating increases their thermal energy and causes them to vibrate more vigorously.
3. At the melting point, particles overcome enough attractive force to leave their fixed positions, producing a liquid.
4. Further heating makes the liquid particles move increasingly vigorously and farther apart.
5. At the boiling point, particles can escape from the liquid and form vapour or the gaseous state.

3. Describe an experiment to demonstrate interparticle spaces in water.

Answer:

1. Take a glass vessel half-filled with water and mark its level.
2. Add two teaspoons of sugar and mark the new level.
3. Stir until the sugar completely dissolves and observe the final level.
4. The volume of the solution is less than the sum of the separate volumes of water and sugar.
5. This shows that dissolved sugar particles occupy spaces between water particles.

4. Explain the relationship between interparticle spacing, interparticle attraction and particle movement in the three states of matter.

Answer:

1. In solids, interparticle spacing is minimum and attraction is strongest, so particles can only vibrate.
2. In liquids, spacing is greater and attraction is weaker, allowing particles to move within a limited space.
3. In gases, interparticle spacing is maximum and attraction is negligible.
4. Consequently, gas particles move freely in all directions and occupy all available space.
5. Thus, differences in spacing and attractive forces account for the different physical properties of solids, liquids and gases.

5. Describe experiments/observations that demonstrate the continuous movement of particles in liquids and gases.

Answer:

1. Potassium permanganate placed in water gradually spreads and makes the water uniformly pink.
2. This demonstrates the constant movement of particles in a liquid.
3. An incense stick burnt in one corner of a room can eventually be smelled throughout the room.
4. Moving air particles help fragrance particles spread through the available space.
5. Together, these observations demonstrate that particles of both liquids and gases are continuously moving.

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8^{th} Standard Science Book Chapter 8

Chapter 8: Nature of Matter: Elements, Compounds, and Mixtures

8.1 Summary of the Chapter:

Chapter 8: Nature of Matter – Elements, Compounds, and Mixtures

Summary:

1. **Matter and its composition:** Everything that has mass and occupies space is matter. Matter is made up of tiny particles, and most materials around us consist of two or more substances.
2. **Mixtures:** A **mixture** is formed when two or more substances are mixed together without chemically reacting. Each substance retains its individual properties, and the substances present are called **components**.
3. **Uniform and non-uniform mixtures:** In a **uniform mixture**, components are evenly distributed and cannot be distinguished separately, as in sugar solution and air. In a **non-uniform mixture**, the different components can generally be distinguished, as in sprout salad or sand and water.
4. **Air as a mixture:** Air is a uniform mixture consisting mainly of **nitrogen, oxygen, argon, carbon dioxide and water vapour**. The lime-water experiment demonstrates the presence of carbon dioxide in air, while dust particles suspended in air are considered pollutants.
5. **Types of mixtures:** Mixtures may contain substances in different physical states, such as **gas–gas, gas–liquid, solid–gas, liquid–liquid, solid–liquid and solid–solid**. Alloys such as brass, bronze and stainless steel are important examples of mixtures.
6. **Pure substances:** In science, a **pure substance** contains only one type of particle and cannot be separated into other kinds of matter by physical processes. Pure substances are classified into **elements and compounds**.
7. **Elements:** An **element** is a pure substance that cannot be broken down into simpler substances. Each element consists of identical particles called **atoms**, and elements are the basic building blocks of matter. Examples include hydrogen, oxygen, carbon, sulfur, gold and silver.
8. **Atoms and molecules:** Atoms of many elements cannot exist independently. Two or more atoms may combine to form a stable particle called a **molecule**; for example, two hydrogen atoms form a hydrogen molecule and two oxygen atoms form an oxygen molecule.
9. **Compounds:** A **compound** is formed when two or more different elements combine chemically in a **fixed ratio**. A compound has properties different from its constituent elements, and its elements cannot be separated by physical methods. Water, for example, contains hydrogen and oxygen atoms in a **2:1 ratio**.
10. **Mixture versus compound:** The iron-and-sulfur experiment clearly distinguishes a mixture from a compound. In their mixture, iron and sulfur retain their individual properties and iron can be separated using a magnet. On heating, however, they form **iron sulfide**, a compound with entirely new properties whose components cannot be separated physically.
11. **Importance in everyday life:** Elements, compounds and mixtures have numerous applications. Elements such as iron and aluminium are used in construction and vehicles; compounds are important in medicines, vaccines and fertilisers; and mixtures such as stainless steel provide useful properties like strength and durability.
12. **Minerals:** **Minerals** are naturally occurring solid substances found on Earth with a fixed chemical composition. Most minerals are compounds, though some occur as pure

elements. Quartz, calcite, mica, pyroxene, olivine and talc are examples, and many everyday materials are obtained from minerals.

8.2 Important Formulas:

Important Formulae / Quantitative Relationships – Chapter 8

Nature of Matter: Elements, Compounds, and Mixtures

This chapter is **mainly conceptual and experimental**, so it contains relatively few mathematical formulae. The following are the important **ratios, quantitative relationships, and equations** that students may need for numerical or application-based questions.

1. **Ratio of atoms in water**

$$\text{Hydrogen atoms : Oxygen atoms} = 2:1$$

Thus, every water molecule contains **2 hydrogen atoms for every 1 oxygen atom**.

2. **Ratio of sodium and chlorine particles in sodium chloride**

$$\text{Sodium : Chlorine} = 1:1$$

This illustrates the important principle that elements in a **compound combine in a fixed ratio**.

3. **Bronze composition given in the chapter**

$$\text{Copper : Tin} = 4:1$$

Therefore, if the total number of parts is 5:

$$\text{Copper fraction} = \frac{4}{5},\ \text{Tin fraction} = \frac{1}{5}$$

This relationship can be used for simple alloy-composition problems.

4. **Percentage composition of a component**

For quantitative mixture questions:

$$\boxed{\%\text{ of component} = \frac{\text{Amount of component}}{\text{Total amount of mixture}} \times 100}$$

This formula is **not explicitly stated as a formula in the chapter**, but is a useful mathematical extension of its discussion of mixtures and components. The chapter defines a mixture as containing two or more components.

5. **Amount of a component from percentage**

$$\boxed{\text{Amount of component} = \frac{\text{Percentage}}{100} \times \text{Total amount of mixture}}$$

This is useful when the percentage composition and total quantity are given.

6. **Total mass of a mixture**

For simple mixing problems:

$$\boxed{\text{Total mass} = \text{Mass of component 1} + \text{Mass of component 2} + \cdots}$$

For two components:

$$M = m_1 + m_2$$

7. **Calculating quantities from a given ratio**

If two substances are in the ratio $a:b$:

$$\boxed{\text{Amount of A} = \frac{a}{a+b} \times \text{Total amount}}$$

$$\boxed{\text{Amount of B} = \frac{b}{a+b} \times \text{Total amount}}$$

For example, bronze has Cu:Sn = 4:1. In 100 g of such an alloy:

$$\text{Cu} = \frac{4}{5} \times 100 = 80\ g$$

$$\text{Sn} = \frac{1}{5} \times 100 = 20\ g$$

8. **Percentage of nitrogen in air**

The chapter states that nitrogen constitutes approximately:

$$\boxed{78\% \text{ of air}}$$

Therefore, for simple textbook calculations:

$$\text{Amount of nitrogen} = \frac{78}{100} \times \text{Amount of air}$$

9. **Iron and sulfur quantities used in the experiment**

The chapter uses:

$$\text{Iron} = 5.6\ g,\ \text{Sulfur} = 3.2\ g$$

Hence:

$$\text{Fe:S} = 5.6:3.2 = 7:4$$

and the combined mass before reaction is:

$$5.6 + 3.2 = \boxed{8.8\ g}$$

These quantities are given in the iron–sulfur activity that produces iron sulfide on heating.

10. **Temperature conversion relationship**

The chapter gives approximately:

$$30^\circ C = 303\ K$$

The general conversion useful for such questions is:

$$\boxed{K =^\circ C + 273}$$

and

$$\boxed{^\circ C = K - 273}$$

The chapter mentions gallium and caesium becoming liquid at around $30^\circ C$or $303\ K$.

Important word equations to remember

Although these are **chemical equations rather than numerical formulae**, they are particularly important for Chapter 8:

$$\boxed{\text{Calcium hydroxide} + \text{Carbon dioxide} \rightarrow \text{Calcium carbonate} + \text{Water}}$$

This is the reaction responsible for lime water turning milky.

$$\boxed{\text{Water} \rightarrow \text{Hydrogen} + \text{Oxygen}}$$

The electrolysis activity shows that water can be decomposed into hydrogen and oxygen.

$$\boxed{\text{Iron} + \text{Dilute hydrochloric acid} \rightarrow \text{Iron chloride} + \text{Hydrogen}}$$

$$\boxed{\text{Iron sulfide} + \text{Dilute hydrochloric acid} \rightarrow \text{Iron chloride} + \text{Hydrogen sulfide}}$$

These two reactions are used to distinguish the **iron–sulfur mixture (Sample A)** from the **iron sulfide compound (Sample B)**.

For Grade 8 examination purposes, the most important quantitative ideas are therefore: fixed ratio in compounds, component ratios in mixtures/alloys, percentage composition, total mass, and °C–K conversion. The chapter itself emphasizes that compounds contain elements chemically combined in a **fixed ratio**, whereas mixtures retain the properties of their components.

8.3 Fill-Up the Blank LOTS type questions with Answers: (50 Questions)

The following questions focus on **Remembering and basic Understanding (LOTS)** and are based directly on the Chapter 8.

1. Anything that has mass and occupies space is called ___________.
   Answer: Matter

2. When two or more substances are mixed and each substance retains its properties, the resulting substance is called a __________.
   Answer: Mixture
3. The individual substances that make up a mixture are called its __________.
   Answer: Components
4. In a mixture, the components do not react __________ with each other.
   Answer: Chemically
5. A mixture in which the different components can generally be seen separately is called a __________ mixture.
   Answer: Non-uniform
6. A mixture in which the components are evenly distributed and cannot be distinguished is called a __________ mixture.
   Answer: Uniform
7. Air is a __________ mixture of gases.
   Answer: Uniform
8. Nitrogen constitutes about __________ per cent of air.
   Answer: 78
9. The gas in air that supports combustion is __________.
   Answer: Oxygen
10. Brass is an alloy of copper and __________.
    Answer: Zinc
11. Bronze is an alloy of copper and __________.
    Answer: Tin
12. Stainless steel contains iron, nickel, chromium and a small amount of __________.
    Answer: Carbon
13. Calcium hydroxide solution is commonly called __________.
    Answer: Lime water
14. Lime water turns __________ when carbon dioxide is passed through it.
    Answer: Milky
15. Carbon dioxide reacts with calcium hydroxide to form calcium carbonate and __________.
    Answer: Water
16. The air quality index is abbreviated as __________.
    Answer: AQI
17. Dust and soot are examples of __________ matter present in polluted air.
    Answer: Particulate
18. A substance that consists of the same type of particles is called a __________ substance.
    Answer: Pure
19. A pure substance cannot be separated into other kinds of matter by any __________ process.
    Answer: Physical
20. Each element is made up of identical particles called __________.
    Answer: Atoms
21. Elements cannot be broken down into __________ substances.
    Answer: Simpler
22. Two or more atoms may combine to form a stable particle called a __________.
    Answer: Molecule
23. Two atoms of hydrogen combine to form one __________ of hydrogen.
    Answer: Molecule

24. Gold, silver, magnesium, iron and aluminium are examples of __________.
    Answer: Metals
25. Carbon, sulfur, hydrogen and oxygen are examples of __________.
    Answer: Non-metals
26. Silicon and boron are examples of __________.
    Answer: Metalloids
27. The number of elements known at present is __________.
    Answer: 118
28. The two elements that are liquid at room temperature are mercury and __________.
    Answer: Bromine
29. Water is made up of the elements hydrogen and __________.
    Answer: Oxygen
30. The ratio of hydrogen atoms to oxygen atoms in water is __________.
    Answer: 2:1
31. Different elements combine in fixed ratios to form a __________.
    Answer: Compound
32. Sodium and chlorine are present in sodium chloride in the ratio __________.
    Answer: 1:1
33. When sugar is heated strongly, __________ is left behind in the boiling tube.
    Answer: Carbon / Charcoal
34. Sugar consists of the elements carbon, hydrogen and __________.
    Answer: Oxygen
35. A mixture of iron filings and sulfur powder is labelled as Sample __________ in the chapter's experiment.
    Answer: A
36. On heating iron and sulfur together, a black compound called __________ is formed.
    Answer: Iron sulfide
37. Iron filings in the iron-sulfur mixture can be separated using a __________.
    Answer: Magnet
38. Iron reacts with dilute hydrochloric acid to produce __________ gas.
    Answer: Hydrogen
39. Hydrogen gas burns with a characteristic __________ sound.
    Answer: Pop
40. Iron sulfide reacts with dilute hydrochloric acid to produce __________ gas.
    Answer: Hydrogen sulfide
41. Hydrogen sulfide gas has a __________ egg-like odour.
    Answer: Rotten
42. Most rocks are mixtures of __________.
    Answer: Minerals
43. Minerals that occur as pure elements are called __________ minerals.
    Answer: Native
44. Quartz, calcite, mica, pyroxene and olivine are examples of __________.
    Answer: Minerals
45. Talcum powder is made from the mineral __________.
    Answer: Talc
46. Graphene aerogel is made from __________.
    Answer: Carbon
47. Graphene aerogel has a high __________ capacity because it is highly porous.
    Answer: Absorbing

48. Light, heat and electricity are __________ matter.
    Answer: Not
49. Pure substances can be either elements or __________.
    Answer: Compounds
50. Compounds contain two or more elements combined chemically in a __________ ratio.
    Answer: Fixed

8.4 Fill-Up the Blank HOTS type questions with Answers: (40 Questions)

These questions require students to **apply, analyse, infer, compare, predict, and reason**, rather than merely recall facts. They are based on the concepts and experiments in the chapter, including the chapter's own higher-order exercises.

1. A student mixes iron filings and sulfur powder. Since the iron can still be removed using a magnet, the sample should be classified as a __________.
   Answer: Mixture
2. When iron and sulfur are heated together, the resulting black substance cannot be separated using a magnet. This indicates the formation of a __________.
   Answer: Compound
3. If two substances are mixed and each retains its original properties, the resulting material is most likely a __________.
   Answer: Mixture
4. If a substance cannot be separated into its components by physical methods and its components are chemically combined in a fixed ratio, it is a __________.
   Answer: Compound
5. A colourless gas produced when iron reacts with dilute hydrochloric acid burns with a 'pop' sound. From this observation, the gas can be identified as __________.
   Answer: Hydrogen
6. A colourless gas produced when iron sulfide reacts with dilute hydrochloric acid has a rotten egg-like odour. The gas is __________.
   Answer: Hydrogen sulfide
7. Sample A contains visible black iron and yellow sulfur particles, whereas Sample B has the same appearance throughout. This suggests that Sample B is a __________ substance than Sample A.
   Answer: More uniform
8. If a magnet attracts particles from a sample containing iron and sulfur, the iron and sulfur have __________ their individual properties.
   Answer: Retained
9. If a magnet fails to attract iron from heated iron and sulfur, it indicates that iron has __________ with sulfur to form a new substance.
   Answer: Chemically combined
10. Water cannot be separated into hydrogen and oxygen using ordinary physical methods because water is a __________.
    Answer: Compound
11. If hydrogen and oxygen were merely mixed instead of chemically combined, the resulting material would be classified as a __________.
    Answer: Mixture
12. Hydrogen is a fuel and oxygen supports combustion, but water extinguishes fire. This demonstrates that a compound can have __________ properties from its constituent

elements.
Answer: Different

13. If a water molecule contains twice as many hydrogen atoms as oxygen atoms, the ratio of hydrogen to oxygen atoms is __________.
Answer: 2:1
14. Sodium is a soft metal and chlorine is a hazardous gas, but together they form harmless sodium chloride. This demonstrates that the properties of a compound are __________ from those of its constituent elements.
Answer: Different
15. If a substance breaks down into carbon and water when heated, it cannot be classified as an __________.
Answer: Element
16. When sugar is strongly heated and carbon and water are obtained, this evidence supports the conclusion that sugar is a __________.
Answer: Compound
17. When electricity is passed through water, two different gases are produced. This observation shows that water contains more than one __________.
Answer: Element
18. During electrolysis of water, a gas burns with a pop sound. The student can infer that this gas is __________.
Answer: Hydrogen
19. During electrolysis, if a gas makes the flame of a burning candle glow brighter, the gas is __________.
Answer: Oxygen
20. The gases collected during electrolysis cannot be water vapour because water vapour would __________ back into liquid water.
Answer: Condense
21. A sample contains particles that are evenly distributed and cannot be distinguished separately. The sample is most likely a __________ mixture.
Answer: Uniform
22. A student mixes oil and water and observes two distinguishable portions. The mixture should therefore be classified as __________.
Answer: Non-uniform
23. If sugar completely dissolves in water and its particles cannot be distinguished separately, the resulting mixture is __________ in nature.
Answer: Uniform
24. Although air appears to be a single substance, it is classified as a mixture because its gases are not __________ combined with one another.
Answer: Chemically
25. Lime water left exposed to air becomes milky. From this observation, one can infer the presence of __________ in air.
Answer: Carbon dioxide
26. If lime water does not turn milky when exposed to a particular gas, the gas is unlikely to be __________.
Answer: Carbon dioxide
27. A black sheet kept near an open window collects more dust on one day than another. This supports the conclusion that the amount of dust in air can vary with __________ and place.
Answer: Time

28. If an unknown material contains only one type of particle and cannot be separated by a physical process, it can be classified as a __________ substance.
    Answer: Pure
29. A substance cannot be both an element and a compound because an element contains only one kind of __________, whereas a compound contains two or more elements chemically combined.
    Answer: Atom
30. If substances A and B cannot be broken down into simpler substances and chemically combine to form C, then A and B are __________ while C is a compound.
    Answer: Elements
31. Stainless steel is preferred to pure iron for many applications because it is stronger and more __________.
    Answer: Durable
32. If a material is highly porous and can absorb large quantities of substances, it may be useful for cleaning up __________ spills.
    Answer: Oil
33. Graphene aerogel can potentially serve as an environmental cleaner because of its high __________ capacity.
    Answer: Absorbing
34. Gold can be classified both as a metal and a mineral when it occurs naturally as a __________ mineral.
    Answer: Native
35. A mineral consisting of a pure element rather than a compound is called a __________ mineral.
    Answer: Native
36. Since most rocks contain several minerals rather than a single substance, most rocks are classified as __________.
    Answer: Mixtures
37. If two elements combine in varying proportions without chemically reacting, the product would be a __________ rather than a compound.
    Answer: Mixture
38. If the components of a material can be separated by physical methods, the material is more likely to be a __________ than a compound.
    Answer: Mixture
39. A newly formed substance has properties completely different from the substances used to make it and has a fixed composition. It is most likely a __________.
    Answer: Compound
40. If a material has mass and occupies space, it is classified as __________; light and heat do not satisfy this condition.
    Answer: Matter

8.5 One-mark questions with Answers of LOTS Type: (55 Questions)

The following are **Lower Order Thinking Skills (LOTS)** questions based directly on the definitions, facts, examples, activities, and observations in this chapter.

1. **What is a mixture?**
   Answer: A mixture is formed when two or more substances are mixed together and each substance retains its individual properties.
2. **What are the components of a mixture?**
   Answer: The individual substances that make up a mixture are called its components.

3. **What is a uniform mixture?**
   Answer: A uniform mixture is one in which the components are evenly distributed and cannot be distinguished separately.
4. **What is a non-uniform mixture?**
   Answer: A non-uniform mixture is one in which the different components can generally be seen separately.
5. **Give one example of a uniform mixture.**
   Answer: Sugar dissolved in water is an example of a uniform mixture.
6. **Give one example of a non-uniform mixture.**
   Answer: Sprout salad is an example of a non-uniform mixture.
7. **Why is air considered a mixture?**
   Answer: Air is a mixture because it contains gases such as nitrogen, oxygen, argon, carbon dioxide, and water vapour.
8. **Which gas forms about 78% of air?**
   Answer: Nitrogen constitutes about 78% of air.
9. **Which gas present in air supports combustion?**
   Answer: Oxygen present in air supports combustion.
10. **How can the presence of carbon dioxide in air be demonstrated?**
    Answer: The presence of carbon dioxide can be demonstrated by exposing lime water to air, which turns it milky.
11. **What are alloys?**
    Answer: Alloys are uniform mixtures containing metals along with other substances.
12. **Name the metals present in brass.**
    Answer: Brass is a mixture of copper and zinc.
13. **Name the metals present in bronze.**
    Answer: Bronze is a mixture of copper and tin.
14. **What is stainless steel made of?**
    Answer: Stainless steel contains iron, nickel, chromium, and a small amount of carbon.
15. **What is a pure substance according to science?**
    Answer: A pure substance consists of the same type of particles and contains no other substance.
16. **What are the two types of pure substances?**
    Answer: The two types of pure substances are elements and compounds.
17. **What is an element?**
    Answer: An element is a substance that cannot be broken down further into simpler substances.
18. **What are atoms?**
    Answer: Atoms are the identical particles that make up an element.
19. **What is a molecule of an element?**
    Answer: A molecule is a stable particle formed when two or more atoms of an element combine.
20. **Give two examples of elements.**
    Answer: Gold and oxygen are examples of elements.
21. **What are metals? Give two examples.**
    Answer: Metals are a class of elements, examples of which include iron and aluminium.
22. **Give two examples of non-metals.**
    Answer: Carbon and sulfur are examples of non-metals.

23. **What are metalloids?**
    Answer: Metalloids are elements that have properties intermediate between those of metals and non-metals.
24. **Name the two elements that are liquid at room temperature.**
    Answer: Mercury and bromine are the two elements that are liquid at room temperature.
25. **What is a compound?**
    Answer: A compound is a substance formed when different elements combine chemically in a fixed ratio.
26. **Why is water called a compound?**
    Answer: Water is a compound because hydrogen and oxygen are chemically combined in it in a fixed ratio.
27. **What is the ratio of hydrogen atoms to oxygen atoms in water?**
    Answer: The ratio of hydrogen atoms to oxygen atoms in water is 2:1.
28. **Which elements form sodium chloride?**
    Answer: Sodium chloride is formed from sodium and chlorine.
29. **What is the ratio of sodium to chlorine particles in sodium chloride?**
    Answer: Sodium and chlorine are present in sodium chloride in a 1:1 ratio.
30. **Which elements are present in sugar?**
    Answer: Sugar consists of carbon, hydrogen, and oxygen.
31. **What happens to sugar when it is heated?**
    Answer: Sugar decomposes on heating to give carbon and water.
32. **What substance is left behind when sugar is heated strongly?**
    Answer: Charcoal or carbon is left behind when sugar is heated strongly.
33. **What is formed when iron and sulfur are heated together?**
    Answer: Iron and sulfur form the compound iron sulfide when heated together.
34. **What happens when a magnet is brought near a mixture of iron and sulfur?**
    Answer: The iron filings in the mixture are attracted towards the magnet.
35. **Which gas is produced when iron reacts with dilute hydrochloric acid?**
    Answer: Hydrogen gas is produced when iron reacts with dilute hydrochloric acid.
36. **How can hydrogen gas be identified?**
    Answer: Hydrogen gas can be identified by the characteristic ‘pop’ sound it produces on burning.
37. **Which gas is produced when iron sulfide reacts with dilute hydrochloric acid?**
    Answer: Hydrogen sulfide gas is produced when iron sulfide reacts with dilute hydrochloric acid.
38. **What is the characteristic odour of hydrogen sulfide gas?**
    Answer: Hydrogen sulfide gas has a rotten egg-like odour.
39. **What are minerals?**
    Answer: Minerals are natural solid substances found on Earth that have a fixed chemical composition.
40. **What are native minerals?**
    Answer: Native minerals are minerals that occur as pure elements rather than compounds.
41. **Give two examples of native metallic minerals.**
    Answer: Gold and silver are examples of native metallic minerals.
42. **Name any two common minerals.**
    Answer: Quartz and calcite are two common minerals.
43. **Which mineral is used to make talcum powder?**
    Answer: Talcum powder is made from the mineral talc.

44. **What is graphene aerogel made from?**
    Answer: Graphene aerogel is made from carbon.
45. **Why can graphene aerogel be used to clean oil spills?**
    Answer: Graphene aerogel can be used to clean oil spills because it is highly porous and has a high absorbing capacity.
46. **What is matter?**
    Answer: Matter is anything that has mass and occupies space.
47. **Name two things that are not matter.**
    Answer: Light and heat are not matter.
48. **What metals are used in Dhokra art?**
    Answer: Molten brass or bronze is used in making Dhokra art.

Activity-Based LOTS Questions

49. **Which gas gives a 'pop' sound when tested with a burning candle?**
    Answer: Hydrogen gas gives a 'pop' sound when tested with a burning candle.
50. **How is oxygen identified in the electrolysis-of-water activity?**
    Answer: Oxygen is identified because the flame of a burning candle glows brighter in its presence.
51. **What two gases are obtained when electricity is passed through water?**
    Answer: Hydrogen and oxygen gases are obtained when electricity is passed through water.
52. **What happens to lime water in the presence of carbon dioxide?**
    Answer: Lime water turns milky in the presence of carbon dioxide.
53. **What does the black-sheet activity demonstrate about air?**
    Answer: The black-sheet activity demonstrates that dust particles are suspended in air.
54. **Name two major particulate pollutants found in air.**
    Answer: Dust and soot are two major particulate pollutants found in air.
55. **What is AQI?**
    Answer: The Air Quality Index (AQI) is a tool used to describe air quality.

8.6 One-mark questions with Answers of HOTS Type: (40 Questions)

1. **Why is sugar solution considered a mixture even though sugar cannot be seen in it?**
   Answer: Sugar solution is a mixture because sugar retains its properties even though its particles are uniformly distributed in water.
2. **A student mixes sand with water and observes that the sand remains visible; what type of mixture is formed and why?**
   Answer: A non-uniform mixture is formed because its components are not evenly distributed and can be distinguished.
3. **Why can iron filings be separated from a mixture of iron and sulfur using a magnet?**
   Answer: Iron retains its magnetic property in the mixture and is therefore attracted by a magnet.
4. **Why cannot iron be separated from iron sulfide using a magnet?**
   Answer: Iron sulfide is a new compound with properties different from iron, so it is not attracted by a magnet.
5. **If a substance can be separated into its components by a physical process, what can you infer about it?**

Answer: The substance can be inferred to be a mixture because the components of mixtures can be separated physically.

6. **Why is water classified as a compound rather than a mixture of hydrogen and oxygen?**
   Answer: Water is a compound because hydrogen and oxygen are chemically combined in a fixed 2:1 atomic ratio.
7. **Why does water extinguish fire even though hydrogen burns and oxygen supports combustion?**
   Answer: Water has properties entirely different from those of the hydrogen and oxygen from which it is formed.
8. **If hydrogen and oxygen in water could be separated by filtration, would water still qualify as a compound? Why?**
   Answer: No, because components separable by a physical method would indicate a mixture rather than a compound.
9. **A colourless gas produces a 'pop' sound near a flame; what can you infer about the gas?**
   Answer: The gas can be inferred to be hydrogen because hydrogen burns with a characteristic 'pop' sound.
10. **A gas makes the flame of a candle glow brighter; what does this observation indicate?**
    Answer: The observation indicates that the gas is oxygen because oxygen supports combustion.
11. **Why can the gases produced by passing electricity through water not be water vapour?**
    Answer: They cannot be water vapour because water vapour would condense back into liquid water.
12. **Lime water left exposed to air turns milky; what conclusion can you draw from this observation?**
    Answer: We can conclude that air contains carbon dioxide because it reacts with lime water to form insoluble calcium carbonate.
13. **Why might a black sheet kept near a busy road collect more particles than one kept inside a closed room?**
    Answer: The sheet near the road may collect more particles because the amount of suspended dust and pollutants varies from place to place.
14. **If the amount of particulate matter in air increases greatly, what can you infer about the air quality?**
    Answer: The air quality would become poorer because particulate matter such as dust and soot are major air pollutants.
15. **Why is stainless steel preferred over pure iron for many useful objects?**
    Answer: Stainless steel is preferred because the alloy is stronger and more durable than pure iron.
16. **Brass looks uniform throughout but contains copper and zinc; why is it still a mixture?**
    Answer: Brass is a mixture because copper and zinc are mixed uniformly without forming a single compound.
17. **Why can an alloy be classified as a uniform mixture even when its components cannot be seen separately?**
    Answer: An alloy is a uniform mixture because its components are evenly distributed throughout it.

18. **If heating a substance produces two or more simpler substances, what can you infer about the original substance?**
    Answer: The original substance may be a compound because it can chemically decompose into simpler substances.
19. **Why does the formation of carbon and water on heating sugar prove that sugar is not an element?**
    Answer: It proves that sugar is not an element because sugar can be decomposed into substances containing different elements.
20. **A dry sample of sugar produces water droplets when heated; why are the droplets considered to have come from sugar rather than air?**
    Answer: The droplets are considered to come from sugar because heating prevents atmospheric water vapour from condensing inside the hot tube.
21. **Why does heating iron and sulfur result in a substance with properties different from both iron and sulfur?**
    Answer: Heating causes iron and sulfur to chemically combine and form the new compound iron sulfide.
22. **Two samples look different and respond differently to a magnet; how can this observation help distinguish a mixture from a compound?**
    Answer: A mixture retains the magnetic property of iron whereas the compound iron sulfide does not.
23. **If iron and sulfur could still be separated after heating, what would this suggest about the product?**
    Answer: It would suggest that a compound had not formed and that the substances remained a mixture.
24. **Why do Sample A and Sample B produce different gases when dilute hydrochloric acid is added?**
    Answer: Sample A contains free iron whereas Sample B contains iron chemically combined with sulfur as iron sulfide.
25. **A substance consists of identical particles and cannot be separated by physical methods; what can you infer about it?**
    Answer: The substance can be inferred to be a pure substance because it contains only one type of particle.
26. **Can a substance be both an element and a compound? Give a reason.**
    Answer: No, because an element contains one type of atom whereas a compound contains different elements chemically combined.
27. **Why can gold be classified as both a metal and a native mineral?**
    Answer: Gold is a metal by its elemental nature and can be a native mineral when it occurs naturally as a pure element.
28. **Why are most rocks classified as mixtures rather than pure substances?**
    Answer: Most rocks are mixtures because they contain two or more different minerals.
29. **Why can graphene aerogel be useful for cleaning oil spills?**
    Answer: Graphene aerogel can absorb large amounts of material because its highly porous structure gives it a high absorbing capacity.
30. **Why are minerals important in the manufacture of everyday materials such as cement?**
    Answer: Minerals are important because they provide substances such as calcite, quartz, alumina, and iron oxide needed to manufacture cement.
31. **If water were a mixture of hydrogen and oxygen instead of a compound, how would its properties be expected to differ?**

Answer: Its components would retain their individual properties and could potentially be separated by physical methods.

32. **A substance has the same composition throughout but can be physically separated into different substances; should it be called a compound? Why?**
    Answer: No, it should be called a uniform mixture because compounds cannot be separated into their constituent elements by physical methods.
33. **Why is air considered a mixture although it appears to be a single substance?**
    Answer: Air is a mixture because several gases are uniformly mixed while retaining their individual properties.
34. **If nitrogen in air suddenly supported combustion like oxygen, would this represent the normal properties of air described in the chapter?**
    Answer: No, because the chapter states that nitrogen does not take part in combustion whereas oxygen supports it.
35. **Why can knowledge of elements, compounds, and mixtures help scientists develop new materials?**
    Answer: This knowledge helps scientists combine substances appropriately to produce materials with useful and improved properties.
36. **Why can discovering a compound that absorbs carbon dioxide help address environmental problems?**
    Answer: Such a compound could help reduce carbon dioxide in the air by capturing and removing it.
37. **Why is molten brass or bronze suitable for making Dhokra art instead of using only pure metals?**
    Answer: Brass and bronze provide useful properties such as strength and a shiny golden appearance for Dhokra figures.
38. **A student says that everything visible around us is matter; why is this conclusion incorrect?**
    Answer: The conclusion is incorrect because light is visible but is not matter as described in the chapter.
39. **Why does changing water into ice not prove that water has decomposed into simpler substances?**
    Answer: Freezing only changes the physical state of water while its particles remain the same.
40. **Why is electrolysis of water different from simply boiling water?**
    Answer: Electrolysis breaks water into hydrogen and oxygen, whereas boiling only changes water into vapour without changing its particles.

8.7 Two-mark questions with Answers of LOTS Type: (25 Questions)

1. What is a mixture? What are its components?
Answer:

- A mixture is formed when two or more substances are mixed together without undergoing a chemical reaction.
- The individual substances that make up a mixture are called its **components**.

2. Differentiate between uniform and non-uniform mixtures.
Answer:

- In a **uniform mixture**, the components are evenly distributed and cannot be distinguished separately.
- In a **non-uniform mixture**, the different components can generally be seen separately.

3. Why is air considered a mixture? Name its two major components.
Answer:

- Air is a uniform mixture because it contains different gases mixed together without chemically combining.
- Its two major components are **nitrogen and oxygen**.

4. What are alloys? Give two examples.
Answer:

- Alloys are uniform mixtures containing metals in which the individual substances cannot be seen separately.
- **Brass** and **bronze** are examples of alloys.

5. What is a pure substance according to science? Mention one characteristic.
Answer:

- A pure substance is matter that contains no other substance and consists of the same type of particles.
- It cannot be separated into other kinds of matter by any physical process.

6. What are the two types of pure substances? Give one example of each.
Answer:

- The two types of pure substances are **elements and compounds**.
- **Gold** is an example of an element, while **water** is an example of a compound.

7. What is an element? Give any two examples.
Answer:

- An element is a substance that cannot be broken down further into simpler substances.
- **Gold and sulfur** are two examples of elements.

8. What are atoms and molecules?
Answer:

- An **atom** is an identical particle that makes up an element.
- A **molecule** is a stable particle formed when two or more atoms combine.

9. How are elements classified? Give two examples of each major category.
Answer:

- Elements are mainly classified into **metals and non-metals**.
- Gold and iron are metals, while carbon and sulfur are non-metals.

10. What is a compound? Mention one important property of compounds.
Answer:

- A compound is formed when different elements chemically combine in a fixed ratio to form a new substance.
- A compound has properties different from those of the elements that form it.

11. Why is water called a compound? What is the ratio of hydrogen and oxygen atoms in water?
Answer:

- Water is a compound because hydrogen and oxygen are chemically combined in a fixed ratio.
- The ratio of the number of hydrogen atoms to oxygen atoms in water is **2:1**.

12. What happens when electric current is passed through water? How are the gases identified?
Answer:

- Water breaks down into **hydrogen and oxygen gases** when electric current is passed through it.
- Hydrogen produces a **pop sound**, while oxygen makes the flame of a burning candle **glow brighter**.

13. What happens when sugar is heated in a boiling tube?
Answer:
- Sugar first turns brown and then becomes blackish as it chars on heating.
- Water droplets are formed and **carbon** is left behind in the boiling tube.

14. Which elements are present in sugar? How does the heating experiment indicate their presence?
Answer:
- Sugar contains **carbon, hydrogen, and oxygen**.
- On heating, it gives carbon and water, and water itself contains hydrogen and oxygen.

15. What is Sample A in the iron and sulfur experiment? State one of its properties.
Answer:
- Sample A is a **mixture of iron and sulfur** in which both components retain their individual properties.
- Iron filings in Sample A are attracted by a magnet and can be separated from sulfur.

16. What is Sample B in the iron and sulfur experiment? Mention one of its properties.
Answer:
- Sample B is **iron sulfide**, a compound formed by heating iron and sulfur together.
- It is not attracted by a magnet, and iron and sulfur can no longer be separated physically.

17. What happens when dilute hydrochloric acid is added to a mixture of iron and sulfur?
Answer:
- Iron reacts with dilute hydrochloric acid to produce **iron chloride and hydrogen gas**.
- The hydrogen gas is colourless, odourless and burns with a **pop sound**.

18. What happens when iron sulfide reacts with dilute hydrochloric acid?
Answer:
- Iron sulfide reacts with dilute hydrochloric acid to form **iron chloride and hydrogen sulfide gas**.
- Hydrogen sulfide is a colourless gas with a characteristic **rotten egg-like odour**.

19. How can the presence of carbon dioxide in air be demonstrated using lime water?
Answer:
- When lime water is exposed to air, carbon dioxide reacts with calcium hydroxide and turns the solution milky.
- The milkiness is due to the formation of insoluble white particles of **calcium carbonate**.

20. How can we demonstrate the presence of dust particles in air?
Answer:
- A clean black sheet of paper is kept near an open window or in a garden for a few hours.
- Tiny particles settling on the sheet show that **dust particles are suspended in air**.

21. What are minerals? Give any four examples.
Answer:
- Minerals are natural, solid substances found on Earth that have a fixed chemical composition.
- **Quartz, calcite, mica, and olivine** are examples of minerals.

22. What are native minerals? Give two examples.
Answer:
- Native minerals are minerals that occur naturally as **pure elements rather than compounds**.
- **Gold and silver** are examples of native minerals.

23. Mention any two uses of minerals given in the chapter.
Answer:
- Minerals such as calcite, quartz, alumina, and iron oxide are used in making **cement**.
- The mineral **talc** is used to make talcum powder.

24. What is graphene aerogel? Mention one possible use of it.
Answer:
- Graphene aerogel is a highly porous and extremely light material made from carbon.
- Its high absorbing capacity makes it potentially useful for **cleaning oil spills**.

25. What is Dhokra art? Which materials are used to make Dhokra figures?
Answer:
- Dhokra art is an old craft in which metal figures inspired by people, animals, and nature are created using moulds.
- Molten **brass or bronze** is poured into the mould to produce strong figures with a shiny golden colour.

8.8. Two-mark questions with Answers of HOTS Type: (25 Questions)

1. A student says that sugar solution is a pure substance because it looks the same throughout. Do you agree? Justify.
Answer:
- No. Sugar solution is a **uniform mixture** because it contains two substances—sugar and water.
- Its components cannot be seen separately, but they are not chemically combined and can be separated by physical processes.

2. Air appears uniform everywhere. Why is it still classified as a mixture and not a compound?
Answer:
- Air contains different gases such as nitrogen, oxygen, argon and carbon dioxide that are not chemically combined.
- These gases retain their individual properties, so air is classified as a **uniform mixture**.

3. A student exposes lime water to air and finds that it turns milky. What can the student conclude? Explain.
Answer:
- The observation confirms that **carbon dioxide is present in air**.
- Carbon dioxide reacts with calcium hydroxide in lime water to form insoluble calcium carbonate, which causes the milkiness.

4. Two samples look uniform throughout. Can you conclude that both are pure substances? Give a reason.
Answer:
- No, appearance alone cannot be used to decide whether a substance is pure because a **uniform mixture can also appear the same throughout**.
- A pure substance contains only one type of particle, whereas a uniform mixture contains more than one pure substance evenly distributed.

5. A black sheet kept near a busy road collects more dust than one kept inside a classroom. What can you infer?
Answer:
- The air near the busy road probably contains a **greater amount of suspended dust particles**.

- This supports the idea that the amount and nature of dust in air can vary from place to place.

6. Water changes into steam on heating and can be changed back into water on cooling. Does this prove that water is a mixture? Why?

Answer:

- No. During these changes, the particles of water remain the same and no new substance is formed.
- Therefore, changing the physical state of water does not make it a mixture.

7. During electrolysis of water, one gas burns with a 'pop' sound while another makes a candle flame glow brighter. Identify the gases and justify your answer.

Answer:

- The gas producing the **pop sound is hydrogen**, showing its combustible nature.
- The gas making the candle flame glow brighter is **oxygen**, because oxygen supports combustion.

8. Hydrogen is a fuel and oxygen supports combustion, yet water extinguishes fire. What does this tell you about compounds?

Answer:

- It shows that a compound can have **properties completely different from those of its constituent elements**.
- Hydrogen and oxygen chemically combine in a fixed ratio to form water with entirely new properties.

9. A substance cannot be broken down into simpler substances. How would you classify it? Give a reason.

Answer:

- The substance can be classified as an **element**.
- Elements are the simplest substances and cannot be broken down further into simpler substances.

10. Sodium is a soft metal and chlorine is a hazardous gas, but sodium chloride is safe for use in food. What conclusion can you draw?

Answer:

- When elements chemically combine, the resulting compound may have properties very different from its constituent elements.
- Sodium and chlorine combine in a fixed **1:1 ratio** to form sodium chloride with new properties.

11. On heating dry sugar, a student observes water droplets and a black residue. What can be inferred about the composition of sugar?

Answer:

- The black residue is carbon, while the water formed indicates the presence of hydrogen and oxygen.
- Therefore, sugar is a **compound containing carbon, hydrogen and oxygen**, rather than an element.

12. Iron filings and sulfur powder are mixed together. How can you prove that the resulting material is a mixture?

Answer:

- A magnet can attract and separate the iron filings, showing that iron retains its original magnetic property.
- The visible iron and sulfur particles retain their individual properties and therefore form a mixture.

13. Why does a magnet attract iron from Sample A but not from Sample B in the iron–sulfur experiment?
Answer:
- Sample A is a mixture, so iron retains its magnetic property and can be attracted by a magnet.
- In Sample B, iron has chemically combined with sulfur to form **iron sulfide**, a new compound with different properties.

14. A student claims that heating iron and sulfur only changes their appearance. How would you prove that a new substance is actually formed?
Answer:
- The black product formed is not attracted by a magnet, unlike the original iron present in the mixture.
- It also reacts with dilute hydrochloric acid to produce hydrogen sulfide gas, showing that **iron sulfide with new properties** has formed.

15. Two unknown samples produce gases when dilute hydrochloric acid is added. One gas gives a 'pop' sound and the other smells like rotten eggs. What can you infer about the samples?
Answer:
- The sample producing hydrogen gas with a pop sound may contain **iron**, as in the iron–sulfur mixture.
- The sample producing rotten egg-smelling hydrogen sulfide indicates the presence of **iron sulfide**.

16. Why can iron and sulfur be separated from their mixture but not from iron sulfide by using a magnet?
Answer:
- In the mixture, iron and sulfur retain their individual properties, so magnetic iron can be physically separated.
- In iron sulfide, they are chemically combined to form a compound whose constituents cannot be separated by physical methods.

17. A student is given seawater and pure water. Without depending only on their appearance, how would you classify them scientifically?
Answer:
- Seawater is a **mixture** because it contains water along with dissolved substances such as salts.
- Pure water is a **compound** because hydrogen and oxygen are chemically combined in a fixed ratio of 2:1.

18. Stainless steel is preferred to pure iron for many applications. Explain why using the concept of mixtures.
Answer:
- Stainless steel is an alloy—a uniform mixture containing iron, nickel, chromium and a small amount of carbon.
- Such alloys can have useful properties such as **greater strength and durability** compared with pure iron.

19. A material is highly porous and can absorb large amounts of liquid. Suggest an environmental application based on the chapter and justify it.
Answer:
- Such a material could be used to **clean up oil spills** in seas or on land.
- Graphene aerogel has high absorbing capacity because of its porous nature and is suggested for this purpose in the chapter.

20. Gold can be called both an element and a mineral. Explain how both classifications can be correct.
Answer:
- Gold is an **element** because it is a pure substance that cannot be broken down into simpler substances.
- When gold occurs naturally on Earth as a pure element, it is classified as a **native mineral**.

21. If water were a mixture of hydrogen and oxygen instead of a compound, how would its properties be expected to differ?
Answer:
- Hydrogen and oxygen would retain their individual properties instead of producing the distinct properties of water.
- They could also be separated by physical methods because components of a mixture are not chemically combined.

22. A substance contains two elements but they cannot be separated by physical methods. What would you infer about the substance?
Answer:
- The substance is likely to be a **compound**, provided the elements are chemically combined in a fixed ratio.
- Compounds have properties different from their constituent elements and cannot be separated by physical methods.

23. Why would separating the components of a mixture be useful to a scientist?
Answer:
- Separation enables a scientist to obtain the individual **pure substances** present in a mixture.
- These pure substances can then be identified and studied based on their characteristic properties.

24. A student says, "All minerals are compounds." Is the statement correct? Justify your answer.
Answer:
- No. Most minerals are compounds, but some **native minerals are pure elements**.
- Gold, silver and copper are examples of metals that may occur naturally as native minerals.

25. Why is understanding elements, compounds, and mixtures important for developing new materials?
Answer:
- Scientists can combine substances in suitable ways to develop materials having desirable or improved properties.
- For example, understanding mixtures has enabled the development of **stainless steel**, which is stronger and more durable than pure iron.

8.9. Three-mark questions with Answers of LOTS Type: (20 Questions)

1. What is a mixture? State any two characteristics of a mixture.
Answer:
1. A mixture is formed when **two or more substances are mixed together**.
2. The substances present in a mixture **retain their individual properties**.
3. The components of a mixture **do not react chemically with one another**.

2. Differentiate between uniform and non-uniform mixtures.
Answer:

1. In a **uniform mixture**, the components are evenly distributed throughout the mixture.
2. In a **non-uniform mixture**, the different components can generally be distinguished or seen separately.
3. Sugar dissolved in water is a uniform mixture, while sprout salad is a non-uniform mixture.

3. Describe the composition of air and explain why it is called a mixture.

Answer:

1. Air is mainly made up of **nitrogen, oxygen, argon, carbon dioxide, and water vapour**.
2. Nitrogen constitutes about **78% of air**, while oxygen is essential for most living beings and supports combustion.
3. Air is called a **uniform mixture** because its different gases are mixed uniformly.

4. Explain how the presence of carbon dioxide in air can be demonstrated using lime water.

Answer:

1. A colourless solution of calcium hydroxide called **lime water** is exposed to air for a few hours.
2. The lime water gradually turns **milky** because carbon dioxide reacts with calcium hydroxide.
3. Insoluble white particles of **calcium carbonate** are formed, confirming the presence of carbon dioxide in air.

5. What is a pure substance? Mention its main characteristics.

Answer:

1. A pure substance contains **no other substance mixed with it**.
2. It consists of the **same type of particles**, which behave identically.
3. A pure substance cannot be separated into other kinds of matter by any **physical process**.

6. What are elements? Give suitable examples.

Answer:

1. Elements are **pure substances that cannot be broken down into simpler substances**.
2. Each element consists of identical particles called **atoms** and acts as a building block of matter.
3. Gold, silver, sulfur, carbon, hydrogen, and oxygen are examples of elements.

7. Explain how elements are classified into metals, non-metals, and metalloids.

Answer:

1. Elements such as **gold, silver, magnesium, iron, and aluminium** are classified as metals.
2. Elements such as **carbon, sulfur, hydrogen, and oxygen** are classified as non-metals.
3. Elements such as **silicon and boron**, which have intermediate properties between metals and non-metals, are called metalloids.

8. What is a compound? State two important characteristics of compounds.

Answer:

1. A compound is formed when **different elements combine chemically in a fixed ratio** to form a new substance.
2. The properties of a compound are **different from the properties of the elements** forming it.
3. The constituent elements of a compound **cannot be separated by physical methods**.

9. Explain why water is considered a compound.

Answer:

1. Water is made up of two different elements—**hydrogen and oxygen**.

2. Hydrogen and oxygen are chemically combined in water in a fixed atomic ratio of **2:1**.
3. These elements cannot be separated from water by ordinary physical methods; hence, water is a compound.

10. Describe what happens when electric current is passed through water.
Answer:
1. When electric current is passed through water, **gas bubbles are produced at both terminals**.
2. One gas burns with a **pop sound**, showing that it is hydrogen.
3. The other gas makes a burning candle glow brighter, confirming that it is **oxygen**.

11. Describe what happens when sugar is heated in a boiling tube.
Answer:
1. On heating, sugar first **turns brown and later becomes blackish** as it chars.
2. Small **water droplets** appear near the open end of the boiling tube.
3. Carbon is left behind, showing that sugar is a compound containing **carbon, hydrogen, and oxygen**.

12. Describe Sample A in the iron and sulfur experiment.
Answer:
1. Sample A is a **mixture of iron filings and sulfur powder**, in which both substances can be observed separately.
2. Iron retains its magnetic property and can therefore be **separated using a magnet**.
3. When dilute hydrochloric acid is added, iron produces **hydrogen gas**, which burns with a pop sound.

13. Describe the formation and properties of iron sulfide (Sample B).
Answer:
1. When a mixture of iron and sulfur is heated, a **black compound called iron sulfide** is formed.
2. Iron sulfide is not attracted by a magnet, and its constituent elements **cannot be separated physically**.
3. It reacts with dilute hydrochloric acid to produce **hydrogen sulfide gas**, which has a rotten egg-like odour.

14. What are alloys? Give examples and their components.
Answer:
1. Alloys are mixtures in which their components are mixed so uniformly that the individual substances cannot be seen separately.
2. **Stainless steel** contains iron, nickel, chromium, and a small amount of carbon.
3. **Brass** is a mixture of copper and zinc, while **bronze** is a mixture of copper and tin.

15. What are minerals? Give examples.
Answer:
1. Minerals are **natural, solid substances found on the Earth** and have a fixed chemical composition.
2. Most minerals are compounds, while some native minerals can occur as pure elements.
3. **Quartz, calcite, mica, pyroxene, and olivine** are examples of minerals.

16. What are native minerals? Give examples.
Answer:
1. Native minerals are minerals that occur naturally as **pure elements rather than compounds**.
2. Gold, silver, and copper are examples of **metallic native minerals**.
3. Sulfur and carbon are examples of **non-metallic native minerals**.

17. Explain three uses of elements, compounds, and mixtures in everyday life.
Answer:

1. Elements such as **iron and aluminium** are used for constructing bridges, buildings, and vehicles.
2. Knowledge of elements and compounds helps chemists develop **medicines, vaccines, and fertilisers**.
3. Mixtures and compounds are also used to develop useful materials such as **stainless steel, concrete, and other building materials**.

18. Write three important features of graphene aerogel.
Answer:
1. Graphene aerogel is made from **carbon** and is described as an extremely light material.
2. It is highly porous and therefore has a **high absorbing capacity**.
3. It can potentially be used for cleaning oil spills and for making **energy-saving devices and special building coatings**.

19. Explain the use of elements, compounds, and mixtures in Dhokra art.
Answer:
1. In Dhokra art, a design is first shaped using **beeswax and then covered with clay to make a mould**.
2. After the clay hardens, the wax is melted out, leaving a hollow space inside the mould.
3. The hollow space is filled with molten **brass or bronze**, which gives the artwork strength and a shiny golden colour.

20. Distinguish between an element, a compound, and a mixture.
Answer:
1. An **element** is a pure substance that cannot be broken down into simpler substances.
2. A **compound** contains two or more elements chemically combined in a fixed ratio and has properties different from its constituent elements.
3. A **mixture** contains two or more substances that are not chemically combined and retain their individual properties.

8.10. Three-mark questions with Answers of HOTS Type: (20 Questions)

1. A student says that air is a compound because it contains several gases. Do you agree? Justify your answer.
Answer:
1. No, air is a **mixture** because gases such as nitrogen, oxygen, argon, and carbon dioxide are mixed together without chemically combining.
2. The gases present in air **retain their individual properties**, such as oxygen supporting combustion.
3. Therefore, air is a **uniform mixture and not a compound**.

2. Sugar completely disappears when dissolved in water. Can we conclude that sugar has changed into a new substance? Give reasons.
Answer:
1. No, sugar does not form a new substance because it only **mixes uniformly with water**.
2. Sugar and water do not chemically react, and sugar retains its properties in the solution.
3. Therefore, sugar solution is a **uniform mixture**, even though its components cannot be seen separately.

3. A student finds a substance containing two different materials but cannot distinguish them even with a microscope. What can the student infer?
Answer:
1. The student cannot conclude merely from appearance that the substance is a compound because **uniform mixtures also appear the same throughout**.

2. The student should determine whether the components are chemically combined or merely uniformly mixed.
3. If the components retain their properties and are not chemically combined, the substance should be classified as a **uniform mixture**.

4. Hydrogen burns as a fuel and oxygen supports burning, but water extinguishes fire. What does this observation tell us about compounds?

Answer:

1. Water is a compound formed when **hydrogen and oxygen combine chemically in a fixed ratio**.
2. A compound can have properties that are **completely different from those of its constituent elements**.
3. Therefore, the properties of water cannot be predicted simply from the properties of hydrogen and oxygen.

5. A student wants to separate iron from a mixture of iron and sulfur. Which method should be used, and why would the same method fail after heating the mixture?

Answer:

1. Before heating, a **magnet** can be used because iron retains its magnetic property in the mixture.
2. On heating, iron and sulfur chemically combine to form a new compound called **iron sulfide**.
3. Iron sulfide is not attracted by a magnet; therefore, iron can no longer be separated from it using this physical method.

6. Two samples contain iron and sulfur. Sample X is attracted by a magnet, while Sample Y is not. What can you infer about the two samples?

Answer:

1. Sample X is likely a **mixture of iron and sulfur** because iron retains its magnetic property.
2. Sample Y is likely **iron sulfide**, a compound formed by chemically combining iron and sulfur through heating.
3. Thus, the magnet test helps distinguish the **mixture from the compound** based on their different properties.

7. A colourless gas produced during an experiment burns with a 'pop' sound. Another gas makes a candle flame glow brighter. Identify the gases and justify your answer.

Answer:

1. The gas that burns with a **pop sound is hydrogen**, as shown by the gas test described in the chapter.
2. The gas that makes the candle flame **glow brighter is oxygen** because oxygen supports combustion.
3. These observations can therefore be used to distinguish hydrogen from oxygen experimentally.

8. A student claims that water changing into steam proves that water is made of simpler substances. Is the student correct? Explain.

Answer:

1. No, changing water into steam is only a **change in the physical state of water**.
2. During heating or cooling, the particles of water remain the same, and water can be obtained again by cooling the vapour.
3. Water is broken into hydrogen and oxygen only through a process such as **passing electric current through it**.

9. Lime water kept exposed to air gradually turns milky. What conclusion can you draw from this observation?

Answer:

1. Lime water turns milky when **carbon dioxide reacts with calcium hydroxide**.
2. The reaction produces insoluble white particles of **calcium carbonate**, which cause the milkiness.
3. Therefore, the observation provides evidence for the **presence of carbon dioxide in air**.

10. Sugar is a white solid, but on heating it produces water and leaves carbon behind. What does this tell you about the nature of sugar?

Answer:

1. The formation of water and carbon shows that sugar contains **more than one element**.
2. Since water itself contains hydrogen and oxygen, sugar contains **carbon, hydrogen, and oxygen**.
3. Therefore, sugar cannot be an element and is classified as a **compound**.

11. Why can common salt be separated from salt water by evaporation, but sodium and chlorine cannot be separated from common salt by the same method?

Answer:

1. Salt water is a **mixture**, so salt and water are not chemically combined and can be separated physically.
2. Common salt is sodium chloride, in which sodium and chlorine are **chemically combined in a fixed ratio**.
3. Therefore, evaporation can separate salt from water but cannot separate the constituent elements of sodium chloride.

12. A black sheet kept near an open window collects more dust on one day than another. Explain why this observation is possible.

Answer:

1. Dust particles are **suspended in air**, but they are not an integral part of air.
2. The nature and number of dust particles can **vary with time and place**.
3. Therefore, different amounts of dust may settle on the sheet on different days depending on the amount of particulate matter present in the air.

13. Stainless steel contains several substances. Why is it preferred over pure iron for many applications?

Answer:

1. Stainless steel is an **alloy containing iron, nickel, chromium, and a small amount of carbon**.
2. Engineers develop such mixtures to obtain useful properties that may be better than those of individual substances.
3. Stainless steel is **stronger and more durable than pure iron**, making it useful for many applications.

14. A substance cannot be broken down into anything simpler. Another substance can be broken down into two different elements. How would you classify them?

Answer:

1. The first substance should be classified as an **element** because elements cannot be broken down into simpler substances.
2. The second substance should be classified as a **compound** because it contains different elements chemically combined.
3. Thus, the ability to break a substance chemically into simpler substances helps distinguish a compound from an element.

15. Gold can be called both a mineral and an element. Explain how both classifications can be correct.

Answer:

1. Gold is an **element** because it is a pure substance that cannot be broken down into simpler substances.
2. Some minerals occur naturally as pure elements and are called **native minerals**.
3. Since gold occurs naturally as a native mineral, it can correctly be classified as both a **mineral and a metallic element**.

16. Suppose water were a mixture of hydrogen and oxygen instead of a compound. How would its properties be different?

Answer:

1. If water were a mixture, hydrogen and oxygen would **retain their individual properties** instead of forming a substance with new properties.
2. Hydrogen would retain its ability to burn, while oxygen would continue to support combustion.
3. The components could potentially be separated by physical means, unlike actual water, in which hydrogen and oxygen are **chemically combined**.

17. Two unknown samples react with dilute hydrochloric acid. Gas from Sample P burns with a pop sound, while gas from Sample Q has a rotten egg-like smell. Identify the likely samples.

Answer:

1. Sample P is likely the **iron-sulfur mixture**, because its iron reacts with dilute hydrochloric acid and produces hydrogen gas that burns with a pop sound.
2. Sample Q is likely **iron sulfide**, because it reacts with dilute hydrochloric acid to produce hydrogen sulfide gas.
3. The different gases produced demonstrate that the compound iron sulfide has **different properties from the original iron-sulfur mixture**.

18. Why would graphene aerogel be useful for cleaning an oil spill?

Answer:

1. Graphene aerogel is **highly porous** and therefore possesses a high absorbing capacity.
2. This property allows it to absorb materials such as oil and makes it potentially useful as an **environmental cleaner**.
3. Hence, its physical properties make it suitable for helping clean oil spills both **on land and in seas**.

19. A rock contains several visible minerals. Should the rock be classified as a pure substance? Justify your answer.

Answer:

1. No, most rocks contain a **mixture of different minerals** rather than only one type of substance.
2. These minerals may sometimes be distinguished with the naked eye, a magnifying glass, or a microscope.
3. Therefore, such a rock cannot be considered a pure substance because it contains **more than one component**.

20. A student says, “If the components of a substance cannot be seen separately, it must be a compound.” Evaluate this statement.

Answer:

1. The statement is incorrect because the components of a **uniform mixture** also cannot be distinguished separately.
2. For example, sugar dissolved in water forms a uniform mixture even though sugar and water particles cannot be seen separately.
3. A compound is identified by elements being **chemically combined in a fixed ratio**, not merely by its uniform appearance.

8.11 Five-mark questions with Answers of LOTS Type: (10 Questions)

1. What is a mixture? Explain its main characteristics with examples.
Answer:
1. A **mixture** is formed when two or more substances are mixed together.
2. The individual substances that make up a mixture are called its **components**.
3. Each component retains its own properties in the mixture.
4. The components of a mixture do not chemically react with one another.
5. Sugar solution, lemonade, air, poha, and sprout salad are examples of mixtures.

2. Differentiate between uniform and non-uniform mixtures.
Answer:
1. In a **uniform mixture**, the components are evenly distributed throughout the mixture.
2. The individual components of a uniform mixture cannot be distinguished separately.
3. Sugar dissolved in water and air are examples of uniform mixtures.
4. In a **non-uniform mixture**, the different components can generally be distinguished separately.
5. Sprout salad, sand and water, and oil and water are examples of non-uniform mixtures.

3. Describe the composition of air and explain why it is considered a mixture.
Answer:
1. Air is a **uniform mixture of different gases**.
2. It mainly contains nitrogen, oxygen, argon, carbon dioxide, and water vapour.
3. Nitrogen constitutes about **78% of air** and does not take part in combustion.
4. Oxygen is required by most living beings and also supports combustion.
5. These gases are mixed together without chemically combining, so air is classified as a mixture.

4. What is a pure substance? Explain its important features.
Answer:
1. A **pure substance** is a substance that has no other substance present in it.
2. It consists of only the **same type of particles**.
3. All the constituent particles of a pure substance behave identically.
4. A pure substance cannot be separated into other kinds of matter by any physical process.
5. Pure substances can be classified into two main types—**elements and compounds**.

5. What are elements? Explain their main characteristics with examples.
Answer:
1. An **element** is a pure substance that cannot be broken down into simpler substances.
2. Each element is made up of identical particles called **atoms**.
3. The particles of one element are different from the particles of other elements.
4. Elements are considered the **building blocks of all matter**.
5. Gold, silver, sulfur, carbon, hydrogen, and oxygen are examples of elements.

6. What are compounds? State their important characteristics.
Answer:
1. A **compound** is formed when two or more different elements combine chemically.
2. The elements in a compound combine in a **fixed ratio**.
3. A compound has properties different from those of the elements that form it.
4. The constituent elements of a compound cannot be separated by physical methods.
5. Water, sodium chloride, and sugar are examples of compounds discussed in the chapter.

7. Describe how electrolysis shows that water is made up of hydrogen and oxygen.
Answer:
1. Water containing a few drops of dilute sulfuric acid is taken in a beaker, and electric current is passed through it.

2. Gas bubbles are formed and collected in test tubes placed over the two terminals.
3. One gas burns with a **pop sound**, confirming that it is hydrogen.
4. The other gas makes a burning candle flame **glow brighter**, confirming that it is oxygen.
5. Thus, the experiment demonstrates that water is composed of the two elements **hydrogen and oxygen**.

8. Explain what happens when sugar is heated in a boiling tube.
Answer:
1. When sugar is heated gently, it first **turns brown**.
2. On further heating, the sugar begins to char and becomes blackish.
3. Small droplets of water appear near the open end of the boiling tube.
4. **Carbon or charcoal** is left behind in the boiling tube.
5. Since sugar gives carbon and water on heating, it is a compound containing **carbon, hydrogen, and oxygen**.

9. Describe the differences between a mixture of iron and sulfur and the compound iron sulfide.
Answer:
1. A mixture of iron and sulfur contains visible iron and sulfur particles, whereas iron sulfide has the same black appearance throughout.
2. In the mixture, iron and sulfur retain their individual properties.
3. Iron in the mixture is attracted by a magnet and can therefore be separated from sulfur.
4. Iron sulfide is not attracted by a magnet, and its constituent elements cannot be separated physically.
5. Thus, the iron-sulfur mixture is a **mixture**, while iron sulfide formed after heating is a **compound**.

10. What are minerals? Give their types and examples.
Answer:
1. Minerals are **natural, solid substances found on the Earth**.
2. Most rocks consist of a mixture of different minerals.
3. Some minerals called **native minerals** occur as pure elements rather than compounds.
4. Gold, silver, copper, sulfur, and carbon are examples of elements that can occur as native minerals.
5. Most minerals are compounds, and examples include **quartz, calcite, mica, pyroxene, and olivine**.

8.12 Five-mark questions with Answers of HOTS Type: (10 Questions)

The following questions are designed as **HOTS (Higher Order Thinking Skills)** questions, requiring students to **analyse, compare, justify, predict, infer, and apply concepts**. Each answer contains **five points/sentences suitable for 5 marks**. The chapter itself encourages such reasoning through questions involving classification, justification, prediction, and analysis.

1. Water is made from hydrogen, which burns, and oxygen, which supports burning. Yet water is used to extinguish fire. How does this prove that water is a compound?
Answer:
1. Hydrogen is a combustible gas, while oxygen supports combustion.
2. When hydrogen and oxygen combine chemically in a fixed ratio, they form water.
3. Water has properties completely different from those of hydrogen and oxygen.

4. The hydrogen and oxygen present in water cannot be separated by ordinary physical methods.
5. Therefore, water demonstrates an important property of compounds—the compound formed has properties different from its constituent elements.

2. A student mixes iron filings and sulfur powder. Another student heats the same mixture until a black substance is formed. Analyse how you would determine which sample is a mixture and which is a compound.

Answer:

1. Before heating, iron and sulfur remain separately visible and retain their individual properties, so the sample is a mixture.
2. A magnet can attract and separate the iron filings from the unheated mixture.
3. On heating, iron and sulfur react chemically and form a new black substance called **iron sulfide**.
4. Iron sulfide is not attracted by a magnet, and iron and sulfur can no longer be physically separated.
5. Therefore, the unheated sample is a **mixture**, while the black substance formed after heating is a **compound**.

3. Suppose water were a mixture of hydrogen and oxygen instead of a compound. Predict how its properties would be different.

Answer:

1. If water were a mixture, hydrogen and oxygen would retain their individual properties.
2. Hydrogen would continue to show its property of being a fuel.
3. Oxygen would continue to support combustion.
4. The two gases could possibly be separated using suitable physical methods because components of mixtures are not chemically combined.
5. Therefore, water would not possess its present characteristic properties, such as extinguishing fire, showing why water must be a compound rather than a mixture.

4. A colourless solution turns milky after being left exposed to air for some time. Identify the solution and explain what conclusion can be drawn from this observation.

Answer:

1. The colourless solution is **lime water**, which is a solution of calcium hydroxide.
2. When exposed to air, carbon dioxide present in the air comes in contact with the lime water.
3. Carbon dioxide reacts with calcium hydroxide to form calcium carbonate and water.
4. The insoluble tiny white particles of calcium carbonate make the solution appear milky.
5. Hence, the change from colourless to milky provides evidence for the **presence of carbon dioxide in air**.

5. A student says, "Air is a pure substance because it looks the same everywhere." Do you agree? Justify your answer.

Answer:

1. No, air cannot be classified as a pure substance merely because it appears uniform.
2. Air contains nitrogen, oxygen, argon, carbon dioxide, and water vapour.
3. These gases are evenly distributed, making air a **uniform mixture**.
4. The different gases do not chemically combine to form a single new substance.
5. Therefore, air is a uniform mixture and not a pure substance, even though its components cannot normally be distinguished visually.

6. A student heats sugar and observes water droplets near the mouth of the tube and a black substance left behind. What conclusions can the student draw from these observations?

Answer:

1. On heating, sugar first turns brown and later becomes black due to charring.
2. The water droplets formed near the mouth of the tube come from the decomposition of sugar.
3. The black substance remaining in the tube is carbon.
4. Since water contains hydrogen and oxygen, the observations show that sugar contains carbon, hydrogen, and oxygen.
5. Therefore, sugar is not an element but a **compound made up of different elements**.

7. Both stainless steel and iron sulfide contain more than one element. Why is stainless steel considered a mixture while iron sulfide is considered a compound?

Answer:

1. Stainless steel contains substances such as iron, nickel, chromium, and a small amount of carbon.
2. These components are mixed uniformly, making stainless steel an **alloy and a mixture**.
3. Iron sulfide is formed when iron and sulfur undergo a chemical reaction on heating.
4. The resulting iron sulfide has new properties different from those of iron and sulfur, and its constituents cannot be separated physically.
5. Hence, stainless steel is a **mixture**, whereas iron sulfide is a **compound**.

8. Two unknown samples A and B are tested with a magnet. The magnet attracts particles from Sample A but has no effect on Sample B. If both originally contained iron and sulfur, what can you infer?

Answer:

1. Sample A is likely an unreacted mixture of iron and sulfur.
2. Iron retains its magnetic property in Sample A and is therefore attracted by the magnet.
3. Sample B is likely iron sulfide formed after iron and sulfur were heated together.
4. Iron in Sample B no longer shows its original magnetic property because a new compound has formed.
5. Thus, the magnet test provides evidence that **Sample A is a mixture while Sample B is a compound**.

9. Why can sodium chloride be considered a good example to show that a compound may have properties very different from its constituent elements?

Answer:

1. Sodium is a soft metal, while chlorine is a hazardous gas.
2. When sodium and chlorine combine chemically, they form sodium chloride.
3. Sodium and chlorine occur in sodium chloride in a fixed particle ratio of **1:1**.
4. The resulting sodium chloride is a harmless, taste-enhancing substance essential in our lives.
5. Thus, sodium chloride demonstrates that a compound can possess properties completely different from the elements from which it is formed.

10. Graphene aerogel has a very high absorbing capacity. Analyse how this property can make it useful in solving environmental problems.

Answer:

1. Graphene aerogel is a material made from carbon and is extremely light.
2. It is highly porous, which gives it a high absorbing capacity.
3. Because of this property, it can absorb substances such as oil.
4. It can therefore potentially be used to clean up **oil spills in seas and on land**.
5. This demonstrates how understanding the properties of matter can help scientists develop innovative materials for addressing environmental problems.

8.13 Five-mark questions with Answers of Applied Type: (10 Questions)

The following questions focus on **applying the concepts learned in the chapter to everyday situations, experiments, materials, and environmental problems**. Each answer is given in **five points/sentences for 5 marks**. The chapter itself emphasizes real-life application through materials, environmental cleaners, product labels, and everyday examples.

1. While preparing lemonade, a student mixes sugar and lemon juice with water. Apply your knowledge of mixtures to explain the nature of the lemonade formed.

Answer:

1. Lemonade is formed by mixing two or more substances such as water, sugar, and lemon juice.
2. These substances do not chemically combine to form a new compound.
3. Each component retains its basic properties even after mixing.
4. When the components are evenly distributed, the lemonade appears uniform throughout.
5. Therefore, lemonade is an example of a **mixture** encountered in our daily life.

2. A cook accidentally mixes iron filings with sulfur powder in a laboratory demonstration. How can the iron be recovered, and what scientific principle is applied?

Answer:

1. The iron filings and sulfur powder together form a mixture because they have not chemically reacted.
2. Iron retains its magnetic property even after being mixed with sulfur.
3. A magnet can therefore be moved over the mixture to attract the iron filings.
4. The sulfur remains behind because it is not attracted by the magnet.
5. This demonstrates that the components of a **mixture retain their individual properties and can be separated by physical methods**.

3. A family living near a busy road notices more dust settling on their furniture than a family living in a less crowded area. Apply the concepts from the chapter to explain this observation.

Answer:

1. Dust particles can remain suspended in the air and eventually settle on exposed surfaces.
2. Dust is not an integral component of air but is considered a **pollutant**.
3. The amount and nature of dust present in air can vary from one place to another.
4. A busy road may have more suspended dust and particulate matter, so more particles may settle on nearby surfaces.
5. Therefore, observing the amount of dust deposited on surfaces can give an indication of differences in local air pollution.

4. Stainless steel is preferred over pure iron for many utensils and other products. Apply your knowledge of mixtures to explain why stainless steel is useful.

Answer:

1. Stainless steel is a mixture containing iron, nickel, chromium, and a small amount of carbon.
2. These substances are mixed uniformly, so stainless steel is classified as an **alloy**.
3. Engineers develop alloys to obtain materials with useful and improved properties.
4. Stainless steel is stronger and more durable than pure iron.
5. Therefore, understanding mixtures and alloys enables us to select and design materials suitable for practical applications.

5. An oil spill occurs in the sea. How could graphene aerogel be applied to help reduce the environmental damage?

Answer:

1. Graphene aerogel is a very light material made from carbon.

2. It has a highly porous structure and therefore possesses a high absorbing capacity.
3. This property enables it to absorb materials such as spilled oil.
4. It can potentially be used to clean oil spills both in seas and on land.
5. Thus, graphene aerogel shows how knowledge about the properties of matter can be applied to develop materials for solving environmental problems.

6. A student wants to check whether carbon dioxide is present in the air. Describe how the student can apply the lime-water test for this purpose.

Answer:

1. The student should prepare a colourless solution of calcium hydroxide called **lime water**.
2. The lime water can be kept exposed to air in a petri dish for a few hours.
3. Carbon dioxide present in the air reacts with calcium hydroxide.
4. Insoluble white particles of calcium carbonate are formed, causing the lime water to turn milky.
5. Therefore, the appearance of milkiness confirms the **presence of carbon dioxide in air**.

7. A student is given seawater and is asked to classify it as a pure substance or a mixture. How should the student apply the scientific definition of purity?

Answer:

1. In science, a pure substance contains only the same type of particles.
2. A pure substance cannot be separated into other kinds of matter by a physical process.
3. Seawater contains water along with dissolved substances such as salts.
4. Therefore, it contains more than one substance and its components can be separated using suitable physical processes.
5. Hence, seawater should be classified as a **mixture and not a pure substance**.

8. A manufacturer wants to select materials for constructing a strong and durable building. How can knowledge of elements, compounds, and mixtures help?

Answer:

1. Knowledge of matter helps engineers understand the properties of different construction materials.
2. Elements such as iron and aluminium are widely used in constructing buildings, bridges, and vehicles.
3. Mixtures such as steel and concrete are useful building materials because of their suitable properties.
4. Alloys can be developed by combining materials to obtain improved strength and durability.
5. Therefore, understanding elements, compounds, and mixtures helps engineers **select or design materials according to their intended use**.

9. A craftsperson wants to make a Dhokra figure that is strong and has a shiny golden appearance. Which materials and process described in the chapter could be applied?

Answer:

1. The craftsperson can first prepare the desired design using beeswax.
2. The wax model is covered with clay to form a mould.
3. After the clay hardens, the wax is melted and removed, leaving a hollow space.
4. Molten **brass or bronze**, which are alloys, can then be poured into this hollow mould.
5. These materials make Dhokra figures **strong and give them a shiny golden colour**, showing a traditional application of mixtures and alloys.

10. You are given a rock containing several visible substances. How would you apply your knowledge of minerals and mixtures to explain its composition?

Answer:

1. Most rocks are mixtures made up of different minerals.
2. Some minerals in a rock can be observed with the naked eye, magnifying glass, or microscope.
3. A few minerals are native minerals consisting of pure elements such as gold, silver, copper, sulfur, or carbon.
4. Most minerals, however, are compounds made up of more than one element.
5. Therefore, examining the different minerals present can help us understand the **composition and possible useful substances present in the rock**.

8.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

1. A student mixes iron filings and sulfur powder. The iron can still be removed using a magnet. Which conclusion is most appropriate?
A) A new compound has been formed
B) Iron has lost its original properties
C) The substances form a mixture because they retain their properties
D) Sulfur has changed into a magnetic substance
Answer: C) The substances form a mixture because they retain their properties

---

2. Four substances P, Q, R and S have the following properties:

- P cannot be broken into simpler substances.
- Q contains two elements chemically combined in a fixed ratio.
- R contains two substances that can be physically separated.
- S consists of identical atoms.

Which pair must be elements?
A) P and Q
B) P and S
C) Q and R
D) R and S
Answer: B) P and S

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3. A student observes that a colourless solution of lime water becomes milky after being exposed to air. The observation provides evidence for the presence of:
A) oxygen in air
B) nitrogen in air
C) carbon dioxide in air
D) water vapour in air
Answer: C) Carbon dioxide in air
The milkiness is due to the formation of insoluble calcium carbonate.

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4. Which sequence correctly represents the classification from the broadest category to the most specific?
A) Matter → Pure substance → Element → Iron
B) Matter → Mixture → Compound → Water
C) Matter → Element → Pure substance → Oxygen
D) Pure substance → Matter → Compound → Water
Answer: A) Matter → Pure substance → Element → Iron

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5. A sample looks identical throughout and its individual components cannot be distinguished even with a microscope. Which conclusion is necessarily correct?

A) It must be an element.
B) It must be a compound.
C) It may be a uniform mixture.
D) It must contain only one type of atom.
Answer: C) It may be a uniform mixture.

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6. Water is decomposed by passing electricity through it. One gas produces a 'pop' sound while the other makes a candle flame glow brighter. The gases are respectively:
A) oxygen and hydrogen
B) hydrogen and oxygen
C) carbon dioxide and oxygen
D) nitrogen and hydrogen
Answer: B) Hydrogen and oxygen

---

7. Hydrogen is a fuel and oxygen supports combustion, but water can extinguish fire. This observation best demonstrates that:
A) compounds always have the same properties as their elements
B) elements lose their identity when chemically combined into a compound
C) water is a mixture of hydrogen and oxygen
D) hydrogen and oxygen cannot react chemically
Answer: B) Elements lose their identity when chemically combined into a compound

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8. Consider the following:
I. Air
II. Seawater
III. Bronze
IV. Sugar
V. Oxygen
Which group contains **only mixtures**?
A) I, II and III
B) II, III and IV
C) I, IV and V
D) III, IV and V
Answer: A) I, II and III

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9. Substance X contains two different elements. Its constituents cannot be separated by physical methods, and X has properties different from either constituent. X is most likely:
A) an element
B) a compound
C) a non-uniform mixture
D) an alloy
Answer: B) A compound

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10. Which of the following correctly distinguishes a mixture from a compound?
A) Mixture — fixed ratio; Compound — variable ratio
B) Mixture — components retain properties; Compound — new properties are obtained
C) Mixture — cannot be separated physically; Compound — can be separated physically
D) Mixture — always non-uniform; Compound — always contains only one element
Answer: B) Mixture — components retain properties; Compound — new properties are obtained

11. A scientist receives four samples:
- P: iron
- Q: seawater
- R: sodium chloride
- S: air

Which samples are pure substances according to the scientific definition?
A) P and Q
B) P and R
C) Q and S
D) R and S
Answer: B) P and R

12. Sugar is heated strongly in a boiling tube. Water droplets appear near the mouth of the tube and carbon remains behind. Which conclusion is best supported?
A) Sugar is an element.
B) Sugar contains only carbon.
C) Sugar is a compound containing carbon, hydrogen and oxygen.
D) Sugar is a mixture of carbon and water.
Answer: C) Sugar is a compound containing carbon, hydrogen and oxygen.

13. Sample A is an iron–sulfur mixture, while Sample B is formed by heating iron and sulfur together. A magnet is brought near both. What should happen?
A) Both A and B are attracted.
B) Neither is attracted.
C) A is attracted, but B is not.
D) B is attracted, but A is not.
Answer: C) A is attracted, but B is not.

14. Samples A and B from Question 13 are separately treated with dilute hydrochloric acid. Which observation correctly identifies Sample B as iron sulfide?
A) A colourless, odourless gas giving a pop sound is produced.
B) A colourless gas with a rotten egg-like odour is produced.
C) No gas is produced.
D) Oxygen is released.
Answer: B) A colourless gas with a rotten egg-like odour is produced.

15. A student says, "All substances that appear uniform must be pure substances." Which example from the chapter disproves the statement most effectively?
A) Gold
B) Oxygen
C) Air
D) Sulfur
Answer: C) Air

16. Which of the following represents a **solid–liquid non-uniform mixture**?
A) Seawater
B) Sand and water
C) Vinegar
D) Oxygen dissolved in water

Answer: B) Sand and water

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17. Stainless steel contains iron, nickel, chromium and a small amount of carbon, yet appears the same throughout. It is best classified as:
A) an element
B) a compound
C) a uniform mixture or alloy
D) a non-uniform mixture
Answer: C) A uniform mixture or alloy

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18. Sodium is a soft metal and chlorine is a hazardous gas. They combine to produce sodium chloride, a harmless taste-enhancing substance. This illustrates that:
A) compounds retain all properties of their constituent elements
B) compounds may have entirely different properties from their constituent elements
C) sodium chloride is a mixture
D) chemical combination does not produce new substances
Answer: B) Compounds may have entirely different properties from their constituent elements

---

19. In water, the ratio of the number of hydrogen atoms to oxygen atoms is:
A) 1 : 1
B) 1 : 2
C) 2 : 1
D) 2 : 2
Answer: C) 2 : 1

---

20. Consider the statements:
I. All elements are pure substances.
II. All compounds are pure substances.
III. All mixtures are pure substances.
IV. Elements cannot be broken down into simpler substances.
Which are correct?
A) I and II only
B) I, II and IV only
C) II, III and IV only
D) I, II, III and IV
Answer: B) I, II and IV only

---

21. Which pair represents the two elements that are liquids at room temperature according to the chapter?
A) Mercury and bromine
B) Gallium and mercury
C) Caesium and bromine
D) Gallium and caesium
Answer: A) Mercury and bromine

---

22. A rock sample contains quartz, calcite and mica. How should the rock itself be classified?
A) Element
B) Compound

C) Mixture of minerals
D) Native mineral
Answer: C) Mixture of minerals

---

23. Gold found naturally in the Earth can be classified both as a mineral and an element because:
A) all minerals are elements
B) gold is a native mineral that exists as a pure element
C) gold is a mixture of several metals
D) all metals are compounds
Answer: B) Gold is a native mineral that exists as a pure element

---

24. Graphene aerogel can potentially be used to clean oil spills mainly because it is:
A) magnetic and dense
B) highly porous with high absorbing capacity
C) a liquid at room temperature
D) soluble in oil
Answer: B) Highly porous with high absorbing capacity

---

25. Olympiad Challenge:
A student is given an unknown substance X. The following observations are made:
1. X has the same appearance throughout.
2. X cannot be separated into its constituents by physical methods.
3. X can be chemically broken down into two simpler substances.
4. The simpler substances have properties different from X.

What is X?
A) A uniform mixture
B) A non-uniform mixture
C) An element
D) A compound
Answer: D) A compound
Reason: A compound is a pure substance made of two or more elements chemically combined in a fixed ratio. Its constituents cannot be separated by physical methods and the compound has properties different from its constituent elements.
Answer Key

Q	Ans.	Q	Ans.	Q	Ans.	Q	Ans.	Q	Ans.
1	C	6	B	11	B	16	B	21	A
2	B	7	B	12	C	17	C	22	C
3	C	8	A	13	C	18	B	23	B
4	A	9	B	14	B	19	C	24	B
5	C	10	B	15	C	20	B	25	D

8.15 Best Practices Opportunity List from the Chapter: (8 Ideas)

This chapter offers particularly good opportunities for **experiential, inquiry-based and application-oriented teaching** because it combines classification of matter with experiments, observations, real-life materials, environmental applications and interdisciplinary projects.

(1) **Learning by Experimentation – "Mixture vs Compound Lab":**

Allow students to prepare an **iron-and-sulfur mixture**, test it with a magnet, and then compare it with the compound formed after heating. Students maintain an *Observation–Evidence–Inference* sheet to discover the difference between mixtures and compounds themselves. The chapter specifically develops this through Samples A and B and magnet/gas tests.

(2) **"Matter Around Me" Classification Challenge:**
Students collect or photograph 10–15 everyday materials—salt, sugar, soil, air, milk, stainless steel, aluminium, water, fruit juice, etc.—and classify them as **element, compound, uniform mixture or non-uniform mixture**, giving a scientific reason for every classification. This converts classification from memorisation into real-life scientific reasoning.

(3) **Product-Label Science Investigation:**
Ask students to bring labels/wrappers from safe household products such as packaged foods, toothpaste, detergents and beverages. They study the listed ingredients and identify possible **elements, compounds and mixtures**. This directly extends the chapter's suggested "Read labels" interdisciplinary activity.

(4) **Air Detective – Environmental Science Integration:**
Students can investigate air as a mixture through the **lime-water test for carbon dioxide** and the **black-paper dust collection activity**. They can then relate their observations to air pollution and AQI, making the lesson locally relevant and environmentally conscious.

(5) **Concept Debate – "Which Is More Important?":**
Divide the class into three teams—**Elements, Compounds and Mixtures**. Each team must defend why its category is most important to human life, using examples and scientific evidence. This develops **communication, critical thinking and scientific argumentation**, and is also specifically suggested as a group activity in the chapter.

(6) **Indian Knowledge & Scientific Heritage Connection:**
Integrate the chapter with Indian heritage by exploring **Mishraloha (alloys), Kamsya/bronze and Dhokra art**. Students can investigate how traditional Indian practices used mixtures and alloys long before modern material science terminology, thereby connecting **science with history, art and Indian Knowledge Systems**.

(7) **"Young Material Scientist" Innovation Challenge:**
Present the chapter's example of **graphene aerogel**, which is highly porous and has potential applications in cleaning oil spills. Ask groups to propose a material or solution for an environmental problem and explain what properties the material should possess. This introduces **design thinking and STEM problem-solving**.

(8) **Olympiad Corner – Five-Minute HOTS Challenge:**
End each lesson with one **Olympiad/HOTS question** involving an unfamiliar situation rather than direct textbook recall—for example: *"A substance cannot be separated physically, but on chemical decomposition gives two simpler substances. How would you classify it? Justify."* Students should not merely choose an answer but defend it using scientific reasoning.

Best-practice documentation idea for the teacher: These activities can be maintained as a **"Matter Investigation Portfolio"** containing students' hypotheses, photographs, observation tables, classification charts, product-label investigations, reflections and Olympiad questions. This provides tangible evidence of **experiential learning, competency-based assessment, interdisciplinary learning and student participation**.

8.16 Innovations Opportunity List from the Chapter: (10 Ideas)

The chapter itself encourages students to **probe, ponder, discover, design and debate**, making it suitable for innovative teaching beyond conventional explanation and note-writing.

(1) **Virtual "Build-a-Molecule" Laboratory:**
Use an interactive digital/3D simulation in which students drag and combine atoms to construct molecules such as **H_2, O_2, H_2O and NaCl**. Students can visually understand how elements combine in fixed ratios to form compounds—a key idea illustrated through water in the chapter.

(2) **AI as a "Matter Detective":**
Students photograph or list everyday objects—water, steel utensils, air, salt, soil, jewellery, soft drinks, etc.—and use an AI tool to investigate their composition. They must then **verify the AI response using textbook concepts** and classify each as an element, compound, uniform mixture or non-uniform mixture. This also develops **AI literacy and fact-checking skills**.

(3) **AR Periodic Table / QR Learning Stations:**
Create QR codes around the classroom for selected elements such as **iron, oxygen, carbon, aluminium, gold and sulfur**. Scanning each code can reveal its atomic representation, physical state, everyday uses and whether it is a metal/non-metal. The chapter introduces elements as the fundamental building blocks of matter.

(4) **"Invent a Wonder Material" Design Challenge:**
Inspired by the chapter's discussion of **graphene aerogel**, students work as young material scientists to design an imaginary new material for solving a real problem—oil spills, water purification, heat protection, lightweight buildings, etc. They specify its desired properties, possible components and applications, and present a prototype/poster.

(5) **Digital Experiment Prediction – Observe – Explain (POE):**
Before demonstrations such as **electrolysis of water, heating sugar, or heating iron and sulfur**, students use a digital poll to predict the outcome. After observing the experiment, they record what actually happened and scientifically explain differences between their prediction and observation. The chapter provides several demonstration-based experiments suitable for this approach.

(6) **Matter Escape Room / Gamified Classroom:**
Convert the classroom into a **"Matter Mystery Escape Room."** Teams solve successive clues—for example, identify an unknown substance, distinguish a mixture from a compound, classify samples, interpret a chemical change and decode a final scientific password. Correct answers unlock the next QR-code challenge. This turns assessment into collaborative problem-solving.

(7) **Student-Created Science Reels / Digital Comics:**
Instead of a conventional assignment, students create a **60–90 second science video, animation or digital comic** titled *"Element vs Compound vs Mixture."* They must use real-life examples and explain the differences scientifically. This extends the textbook's own recommendation to create comic strips from real-life examples.

(8) **"Smart Air Lab" – Data-Based Environmental Learning:**
Extend the chapter's activities on **CO_2, suspended dust particles and AQI** by asking students to record the local AQI over several days, prepare a simple graph and relate changes to traffic, weather or other observable conditions. This integrates **Science + Mathematics + Environmental Education + Data Literacy**.

(9) **Reverse Classroom – Students Become the Teachers:**
Assign groups the roles of **Elements, Compounds, Mixtures, Alloys and Minerals**. Each group prepares a five-minute micro-lesson using models, demonstrations, riddles

or digital media and teaches the concept to classmates. Peer questions and a short quiz determine how effectively each group taught its concept.

(10) **Innovation Pitch: "Matter for a Better World":**
Conclude the chapter with a mini **Science Innovation Expo**. Teams identify one real-world problem and pitch how knowledge of elements, compounds or mixtures could contribute to a solution. This is strongly connected to the chapter's emphasis that understanding matter is a **key to innovation**, including medicines, vaccines, fertilisers, alloys and advanced materials.

For a school lesson-plan format, the **five strongest innovations** to highlight would be: **AI Matter Detective, Virtual Build-a-Molecule Lab, Matter Escape Room, Invent-a-Wonder-Material Challenge, and Smart Air Lab**. These clearly demonstrate innovation through **AI integration, simulation, gamification, design thinking and data-driven learning**.

8.17: Practicing Questions/Question Bank:

Question Bank – Grade 8 Science:

Chapter 8: Nature of Matter – Elements, Compounds, and Mixtures

A. Fill in the Blanks – 1 Mark Each:

1. The individual substances that make up a mixture are called __________.
2. A mixture in which the components are evenly distributed is called a __________ mixture.
3. Air is mainly a mixture of nitrogen, oxygen, argon, carbon dioxide and __________.
4. Nitrogen constitutes about __________% of air.
5. Lime water turns __________ in the presence of carbon dioxide.
6. Stainless steel is a mixture of iron, nickel, chromium and a small amount of __________.
7. Brass is an alloy of copper and __________.
8. Bronze is an alloy of copper and __________.
9. A pure substance consists of the __________ type of particles.
10. The smallest identical particles that make up an element are called __________.
11. Two or more atoms may combine to form a stable particle called a __________.
12. Elements are the __________ blocks of all matter.
13. The ratio of hydrogen atoms to oxygen atoms in water is __________.
14. Sodium and chlorine combine in a __________ ratio to form sodium chloride.
15. On heating sugar, __________ is left behind in the boiling tube.
16. Sugar consists of carbon, hydrogen and __________.
17. Heating iron and sulfur together produces __________.
18. Hydrogen gas burns with a characteristic __________ sound.
19. Hydrogen sulfide has a __________ egg-like odour.

20. The lightest material mentioned in the chapter is __________.
21. Most rocks are mixtures of __________.
22. Talcum powder is made from the mineral __________.
23. Gold, silver and copper occurring as pure elements are called __________ minerals.
24. Light, heat and electricity are __________ matter.
25. The Air Quality Index is abbreviated as __________.

These questions draw directly from the chapter's definitions and examples of mixtures, elements, compounds and minerals.

B. One-Mark Questions – Very Short Answer:

1. What is a mixture?
2. What are the components of a mixture?
3. Give one example of a uniform mixture.
4. Give one example of a non-uniform mixture.
5. Is air a uniform or non-uniform mixture?
6. What is an alloy?
7. Name the components of brass.
8. Name the components of bronze.
9. What is a pure substance?
10. Define an element.
11. Give two examples of non-metallic elements.
12. Name the two elements present in water.
13. What is a molecule?
14. What is a compound?
15. What is the atomic ratio of hydrogen and oxygen in water?
16. Name the elements present in common salt.
17. Which gas gives a 'pop' sound when tested with a burning candle?
18. Which gas makes the flame of a burning candle glow brighter?
19. What compound is formed when iron and sulfur are heated together?
20. What is the smell of hydrogen sulfide?
21. Name the two elements that are liquids at room temperature.
22. What is a mineral?
23. Give two examples of native minerals.

24. Name any two minerals used in making cement.
25. Why is graphene aerogel called a 'wonder' material?

The water experiment in the chapter identifies hydrogen by its pop sound and oxygen by making the candle flame glow brighter.

C. Two-Mark Questions – Short Answer:

1. Differentiate between a **uniform mixture and a non-uniform mixture**, with one example each.
2. Why is **air considered a mixture**? Name any three components of air.
3. What are **alloys**? Give two examples along with their components.
4. Differentiate between the scientific meaning and common meaning of a **pure substance**.
5. Why is water considered a **compound and not a mixture**?
6. Distinguish between an **atom and a molecule**.
7. What happens when an electric current is passed through water? Name the gases obtained.
8. How can hydrogen and oxygen gases obtained from water be identified?
9. What happens when sugar is heated strongly? What does this experiment indicate about sugar?
10. State any **two characteristics of compounds**.
11. Why can iron be separated from an iron-sulfur mixture using a magnet but not from iron sulfide?
12. Give two differences between **Sample A (iron + sulfur mixture)** and **Sample B (iron sulfide)** from Activity 8.5.
13. What happens when dilute hydrochloric acid is added to an iron-sulfur mixture?
14. What happens when dilute hydrochloric acid is added to iron sulfide?
15. Differentiate between a **mixture and a compound** on the basis of composition and properties.
16. What are native minerals? Give two examples.
17. Why are dust particles present in air considered pollutants rather than components of air?
18. Mention any two uses of our knowledge of elements, compounds and mixtures in everyday life.

The distinction between the iron-sulfur mixture and iron sulfide is particularly suitable for reasoning questions because the chapter shows that the mixture retains the properties of its components, whereas the compound has new properties.

D. Three-Mark Questions:

1. **Explain three differences between an element, a compound and a mixture**, giving one example of each.

2. Explain how the **lime-water experiment demonstrates the presence of carbon dioxide in air**.
3. Describe the experiment used to show that **dust particles are suspended in air**. What conclusion can you draw?
4. Describe how passing electricity through water demonstrates that **water is a compound of hydrogen and oxygen**.
5. Explain how hydrogen and oxygen collected during the electrolysis of water can be identified experimentally.
6. Explain any **three characteristics of elements**. Give suitable examples.
7. Explain any **three characteristics of compounds** with examples.
8. What happens when sugar is heated? State the observations and conclusion of the experiment.
9. Compare an **iron-sulfur mixture and iron sulfide** under the following headings:
    - Appearance
    - Effect of magnet
    - Ability to separate the constituents
10. Explain the reactions of **Sample A and Sample B with dilute hydrochloric acid**. How can the gases produced be distinguished?
11. Classify the following into **elements, compounds and mixtures**, giving reasons: **oxygen, seawater, sodium chloride, gold, air and iron sulfide.**
12. Explain how knowledge of elements, compounds and mixtures contributes to **medicine, agriculture and material science**.
13. What are minerals? Explain the difference between **native minerals and compound minerals**, with examples.
14. Explain any three ways in which minerals are useful in our daily life.
15. "Not everything around us is matter." Explain the statement using suitable examples.

The chapter explicitly notes that light, heat, electricity, thoughts and emotions are not matter, while elements and compounds form the materials around us.

E. Five-Mark Descriptive / Long-Answer Questions:

1. Differentiate between elements, compounds and mixtures. Explain the differences under the following headings: composition, nature of particles, properties, separation and examples.

2. Describe Activity 8.5 involving iron and sulfur. Explain how the activity demonstrates the difference between a mixture and a compound. Include the magnet test and the reaction with dilute hydrochloric acid.

3. Describe the experiment demonstrating the decomposition of water by electricity. Include the experimental setup, observations, identification of gases and conclusion.

4. Explain the different types of mixtures based on the physical states of their components. Give suitable examples of gas–gas, gas–liquid, solid–gas, liquid–liquid, solid–liquid and solid–solid mixtures. The chapter's Table 8.1 provides examples such as air, aerated water, carbon particles in air, vinegar, seawater and alloys.

5. “The properties of a compound are different from those of the elements forming it.” Explain this statement using **water and sodium chloride** as examples.

6. Describe the experiment of heating sugar. State the observations, products formed and conclusion. Explain how the experiment proves that sugar is a compound.

7. What are minerals? Explain native minerals and compound minerals. Give examples and discuss how minerals are used to produce everyday materials such as cement and talcum powder.

8. Explain how the study of elements, compounds and mixtures contributes to technological and societal development. Discuss applications in medicines, vaccines, fertilisers, alloys, construction materials and environmental protection.

9. Compare Sample A (iron + sulfur) and Sample B (iron sulfide) with respect to formation, appearance, properties, magnetic behaviour, separation of constituents and reaction with dilute hydrochloric acid.

10. “Matter science is a key to innovation.” Justify the statement using examples from the chapter such as stainless steel, medicines, fertilisers and graphene aerogel.

Higher-Order / Competency-Based Questions

I would also recommend adding a few questions that students **cannot answer merely by memorising definitions**, since the textbook itself includes reasoning and application-oriented exercises.

1. **A student mixes iron filings and sulfur powder. Another student heats the same mixture strongly. Both samples contain iron and sulfur. Are they still the same kind of substance? Explain.** *(3 marks)*
2. **Hydrogen burns, oxygen supports combustion, but water extinguishes fire. What important property of compounds does this observation demonstrate? Explain.** *(2 marks)*
3. **Riya says, “Packed fruit juice says ‘pure’ on the packet, so scientifically it must be a pure substance.” Do you agree? Give reasons.** *(2 marks)*
4. **Suppose water were a mixture rather than a compound. How would its properties and composition be different?** *(3 marks)*
5. **A black substance does not respond to a magnet and produces a rotten egg-smelling gas when dilute HCl is added. Identify the substance and justify your answer.** *(3 marks)*
6. **A material is extremely light, highly porous and can absorb substances from its surroundings. Based on the chapter, identify a possible material and suggest one environmental application.** *(2 marks)*
7. **A student says, “All minerals are compounds.” Is the statement correct? Justify your answer with examples.** *(3 marks)*
8. **Gold can be described both as an element and as a mineral. Explain how both descriptions can be scientifically correct.** *(3 marks)*

This combination would make the question bank much stronger because it progresses from **Recall → Understanding → Application → Analysis → Experimental reasoning**, rather than simply increasing the length of answers as the marks increase.

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8th Standard Science Book Chapter 9

Chapter 9: The Amazing World of Solutes, Solvents, and Solutions

9.1 Summary of the Chapter:

Summary – Chapter 9: ***The Amazing World of Solutes, Solvents, and Solutions***

(1) A **solution** is a uniform mixture formed when two or more substances mix evenly. In a solid–liquid solution, the substance that dissolves is the **solute**, while the liquid in which it dissolves is the **solvent**.

(2) A solution in which **more solute can still dissolve** at a given temperature is called an **unsaturated solution**. When no more solute can dissolve at that temperature, it is called a **saturated solution**.

(3) **Concentration** refers to the amount of solute present in a fixed quantity of solution or solvent. A solution containing less solute is called **dilute**, while one containing more solute is called **concentrated**.

(4) **Solubility** is the maximum amount of solute that can dissolve in a fixed quantity of solvent at a particular temperature. For most solid substances, solubility **increases with an increase in temperature**.

(5) Gases such as **oxygen can dissolve in water**. Dissolved oxygen is essential for aquatic organisms. Unlike most solids, the solubility of gases generally **decreases as temperature increases**, so cold water can contain more dissolved oxygen than warm water.

(6) Whether an object floats or sinks in water is related partly to its **density**. Density describes how much mass is contained in a given volume of a substance.

(7) **Density is the mass present per unit volume** of a substance and is calculated using the formula **Density = Mass ÷ Volume**. Its SI unit is **kg/m^3**, while units such as **g/mL** and **g/cm^3** are also commonly used.

(8) **Mass** is the quantity of matter present in an object and can be measured using a **balance**. **Volume** is the space occupied by an object or substance and the volume of liquids can be measured using a **measuring cylinder**.

(9) While measuring the volume of water or other colourless liquids, the reading should be taken at the **bottom of the meniscus**, with the eye at the same level. For coloured liquids, the reading is taken at the **top of the meniscus**.

(10) The volume of a **regularly shaped solid** can be calculated using its dimensions; for a cuboid, **Volume = length × width × height**. The volume of an **irregular solid**, such as a stone, can be determined using the **water displacement method**.

(11) Temperature affects density. Generally, when a substance is **heated, its volume increases and its density decreases** because its particles spread farther apart. This principle explains why **hot air rises** and how a hot-air balloon works.

(12) **Pressure affects the density of gases more strongly than solids and liquids.** Increasing pressure brings gas particles closer together and increases their density. Water also has a special behaviour: **ice is less dense than liquid water and therefore floats**, helping aquatic organisms survive in cold conditions.

Key concepts to remember:
Solute + Solvent → Solution | Saturated & Unsaturated Solutions | Solubility | Mass | Volume | Density = Mass/Volume | Meniscus | Water Displacement | Floating & Sinking | Effects of Temperature and Pressure.

9.2 Important Formulas:

1. Density

$$\boxed{\text{Density} = \frac{\text{Mass}}{\text{Volume}}}$$

or

$$\boxed{\rho = \frac{m}{V}}$$

where m= mass, V= volume and ρ= density.
Common units:

$$\boxed{\text{kg/m}^3,\ \text{g/cm}^3,\ \text{g/mL}}$$

The chapter, for example, calculates the density of a 27 g aluminium block of volume 10 cm^3 as **2.7 g/cm^3**.

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2. Mass from Density
Rearranging the density formula:

$$\boxed{\text{Mass} = \text{Density} \times \text{Volume}}$$

or

$$\boxed{m = \rho V}$$

Example: If density = 2.5 g/cm^3 and volume = 20 cm^3,

$$m = 2.5 \times 20 = \boxed{50\ \text{g}}$$

---

3. Volume from Density

$$\boxed{\text{Volume} = \frac{\text{Mass}}{\text{Density}}}$$

or

$$\boxed{V = \frac{m}{\rho}}$$

This is directly required for the chapter exercise asking for the volume of an iron block when its mass and density are given.

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4. Relative Density

$$\boxed{\text{Relative Density} = \frac{\text{Density of substance}}{\text{Density of water at that temperature}}}$$

Relative density **has no unit** because it is a ratio of two densities.

---

5. Volume of a Cuboid / Regular Solid
For a cuboid:

$$\boxed{V = l \times w \times h}$$

where l= length, w= width and h= height.
The chapter gives the example:

$$25\ \text{cm} \times 18\ \text{cm} \times 2\ \text{cm} = \boxed{900\ \text{cm}^3}$$

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6. Volume of an Irregular Solid – Water Displacement Method

$$\boxed{\text{Volume of object} = \text{Final water volume} - \text{Initial water volume}}$$

or

$$\boxed{V_{\text{object}} = V_f - V_i}$$

For the example in the chapter:

$$55 \text{ mL} - 50 \text{ mL} = 5 \text{ mL} = 5 \text{ cm}^3$$

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7. Smallest Reading / Least Count of a Measuring Cylinder

$$\boxed{\text{Smallest division} = \frac{\text{Difference between two marked readings}}{\text{Number of divisions between them}}}$$

For example:

$$\frac{20 - 10}{10} = \boxed{1 \text{ mL}}$$

---

8. Remaining Capacity of a Container

$$\boxed{\text{Remaining Capacity} = \text{Total Capacity} - \text{Volume already filled}}$$

For example, the chapter asks about a **2 L bottle containing 500 mL of water**.
First,

$$2 \text{ L} = 2000 \text{ mL}$$

Therefore,

$$2000 - 500 = \boxed{1500 \text{ mL}}$$

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9. Important Volume Conversions
Remember:

$$\boxed{1 \text{ L} = 1000 \text{ mL}}$$
$$\boxed{1 \text{ L} = 1 \text{ dm}^3}$$
$$\boxed{1 \text{ mL} = 1 \text{ cm}^3 = 1 \text{ cc}}$$

These conversions are particularly important in displacement-method and density numericals.

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10. Important Mass Conversions

$$\boxed{1 \text{ kg} = 1000 \text{ g}}$$

Therefore,

$$\boxed{1 \text{ g} = 0.001 \text{ kg}}$$

Use consistent units for mass and volume before calculating density.

---

11. Density Unit Relationships
The chapter gives:

$$\boxed{1 \text{ kg/m}^3 = 1 \text{ g/L}}$$

and consequently,

$$\boxed{1000 \text{ kg/m}^3 = 1 \text{ g/cm}^3 = 1 \text{ g/mL}}$$

Water has a mass of approximately **1 g for every 1 mL** at room temperature.

Quick Formula Sheet

Quantity	**Formula**
Density	$\boxed{\rho = m/V}$
Mass	$\boxed{m = \rho V}$
Volume	$\boxed{V = m/\rho}$

Quantity	Formula
Relative Density	$\boxed{\rho_{\text{substance}}/\rho_{\text{water}}}$
Cuboid Volume	$\boxed{V = lwh}$
Irregular Solid Volume	$\boxed{V = V_f - V_i}$
Smallest Division	$\boxed{\frac{\text{difference between marked readings}}{\text{number of divisions}}}$
Remaining Capacity	$\boxed{\text{Total capacity} - \text{volume filled}}$

Most important formula for examination:

$$\boxed{\text{Density} = \frac{\text{Mass}}{\text{Volume}}}$$

A large proportion of the chapter's quantitative questions involve using this formula directly or rearranging it to calculate **mass or volume**, including the end-of-chapter problems on density comparisons, stone density, and the volume of an iron block.

9.3 Fill-Up the Blank LOTS type questions with Answers: (50 Questions)

1. A uniform mixture of two or more substances is called a __________.
   Answer: Solution
2. The substance that dissolves in a solvent is called the __________.
   Answer: Solute
3. The substance in which a solute dissolves is called the __________.
   Answer: Solvent
4. In a solution of salt and water, salt is the __________.
   Answer: Solute
5. In a solution of sugar and water, water acts as the __________.
   Answer: Solvent
6. A solution in which more solute can still be dissolved at a given temperature is called an __________ **solution**.
   Answer: Unsaturated
7. A solution in which no more solute can dissolve at a given temperature is called a __________ **solution**.
   Answer: Saturated
8. A solution containing a relatively small amount of solute is called a __________ **solution**.
   Answer: Dilute
9. A solution containing a relatively large amount of solute is called a __________ **solution**.
   Answer: Concentrated
10. The amount of solute present in a fixed quantity of solution or solvent is termed its __________.
    Answer: Concentration
11. The maximum amount of solute that dissolves in a fixed quantity of solvent is called its __________.
    Answer: Solubility
12. For most substances, the solubility of solids __________ with an increase in temperature.
    Answer: Increases

13. The solubility of gases generally __________ as temperature increases.
    Answer: Decreases
14. More oxygen can dissolve in __________ **water** than in warm water.
    Answer: Cold
15. Dissolved __________ in water helps sustain aquatic life.
    Answer: Oxygen
16. The amount of matter present in an object is called its __________.
    Answer: Mass
17. The space occupied by an object is called its __________.
    Answer: Volume
18. Mass per unit volume of a substance is called its __________.
    Answer: Density
19. Density is calculated by dividing mass by __________.
    Answer: Volume
20. The SI unit of density is __________.
    Answer: kg/m^3
21. The instrument used to measure the mass of an object is called a __________.
    Answer: Balance / weighing balance
22. The SI unit of mass is __________.
    Answer: Kilogram (kg)
23. Weight is measured in __________.
    Answer: Newtons (N)
24. A commonly used apparatus for measuring the volume of liquids is a __________.
    Answer: Measuring cylinder
25. The SI unit of volume is __________.
    Answer: Cubic metre (m^3)
26. One litre is equivalent to one __________.
    Answer: Cubic decimetre (dm^3)
27. One millilitre is equivalent to one __________.
    Answer: Cubic centimetre (cm^3)
28. The curved surface formed by water in a measuring cylinder is called the __________.
    Answer: Meniscus
29. For water and other colourless liquids, the reading is taken at the __________ **of the meniscus**.
    Answer: Bottom
30. For coloured liquids, the reading should be taken at the __________ **of the meniscus**.
    Answer: Top
31. The volume of a cuboid is calculated using the formula $l \times w \times$__________.
    Answer: h (height)
32. The volume of an irregular solid can be determined using the __________ **method**.
    Answer: Displacement
33. The volume of an irregular object is equal to the volume of water __________ by it.
    Answer: Displaced
34. The relative density of a substance is a number without any __________.
    Answer: Units
35. Aluminium has a relative density of __________ with respect to water, as given in the chapter.
    Answer: 2.7

36. Generally, the density of a substance __________ on heating.
    Answer: Decreases
37. Generally, the density of a substance __________ on cooling.
    Answer: Increases
38. Hot air rises because it is **__________ dense than the cool air around it.
    Answer: Less
39. Increasing pressure on a gas generally __________ its density.
    Answer: Increases
40. Water has its highest density at __________ **°C**.
    Answer: 4
41. Ice floats on water because ice is **__________ dense than liquid water.
    Answer: Less
42. Water turns into ice at __________ **°C**.
    Answer: 0
43. A mixture of sand and water is a __________ **mixture**.
    Answer: Non-uniform
44. A mixture of salt and water forms a __________ **mixture**.
    Answer: Uniform
45. In a uniform mixture, the components are __________ **distributed throughout**.
    Answer: Evenly
46. Sawdust generally __________ on water.
    Answer: Floats
47. Sand generally __________ in water.
    Answer: Sinks
48. Oil generally __________ on water.
    Answer: Floats
49. The mass of 1 mL of water is approximately __________ at room temperature.
    Answer: 1 g
50. The density of an object can be determined by measuring its mass and __________.
    Answer: Volume

These 50 questions cover the chapter's major LOTS areas: **solute–solvent–solution, saturated and unsaturated solutions, concentration, solubility, gases in water, mass, volume, density, relative density, measuring cylinders, meniscus, displacement method, temperature, pressure, floating and sinking**.

9.4 Fill-Up the Blank HOTS type questions with Answers: (40 Questions)

1. A saturated solution of baking soda at 20°C is heated to 50°C. It can now dissolve more baking soda and therefore behaves as an __________ **solution**.
   Answer: Unsaturated
2. Two glasses contain equal amounts of water. Glass A contains two spoons of salt and Glass B contains four spoons. Glass __________ is more concentrated.
   Answer: B
3. One solution contains 2 spoons of salt in 100 mL of water, while another contains 4 spoons in 50 mL. The __________ **solution** is more concentrated.
   Answer: Second solution
4. If some undissolved salt remains at the bottom of a salt solution and the temperature remains unchanged, the solution is most likely __________.
   Answer: Saturated

5. A saturated solution is heated and the previously undissolved solute begins to dissolve. This indicates that the solubility of the solute has __________.
   Answer: Increased
6. If warm water in an aquarium contains less dissolved oxygen than cold water, increasing the water temperature has __________ the solubility of oxygen.
   Answer: Decreased
7. During very hot weather, aquatic organisms may receive less dissolved oxygen because warm water holds **__________ oxygen than cold water.
   Answer: Less
8. A packet contains 1 litre of oil but its mass is only about 910 g. This suggests that oil is **__________ dense than water.
   Answer: Less
9. An aluminium block has a mass of 27 g and a volume of 10 cm³. Its density is __________ **g/cm³**.
   Answer: 2.7
10. An object has a mass of 200 g and a volume of 40 cm³. Its density is __________ **g/cm³**.
    Answer: 5
11. Object A has a density of 5 g/cm³ while Object B has a density of 4 g/cm³. Therefore, Object __________ is denser.
    Answer: A
12. A stone has a mass of 225 g and a volume of 90 cm³. Its density is __________ **g/cm³**.
    Answer: 2.5
13. Since the density of the above stone is greater than that of water, it will __________ in water.
    Answer: Sink
14. A stone raises the water level in a measuring cylinder from 50 mL to 55 mL. The volume of the stone is __________ **cm³**.
    Answer: 5
15. If a stone has a mass of 16.4 g and a volume of 5 cm³, its density is __________ **g/cm³**.
    Answer: 3.28
16. A notebook measures 25 cm × 18 cm × 2 cm. Its volume is __________ **cm³**.
    Answer: 900
17. A 50 mL measuring cylinder is used to measure 70 mL of water. The measurement must be completed in at least __________ **steps**.
    Answer: Two
18. For measuring exactly 70 mL of water, a 100 mL measuring cylinder is preferable to a 500 mL cylinder because it provides greater __________.
    Answer: Accuracy
19. If a student reads the water level while looking from above rather than at the level of the meniscus, the reading may be __________.
    Answer: Inaccurate
20. To obtain an accurate reading for water in a measuring cylinder, the eye should be at the same level as the __________ **of the meniscus**.
    Answer: Bottom
21. When a substance is heated, its mass remains unchanged but its volume generally increases. Therefore, its density generally __________.
    Answer: Decreases

22. Hot air rises above cool air because hot air is __________ **dense** than cool air.
    Answer: Less
23. A hot-air balloon rises when the air inside it is heated because heating causes the air to expand and become __________ **dense**.
    Answer: Less
24. If the same mass of a substance occupies a larger volume after heating, the value of mass ÷ volume will __________.
    Answer: Decrease
25. When pressure on a gas is increased, its particles move closer together and its volume __________.
    Answer: Decreases
26. Since the mass of a gas remains the same while its volume decreases under pressure, its density __________.
    Answer: Increases
27. If the same pressure is applied to a solid and a gas, the change in density will generally be much greater in the __________.
    Answer: Gas
28. Water has its maximum density at __________ **°C**.
    Answer: 4
29. When water freezes, its particles arrange themselves so that the same amount of water occupies more space. Hence, the density of ice __________.
    Answer: Decreases
30. Ice floats on liquid water because the density of ice is __________ than the density of liquid water.
    Answer: Lower / less
31. A raw egg sinks in ordinary water. If the density of the surrounding water is sufficiently increased by dissolving salt in it, the egg may __________.
    Answer: Float
32. A piece of modelling clay has a mass of 120 g and a volume of 60 cm^3. Its density is __________ **g/cm^3**.
    Answer: 2
33. If the same piece of modelling clay is flattened without changing its mass or volume, its density will remain __________.
    Answer: Unchanged / the same
34. The above example shows that the density of a substance is independent of its __________.
    Answer: Shape
35. An iron block has a mass of 600 g and a density of 7.9 g/cm^3. Its volume is approximately __________ **cm^3**.
    Answer: 75.95 cm^3 (approximately 76 cm^3)
36. In the experiment where a test tube containing water is placed in hot water, the water level in the glass tube rises. This indicates that the water has __________ on heating.
    Answer: Expanded
37. As the water in the above experiment expands without a change in mass, its density __________.
    Answer: Decreases
38. If two objects have equal masses but Object A occupies less volume than Object B, Object __________ has the greater density.
    Answer: A

39. If two objects have equal volumes but Object X has greater mass than Object Y, Object __________ is denser.
    Answer: X
40. If the mass of an object doubles while its volume remains unchanged, its density becomes __________ its original value.
    Answer: Twice / double

Answer Key – Quick Reference:
1. Unsaturated | **2.** B | **3.** Second | **4.** Saturated | **5.** Increased | **6.** Decreased | **7.** Less | **8.** Less | **9.** 2.7 | **10.** 5 | **11.** A | **12.** 2.5 | **13.** Sink | **14.** 5 | **15.** 3.28 | **16.** 900 | **17.** Two | **18.** Accuracy | **19.** Inaccurate | **20.** Bottom | **21.** Decreases | **22.** Less | **23.** Less | **24.** Decrease | **25.** Decreases | **26.** Increases | **27.** Gas | **28.** 4 | **29.** Decreases | **30.** Lower | **31.** Float | **32.** 2 | **33.** Unchanged | **34.** Shape | **35.** ≈76 | **36.** Expanded | **37.** Decreases | **38.** A | **39.** X | **40.** Twice.

9.5 One-mark questions with Answers of LOTS Type: (30 Questions)

1. **What is a solution?**
   Answer: A solution is a uniform mixture formed when two or more substances mix together.
2. **What is a solute?**
   Answer: A solute is the substance that dissolves in a solvent to form a solution.
3. **What is a solvent?**
   Answer: A solvent is the substance in which a solute dissolves to form a solution.
4. **What is a uniform mixture?**
   Answer: A uniform mixture is one in which the components are evenly distributed throughout.
5. **Give one example of a non-uniform mixture.**
   Answer: Sand mixed with water is an example of a non-uniform mixture.
6. **What is an unsaturated solution?**
   Answer: An unsaturated solution is one in which more solute can be dissolved at a given temperature.
7. **What is a saturated solution?**
   Answer: A saturated solution is one in which no more solute can dissolve at a particular temperature.
8. **What is concentration of a solution?**
   Answer: Concentration is the amount of solute present in a fixed quantity of solution or solvent.
9. **What is a dilute solution?**
   Answer: A dilute solution contains a relatively small amount of solute.
10. **What is a concentrated solution?**
    Answer: A concentrated solution contains a relatively large amount of solute.
11. **What is solubility?**
    Answer: Solubility is the maximum amount of solute that can dissolve in a fixed quantity of solvent at a particular temperature.
12. **How does an increase in temperature generally affect the solubility of solids in liquids?**
    Answer: The solubility of most solids in liquids generally increases with an increase in temperature.
13. **What happens to a saturated solution when its temperature is increased?**
    Answer: A saturated solution may behave as an unsaturated solution when its temperature is increased.

14. **Name one gas that dissolves in water.**
    Answer: Oxygen is a gas that dissolves in water.
15. **Why is dissolved oxygen important in water?**
    Answer: Dissolved oxygen is important because it sustains aquatic plants, fishes, and other organisms.
16. **How does increasing temperature affect the solubility of gases in water?**
    Answer: The solubility of gases in water generally decreases as temperature increases.
17. **What is density?**
    Answer: Density is the mass present per unit volume of a substance.
18. **Write the formula for calculating density.**
    Answer: Density = Mass ÷ Volume.
19. **Does the density of a substance depend on its shape or size?**
    Answer: No, the density of a substance is independent of its shape or size.
20. **Name the two factors that can affect the density of a substance.**
    Answer: Temperature and pressure can affect the density of a substance.
21. **What is the SI unit of density?**
    Answer: The SI unit of density is kilogram per cubic metre (kg/m^3).
22. **What is relative density?**
    Answer: Relative density is the ratio of the density of a substance to the density of water at that temperature.
23. **Does relative density have a unit?**
    Answer: No, relative density has no unit.
24. **What is mass?**
    Answer: Mass is the quantity of matter present in an object or substance.
25. **Which instrument is used to measure mass?**
    Answer: A balance is used to measure the mass of an object.
26. **What are the commonly used units of mass?**
    Answer: Gram (g) and kilogram (kg) are commonly used units of mass.
27. **What is weight?**
    Answer: Weight is the force by which the Earth attracts an object towards itself.
28. **What is the unit of weight?**
    Answer: Weight is measured in newtons (N).
29. **What is volume?**
    Answer: Volume is the space occupied by an object or substance.
30. **What is the SI unit of volume?**
    Answer: The SI unit of volume is

9.6 One-mark questions with Answers of HOTS Type: (40 Questions)

1. **Why does undissolved salt remain at the bottom when too much salt is added to water?**
   Answer: The salt remains undissolved because the solution has become saturated and cannot dissolve more salt at that temperature.
2. **How can you make more salt dissolve in a saturated salt solution without adding more water?**
   Answer: The solution can be heated because the solubility of most solids increases with temperature.

3. **Why can a saturated solution become unsaturated when heated?**
   Answer: Heating generally increases the solubility of a solid, allowing the solution to dissolve more solute.
4. **Why is cold water generally better for aquatic animals than very warm water?**
   Answer: Cold water can contain more dissolved oxygen because the solubility of gases decreases with increasing temperature.
5. **Why might fish face difficulty surviving if the temperature of a pond rises greatly?**
   Answer: A rise in water temperature reduces dissolved oxygen, making less oxygen available for fish.
6. **Why is water containing dissolved oxygen considered a uniform mixture?**
   Answer: It is a uniform mixture because the dissolved oxygen is evenly distributed throughout the water.
7. **Two salt solutions contain 2 spoons of salt in 100 mL and 4 spoons in 50 mL of water; which is more concentrated?**
   Answer: The solution containing 4 spoons of salt in 50 mL of water is more concentrated.
8. **Why does oil float when it is poured into water?**
   Answer: Oil floats on water because its density is lower than that of water.
9. **Why does rice sink while husk particles generally float during washing?**
   Answer: Rice and husk behave differently because their densities relative to water are different.
10. **An aluminium block has a mass of 27 g and a volume of 10 cm^3; what can you infer about its density?**
    Answer: Its density is 2.7 g/cm^3, which means aluminium is 2.7 times denser than water.
11. **Why does changing the shape of a piece of modelling clay not change its density?**
    Answer: Changing only the shape does not change its mass-to-volume relationship and therefore does not change its density.
12. **Why is a 100 mL measuring cylinder preferable to a 500 mL cylinder for measuring 70 mL of water accurately?**
    Answer: A 100 mL cylinder has smaller divisions and therefore provides a more accurate measurement.
13. **Why is a 50 mL measuring cylinder inconvenient for measuring exactly 70 mL of water?**
    Answer: It requires the water to be measured in more than one step because its maximum capacity is only 50 mL.
14. **Why should your eye be at the same level as the meniscus while measuring water?**
    Answer: Keeping the eye at the level of the meniscus helps obtain an accurate volume reading.
15. **Why is the bottom of the meniscus used to measure the volume of water?**
    Answer: The bottom of the curved meniscus gives the correct reading for water and other colourless liquids.
16. **Why is the top of the meniscus used while measuring a coloured liquid?**
    Answer: The top of the meniscus is used because the lower curved surface may not be clearly visible in a coloured liquid.
17. **How can you determine the volume of an irregular stone using water?**
    Answer: Subtract the initial water level from the final water level after immersing the stone.

18. **A stone raises the water level in a measuring cylinder from 50 mL to 55 mL; what is its volume?**
    Answer: The volume of the stone is 5 cm^3 because it displaces 5 mL of water.
19. **A stone has a mass of 16.4 g and a volume of 5 cm^3; what is its density?**
    Answer: The density of the stone is 3.28 g/cm^3.
20. **Why does the density of most substances decrease when they are heated?**
    Answer: Heating generally increases the volume without changing the mass, thereby decreasing density.
21. **Why does hot air rise above cooler air?**
    Answer: Hot air rises because heating makes it less dense than the surrounding cooler air.
22. **How does heating help a hot-air balloon rise?**
    Answer: Heating the air inside the balloon lowers its density, causing the balloon to rise.
23. **Why does increasing pressure increase the density of a gas?**
    Answer: Increasing pressure brings gas particles closer together and reduces their volume, thereby increasing density.
24. **Why does pressure have little effect on the density of liquids and solids?**
    Answer: Liquids and solids are difficult to compress because their particles are already relatively close together.
25. **Why does ice float on liquid water even though both are made of the same substance?**
    Answer: Ice floats because freezing causes water to expand, making ice less dense than liquid water.
26. **How does floating ice help aquatic organisms survive during extremely cold weather?**
    Answer: Floating ice forms a surface layer that keeps the water underneath warm enough for aquatic organisms to survive.
27. **A raw egg sinks in plain water; what change could help make it float?**
    Answer: Dissolving sufficient salt in the water can increase the density of the solution and help the egg float.
28. **A stone sculpture has a mass of 225 g and a volume of 90 cm^3; what is its density?**
    Answer: Its density is 2.5 g/cm^3.
29. **Will the stone sculpture of density 2.5 g/cm^3 float or sink in water?**
    Answer: It will sink because its density is greater than the density of water.
30. **Object A has a mass of 200 g and volume of 40 cm^3, while Object B has a mass of 240 g and volume of 60 cm^3; which is denser?**
    Answer: Object A is denser because its density is 5 g/cm^3 compared with 4 g/cm^3 for Object B.
31. **Why can an unpeeled orange float while the same orange may sink after peeling?**
    Answer: The peel helps lower the overall density of the orange, whereas removing it makes the remaining orange relatively denser.
32. **A piece of clay is flattened from a cube into a thin sheet; what happens to its density?**
    Answer: Its density remains unchanged because reshaping alone does not change its mass or the amount of material.
33. **Why are bamboo poles suitable for making traditional rafts?**
    Answer: Bamboo is light and hollow and therefore floats easily on water.

34. **Why does a one-litre packet of oil weigh less than approximately one litre of water?**
    Answer: One litre of oil weighs less because oil has a lower density than water.
35. **Why does the water level rise when an irregular solid is immersed in a measuring cylinder?**
    Answer: The immersed solid occupies space and displaces a volume of water equal to its own volume.
36. **If two objects have the same volume but different masses, which one will have greater density?**
    Answer: The object with greater mass will have greater density because density is mass divided by volume.
37. **If two objects have the same mass but different volumes, which one will be denser?**
    Answer: The object with the smaller volume will be denser because the same mass is packed into less space.
38. **Why is density considered more useful than mass alone when comparing different substances?**
    Answer: Density relates mass to unit volume and therefore allows substances of different sizes to be compared.
39. **Why does heating a substance usually increase its volume even though its mass remains unchanged?**
    Answer: Heating causes its particles to move farther apart, increasing the space occupied by the substance.
40. **If the water level in the glass tube of the chapter's heating experiment rises on heating, what happens to the density of water?**
    Answer: The density decreases because heating increases the volume while the mass remains unchanged.

9.7 Two-mark questions with Answers of LOTS Type: (25 Questions)

1. What is a solution? Give one example.
Answer:
1. A solution is a uniform mixture formed when two or more substances mix together.
2. Salt dissolved in water is an example of a solution.

2. Define solute and solvent.
Answer:
1. The substance that dissolves in a solvent to form a solution is called the **solute**.
2. The substance in which the solute dissolves is called the **solvent**.

3. Differentiate between uniform and non-uniform mixtures.
Answer:
1. In a uniform mixture, the components are evenly distributed throughout the mixture.
2. In a non-uniform mixture, the components are not evenly distributed and may be seen separately.

4. What is an unsaturated solution? What is a saturated solution?
Answer:
1. An unsaturated solution is one in which more solute can still be dissolved at a given temperature.
2. A saturated solution is one in which no more solute can dissolve at that particular temperature.

5. What is meant by concentration of a solution? Name its two common descriptions.
Answer:
1. Concentration is the amount of solute present in a fixed quantity of solution or solvent.
2. Depending on the amount of solute, a solution may be described as **dilute** or **concentrated**.

6. What is solubility? How does temperature generally affect the solubility of solids?
Answer:
1. Solubility is the maximum amount of solute that can dissolve in a fixed quantity of solvent.
2. For most solid substances, solubility increases with an increase in temperature.

7. What happens to a saturated solution when its temperature is increased?
Answer:
1. On increasing the temperature, more solute can generally dissolve in the solution.
2. Thus, a saturated solution at one temperature may behave as an unsaturated solution at a higher temperature.

8. What is dissolved oxygen? Why is it important?
Answer:
1. Dissolved oxygen is the small amount of oxygen gas that dissolves in water.
2. It is essential for sustaining aquatic plants, fishes, and other organisms.

9. How does temperature affect the solubility of gases in water?
Answer:
1. The solubility of gases in water generally decreases as the temperature increases.
2. Therefore, more oxygen can dissolve in cold water than in warm water.

10. What is density? Write its mathematical formula.
Answer:
1. Density is defined as the mass present in a unit volume of a substance.
2. It is calculated using the formula **Density = Mass ÷ Volume**.

11. State any two units used for expressing density.
Answer:
1. The SI unit of density is **kilogram per cubic metre (kg/m^3)**.
2. Density may also be expressed in **g/mL** or **g/cm^3**.

12. What is relative density? Does it have a unit?
Answer:
1. Relative density is the ratio of the density of a substance to the density of water at that temperature.
2. Relative density is a number without any unit.

13. What is mass? Which instrument is used to measure it?
Answer:
1. Mass is the quantity of matter present in an object or substance.
2. A **balance**, such as a digital weighing balance, is used to measure mass.

14. Distinguish between mass and weight.
Answer:
1. Mass is the quantity of matter present in an object and is measured in grams or kilograms.
2. Weight is the force with which the Earth attracts an object and is measured in newtons.

15. What is volume? Mention the SI unit of volume.
Answer:
1. Volume is the amount of space occupied by an object or substance.

2. The SI unit of volume is **cubic metre (m^3)**.

16. What is a measuring cylinder? What is it used for?

Answer:

1. A measuring cylinder is a narrow, transparent cylindrical container with volume markings on its body.
2. It is used to measure a required volume of liquid.

17. What is a meniscus? How should the volume of water be read?

Answer:

1. The curved surface formed by a liquid in a measuring cylinder is called the **meniscus**.
2. For water and other colourless liquids, the reading is taken at the **bottom of the meniscus**.

18. How should the eye be positioned while reading the volume in a measuring cylinder? How are coloured liquids read?

Answer:

1. The eye should be kept at the same level as the meniscus while taking the reading.
2. For coloured liquids, the reading should coincide with the **top of the meniscus**.

19. How is the volume of a cuboid-shaped solid calculated? Give the formula.

Answer:

1. Measure the length, width, and height of the cuboid using a scale.
2. Its volume is calculated using **Volume = length × width × height (l × w × h)**.

20. How can the volume of an irregular solid such as a stone be determined?

Answer:

1. Immerse the object in water in a measuring cylinder and note the initial and final water levels.
2. The volume of the object equals **final water volume − initial water volume**.

21. State the general effect of temperature on the density of a substance.

Answer:

1. The density of a substance generally decreases when it is heated.
2. It generally increases when the substance is cooled.

22. Why does hot air rise? Mention one application of this property.

Answer:

1. Hot air rises because heating makes it less dense than the cooler air around it.
2. This principle is used in the working of a **hot-air balloon**.

23. How does increasing pressure affect the density of gases?

Answer:

1. Increasing pressure brings the particles of a gas closer together and decreases its volume.
2. As a result, the density of the gas increases.

24. Why does ice float on water?

Answer:

1. When water freezes, its particles arrange themselves so that the same amount of water occupies more space.
2. This lowers the density of ice, making it lighter than liquid water and allowing it to float.

25. How does floating ice help aquatic organisms in cold regions?

Answer:

1. Ice floats on the surface of water and forms a layer on top.
2. This layer keeps the water underneath warm enough for fish and other aquatic organisms to survive.

9.8. Two-mark questions with Answers of HOTS Type: (25 Questions)

1. Riya adds salt continuously to a glass of water. After some time, some salt remains at the bottom. What can you conclude?

Answer:

1. The solution has become saturated because it has dissolved the maximum possible amount of salt at that temperature.
2. The extra salt remains undissolved because the water cannot dissolve any more salt at that temperature.

2. A saturated solution of baking soda is heated from 20°C to 70°C. Predict what will happen to the undissolved baking soda and explain why.

Answer:

1. The undissolved baking soda will dissolve as the temperature of the solution increases.
2. This happens because the solubility of most solid substances increases with an increase in temperature.

3. Two glasses contain equal amounts of water. Glass A contains one spoon of salt, while Glass B contains three spoons of completely dissolved salt. Which is more concentrated and why?

Answer:

1. Glass B is more concentrated because it contains a greater amount of solute in the same quantity of water.
2. Glass A is comparatively dilute because it contains less salt in the same amount of solvent.

4. Fish in a pond may experience difficulty when the water becomes unusually warm. Explain this using the concept of solubility.

Answer:

1. As the temperature of water increases, the solubility of oxygen in water decreases.
2. Therefore, warm water contains less dissolved oxygen available for fish and other aquatic organisms.

5. A student says, "Any mixture containing water is a solution." Do you agree? Justify your answer.

Answer:

1. No, because a solution must be a uniform mixture in which the components are evenly distributed.
2. For example, sand mixed with water forms a non-uniform mixture and therefore is not a solution.

6. Oil floats when poured into water. What can you infer about the relative densities of oil and water?

Answer:

1. The observation indicates that oil is less dense than water.
2. Therefore, water is denser than oil, which is consistent with the oil forming a layer above it.

7. A stone has a mass of 225 g and a volume of 90 cm³. Calculate its density and predict whether it will float or sink in water.

Answer:

1. Density = Mass ÷ Volume = 225 ÷ 90 = **2.5 g/cm³**.
2. Since its density is greater than that of water, the stone will sink in water.

8. Object A has a mass of 200 g and volume of 40 cm³, while Object B has a mass of 240 g and volume of 60 cm³. Which object is denser?
Answer:
1. Density of A = 200 ÷ 40 = **5 g/cm³**, while density of B = 240 ÷ 60 = **4 g/cm³**.
2. Therefore, Object A is denser than Object B even though Object B has greater mass.

9. A piece of modelling clay is first shaped into a cube and then flattened into a thin sheet without adding or removing any clay. Predict what happens to its density.
Answer:
1. Its density remains unchanged because moulding changes only its shape, not its mass or volume.
2. Density is independent of the shape or size of a substance.

10. Why is a 100 mL measuring cylinder more suitable than a 500 mL measuring cylinder for measuring exactly 70 mL of water?
Answer:
1. A 100 mL measuring cylinder can measure 70 mL in one step and has smaller divisions for greater accuracy.
2. A 500 mL cylinder has larger smallest divisions, so the measurement would be less accurate.

11. A student reads the water level in a measuring cylinder while looking from above the meniscus. Why might the measurement be incorrect?
Answer:
1. The eye must be at the same level as the bottom of the meniscus to obtain the correct reading for water.
2. Looking from above changes the apparent position of the meniscus and can lead to an incorrect reading.

12. The water level in a measuring cylinder rises from 50 mL to 58 mL when a stone is completely immersed. What is the volume of the stone? Explain.
Answer:
1. Volume of the stone = 58 mL − 50 mL = **8 mL or 8 cm³**.
2. The increase in water level represents the volume of water displaced by the immersed stone.

13. Why does hot air rise above cooler air? Relate your answer to density.
Answer:
1. On heating, air expands and occupies a greater volume while its mass remains unchanged, so its density decreases.
2. The less-dense hot air therefore rises above the denser cool air, a principle used in hot-air balloons.

14. A gas is compressed into a smaller container without changing its mass. Predict what happens to its density and explain.
Answer:
1. The density of the gas increases because its particles are brought closer together and its volume decreases.
2. Since density equals mass divided by volume, decreasing volume while keeping mass unchanged increases density.

15. Ice is made of water, yet it floats on liquid water. Explain this apparent contradiction.
Answer:
1. When water freezes, its particles arrange themselves in a structure that occupies more space, increasing its volume.

2. The increase in volume lowers the density of ice, making it less dense than liquid water and allowing it to float.

16. An unpeeled orange floats in water, but the same orange may sink after its peel is removed. How can this observation be explained using density?

Answer:

1. The peel helps the whole orange have a lower overall density, allowing the unpeeled orange to float.
2. Removing the peel increases the average density of the remaining orange relative to water, causing it to sink.

17. A raw egg sinks in plain water. Suggest a change that could help it float and explain the principle involved.

Answer:

1. Salt can be dissolved in the water to increase the density of the surrounding solution.
2. As the salt solution becomes sufficiently dense relative to the egg, the egg can float instead of sinking.

18. Why is the water below a frozen lake able to support aquatic life even when the surface is covered with ice?

Answer:

1. Ice is less dense than liquid water and therefore floats, forming a layer on the surface.
2. This floating ice layer helps keep the water underneath warm enough for fish and other aquatic organisms to survive.

19. A student heats water in the experimental setup shown in Fig. 9.26, and the water level in the glass tube rises. What does this indicate about its density?

Answer:

1. The rising water level indicates that the water expands and its volume increases on heating.
2. Since its mass remains unchanged while volume increases, its density decreases.

20. Why does increasing pressure affect the density of gases much more than that of solids?

Answer:

1. Gas particles can be pushed much closer together, so increasing pressure considerably reduces the volume of a gas and increases its density.
2. Solid particles are already packed very closely, so pressure causes negligible change in their volume and density.

21. A student has a 50 mL, 100 mL, and 250 mL measuring cylinder and wants to measure 70 mL of water. Which should be selected and why?

Answer:

1. The **100 mL measuring cylinder** should be selected because 70 mL can be measured directly in one step.
2. The 50 mL cylinder requires two measurements, while the 250 mL cylinder provides lower accuracy because its smallest division is larger.

22. Two equal-sized blocks, one made of wood and the other of iron, have different masses. What does this tell you about their densities?

Answer:

1. Since both blocks have the same volume but the iron block has greater mass, iron has greater density.
2. This follows from the relationship **Density = Mass ÷ Volume**.

23. Why would adding more salt to an already saturated salt solution not make the dissolved solution more concentrated at the same temperature?

Answer:

1. A saturated solution has already dissolved the maximum amount of solute possible at that temperature.
2. Any additional salt will remain undissolved instead of increasing the amount of dissolved salt.

24. A bottle of oil has a volume of 1 litre but a mass of about 910 g. What can you infer by comparing it with water?
Answer:
1. One litre of water has a mass of approximately 1000 g, while the same volume of oil has a lower mass.
2. Therefore, oil has a lower density than water, which helps explain why oil floats on water.

25. Why might aquatic organisms in cold water have better access to dissolved oxygen than those in warmer water?
Answer:
1. Gases such as oxygen are generally more soluble in cold water than in warm water.
2. Therefore, colder water can contain more dissolved oxygen to support aquatic organisms.

9.9. Three-mark questions with Answers of LOTS Type: (20 Questions)

1. What is a solution? Explain the terms solute and solvent.
Answer:
1. A **solution** is a uniform mixture formed when two or more substances mix together.
2. The substance that dissolves is called the **solute**.
3. The substance in which the solute dissolves is called the **solvent**.

2. Differentiate between uniform and non-uniform mixtures with examples.
Answer:
1. In a **uniform mixture**, the components are evenly distributed throughout the mixture.
2. Salt or sugar dissolved in water forms a uniform mixture called a solution.
3. Sand, chalk powder, or sawdust mixed with water forms a **non-uniform mixture** because the components are not evenly distributed.

3. What is a saturated solution? Describe how it is formed.
Answer:
1. A saturated solution contains the maximum amount of solute that can dissolve at a particular temperature.
2. It is formed by continuously adding solute to a solvent until no more solute can dissolve.
3. The excess undissolved solute then settles at the bottom of the container.

4. What is an unsaturated solution? How is it different from a saturated solution?
Answer:
1. An **unsaturated solution** is one in which more solute can still be dissolved at a given temperature.
2. A **saturated solution** cannot dissolve any more solute at that particular temperature.
3. Thus, the main difference between them is their capacity to dissolve additional solute.

5. Define concentration. What are dilute and concentrated solutions?
Answer:
1. **Concentration** is the amount of solute present in a fixed quantity of solution or solvent.
2. A solution containing a relatively smaller amount of solute is called a **dilute solution**.

3. A solution containing a relatively larger amount of solute is called a **concentrated solution**.

6. What is solubility? Explain the effect of temperature on the solubility of most solids.
Answer:
1. **Solubility** is the maximum amount of solute that dissolves in a fixed quantity of solvent at a particular temperature.
2. For most substances, the solubility increases when the temperature increases.
3. Therefore, a saturated solution at a lower temperature may behave as an unsaturated solution when heated.

7. Describe the solubility of gases in water and its importance to aquatic life.
Answer:
1. Many gases, including oxygen, dissolve in water, although oxygen dissolves only to a small extent.
2. The dissolved oxygen present in water supports aquatic plants, fishes, and other organisms.
3. More oxygen dissolves in cold water because the solubility of gases generally decreases as temperature increases.

8. What is density? Write its formula and SI unit.
Answer:
1. **Density** is defined as the mass present in a unit volume of a substance.
2. It is calculated using the formula **Density = Mass ÷ Volume**.
3. The SI unit of density is **kilogram per cubic metre (kg/m^3)**.

9. What is relative density? Explain it with the example of aluminium given in the chapter.
Answer:
1. Relative density is the ratio of the density of a substance to the density of water at that temperature.
2. Aluminium with a density of 2.7 g/cm^3 has a relative density of **2.7** with respect to water.
3. Relative density is expressed as a number and has **no unit**.

10. What is mass? How can the mass of a solid object be measured using a digital weighing balance?
Answer:
1. **Mass** is the quantity of matter present in an object or substance.
2. A digital weighing balance is first set to zero using the tare or reset button.
3. The solid object is then placed on the balance and the displayed reading gives its mass.

11. Differentiate between mass and weight.
Answer:
1. **Mass** is the quantity of matter present in an object and is measured in grams or kilograms.
2. **Weight** is the force with which the Earth attracts an object towards itself.
3. Weight is measured in **newtons (N)**, whereas mass is measured in **grams (g) or kilograms (kg)**.

12. What is volume? State its SI unit and the units commonly used for liquids.
Answer:
1. **Volume** is the amount of space occupied by an object or substance.
2. The SI unit of volume is **cubic metre (m^3)**.
3. The volume of liquids is commonly expressed in **litres (L)** and **millilitres (mL)**.

13. Describe a measuring cylinder and its use.
Answer:
1. A measuring cylinder is a narrow, transparent, cylindrical container used for measuring the volume of liquids.
2. Its transparent body has markings that indicate different volumes.
3. Measuring cylinders are available in different capacities such as 5 mL, 10 mL, 25 mL, 50 mL, 100 mL and 250 mL.

14. What is a meniscus? Explain how the volume of water should be read in a measuring cylinder.
Answer:
1. The curved surface formed by water inside a measuring cylinder is called the **meniscus**.
2. For water and other colourless liquids, the reading is taken at the **bottom of the meniscus**.
3. The observer's eyes should be at the same level as the bottom of the meniscus while taking the reading.

15. How is the volume of a regularly shaped cuboid object determined?
Answer:
1. The **length, width, and height** of the cuboid are measured using a scale.
2. Its volume is calculated using the formula **Volume = length × width × height (l × w × h)**.
3. For example, an object measuring 25 cm × 18 cm × 2 cm has a volume of **900 cm³**.

16. Explain how the volume of an irregular solid such as a stone can be measured.
Answer:
1. Record the initial volume of water in a measuring cylinder and then completely immerse the stone in it.
2. Record the final volume of water after the water level rises.
3. The volume of the stone is calculated as **Final volume − Initial volume**.

17. Explain the effect of temperature on the density of a substance.
Answer:
1. Generally, the density of a substance **decreases on heating and increases on cooling**.
2. On heating, the particles spread apart, causing the volume to increase while the mass remains unchanged.
3. Since density is mass divided by volume, an increase in volume causes the density to decrease.

18. Explain the effect of pressure on the density of gases, liquids, and solids.
Answer:
1. Increasing pressure brings gas particles closer together, decreasing their volume and increasing their density.
2. Pressure has only a small effect on liquids because they are nearly incompressible.
3. The effect of pressure on the density of solids is usually negligible because their particles are already very close together.

19. Why does ice float on water? Explain in three points.
Answer:
1. When water freezes at 0°C, its particles arrange themselves in a structure that occupies more space.
2. The same amount of water therefore occupies a larger volume, causing its density to decrease.
3. Ice becomes less dense than liquid water and hence floats on its surface.

20. Describe the use of water and other solvents in traditional Indian systems of medicine.

Answer:

1. Water has traditionally been used as a solvent for preparing medicinal formulations in Ayurveda, Siddha, and other Indian systems of medicine.
2. Hydro-alcoholic extracts of herbs have also been used in the preparation of drug formulations.
3. Oils, ghee, milk, and other substances have been used as solvents to help obtain the therapeutic benefits of drugs.

9.10. Three-mark questions with Answers of HOTS Type: (20 Questions)

1. Riya keeps adding sugar to a glass of water until some sugar remains at the bottom. She wants the remaining sugar to dissolve without adding more water. What should she do? Explain why.

Answer:

1. Riya should **heat the solution** while stirring it.
2. For most solid substances, solubility in water increases with an increase in temperature.
3. Therefore, the saturated solution can become unsaturated on heating and dissolve some more sugar.

2. Two glasses contain equal amounts of water. Glass A contains one spoon of salt and Glass B contains four spoons of salt, with all the salt dissolved. Compare the two solutions and justify your answer.

Answer:

1. Glass B has a **higher concentration** because it contains more salt in the same amount of water.
2. Glass A is dilute relative to Glass B, while Glass B is more concentrated.
3. This is because concentration depends on the amount of solute present in a fixed quantity of solution or solvent.

3. Fish in a pond may face difficulty in obtaining sufficient oxygen when the water becomes unusually warm. Explain why.

Answer:

1. The solubility of gases in water generally **decreases as temperature increases**.
2. Therefore, warm water contains less dissolved oxygen than cold water.
3. Since aquatic organisms depend on dissolved oxygen, warmer water may provide them with less oxygen for survival.

4. A bottle of cooking oil is labelled "1 litre," but its mass is only about 910 g. What can you infer about the density of the oil compared with water?

Answer:

1. One litre of water has a mass of approximately 1000 g, whereas the same volume of oil has a mass of about 910 g.
2. Therefore, oil has a **lower density than water**.
3. This also helps explain why oil generally floats on water.

5. A student has 50 mL, 100 mL, 250 mL, and 500 mL measuring cylinders and wants to measure 70 mL of water accurately. Which one should the student select and why?

Answer:

1. The student should select the **100 mL measuring cylinder**.
2. A 50 mL cylinder would require more than one measurement, while larger cylinders have bigger smallest divisions and therefore reduced accuracy.

3. The 100 mL cylinder can measure 70 mL in one step and has a smallest reading of 1 mL.

6. A student reads the volume of water in a measuring cylinder while looking at it from above. Explain why the reading may be incorrect and how it should be taken.
Answer:
1. Looking from above can give an incorrect reading because the eye is not at the proper level with the meniscus.
2. The student's eyes should be positioned at the **same level as the bottom of the meniscus**.
3. For water and other colourless liquids, the reading should be taken at the bottom of the meniscus.

7. A stone has a mass of 30 g. The water level in a measuring cylinder rises from 40 mL to 50 mL when the stone is completely immersed. Calculate the volume and density of the stone.
Answer:
1. Volume of the stone = 50 − 40 = **10 mL = 10 cm^3**.
2. Density = Mass ÷ Volume = 30 ÷ 10 = **3 g/cm^3**.
3. Thus, the stone has a volume of 10 cm^3 and a density of 3 g/cm^3.

8. Reema moulds the same piece of modelling clay first into a cube and then into a thin sheet. Predict whether its density changes and justify your answer.
Answer:
1. Changing the shape of the clay does **not change its density**, provided its mass and volume remain unchanged.
2. Density is determined by the ratio **mass ÷ volume** and is independent of the shape or size of a substance.
3. Therefore, merely flattening the same clay into a sheet does not alter its density.

9. A hot-air balloon rises after the air inside it is heated. Explain this observation using the concept of density.
Answer:
1. When air is heated, its particles spread apart and its volume increases.
2. Since the mass remains unchanged while the volume increases, the density of the hot air decreases.
3. The hot air becomes less dense than the cooler surrounding air, helping the balloon rise.

10. A raw egg sinks when placed in ordinary water. Suggest a way to make it float and explain your reasoning using the concept of density.
Answer:
1. Salt can be dissolved in the water to increase the **density of the water**.
2. As more salt dissolves, the salt solution becomes denser than ordinary water.
3. When the surrounding solution becomes sufficiently dense compared with the egg, the egg can float.

11. Object A has a mass of 200 g and a volume of 40 cm^3, while Object B has a mass of 240 g and a volume of 60 cm^3. Which object is denser? Show your reasoning.
Answer:
1. Density of A = 200 ÷ 40 = **5 g/cm^3**.
2. Density of B = 240 ÷ 60 = **4 g/cm^3**.
3. Therefore, **Object A is denser than Object B** because it has greater mass per unit volume.

12. An unpeeled orange floats in water, whereas the same orange may sink after its peel is removed. Analyse why this happens.

Answer:

1. The peel contributes to the overall volume of the orange and helps make the unpeeled orange less dense overall.
2. After the peel is removed, the overall density of the remaining orange can become greater relative to water.
3. Therefore, the unpeeled orange can float while the peeled orange sinks, as illustrated in Fig. 9.25 of the chapter.

13. A saturated solution of baking soda is prepared at 20°C. Predict what happens when it is heated first to 50°C and then to 70°C. Give reasons.

Answer:

1. On heating to 50°C, some of the previously undissolved baking soda dissolves in the water.
2. On further heating to 70°C, still more baking soda can dissolve because its solubility has increased further.
3. Thus, a solution saturated at a lower temperature may behave as an unsaturated solution when its temperature increases.

14. Two identical balloons contain the same gas, but one is heated while the other remains cool. Compare their densities if heating allows the gas to expand.

Answer:

1. Heating causes the gas particles to spread apart, increasing the volume of the heated gas.
2. If its mass remains unchanged, its density decreases because **Density = Mass ÷ Volume**.
3. Therefore, the heated gas will be **less dense** than the cooler gas.

15. Explain why increasing pressure affects the density of a gas much more than that of a solid.

Answer:

1. Gas particles have large spaces between them, so increasing pressure can bring them much closer together and reduce their volume.
2. Particles in solids are already packed very closely and therefore cannot be compressed easily.
3. Hence, increasing pressure significantly increases the density of gases, whereas the change in the density of solids is usually negligible.

16. A block has a mass of 225 g and a volume of 90 cm^3. Calculate its density and predict whether it will float or sink in water.

Answer:

1. Density of the block = 225 ÷ 90 = **2.5 g/cm^3**.
2. The density of water is approximately **1 g/cm^3**, so the block is denser than water.
3. Therefore, based on the density comparison, the block is expected to **sink in water**.

17. A student claims, "A saturated solution can never dissolve any more solute." Is the statement completely correct? Justify your answer.

Answer:

1. The statement is not completely correct because a solution is saturated only **at a particular temperature**.
2. Increasing the temperature generally increases the solubility of most solid solutes.
3. Therefore, a solution saturated at one temperature may become unsaturated on heating and dissolve more solute.

18. Water in a test tube is heated by placing it in hot water, and the water level in an attached glass tube rises. What can you infer about its volume and density?
Answer:
1. The rise in water level indicates that the **volume of water has increased on heating**.
2. Since its mass remains unchanged while its volume increases, its density decreases according to Density = Mass ÷ Volume.
3. Therefore, heating generally causes expansion and a **decrease in density**.

19. Ice is made of water, yet it floats on liquid water. Analyse this apparent contradiction.
Answer:
1. When water freezes, its particles arrange themselves in a structure that occupies more space.
2. The increased volume for the same mass causes the density of ice to become lower than that of liquid water.
3. Therefore, ice floats on water and forms a surface layer that helps aquatic organisms survive in very cold conditions.

20. A student says that an iron object will always sink in water simply because iron is "heavy." Why is this explanation scientifically incomplete?
Answer:
1. Whether an object floats or sinks cannot be explained simply by calling it heavy or light.
2. **Density**, which represents mass per unit volume, is an important property for understanding floating and sinking.
3. The chapter also specifically notes that density is **not the only factor** deciding whether an object floats or sinks in a particular liquid.

9.11 Five-mark questions with Answers of LOTS Type: (12 Questions)

1. What are solute, solvent, and solution? Explain with examples.
Answer:
1. A **solution** is a uniform mixture formed when two or more substances mix together.
2. When a solid dissolves in a liquid, the solid component is called the **solute**.
3. The liquid in which the solute dissolves is called the **solvent**.
4. For example, when salt is dissolved in water, salt is the solute and water is the solvent.
5. The salt and water together form a uniform mixture called a **salt solution**.

2. Explain saturated and unsaturated solutions and define solubility.
Answer:
1. An **unsaturated solution** is one in which more solute can still dissolve at a given temperature.
2. A **saturated solution** is one in which no more solute can dissolve at that particular temperature.
3. In a saturated solution, additional solute remains undissolved and may settle at the bottom.
4. **Solubility** is the maximum amount of solute that can dissolve in a fixed quantity of solvent at a particular temperature.
5. Thus, whether a solution is saturated or unsaturated depends on the amount of solute dissolved and the temperature.

3. Describe how temperature affects the solubility of solids in water.
Answer:
1. Temperature generally affects the amount of a solid that can dissolve in water.

2. For most substances, **solubility increases when the temperature increases**.
3. In the chapter experiment, water at 50°C dissolves more baking soda than water at 20°C.
4. Water at 70°C dissolves still more baking soda than water at 50°C.
5. Therefore, a solution that is saturated at a lower temperature may become unsaturated when it is heated.

4. Explain the solubility of gases in water and the effect of temperature on it.

Answer:

1. Many gases, including **oxygen**, can dissolve in water.
2. Oxygen dissolves only in small quantities, but dissolved oxygen is essential for aquatic life.
3. Gases dissolved evenly in water form a **uniform mixture**.
4. The solubility of gases generally **decreases as the temperature increases**.
5. Therefore, cold water can contain more dissolved oxygen than warm water and can better support aquatic organisms.

5. What is density? Explain its formula, units, and important characteristics.

Answer:

1. **Density** is defined as the mass present in a unit volume of a substance.
2. It is calculated using the formula **Density = Mass ÷ Volume**.
3. The SI unit of density is **kilogram per cubic metre (kg/m^3)**.
4. Other commonly used units are **gram per millilitre (g/mL)** and **gram per cubic centimetre (g/cm^3)**.
5. The density of a substance is independent of its shape or size but depends on factors such as temperature and pressure.

6. Describe the procedure for measuring the mass of a solid object using a digital weighing balance.

Answer:

1. Switch on the digital weighing balance and check whether its initial reading is zero.
2. If it does not show zero, press the **tare or reset button** to bring the reading to zero.
3. Place a clean and dry watch glass or butter paper on the pan and reset the balance again.
4. Carefully place the solid object on the watch glass.
5. Note the reading displayed on the balance, which gives the **mass of the solid object**.

7. Explain how the volume of a liquid is measured using a measuring cylinder.

Answer:

1. A **measuring cylinder** is a narrow, transparent cylindrical container with markings for measuring liquid volume.
2. Place a clean and dry measuring cylinder on a flat surface and slowly pour the liquid into it.
3. The curved surface formed by water in the cylinder is called the **meniscus**.
4. For water and other colourless liquids, the reading is taken at the **bottom of the meniscus**, with the eyes at the same level.
5. For coloured liquids, the reading should coincide with the **top of the meniscus**.

8. Describe how the volume of an irregular solid such as a stone can be measured.

Answer:

1. Take some water in a measuring cylinder and record its **initial volume**.
2. Tie the irregular object, such as a stone, with a thread and slowly immerse it completely in the water.
3. Record the **final volume** after the water level rises.
4. Subtract the initial water volume from the final water volume to obtain the volume of water displaced.

5. The volume of water displaced is equal to the **volume of the irregular solid**, with 1 mL being equivalent to 1 cm^3.

9. Explain the effect of temperature on the density of substances.

Answer:

1. Generally, the density of a substance **decreases on heating and increases on cooling**.
2. When a substance is heated, its particles tend to move farther apart.
3. As a result, the substance generally occupies a greater volume while its mass remains unchanged.
4. Since density is mass divided by volume, an increase in volume results in a decrease in density.
5. This explains why **hot air rises** and why a hot-air balloon can move upward.

10. Explain the effect of pressure on the density of solids, liquids, and gases.

Answer:

1. Pressure affects the density of substances differently depending on their **state of matter**.
2. In gases, increasing pressure brings the particles closer together and decreases their volume.
3. Therefore, the density of a gas **increases when pressure increases**.
4. Pressure has only a small effect on the density of liquids because liquids are nearly incompressible.
5. The effect of pressure on solids is even smaller, and changes in their density are usually negligible.

11. Explain why ice floats on water and state its importance for aquatic life.

Answer:

1. Water has its highest density at about **4°C**.
2. When water freezes at 0°C, its particles arrange themselves in a structure that occupies more space.
3. This expansion increases the volume of the same amount of water and therefore decreases its density.
4. Ice is consequently less dense than liquid water and **floats on its surface**.
5. The floating ice forms a layer over the water, helping keep the water underneath warm enough for fish and other aquatic organisms to survive in extremely cold weather.

12. Explain mass and volume and mention how they are measured.

Answer:

1. **Mass** is the quantity of matter present in an object or substance.
2. The commonly used units of mass are **gram (g) and kilogram (kg)**.
3. **Volume** is the amount of space occupied by an object or substance.
4. Mass can be measured using a **weighing balance**, while the volume of a liquid can be measured using a **measuring cylinder**.
5. The SI unit of volume is **cubic metre (m^3)**, while litre (L), millilitre (mL), and cubic centimetre (cm^3) are also commonly used.

9.12 Five-mark questions with Answers of HOTS Type: (5 Questions)

1. Riya prepares a saturated sugar solution at room temperature. She wants to dissolve more sugar without adding more water. What should she do? Explain.

Answer:

1. Riya should **heat the saturated sugar solution** to a higher temperature.
2. For most solid solutes, solubility increases when the temperature of the solvent increases.

3. On heating, the solution that was saturated at room temperature can behave as an **unsaturated solution**.
4. Therefore, some additional sugar can now dissolve in the same quantity of water.
5. This shows that the **solubility of most solids increases with an increase in temperature**.

2. During summer, the temperature of a pond rises considerably. Predict how this may affect the fish living in the pond.

Answer:

1. As the temperature of pond water rises, the **solubility of oxygen in water decreases**.
2. Therefore, warm pond water contains less dissolved oxygen than cold water.
3. Fish and other aquatic organisms depend on dissolved oxygen for their survival.
4. A considerable rise in water temperature can therefore reduce the amount of oxygen available to them.
5. Hence, excessively warm water may make conditions **less favourable for aquatic life**.

3. A packet contains 1 litre of oil but its mass is only about 910 g. What can you infer about the density of oil compared with water?

Answer:

1. The chapter states that **1 mL of water has a mass close to 1 g** at room temperature.
2. Therefore, 1 litre or 1000 mL of water has a mass of approximately 1000 g.
3. If 1 litre of oil has a mass of only about 910 g, the same volume of oil has less mass than water.
4. Since density is mass divided by volume, the density of the oil is approximately **0.91 g/mL**.
5. Therefore, we can infer that the oil is **less dense than water**, which also helps explain why oil floats on water.

4. A student has 50 mL, 100 mL, 250 mL, and 500 mL measuring cylinders. Which one should be selected to measure 70 mL of water accurately? Justify.

Answer:

1. The **100 mL measuring cylinder** is the most suitable choice for measuring 70 mL of water.
2. A 50 mL cylinder would require the water to be measured in more than one step.
3. A 250 mL or 500 mL cylinder can measure 70 mL in one step but provides lower accuracy because its smallest divisions are larger.
4. A 100 mL cylinder can measure the entire 70 mL in one step and has a smallest reading of **1 mL**.
5. Therefore, the 100 mL measuring cylinder provides the best combination of **convenience and accuracy**.

5. A stone has a mass of 225 g and a volume of 90 cm³. Calculate its density and predict whether it will float or sink in water.

Answer:

1. Density is calculated using the formula **Density = Mass ÷ Volume**.
2. Therefore, density of the stone = **225 g ÷ 90 cm³**.
3. The density of the stone is **2.5 g/cm³**.
4. Since the density of water is approximately 1 g/cm³, the stone is denser than water.
5. Therefore, the stone will **sink in water**.

6. An unpeeled orange floats in water, but the same orange sinks after its peel is removed. Analyse why this happens.

Answer:

1. The chapter illustrates that an **unpeeled orange floats**, whereas a peeled orange sinks in water.

2. The peel contributes to the overall volume of the orange without increasing its mass proportionately.
3. Therefore, the unpeeled orange has a lower **average density** than the peeled orange.
4. Removing the peel reduces the volume and changes the average density of the orange so that it becomes denser relative to water.
5. Hence, the **unpeeled orange floats while the peeled orange sinks** because their overall densities relative to water are different.

7. Reema changes a 120 g piece of modelling clay from a compact cube into a thin sheet. Predict what happens to its density and justify your answer.

Answer:

1. The mass of the modelling clay remains **120 g** even after its shape is changed.
2. Moulding the clay into a thin sheet changes its shape but does not change the amount of material present.
3. The volume of the same clay material also remains unchanged if no material is added or removed.
4. Since **Density = Mass ÷ Volume**, its density remains unchanged.
5. Therefore, changing only the **shape of an object does not change the density of its material**.

8. A raw egg sinks in ordinary water. How could you make it float using the concepts learned in this chapter? Explain your reasoning.

Answer:

1. A raw egg sinks in ordinary water because its density is greater than that of the surrounding water.
2. Salt can be added to the water and stirred until it dissolves.
3. Dissolving salt increases the mass present in a given volume of the solution and therefore increases its density.
4. As more salt is dissolved, the salt solution can eventually become sufficiently dense for the egg to float.
5. Thus, the egg can be made to float by **increasing the density of water through the addition of salt**.

9. Why can a hot-air balloon rise even though the balloon and basket have considerable mass? Analyse using the concept of density.

Answer:

1. When the air inside the balloon is heated, its particles spread farther apart.
2. The heated air therefore occupies more volume without a corresponding increase in its mass.
3. Since density is mass divided by volume, the **density of the heated air decreases**.
4. The hot air inside the balloon becomes less dense than the cooler surrounding air.
5. This difference in density helps explain why the **hot-air balloon rises upward**.

10. Why does ice floating on a lake help aquatic organisms survive during extremely cold weather?

Answer:

1. Water has its **highest density at about 4°C**, while ice is less dense than liquid water.
2. When water freezes, its particles arrange themselves in a structure that occupies more space.
3. The increased volume lowers the density of ice, causing it to float on the water surface.
4. The floating ice forms a layer on top while liquid water remains underneath.
5. This helps keep the water below warm enough for **fish and other aquatic organisms to survive extremely cold conditions**.

11. Two objects have the following measurements: A = 200 g and 40 cm^3; B = 240 g and 60 cm^3. Which object is denser? Show your reasoning.

Answer:

1. Density of Object A = **200 ÷ 40 = 5 g/cm^3**.
2. Density of Object B = **240 ÷ 60 = 4 g/cm^3**.
3. Although Object B has greater mass, it also occupies a greater volume.
4. Object A has more mass packed into each unit volume than Object B.
5. Therefore, **Object A is denser than Object B**, showing that mass alone cannot determine density.

12. A saturated solution is heated and the previously undissolved solid begins to dissolve. What can you infer from this observation?

Answer:

1. Initially, the solution was saturated because no more solute could dissolve at that temperature.
2. When the solution was heated, the undissolved solid began to dissolve.
3. This indicates that the solvent could dissolve a greater quantity of the solid at the higher temperature.
4. Therefore, the previously saturated solution behaves as an **unsaturated solution after heating**.
5. We can infer that, for most solid substances, **solubility increases as temperature increases**.

9.13 Five-mark questions with Answers of Applied Type: (5 Questions)

1. While preparing lemonade, Meera finds that the sugar added to the water no longer dissolves and settles at the bottom. Explain what has happened and suggest a way to dissolve more sugar.

Answer:

1. The sugar initially dissolves in water to form a uniform solution.
2. When no more sugar can dissolve at that temperature, the solution becomes a **saturated solution**.
3. The additional sugar therefore remains undissolved and settles at the bottom.
4. Meera can heat the solution because the solubility of most solids increases with an increase in temperature.
5. Thus, heating allows more sugar to dissolve in the same quantity of water.

2. A fish farmer notices that fish become uncomfortable when the pond water becomes very warm during summer. Apply your knowledge of gas solubility to explain the reason.

Answer:

1. Fish depend on **oxygen dissolved in water** for their survival.
2. The solubility of gases generally decreases when the temperature of water increases.
3. Therefore, warm pond water contains less dissolved oxygen than cold water.
4. The fish may experience difficulty because less oxygen is available to them in warmer water.
5. Hence, maintaining suitable water temperature is important for supporting aquatic life.

3. You have to measure exactly 70 mL of water in a laboratory. You are given measuring cylinders of 50 mL, 100 mL, 250 mL, and 500 mL capacities. Which one would you use and why?

Answer:

1. I would select the **100 mL measuring cylinder**.
2. A 50 mL cylinder would require 70 mL to be measured in two steps.

3. The 250 mL and 500 mL cylinders can measure it in one step but have larger smallest divisions.
4. The 100 mL cylinder has a smallest reading of **1 mL**, allowing a more accurate measurement.
5. Therefore, it is the most convenient and accurate cylinder for measuring 70 mL of water.

4. A student wants to determine the volume of a small irregular stone. Describe how the student can do this using a measuring cylinder.

Answer:

1. Pour water into a measuring cylinder and record its **initial volume**.
2. Tie the stone with a thread and lower it completely into the water.
3. Record the **final volume** of water after the stone is immersed.
4. Subtract the initial water volume from the final volume to find the volume of water displaced.
5. The volume of displaced water is equal to the **volume of the irregular stone**, with 1 mL equivalent to 1 cm^3.

5. A stone has a mass of 16.4 g and displaces 5 mL of water in a measuring cylinder. Calculate its density.

Answer:

1. The mass of the stone is **16.4 g**.
2. Its volume is equal to the volume of water displaced, which is **5 mL or 5 cm^3**.
3. Density is calculated using the formula **Density = Mass ÷ Volume**.
4. Therefore, density = 16.4 ÷ 5 = **3.28 g/cm^3**.
5. Hence, the density of the stone is **3.28 g/cm^3**.

6. While measuring 50 mL of water, a student observes a curved water surface in the measuring cylinder. Explain how the correct reading should be taken.

Answer:

1. The curved surface of water in the measuring cylinder is called the **meniscus**.
2. The measuring cylinder should be kept upright on a flat surface.
3. The student's eyes should be positioned at the same level as the meniscus.
4. For water and other colourless liquids, the reading should be taken at the **bottom of the meniscus**.
5. Following this method helps obtain a more accurate measurement of the liquid's volume.

7. A raw egg sinks when placed in ordinary water. Using the concept of density, suggest a practical method to make the egg float.

Answer:

1. The raw egg sinks because its density is greater than that of ordinary water.
2. Salt can be gradually added to the water and stirred until it dissolves.
3. Dissolved salt increases the mass present in a given volume of the solution.
4. This increases the density of the salt solution compared with ordinary water.
5. When the solution becomes sufficiently dense, the egg can **float instead of sinking**.

8. A shopkeeper sells a 1-litre packet of oil whose mass is only 910 g. Apply the concept of density to explain why its mass is less than that of 1 litre of water.

Answer:

1. Density represents the **mass present per unit volume** of a substance.
2. One litre of water has a mass of approximately **1000 g** at room temperature.
3. The same volume of oil has a mass of only about **910 g**.
4. Therefore, oil has a lower density than water, approximately **0.91 g/mL**.
5. This lower density also helps explain why oil forms a layer above water when the two are mixed.

9. A hot-air balloon is heated before it rises into the sky. Apply the concept of density to explain how heating helps the balloon rise.

Answer:

1. When the air inside the balloon is heated, its particles move farther apart.
2. As a result, the heated air expands and occupies a larger volume.
3. Its mass remains unchanged while its volume increases.
4. Since density is mass divided by volume, the **density of the heated air decreases**.
5. Thus, the hot air becomes less dense than the cooler surrounding air, helping the balloon rise.

10. During winter, a layer of ice forms on the surface of a lake, but fish continue to live in the water below. Apply the concept of density to explain this observation.

Answer:

1. Water has its highest density at about **4°C**.
2. When water freezes at 0°C, its particles arrange themselves so that the same amount of water occupies more space.
3. The increase in volume causes the density of ice to become lower than that of liquid water.
4. Therefore, ice floats and forms a layer on the surface instead of sinking.
5. This floating ice helps keep the water underneath warm enough for fish and other aquatic organisms to survive.

9.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

Olympiad-Type Multiple Choice Questions

1. Riya adds salt to 100 mL of water until some salt remains undissolved at the bottom. She then heats the solution. What is most likely to happen?

A. More salt settles at the bottom
B. Some of the undissolved salt dissolves
C. All the water immediately evaporates
D. The solution becomes non-uniform permanently

Answer: B. Some of the undissolved salt dissolves

Reason: For most solid substances, solubility increases with temperature.

---

2. Four students prepare the following mixtures:
P: Salt + water
Q: Sand + water
R: Sugar + water
S: Sawdust + water
Which pair represents uniform mixtures?
A. P and Q
B. Q and S
C. P and R
D. R and S

Answer: C. P and R

Reason: Salt and sugar dissolve evenly in water to form solutions.

---

3. Two solutions are prepared:

- Solution X: 2 spoons of salt in 100 mL water
- Solution Y: 4 spoons of salt in 50 mL water

Assuming all the salt dissolves, which statement is correct?

A. X is more concentrated than Y
B. Y is more concentrated than X
C. Both have the same concentration
D. Concentration cannot depend on the amount of salt
Answer: B. Y is more concentrated than X

---

4. A saturated solution at 25°C is heated to 60°C. For most solid solutes, the solution will initially behave as:
A. A non-uniform mixture
B. An unsaturated solution
C. A gas
D. A more saturated solution
Answer: B. An unsaturated solution
Reason: Heating generally increases the solubility of solids.

---

5. Which situation would generally provide the **maximum amount of dissolved oxygen** to fish?
A. Water at 10°C
B. Water at 30°C
C. Water at 50°C
D. Water at 70°C
Answer: A. Water at 10°C
Reason: The solubility of gases generally decreases as temperature increases.

---

6. A block has a mass of 150 g and a volume of 50 cm^3. Its density is:
A. 0.33 g/cm^3
B. 3 g/cm^3
C. 7.5 g/cm^3
D. 200 g/cm^3
Answer: B. 3 g/cm^3
Calculation: Density = 150 ÷ 50 = **3 g/cm^3**. The chapter defines density as mass per unit volume.

---

7. Object P has a mass of 120 g and volume of 40 cm^3. Object Q has a mass of 200 g and volume of 100 cm^3. Which is denser?
A. P
B. Q
C. Both have equal density
D. Cannot be determined
Answer: A. P
Reason:
P = 120/40 = **3 g/cm^3**
Q = 200/100 = **2 g/cm^3**

---

8. A student wants to measure exactly 70 mL of water. Which measuring cylinder would be the **best choice**?
A. 50 mL cylinder
B. 100 mL cylinder
C. 250 mL cylinder
D. 500 mL cylinder

Answer: B. 100 mL cylinder
Reason: It measures 70 mL in one step while providing better accuracy than the larger cylinders.

---

9. A 100 mL measuring cylinder has 10 equal divisions between the 20 mL and 30 mL marks. Its smallest reading is:
A. 0.1 mL
B. 1 mL
C. 2 mL
D. 10 mL
Answer: B. 1 mL
Calculation: $(30 - 20) \div 10 =$ **1 mL**.

---

10. A stone is immersed in a measuring cylinder. The initial water level is 42 mL and the final level is 58 mL. What is the volume of the stone?
A. 16 cm^3
B. 42 cm^3
C. 58 cm^3
D. 100 cm^3
Answer: A. 16 cm^3
Calculation: $58 - 42 =$ **16 mL = 16 cm^3**.

---

11. The stone in Question 10 has a mass of 48 g. What is its density?
A. 2 g/cm^3
B. 3 g/cm^3
C. 4 g/cm^3
D. 6 g/cm^3
Answer: B. 3 g/cm^3
Calculation: $48 \div 16 =$ **3 g/cm^3**.

---

12. A piece of modelling clay has a mass of 120 g and volume of 60 cm^3. It is flattened into a thin sheet without losing any material. What happens to its density?
A. It increases
B. It decreases
C. It remains unchanged
D. It becomes zero
Answer: C. It remains unchanged
Reason: Density is independent of the shape or size of the object when mass and volume of the material remain unchanged.

---

13. Which statement correctly explains why hot air rises?
A. Heating increases the mass of air
B. Heating decreases the volume of air
C. Heating increases volume and decreases density
D. Heating increases both mass and density
Answer: C. Heating increases volume and decreases density

---

14. If the pressure on a gas is increased while other conditions remain suitable, its particles move closer together. Therefore:

A. Volume increases and density decreases
B. Volume decreases and density increases
C. Both volume and density decrease
D. Density remains unchanged
Answer: B. Volume decreases and density increases

---

15. Pressure has the **least effect** on the density of:
A. Gases
B. Solids
C. Gas mixtures
D. Air
Answer: B. Solids
Reason: Solid particles are already very close together, so changes in their density due to pressure are usually negligible.

---

16. Water has its highest density at approximately:
A. 0°C
B. 4°C
C. 25°C
D. 100°C
Answer: B. 4°C

---

17. Ice floats on liquid water mainly because:
A. Ice has greater mass than water
B. Freezing decreases the volume of water
C. Ice occupies more volume for the same amount of water, lowering its density
D. Ice has the same density as water
Answer: C. Ice occupies more volume for the same amount of water, lowering its density

---

18. A 1-litre packet of oil has a mass of 910 g. Its approximate density is:
A. 0.091 g/mL
B. 0.91 g/mL
C. 1.00 g/mL
D. 9.10 g/mL
Answer: B. 0.91 g/mL
Calculation: 1 L = 1000 mL; density = 910/1000 = **0.91 g/mL**.

---

19. The density of aluminium is 2.7 g/cm^3. If the density of water is approximately 1 g/cm^3, the relative density of aluminium with respect to water is:
A. 0.27
B. 1.7
C. 2.7
D. 27 g/cm^3
Answer: C. 2.7
Reason: Relative density is a ratio and therefore has **no unit**.

---

20. Which of the following is **NOT** a correct unit of density?
A. kg/m^3
B. g/mL

C. g/cm^3
D. kg/m^2
Answer: D. kg/m^2

---

21. While measuring water in a measuring cylinder, Rahul looks at the liquid level from above. What is the best correction to his method?
A. Tilt the cylinder
B. Keep his eye level with the bottom of the meniscus
C. Read the uppermost graduation
D. Hold the cylinder in his hand
Answer: B. Keep his eye level with the bottom of the meniscus
Reason: Water and other colourless liquids are read at the bottom of the meniscus with the eye at the same level.

---

22. A coloured liquid is placed in a measuring cylinder. According to the method given in the chapter, its volume should be read at:
A. The bottom of the meniscus
B. The top of the meniscus
C. Any point on the meniscus
D. The base of the cylinder
Answer: B. The top of the meniscus

---

23. A cuboidal notebook measures 25 cm × 18 cm × 2 cm. Its volume is:
A. 45 cm^3
B. 90 cm^3
C. 450 cm^3
D. 900 cm^3
Answer: D. 900 cm^3
Calculation: 25 × 18 × 2 = **900 cm^3**.

---

24. An iron block has a mass of 600 g and density of 7.5 g/cm^3. What is its volume?
A. 45 cm^3
B. 80 cm^3
C. 450 cm^3
D. 4,500 cm^3
Answer: B. 80 cm^3
Calculation: Volume = Mass ÷ Density = 600 ÷ 7.5 = **80 cm^3**.

---

25. Four observations are made:
I. Salt dissolves uniformly in water.
II. Sand settles at the bottom of water.
III. Sawdust may float on water.
IV. Dissolved oxygen is distributed evenly in water.
Which observations represent **solutions/uniform mixtures**?
A. I and II only
B. I and IV only
C. II and III only
D. I, II and IV

Answer: B. I and IV only
Reason: A solution is a uniform mixture. Dissolved gases can also form uniform mixtures with water.

Higher-Order Olympiad Questions
26. Three equal-volume objects P, Q and R have masses 50 g, 75 g and 100 g respectively. Which statement must be correct?
A. P has the highest density
B. Q has the highest density
C. R has the highest density
D. All have the same density
Answer: C. R has the highest density
Reason: For equal volumes, the object with greater mass has greater density.

---

27. Two objects have the following properties:

- A: Mass = 200 g; Volume = 40 cm^3
- B: Mass = 240 g; Volume = 60 cm^3

Which statement is correct?
A. B is denser because it has greater mass
B. A is denser because its density is 5 g/cm^3
C. Both have density 4 g/cm^3
D. Their densities cannot be compared
Answer: B. A is denser because its density is 5 g/cm^3
Calculation:
A = 200/40 = **5 g/cm^3**
B = 240/60 = **4 g/cm^3**. This comparison is also posed in the chapter's exercise.

---

28. A saturated baking-soda solution at 20°C contains some undissolved baking soda. It is heated first to 50°C and then to 70°C. Which sequence is most consistent with the chapter's experiment?
A. More baking soda remains undissolved at each stage
B. Undissolved baking soda dissolves as temperature increases
C. Baking soda changes into a gas
D. Water loses its ability to act as a solvent
Answer: B. Undissolved baking soda dissolves as temperature increases

---

29. Consider the following statements:
I. Density depends on mass and volume.
II. Density of a substance is independent of its shape or size.
III. Heating generally decreases density.
IV. Increasing pressure greatly changes the density of solids.
Which combination is correct?
A. I and II only
B. I, II and III only
C. II, III and IV only
D. I, II, III and IV
Answer: B. I, II and III only
Reason: Pressure usually has a negligible effect on the density of solids.

---

30. A student places a raw egg in water and it sinks. Which change is most likely to help make it float, based on the density concept explored in the chapter?
A. Increase the density of the surrounding liquid
B. Decrease the density of the surrounding liquid
C. Increase the mass of the egg without changing its volume
D. Replace the water with warmer water only
Answer: A. Increase the density of the surrounding liquid
Reason: The chapter uses the sinking raw egg as an application of density and asks students to determine what change could make it float.

9.15 Best Practices Opportunity List from the Chapter: (5 Ideas)

Suggested "Best Practices" Opportunities:

No.	Best Practice	Suggested Classroom Implementation
1	**Learning by Doing – Mini Science Lab**	Allow students to prepare different mixtures using **salt, sugar, sand, chalk powder, sawdust, water and oil**. Students classify them as uniform/non-uniform mixtures and identify solute, solvent and solution. This directly reinforces the chapter's treatment of mixtures and solutions.
2	**Predict–Experiment–Observe–Explain (PEOE)**	Before each experiment, ask students to **predict the result**, conduct the experiment, record observations and scientifically explain the outcome. For example: *"Will more baking soda dissolve when the water is heated?"* The chapter demonstrates that increasing temperature generally increases the solubility of solids.
3	**Density Detective Challenge**	Give groups different objects such as **stones, keys, wooden pieces, plastic objects and metal objects**. Students measure mass and volume, calculate density using **Density = Mass ÷ Volume**, and rank the objects from least to most dense.
4	**Float-or-Sink Prediction Challenge**	Display everyday objects and ask students to predict whether each will float or sink before testing it. Extend the activity to the chapter's **raw-egg experiment**, challenging students to find a way to make the sinking egg float. This encourages hypothesis formation rather than simply memorising density concepts.
5	**Measurement Skill Stations**	Create classroom stations for **digital balance, measuring cylinder, regular solids and irregular solids**. Students rotate through stations to practise mass measurement, meniscus reading, volume calculation and water-displacement methods. The chapter specifically develops these experimental measurement skills.
6	**Science from the Kitchen**	Connect concepts to familiar examples such as **ORS, sugar syrup/chashni, salt water, cooking oil and beverages**. Students can identify the solute and solvent and compare dilute, concentrated, saturated and unsaturated solutions. This makes abstract terminology relevant to daily life.
7	**Student Research & Interdisciplinary Project**	Assign small-group projects such as **"Why is the Dead Sea so salty?"**, **"Why does ice float?"**, **"Why do hot-air balloons rise?"**, or **"How does temperature affect aquatic life?"** The

No.	Best Practice	Suggested Classroom Implementation
		chapter itself proposes Dead Sea research and links dissolved oxygen, density and temperature with real-world phenomena.
8	**Indian Knowledge & Local Heritage Integration**	Connect science with Indian heritage through the chapter's examples of **traditional medicinal formulations** and **traditional salt production at Ningel village, Manipur**. Students could investigate traditional salt-making or the use of water, oil, ghee and milk as solvents in traditional practices.
9	**Think Like a Scientist – Question Wall**	Maintain a **"Why? What if? How?" Science Question Wall** throughout the chapter. Students post questions such as *"Why does oil float on water?"*, *"Why does ice float?"*, and *"Why does cold water contain more dissolved oxygen?"* Students then investigate selected questions experimentally or through discussion.
10	**Olympiad/HOTS Challenge Corner**	End each lesson with one **Higher-Order Thinking/Olympiad problem** involving experimental data, density calculations, solubility, measurement errors or prediction. Students should not merely select an answer but **justify why the other alternatives are incorrect**. This aligns particularly well with the chapter's own application-oriented exercises.

For a school lesson plan or observation record, the **five strongest practices** to highlight would be: **Learning by Doing, Predict–Experiment–Observe–Explain, Density Detective Challenge, Measurement Skill Stations, and Olympiad/HOTS Challenge Corner.** These demonstrate experiential learning, scientific inquiry, competency-based education, collaboration and higher-order thinking rather than lecture-based teaching alone.

9.16 Innovations Opportunity List from the Chapter: (10 Ideas)

Suggested "Innovations" Opportunities:

No.	Innovative Idea	How it can be implemented
1.	**Virtual Science Lab / Simulation-Based Learning**	Before performing experiments, students can use a digital/interactive simulation to **change the amount of solute, solvent and temperature** and predict when a solution becomes saturated. They then verify their virtual results through the actual experiment. The chapter specifically demonstrates how increasing temperature affects the solubility of baking soda.
2.	**"Design a Floating Object" STEM Challenge**	Give groups aluminium foil, clay, straws or other simple materials and challenge them to **design an object that carries maximum load without sinking**. Students redesign their models after testing and connect their observations with density and floating/sinking. The chapter introduces density as mass per unit volume and explores why objects float or sink.
3.	**Student-Created QR Science Stations**	Create QR codes around the classroom linking to short videos, clues or questions on **solute-solvent identification, saturation, density, meniscus, water displacement and floating/sinking**. Groups rotate through the stations, conduct mini-tasks and record their findings in a "Science Passport."

No.	Innovative Idea	How it can be implemented
4.	**AI-Assisted "Ask a Scientist" Activity**	Students frame questions such as *"Why does ice float?"*, *"Why does hot air rise?"* or *"Why does cold water contain more dissolved oxygen?"* They first write their own explanation, then use a teacher-supervised AI tool to compare explanations, identify differences and improve their scientific reasoning. The chapter itself encourages students to frame and investigate their own questions.
5.	**Mystery Substance – Science Detective Activity**	Provide groups with unknown/sample materials. Students measure **mass and volume, calculate density, observe solubility and classify mixtures**, and then use the collected evidence to identify or compare the substances. This integrates several concepts from the chapter into a single inquiry.
6.	**Digital Data Logger & Graphing Experiment**	Instead of merely recording observations, students enter experimental data into a spreadsheet and create graphs such as **Temperature vs. Solubility** or **Mass vs. Volume**. They interpret the graph and derive conclusions. This introduces Grade 8 students to **data science and evidence-based scientific reasoning**.
7.	**"Science Reel" – Student Micro-Teaching**	Groups create a **60–90 second educational video/reel** explaining one concept: saturated solution, solubility, density, meniscus, water displacement, floating/sinking, etc. The rule can be: *Explain it using one everyday object and one experiment.* This turns students from content consumers into content creators.
8.	**Solve a Real-World Problem – Design Thinking**	Present a problem such as: **"How can you make a sinking egg float without touching or supporting it?"** Students follow *Empathise → Define → Ideate → Experiment → Improve → Explain*. The textbook itself presents the raw-egg challenge after discussing density.
9.	**Science + Heritage Innovation Project**	Students study the traditional **salt-making practice of Ningel village, Manipur**, and then design a **modern miniature salt-production model** using evaporation. They can compare traditional knowledge with modern scientific concepts of solutions, concentration and evaporation. The chapter explicitly presents Ningel salt production as India's living scientific and cultural heritage.
10.	**"Science Shark Tank" – Innovation Pitch**	Groups invent a product/application based on the chapter—for example, a **density-based liquid separator, accurate measuring device, floating emergency container, solution concentration indicator, or improved salt-making model**. Each group gives a 2-minute pitch explaining the scientific principle behind its innovation.

Five particularly strong innovations for a school record

If only **five points** are required under the heading **"Innovations in Teaching-Learning"**, I suggest recording:

1. **Virtual Laboratory and Simulation-Based Learning**
2. **STEM Design Challenge – Design a Floating Object**
3. **QR-Code-Based Interactive Science Learning Stations**
4. **AI-Assisted Inquiry and Scientific Reasoning**
5. **Mystery Substance – Science Detective Investigation**

9.17: Practicing Questions/Question Bank

A. Fill in the Blanks:

1. A uniform mixture of a solute and a solvent is called a __________.
2. The substance that dissolves in a solvent is called the __________.
3. The component present in a larger amount in a solution of two liquids is generally called the __________.
4. A solution in which more solute can still be dissolved at a given temperature is called an __________ solution.
5. A solution that cannot dissolve any more solute at a particular temperature is called a __________ solution.
6. The maximum amount of solute that dissolves in a fixed quantity of solvent is called __________.
7. For most solid substances, solubility __________ with an increase in temperature.
8. The solubility of gases generally __________ as temperature increases.
9. The amount of matter present in an object is called its __________.
10. The space occupied by an object is called its __________.
11. Mass per unit volume of a substance is called __________.
12. The SI unit of density is __________.
13. The instrument commonly used to measure the volume of a liquid is a __________.
14. The curved surface formed by water in a measuring cylinder is called the __________.
15. For a colourless liquid such as water, the reading should be taken at the __________ of the meniscus.
16. The volume of an irregular solid can be determined by the __________ method.
17. One millilitre is equivalent to __________ cubic centimetre.
18. Relative density has __________ unit.
19. Generally, the density of a substance __________ when it is heated.
20. Ice floats on water because its density is __________ than that of liquid water.

These questions reflect the chapter's core definitions and relationships.

B. 1-Mark Questions:

1. What is a solution?
2. Define solute.
3. Define solvent.
4. What is an unsaturated solution?
5. What is a saturated solution?

6. Define concentration of a solution.
7. What is solubility?
8. Name one gas that dissolves in water and is essential for aquatic life.
9. How does an increase in temperature generally affect the solubility of gases in water?
10. Define mass.
11. Define volume.
12. Define density.
13. Write the formula for calculating density.
14. State the SI unit of density.
15. What is relative density?
16. Name the instrument used to measure mass.
17. Name the apparatus used to measure the volume of a liquid.
18. What is a meniscus?
19. State the relationship between 1 mL and 1 cm^3.
20. Write the formula used to calculate the volume of a cuboid.
21. Which method is used to determine the volume of an irregular solid?
22. What generally happens to the density of a substance when its temperature increases?
23. Why does hot air rise?
24. At what temperature does water have its highest density?
25. Why does ice float on liquid water?

The chapter defines density as mass per unit volume and notes that it is independent of an object's shape or size.

C. 2-Mark Questions:

1. Differentiate between a **solute and a solvent**, with one example.
2. Differentiate between a **uniform and non-uniform mixture**, giving one example of each.
3. Distinguish between a **saturated and an unsaturated solution**.
4. Differentiate between a **dilute and concentrated solution**.
5. Explain how temperature affects the solubility of most solid substances in water.
6. How does temperature affect the solubility of oxygen in water? Why is this important for aquatic life?
7. Why is dissolved oxygen important for fishes and other aquatic organisms?
8. Why is water considered the solvent even when a large amount of sugar is used to prepare *chashni*?

9. Distinguish between mass and volume.
10. Write any two units used to express density.
11. What is the difference between density and relative density?
12. Why should the eye be kept at the level of the meniscus while measuring the volume of water?
13. Why is a 100 mL measuring cylinder preferable to a 500 mL measuring cylinder for measuring 70 mL of water accurately?
14. Explain how the water-displacement method helps determine the volume of an irregular object.
15. Why does hot air move upwards?
16. How does increasing pressure affect the density of a gas?
17. Why is the effect of pressure on the density of solids generally negligible?
18. Explain why bamboo is suitable for making traditional rafts.
19. Why does ice floating on lakes help aquatic organisms survive during extremely cold weather?
20. Why does oil float when poured into water?

The textbook particularly emphasizes that cold water can contain more dissolved oxygen than warm water.

D. 3-Mark Questions:

1. Explain the terms **solute, solvent, and solution** using a suitable example.
2. Explain an activity to distinguish between a saturated and an unsaturated solution.
3. Describe the experiment using baking soda to show the effect of temperature on solubility.
4. Explain the effect of temperature on the solubility of **solids and gases**, highlighting the difference between them.
5. Define density. Write its formula and SI unit.
6. Explain how the mass of a solid object can be measured using a digital weighing balance.
7. Describe the correct procedure for measuring 50 mL of water using a measuring cylinder.
8. Explain how the smallest measurable volume of a measuring cylinder can be determined from its markings.
9. Describe how you would determine the volume of an irregular stone using a measuring cylinder.
10. Explain how the volume of a regular cuboid can be determined. Write the formula.
11. Explain the effect of heating on the density of a substance using the particle model.
12. Explain the effect of pressure on the density of gases, liquids, and solids.
13. Why does ice float on water? Explain in terms of density and expansion.

14. Explain why the density of a substance does not change merely because its shape is changed.
15. A stone has a mass of **16.4 g** and displaces **5 mL** of water. Calculate its density.
16. An aluminium block has a mass of **27 g** and a volume of **10 cm³**. Calculate its density and relative density with respect to water.
17. Object A has a mass of **200 g and volume 40 cm³**, while Object B has a mass of **240 g and volume 60 cm³**. Calculate their densities and identify the denser object.
18. A stone sculpture has a mass of **225 g and volume 90 cm³**. Calculate its density and predict whether it will float or sink in water.
19. Explain why a raw egg normally sinks in water. Suggest a change to the water that could make it float, using the concept of density.
20. Explain why an unpeeled orange may float while a peeled orange sinks.

The water-displacement activity in the chapter uses the rise in water level to calculate the volume of an irregular solid and then combines mass and volume to determine density.

E. 5-Mark Descriptive / Long-Answer Questions:

1. **Explain saturated and unsaturated solutions.** Describe an experiment using salt and water to demonstrate how a saturated solution is formed. How can temperature influence saturation?
2. **Describe the effect of temperature on solubility.** Explain separately how increasing temperature affects the solubility of most solids and gases in water, with suitable examples.
3. **What is density?** Define density, write its mathematical formula and SI unit, and explain how the density of an irregular solid can be experimentally determined.
4. **Describe the complete procedure for determining the density of an irregular stone.** Include:
    - measurement of mass,
    - measurement of initial water volume,
    - measurement after immersing the stone,
    - calculation of volume by displacement, and
    - calculation of density.
5. **Explain how volume is measured in the laboratory.** Describe the construction/use of a measuring cylinder, smallest division, meniscus, correct eye position and precautions required for accurate measurement.
6. **Discuss the effect of temperature on density.** Explain the phenomenon using the particulate nature of matter and relate it to the working of a hot-air balloon.
7. **Explain how pressure affects density in solids, liquids and gases.** Why is its effect much greater in gases?
8. **"The density of a substance is independent of its shape and size." Explain.** A 120 g piece of modelling clay occupies 60 cm³. Calculate its density. Predict what happens to its density if the same clay is flattened into a thin sheet without loss of material.

9. **Explain scientifically why ice floats on water.** Include the change in arrangement of particles, expansion during freezing, change in volume and density, and its importance to aquatic life. The chapter notes that water has its highest density at 4°C and that freezing produces a structure occupying greater volume.

10. **Compare uniform and non-uniform mixtures.** Explain their characteristics with examples such as salt water, sugar water, sand in water and sawdust in water. Relate your answer to solutions and floating/sinking.

11. **A student is given an unknown irregular solid. Design an experiment to determine whether it is denser than water.** Mention the apparatus required, observations, measurements, calculations and conclusion.

12. **Explain the relationship among mass, volume and density.** Support your explanation with a numerical example and explain how heating can change density without changing mass.

13. **Describe the scientific principles involved in traditional salt production at Ningel village in Manipur.** Explain how salty water, solution formation, heating, evaporation and salt crystallisation are connected with concepts learned in this chapter. The chapter presents Ningel's traditional salt-making practice as an example connecting science with India's living cultural heritage.

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8^{th} Standard Science Book Chapter 10

Chapter 10: Light: Mirrors and Lenses:

10.1 Summary of the Chapter:

(1) **Spherical mirrors** are curved mirrors whose reflecting surfaces form part of a sphere. They are of two types: **concave mirrors**, which curve inwards, and **convex mirrors**, which curve outwards.

(2) A **concave mirror** can form an enlarged, diminished, or same-sized image, which may be erect or inverted depending on the distance of the object from the mirror. When the object is close, the image is erect and enlarged; when moved farther away, it becomes inverted.

(3) A **convex mirror** always forms an **erect and diminished image**. It also provides a wider field of view and is therefore used as a side-view mirror in vehicles, at road bends, and for surveillance in stores.

(4) **Concave mirrors** are commonly used as reflectors in torches and vehicle headlights and by dentists because they can provide an enlarged view of nearby objects. Large concave mirrors are also used in reflecting telescopes.

(5) A ray of light falling on a mirror is called the **incident ray**, while the ray that returns after reflection is the **reflected ray**. The perpendicular drawn to the reflecting surface at the point of incidence is called the **normal**.

(6) There are **two laws of reflection**:
   - The **angle of incidence is equal to the angle of reflection**.
   - The incident ray, normal at the point of incidence, and reflected ray **lie in the same plane**. These laws apply to plane, concave, and convex mirrors.

(7) When parallel rays of light fall on mirrors, a **plane mirror keeps them parallel**, a **concave mirror converges them**, and a **convex mirror diverges them**.

(8) A concave mirror can **concentrate sunlight at a small bright spot**, producing considerable heat. This principle is used in **solar concentrators, solar furnaces, and large-scale solar cooking systems**.

(9) A **lens** is a transparent material, usually glass or plastic, having curved surfaces. A **convex lens** is thicker in the middle than at the edges, while a **concave lens** is thicker at the edges than in the middle.

(10) A **convex lens** can produce enlarged, diminished, erect, or inverted images depending on the object's distance from the lens. A **concave lens**, however, always makes an object appear **erect and diminished**.

(11) A **convex lens is a converging lens** because it brings parallel light rays together, whereas a **concave lens is a diverging lens** because it spreads parallel light rays apart.

(12) **Lenses have many applications in everyday life.** They are used in eyeglasses, magnifying glasses, cameras, telescopes, and microscopes. The **human eye also contains a convex lens** that can change its shape to help us see objects at different distances.

The chapter explains how **concave and convex mirrors and lenses form different kinds of images, how light obeys the laws of reflection, and how curved mirrors and lenses can converge or diverge light**, connecting these principles to practical devices used in daily life.

10.2 Important Formulas:

Based strictly on the **Chapter 10 – "Light: Mirrors and Lenses"**, the quantitative work is intentionally limited. The chapter does **not introduce the mirror formula, lens formula, magnification formula, focal length, or power of a lens**. Its numerical questions mainly involve **angles of incidence and reflection**.

Important Formulas / Relations for Quantitative Problems:

No.	Formula / Relation	Meaning / Use
1	**∠i = ∠r**	**Law of reflection:** Angle of incidence equals angle of reflection.
2	**i + angle between incident ray and mirror = 90°**	Converts the angle made with the **mirror surface** into the angle of incidence.
3	**r + angle between reflected ray and mirror = 90°**	Converts the angle of reflection into the angle made by the reflected ray with the mirror.
4	**Angle between incident ray and reflected ray = i + r = 2i = 2r**	Finds the angle between the incident and reflected rays.
5	**If i = 0°, then r = 0°**	When light falls **along the normal**, it is reflected back along the same path.
6	**Normal ⊥ Mirror ⇒ angle = 90°**	The normal is always perpendicular to the reflecting surface at the point of incidence.

The textbook explicitly defines **i** as the angle between the incident ray and normal and **r** as the angle between the reflected ray and normal, and establishes **i = r**.

Most Important Formula

$$\boxed{\text{Angle of incidence } (i) = \text{Angle of reflection } (r)}$$

or simply,

$$\boxed{i = r}$$

This is the **main formula required for numerical problems in this chapter**. The end-of-chapter exercises specifically ask students to calculate angles using this law.

Example 1 — Angle with the mirror

If the angle of incidence is **40°**:

$$i = r = 40^\circ$$

Therefore, the angle made by the reflected ray with the **mirror** is:

$$90^\circ - r$$

$$= 90^\circ - 40^\circ = \boxed{50^\circ}$$

This is exactly the type of quantitative problem given in Question 1 of the chapter exercise.

Example 2 — Ray along the normal

If a ray falls along the normal:

$$\boxed{i = 0^\circ}$$

By the law of reflection:

$$r = i$$

Therefore,

$$\boxed{r = 0^\circ}$$

The reflected ray retraces the same path. The chapter explicitly discusses this special case.

Example 3 — Incident ray makes 30° with the mirror

Since the normal is perpendicular to the mirror:

$$i = 90^\circ - 30^\circ$$

$$\boxed{i = 60^\circ}$$

Therefore,

$$\boxed{r = 60^\circ}$$

and the reflected ray makes:

$$90^\circ - 60^\circ = \boxed{30^\circ}$$

with the mirror.

Formula Box for Students

LIGHT: MIRRORS AND LENSES — QUICK FORMULAS

$$\boxed{i = r}$$

$$\boxed{i = 90^\circ - \text{angle between incident ray and mirror}}$$

$$\boxed{\text{angle between reflected ray and mirror} = 90^\circ - r}$$

$$\boxed{\text{angle between incident and reflected rays} = 2i = 2r}$$

$$\boxed{\text{Normal makes } 90^\circ \text{ with the mirror}}$$

$$\boxed{i = 0^\circ \Rightarrow r = 0^\circ}$$

Important: For this uploaded Grade 8 chapter, students **do not need** $1/f = 1/v + 1/u$, $m = v/u$, $P = 1/f$, or $R = 2f$. Those formulas are **not introduced in this chapter**; the treatment of spherical mirrors and lenses here is primarily qualitative.

10.3 Fill-Up the Blank LOTS type questions with Answers: (40 Questions)

The following questions are based on the definitions, characteristics of mirrors and lenses, laws of reflection, and their applications given in the chapter.

1. Mirrors whose reflecting surfaces are spherical are called __________ **mirrors**.
   Answer: Spherical
2. A spherical mirror whose reflecting surface curves inwards is called a __________ **mirror**.
   Answer: Concave
3. A spherical mirror whose reflecting surface curves outwards is called a __________ **mirror**.
   Answer: Convex
4. A plane mirror always forms an __________ image of the same size as the object.
   Answer: Erect
5. When an object is placed close to a concave mirror, its image is erect and __________.
   Answer: Enlarged
6. The image formed by a convex mirror is always erect and __________ in size.
   Answer: Diminished
7. The mirrors used as reflectors in torches and vehicle headlights are __________ **mirrors**.
   Answer: Concave
8. Dentists use a __________ **mirror** to obtain an enlarged view of teeth.
   Answer: Concave
9. The side-view mirrors used in vehicles are __________ **mirrors**.
   Answer: Convex
10. Convex mirrors provide a much __________ area of view than plane mirrors.
    Answer: Wider

These image characteristics and applications of concave and convex mirrors are described in the chapter.

11. The ray of light that falls on a mirror is called the __________ **ray**.
    Answer: Incident

12. The ray of light that comes back from a mirror is called the __________ **ray**.
    Answer: Reflected
13. The line drawn perpendicular to the reflecting surface at the point of incidence is called the __________.
    Answer: Normal
14. The normal makes an angle of __________ with the mirror surface.
    Answer: 90°
15. The angle between the incident ray and the normal is called the angle of __________.
    Answer: Incidence
16. The angle between the reflected ray and the normal is called the angle of __________.
    Answer: Reflection
17. According to the law of reflection, the angle of incidence is __________ to the angle of reflection.
    Answer: Equal
18. When a ray of light falls along the normal, the angle of incidence is __________.
    Answer: 0°
19. The incident ray, normal and reflected ray all lie in the same __________.
    Answer: Plane
20. The laws of reflection are valid for __________ kinds of mirrors.
    Answer: All

The chapter defines the incident ray, reflected ray, normal, angle of incidence and angle of reflection and establishes the two laws of reflection.

21. A concave mirror causes parallel reflected rays to __________.
    Answer: Converge
22. A convex mirror causes parallel reflected rays to __________.
    Answer: Diverge
23. When parallel rays fall on a plane mirror, the reflected rays remain __________.
    Answer: Parallel
24. Devices that concentrate sunlight into a small area using mirrors and lenses are called solar __________.
    Answer: Concentrators
25. A lens is usually made of transparent glass or __________.
    Answer: Plastic
26. A lens that is thicker at the middle than at the edges is called a __________ **lens**.
    Answer: Convex
27. A lens that is thicker at the edges than at the middle is called a __________ **lens**.
    Answer: Concave
28. Unlike mirrors, lenses allow __________ to pass through them.
    Answer: Light
29. A magnifying glass uses a __________ **lens**.
    Answer: Convex
30. An object placed close behind a convex lens appears erect and __________.
    Answer: Enlarged
31. An object viewed through a concave lens always appears erect and __________.
    Answer: Diminished
32. A convex lens is also known as a __________ **lens**.
    Answer: Converging
33. A concave lens is also known as a __________ **lens**.
    Answer: Diverging

34. A convex lens __________ parallel beams of light falling on it.
    Answer: Converges
35. A concave lens __________ parallel beams of light falling on it.
    Answer: Diverges

These properties of convex and concave lenses are stated directly in the chapter.

36. Eyeglasses used to help people see clearly contain __________.
    Answer: Lenses
37. Cameras, telescopes and __________ use lenses to work.
    Answer: Microscopes
38. The human eye has a __________ **lens** inside it.
    Answer: Convex
39. The lens inside our eye can change its __________.
    Answer: Shape
40. Lateral inversion is seen in plane, concave and __________ mirrors.
    Answer: Convex

The chapter's summary confirms the key distinctions: a convex mirror always produces an erect, diminished image; a concave mirror converges light; a convex lens converges light; and a concave lens diverges light.

10.4 Fill-Up the Blank HOTS type questions with Answers: (40 Questions)

These questions require students to **apply, analyse, compare, predict, and reason** using the concepts in the Grade 8 chapter 10, rather than merely recall definitions.

1. A dentist wants to see a larger, upright image of a patient's tooth. The mirror should be held ________ to the tooth.
   Answer: close
2. If a person moves farther away from a concave mirror, an initially erect image may eventually become ________.
   Answer: inverted
3. A driver needs to observe a larger area of traffic behind the vehicle. Therefore, a ________ mirror is more suitable than a plane mirror.
   Answer: convex
4. If a shopkeeper replaces a convex surveillance mirror with a plane mirror, the area visible in the mirror will become ________.
   Answer: smaller
5. If an unknown mirror always produces an erect and diminished image irrespective of the object's distance, it is most likely a ________ mirror.
   Answer: convex
6. If an unknown mirror produces an erect and enlarged image when an object is brought close to it, the mirror is most likely ________.
   Answer: concave

These applications follow from the chapter's comparison of concave and convex mirrors and their uses in dental mirrors, vehicles, road intersections, and surveillance.

7. A ray strikes a mirror with an angle of incidence of 35°. Its angle of reflection will be ________.
   Answer: 35°
8. If the angle of incidence increases from 20° to 50°, the angle of reflection will become ________.
   Answer: 50°

9. If an incident ray travels exactly along the normal, the angle of reflection will be ________.
   Answer: 0°
10. If a reflected ray makes an angle of 30° with the normal, the incident ray must also make an angle of ________ with the normal.
   Answer: 30°
11. A reflected ray makes an angle of 40° with the normal. Therefore, it makes an angle of ________ with the mirror surface.
   Answer: 50°
12. A ray has an angle of incidence of 25°. The reflected ray therefore makes an angle of ________ with the mirror surface.
   Answer: 65°

These numerical applications use the law that the angle of incidence equals the angle of reflection, with both angles measured from the normal.

13. In the reflection experiment, bending the paper makes the reflected beam disappear because the bent portion is in a different ________.
   Answer: plane
14. If the incident ray, normal and reflected ray are drawn correctly according to the law of reflection, all three must lie in the same ________.
   Answer: plane
15. If several parallel rays strike a plane mirror, the reflected rays will remain ________.
   Answer: parallel
16. If several parallel rays fall on a concave mirror, they move closer together after reflection; hence, the mirror causes them to ________.
   Answer: converge
17. If several parallel rays fall on a convex mirror, they spread apart after reflection; hence, the rays ________.
   Answer: diverge
18. To concentrate sunlight onto a small area using a mirror, a ________ mirror would be more appropriate than a convex mirror.
   Answer: concave

The chapter experimentally demonstrates that plane mirrors preserve parallel beams, whereas concave mirrors converge them and convex mirrors diverge them.

19. A sheet of paper can begin to burn when sunlight reflected from a concave mirror forms a bright spot because the light energy becomes ________ in a small area.
   Answer: concentrated
20. A solar cooker that needs to collect sunlight and produce greater heat should use a surface that ________ the incoming sunlight.
   Answer: converges
21. If a curved mirror spreads parallel sunlight instead of concentrating it, the mirror is most likely ________.
   Answer: convex
22. If the bright spot produced by a concave mirror is no longer sharp, the paper should be moved until the reflected light becomes ________ at one point.
   Answer: concentrated

These questions apply the principle demonstrated in the chapter's sunlight experiment and its discussion of solar concentrators.

23. If small printed letters appear larger when viewed through a water drop, the water drop is behaving like a simple ________.
   Answer: lens

24. A lens that makes a nearby object appear erect and enlarged is most likely a ________ lens.
    Answer: convex
25. If an object viewed through a lens always appears erect and diminished, the lens is most likely ________.
    Answer: concave
26. When an object is gradually moved farther from a convex lens, its initially erect image may eventually become ________.
    Answer: inverted
27. If parallel rays become closer together after passing through an unknown lens, the lens must be ________.
    Answer: convex
28. If parallel rays spread apart after passing through an unknown lens, the lens must be ________.
    Answer: concave
29. If parallel rays pass through a thin flat glass plate without converging or diverging, they continue essentially ________.
    Answer: parallel
30. A student needs a lens to magnify small letters while reading. The appropriate choice is a ________ lens.
    Answer: convex

The chapter compares how objects appear through convex and concave lenses and demonstrates that convex lenses converge light while concave lenses diverge it.

Additional Challenging HOTS Fill-Ups

31. Two unknown mirrors are tested. Mirror A always gives a smaller erect image, while Mirror B gives an enlarged erect image when the object is close. Mirror A is ________ and Mirror B is concave.
    Answer: convex
32. Two unknown lenses are tested with parallel beams. Lens A brings the beams together while Lens B spreads them apart. Lens A is ________.
    Answer: convex
33. Since both a concave mirror and a convex lens can concentrate sunlight, both are described as ________ devices with respect to parallel light beams.
    Answer: converging
34. A convex mirror is useful at a blind road bend mainly because it provides a ________ area of view.
    Answer: wider
35. If a mirror gives an image of the same size regardless of the object's distance from it, it is most likely a ________ mirror.
    Answer: plane
36. If a lens is thicker at the edges and causes parallel light rays to spread apart, it must be a ________ lens.
    Answer: concave
37. A student wants to concentrate sunlight using a lens rather than a mirror. The student should choose a ________ lens.
    Answer: convex
38. If a mirror produces an inverted image of an object, it cannot be a ________ mirror because that type always produces an erect image.
    Answer: convex

39. If an object viewed through a lens is always diminished and never inverted, the lens can be identified as ________.
    Answer: concave
40. A device designed to spread a parallel beam of light should use a convex mirror or a ________ lens.
    Answer: concave

The chapter's summary directly supports these comparisons among image formation, convergence and divergence by mirrors and lenses.

10.5 One-mark questions with Answers of LOTS Type: (36 Questions)

The following questions are based directly on the Grade 8 chapter 10 **"Light: Mirrors and Lenses."**

1. **What is a spherical mirror?**
   Answer: A spherical mirror is a curved mirror whose reflecting surface is shaped like a part of a hollow sphere.
2. **What is a concave mirror?**
   Answer: A concave mirror is a spherical mirror whose reflecting surface curves inwards.
3. **What is a convex mirror?**
   Answer: A convex mirror is a spherical mirror whose reflecting surface curves outwards.
4. **How does a plane mirror form the image of an object?**
   Answer: A plane mirror always forms an erect image of the same size as the object.
5. **What kind of image is formed by a convex mirror?**
   Answer: A convex mirror always forms an erect and diminished image.
6. **What happens to the image in a concave mirror when the object is placed close to it?**
   Answer: The concave mirror forms an erect and enlarged image when the object is placed close to it.
7. **What happens to the image in a concave mirror when the object is moved farther away?**
   Answer: The image becomes inverted and gradually decreases in size as the object is moved farther away.
8. **Why are concave mirrors used by dentists?**
   Answer: Concave mirrors are used by dentists because they provide an enlarged view of the teeth when held close to them.
9. **Why are convex mirrors used as side-view mirrors in vehicles?**
   Answer: Convex mirrors are used as side-view mirrors because they provide an erect, diminished image and a wider view of the road behind.
10. **Where are convex mirrors used for road safety?**
    Answer: Convex mirrors are installed at road intersections and sharp bends to provide a wider view and help prevent collisions.
11. **What is an incident ray?**
    Answer: The ray of light that falls on a mirror is called the incident ray.
12. **What is a reflected ray?**
    Answer: The ray of light that comes back from a mirror after reflection is called the reflected ray.
13. **What is the normal to a reflecting surface?**
    Answer: The normal is a line drawn at 90° to the reflecting surface at the point of incidence.

14. **What is the angle of incidence?**
    Answer: The angle between the incident ray and the normal is called the angle of incidence.
15. **What is the angle of reflection?**
    Answer: The angle between the reflected ray and the normal is called the angle of reflection.
16. **State the first law of reflection.**
    Answer: The angle of incidence is equal to the angle of reflection.
17. **State the second law of reflection.**
    Answer: The incident ray, normal at the point of incidence, and reflected ray all lie in the same plane.
18. **What is the angle of incidence when light falls along the normal?**
    Answer: The angle of incidence is 0° when light falls along the normal.
19. **What happens to parallel light rays when they fall on a plane mirror?**
    Answer: Parallel light rays remain parallel after reflection from a plane mirror.
20. **What happens to parallel light rays when they fall on a concave mirror?**
    Answer: Parallel light rays converge after reflection from a concave mirror.
21. **What happens to parallel light rays when they fall on a convex mirror?**
    Answer: Parallel light rays diverge after reflection from a convex mirror.
22. **What is a solar concentrator?**
    Answer: A solar concentrator is a device that uses mirrors or lenses to concentrate sunlight into a small area.
23. **Why can a concave mirror burn a piece of paper in sunlight?**
    Answer: A concave mirror concentrates sunlight at a small spot and produces enough heat to ignite the paper.
24. **What is a lens?**
    Answer: A lens is a piece of transparent material, usually glass or plastic, having curved surfaces.
25. **What is a convex lens?**
    Answer: A convex lens is a lens that is thicker at the middle than at the edges.
26. **What is a concave lens?**
    Answer: A concave lens is a lens that is thicker at the edges than at the middle.
27. **What kind of image does a convex lens form when an object is placed close to it?**
    Answer: A convex lens makes a nearby object appear erect and enlarged.
28. **What kind of image does a concave lens form?**
    Answer: A concave lens always makes an object appear erect and diminished.
29. **Why is a convex lens called a converging lens?**
    Answer: A convex lens is called a converging lens because it brings parallel light rays closer together.
30. **Why is a concave lens called a diverging lens?**
    Answer: A concave lens is called a diverging lens because it spreads parallel light rays apart.
31. **How does light behave when it passes through a thin transparent glass plate?**
    Answer: A parallel beam of light passes through a thin transparent glass plate essentially as it is.
32. **How does a water drop act like a lens?**
    Answer: A water drop acts like a simple lens because its curved surface can make the text beneath it appear larger.

33. **What type of lens is used in a magnifying glass?**
    Answer: A magnifying glass uses a convex lens to make small objects or letters appear larger.
34. **Name any two devices that use lenses.**
    Answer: Cameras and microscopes are two devices that use lenses.
35. **What type of lens is present inside the human eye?**
    Answer: The human eye has a convex lens that can change its shape to help us see objects at different distances.
36. **Are the laws of reflection applicable only to plane mirrors?**
    Answer: No, the laws of reflection are applicable to plane, concave, and convex mirrors.

10.6 One-mark questions with Answers of HOTS Type: (35 Questions)

The following **Higher Order Thinking Skills (HOTS)** questions require students to apply, analyse, predict, compare, or reason using concepts from the chapter 10.

1. **A dentist wants to see an enlarged image of a patient's tooth; which mirror should be used and why?**
   Answer: A concave mirror should be used because it forms an erect and enlarged image when the tooth is held close to it.
2. **Why is a convex mirror more suitable than a plane mirror as a side-view mirror of a vehicle?**
   Answer: A convex mirror is more suitable because it provides an erect, diminished image and a wider view of the traffic behind.
3. **A shopkeeper wants to monitor a large area of the store using a single mirror; which mirror should be chosen?**
   Answer: The shopkeeper should choose a convex mirror because it provides a wider field of view.
4. **A person's image in a mirror is always erect but smaller than the person; what type of mirror is it likely to be?**
   Answer: It is likely to be a convex mirror because a convex mirror always forms an erect and diminished image.
5. **A person's image changes from inverted to erect and enlarged while moving towards a mirror; which mirror is being used?**
   Answer: The mirror is concave because the nature and size of its image change with the object's distance.
6. **Why would replacing a vehicle's convex side-view mirror with a plane mirror reduce road safety?**
   Answer: A plane mirror would show a smaller area behind the vehicle than a convex mirror, reducing the driver's field of view.
7. **If a ray of light strikes a mirror with an angle of incidence of 35°, what will be its angle of reflection?**
   Answer: The angle of reflection will be 35° because the angle of reflection is equal to the angle of incidence.
8. **If the angle of incidence increases from 20° to 40°, what happens to the angle of reflection?**
   Answer: The angle of reflection also increases from 20° to 40° according to the law of reflection.
9. **A ray of light falls normally on a plane mirror; in which direction will it be reflected?**

Answer: The ray will be reflected back along the same path because both the angle of incidence and angle of reflection are zero.

10. **Why does the reflected beam disappear from the paper when the paper in Activity 10.5 is bent?**
    Answer: The reflected beam disappears because the bent portion is no longer in the same plane as the incident ray, normal, and reflected ray.
11. **Parallel rays remain parallel after striking one mirror; what type of mirror is it?**
    Answer: It is a plane mirror because parallel rays remain parallel after reflection from it.
12. **Parallel rays of light come closer together after reflection; which mirror has most likely reflected them?**
    Answer: A concave mirror has reflected them because it converges parallel rays of light.
13. **Parallel rays spread apart after striking a mirror; what can you infer about the mirror?**
    Answer: The mirror is convex because a convex mirror causes parallel reflected rays to diverge.
14. **Why can a concave mirror cause a piece of paper to burn when sunlight is reflected onto it?**
    Answer: A concave mirror concentrates sunlight into a small area, producing sufficient heat to ignite the paper.
15. **Why should we never direct sunlight reflected from a concave mirror towards someone's eyes?**
    Answer: The concentrated reflected sunlight can produce intense heat and light that may damage the eyes.
16. **A student wants to design a solar cooker; which type of mirror would be useful and why?**
    Answer: A concave mirror would be useful because it can converge sunlight and concentrate heat for cooking.
17. **Why can a water drop placed over printed text make the letters appear larger?**
    Answer: The curved water drop acts like a simple lens and can magnify the letters beneath it.
18. **A lens is thick at the centre and thin at the edges; what effect will it have on parallel light rays?**
    Answer: It will converge parallel light rays because it is a convex lens.
19. **A lens is thin at the centre and thick at the edges; what will it do to parallel light rays?**
    Answer: It will diverge parallel light rays because it is a concave lens.
20. **An object viewed through a lens always appears erect and smaller; which lens is being used?**
    Answer: A concave lens is being used because it always makes an object appear erect and diminished.
21. **Why is a convex lens called a converging lens?**
    Answer: A convex lens is called a converging lens because it brings parallel rays of light closer together.
22. **Why is a concave lens called a diverging lens?**
    Answer: A concave lens is called a diverging lens because it spreads parallel rays of light apart.
23. **A student looks through a flat glass plate and a convex lens; through which one is the object's appearance more likely to change?**

Answer: The object's appearance is more likely to change through the convex lens because it changes the direction of light rays, whereas the thin glass plate allows the beam to pass essentially as it is.

24. **If a convex lens is moved gradually away from a nearby object, what change can be observed in the image?**
    Answer: The image can change from erect and enlarged to inverted and eventually become smaller as the distance increases.
25. **Why can a convex lens, like a concave mirror, be used to burn a piece of paper in sunlight?**
    Answer: Both can converge sunlight into a small area, producing enough heat to burn the paper.
26. **If you need to read very small print, would you choose a convex or concave lens and why?**
    Answer: I would choose a convex lens because it can make nearby small print appear enlarged.
27. **Why would a concave lens not be suitable as a magnifying glass?**
    Answer: A concave lens is unsuitable because it makes objects appear diminished rather than enlarged.
28. **A mirror makes your face look enlarged when you stand close but inverted when you move away; how can you identify the mirror?**
    Answer: It can be identified as a concave mirror because its image changes from erect and enlarged to inverted as the object moves away.
29. **Two mirrors obey the same laws of reflection, yet one converges parallel rays and the other diverges them; why?**
    Answer: Their differently curved reflecting surfaces cause the reflected rays to converge in a concave mirror and diverge in a convex mirror.
30. **Why are curved mirrors useful even though every ray reflected from them follows the same laws of reflection as a plane mirror?**
    Answer: Their curved surfaces direct different reflected rays in different directions, allowing light to be converged or diverged.
31. **A student wants to concentrate sunlight without using a mirror; which optical device can be used?**
    Answer: A convex lens can be used because it converges sunlight into a small bright spot.
32. **Why should one never look directly at the Sun through a convex lens?**
    Answer: A convex lens can concentrate intense sunlight into the eye and cause serious eye damage.
33. **A driver approaching a sharp blind bend cannot see vehicles coming from the opposite direction; how can a mirror help?**
    Answer: A convex mirror placed at the bend can provide a wider view of approaching traffic and help prevent collisions.
34. **If an image in a mirror is erect and exactly the same size as the object, which mirror is most likely being used?**
    Answer: A plane mirror is most likely being used because it always forms an erect image of the same size as the object.
35. **A student finds that a lens makes an object erect and enlarged when close but inverted when farther away; which lens is it?**
    Answer: It is a convex lens because the image formed by it changes with the distance of the object.

10.7 Two-mark questions with Answers of LOTS Type: (25 Questions)

The following questions are based directly on the concepts, definitions, observations, and applications covered in the Grade 8 chapter 10.

1. What are spherical mirrors? Name their two types.

Answer:

- Mirrors whose reflecting surfaces are spherical are called **spherical mirrors**.
- The two types of spherical mirrors are **concave mirrors and convex mirrors**.

2. Differentiate between a concave mirror and a convex mirror.

Answer:

- A **concave mirror** has a reflecting surface that curves inwards.
- A **convex mirror** has a reflecting surface that curves outwards.

3. State two characteristics of the image formed by a convex mirror.

Answer:

- The image formed by a convex mirror is always **erect**.
- The image is always **smaller (diminished) than the object**.

4. How does the image formed by a concave mirror change when an object is moved away from it?

Answer:

- When the object is close to the mirror, its image is **erect and enlarged**.
- As the object is moved farther away, the image becomes **inverted and gradually smaller**.

5. State two differences between the images formed by a plane mirror and a convex mirror.

Answer:

- A plane mirror forms an erect image of the **same size** as the object.
- A convex mirror forms an erect image that is always **smaller than the object**.

6. Mention any two uses of concave mirrors.

Answer:

- Concave mirrors are used as **reflectors in torches and vehicle headlights**.
- Dentists use concave mirrors to obtain an **enlarged view of teeth**.

7. Mention any two uses of convex mirrors.

Answer:

- Convex mirrors are used as **side-view mirrors in vehicles**.
- They are also used as **surveillance mirrors in large stores and as safety mirrors at road bends**.

8. What are an incident ray and a reflected ray?

Answer:

- The ray of light that falls on a mirror is called the **incident ray**.
- The ray of light that comes back from the mirror is called the **reflected ray**.

9. What is the normal to a reflecting surface? What is the point of incidence?

Answer:

- The **normal** is a line drawn at 90° to the reflecting surface at the point where the incident ray strikes it.
- The point where the incident ray strikes the mirror is called the **point of incidence**.

10. Define angle of incidence and angle of reflection.

Answer:

- The angle between the **incident ray and the normal** is called the angle of incidence.
- The angle between the **reflected ray and the normal** is called the angle of reflection.

11. State the two laws of reflection.
Answer:
- The **angle of incidence is equal to the angle of reflection**.
- The incident ray, normal at the point of incidence, and reflected ray **all lie in the same plane**.

12. What happens when a ray of light falls on a mirror along the normal?
Answer:
- The angle of incidence is **zero** because the incident ray travels along the normal.
- The angle of reflection is also **zero**, and the ray is reflected back along the same path.

13. What happens to parallel rays of light when they fall on a concave and a convex mirror?
Answer:
- A concave mirror causes parallel reflected rays to **come closer or converge**.
- A convex mirror causes parallel reflected rays to **spread apart or diverge**.

14. Why does a piece of paper burn when sunlight is concentrated on it using a concave mirror?
Answer:
- A concave mirror **concentrates the reflected sunlight at a small bright spot**.
- The concentrated sunlight produces sufficient **heat to ignite the paper**.

15. What are solar concentrators? Mention one use of them.
Answer:
- Devices that concentrate sunlight into a small area using mirrors or lenses are called **solar concentrators**.
- They can be used to produce steam for **generating electricity, cooking, or heating purposes**.

16. What is a lens? Name its two types.
Answer:
- A lens is a piece of transparent material, usually glass or plastic, having **curved surfaces**.
- The two types of lenses are **convex lenses and concave lenses**.

17. Differentiate between a convex lens and a concave lens based on their shape.
Answer:
- A convex lens is **thicker at the middle than at the edges**.
- A concave lens is **thicker at the edges than at the middle**.

18. State two characteristics of the image seen through a concave lens.
Answer:
- An object seen through a concave lens always appears **erect**.
- Its image always appears **smaller or diminished in size**.

19. How does an object appear through a convex lens when its distance from the lens is changed?
Answer:
- At a small distance, the object appears **erect and enlarged**.
- As the distance increases, the object appears **inverted and eventually diminished in size**.

20. Why are convex and concave lenses also called converging and diverging lenses?
Answer:
- A convex lens is called a **converging lens** because it brings parallel light rays together.
- A concave lens is called a **diverging lens** because it spreads parallel light rays apart.

21. Mention any two devices that use lenses.
Answer:
- Lenses are used in **cameras and microscopes**.
- They are also used in **eyeglasses and telescopes**.

22. What is special about the lens present in the human eye?
Answer:
- The human eye contains a **convex lens**.
- This lens can **change its shape**, allowing us to see both nearby and distant objects clearly.

23. What happens to parallel beams of light when they fall on a plane mirror? How is this different from a concave mirror?
Answer:
- Parallel rays falling on a plane mirror remain **parallel after reflection**.
- Parallel rays reflected from a concave mirror **converge or come closer together**.

24. How is a lens different from a mirror in the way we see objects?
Answer:
- A lens allows **light to pass through it**.
- Therefore, we see objects **through a lens**, whereas we see images **in a mirror**.

25. What happens when parallel light beams pass through a thin glass plate and a convex lens?
Answer:
- Parallel light beams pass through a **thin glass plate essentially as they are**.
- A **convex lens converges** the parallel light beams falling on it.

10.8. Two-mark questions with Answers of HOTS Type: (25 Questions)

The following questions are designed as **Higher Order Thinking Skills (HOTS)** questions. They require students to **apply, analyse, compare, predict, or justify** concepts from the chapter rather than merely recall definitions. The chapter itself encourages this type of reasoning through activities involving changing object distances, identifying mirrors/lenses from images, and applying the laws of reflection.

1. A dentist wants to see an enlarged and erect image of a patient's tooth. Which type of mirror should be used? Why?
Answer:
- The dentist should use a **concave mirror** and hold it close to the tooth.
- A concave mirror forms an **erect and enlarged image** when the object is placed close to it.

2. Why are convex mirrors preferred over plane mirrors as side-view mirrors in vehicles? Give two reasons.
Answer:
- A convex mirror provides a **wider view of the road behind**, helping the driver observe a larger area.
- It forms **erect and diminished images**, allowing more vehicles to be seen in the mirror.

3. A shopkeeper wants to monitor a large area of a store using a single mirror. Which mirror should be chosen? Justify your answer.
Answer:
- The shopkeeper should choose a **convex mirror**.
- It provides a **wide field of view**, enabling a large area of the store to be monitored at once.

4. A person looks into a curved mirror and sees an erect, enlarged image. What type of mirror is it? What will happen if the person moves farther away?
Answer:
- It is a **concave mirror**, because it can produce an erect and enlarged image when the person is close to it.
- As the person moves farther away, the image eventually becomes **inverted and changes in size**.

5. A child sees an erect and smaller image of herself in a curved mirror, irrespective of her distance from it. Identify the mirror and justify your answer.
Answer:
- The mirror is a **convex mirror**.
- A convex mirror always forms an **erect and diminished image**, though its size changes slightly with distance.

6. Two parallel rays fall on a concave mirror. Predict what will happen to them after reflection and explain why.
Answer:
- The reflected rays will **come closer together or converge**.
- The curved reflecting surface of a concave mirror causes parallel rays to converge while still obeying the laws of reflection.

7. A ray of light strikes a plane mirror along the normal. Predict the path of the reflected ray and give a reason.
Answer:
- The reflected ray will **travel back along the same path** as the incident ray.
- The angle of incidence is 0°, so according to the law of reflection, the **angle of reflection is also 0°**.

8. A ray of light strikes a mirror at an angle of incidence of 35°. What will be its angle of reflection? Explain your reasoning.
Answer:
- The angle of reflection will be **35°**.
- This follows the law of reflection, which states that the **angle of incidence is equal to the angle of reflection**.

9. In an experiment, the reflected beam disappears when the chart paper is bent but reappears when it is flattened. What can you conclude from this observation?
Answer:
- The observation shows that the incident ray, normal and reflected ray must lie in the **same plane**.
- Bending the paper creates a different plane, so the reflected beam is no longer visible on that portion.

10. Why can a concave mirror burn a piece of paper when it is held facing the Sun?
Answer:
- A concave mirror **converges the Sun's rays and concentrates them at a small bright spot**.
- The concentrated sunlight produces enough heat at that spot to **ignite the paper**.

11. Would a convex mirror be suitable for concentrating sunlight in a solar cooker? Justify your answer.
Answer:
- No, a convex mirror would **not be suitable** because it spreads or diverges the reflected rays.
- A solar cooker needs the Sun's rays to be **concentrated in a small area to produce heat**, so a converging arrangement is required.

12. A student looks at printed words through a water drop and finds that they appear larger. What can the student infer about the water drop?
Answer:

- The curved water drop is behaving like a **simple lens**.
- Its outward-curved surface can make the letters beneath it **appear enlarged**, similar to a magnifying glass.

13. A student needs a lens that will always make an object appear erect and smaller. Which lens should be selected? Why?
Answer:

- The student should select a **concave lens**.
- An object viewed through a concave lens always appears **erect and diminished in size**.

14. A convex lens is moved gradually away from a small object. Predict how the appearance of the object may change.
Answer:

- At a small distance, the object appears **erect and enlarged** through the convex lens.
- As the distance increases, the image becomes **inverted and eventually diminishes in size**.

15. A student passes parallel beams of light through a flat glass plate and a convex lens. How will the results differ?
Answer:

- The parallel light beams pass through the **thin glass plate essentially as they are**.
- The convex lens changes their paths so that the beams **converge towards one another**.

16. You are given a convex lens and a concave lens without labels. How can you distinguish between them by observing a distant object?
Answer:

- The lens through which the distant object can appear **inverted** is the convex lens.
- The lens through which the object remains **erect and diminished** is the concave lens.

17. A driver wants a mirror at a sharp road bend to see vehicles approaching from the other side. Which mirror would you recommend and why?
Answer:

- A **convex mirror** should be installed at the bend.
- It provides a **wider area of visibility**, helping drivers on both sides notice approaching vehicles and avoid collisions.

18. A plane mirror and a convex mirror are placed side by side. How can you identify them without touching them?
Answer:

- Observe your image: the plane mirror will produce an **erect image of the same size** as you.
- The convex mirror will produce an **erect but diminished image**, making it easy to distinguish the two.

19. Both a concave mirror and a convex lens can concentrate sunlight. What common property do they show?
Answer:

- Both cause parallel rays of light to **converge towards a small region**.
- Therefore, both can concentrate sunlight sufficiently to **produce considerable heat** at the concentrated spot.

20. A student says, "Since a convex mirror is curved, it may sometimes form an enlarged image." Is the statement correct? Justify.
Answer:
- No, the statement is **incorrect**.
- A convex mirror always produces an **erect and diminished image**, irrespective of the object's distance from the mirror.

21. Why can the laws of reflection still apply to a curved mirror even though parallel rays may not remain parallel after reflection?
Answer:
- Each individual ray falling on the curved surface **obeys the laws of reflection** at its point of incidence.
- Since different points on the curved surface have different orientations, the reflected rays may **converge or diverge**.

22. A student wants to read very small letters in a book. Should the student use a convex lens or a concave lens? Explain.
Answer:
- The student should use a **convex lens** as a magnifying glass.
- When kept at a suitable small distance from the text, it makes the letters appear **erect and enlarged**.

23. Why would replacing a vehicle's convex side-view mirror with a plane mirror reduce the driver's ability to observe traffic?
Answer:
- A plane mirror would show a **smaller area of the road behind** compared with a convex mirror.
- A convex mirror provides a much **wider field of view**, which helps the driver observe more surrounding traffic.

24. A student claims that concave mirrors and concave lenses must behave similarly because both are called "concave." Do you agree? Give reasons.
Answer:
- No. A **concave mirror converges** parallel light rays after reflection, whereas a **concave lens diverges** light passing through it.
- Therefore, their effects on parallel beams are **opposite despite both being called concave**.

25. A convex lens is placed in sunlight and a sharp bright spot is obtained on a sheet of paper. Why does moving the paper away from this position reduce the heating effect?
Answer:
- At the sharp bright spot, the convex lens has **concentrated the sunlight into a small area**, producing greater heating.
- Moving the paper away spreads the light over a larger area, so the **heat is less concentrated**.

These questions cover the chapter's main HOTS areas: **application of mirrors and lenses, prediction of image changes, laws of reflection, convergence/divergence, identification of optical devices, and real-life problem solving**.

10.9. Three-mark questions with Answers of LOTS Type: (20 Questions)

The following are **LOTS (Lower Order Thinking Skills)** questions based directly on the Grade 8 chapter 10. They focus mainly on **remembering, understanding, describing, identifying, and explaining basic concepts** of mirrors, reflection, and lenses.

1. What are spherical mirrors? Name their two types and describe their reflecting surfaces.
Answer:
1. Mirrors whose reflecting surfaces are spherical are called **spherical mirrors**.
2. A **concave mirror** has a reflecting surface that curves inwards.
3. A **convex mirror** has a reflecting surface that curves outwards.

2. Describe the images formed by a concave mirror when an object is moved away from it.
Answer:
1. When the object is close to a concave mirror, its image is **erect and enlarged**.
2. When the object is moved farther away, the image becomes **inverted**.
3. The inverted image is initially enlarged and then **keeps getting smaller** as the object is moved farther away.

3. State three characteristics of the image formed by a convex mirror.
Answer:
1. The image formed by a convex mirror is always **erect**.
2. The image is always **smaller or diminished** compared with the object.
3. The size of the image decreases slightly as the object is **moved farther away** from the mirror.

4. Mention any three uses of concave mirrors.
Answer:
1. Concave mirrors are used as **reflectors in torches**.
2. They are used as reflectors in the **headlights of cars and scooters**.
3. Dentists use concave mirrors to obtain an **enlarged view of teeth** when the mirror is held close to them.

5. Mention three uses of convex mirrors.
Answer:
1. Convex mirrors are used as **side-view mirrors in vehicles**.
2. They are installed at **road intersections and sharp bends** to improve visibility and prevent collisions.
3. They are used as **surveillance mirrors in large stores** to monitor a wider area.

6. Define incident ray, reflected ray and normal.
Answer:
1. The ray of light that falls on a mirror is called the **incident ray**.
2. The ray of light that comes back from the mirror after reflection is called the **reflected ray**.
3. The **normal** is a line drawn at 90° to the reflecting surface at the point where the incident ray strikes the mirror.

7. What are the angle of incidence and angle of reflection? State their relationship.
Answer:
1. The angle between the **normal and the incident ray** is called the angle of incidence.
2. The angle between the **normal and the reflected ray** is called the angle of reflection.
3. According to the law of reflection, the **angle of incidence is equal to the angle of reflection**.

8. State the two laws of reflection and mention where they are applicable.
Answer:
1. The **angle of incidence is equal to the angle of reflection**.
2. The incident ray, normal at the point of incidence and reflected ray **all lie in the same plane**.
3. These laws are applicable to **plane, concave and convex mirrors**.

9. Describe what happens when parallel beams of light fall on plane, concave and convex mirrors.
Answer:
1. A **plane mirror** reflects parallel beams of light as parallel beams.
2. A **concave mirror** makes the reflected beams come closer together or **converge**.
3. A **convex mirror** makes the reflected beams spread apart or **diverge**.

10. Describe how a concave mirror can concentrate sunlight on a sheet of paper.
Answer:
1. A concave mirror is held with its **reflecting surface facing the Sun**.
2. The distance of the paper is adjusted until a **sharp bright spot** is obtained on it.
3. The sunlight gets concentrated at this spot and produces sufficient **heat to ignite the paper**.

11. What is a lens? Name its two types and state what material is generally used to make lenses.
Answer:
1. A lens is a piece of **transparent material having curved surfaces**.
2. Lenses are usually made of **glass or plastic**.
3. The two main types of lenses are **convex lens and concave lens**.

12. Differentiate between a convex lens and a concave lens based on their shape and effect on light.
Answer:
1. A convex lens is **thicker at the middle than at the edges**, whereas a concave lens is thicker at the edges than at the middle.
2. A convex lens causes parallel light beams to **converge** and is therefore called a converging lens.
3. A concave lens causes parallel light beams to **diverge** and is therefore called a diverging lens.

13. Describe the image formed by a convex lens as the distance of the object from the lens increases.
Answer:
1. When an object is placed close to a convex lens, it appears **erect and enlarged**.
2. As the distance between the object and lens increases, the image becomes **inverted**.
3. The image is initially enlarged and later becomes **diminished in size** as the distance increases further.

14. State three characteristics of the image seen through a concave lens.
Answer:
1. The image seen through a concave lens is always **erect**.
2. It is always **diminished or smaller than the object**.
3. Its size changes as the **distance between the object and lens increases**.

15. Mention any three devices or places where lenses are used.
Answer:
1. Lenses are used in **eyeglasses** to help people see clearly.
2. They are used in **cameras, telescopes and microscopes**.
3. The **human eye also contains a convex lens**, which can change its shape to help us see nearby and distant objects.

16. Explain how a water drop can act like a simple lens.
Answer:
1. A water drop placed on a suitable surface develops a **curved outward surface**.
2. When printed text is viewed through the drop, the letters may appear **larger than the surrounding letters**.

3. Thus, the curved water drop behaves like a **simple lens**, similar to a magnifying glass.

17. What are solar concentrators? Mention two uses of concentrated sunlight.

Answer:

1. Devices that use mirrors or lenses to **concentrate sunlight into a small area** are called solar concentrators.
2. Concentrated sunlight can heat a liquid to produce **steam for generating electricity**.
3. It can also provide heat for **large-scale cooking and solar furnaces**, including furnaces used for melting steel.

18. Describe the difference between a plane mirror, concave mirror and convex mirror in terms of image formation.

Answer:

1. A **plane mirror** always forms an erect image of the same size as the object.
2. A **concave mirror** can form enlarged or diminished and erect or inverted images depending on the object's distance.
3. A **convex mirror** always forms an erect and diminished image.

19. What happens when light falls along the normal to a mirror?

Answer:

1. When light falls along the normal, the **angle of incidence is 0°**.
2. According to the law of reflection, the **angle of reflection is also 0°**.
3. Therefore, the reflected light travels back **along the same path as the incident light**.

20. Describe the behaviour of light through a thin glass plate, convex lens and concave lens.

Answer:

1. A parallel beam of light passes through a **thin glass plate essentially as it is**.
2. A **convex lens converges** the light falling on it.
3. A **concave lens diverges** the light falling on it.

10.10. Three-mark questions with Answers of HOTS Type: (18 Questions)

The following **HOTS (Higher Order Thinking Skills)** questions require students to **apply, analyse, compare, predict, justify, and infer** using concepts from the chapter 10.

1. A dentist wants to examine a patient's tooth closely. Which type of mirror should be used? Justify your answer.

Answer:

1. The dentist should use a **concave mirror**.
2. When an object such as a tooth is held close to a concave mirror, it forms an **erect and enlarged image**.
3. Therefore, the dentist can observe the tooth more clearly and examine its small details.

2. Why are convex mirrors preferred over plane mirrors as side-view mirrors in vehicles?

Answer:

1. A convex mirror always forms an **erect and diminished image** of the traffic behind the vehicle.
2. Its outward-curved surface provides a **much wider view of the road** than a plane mirror.
3. Therefore, the driver can observe a larger area behind the vehicle, making driving safer.

3. A shopkeeper wants to monitor a large area of a store using only one mirror. Which mirror would you recommend and why?

Answer:
1. A **convex mirror** would be the most suitable choice.
2. It provides a **wide field of view** and forms erect, diminished images of objects.
3. Therefore, the shopkeeper can monitor a large portion of the store with a single mirror and help deter theft.

4. A student places an object close to a concave mirror and then slowly moves it away. Predict the changes the student will observe in the image.
Answer:
1. When the object is close to the mirror, its image will be **erect and enlarged**.
2. As the object is moved farther away, the image becomes **inverted and is initially enlarged**.
3. On moving the object still farther, the inverted image **keeps decreasing in size**.

5. Two mirrors are kept on a table. Mirror A always forms an erect and diminished image, while Mirror B forms an erect enlarged image when the object is close to it. Identify the mirrors and justify your answer.
Answer:
1. Mirror A is a **convex mirror** because a convex mirror always produces an erect and diminished image.
2. Mirror B is a **concave mirror** because it produces an erect and enlarged image when the object is placed close to it.
3. Thus, the mirrors can be identified by analysing the **size and orientation of the images** they form.

6. A ray of light strikes a plane mirror at an angle of incidence of 35°. Predict the angle of reflection. What happens if the incident ray travels along the normal?
Answer:
1. The angle of reflection will be **35°**, because the angle of reflection is equal to the angle of incidence.
2. If the incident ray travels along the normal, its angle of incidence becomes **0°**.
3. Hence, the angle of reflection will also be **0°**, and the reflected ray will travel back along the same path.

7. Parallel beams of light are directed separately at a plane mirror, concave mirror, and convex mirror. Predict how the reflected beams will behave.
Answer:
1. The plane mirror will reflect the parallel beams so that they **remain parallel**.
2. The concave mirror will make the reflected beams come closer together or **converge**.
3. The convex mirror will cause the reflected beams to spread apart or **diverge**.

8. A student wants to concentrate sunlight onto a small area to produce heat. Should the student choose a concave or convex mirror? Explain.
Answer:
1. The student should choose a **concave mirror** because it converges parallel beams of light.
2. Sunlight reflected by the concave mirror can be concentrated into a **small bright spot**.
3. The concentrated sunlight produces sufficient heat and can even **ignite a piece of paper**.

9. A student observes that the reflected beam disappears when the chart paper used in a reflection experiment is bent. What can the student infer from this observation?
Answer:
1. Bending the paper creates a **different plane**, so the reflected beam is no longer visible on the bent portion.

2. When the paper is flattened again, the reflected beam reappears because the original alignment is restored.
3. This proves that the **incident ray, normal, and reflected ray all lie in the same plane**.

10. You are given a convex lens, a concave lens, and a thin transparent glass plate. How can you identify each by passing parallel beams of light through them?

Answer:

1. The thin glass plate allows the parallel beams to **pass through essentially as they are**.
2. The convex lens makes the beams **converge**, so it can be identified as the converging lens.
3. The concave lens makes the beams **diverge**, so it can be identified as the diverging lens.

11. A child sees enlarged letters through a water drop placed on a transparent sheet. Explain why the letters appear larger.

Answer:

1. The surface of the water drop is **curved outwards**, rather than flat.
2. The curved water drop behaves like a **simple lens** and changes the apparent size of the letters beneath it.
3. Therefore, the letters viewed through the water drop may appear **larger than the nearby letters**.

12. A student wants to read very small print using a lens. Which lens should be selected and how should it be used?

Answer:

1. The student should select a **convex lens**, such as the one used in a magnifying glass.
2. The small print should be kept at a **small distance behind the convex lens**.
3. At a suitable small distance, the letters appear **erect and enlarged**, making them easier to read.

13. A student looks at the same object through two lenses. Lens A always produces an erect and diminished view, while Lens B can produce an enlarged or inverted view. Identify the lenses.

Answer:

1. Lens A is a **concave lens** because it always makes an object appear erect and diminished.
2. Lens B is a **convex lens** because the image produced by it changes with the object's distance and may be enlarged or inverted.
3. Therefore, the nature of the image can be used to **distinguish a concave lens from a convex lens**.

14. A convex lens and a concave mirror can both make a piece of paper hot when sunlight is used. What common property makes this possible?

Answer:

1. Both a **convex lens and a concave mirror converge light**.
2. They can concentrate the Sun's rays into a **small area**, increasing the heat at that point.
3. Therefore, when sunlight is sufficiently concentrated, the paper may become hot enough to **burn**.

15. Why would a convex mirror be more useful than a concave mirror at a sharp road bend?

Answer:

1. A convex mirror provides a **much wider area of visibility** because its reflecting surface curves outwards.
2. It always forms **erect and diminished images**, allowing drivers to see more vehicles or objects at once.
3. Therefore, placing convex mirrors at sharp bends helps drivers see traffic approaching from the other side and **prevent collisions**.

16. A student claims that the laws of reflection apply only to plane mirrors because curved mirrors change the direction of parallel rays. Is the student correct? Justify.
Answer:
1. The student is **not correct**, because the laws of reflection apply to plane, concave, and convex mirrors.
2. Every individual ray striking a spherical mirror still follows the **laws of reflection**.
3. The curved surfaces cause different reflected rays to **converge or diverge**, even though each ray obeys the laws of reflection.

17. A solar cooker has to concentrate maximum sunlight to produce heat. What optical arrangement would you suggest and why?
Answer:
1. A **concave reflecting surface** can be used to collect and converge sunlight.
2. The reflected sunlight should be directed towards a **small region where the cooking vessel is placed**.
3. Concentrating sunlight in this way produces greater heat and can reduce the need for **electricity or fossil fuels**.

18. A student says, "A convex mirror and a concave lens are similar because both make objects look smaller." Evaluate this statement.
Answer:
1. The statement is **partly correct**, because both a convex mirror and a concave lens produce an erect and diminished image/view of an object.
2. However, a convex mirror **reflects light and causes reflected parallel beams to diverge**, while a concave lens allows light to pass through and diverges it.
3. Therefore, their effect on image size is similar, but their **structure and way of interacting with light are different**.

10.11 Five-mark questions with Answers of LOTS Type: (10 Questions)

1. What are spherical mirrors? Explain the two types of spherical mirrors.
Answer:
1. Spherical mirrors are curved mirrors whose reflecting surfaces are shaped like a part of a hollow sphere.
2. The two types of spherical mirrors are **concave mirrors** and **convex mirrors**.
3. A concave mirror has a reflecting surface that curves **inwards**.
4. A convex mirror has a reflecting surface that curves **outwards**.
5. Concave and convex mirrors form images of different sizes and orientations depending on their type and the position of the object.

2. Describe the characteristics of images formed by concave and convex mirrors.
Answer:
1. When an object is placed close to a concave mirror, its image is **erect and enlarged**.
2. When the object is moved farther from the concave mirror, the image becomes **inverted**.
3. The inverted image is initially enlarged and then becomes smaller as the object is moved farther away.

4. A convex mirror always forms an image that is **erect and diminished**.
5. The image in a convex mirror becomes slightly smaller as the object is moved farther away.

3. Explain five uses of concave and convex mirrors in everyday life.
Answer:
1. Concave mirrors are used as **reflectors in torches** to direct light effectively.
2. They are also used in the **headlights of cars and scooters**.
3. Dentists use concave mirrors because they provide an **enlarged view of teeth** when held close to them.
4. Convex mirrors are used as **side-view mirrors in vehicles** because they provide a wider view of the road behind.
5. Convex mirrors are also used at **road bends and in large stores** for road safety and surveillance.

4. State and explain the two laws of reflection.
Answer:
1. The ray of light falling on a mirror is called the **incident ray**, while the ray returning from it is called the **reflected ray**.
2. The angle between the incident ray and the normal is called the **angle of incidence**.
3. The angle between the reflected ray and the normal is called the **angle of reflection**.
4. The first law of reflection states that the **angle of incidence is equal to the angle of reflection**.
5. The second law states that the **incident ray, normal at the point of incidence, and reflected ray all lie in the same plane**.

5. Describe how plane, concave, and convex mirrors behave when parallel beams of light fall on them.
Answer:
1. When parallel beams of light fall on a **plane mirror**, the reflected beams remain parallel.
2. When parallel beams fall on a **concave mirror**, the reflected beams come closer together.
3. This coming together of light beams is called **convergence**.
4. When parallel beams fall on a **convex mirror**, the reflected beams spread apart or **diverge**.
5. Thus, a concave mirror is converging in nature, whereas a convex mirror is diverging in nature.

6. What is a lens? Describe convex and concave lenses.
Answer:
1. A lens is a piece of **transparent material**, usually made of glass or plastic, having curved surfaces.
2. Lenses allow light to pass through them, and objects are viewed **through a lens**.
3. A **convex lens** is thicker at the middle than at its edges.
4. A **concave lens** is thicker at the edges than at the middle.
5. A convex lens converges light, whereas a concave lens diverges light.

7. Describe the characteristics of images seen through convex and concave lenses.
Answer:
1. When an object is placed at a small distance behind a convex lens, it appears **erect and enlarged**.
2. As the distance between the object and convex lens increases, the object appears **inverted**.

3. The inverted image is initially enlarged and then becomes diminished as the distance increases further.
4. An object viewed through a concave lens always appears **erect and diminished**.
5. Thus, the image formed by a convex lens varies with distance, while a concave lens always gives an erect and diminished view.

8. Explain the difference between the action of a convex lens and a concave lens on parallel beams of light.

Answer:

1. A convex lens and a concave lens affect parallel beams of light differently.
2. A **convex lens brings parallel light beams closer together** after they pass through it.
3. Therefore, a convex lens is also called a **converging lens**.
4. A **concave lens spreads parallel light beams apart** after they pass through it.
5. Therefore, a concave lens is also called a **diverging lens**.

9. Explain how a concave mirror can concentrate sunlight and produce heat.

Answer:

1. A concave mirror is held with its reflecting surface facing the Sun.
2. Sunlight falling on the mirror is reflected and **converged towards a small area**.
3. By adjusting the distance of a sheet of paper, a **sharp bright spot** can be obtained on it.
4. The concentrated sunlight produces a large amount of **heat at the bright spot**.
5. If the paper is kept there for some time, the heat may become sufficient to ignite the paper.

10. Write five points about the uses and importance of lenses.

Answer:

1. Lenses are used in **eyeglasses** to help people see clearly.
2. They are used in **cameras**, including smartphone cameras, to form images.
3. **Telescopes** use lenses for observing distant objects.
4. **Microscopes** use lenses for viewing very small objects.
5. The human eye itself contains a **convex lens that can change its shape**, allowing us to see both nearby and distant objects.

10.12 Five-mark questions with Answers of HOTS Type: (10 Questions)

1. A driver wants to replace the convex side-view mirror of a car with a plane mirror. Do you think this is a good idea? Justify your answer.

Answer:

1. No, replacing the convex mirror with a plane mirror would not be a good idea.
2. A convex mirror provides a **much wider view of the road behind** than a plane mirror.
3. It always forms an **erect and diminished image**, allowing the driver to see a larger area of traffic at once.
4. A plane mirror would show a smaller field of view and therefore provide less information about vehicles approaching from behind.
5. Hence, a convex mirror is safer and more suitable as a side-view mirror, although the diminished images make vehicles appear farther away than they actually are.

2. A dentist has a plane mirror, a concave mirror, and a convex mirror. Which one should the dentist choose to examine a patient's tooth closely? Give reasons.

Answer:

1. The dentist should choose a **concave mirror**.
2. When an object is placed close to a concave mirror, it forms an **erect and enlarged image**.

3. A tooth held close to such a mirror therefore appears larger, making its details easier to examine.
4. A plane mirror would give an image of the same size, while a convex mirror would produce a diminished image.
5. Therefore, a concave mirror is the most suitable of the three mirrors for closely examining teeth.

3. A student observes an erect and enlarged image in a mirror. When she moves farther away, her image becomes inverted. Identify the mirror and explain your reasoning.

Answer:

1. The mirror must be a **concave mirror**.
2. When an object is close to a concave mirror, its image is erect and enlarged.
3. As the object is moved farther away, the image formed by the concave mirror becomes inverted.
4. Initially, the inverted image may be enlarged, but it becomes smaller as the object is moved farther away.
5. Neither a plane mirror nor a convex mirror shows this combination of changes, so the observations identify it as a concave mirror.

4. Three parallel beams of light are directed separately at a plane mirror, a concave mirror, and a convex mirror. Predict what will happen to the reflected beams and explain why.

Answer:

1. The beams reflected from the **plane mirror will remain parallel**.
2. The beams reflected from the **concave mirror will come closer together or converge**.
3. The beams reflected from the **convex mirror will spread apart or diverge**.
4. Each individual ray still obeys the laws of reflection in all three mirrors.
5. However, the curved surfaces of spherical mirrors cause parallel rays to converge in a concave mirror and diverge in a convex mirror.

5. A student wants to read very small letters in a book. She has a convex lens and a concave lens. Which lens should she use? Explain how she should use it.

Answer:

1. The student should use the **convex lens**.
2. She should keep the small printed letters at a suitable small distance from the convex lens.
3. At a small distance, the letters viewed through the convex lens appear **erect and enlarged**.
4. A concave lens would not be suitable because it always makes the object appear **erect but diminished**.
5. Therefore, a convex lens works as a magnifying glass and makes small print easier to read.

6. A student moves an object gradually away from a convex lens. Predict the changes she will observe in the image.

Answer:

1. When the object is kept at a small distance from the convex lens, it appears **erect and enlarged**.
2. As the distance between the object and lens increases, the appearance of the image changes.
3. At a greater distance, the object appears **inverted** through the lens.
4. The inverted image is initially enlarged and then becomes smaller as the distance increases further.

5. Thus, unlike a concave lens, the characteristics of the image seen through a convex lens depend strongly on the distance of the object from the lens.

7. A student directs sunlight onto a sheet of paper using a concave mirror and observes a very bright spot. After some time, the paper begins to burn. Explain why.

Answer:

1. Sunlight reaching the concave mirror is reflected from its curved surface.
2. A concave mirror causes the light rays to **converge or come closer together**.
3. By adjusting the position of the paper, the reflected sunlight can be concentrated into a small bright spot.
4. Concentrating a large amount of sunlight in a small area produces sufficient heat to ignite the paper.
5. The same principle is applied in **solar concentrators and solar furnaces** to produce useful heat.

8. A shop owner wants to monitor the maximum possible area of a large store using a single mirror. Which type of mirror should be installed? Analyse the reasons for your choice.

Answer:

1. The shop owner should install a **convex mirror**.
2. A convex mirror provides a much **wider viewing area** than a plane mirror.
3. It always forms erect and diminished images of objects.
4. Because the images are diminished, a larger number of objects and people can be seen within the mirror's field of view.
5. Therefore, convex mirrors are suitable for surveillance in large stores and can help in monitoring the area and deterring theft.

9. A ray of light strikes a plane mirror at an angle of incidence of 40°. Predict the angle of reflection. What happens if the ray is made to fall along the normal?

Answer:

1. According to the law of reflection, the **angle of incidence is equal to the angle of reflection**.
2. Therefore, when the angle of incidence is 40°, the angle of reflection will also be **40°**.
3. If the incident ray is made to fall along the normal, the angle of incidence becomes **0°**.
4. The angle of reflection will consequently also be **0°**.
5. Hence, in this case the reflected ray travels back along the same path as the incident ray.

10. Both a concave mirror and a convex lens can concentrate sunlight on a small area. Compare their working and explain the similarity and difference between them.

Answer:

1. Both a concave mirror and a convex lens can **converge light rays**.
2. A concave mirror converges sunlight by **reflecting** the light from its curved reflecting surface.
3. A convex lens converges sunlight when light **passes through** the transparent lens.
4. In both cases, concentrated sunlight can produce enough heat at a small area to burn paper.
5. Thus, their common effect is convergence of light, but the concave mirror works through reflection whereas the convex lens allows light to pass through it.

10.13 Five-mark questions with Answers of Applied Type: (10 Questions)

1. Why are convex mirrors used as side-view mirrors in vehicles? Explain their advantages.

Answer:

1. Convex mirrors always form an **erect and diminished image** of the vehicles behind.
2. Since the images are diminished, the mirror can show a **larger area of the road**.
3. This enables the driver to observe several vehicles behind at the same time.
4. A wider field of view helps the driver while **turning, changing lanes and overtaking**.
5. Hence, convex mirrors are used as side-view mirrors to improve visibility and road safety.

2. A dentist needs to examine a patient's tooth closely. Which type of mirror should be used and why?

Answer:

1. A dentist uses a **concave mirror** for examining teeth.
2. When a tooth is held close to a concave mirror, its image appears **erect and enlarged**.
3. The enlarged image allows the dentist to observe the tooth more clearly.
4. Small details of the tooth that are difficult to see directly become easier to inspect.
5. Therefore, the image-forming property of a concave mirror makes it useful as a dental mirror.

3. Convex mirrors are installed at sharp bends and road intersections. Explain how they help prevent accidents.

Answer:

1. At a sharp bend, drivers may not be able to see vehicles approaching from the other side.
2. A convex mirror provides a **much wider viewing area** than a plane mirror.
3. It forms erect and diminished images of approaching vehicles.
4. Drivers on both sides can therefore see traffic that would otherwise be hidden from their direct view.
5. Thus, convex mirrors improve visibility at blind turns and help in preventing collisions.

4. Explain how a concave mirror can be used to concentrate sunlight and mention its practical applications.

Answer:

1. A concave mirror causes parallel rays of light falling on it to **converge** after reflection.
2. When sunlight falls on it, the reflected sunlight can be concentrated into a small bright area.
3. The concentration of sunlight produces a large amount of **heat** in that area.
4. This principle is used in devices called **solar concentrators** for heating liquids and producing steam.
5. Such concentrated solar energy can be used for generating electricity, large-scale cooking and even in solar furnaces.

5. A person finds it difficult to read very small letters. How can a magnifying glass help? Explain the principle involved.

Answer:

1. A magnifying glass contains a **convex lens**.
2. A convex lens is thicker at the middle than at its edges.
3. When small letters are placed at a suitable small distance from it, they appear **erect and enlarged**.
4. The enlarged appearance makes small print easier for the person to observe and read.
5. Therefore, convex lenses are commonly used as magnifying glasses for viewing small objects or letters.

6. Why are convex mirrors installed in large shops and supermarkets? Explain their usefulness.

Answer:

1. Large shops need to monitor a wide area from a limited number of locations.
2. A convex mirror provides a **wider field of view** because of its outward-curved reflecting surface.
3. It produces erect but diminished images of people and objects.
4. Therefore, a large portion of the shop can be observed through a single mirror.
5. For this reason, convex mirrors are used as **surveillance mirrors to monitor large areas and deter theft**.

7. Explain why concave mirrors are used as reflectors in torches and vehicle headlights.

Answer:

1. The reflectors used in torches and the headlights of cars and scooters are **concave in shape**.
2. A concave mirror has a reflecting surface that curves inward.
3. It has the property of **converging reflected light rays**, depending on how the light falls on it.
4. This ability to control the direction of reflected light makes a concave mirror useful as a reflector in lighting devices.
5. Therefore, concave mirrors are commonly used in torches and vehicle headlights.

8. A student has a convex lens and a concave lens. How can the student identify them by observing an object through each lens?

Answer:

1. The student should place an object at a small distance behind each lens and observe it from the other side.
2. Through a **convex lens**, a nearby object appears erect and enlarged.
3. If the object is moved farther away from the convex lens, its image can become inverted.
4. Through a **concave lens**, the object always appears erect and diminished.
5. Hence, the different appearance of the object can be used to distinguish a convex lens from a concave lens.

9. How are lenses useful in devices that we use in our daily life? Give suitable examples.

Answer:

1. Lenses are used in **eyeglasses** to help people see clearly.
2. Cameras, including smartphone cameras, use lenses for their functioning.
3. **Microscopes** use lenses to help us observe very small objects.
4. **Telescopes** also use lenses for observing distant objects.
5. Even the human eye contains a **convex lens that can change its shape**, allowing us to see both nearby and distant objects.

10. A village wants to reduce the use of electricity and fossil fuels for large-scale cooking. How can the concepts of this chapter be applied to solve the problem?

Answer:

1. The village can use a **solar cooker or solar concentrator** to utilise energy from sunlight.
2. Mirrors can be arranged to **converge sunlight** onto a small area.
3. Concentrated sunlight produces heat that can be used for cooking.
4. Such devices make use of renewable solar energy and can reduce dependence on electricity and fossil fuels.
5. The chapter specifically highlights the use of such solar designs in Indian villages as an application for saving energy.

10.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

Olympiad-Type Multiple Choice Questions:

1. Riya looks at her face using the inner polished surface of a steel spoon. Her face appears enlarged when the spoon is very close to her. Which conclusion is most appropriate?
A. The inner surface behaves like a convex mirror.
B. The inner surface behaves like a concave mirror.
C. The inner surface behaves like a plane mirror.
D. The spoon does not obey the laws of reflection.
Answer: B. The inner surface behaves like a concave mirror.
A concave mirror can produce an erect and enlarged image when the object is close to it.

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2. Four students make the following statements about a convex mirror:
P: It always forms an erect image.
Q: It always forms a diminished image.
R: It can form an inverted image if the object is sufficiently far away.
S: It provides a wider view than a plane mirror.
Which statements are correct?
A. P and Q only
B. P, Q and S only
C. Q, R and S only
D. P, Q, R and S
Answer: B. P, Q and S only.

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3. A driver wants a mirror that shows the maximum possible area of the road behind while keeping the images erect. Which mirror should be selected?
A. Plane mirror
B. Concave mirror
C. Convex mirror
D. Either plane or concave mirror
Answer: C. Convex mirror.
Its outward-curved surface provides a wider view, while the images remain erect and diminished.

---

4. A ray of light makes an angle of **35° with the normal** to a plane mirror. What angle does the reflected ray make with the mirror surface?
A. 35°
B. 45°
C. 55°
D. 70°
Answer: C. 55°.
The angle of reflection is 35° with the normal. Therefore, with the mirror surface it is $90° - 35° = 55°$. The chapter establishes that angle of incidence equals angle of reflection.

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5. A light ray strikes a mirror **along the normal**. Which statement is correct?
A. It is reflected at 90° to the normal.
B. Its angle of incidence is 45°.
C. It returns along the same path.
D. No reflection occurs.
Answer: C. It returns along the same path.
Both the angle of incidence and angle of reflection are 0°.

---

6. In an experiment, the angle between an incident ray and the reflected ray is **80°**. What is the angle of incidence?
A. 20°
B. 40°
C. 80°
D. 160°
Answer: B. 40°.
Since $i = r$, the angle between the two rays is $i + r = 2i$. Therefore, $2i = 80°$, giving $i = 40°$.

---

7. Three parallel beams of light are directed separately towards a plane mirror, a concave mirror and a convex mirror. Which sequence correctly describes the reflected beams?
A. Converge – parallel – diverge
B. Parallel – converge – diverge
C. Parallel – diverge – converge
D. Diverge – converge – parallel
Answer: B. Parallel – converge – diverge.

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8. A dentist wants to see an enlarged, upright view of a patient's tooth. Which arrangement is most suitable?
A. Convex mirror with tooth close to it
B. Plane mirror with tooth far from it
C. Concave mirror with tooth close to it
D. Concave lens with tooth close to it
Answer: C. Concave mirror with tooth close to it.

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9. A shopkeeper wants to monitor the largest possible area of a supermarket using a single mirror. Which property is most useful for this purpose?
A. A concave mirror magnifies nearby objects.
B. A convex mirror provides a wide field of view.
C. A plane mirror forms same-sized images.
D. A concave mirror converges sunlight.
Answer: B. A convex mirror provides a wide field of view.

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10. A student places an object close to a concave mirror and then slowly moves it farther away. Which sequence best describes the image according to the chapter?
A. Erect and diminished → erect and enlarged
B. Erect and enlarged → inverted and initially enlarged → progressively smaller
C. Inverted and diminished → erect and enlarged
D. Always erect and enlarged
Answer: B. Erect and enlarged → inverted and initially enlarged → progressively smaller.

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11. Which pair has the **same effect on a parallel beam of light**, even though one works by reflection and the other allows light to pass through?
A. Convex mirror and convex lens
B. Concave mirror and concave lens
C. Concave mirror and convex lens
D. Plane mirror and convex lens
Answer: C. Concave mirror and convex lens.
Both converge light beams.

12. Which pair causes parallel light rays to **diverge**?
A. Concave mirror and convex lens
B. Convex mirror and concave lens
C. Concave mirror and concave lens
D. Convex mirror and convex lens
Answer: B. Convex mirror and concave lens.

13. A student observes an object through an unknown lens. No matter how the distance is changed, the image remains erect and diminished. The unknown lens is most likely a:
A. convex lens
B. concave lens
C. flat glass plate
D. magnifying glass
Answer: B. Concave lens.

14. Which observation most clearly distinguishes a convex lens from a concave lens?
A. Both are transparent.
B. Both allow light to pass through them.
C. A convex lens can make a nearby object appear enlarged, while a concave lens makes it appear diminished.
D. Both can be made of glass.
Answer: C.

15. A convex lens is called a **converging lens** because:
A. it reflects parallel rays back along the same path.
B. it causes parallel light rays passing through it to come closer together.
C. it always produces an enlarged image.
D. it prevents light from passing through it.
Answer: B.

16. Consider the following:
I. Concave mirror
II. Convex mirror
III. Convex lens
IV. Concave lens
Which of these can converge a parallel beam of light?
A. I and II
B. II and III
C. I and III
D. III and IV
Answer: C. I and III.

17. A student obtains a tiny, very bright spot of sunlight on a piece of paper using an optical device. Which of the following could have been used?
A. Only a convex mirror
B. Only a concave lens
C. A concave mirror or a convex lens
D. A convex mirror or a concave lens

Answer: C. A concave mirror or a convex lens.
Both can concentrate sunlight by converging light.

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18. Why can concentrating sunlight using a concave mirror cause paper to burn?
A. The mirror chemically reacts with the paper.
B. Light gets concentrated in a small area, producing sufficient heat.
C. The mirror itself becomes a source of fire.
D. The paper reflects all the sunlight.
Answer: B.

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19. In an experiment, the incident ray, normal and reflected ray are initially drawn on a flat sheet. The part of the sheet carrying the reflected ray is then bent out of the original plane. The reflected beam is no longer seen along that portion. What does this demonstrate?
A. Light does not travel in straight lines.
B. Angle of incidence is always 90°.
C. The incident ray, normal and reflected ray lie in the same plane.
D. Reflection occurs only from plane mirrors.
Answer: C.

---

20. Which statement regarding the laws of reflection is **incorrect**?
A. Angle of incidence equals angle of reflection.
B. Incident ray, normal and reflected ray lie in the same plane.
C. The laws apply only to plane mirrors.
D. The laws also apply to spherical mirrors.
Answer: C. The laws apply only to plane mirrors.
The laws are valid for plane, concave and convex mirrors.

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21. A transparent optical object is **thicker at its centre than at its edges**. When parallel light falls on it, the rays move closer together after passing through it. Identify the object.
A. Concave lens
B. Convex lens
C. Convex mirror
D. Plane mirror
Answer: B. Convex lens.

---

22. Three optical objects P, Q and R behave as follows:

- P: parallel light passes through essentially as it is.
- Q: parallel light converges after passing through.
- R: parallel light diverges after passing through.

P, Q and R respectively are:
A. Convex lens, glass plate, concave lens
B. Glass plate, convex lens, concave lens
C. Glass plate, concave lens, convex lens
D. Concave lens, convex lens, glass plate
Answer: B. Glass plate, convex lens, concave lens.

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23. A child places a drop of water on a transparent sheet and notices that the letters below the drop appear larger. Which conclusion best explains the observation?
A. Water always reflects light like a plane mirror.
B. The curved water drop acts like a simple lens.

C. The water drop behaves like a convex mirror.
D. Water prevents light from passing through it.
Answer: B. The curved water drop acts like a simple lens.

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24. Assertion–Reason Question
Assertion (A): Convex mirrors are installed at sharp road bends.
Reason (R): Convex mirrors provide a wider viewing area and form erect, diminished images.
Choose the correct answer:
A. Both A and R are true, and R correctly explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.
Answer: A. Both A and R are true, and R correctly explains A.
The wider view helps drivers see traffic approaching from the other side of a bend and can help prevent collisions.

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25. Olympiad Challenge Question
Four optical devices are labelled P, Q, R and S.

- **P** always forms an erect, diminished image by reflection.
- **Q** can form an erect enlarged image when an object is close to it and works by reflection.
- **R** always makes an object appear erect and diminished when viewed through it.
- **S** can make a nearby object appear erect and enlarged and converges light.

Which identification is correct?
A. P–Concave mirror; Q–Convex mirror; R–Convex lens; S–Concave lens
B. P–Convex mirror; Q–Concave mirror; R–Concave lens; S–Convex lens
C. P–Plane mirror; Q–Concave mirror; R–Convex lens; S–Convex mirror
D. P–Convex mirror; Q–Plane mirror; R–Concave lens; S–Concave mirror
Answer: B. P–Convex mirror; Q–Concave mirror; R–Concave lens; S–Convex lens.
Answer Key

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.
1	B	6	B	11	C	16	C	21	B
2	B	7	B	12	B	17	C	22	B
3	C	8	C	13	B	18	B	23	B
4	C	9	B	14	C	19	C	24	A
5	C	10	B	15	B	20	C	25	B

10.15 Best Practices Opportunity List from the Chapter: (10 Ideas)

Since Chapter 10, **"Light: Mirrors and Lenses,"** is strongly activity-oriented, the "Best Practices" can go beyond ordinary explanation and emphasize **experiential, inquiry-based, application-oriented and technology-enabled learning**. The chapter itself encourages exploration through curved mirrors, experiments with reflection, lenses, real-life applications, virtual experiments, and even solar-cooker design.

Suggested "Best Practices" Opportunities:

(1) **Learning by Doing – Mini Optics Laboratory:**
Create a classroom **"Light Lab"** where students handle plane, concave and convex mirrors and convex and concave lenses. Students should predict the image first, perform

the activity, record observations, and then explain the result. This directly reinforces the chapter's experimental approach to image formation.

(2) **Mirror and Lens Hunt – Connecting Science with Daily Life:**
Organise a **"Mirror & Lens Hunt"** in which students identify applications around them—vehicle side-view mirrors, dental mirrors, torch reflectors, spectacles, cameras, microscopes, telescopes and surveillance mirrors. Each student/group can explain **why a particular type of mirror or lens is suitable for that application**.

(3) **Predict–Experiment–Explain (PEE) Method:**
Before demonstrating reflection or image formation, ask students to **predict** what will happen when the object or light source is moved. They then **experiment**, compare the observation with their prediction, and finally **explain** the scientific reason. This makes students discover concepts instead of merely memorising them.

(4) **Student-Designed Experiments on Laws of Reflection:**
Let groups construct their own simple setup using a mirror, torch, paper, comb/slit and protractor to verify that **angle of incidence = angle of reflection**. Students can tabulate several readings and discuss experimental errors. The chapter specifically encourages repeated measurements at different angles.

(5) **ICT-Based Virtual Optics Laboratory:**
Use interactive simulations/animations where students can move an object towards or away from different mirrors and lenses and immediately observe changes in **size, orientation, convergence and divergence**. This is especially useful when physical apparatus is limited and is explicitly suggested as an extension activity in the chapter.

(6) **STEM Challenge – Design a Solar Cooker:**
Give groups the challenge: **"Can you design a low-cost solar cooker for our school?"** Students can apply their understanding of converging light, prepare a model/design, estimate materials and cost, and explain the science behind it. The chapter itself proposes designing a solar cooker and preparing a budget.

(7) **Science through Community Exposure:**
Arrange a visit or interaction with a **dentist/ENT specialist, photographer, optician or telescope enthusiast**. Students identify the mirrors/lenses used and interview the professional about their purpose. The chapter specifically recommends observing mirrors used by dentists and ENT specialists.

(8) **Peer Teaching through "Optics Expert Groups":**
Divide students into expert groups—**Concave Mirror, Convex Mirror, Convex Lens, Concave Lens and Laws of Reflection**. Each group conducts a demonstration and teaches its concept to the rest of the class. Afterwards, rotate groups or conduct a peer quiz.

(9) **Olympiad Corner – Higher-Order Thinking Practice:**
At the end of each subtopic, conduct a short **"Olympiad Challenge"** containing diagram-based MCQs, assertion–reason questions, application problems and prediction questions rather than direct definitions. The chapter's own assessment includes matching, diagram interpretation and assertion–reason questions.

(10) **Science Heritage Connection – Optics in Ancient India:**
Integrate **Indian Knowledge Systems (IKS)** by discussing the chapter's example of astronomers during the period of **Bhāskara II**, who used water-filled shallow bowls and reflected images to observe celestial bodies. Students can investigate how principles of light were applied historically and compare these methods with modern optical instruments.

For a school **lesson plan/teacher diary**, the strongest five to record under **"Best Practices"** would be: **Mini Optics Laboratory, Predict–Experiment–Explain, Mirror & Lens Hunt,**

ICT-Based Virtual Optics Lab, and STEM Solar Cooker Challenge. These provide a good balance of hands-on learning, inquiry, real-life application, digital learning and innovation.

10.16 Innovations Opportunity List from the Chapter: (5 Ideas)

For Grade 8 Chapter 10, **"Light: Mirrors and Lenses,"** the following can be recorded under the **"Innovations" opportunity** in the Teaching–Learning process. The chapter is particularly suitable for innovative pedagogy because it combines observation, experimentation, real-life applications, design challenges and virtual experimentation.

Innovations in Teaching–Learning:

(1) **Virtual Optics Lab with Interactive Simulations:**
Introduce a digital/virtual laboratory where students can drag an object towards or away from concave/convex mirrors and lenses and instantly observe changes in **image size, position and orientation**. The textbook itself recommends using online tools and animations for virtual experiments.

(2) **"Optics Detective" – Mystery Mirror/Lens Challenge:**
Give groups an **unlabelled mirror or lens** and ask them to identify whether it is plane, concave, convex, converging or diverging **only through experimentation**. Students must provide evidence for their conclusion based on the image formed or behaviour of light. This converts concept learning into scientific investigation.

(3) **Smartphone-Based Optics Exploration:**
Turn students' familiarity with technology into a learning opportunity. Under teacher supervision, demonstrate how the **smartphone camera uses lenses**, compare it with the human eye, magnifying glass and spectacles, and ask students to create a short digital presentation titled *"Optics Inside My Smartphone."* The chapter explicitly connects lenses with cameras, microscopes, telescopes, eyeglasses and the human eye.

(4) **STEM Innovation Challenge – Build a Solar Cooker:**
Students work in teams as young engineers to **design a low-cost solar cooker** using their understanding of convergence of light. They can prepare a model/prototype, material list, budget and explanation of the underlying science. This directly extends the chapter's "Discover, design, and debate" activity.

(5) **Student-Created 3D Ray Models:**
Instead of limiting ray diagrams to notebooks, students create **3D models of incident rays, normals and reflected rays** using cardboard, mirrors, strings, sticks or laser-safe substitutes. They can physically change the angle of incidence and demonstrate how the reflected ray changes, reinforcing the laws of reflection.

(6) **"Science Reel" / One-Minute Concept Video:**
Groups create a **60–90 second educational video** explaining one concept—concave mirror, convex mirror, convex lens, concave lens, laws of reflection or applications of lenses. The rule can be: *one experiment + one explanation + one real-life application*. This encourages digital creativity as well as conceptual understanding.

(7) **Design Thinking – Road Safety with Convex Mirrors:**
Present a real-life problem: **"There is a blind turn near a school. How can optics make it safer?"** Students propose where a convex mirror should be installed and justify their design scientifically. This directly connects with the textbook's discussion of convex mirrors at road intersections and sharp bends because they provide a wider field of view.

(8) **Student-Generated QR Learning Stations:**

Create different **QR-based learning stations** around the classroom—Mirror Station, Lens Station, Reflection Station, Application Station and Challenge Station. Scanning each QR code can reveal a short video, simulation, puzzle or question. Groups rotate through the stations and maintain an “Optics Investigation Sheet.”

(9) **Low-Cost “Lens from a Water Drop” Innovation:**
Allow students to create a simple lens using a **drop of water on transparent glass/plastic** and investigate how printed letters appear through it. Students can then explore whether changing the size of the water drop changes magnification. This builds innovatively on Activity 10.8, where a curved water drop acts as a simple lens.

(10) **IKS–Modern Science Innovation Bridge:**
Ask students to recreate or model the historical method described in the chapter in which astronomers during the period of **Bhāskara II used reflected images in shallow bowls of water to observe celestial bodies**. Students can then compare the principle with modern telescopes and propose a modernised version of the historical instrument.

Best 5 to enter in a Lesson Plan:
If the **“Innovations”** column requires only brief entries, then following are suggested:
1. Virtual Optics Laboratory using interactive simulations
2. Optics Detective – Mystery Mirror/Lens Challenge
3. Smartphone-Based Optics Exploration
4. STEM Design Challenge – Low-Cost Solar Cooker
5. QR-Based Interactive Optics Learning Stations

These are more appropriately classified as **innovations** rather than routine classroom activities because they introduce **technology integration, gamification, design thinking, student-created digital content and STEM problem-solving** into the teaching of the chapter.

10.17: Practicing Questions/Question Bank :

Based specifically on the uploaded Grade 8 Science Chapter 10, **“Light: Mirrors and Lenses,”** we suggest the following question bank. It covers spherical mirrors, image characteristics, laws of reflection, convergence/divergence, lenses, their applications, and activity/application-based learning.

A. Fill in the Blanks — 1 Mark Each:

1. A spherical mirror whose reflecting surface curves inwards is called a __________ mirror.
2. A spherical mirror whose reflecting surface curves outwards is called a __________ mirror.
3. A convex mirror always forms an __________ and diminished image.
4. The ray of light that falls on a mirror is called the __________ ray.
5. The ray of light that comes back from a mirror is called the __________ ray.
6. The perpendicular drawn to the reflecting surface at the point of incidence is called the __________.
7. The angle between the incident ray and the normal is called the angle of __________.
8. According to the law of reflection, the angle of incidence is __________ to the angle of reflection.
9. A concave mirror __________ parallel beams of light.

10. A convex mirror __________ parallel beams of light.
11. A lens thicker at the middle than at the edges is called a __________ lens.
12. A lens thicker at the edges than at the middle is called a __________ lens.
13. A convex lens is also called a __________ lens.
14. A concave lens is also called a __________ lens.
15. A magnifying glass uses a __________ lens.
16. The lens present in the human eye is a __________ lens.
17. Side-view mirrors of vehicles are generally __________ mirrors.
18. A dentist uses a __________ mirror to obtain an enlarged view of teeth.
19. The incident ray, normal and reflected ray all lie in the same __________.
20. Devices that concentrate sunlight into a small area using mirrors or lenses are called solar __________.

Answer Key: 1. concave; 2. convex; 3. erect; 4. incident; 5. reflected; 6. normal; 7. incidence; 8. equal; 9. converges; 10. diverges; 11. convex; 12. concave; 13. converging; 14. diverging; 15. convex; 16. convex; 17. convex; 18. concave; 19. plane; 20. concentrators.

B. One-Mark Questions:

1. What is a spherical mirror?
2. Define a concave mirror.
3. Define a convex mirror.
4. Name the mirror used as the side-view mirror of a vehicle.
5. Which type of mirror is used by dentists?
6. What is an incident ray?
7. What is a reflected ray?
8. What is the normal to a reflecting surface?
9. Define angle of incidence.
10. Define angle of reflection.
11. State the relationship between the angle of incidence and angle of reflection.
12. What happens when a ray of light is incident along the normal to a mirror?
13. Which spherical mirror converges a parallel beam of light?
14. Which spherical mirror diverges a parallel beam of light?
15. What is a lens?
16. Define a convex lens.

17. Define a concave lens.
18. Which lens is called a converging lens?
19. Which lens is called a diverging lens?
20. Name any two devices that use lenses.

These definitions and concepts follow directly from the chapter's treatment of reflection and lenses.

C. Two-Mark Questions:

1. Distinguish between a concave mirror and a convex mirror based on the shape of their reflecting surfaces.
2. State the **two laws of reflection**.
3. Write any two uses of a concave mirror.
4. Write any two uses of a convex mirror.
5. Why are convex mirrors used as side-view mirrors in vehicles?
6. What happens to parallel rays of light when they fall on:
   (a) a concave mirror, and
   (b) a convex mirror?
7. Differentiate between a convex lens and a concave lens based on their shapes.
8. Why is a convex lens called a converging lens and a concave lens called a diverging lens?
9. What kind of image is formed by a convex mirror? Mention two characteristics.
10. What kind of image is formed by a concave lens? Mention two characteristics.
11. What happens to the image formed by a concave mirror when the object is moved farther away from the mirror?
12. What happens to the appearance of an object viewed through a convex lens as the object is moved farther from the lens?
13. Why can a concave mirror concentrate sunlight at a small spot?
14. Why can a convex lens be used as a magnifying glass?
15. Mention any four devices or objects in which lenses are used.

The chapter specifically identifies eyeglasses, cameras, telescopes, microscopes and the human eye as examples involving lenses.

D. Three-Mark Questions:

1. **Compare plane, concave and convex mirrors** with respect to the size and orientation of the images they form.
2. Explain how you can distinguish between a concave mirror and a convex mirror by observing the images formed in them.

3. Explain with an example how a **concave mirror acts as a converging mirror**.
4. Explain how a **convex mirror provides a wider field of view**. Give two practical applications.
5. Describe an experiment to verify that the **angle of incidence is equal to the angle of reflection**.
6. Explain the terms:
   (a) incident ray,
   (b) reflected ray, and
   (c) normal.
7. Draw a labelled diagram showing an incident ray, normal and reflected ray, and mark the **angle of incidence (i)** and **angle of reflection (r)**.
8. Describe the changes observed in the image formed by a **concave mirror** as an object is moved away from it.
9. Compare the images seen through a **convex lens and concave lens** when an object is placed behind them.
10. Describe an activity to show that a convex lens converges light while a concave lens diverges light.
11. Explain how a water drop can behave like a simple lens.
12. Explain how a concave mirror can concentrate sunlight sufficiently to heat or burn a piece of paper.
13. What are solar concentrators? Explain any two uses of concentrated solar energy.
14. Explain why convex mirrors are installed at road intersections, sharp bends and in large stores.
15. Describe three everyday applications of lenses and explain their importance.

The textbook's experiments show that a concave mirror converges parallel rays while a convex mirror diverges them, and similarly a convex lens converges while a concave lens diverges light.

E. Five-Mark Descriptive Questions:

1. Laws of Reflection

State the two laws of reflection. Describe an experiment to verify the first law of reflection. Draw a neat labelled diagram showing the incident ray, reflected ray, normal, angle of incidence and angle of reflection.

2. Spherical Mirrors

What are spherical mirrors? Explain the two types of spherical mirrors. Compare the nature of images formed by concave and convex mirrors and give two applications of each.

3. Concave and Convex Mirrors – Comparative Question

Compare **concave and convex mirrors** under the following headings:

- Shape of reflecting surface

- Nature of image
- Size of image
- Effect on parallel rays
- Two practical applications

4. Lenses

What is a lens? Describe convex and concave lenses. Explain their effect on parallel beams of light and compare the images observed through them.

5. Convex and Concave Lenses – Comparative Question

Differentiate between convex and concave lenses based on:

- Shape
- Thickness at centre and edges
- Effect on parallel light rays
- Nature of image
- Applications

6. Experimental Question

Describe an experiment using a **torch, comb and mirrors** to investigate what happens when multiple parallel beams of light fall on plane, concave and convex mirrors. State the observations and conclusion.

7. Activity-Based Question

Describe an experiment to investigate the effect of a convex and concave lens on parallel beams of light. What happens when the same beams pass through a thin transparent glass plate? Give your conclusion.

8. Application-Based Question

Explain the scientific reasons for the following:
(a) Dentists use concave mirrors.
(b) Convex mirrors are used as side-view mirrors.
(c) Convex mirrors are installed at sharp road bends.
(d) Convex mirrors are used for surveillance in large stores.
(e) Concave mirrors are used in torch reflectors.

9. Solar Energy and Optics

Explain how concave mirrors and convex lenses can concentrate sunlight. What are **solar concentrators**? Discuss how this principle can be applied in solar cookers, solar furnaces and electricity generation.

10. HOTS / Real-Life Application

A school wants to install mirrors at a **blind road bend**, provide a mirror for its **dental health camp**, and design a device to **concentrate sunlight for a solar cooker**. Recommend the appropriate type of mirror for each purpose and justify your choices scientifically.

The last question closely connects with the chapter's emphasis on applying optics to road safety, medical examination and solar-energy solutions. The textbook itself asks students to develop a proposal for a solar cooker using mirrors to converge sunlight.

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8th Standard Science Book Chapter 11

Chapter 11: Keeping Time with the Skies

11.1 Summary of the Chapter:

Chapter 11: Keeping Time with the Skies — Summary

(1) **Phases of the Moon:** The Moon appears to change its shape from day to day. These changing shapes of its bright portion, as seen from Earth, are called the **phases of the Moon**.

(2) **Waxing and Waning:** From the **new Moon (Amavasya)** to the **full Moon (Purnima)**, the illuminated portion gradually increases; this is the **waxing period or Shukla Paksha**. From full Moon to new Moon, it decreases; this is the **waning period or Krishna Paksha**.

(3) **Cause of Moon Phases:** The Moon does not produce its own light; it **reflects sunlight**. As the Moon revolves around Earth, we see different fractions of its illuminated half, producing different phases such as crescent, half Moon, gibbous and full Moon.

(4) **Moon's Motion:** The Moon completes a cycle of phases in about **29.5 days**, or nearly a month. Its position in the sky also changes each day, and it generally appears about **50 minutes later** on successive days.

(5) **Natural Cycles and Time:** Humans developed units of time by observing repeating astronomical events. Earth's rotation provides the basis for a **day**, the Moon's phases for a **month**, and Earth's revolution around the Sun and the cycle of seasons for a **year**.

(6) **Solar Day:** A **mean solar day** is the average time taken by the Sun to return to its highest position in the sky on successive days. Its duration is about **24 hours**.

(7) **Lunar and Solar Calendars:** A **lunar calendar** is based on the Moon's phases and has 12 lunar months totalling about **354 days**. A **solar calendar** follows Earth's revolution and the seasonal cycle and has about **365 days**. The Gregorian calendar is a solar calendar.

(8) **Luni-solar Calendars:** These calendars combine lunar months with the solar year. Since 12 lunar months are about 11 days shorter than a solar year, an extra month called **Adhika Maasa** is added every few years to keep the two cycles synchronised.

(9) **Indian National Calendar:** India also uses the **Indian National Calendar**, a solar calendar of 365 days, for official purposes along with the Gregorian calendar. Its year normally begins on **22 March**, and in a leap year on **21 March**.

(10) **Astronomy and Indian Festivals:** Many Indian festivals are linked to astronomical phenomena and lunar phases. For example, **Diwali** occurs on a new Moon, while **Holi and Buddha Purnima** occur on full Moon days. Therefore, their Gregorian calendar dates may change from year to year.

(11) **Artificial Satellites:** The Moon is Earth's **natural satellite**, while artificial satellites are human-made objects placed in orbit. They are useful for **communication, navigation, weather monitoring, disaster management and scientific research**.

(12) **India's Contribution to Space Science:** ISRO has developed satellites and missions such as **Cartosat, AstroSat, Chandrayaan, Aditya-L1 and Mangalyaan**. The chapter also highlights **Vikram Sarabhai**, known as the Father of the Indian Space Programme, and discusses the growing problem of **space debris**.

11.2 Important Formulas:

For the **Chapter 11 – "Keeping Time with the Skies"**, there are relatively few formal equations. However, several **calculation relationships and conversions** are important for solving quantitative questions on solar days, lunar months, calendars, leap years, moonrise times, and satellite motion. The chapter establishes a mean solar day as about 24 hours, a lunar-phase cycle as about 29.5 days, and a solar year as about $365\frac{1}{4}$days.

Important Formulas / Relationships:

No.	Formula / Relationship	Use
1	**Duration = Final time − Initial time**	Finding elapsed time between two observations
2	$\text{Average duration} = \dfrac{\text{Sum of durations}}{\text{Number of observations}}$	Finding the average solar-day duration from observations
3	**1 mean solar day ≈ 24 hours**	Problems involving Earth's daily rotation / solar day
4	**1 lunar month ≈ 29.5 days**	Calculations involving one complete cycle of Moon phases
5	$\text{Lunar year} = 12 \times \text{lunar month}$	Finding the approximate length of a lunar year
6	**1 lunar year ≈ 354 days**	Calendar calculations
7	**1 solar year ≈** $365\frac{1}{4}$**days = 365.25 days**	Problems involving Earth's revolution around the Sun
8	$\text{Difference} = \text{Solar year} - \text{Lunar year}$	Comparing solar and lunar calendars
9	$365 - 354 \approx 11 \text{ days}$	Approximate annual difference between solar and lunar calendars
10	$\text{Accumulated difference} = 11 \times n\text{days}$	Finding the lunar–solar calendar difference after $n$years
11	$\dfrac{1}{4} \text{ day} \times 4 = 1 \text{ day}$	Explaining why a leap day is required approximately every four years
12	**Ordinary year = 365 days; Leap year = 366 days**	Calendar calculations
13	**Gregorian leap year:** divisible by 4; century years must also be divisible by 400	Determining whether a year is a leap year*
14	$\text{Moonrise time after } n \text{ days} \approx \text{initial moonrise time} + (50n) \text{ minutes}$	Estimating how much later the Moon rises
15	$\text{Number of satellite orbits} = \dfrac{\text{Total time}}{\text{Time for one orbit}}$	Artificial-satellite numerical problems
16	**Satellite orbital period ≈ 100 min**	Chapter-based satellite calculations
17	$\text{Number of cycles} = \dfrac{\text{Total duration}}{\text{Duration of one cycle}}$	General problems involving lunar, solar or satellite cycles

The chapter specifically notes that the Moon takes about **29.5 days** to complete all its phases and that 12 lunar months make a lunar year of about **354 days**. The resulting shortfall is about **11 days per year**, which accumulates until an extra month (**Adhika Maasa**) is inserted in luni-solar calendars.

Useful Time Conversions

$$1 \text{ day} = 24 \text{ hours}$$

$$1 \text{ hour} = 60 \text{ minutes}$$
$$1 \text{ day} = 24 \times 60 = \boxed{1440 \text{ minutes}}$$

For example, because the Moon generally returns to nearly the same position about **50 minutes later each day**, after 3 days the approximate delay is:

$$3 \times 50 = 150 \text{ min} = 2 \text{ h } 30 \text{ min}$$

This 50-minute daily shift is explained in the chapter through the simultaneous rotation of Earth and revolution of the Moon.

Especially Important for Grade 8 Problems

Students should particularly remember:

$$\boxed{\text{Lunar month} \approx 29.5 \text{ days}}$$
$$\boxed{\text{Lunar year} \approx 354 \text{ days}}$$
$$\boxed{\text{Solar year} \approx 365.25 \text{ days}}$$
$$\boxed{\text{Solar year} - \text{Lunar year} \approx 11 \text{ days}}$$
$$\boxed{\text{Mean solar day} \approx 24 \text{ hours}}$$
$$\boxed{\text{Moonrise shifts by about 50 min/day}}$$
$$\boxed{\text{Artificial satellite orbital period} \approx 100 \text{ min}}$$

The satellite value comes directly from the chapter, which states that many artificial satellites orbit roughly 800 km above Earth's surface and take approximately **100 minutes to complete one orbit**.

*For leap years, the chapter first gives the simple "divisible by 4" rule and then explains the **century exception and 400-year correction** in its "A step further" section.

11.3 Fill-Up the Blank LOTS type questions with Answers: (40 Questions)

Fill in the Blanks – LOTS Type:

1. The changing shapes of the bright portion of the Moon as seen from Earth are called the ___________ of the Moon.
   Answer: phases
2. The day on which the Moon appears as a full bright circle is called ___________.
   Answer: Full Moon day / Purnima
3. The day on which the illuminated portion of the Moon cannot be seen from Earth is called ___________.
   Answer: New Moon day / Amavasya
4. The period during which the bright portion of the Moon decreases is called the ___________ **period**.
   Answer: waning
5. In India, the waning period of the Moon is generally called ___________ **Paksha**.
   Answer: Krishna
6. The waxing period of the Moon is generally called ___________ **Paksha**.
   Answer: Shukla
7. The Moon shines because it ___________ sunlight falling on it.
   Answer: reflects
8. The half of the Moon facing the Sun becomes ___________.
   Answer: illuminated
9. When more than half of the illuminated portion of the Moon is visible, it is called the ___________ **phase**.
   Answer: gibbous

10. When less than half of the illuminated portion of the Moon is visible, it is called the __________ **phase**.
    Answer: crescent
11. The Moon revolves around the __________.
    Answer: Earth
12. The Moon takes about __________ to revolve once around the Earth and complete its cycle of phases.
    Answer: one month
13. The Moon rises about __________ **minutes** later each successive day.
    Answer: 50
14. The Earth completes one rotation about its axis in approximately __________ **hours**.
    Answer: 24
15. The average time between the Sun's highest position on two successive days is called the __________ **solar day**.
    Answer: mean
16. A mean solar day has approximately __________ **hours**.
    Answer: 24
17. The shadow of an object is shortest when the Sun is at its __________ **position** in the sky.
    Answer: highest
18. The Moon takes about __________ **days** to cycle through all its phases.
    Answer: 29.5
19. The cycle of the Moon's phases forms the basis for the unit called a __________.
    Answer: month
20. The Earth takes nearly __________ **days** to complete one revolution around the Sun.
    Answer: 365¼ / 365.25

The chapter explains that a day is related to Earth's rotation, a month to the cycle of Moon phases, and a solar year to Earth's revolution around the Sun.

21. A lunar year consists of __________ **lunar months**.
    Answer: 12
22. A lunar year is approximately __________ **days** long.
    Answer: 354
23. The Gregorian calendar is an example of a __________ **calendar**.
    Answer: solar
24. An extra day is generally added every four years in a __________ **year**.
    Answer: leap
25. In a leap year, February has __________ **days**.
    Answer: 29
26. Calendars that combine elements of both lunar and solar calendars are called __________ **calendars**.
    Answer: luni-solar
27. Twelve lunar months fall short of a solar year by nearly __________ **days**.
    Answer: 11
28. The extra month added in some luni-solar calendars is called __________ **Maasa**.
    Answer: Adhika
29. The Indian National Calendar begins with the month of __________.
    Answer: Chaitra
30. The Indian National Calendar normally begins on __________ **March**.
    Answer: 22

The chapter states that the Indian National Calendar is a **solar calendar of 365 days**; in a regular year it begins on 22 March, while in a leap year it begins on 21 March.

Additional LOTS Questions – Festivals, Scientists & Satellites:

31. Diwali falls on the __________ **Moon** of the month of Kartika.
    Answer: new
32. Holi is celebrated on the full Moon of the month of __________.
    Answer: Phalguna
33. Buddha Purnima occurs on the full Moon of __________.
    Answer: Vaisakha
34. The chairperson of the Calendar Reform Committee was __________.
    Answer: Meghnad Saha
35. The mathematical equation developed by Meghnad Saha is popularly known as the __________ **equation**.
    Answer: Saha
36. The Moon is Earth's __________ **satellite**.
    Answer: natural
37. Human-made objects sent into orbit around Earth are called __________ **satellites**.
    Answer: artificial
38. Most artificial satellites mentioned in the chapter orbit about __________ **km** above Earth's surface.
    Answer: 800
39. These artificial satellites take roughly __________ **minutes** to complete one orbit.
    Answer: 100
40. The Indian organisation that has launched many artificial satellites is __________.
    Answer: ISRO
41. The __________ series of satellites captures high-quality images of Earth for mapping and disaster management.
    Answer: Cartosat
42. __________ is an ISRO mission used to make scientific observations of stars and other celestial objects.
    Answer: AstroSat
43. India's mission to study the Sun mentioned in the chapter is __________.
    Answer: Aditya L1
44. India's mission to Mars is called __________.
    Answer: Mangalyaan
45. __________ **Sarabhai** is known as the Father of the Indian Space Programme.
    Answer: Vikram

The satellite section describes the Moon as Earth's natural satellite and explains that artificial satellites support communication, navigation, weather monitoring, disaster management and scientific research.

11.4 Fill-Up the Blank HOTS type questions with Answers: (38 Questions)

The following questions are designed as **HOTS (Higher Order Thinking Skills)**. Unlike direct-recall fill-ups, these require students to **apply concepts, analyse situations, infer relationships, calculate, or predict outcomes** using ideas from the chapter. The chapter explains that Moon phases arise from the changing fraction of its illuminated portion visible from Earth, rather than from Earth's shadow.

1. If a student observes a **waning Moon** at the most suitable time, the student should look for it around __________.
   Answer: sunrise
2. If the Moon is seen nearly opposite the Sun in the sky, it is most likely in the __________ **Moon** phase.
   Answer: full
3. If the illuminated portion of the Moon visible from Earth is increasing each night, the Moon is undergoing __________.
   Answer: waxing
4. If less than half of the Moon's illuminated portion is visible from Earth, the Moon is in the __________ **phase**.
   Answer: crescent
5. If more than half, but not all, of the illuminated portion of the Moon is visible, it is called the __________ **phase**.
   Answer: gibbous
6. A student claims that Earth's shadow causes the regular phases of the Moon. This conclusion is __________ because Earth's shadow on the Moon causes a lunar eclipse instead.
   Answer: incorrect
7. If the entire illuminated portion of the Moon faces Earth, an observer on Earth will see a __________ **Moon**.
   Answer: full
8. If the illuminated half of the Moon faces completely away from Earth, an observer will experience a __________ **Moon**.
   Answer: new
9. If today the Moon is overhead at a particular time, tomorrow it will reach nearly the same position about __________ **minutes later**.
   Answer: 50
10. The Moon reaches nearly the same position later each successive day because while Earth rotates, the Moon also moves ahead in its __________.
    Answer: orbit
11. If a lunar eclipse is observed, the Moon must be in the __________ **Moon** phase.
    Answer: full
12. If a solar eclipse occurs, the Moon must be in the __________ **Moon** phase.
    Answer: new
13. Solar and lunar eclipses do not occur every month because the Moon's orbit is slightly __________ relative to Earth's orbit around the Sun.
    Answer: tilted

These applications follow the chapter's explanation that the Moon moves ahead in its orbit while Earth completes its daily rotation, and that eclipses occur only under particular alignments because the Moon's orbit is slightly tilted.

14. If the shortest shadow of a vertical stick is observed at 12:20 p.m., the Sun is at its __________ **position** in the sky at that time.
    Answer: highest
15. If the Moon completes one phase cycle in about 29.5 days, two complete cycles would take approximately __________ **days**.
    Answer: 59
16. If 12 lunar months contain about 354 days while a solar year contains about 365 days, the lunar year is approximately __________ **days shorter**.
    Answer: 11

17. If a purely lunar calendar is followed for several years, the same lunar month will not remain associated with the same __________.
    Answer: season
18. If the difference of about 11 days between a lunar and solar year accumulates for roughly three years, it becomes approximately one __________.
    Answer: month
19. To bring lunar months back into step with the solar year, some Indian calendars periodically add an __________.
    Answer: Adhika Maasa / intercalary month
20. A calendar that tracks Moon phases but periodically adjusts itself to remain synchronised with the seasons is classified as a __________ **calendar**.
    Answer: luni-solar
21. If Earth took exactly 365 days to revolve around the Sun, the need to add a leap day every four years would largely __________.
    Answer: disappear
22. If a Gregorian year divisible by four is treated as a leap year under the basic rule discussed in the chapter, February will have __________ **days**.
    Answer: 29
23. If the Indian National Calendar is in a leap year, its new year begins on __________ **March** instead of 22 March.
    Answer: 21

The chapter connects a day with Earth's rotation, a month with the Moon's approximately 29.5-day phase cycle, and a solar year with Earth's approximately 365¼-day revolution. It also explains why lunar and solar calendars need different corrections.

24. If a festival is determined entirely by lunar phases without correction for the solar year, its Gregorian date can gradually occur in different __________ of the year.
    Answer: months
25. If a festival follows a luni-solar calendar, its Gregorian date generally does not shift as widely as that of a purely lunar festival because an __________ **month** is periodically added.
    Answer: intercalary
26. Diwali does not occur on exactly the same Gregorian date every year because its date is linked to the __________ rather than only to the Gregorian calendar.
    Answer: phases of the Moon
27. If sunrise occurs earlier in eastern India than in western India, a festival based on the exact lunar phase at sunrise may differ between the two regions by __________ **day**.
    Answer: one
28. A festival based on a solar sidereal calendar can slowly shift relative to the Gregorian calendar because the sidereal and tropical years have slightly different __________.
    Answer: durations
29. If Makar Sankranti moves ahead by approximately one day every 71 years, after about 142 years the accumulated shift would be approximately __________ **days**.
    Answer: two

These questions apply the chapter's discussion of why lunar and luni-solar festivals shift relative to Gregorian dates, as well as the gradual shift of festivals based on the sidereal calendar.

30. If a fast-moving point of light crosses the night sky steadily without looking like a normal star, it could be an __________ **satellite**.
    Answer: artificial

31. If an artificial satellite completes one orbit in about 100 minutes, it would complete approximately __________ **orbits in 500 minutes**.
    Answer: five
32. If scientists need high-quality images to study land use and plan cities, the ISRO satellite series most relevant to their work would be __________.
    Answer: Cartosat
33. If astronomers want to make scientific observations of stars and other celestial objects using the Indian mission mentioned in the chapter, they would use __________.
    Answer: AstroSat
34. If a satellite has stopped functioning but remains in orbit, it can contribute to __________ **debris**.
    Answer: space
35. If space debris collides with an operational satellite, it may threaten the satellite's ability to perform its intended __________.
    Answer: function / mission
36. Small pieces of space debris falling towards Earth are less likely to reach the ground because they usually __________ in the atmosphere.
    Answer: burn up
37. If a country wants satellite-based assistance for communication, navigation, weather monitoring and disaster management, it would depend on __________ **satellites**.
    Answer: artificial
38. If an observer wants to identify an artificial satellite without a telescope, the observer should look for a rapidly moving __________ **of light** across the sky.
    Answer: point

The chapter describes artificial satellites as tools for communication, navigation, weather monitoring, disaster management and scientific research, while also highlighting the growing problem of space debris.

11.5 One-mark questions with Answers of LOTS Type: (40 Questions)

1. **What are the phases of the Moon?**
   Answer: The changing shapes of the bright portion of the Moon seen from Earth are called the phases of the Moon.
2. **What is a full Moon day?**
   Answer: The day on which the Moon appears as a full bright circle is called the full Moon day or Purnima.
3. **What is a new Moon day?**
   Answer: The day on which the Moon is not visible is called the new Moon day or Amavasya.
4. **What is the waning period of the Moon?**
   Answer: The period during which the bright portion of the Moon gradually decreases is called the waning period.
5. **What is the waxing period of the Moon?**
   Answer: The period during which the bright portion of the Moon increases is called the waxing period.
6. **What is Krishna Paksha?**
   Answer: The waning period of the Moon is generally called Krishna Paksha in India.
7. **What is Shukla Paksha?**
   Answer: The waxing period of the Moon is generally called Shukla Paksha in India.
8. **Why does the Moon shine?**
   Answer: The Moon shines because it reflects the sunlight falling on it.

9. **Which part of the Moon is illuminated by the Sun?**
   Answer: The half of the Moon that faces the Sun receives sunlight and becomes illuminated.
10. **What causes the phases of the Moon?**
    Answer: The phases are caused by changes in the fraction of the Moon's illuminated portion that can be seen from Earth.
11. **What is the gibbous phase of the Moon?**
    Answer: The phase in which more than half of the illuminated portion of the Moon can be seen is called the gibbous phase.
12. **What is the crescent phase of the Moon?**
    Answer: The phase in which less than half of the illuminated portion of the Moon can be seen is called the crescent phase.
13. **How long does one complete cycle of the Moon's phases take?**
    Answer: One complete cycle of the Moon's phases takes about 29.5 days.
14. **When is a waxing Moon easiest to spot?**
    Answer: A waxing Moon is easiest to spot at sunset.
15. **When is a waning Moon easiest to spot?**
    Answer: A waning Moon is easiest to spot at sunrise.
16. **How much later does the Moon rise each day?**
    Answer: The Moon rises about 50 minutes later each day.
17. **What causes a lunar eclipse?**
    Answer: A lunar eclipse occurs when the Earth's shadow falls on the Moon.
18. **On which Moon phase can a lunar eclipse occur?**
    Answer: A lunar eclipse can occur only on a full Moon day.
19. **On which Moon phase can a solar eclipse occur?**
    Answer: A solar eclipse can occur only on a new Moon day.
20. **What is a mean solar day?**
    Answer: The average time taken by the Sun to go from its highest position on one day to its highest position the next day is called a mean solar day.
21. **What is the duration of a mean solar day?**
    Answer: The duration of a mean solar day is 24 hours.
22. **How can we identify the highest position of the Sun using a shadow?**
    Answer: The Sun is at its highest position in the sky when the shadow cast by an object is shortest.
23. **What natural cycle forms the basis of a month?**
    Answer: The cycle of the phases of the Moon forms the basis of a month.
24. **What is a solar year?**
    Answer: The time taken by Earth to complete one revolution around the Sun and one cycle of seasons defines a solar year.
25. **How long is a lunar year?**
    Answer: A lunar year consisting of 12 lunar months is about 354 days long.
26. **What is a solar calendar?**
    Answer: A solar calendar is a calendar designed to remain synchronised with the cycle of seasons.
27. **Why is an extra day added during a leap year?**
    Answer: An extra day is added to compensate for the extra quarter day that Earth takes beyond 365 days to revolve around the Sun.
28. **What is a luni-solar calendar?**
    Answer: A luni-solar calendar uses the Moon's phases for counting days and months while making adjustments to remain synchronised with the seasons.

29. **What is Adhika Maasa?**
    Answer: Adhika Maasa is an extra or intercalary month added every few years in some luni-solar calendars.
30. **What is the Indian National Calendar?**
    Answer: The Indian National Calendar is a solar calendar used by the Government of India along with the Gregorian calendar for official purposes.
31. **When does the Indian National Calendar normally begin?**
    Answer: The Indian National Calendar normally begins on 22 March.
32. **Who was Meghnad Saha?**
    Answer: Meghnad Saha was a pioneering Indian astrophysicist and the chairperson of the Calendar Reform Committee.
33. **On which lunar phase is Diwali celebrated?**
    Answer: Diwali is celebrated on the new Moon of the month of Kartika.
34. **On which lunar phase is Holi celebrated?**
    Answer: Holi is celebrated on the full Moon of the month of Phalguna.
35. **What is an artificial satellite?**
    Answer: An artificial satellite is a human-made object sent into space to orbit the Earth.
36. **Mention any two uses of artificial satellites.**
    Answer: Artificial satellites are used for purposes such as communication and weather monitoring.
37. **What is the purpose of the Cartosat series of satellites?**
    Answer: Cartosat satellites capture high-quality images of Earth for mapping, city planning and natural-disaster management.
38. **What is AstroSat used for?**
    Answer: AstroSat is used to make scientific observations of stars and other celestial objects.
39. **What is space debris?**
    Answer: Non-functional satellites and discarded rocket parts remaining in space are called space debris or space junk.
40. **Who is known as the Father of the Indian Space Programme?**
    Answer: Vikram Ambalal Sarabhai is known as the Father of the Indian Space Programme.

These **40 questions are LOTS-oriented**, focusing mainly on **remembering, identifying, defining and simple understanding**, and are suitable for **one-mark Grade 8 questions**.

11.6 One-mark questions with Answers of HOTS Type: (35 Questions)

One-Mark Descriptive Questions with Answers – HOTS Type

1. **Why can the Moon sometimes be seen during the daytime?**
   Answer: The Moon can be seen during the daytime when it is above the horizon and its sunlit portion is bright enough to be visible.
2. **Why does the Moon appear to change its shape even though its actual shape does not change?**
   Answer: The Moon appears to change shape because we see different fractions of its illuminated portion as it revolves around Earth.
3. **A student says that the phases of the Moon are caused by Earth's shadow; why is this incorrect?**
   Answer: Earth's shadow causes a lunar eclipse, while Moon phases result from the changing relative orientation of the Sun, Moon and Earth.

4. **Why is the Moon not visible from Earth on a new Moon day?**
   Answer: On a new Moon day, the illuminated portion faces away from Earth while the non-illuminated portion faces us.
5. **Why does the Moon appear as a complete bright circle on a full Moon day?**
   Answer: The Moon appears full because its entire illuminated portion facing Earth is visible to us.
6. **If more than half of the Moon's illuminated portion is visible, which phase should you identify?**
   Answer: It should be identified as the gibbous phase.
7. **If less than half of the Moon's illuminated portion is visible, which phase should you identify?**
   Answer: It should be identified as the crescent phase.
8. **If the Moon's bright portion becomes smaller every night, what can you infer about its phase?**
   Answer: We can infer that the Moon is in its waning or Krishna Paksha phase.
9. **If the illuminated portion of the Moon increases each day, what can you conclude?**
   Answer: We can conclude that the Moon is in its waxing or Shukla Paksha phase.
10. **Why is sunrise a suitable time to observe a waning Moon?**
    Answer: Sunrise is suitable because a waning Moon is generally easier to spot in the sky at that time.
11. **Why is sunset a suitable time to observe a waxing Moon?**
    Answer: Sunset is suitable because a waxing Moon is generally easier to spot in the sky at that time.
12. **If the Moon rises at 3:00 p.m. today, approximately when would you expect it to rise tomorrow?**
    Answer: The Moon would be expected to rise at approximately 3:50 p.m. tomorrow because moonrise occurs about 50 minutes later each day.
13. **Why does the Moon return to nearly the same position in the sky about 50 minutes later each day?**
    Answer: The Moon moves ahead in its orbit while Earth rotates, so Earth must rotate a little more to bring the Moon back to nearly the same position.
14. **Why do people in different parts of Earth see nearly the same phase of the Moon on a given day?**
    Answer: They see nearly the same phase because Earth's one-day rotation is much shorter than the Moon's nearly one-month revolution.
15. **Why does a lunar eclipse not occur on every full Moon day?**
    Answer: A lunar eclipse does not occur every full Moon because the Moon's orbit is slightly tilted relative to Earth's orbit around the Sun.
16. **Why does a solar eclipse not occur on every new Moon day?**
    Answer: A solar eclipse does not occur every new Moon because the slight tilt of the Moon's orbit usually prevents the required alignment.
17. **How could you determine approximately when the Sun is highest in the sky without using a clock?**
    Answer: I could observe a vertical object and identify the time when its shadow becomes the shortest.
18. **Why can the phases of the Moon be used for measuring longer periods of time?**
    Answer: Moon phases repeat regularly in a cycle of about 29.5 days and can therefore be used to measure a month.
19. **Why does a purely lunar calendar gradually become unsynchronised with the seasons?**

Answer: A lunar year has about 354 days whereas the seasonal year is about 365 days, creating an annual difference of about 11 days.

20. **Why was the development of solar calendars especially useful for agriculture?**
Answer: Solar calendars helped people predict the arrival of seasons, which was important for planning agricultural activities.
21. **Why is a leap day added approximately once every four years?**
Answer: A leap day compensates for the approximately one-quarter extra day Earth takes beyond 365 days to complete one revolution around the Sun.
22. **Why would a calendar of exactly 365 days eventually become unsynchronised with the seasons?**
Answer: It would gradually shift because Earth takes slightly more than 365 days to complete its seasonal cycle.
23. **Why do luni-solar calendars need an extra month every few years?**
Answer: An extra month is needed because the lunar year is nearly 11 days shorter than the solar year and the difference accumulates over time.
24. **What would happen to a luni-solar calendar if Adhika Maasa were never added?**
Answer: The lunar months would gradually move out of synchronisation with the solar year and seasons.
25. **Why do festivals such as Diwali and Holi fall on different Gregorian dates each year?**
Answer: Their dates vary because they are determined by lunar or luni-solar calendars rather than solely by the Gregorian solar calendar.
26. **Why can a festival based purely on lunar phases occur in different Gregorian months over successive years?**
Answer: A purely lunar calendar does not correct the difference between the shorter lunar year and the solar year, causing the festival date to shift.
27. **Why can the date of the same lunar festival sometimes differ by a day between Eastern and Western India?**
Answer: The date can differ because sunrise occurs earlier in Eastern India and later in Western India while some festivals depend on the lunar phase at sunrise.
28. **A bright point moves rapidly and steadily across the night sky; why might it be an artificial satellite rather than a star?**
Answer: It may be an artificial satellite because satellites appear as points of light that move rapidly across the sky, whereas stars do not show such rapid motion.
29. **Why are artificial satellites useful during natural disasters?**
Answer: Artificial satellites provide observations and images of Earth that can support weather monitoring, mapping and disaster management.
30. **Why can space debris become dangerous even though it is no longer useful?**
Answer: Space debris can collide with working satellites, while larger pieces may even fall towards Earth and reach the ground.
31. **If Earth stopped rotating but continued revolving around the Sun, which natural basis for our present 24-hour day would be affected?**
Answer: The regular daily apparent motion of the Sun used to define the mean solar day would be affected because it primarily results from Earth's rotation.
32. **If the Moon did not revolve around Earth, what important natural cycle used in traditional timekeeping would be affected?**
Answer: The regular cycle of lunar phases used to define a month would be affected because the phases depend on the Moon's revolution around Earth.
33. **If Earth took exactly 365 days to complete its seasonal cycle, why would the present four-year leap-day correction become unnecessary?**

Answer: The correction would be unnecessary because there would be no extra quarter-day accumulating to form an additional day.

34. **Why are natural astronomical cycles suitable for developing calendars?**
Answer: Astronomical cycles are suitable because they repeat in regular and predictable patterns that can be used to measure the passage of time.
35. **Why is a luni-solar calendar more effective than a purely lunar calendar for keeping festivals linked with seasons?**
Answer: A luni-solar calendar periodically adds an extra month to keep lunar months approximately synchronised with the solar year and seasons.

11.7 Two-mark questions with Answers of LOTS Type: (20 Questions)

1. What are the phases of the Moon? Name the two periods associated with them.
Answer:
1. The changing shapes of the bright portion of the Moon as seen from Earth are called the phases of the Moon.
2. The two periods are the **waxing period (Shukla Paksha)** and the **waning period (Krishna Paksha)**.

2. What is meant by waxing and waning of the Moon?
Answer:
1. Waxing is the period during which the visible bright portion of the Moon gradually increases.
2. Waning is the period during which the visible bright portion of the Moon gradually decreases.

3. What are Purnima and Amavasya?
Answer:
1. The day on which the Moon appears as a full bright circle is called **Purnima or full Moon day**.
2. The day on which the Moon is not visible is called **Amavasya or new Moon day**.

4. Why does the Moon shine although it has no light of its own?
Answer:
1. The Moon shines because it reflects sunlight falling on its surface.
2. The half of the Moon facing the Sun is illuminated, while the other half remains non-illuminated.

5. Why does the Moon appear different on different days?
Answer:
1. The Moon revolves around Earth, so its position with respect to the Sun and Earth keeps changing.
2. Therefore, we see different fractions of its illuminated portion on different days.

6. What are the crescent and gibbous phases of the Moon?
Answer:
1. When less than half of the illuminated portion of the Moon is visible, it is called the **crescent phase**.
2. When more than half of the illuminated portion is visible, it is called the **gibbous phase**.

7. How long does the Moon take to complete one cycle of its phases? What unit of time is based on this cycle?
Answer:
1. The Moon takes about **29.5 days**, or nearly a month, to complete one cycle of all its phases.

2. This cycle of Moon phases forms the basis for the unit of time called a **month**.

8. What is a mean solar day? How long is it?

Answer:

1. A mean solar day is the average time taken by the Sun to go from its highest position on one day to its highest position the next day.
2. The duration of a mean solar day is **24 hours**.

9. How can the highest position of the Sun in the sky be identified using shadows?

Answer:

1. The length of the shadow cast by a vertical object can be observed at different times during the day.
2. The Sun is at its highest position when the shadow of the object is the shortest.

10. What natural cycles are used to define a day, a month and a year?

Answer:

1. Earth's rotation and the cycle of the Moon's phases are used to define a **day and a month**, respectively.
2. Earth's revolution around the Sun and the associated cycle of seasons are used to define a **year**.

11. What is a lunar calendar?

Answer:

1. A lunar calendar is based on the regular cycle of the phases of the Moon.
2. It has about **29.5 days in a month and 12 lunar months in a lunar year**.

12. Why do the seasons not remain synchronised with the months in a lunar calendar?

Answer:

1. A lunar year is about **354 days long**, while the seasons repeat in approximately **365 days**.
2. Because of this difference, the seasons do not remain synchronised with the same lunar months in successive years.

13. What is a solar calendar? Give one example.

Answer:

1. A solar calendar is designed to keep the year synchronised with the cycle of seasons.
2. The **Gregorian calendar** is a widely used example of a solar calendar.

14. What is a leap year? Why is a leap day added?

Answer:

1. A leap year is a year in which an extra day is added to the calendar, making February 29 days long in the Gregorian calendar.
2. The extra day compensates for the additional fraction of a day that Earth takes beyond 365 days to complete its yearly cycle.

15. What is a luni-solar calendar?

Answer:

1. A luni-solar calendar primarily uses the phases of the Moon for counting days and months.
2. It also makes adjustments to keep the lunar cycle synchronised with the cycle of seasons.

16. What is Adhika Maasa and why is it added?

Answer:

1. **Adhika Maasa** is an extra or intercalary month added to some luni-solar calendars every few years.
2. It is added to keep the lunar cycle and the solar year in step with each other.

17. Write any two features of the Indian National Calendar.

Answer:

1. The Indian National Calendar is a solar calendar consisting of **365 days in a regular year**.
2. Its year normally begins on **22 March**, and its months have either 30 or 31 days.

18. How are Indian festivals related to the phases of the Moon? Give two examples.
Answer:
1. Many Indian festivals are based on lunar or luni-solar calendars and are therefore linked with particular phases of the Moon.
2. **Diwali occurs on the new Moon of Kartika, while Holi occurs on the full Moon of Phalguna.**

19. What are artificial satellites? Mention any two uses.
Answer:
1. Artificial satellites are human-made objects launched into space to orbit Earth.
2. They are used for purposes such as **communication, navigation, weather monitoring, disaster management and scientific research**.

20. What is space debris? Mention one danger caused by it.
Answer:
1. Old artificial satellites and rocket parts remaining in space after their useful life are called **space junk or space debris**.
2. Space debris can collide with working satellites, and larger pieces may even crash onto the ground.

11.8. Two-mark questions with Answers of HOTS Type: (20 Questions)

1. A student says that the phases of the Moon are caused by Earth's shadow falling on it. Do you agree? Give reasons.
Answer:
1. No. Moon phases occur because we see different fractions of the Moon's illuminated portion as it revolves around Earth.
2. Earth's shadow falling on the Moon causes a **lunar eclipse**, not the regular phases of the Moon.

2. If you want to observe a waxing Moon, would you choose sunrise or sunset? Why?
Answer:
1. I would choose **sunset**, because a waxing Moon is easiest to observe at that time.
2. During waxing, the Moon's illuminated portion increases and its position in the sky makes it conveniently visible after sunset.

3. A child sees the Moon in the afternoon and thinks something unusual has happened. Is the child correct? Explain.
Answer:
1. No, seeing the Moon during the daytime is a normal occurrence because moonrise does not always happen after sunset.
2. The Moon may rise during the afternoon and become visible in the eastern sky while the Sun is still up.

4. Why does the Moon rise approximately 50 minutes later on successive days?
Answer:
1. While Earth completes one rotation, the Moon also moves a little farther along its orbit around Earth.
2. Therefore, Earth must rotate for some additional time—about **50 minutes**—for the Moon to appear in nearly the same position again.

5. Suppose the Moon stopped revolving around Earth. Would we continue to observe its regular cycle of phases? Give a reason.
Answer:
1. No, the regular monthly cycle of phases depends on the Moon changing its position relative to Earth and the Sun.
2. If it stopped revolving, this regular change in the fraction of its illuminated portion visible from Earth would not occur.

6. Two students living in widely separated places on Earth observe the Moon on the same day. Will they see nearly the same phase? Why?
Answer:
1. Yes, people in different parts of Earth see nearly the same phase of the Moon on a given day.
2. This is because Earth's one-day rotation period is much shorter than the Moon's nearly one-month revolution period.

7. Why can a purely lunar calendar not keep the seasons in the same months every year?
Answer:
1. A lunar year has about **354 days**, whereas the seasonal cycle takes approximately **365 days**.
2. This difference causes the lunar months to gradually shift with respect to the seasons.

8. Why is an extra month added to a luni-solar calendar instead of simply following 12 lunar months every year?
Answer:
1. Twelve lunar months total about 354 days, which is nearly 11 days shorter than a solar year.
2. Adding an extra month every few years compensates for the accumulated difference and keeps the lunar months in step with the seasons.

9. Why was the development of solar calendars especially useful for agriculture?
Answer:
1. Agriculture depends greatly on knowing the arrival and duration of different seasons.
2. Solar calendars remain synchronised with the seasonal cycle and therefore help people anticipate seasonal changes.

10. Earth takes slightly more than 365 days to complete its yearly cycle. What problem would arise if every year were fixed at exactly 365 days?
Answer:
1. The small extra fraction of a day would accumulate over several years and gradually shift calendar dates relative to the seasons.
2. Leap years correct this mismatch by periodically adding an extra day to the calendar.

11. Diwali does not fall on the same Gregorian date every year. Explain why.
Answer:
1. Diwali is determined according to the lunar/luni-solar calendar and occurs on the **new Moon of Kartika**.
2. Since lunar cycles do not exactly match the Gregorian solar calendar, its Gregorian date changes from year to year.

12. Why does Makar Sankranti occur on almost the same Gregorian date each year, while many other Indian festivals do not?
Answer:
1. Makar Sankranti follows a **solar sidereal calendar**, so its date remains almost fixed in relation to the Gregorian calendar.

2. Many other festivals depend on lunar phases, causing their Gregorian dates to vary from year to year.

13. If the shortest shadow of a vertical stick is observed at 12:20 p.m., what can you infer about the Sun at that time?

Answer:

1. The Sun is at its **highest position in the sky** around the time when the shadow is shortest.
2. Repeating this observation on successive days can be used to estimate the duration of a mean solar day.

14. Why would a crescent Moon be more difficult to see when it appears very close to the Sun in the sky?

Answer:

1. During the crescent phase, only a small fraction of the illuminated portion of the Moon is visible from Earth.
2. Its apparent closeness to the bright Sun makes the thin illuminated portion more difficult to notice.

15. If the Moon produced its own light uniformly instead of reflecting sunlight, would we observe the same phases? Explain.

Answer:

1. No, the phases occur because only the half of the Moon facing the Sun is illuminated while the other half remains dark.
2. If the Moon emitted its own light uniformly, its visible surface would not show the same changing illuminated fractions caused by reflected sunlight.

16. A satellite is useful for weather monitoring but becomes non-functional after several years. Why should it not simply be ignored in space?

Answer:

1. A non-functional satellite becomes **space debris** and may collide with working satellites.
2. Large pieces of debris may also survive their fall through the atmosphere and crash onto the ground.

17. Why are artificial satellites valuable during natural disasters?

Answer:

1. Satellites can capture images and provide information about Earth's surface, helping authorities monitor affected regions.
2. Such information can support mapping, planning and disaster-management activities.

18. A moving point of light is observed in the night sky. How could you decide whether it might be an artificial satellite?

Answer:

1. Observe whether the point of light moves rapidly across the sky with steady or flickering brightness.
2. Its expected passage can also be checked using satellite-tracking apps or websites for that location.

19. Why do eclipses not occur during every full Moon and new Moon even though lunar eclipses occur at full Moon and solar eclipses at new Moon?

Answer:

1. The Moon’s orbit is slightly tilted with respect to Earth’s orbit around the Sun.
2. Therefore, the Sun, Earth and Moon are not correctly aligned for an eclipse during every full Moon or new Moon.

20. Ancient people did not have modern clocks or astronomical instruments. How could they still develop reasonably accurate calendars?
Answer:
1. They carefully observed repeating natural patterns such as Moon phases, seasonal changes, solstices and the changing position of the Sun.
2. By recording these regular cycles over long periods, they could estimate the length of months and years and develop calendars.

11.9. Three-mark questions with Answers of LOTS Type: (16 Questions)

1. What are the phases of the Moon? Explain the waxing and waning periods.
Answer:
1. The changing shapes of the bright portion of the Moon seen from Earth are called the **phases of the Moon**.
2. The period during which the bright portion increases is called the **waxing period or Shukla Paksha**.
3. The period during which the bright portion decreases is called the **waning period or Krishna Paksha**.

2. Why does the Moon appear to change its shape on different days?
Answer:
1. The Moon does not produce its own light but shines by **reflecting sunlight**.
2. As the Moon revolves around Earth, the portion of its illuminated half visible from Earth keeps changing.
3. Therefore, the Moon appears to have different shapes or phases on different days.

3. Describe the Full Moon and New Moon.
Answer:
1. On a **Full Moon day or Purnima**, the Moon appears as a complete bright circle.
2. On a **New Moon day or Amavasya**, the illuminated portion of the Moon cannot be seen from Earth.
3. The Moon takes about a month to complete the cycle from one Full Moon to the next.

4. What are the crescent and gibbous phases of the Moon?
Answer:
1. The **crescent phase** occurs when less than half of the illuminated portion of the Moon can be seen from Earth.
2. The **gibbous phase** occurs when more than half of the illuminated portion can be seen.
3. Both these phases occur as the Moon revolves around Earth and the visible illuminated fraction changes.

5. Explain why the Moon rises at different times on successive days.
Answer:
1. The Moon moves ahead in its orbit while Earth completes one rotation in about 24 hours.
2. Earth therefore has to rotate a little more for the Moon to appear in nearly the same position in the sky.
3. As a result, the Moon appears in nearly the same position about **50 minutes later each day**.

6. What is a mean solar day? How can the position of the Sun be used to measure it?
Answer:
1. The average time between the Sun reaching its highest position on two successive days is called a **mean solar day**.

2. A mean solar day has a duration of approximately **24 hours**.
3. The Sun's highest position can be identified by observing when the shadow of a vertical object is the shortest.

7. Explain the natural cycles that form the basis of a day, month and year.

Answer:

1. Earth's **rotation** causes the daily apparent movement of the Sun and forms the basis of a day.
2. The cycle of the **Moon's phases**, lasting about 29.5 days, forms the basis of a month.
3. Earth's **revolution around the Sun** and the resulting cycle of seasons form the basis of a solar year.

8. What is a lunar calendar? State its main features.

Answer:

1. A lunar calendar is based on the repeating cycle of the **phases of the Moon**.
2. A lunar month is approximately **29.5 days**, and a lunar year consists of 12 lunar months.
3. A lunar year is about **354 days**, so its months do not remain synchronised with the seasons.

9. What is a solar calendar? Explain the need for leap years.

Answer:

1. A solar calendar is based on the yearly cycle of seasons associated with Earth's revolution around the Sun.
2. Earth takes about **365 and a quarter days** to complete its yearly cycle.
3. The extra hours accumulate to approximately one day in four years, so an extra day is added in a **leap year**.

10. What is a luni-solar calendar? How is it adjusted?

Answer:

1. A **luni-solar calendar** uses the phases of the Moon for counting days and months while also remaining synchronised with the seasons.
2. Twelve lunar months contain about 354 days, nearly 11 days less than a solar year.
3. Therefore, an extra month called **Adhika Maasa or intercalary month** is added every few years.

11. Write three features of the Indian National Calendar.

Answer:

1. The **Indian National Calendar** is a solar calendar consisting of 365 days in a regular year.
2. Its year begins on **22 March**, the day after the spring equinox, and its months have either 30 or 31 days.
3. In a leap year, one extra day is added to **Chaitra**, and the year begins on 21 March.

12. How are Indian festivals related to the phases of the Moon? Give examples.

Answer:

1. Many Indian festivals are based on lunar or luni-solar calendars and are linked to particular phases of the Moon.
2. **Diwali** occurs on the new Moon of Kartika, while **Holi** occurs on the full Moon of Phalguna.
3. **Buddha Purnima** occurs on the full Moon of Vaisakha, while Eid-ul-Fitr is celebrated after sighting the crescent Moon at the end of Ramazan.

13. What are artificial satellites? Mention their major uses.

Answer:

1. Artificial satellites are **human-made objects** launched into space to orbit Earth.

2. They are used for communication, navigation, weather monitoring and disaster management.
3. They are also used for scientific research and for collecting useful information about Earth and space.

14. Write a short note on Cartosat and AstroSat.

Answer:

1. The **Cartosat series** of satellites captures high-quality images of Earth for mapping, city planning and disaster management.
2. The mapping platform **Bhuvan** uses such images to provide information about terrain, soil, land use and vegetation.
3. **AstroSat** is an ISRO mission used for scientific observations of stars and other celestial objects.

15. What is space debris? Why is it a matter of concern?

Answer:

1. Old artificial satellites and rocket parts that remain in space after their useful life become **space junk or space debris**.
2. Space debris can collide with working satellites and damage them.
3. While small pieces may burn up in the atmosphere, larger pieces can reach the ground and therefore pose a danger.

16. Write three points about Vikram Ambalal Sarabhai and his contribution to Indian space science.

Answer:

1. **Vikram Ambalal Sarabhai (1919–1971)** was a researcher in space science and nuclear physics.
2. He is known as the **Father of the Indian Space Programme** and pioneered efforts to launch India's first artificial satellites.
3. The **Vikram Sarabhai Space Centre (VSSC)** in Thiruvananthapuram is named after him.

11.10. Three-mark questions with Answers of HOTS Type: (17 Questions)

1. Riya says that the phases of the Moon are caused by Earth's shadow falling on the Moon. Do you agree? Justify your answer.

Answer:

1. No, Earth's shadow is **not responsible for the regular phases of the Moon**.
2. The phases occur because, as the Moon revolves around Earth, we see different fractions of its sunlit portion.
3. Earth's shadow falling on the Moon causes a **lunar eclipse**, which can occur only under suitable conditions on a full Moon day.

2. A student observes a full Moon today. Predict how its appearance will change during the next two weeks and explain why.

Answer:

1. After the full Moon, its visible bright portion will gradually decrease during the **waning period or Krishna Paksha**.
2. In about one week, approximately half of the illuminated portion will be visible, and it will continue decreasing.
3. After about two weeks, the illuminated portion will not be visible from Earth, resulting in a **new Moon**.

3. Your friend wants to observe a waxing Moon and a waning Moon. At what times would you advise your friend to look for them? Give reasons.
Answer:
1. A **waxing Moon** is easiest to observe around sunset.
2. A **waning Moon** is easier to observe around sunrise.
3. This happens because the Moon's position relative to the Sun changes continuously as it revolves around Earth.

4. A person says, "The Moon always rises when the Sun sets." Use your knowledge from the chapter to evaluate this statement.
Answer:
1. The statement is incorrect because the Moon does not rise at the same time every day.
2. The Moon moves ahead in its orbit while Earth rotates, so Earth must rotate a little more before the Moon appears in nearly the same position.
3. Therefore, the Moon rises approximately **50 minutes later each day** and can sometimes even be seen during the afternoon.

5. Suppose the Moon produced its own light instead of reflecting sunlight. How might our observation of its phases be different?
Answer:
1. The Moon's phases occur because only the half facing the Sun is illuminated and we see different portions of this illuminated half.
2. If the Moon produced its own light uniformly, its visible side would not depend on illumination by the Sun.
3. Therefore, the familiar sequence of crescent, half, gibbous and new Moon phases caused by sunlight would not occur in the same way.

6. Why would a purely lunar calendar be less suitable than a solar calendar for planning seasonal agricultural activities?
Answer:
1. A lunar year of 12 lunar months is approximately **354 days**, while the seasonal cycle is approximately 365 days.
2. Therefore, lunar months gradually shift with respect to the seasons from one year to another.
3. A solar calendar remains synchronised with the seasons and is therefore more useful for activities such as agriculture that depend on seasonal changes.

7. If an extra month were never added to a luni-solar calendar, what problem would arise over several years? Explain.
Answer:
1. Twelve lunar months total about **354 days**, which is nearly 11 days shorter than a solar year.
2. Without correction, the lunar months would gradually move out of step with the seasons.
3. Hence, an extra month called **Adhika Maasa** is added every few years to keep the lunar and solar cycles synchronised.

8. Why is a leap year necessary in a solar calendar? What would happen if leap years were not used?
Answer:
1. Earth takes nearly **365¼ days** to complete its yearly cycle, while an ordinary calendar year contains 365 days.
2. The extra fraction of a day accumulates to approximately one full day in four years.
3. Without leap-year corrections, the calendar would gradually become unsynchronised with the seasons.

9. Diwali does not fall on the same Gregorian date every year. Explain the astronomical reason behind this variation.

Answer:

1. Diwali is linked to the **new Moon of Kartika** and therefore depends on the lunar/luni-solar calendar.
2. The lunar cycle does not exactly match the length of the Gregorian solar year.
3. Therefore, the corresponding Gregorian date of Diwali changes from one year to another.

10. Makar Sankranti occurs on almost the same Gregorian date every year, while many other Indian festivals shift considerably. Why?

Answer:

1. Makar Sankranti follows a **solar sidereal calendar**, whereas many other Indian festivals are based on lunar or luni-solar calendars.
2. Solar-calendar festivals therefore occur on nearly the same Gregorian date each year, while lunar-based dates shift.
3. However, because of the small difference between sidereal and tropical years, Makar Sankranti itself slowly moves ahead—about **one day every 71 years**.

11. Two students in eastern and western India report different dates for the same Moon-based festival. Can both be correct? Explain.

Answer:

1. Yes, the dates of some festivals depend on the **exact lunar phase at sunrise**.
2. Sunrise occurs earlier in eastern India than in western India, so the required lunar phase may be observed on different dates in the two regions.
3. Therefore, the festival date can sometimes differ by a day between regions, which is one reason the *Rashtriya Panchang* provides standard calculations.

12. A student notices that the shortest shadow of a vertical stick occurs around midday. How can this observation be used to measure a solar day?

Answer:

1. The shadow is shortest when the Sun reaches its **highest position in the sky**.
2. The student can record the time of the shortest shadow on two successive days.
3. The interval between these observations gives approximately one **mean solar day**, which is about 24 hours.

13. A city has suffered severe flooding. Explain how artificial satellites could help authorities before and during such a disaster.

Answer:

1. Earth-observing satellites can provide images and information useful for **weather monitoring and disaster management**.
2. Satellites such as the Cartosat series provide high-quality images that can help in mapping affected areas and understanding terrain and land use.
3. Such information can support authorities in planning and managing responses to natural disasters.

14. Artificial satellites are extremely useful, yet launching more and more satellites can create problems. Analyse this statement.

Answer:

1. Artificial satellites provide important services such as communication, navigation, weather monitoring, disaster management and scientific research.
2. After their useful life, satellites and rocket parts may remain in space as **space debris** and can collide with working satellites.
3. Therefore, the benefits of satellites must be accompanied by efforts to manage and remove dangerous space debris.

15. If the Moon completes its phase cycle in about 29.5 days, why can 12 lunar months not make a solar year?
Answer:
1. Twelve lunar months together contain approximately **354 days**.
2. A solar year based on Earth's revolution and seasonal cycle is approximately **365¼ days**, creating a difference of about 11 days.
3. Therefore, 12 lunar months cannot exactly match a solar year, which explains the need for adjustments in luni-solar calendars.

16. A student sees the Moon in the daytime and concludes that something unusual has happened. Is the conclusion correct? Give reasons.
Answer:
1. No, seeing the Moon during daytime is a **normal astronomical occurrence**.
2. The Moon rises at different times on different days and can sometimes rise during the afternoon.
3. If its illuminated portion is visible and sufficiently separated from the Sun in the sky, the Moon can be observed even while the Sun is above the horizon.

17. Ancient people did not have modern telescopes or knowledge of Earth’s revolution. How were they still able to develop useful calendars?
Answer:
1. Ancient people carefully observed repeating patterns in the positions of the Sun, Moon and stars over long periods.
2. They recognised regular events such as lunar phases, seasonal changes, solstices and changes in the Sun's rising position.
3. By recording these predictable cycles, they could estimate the length of the year and develop calendars even without modern instruments.

11.11 Five-mark questions with Answers of LOTS Type: (10 Questions)

1. Explain the phases of the Moon.
Answer:
1. The changing shapes of the bright portion of the Moon as seen from Earth are called the **phases of the Moon**.
2. The Moon does not produce its own light but shines by **reflecting sunlight**.
3. As the Moon revolves around Earth, we see different fractions of its illuminated portion.
4. The main phases include the **new Moon, crescent, half Moon, gibbous Moon and full Moon**.
5. A complete cycle of the Moon's phases takes about **29.5 days or nearly one month**.

2. Describe the waxing and waning periods of the Moon.
Answer:
1. The period during which the visible bright portion of the Moon gradually **increases** is called the **waxing period**.
2. In India, the waxing period is generally called **Shukla Paksha**.
3. The period during which the visible bright portion gradually **decreases** is called the **waning period**.
4. The waning period is generally called **Krishna Paksha** in India.
5. The Moon continuously passes through waxing and waning periods, and the cycle from one full Moon to the next takes about a month.

3. Explain how natural astronomical cycles form the basis for measuring a day, a month and a year.
Answer:

1. Earth's rotation causes the apparent daily movement of the Sun across the sky and provides the basis for measuring a **day**.
2. The average interval between the Sun's highest positions on two successive days is about **24 hours**, called a mean solar day.
3. The Moon takes about **29.5 days** to complete one cycle of its phases, which forms the basis of a **month**.
4. Earth takes nearly **365¼ days** to complete one revolution around the Sun.
5. During this period, Earth undergoes one cycle of seasons, which is used to define a **solar year**.

4. Describe the main features of a lunar calendar.

Answer:

1. A **lunar calendar** is based mainly on the cycle of the phases of the Moon.
2. One lunar month lasts approximately **29.5 days**.
3. A lunar year consists of **12 lunar months**.
4. A lunar year is about **354 days long**, whereas the seasonal cycle takes approximately 365 days.
5. Therefore, the seasons do not remain synchronised with the same lunar months in successive lunar years.

5. Explain the main features of a solar calendar and the importance of a leap year.

Answer:

1. A **solar calendar** is based on Earth's revolution around the Sun and is designed to remain synchronised with the seasons.
2. The widely used **Gregorian calendar** is an example of a solar calendar.
3. An ordinary Gregorian year contains **365 days**, while Earth actually takes nearly an extra quarter of a day to complete one revolution.
4. These extra hours accumulate to approximately one full day every four years.
5. Therefore, an extra day is added to February in a **leap year**, giving February 29 days and helping the calendar remain synchronised with the seasons.

6. What is a luni-solar calendar? Explain its important features.

Answer:

1. A **luni-solar calendar** primarily uses the phases of the Moon for counting days and months while also remaining connected with the seasonal cycle.
2. Twelve lunar months contain approximately **354 days**, about 11 days fewer than a solar year.
3. Over two to three years, this difference accumulates to nearly one complete month.
4. Therefore, an additional month called **Adhika Maasa or intercalary month** is added every few years.
5. This adjustment keeps the lunar cycle and solar year in step, and such calendars are used in many parts of India.

7. Describe the Indian National Calendar.

Answer:

1. The **Indian National Calendar** is a solar calendar used by the Government of India along with the Gregorian calendar for various official purposes.
2. It consists of **365 days** in a regular year and normally begins on **22 March**.
3. Its months have either **30 or 31 days**, and their names are taken from traditional Indian calendars.
4. In a regular year, the second to sixth months contain 31 days, while the remaining months contain 30 days.
5. During a leap year, an additional day is added to **Chaitra**, and the year begins on 21 March.

8. Explain how Indian festivals are related to the phases of the Moon.
Answer:
1. Many Indian festivals are connected with particular **phases of the Moon** and therefore follow lunar or luni-solar calendars.
2. **Diwali** falls on the new Moon of the month of Kartika.
3. **Holi** is celebrated on the full Moon of Phalguna, while **Buddha Purnima** occurs on the full Moon of Vaisakha.
4. **Eid-ul-Fitr** is celebrated after sighting the crescent Moon at the end of the month of Ramazan.
5. Since lunar and luni-solar calendars do not exactly correspond with the Gregorian calendar, these festivals may occur on different Gregorian dates in successive years.

9. Describe the uses of artificial satellites.
Answer:
1. Artificial satellites are **human-made objects** launched into space to orbit Earth.
2. They are used for **communication and navigation**.
3. They help in **weather monitoring and disaster management**.
4. Satellites such as the **Cartosat series** provide high-quality images useful for mapping, city planning and studying terrain, soil, land use and vegetation.
5. Scientific satellites such as **AstroSat** are used to observe stars and other celestial objects and support space-science research.

10. What is space debris? Describe its causes and problems.
Answer:
1. Old artificial satellites and rocket parts left in space after their useful life are called **space junk or space debris**.
2. The amount of space debris increases as more satellites and rockets are launched.
3. Space debris can **collide with working satellites** and damage them.
4. Smaller pieces may burn up in Earth's atmosphere, while larger pieces can sometimes reach the ground.
5. Countries are therefore working together to find ways of **removing dangerous space debris**.

11.12 Five-mark questions with Answers of HOTS Type: (10 Questions)

1. A student says, “The phases of the Moon occur because Earth’s shadow falls on the Moon.” Do you agree? Justify your answer.
Answer:
1. No, the statement is incorrect because the phases of the Moon are **not caused by Earth’s shadow**.
2. Half of the Moon is always illuminated by sunlight, while the other half remains non-illuminated.
3. As the Moon revolves around Earth, we see different fractions of its illuminated portion.
4. This changing visible illuminated portion produces the different phases such as crescent, half Moon, gibbous and full Moon.
5. Earth’s shadow falling on the Moon causes a **lunar eclipse**, whereas the regular phases result from the changing relative positions of the Sun, Earth and Moon.

2. Rahul observes a full Moon today. Predict how the Moon will appear during the next two weeks and explain your reasoning.
Answer:

1. After the full Moon, the visible bright portion of the Moon will gradually **decrease** each day.
2. After about one week, approximately half of the illuminated portion will be visible from Earth.
3. It will then become a **waning crescent** as the illuminated portion continues to decrease.
4. After about two weeks, the illuminated portion facing Earth will no longer be visible, resulting in a **new Moon**.
5. This happens because the Moon changes its position relative to Earth and the Sun as it revolves around Earth.

3. Suppose a farmer wants a calendar that will help him predict seasons accurately. Would a purely lunar calendar be the best choice? Give reasons.

Answer:

1. A purely lunar calendar would **not be the best choice** if the farmer needs the calendar months to remain synchronised with seasons.
2. A lunar month is approximately 29.5 days, and 12 lunar months make a year of about **354 days**.
3. The seasonal cycle, however, takes approximately **365 days**, creating a difference of about 11 days each year.
4. Therefore, the same season will not remain associated with the same lunar months in successive years.
5. A **solar or luni-solar calendar** would be more suitable because it makes use of the seasonal cycle or makes adjustments to remain synchronised with it.

4. Why is an extra month added every few years in a luni-solar calendar? What would happen if this adjustment were not made?

Answer:

1. Twelve lunar months contain approximately **354 days**, whereas a solar year is about 365 days long.
2. Thus, the lunar year falls short of the solar year by nearly **11 days every year**.
3. In about two to three years, this difference accumulates to nearly one complete month.
4. Therefore, an extra month called **Adhika Maasa or intercalary month** is added every few years to keep the lunar and solar cycles in step.
5. Without this adjustment, the calendar months and festivals based on it would gradually **shift away from the corresponding seasons**.

5. A child observes that the Moon rises later today than it did yesterday. Explain why this happens.

Answer:

1. Earth completes one rotation around its axis in approximately **24 hours**.
2. During the same period, the Moon also moves forward in its orbit around Earth.
3. Therefore, after Earth completes one rotation, the Moon is no longer at exactly the same position in the sky as on the previous day.
4. Earth has to rotate a little more before the Moon appears at nearly the same position again.
5. As a result, the Moon takes about **50 minutes longer each day** to return to nearly the same position in the sky.

6. Diwali does not fall on the same Gregorian date every year, whereas festivals based on solar calendars occur on almost the same date. Analyse the reason.

Answer:

1. Diwali is associated with the **new Moon of Kartika** and therefore follows a lunar or luni-solar calendar.

2. The lunar cycle does not exactly match the length of the Gregorian solar year.
3. Therefore, the corresponding lunar date shifts with respect to the Gregorian calendar from one year to another.
4. Luni-solar calendars periodically add an intercalary month to correct the difference between lunar and solar years.
5. In contrast, festivals based on solar calendars occur on almost the same Gregorian dates because both are connected with the **solar year**.

7. Imagine that leap years were removed from the Gregorian calendar. Predict what would happen over a long period and explain why.
Answer:
1. Earth takes approximately **365 days and an extra quarter of a day** to complete one revolution around the Sun.
2. If every calendar year were fixed at exactly 365 days, these extra hours would accumulate year after year.
3. Approximately one additional day of difference would develop every four years.
4. Over a long period, calendar dates would gradually move away from the **actual seasonal cycle**.
5. Therefore, leap years are necessary to add an extra day periodically and keep the Gregorian calendar closely synchronised with the seasons.

8. Two students in different parts of Earth observe the Moon on the same day. Will they see completely different phases? Give reasons.
Answer:
1. They will generally see **nearly the same phase of the Moon** on the same day.
2. Earth completes one rotation in about one day, allowing people at different places to face the Moon at different times.
3. The Moon, however, takes nearly **one month** to complete one revolution around Earth.
4. Therefore, its position in its orbit changes only a relatively small amount during one Earth day.
5. Hence, people in different parts of Earth see nearly the same fraction of the Moon's illuminated portion and therefore nearly the same lunar phase.

9. A student sees a bright point moving rapidly across the night sky. How could the student reason that it may be an artificial satellite rather than a star?
Answer:
1. Stars generally appear to maintain their positions relative to one another during a short period of observation, while an artificial satellite can be seen **moving rapidly across the sky**.
2. Artificial satellites may appear as small points of light with steady or flickering brightness.
3. Many satellites orbit Earth at about **800 km above its surface** and take roughly 100 minutes to complete an orbit.
4. The student can observe whether the point of light moves noticeably across the background of stars.
5. The observation can also be checked using satellite-tracking information that gives the time when satellites are expected to pass over a particular location.

10. Increasing numbers of artificial satellites are being launched into space. Analyse one major problem this may create and suggest why international cooperation is necessary.
Answer:
1. After completing their useful life, some satellites and rocket parts remain in orbit as **space junk or space debris**.

2. As more objects are launched, the amount of debris around Earth can increase.
3. This debris can collide with functioning satellites and damage systems used for communication, navigation, weather monitoring and scientific research.
4. While small pieces may burn up in the atmosphere, larger pieces can sometimes reach Earth's surface.
5. Since space is used by many countries, **international cooperation is necessary** to reduce and remove dangerous debris and protect useful satellites.

11.13 Five-mark questions with Answers of Applied Type: (10 Questions)

1. Riya wants to observe the Moon for a month and record its changing phases. How should she carry out this activity?

Answer:

1. Riya should begin observing the Moon from the sunrise after a **full Moon day** and look towards the western sky.
2. She should record the **date and time** of each observation in a table.
3. She should draw and shade the Moon to represent the **bright portion visible** on each day.
4. She should note whether the bright portion is **increasing or decreasing** compared with the previous day.
5. She should also observe whether the Moon appears **closer to or farther from the Sun** than on the previous day.

2. Arun wants to demonstrate the phases of the Moon to his classmates using simple materials. Explain how he can do this.

Answer:

1. Arun can use a **small ball as the Moon**, a lamp or torch as the Sun, and his head as the Earth.
2. He should hold the ball at arm's length slightly above his head while standing near the light source.
3. He should slowly turn around while continuously observing the illuminated portion of the ball.
4. When the ball is opposite the lamp, its fully illuminated portion will be visible, representing the **full Moon**.
5. When the ball is towards the lamp, its illuminated portion will not be visible to him, representing the **new Moon**.

3. A farmer wants to know the approximate time of midday without using a clock. How can the position of the Sun and shadows help him?

Answer:

1. The farmer can place a **vertical stick** in an open area receiving sunlight throughout the day.
2. He can observe the shadow of the stick at regular intervals around midday.
3. As the Sun rises higher in the sky, the length of the shadow gradually decreases.
4. The shadow becomes **shortest when the Sun reaches its highest position in the sky**.
5. Therefore, by identifying the time of the shortest shadow, he can estimate the Sun's highest position and use this natural cycle for timekeeping.

4. A calendar based only on the Moon has 12 lunar months. Explain how you would determine why its seasons shift compared with a solar calendar.

Answer:

1. One lunar month is approximately **29.5 days** long.
2. Therefore, 12 lunar months make a lunar year of approximately **354 days**.

3. A solar year, based on Earth's revolution around the Sun, is approximately **365 days** long.
4. Thus, the lunar year is about **11 days shorter** than the solar year.
5. Because of this difference, seasons do not remain associated with the same lunar months in successive lunar years.

5. Your school wants to explain why February sometimes has 29 days. How would you explain the practical need for a leap year?

Answer:

1. Earth takes approximately **365 and a quarter days** to complete one revolution around the Sun.
2. A normal calendar year contains only **365 days**, leaving approximately a quarter of a day unaccounted for.
3. These extra hours accumulate to approximately **one complete day in four years**.
4. Therefore, an extra day is added to February, making it **29 days in a leap year**.
5. This adjustment helps the Gregorian calendar remain properly **synchronised with the seasons**.

6. A family notices that Diwali falls on different Gregorian dates every year. Apply your knowledge of calendars to explain this.

Answer:

1. Diwali is celebrated on the **new Moon of the month of Kartika**.
2. Its date is therefore determined using a calendar connected with the **phases of the Moon**.
3. The lunar cycle does not exactly match the length of the Gregorian solar year.
4. Luni-solar calendars periodically use an **intercalary month** to adjust the difference between lunar and solar years.
5. Therefore, Diwali and many other Indian festivals occur on **different Gregorian dates in successive years**.

7. Suppose you are outside just after sunset and want to identify an artificial satellite in the sky. What observations would help you identify it?

Answer:

1. First, choose a place with a **clear view of the sky**, away from obstructions such as tall buildings and trees.
2. Observe the sky just after sunset and look for a **small point of light**.
3. Unlike an ordinary star, an artificial satellite will appear to **move rapidly across the sky**.
4. Its brightness may appear steady or may flicker, and it can often be observed with the naked eye or binoculars.
5. A satellite-tracking mobile app or website can also be used to check **when a satellite will pass over the location**.

8. A cyclone is approaching a coastal region. Explain how artificial satellites can be applied to help people and authorities in such a situation.

Answer:

1. Artificial satellites are used for **weather monitoring** and can provide useful information about changing weather conditions.
2. Satellite observations can support authorities in **disaster management** during events such as cyclones.
3. Satellites such as the **Cartosat series** provide high-quality images of Earth's surface.
4. Mapping platforms such as **Bhuvan** use satellite images to provide information about terrain, land use and vegetation.

5. Such satellite-based information can therefore assist authorities in **planning and managing natural disasters more effectively**.

9. Your town is preparing its annual calendar of festivals. Explain how knowledge of astronomical phenomena can help in fixing festival dates.

Answer:

1. Many Indian festivals are linked to particular **phases of the Moon**.
2. For example, Diwali occurs on a new Moon, while Holi and Buddha Purnima occur on full Moon days of particular lunar months.
3. Some festivals are therefore determined using **lunar or luni-solar calendars** rather than fixed Gregorian dates.
4. The exact lunar phase at sunrise may even cause festival dates to differ by a day between different regions.
5. Astronomical calculations of the positions of the **Sun and Moon** are therefore useful for determining festival dates accurately.

10. A working satellite is in danger because of increasing space debris. Explain how this problem develops and why it needs to be controlled.

Answer:

1. Many artificial satellites and rocket parts remain in space after completing their useful life.
2. These unused objects become **space junk or space debris** orbiting Earth.
3. Increasing amounts of debris can collide with and damage **working satellites**.
4. Small pieces may burn up in Earth's atmosphere, while larger pieces may sometimes reach the ground.
5. Therefore, countries need to **work together to remove dangerous debris** and make the space around Earth safer for functioning satellites.

11.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

Olympiad-Type MCQs – Chapter 11: Keeping Time with the Skies

1. A student observes the Moon at sunrise on four successive days after a full Moon. Which change is she most likely to notice?

A. The illuminated portion increases and the Moon moves farther from the Sun
B. The illuminated portion decreases and the Moon appears closer to the Sun
C. The illuminated portion remains unchanged
D. The Moon disappears immediately after the full Moon

Answer: B

Explanation: During the waning period, the visible bright portion decreases, and at sunrise the Moon appears progressively closer to the Sun.

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2. The Moon is spherical, yet it appears as a crescent on some days. What is the best explanation?

A. Earth's shadow covers most of the Moon every month.
B. Clouds permanently cover parts of the Moon.
C. We see only part of the Moon's sunlit half from Earth.
D. The Moon physically changes its shape.

Answer: C

Explanation: Half of the Moon is illuminated by the Sun, but the fraction of that illuminated half visible from Earth changes as the Moon revolves around Earth.

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3. A student sees more than half, but not all, of the illuminated portion of the Moon. Which phase is being observed?
A. Crescent
B. Gibbous
C. New Moon
D. Half Moon
Answer: B

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4. If the Moon is in its waning phase, when would it generally be easiest to observe?
A. At sunrise
B. At noon only
C. At sunset
D. At midnight only
Answer: A
Explanation: A waxing Moon is easiest to spot around sunset, whereas a waning Moon is easiest to spot around sunrise.

---

5. The Moon rises approximately 50 minutes later each successive day. If it rises at 2:10 p.m. today, its approximate moonrise time tomorrow will be:
A. 2:20 p.m.
B. 2:50 p.m.
C. 3:00 p.m.
D. 3:50 p.m.
Answer: C
Explanation: 2:10 p.m. + 50 minutes = **3:00 p.m.**

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6. A student says, "The phases of the Moon occur because Earth's shadow repeatedly falls on the Moon." Which observation most strongly disproves this statement?
A. The Moon revolves around Earth.
B. Lunar eclipses can occur only on full Moon days and do not occur every month.
C. The Moon reflects sunlight.
D. Earth rotates once in about 24 hours.
Answer: B
Explanation: Earth's shadow causes a **lunar eclipse**, not ordinary Moon phases. Moon phases result from changing Sun–Moon–Earth geometry.

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7. Which sequence correctly represents the natural astronomical cycles used to define a day, month and year respectively?
A. Moon's rotation → Earth's rotation → Earth's revolution
B. Earth's rotation → Moon's phases → Earth's revolution
C. Earth's revolution → Moon's rotation → Earth's rotation
D. Sun's rotation → Moon's revolution → Earth's rotation
Answer: B
Explanation: Earth's rotation provides the cycle underlying a day, the Moon's phase cycle gives a month, and Earth's revolution and seasonal cycle define a year.

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8. Four students measure the length of the shadow of a vertical stick at different times. When the shadow is shortest, the Sun is:
A. nearest the horizon
B. at its highest position in the sky

C. setting in the west
D. rising in the east
Answer: B

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9. A lunar year consists of 12 lunar months, each approximately 29.5 days long. Its approximate duration is:
A. 345 days
B. 354 days
C. 365 days
D. 365.25 days
Answer: **B**
Calculation: $12 \times 29.5 =$ **354 days**.

---

10. A purely lunar calendar falls behind a solar calendar by approximately how many days every year?
A. 5 days
B. 7 days
C. 11 days
D. 29.5 days
Answer: **C**
Explanation: Solar year ≈ 365 days; lunar year ≈ 354 days. Difference ≈ **11 days**.

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11. Why is an extra month required every few years in some luni-solar calendars?
A. A lunar month is longer than a solar year.
B. The lunar year is about 11 days shorter than the solar year.
C. Earth rotates slower every few years.
D. The Moon stops revolving around Earth periodically.
Answer: B
Explanation: The annual difference accumulates until it approaches a full month, so an **Adhika Maasa/intercalary month** is added.

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12. Which calendar would be most suitable for a society that wants its agricultural seasons to remain associated with approximately the same months every year?
A. Pure lunar calendar
B. Solar calendar
C. Calendar containing exactly 354 days
D. Calendar based only on Moon phases
Answer: B
Explanation: Solar calendars were developed because keeping the year synchronised with seasons was important, particularly for agriculture.

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13. Consider the following years:
1700, 1800, 1900, 2000
According to the Gregorian calendar correction described in the chapter, which one is a leap year?
A. 1700
B. 1800
C. 1900
D. 2000

Answer: D
Explanation: Century leap years are skipped unless divisible by 400. Thus, **2000** is a leap year.

---

14. The tropical year and sidereal year differ by approximately:
A. 20 seconds
B. 20 minutes
C. 24 hours
D. 29.5 days
Answer: B
Explanation: The chapter states that the sidereal year is about **20 minutes longer** than the tropical year.

---

15. Which combination is correctly matched?
A. Tropical year — time for one complete cycle of Moon phases
B. Sidereal year — time for the same stars to rise again at sunset
C. Mean solar day — exactly one lunar revolution
D. Lunar month — one revolution of Earth around the Sun
Answer: B

---

16. In a luni-solar calendar, 12 lunar months total approximately 354 days. If no correction were made for three years, the accumulated difference from a 365-day solar year would be approximately:
A. 11 days
B. 22 days
C. 29.5 days
D. 33 days
Answer: D
Calculation: 11 days/year × 3 years = **33 days**. This explains why an extra month is periodically required.

---

17. In an **Amant** calendar, a new month begins:
A. on the full Moon day
B. on the first day after the new Moon
C. on the day after the full Moon
D. only on the spring equinox
Answer: B
Explanation: In Amant calendars, the month starts on the first day after the new Moon and ends on the new Moon.

---

18. Which statement about the Indian National Calendar is correct?
A. It is a purely lunar calendar.
B. It normally begins on 22 March and contains 365 days.
C. Every month contains 31 days.
D. Its leap year is independent of the Gregorian calendar.
Answer: B
Explanation: It is a solar calendar of 365 days and normally begins on **22 March**.

---

19. In a leap year, what adjustment is made to the Indian National Calendar?

A. An extra month is added after Chaitra.
B. One day is added to Chaitra and the year begins on 21 March.
C. February is given 30 days.
D. The year begins on 1 January.
Answer: B

---

20. Which pair of festivals is correctly matched with the Moon phase mentioned in the chapter?
A. Diwali — Full Moon; Holi — New Moon
B. Diwali — New Moon; Holi — Full Moon
C. Diwali — Crescent Moon; Holi — New Moon
D. Both Diwali and Holi — New Moon
Answer: B
Explanation: Diwali falls on the **new Moon of Kartika**, while Holi falls on the **full Moon of Phalguna**.

---

21. Why can a festival based on a purely lunar calendar occur in different Gregorian months over successive years?
A. Gregorian months randomly change length.
B. A lunar year is shorter than a solar year and has no intercalary correction.
C. Earth's rotation changes considerably every year.
D. The lunar month becomes longer every year.
Answer: B
Explanation: Pure lunar calendars do not compensate for the difference between the 354-day lunar year and the solar year.

---

22. A festival follows a solar sidereal calendar. Which prediction is most appropriate according to the chapter?
A. It must move about 11 days every Gregorian year.
B. It will always occur on a full Moon.
C. It occurs on almost the same Gregorian date each year but may shift slowly over long periods.
D. Its date changes randomly every year.
Answer: C
Explanation: Festivals such as Makar Sankranti follow a solar sidereal calendar and occur on almost the same Gregorian date, although their dates slowly shift over long periods.

---

23. Makar Sankranti moves ahead by approximately one day every 71 years. If this trend continues, the accumulated shift over approximately 213 years would be:
A. 1 day
B. 2 days
C. 3 days
D. 7 days
Answer: C
Calculation: 213 ÷ 71 = **3 days**.

---

24. An artificial satellite completes one orbit of Earth in approximately 100 minutes. Approximately how many complete orbits can it make in 24 hours?
A. 10
B. 12

C. 14
D. 24
Answer: C
Calculation: 24 hours = 1440 minutes.
1440 ÷ 100 = 14.4, so it completes approximately **14 complete orbits**. The chapter notes that many satellites orbit at about 800 km altitude and take roughly 100 minutes per orbit.

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25. A scientist wants high-quality images of Earth's surface for improving maps, city planning and disaster management. Which satellite series mentioned in the chapter would be most appropriate?
A. AstroSat
B. Cartosat
C. Aditya-L1
D. Chandrayaan
Answer: **B**
Explanation: The **Cartosat** series captures high-quality Earth images useful for mapping, urban planning and disaster management.
Answer Key

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.
1	B	6	B	11	B	16	D	21	B
2	C	7	B	12	B	17	B	22	C
3	B	8	B	13	D	18	B	23	C
4	A	9	B	14	B	19	B	24	C
5	C	10	C	15	B	20	B	25	B

11.15 Best Practices Opportunity List from the Chapter: (8 Ideas)

The chapter **"Keeping Time with the Skies"** offers excellent opportunities for activity-based, experiential and interdisciplinary teaching because it covers Moon phases, observation of shadows, calendars, festivals, satellites and Indian scientific heritage.
Suggested "Best Practices" Opportunities:

(1) **Moon Observation Diary – Learning Beyond the Classroom:**
Students can maintain a **30-day Moon Observation Diary**, recording the date, time, visible shape of the Moon, waxing/waning phase and its apparent position. They may photograph or sketch the Moon and finally prepare a phase chart. This directly extends the chapter's suggested observation activity.

(2) **Learning by Doing – Sun–Earth–Moon Working Model:**
Use a **torch/lamp, globe and ball** to simulate the Sun, Earth and Moon. Students physically change the Moon's position and predict whether they will observe a full Moon, crescent, gibbous or new Moon. This helps eliminate the common misconception that Moon phases are caused by Earth's shadow.

(3) **"Be an Astronomer" – Shadow and Solar-Day Experiment:**
Create a simple school **shadow-observation station** using a one-metre vertical stick. Student teams measure the shadow at regular intervals, identify the shortest shadow and relate it to the Sun's highest position and the concept of a mean solar day.

(4) **Calendar Investigation Project – Mathematics + Science + Culture:**
Divide the class into groups to investigate **lunar, solar and luni-solar calendars**. Students can compare their duration, leap-year/intercalary corrections and relationship

with seasons, then present their findings through posters or comparative charts. This develops mathematical reasoning alongside scientific understanding.

(5) **Festival Astronomy – Connecting Science with Everyday Life:**
Ask students to select festivals such as **Diwali, Holi, Buddha Purnima, Eid-ul-Fitr or Makar Sankranti** and investigate why their Gregorian dates change—or remain nearly constant—from year to year. This provides an excellent **Indian Knowledge Systems (IKS) and interdisciplinary learning opportunity**.

(6) **Digital Astronomy – Technology-Enabled Learning:**
Students can use suitable astronomy applications/web resources to predict **moonrise times and visible satellite passes**, and then verify the predictions through actual observations. The chapter itself encourages using digital resources to identify satellites visible from one's location.

(7) **ISRO Mission Challenge – Research and Presentation:**
Assign groups different Indian space missions such as **Cartosat, AstroSat, Chandrayaan, Aditya-L1 or Mangalyaan**. Each group can prepare a two-minute presentation explaining the mission's purpose and its benefit to society. This connects textbook learning with India's achievements in space science.

(8) **Misconception Challenge – Predict, Discuss, Demonstrate:**
Begin lessons with statements such as **"The Moon can be seen only at night," "Moon phases are caused by Earth's shadow,"** or **"The Moon always rises when the Sun sets."** Students first vote True/False, justify their answers, perform observations/models, and then revisit their original responses. This turns misconceptions into inquiry opportunities.

For a school **Best Practices record**, I would especially recommend documenting **Moon Observation Diary, Sun–Earth–Moon Working Model, Shadow Observation Station, Festival Astronomy Project, and Digital Satellite Tracking** because all five produce clear evidence of experiential and student-centred learning.

11.16 Innovations Opportunity List from the Chapter: (10 Ideas)

For the Grade 8 Science chapter **"Keeping Time with the Skies,"** the following can be introduced as **innovative teaching-learning opportunities**. The chapter itself begins by encouraging students to question how the Moon, Sun and other natural cycles can be used to understand time.

Innovations in Teaching–Learning:

(1) **"Moon Lab" – Month-long Citizen Science Project:**
Convert students into young astronomers by creating a class **Moon Lab**. Students photograph or sketch the Moon from home, record its phase, time and position, and collaboratively build a **30-day digital Moon-phase timeline**. This innovatively extends the textbook's Moon-observation activity.

(2) **Human Solar-System Simulation – Students Become Celestial Bodies:**
Instead of merely showing a model, students themselves can become the **Sun, Earth and Moon**. Using a lamp as the Sun and students physically rotating/revolving, the class can simulate waxing, waning, full Moon and new Moon. The activity can culminate in students explaining why phases result from the changing Sun–Moon–Earth orientation.

(3) **AR/Virtual Sky Classroom – "Travel into Space":**

Use an astronomy app, planetarium software or AR/VR resource to create a **virtual sky laboratory**. Students can change dates and times to predict the Moon's position and then compare the digital prediction with real observations. This is particularly suitable because the chapter itself recommends digital tools for identifying visible satellites.

(4) **Design Your Own Calendar – STEAM Innovation Challenge:**
Give groups the challenge: **"Imagine you are starting a civilisation on another planet. Design its calendar."** Students must decide how to define a day, month, year and leap year based on hypothetical astronomical cycles. They then compare their inventions with lunar, solar and luni-solar calendars. The chapter explains how Earth's rotation, Moon phases and Earth's revolution provide the natural basis for day, month and year.

(5) **Festival Astronomy Digital Map – Science Meets Indian Culture:**
Students create an interactive **"Astronomy Behind Indian Festivals"** chart or digital presentation. They can connect Diwali with new Moon, Holi and Buddha Purnima with full Moon, Eid-ul-Fitr with crescent sighting, and other festivals with solar/lunar calendars. This becomes an innovative integration of **Science + IKS + Culture + ICT**.

(6) **Build a Smart Sundial – Ancient Science Meets Modern Technology:**
After carrying out the textbook's shadow experiment, students can construct a simple **sundial** and compare its indicated time with a digital clock. Advanced groups can record shadow length and time in a spreadsheet and create graphs to determine when the Sun reaches its highest position.

(7) **Satellite Tracker Challenge – Classroom to Real Sky:**
Students use a satellite-tracking application to predict when an artificial satellite will pass over their location. They then attempt an actual supervised observation and maintain a **Satellite Spotting Log**. The chapter specifically describes satellite spotting and recommends apps/websites for predicting visible passes.

(8) **Space-Debris Design Thinking Challenge:**
Introduce a real-world problem: **"How can we clean up space?"** Teams identify problems caused by dead satellites and rocket parts, brainstorm solutions, draw prototypes and pitch their ideas as young space engineers. This converts the chapter's discussion of space debris into **problem-based and design-thinking learning**.

(9) **"Myth or Science?" Interactive Classroom Game:**
Create QR-code stations or digital quizzes containing statements such as *"The Moon is visible only at night," "Earth's shadow causes Moon phases,"* and *"The Moon rises at the same time every day."* Students vote, investigate and experimentally defend their answers. The chapter explicitly addresses the misconception that Earth's shadow causes Moon phases.

(10) **Student Space Mission – From Learner to Mission Designer:**
After learning about Cartosat, AstroSat, Chandrayaan, Aditya-L1 and student-built satellites, teams can invent a **mini satellite mission**. They decide the satellite's name, purpose, instruments, orbit and social benefit, and present a mission poster/model. This promotes creativity while connecting learning with India's space programme.

For a formal **lesson-plan/academic documentation format**, the strongest five innovations could be recorded as: **Moon Lab – Citizen Science, Human Solar-System Simulation, Virtual Sky/AR Learning, Design Your Own Calendar – STEAM Challenge, and Satellite Tracker & Space Mission Design.** These demonstrate technology integration, experiential learning, inquiry, creativity and student-led learning rather than simply repeating the textbook activities.

11.17: Practicing Questions/Question Bank

A. Fill in the Blanks — 1 Mark Each:

1. The changing shapes of the bright portion of the Moon as seen from Earth are called the __________ of the Moon.
   Answer: phases

2. The period during which the bright portion of the Moon increases is called the __________ period.
   Answer: waxing

3. In India, the waxing period of the Moon is called __________.
   Answer: Shukla Paksha

4. The waning period of the Moon is generally called __________ in India.
   Answer: Krishna Paksha

5. The day on which the Moon appears as a full bright circle is called __________.
   Answer: Purnima / Full Moon day

6. The day on which the illuminated portion of the Moon cannot be seen from Earth is called __________.
   Answer: Amavasya / New Moon day

7. The Moon takes about __________ days to complete one cycle of its phases.
   Answer: 29.5 days

8. The average time between two successive highest positions of the Sun in the sky is called a __________.
   Answer: mean solar day

9. A lunar year consists of __________ lunar months.
   Answer: 12

10. A lunar year is approximately __________ days long.
    Answer: 354 days

11. The Gregorian calendar is a __________ calendar.
    Answer: solar

12. The extra month added to some luni-solar calendars is called __________.
    Answer: Adhika Maasa / intercalary month

13. The Indian National Calendar is based on the __________ Era.
    Answer: Shaka

14. The Indian National Calendar normally begins on __________.
    Answer: 22 March

15. __________ is known as the Father of the Indian Space Programme.
    Answer: Vikram Sarabhai

16. The __________ series of satellites is used to obtain high-quality images of Earth.
    Answer: Cartosat

17. India's space observatory used to study stars and other celestial objects is called __________.
    Answer: AstroSat

18. Unwanted artificial objects remaining in space are commonly called space __________.
    Answer: debris / junk

These questions reflect the chapter's treatment of Moon phases, calendars and artificial satellites.

B. One-Mark Questions:

1. What are the phases of the Moon?
2. What is meant by waxing of the Moon?
3. What is meant by waning of the Moon?
4. What is Purnima?
5. What is Amavasya?
6. Name the two main periods in the cycle of Moon phases.
7. Why does the Moon shine?
8. How long does one complete cycle of Moon phases take?
9. Which Moon phase is called the gibbous phase?
10. Which Moon phase is called the crescent phase?
11. Approximately how much later does the Moon return to nearly the same position in the sky each day?
12. What is a mean solar day?
13. How long does Earth take to complete approximately one revolution around the Sun?
14. What is a lunar calendar?
15. How many days are there approximately in a lunar year?
16. What is a solar calendar?
17. What is a leap year?
18. What is Adhika Maasa?
19. Name the first month of the Indian National Calendar.
20. Name any one Indian festival associated with the full Moon.
21. Name any one festival associated with the new Moon.
22. What is Earth's natural satellite?
23. What is an artificial satellite?
24. Name any two uses of artificial satellites.
25. Who is known as the Father of the Indian Space Programme?
26. What is space debris?

The chapter explains that the Moon's phases result from seeing different fractions of its illuminated portion as it revolves around Earth.

C. Two-Mark Questions:

1. **Differentiate between waxing and waning of the Moon.**
2. **Why does the Moon appear to change its shape even though the Moon itself does not change shape?**
3. **Why is the Moon not visible on a new Moon day?**
4. **What is the difference between a crescent Moon and a gibbous Moon?**
5. **Why can we sometimes see the Moon during the daytime?**
6. **Why does the Moon rise approximately 50 minutes later each day?**
7. **Mention two natural astronomical cycles that humans have used for measuring time.**
8. **How is the length of a mean solar day determined using the Sun's position?**
9. **Differentiate between a lunar calendar and a solar calendar.**
10. **Why is a leap day added to the Gregorian calendar approximately every four years?**
11. **Why does a lunar year not remain synchronised with the seasons?**
12. **What is Adhika Maasa? Why is it added to some calendars?**
13. **Mention any two features of the Indian National Calendar.**
14. **Why do festivals such as Diwali and Holi occur on different Gregorian dates in successive years?**
15. **Give any four uses of artificial satellites.**
16. **What is space debris? Mention one danger caused by it.**
17. **Distinguish between the Moon and an artificial satellite.**
18. **State any two contributions/uses of the Cartosat series of satellites.**

The textbook relates a **day** to Earth's rotation, a **month** to the Moon's approximately 29.5-day phase cycle, and a **solar year** to Earth's approximately 365¼-day revolution around the Sun.

D. Three-Mark Questions:

1. **Explain how the phases of the Moon are formed.**
2. **Explain why Earth's shadow is not responsible for the phases of the Moon.**
3. **Describe the positions of the Sun, Earth and Moon during a full Moon and a new Moon. Draw simple diagrams.**
4. **Explain why a waxing Moon is easier to observe at sunset and a waning Moon at sunrise.**

5. **Explain how the natural movements of the Earth and Moon provide us with the units day, month and year.**
6. **Describe an activity using a stick and its shadow to determine when the Sun is at its highest position in the sky.**
7. **Explain how a lunar calendar is constructed. Why does it gradually move out of synchronisation with the seasons?**
8. **Explain how the concept of a leap year helps a solar calendar remain synchronised with the seasons.**
9. **What is a luni-solar calendar? Explain how Adhika Maasa helps it remain synchronised with the solar year.**
10. **Write three important features of the Indian National Calendar.**
11. **Explain the relationship between astronomical phenomena and the dates of Indian festivals with suitable examples.**
12. **Describe three important uses of artificial satellites with examples.**
13. **Write a short note on Cartosat and AstroSat.**
14. **What is space debris? How is it produced, and why is it a matter of concern?**
15. **Write a short note on Vikram Sarabhai and his contribution to India's space programme.**

The chapter explicitly distinguishes Moon phases from eclipses: phases arise from the changing relative orientation of the Sun, Moon and Earth, whereas Earth's shadow falling on the Moon causes a lunar eclipse.

E. Five-Mark Descriptive Questions:

1. Explain the different phases of the Moon with a neat labelled diagram.

Your answer should include:

- Full Moon
- Gibbous phase
- Half Moon
- Crescent phase
- New Moon
- Waxing and waning
- Revolution of the Moon around Earth

The textbook's diagram shows how the fraction of the illuminated Moon visible from Earth changes as the Moon occupies different positions in its orbit.

2. Explain with an activity why we see different phases of the Moon.

Describe the experiment using:

- a ball representing the Moon,
- the student's head representing Earth,
- a lamp/torch representing the Sun,
- movement of the ball through different positions,
- observations of its illuminated portion, and
- the conclusion drawn from the activity.

3. Explain how astronomical cycles led to the development of calendars.

Include:

- Earth's rotation → day
- Moon's phase cycle → month
- Earth's revolution around the Sun → year
- natural periodic events
- need for systematic measurement of time.

4. Compare lunar, solar and luni-solar calendars.

Discuss:

- astronomical basis,
- approximate duration of year,
- relationship with seasons,
- need for adjustments, and
- Adhika Maasa/intercalary month.

A lunar year has 12 lunar months and about 354 days, whereas luni-solar calendars periodically add an extra month to compensate for the difference from the solar year.

5. Describe the Indian National Calendar.

Include:

- Shaka Era
- solar calendar
- 365 days
- beginning of the year
- names and lengths of months
- adjustment during leap years
- its official use in India.

6. Explain how festivals are related to astronomical phenomena.

Give examples such as:

- Diwali – new Moon
- Holi – full Moon
- Buddha Purnima – full Moon
- Eid-ul-Fitr – crescent Moon sighting
- Dussehra – tenth day of Ashwina

Also explain why their Gregorian dates may change from year to year.

7. Explain the importance of artificial satellites in our daily life and scientific development.

Discuss their role in:

- communication
- navigation
- weather monitoring
- disaster management
- mapping
- scientific research

Give suitable Indian examples such as Cartosat and AstroSat.

8. "The sky served as a natural clock and calendar long before modern clocks existed." Explain this statement.

Relate your answer to:

- apparent daily movement of the Sun,
- Earth's rotation,
- Moon phases,
- changing seasons,
- Earth's revolution, and
- development of calendars.

F. Higher-Order / Competency-Based Questions:

These would be particularly useful for an **8th-standard question bank**, because they test application rather than memorisation.

1. **Riya observes a full Moon tonight. What changes would she expect in the Moon's appearance during the next two weeks? Explain.** *(3 marks)*
2. **A student says, "The phases of the Moon occur because Earth's shadow falls on the Moon." Do you agree? Give reasons.** *(3 marks)*

3. **A farmer needs a calendar that remains closely synchronised with seasons. Would a purely lunar calendar be ideal? Justify your answer.** *(3 marks)*
4. **Twelve lunar months contain about 354 days, while a solar year is about 365 days. Calculate the approximate difference. How do luni-solar calendars compensate for this difference?** *(3 marks)*
5. **Suppose Earth stopped rotating but continued revolving around the Sun. Which natural cycle used for defining a day would be affected? Explain.** *(2 marks)*
6. **Two students observe the Moon at the same clock time on two consecutive days and find it in different positions. Explain why.** *(3 marks)*
7. **A satellite has completed its useful life but continues orbiting Earth. What problem can it create? Suggest two ways in which such objects could affect future space activities.** *(3 marks)*
8. **Why is a luni-solar calendar more effective than a purely lunar calendar for keeping lunar months broadly aligned with seasons?** *(5 marks)*

For a **complete school question bank**, I would recommend adding **MCQs, True/False with correction, Assertion–Reason, case-study questions, diagram-based questions, competency-based questions, and an answer key/marking scheme** to these five categories.

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8th Standard Science Book Chapter 12

Chapter 12: How Nature Works in Harmony

12.1 Summary of the Chapter:

Chapter 12: How Nature Works in Harmony — Summary

(1) **Habitats and their components:** A habitat is a place that provides suitable conditions for organisms to live and grow. Every habitat contains **biotic components** such as plants, animals and microorganisms, and **abiotic components** such as air, water, soil, sunlight and temperature.

(2) **Population and community:** A **population** is a group of organisms of the same kind living in a habitat at a given time. Different populations living together and interacting in the same habitat form a **community**.

(3) **Ecosystem:** The interactions between living organisms and the non-living components of their surroundings form an **ecosystem**. Ecosystems may be **aquatic**, such as ponds, rivers and lakes, or **terrestrial**, such as forests, farms and grasslands.

(4) **Interdependence in an ecosystem:** Biotic and abiotic components depend upon and influence one another. Plants require sunlight, carbon dioxide, water and soil, while plants in turn release oxygen, hold soil together, retain moisture and help prevent soil erosion.

(5) **Producers and consumers:** Green plants prepare their own food through photosynthesis and are called **producers or autotrophs**. Organisms that depend on other organisms for food are **consumers or heterotrophs**, which include herbivores, carnivores and omnivores.

(6) **Food chains and trophic levels:** A **food chain** is a simple sequence showing "who eats whom" in an ecosystem. Producers occupy the first trophic level, followed by herbivores and different levels of carnivores. For example: **Grass → Grasshopper → Frog → Snake → Eagle**.

(7) **Food webs:** Food chains in an ecosystem do not exist independently. Several food chains are interconnected to form a **food web**, showing the complex feeding relationships among organisms.

(8) **Decomposers and nutrient recycling:** Fungi, bacteria and other decomposers break down dead plants, animals and organic waste into simpler substances. This **decomposition** returns nutrients to the soil, demonstrating that in nature, materials are continuously recycled.

(9) **Balance in ecosystems:** A change in one component can produce a chain of effects throughout an ecosystem. For example, pollution may kill pond plants, reduce oxygen, decrease fish populations and increase insects. Natural and human-made changes can therefore disturb ecological balance.

(10) **Interactions among organisms:** Organisms interact through competition and other relationships. In **mutualism**, both organisms benefit; in **commensalism**, one benefits while the other is unaffected; and in **parasitism**, one benefits while the other is harmed.

(11) **Importance and protection of ecosystems:** Ecosystems provide humans with essential benefits such as **clean air, water, food, fertile soil, fibres, timber, medicines and recreational value**. Pollution, deforestation, habitat loss and overuse of resources threaten ecosystems, making conservation through protected areas important.

(12) **Sustainable farming:** Excessive use of synthetic fertilisers and pesticides, repeated monoculture, heavy irrigation and other unsustainable practices can harm soil

organisms, reduce biodiversity and disturb ecological balance. **Organic and natural farming** aim to reduce such interference and promote sustainable agriculture.

In essence, the chapter teaches that nature functions as an interconnected system in which every living organism and non-living component has a role. A disturbance in one part can affect many others; therefore, maintaining biodiversity, conserving ecosystems and using natural resources sustainably are essential for ecological balance.

12.2 Important Formulas:

Based strictly on **Chapter 12 – "How Nature Works in Harmony"**, this chapter is mainly conceptual and contains **very few mathematical formulas**. However, the activities and quantitative/application questions can require the following useful formulas and numerical relationships. The chapter asks students to count organisms in a fixed area, compare populations, and interpret changes in food chains and ecosystems.

Important Formulas / Quantitative Relationships – Chapter 12:

No.	Concept	Formula / Relationship	Use
1	**Area of a rectangular/square habitat**	**Area = Length × Breadth**	To calculate the area being surveyed
2	**Population**	**Population = Total number of individuals of the same species in a given area at a given time**	To count a particular organism
3	**Population Density**	**Population Density = Number of individuals ÷ Area surveyed**	To compare abundance of organisms in different areas
4	**Total Population**	**Total = $P_1 + P_2 + P_3 + \dots$**	To find the total number of organisms counted
5	**Difference in Population**	**Difference = Larger population − Smaller population**	To compare two populations
6	**Increase in Population**	**Increase = New population − Original population**	To measure an increase in organisms
7	**Decrease in Population**	**Decrease = Original population − New population**	To measure population decline
8	**Percentage Increase**	**% Increase = (Increase ÷ Original population) × 100**	For problems involving population growth
9	**Percentage Decrease**	**% Decrease = (Decrease ÷ Original population) × 100**	For problems involving population loss
10	**Percentage of a Particular Organism**	**Percentage = (Number of that organism ÷ Total organisms) × 100**	To determine the proportion of a species
11	**Ratio of Two Populations**	**Population Ratio = Population A : Population B**	To compare numbers of two organisms

No.	Concept	Formula / Relationship	Use
12	**Average Population**	**Average = Total number counted ÷ Number of observations/areas**	Useful when observations are made at several locations

Most important chapter-specific calculation:
The textbook specifically asks students to mark an area of **1 m × 1 m** and count the organisms found there.
Therefore:
Area surveyed = Length × Breadth
= 1 m × 1 m = 1 m²
If 20 plants are found in this area:
Population density = 20 ÷ 1 = 20 plants/m²
Quantitative relationships in food chains
The chapter also expects students to **count organisms and arrange their numbers into a pyramid**, with the highest number at the base and lowest at the top. It identifies producers as the first trophic level, herbivores as the second, small carnivores as the third, and larger carnivores at the next level.
A useful representation is:
Producer → Primary Consumer → Secondary Consumer → Tertiary Consumer
For example:
Grass → Grasshopper → Frog → Snake → Eagle

The chapter itself does **not** introduce formulas such as the **10% law of energy transfer, biomass calculations, ecological efficiency, birth rate, death rate, or exponential population growth**. Therefore, We would **not include these as required Grade 8 Chapter 12 formulas** unless the teacher wants enrichment beyond the uploaded NCERT chapter.

12.3 Fill-Up the Blank LOTS type questions with Answers: (50 Questions)

1. The place where an organism lives is called its __________.
   Answer: Habitat
2. The living components of a habitat are called __________ **components**.
   Answer: Biotic
3. The non-living components of a habitat are called __________ **components**.
   Answer: Abiotic
4. Air, sunlight, water, temperature, and soil are examples of __________ **components**.
   Answer: Abiotic
5. A group of organisms of the same kind living in a habitat at a given time is called a __________.
   Answer: Population
6. Different populations sharing the same habitat form a __________.
   Answer: Community
7. The transfer of pollen from stamens to carpels is called __________.
   Answer: Pollination
8. Pollination is essential for the formation of fruits and __________.
   Answer: Seeds
9. Biotic and abiotic components interacting with each other form an __________.
   Answer: Ecosystem

10. Ponds, rivers, and lakes are examples of __________ **ecosystems**.
    Answer: Aquatic
11. Forests and farms are examples of __________ **ecosystems**.
    Answer: Terrestrial
12. Plants prepare their own food through the process of __________.
    Answer: Photosynthesis
13. Organisms that make their own food are called producers or __________.
    Answer: Autotrophs
14. Organisms that cannot produce their own food are called consumers or __________.
    Answer: Heterotrophs
15. Animals that eat only plants are called __________.
    Answer: Herbivores
16. Animals that eat only other animals are called __________.
    Answer: Carnivores
17. Animals that eat both plants and animals are called __________.
    Answer: Omnivores
18. A simple sequence showing "who eats whom" in an ecosystem is called a __________.
    Answer: Food chain
19. The specific position occupied by an organism in a food chain is called a __________ **level**.
    Answer: Trophic
20. Producers occupy the __________ **trophic level** in a food chain.
    Answer: First
21. Herbivores such as hares and deer occupy the __________ **trophic level**.
    Answer: Second
22. Small carnivores such as frogs occupy the __________ **trophic level**.
    Answer: Third
23. Interlinked food chains in an ecosystem form a __________.
    Answer: Food web
24. Fungi and bacteria that break down dead matter are called __________.
    Answer: Decomposers
25. Decomposers are also known as __________.
    Answer: Saprotrophs
26. The process by which dead matter is broken down and nutrients are recycled is called __________.
    Answer: Decomposition
27. Organisms compete for common resources such as food, water, space, and __________.
    Answer: Sunlight
28. A relationship in which both organisms benefit is called __________.
    Answer: Mutualism
29. Honeybees and flowers are an example of __________.
    Answer: Mutualism
30. A relationship in which one organism benefits while the other remains unaffected is called __________.
    Answer: Commensalism
31. Orchids growing on trees are an example of __________.
    Answer: Commensalism

32. A relationship in which one organism benefits while the other is harmed is called __________.
    Answer: Parasitism
33. Ticks living on the body of dogs are an example of __________.
    Answer: Parasitism
34. The Sundarbans have the world's largest __________ **forests**.
    Answer: Mangrove
35. The Sundarbans are located where the Ganges and __________ rivers meet.
    Answer: Brahmaputra
36. UNESCO declared the Sundarbans a World Heritage Site in __________.
    Answer: 1987
37. National parks and wildlife sanctuaries are examples of __________ **areas**.
    Answer: Protected
38. Fish ponds, farms, and parks are examples of __________**-made ecosystems**.
    Answer: Human
39. The period in which the use of machines, synthetic fertilisers, and pesticides increased food production in India is known as the __________ **Revolution**.
    Answer: Green
40. Growing the same crop repeatedly on the same land is known as __________.
    Answer: Monoculture
41. Organic matter in soil that helps bind soil particles is called __________.
    Answer: Humus
42. The ancient text that emphasises soil health and nourishment is called __________.
    Answer: Vrikshayurveda
43. Kunapa Jala is a type of liquid __________.
    Answer: Fertiliser
44. Kunapa Jala is prepared from animal and plant waste through the process of __________.
    Answer: Fermentation
45. Wildlife corridors connect different __________ **habitats** and allow animals to move safely.
    Answer: Forest
46. Fish eat the larvae of __________.
    Answer: Dragonflies
47. Dragonflies usually eat flies, bees, and __________.
    Answer: Butterflies
48. Plants release __________ during photosynthesis.
    Answer: Oxygen
49. Plant roots help hold __________ in place and prevent erosion.
    Answer: Soil
50. Forests provide humans with fresh air, fertile soil, food, fibres, timber, and __________.
    Answer: Medicines

12.4 Fill-Up the Blank HOTS type questions with Answers: (40 Questions)

These questions are designed as **HOTS (Higher Order Thinking Skills)** fill-ups. Students need to **analyse cause-and-effect relationships, predict consequences, apply concepts, and infer answers**, rather than simply recall definitions. The chapter itself emphasizes how changes in one part of an ecosystem can produce cascading effects elsewhere.

1. If the number of fish in a pond increases, the number of dragonflies may __________ because fish feed on dragonfly larvae.
   Answer: decrease
2. If dragonflies decrease around a pond, the number of bees and butterflies is likely to __________.
   Answer: increase
3. An increase in bees and butterflies around flowering plants may result in __________ seed production.
   Answer: increased / more
4. If all organisms in a habitat had exactly the same requirements for food, water, and space, __________ among them would increase.
   Answer: competition
5. If pollution causes many plants in a pond to die, the amount of __________ in the water is likely to decrease.
   Answer: oxygen
6. If the oxygen level in a polluted pond decreases considerably, the fish population is likely to __________.
   Answer: decrease
7. If the fish population decreases, the number of insects in and around the pond may __________.
   Answer: increase
8. An increase in insect pests in nearby farmland may compel farmers to use more __________.
   Answer: pesticides
9. If frogs are removed from the food chain **Grass → Grasshopper → Frog → Snake**, the grasshopper population would most likely __________.
   Answer: increase
10. In the same food chain, disappearance of frogs would probably cause the snake population to __________ because an important food source is lost.
    Answer: decrease
11. If decomposers suddenly disappeared from a forest, dead organic matter would __________ instead of being efficiently broken down.
    Answer: accumulate
12. Without decomposers, the recycling of __________ back into the soil would be greatly reduced.
    Answer: nutrients
13. If plants were removed from a food chain, herbivores would face a shortage of __________.
    Answer: food
14. A decline in herbivores such as deer could eventually cause the population of their predators to __________.
    Answer: decrease
15. If competition did not control population size, one species might multiply excessively and create an ecological __________.
    Answer: imbalance
16. If flowering plants disappear from an area, honeybees may lose an important source of __________.
    Answer: nectar

17. If honeybees decline greatly, flowering plants that depend on them may experience reduced __________.
Answer: pollination
18. If mangrove forests are destroyed along a coast, nearby settlements may become more vulnerable to strong __________ and waves during storms.
Answer: winds
19. Cutting mangrove trees extensively would reduce their ability to absorb __________ from the atmosphere.
Answer: carbon dioxide
20. If forests are fragmented by roads and buildings, wildlife __________ can help animals move safely between forest habitats.
Answer: corridors
21. When vegetation becomes scarce and waterholes dry up, elephants may enter farms primarily in search of food and __________.
Answer: water
22. If a farmer repeatedly grows only one type of crop on the same land, biodiversity is likely to __________.
Answer: decrease
23. Continuous monoculture may negatively affect __________ that are crucial for food production.
Answer: pollinators
24. If excessive synthetic fertilisers reduce friendly soil microorganisms and humus, soil becomes more prone to __________.
Answer: erosion
25. If natural predators of agricultural pests decrease, the pest population is likely to __________.
Answer: increase
26. If some pests develop resistance to pesticides, controlling them becomes more __________.
Answer: difficult
27. If plants are removed from the banks of a pond, the soil may experience greater __________ because plant roots normally hold soil in place.
Answer: erosion
28. If plants release less oxygen because of a major reduction in vegetation, organisms depending on oxygen for __________ may be affected.
Answer: respiration
29. If the Indian hare population suddenly decreases because of disease, predators such as foxes and eagles may have __________ food available.
Answer: less
30. When several food chains are interconnected, the resulting network is more complex than a single food chain and is called a __________.
Answer: food web
31. If one organism in a food web disappears, several other populations may be affected because food chains are __________.
Answer: interlinked
32. When frog populations declined because of large-scale harvesting in India, agricultural pest populations __________ because frogs normally feed on insects.
Answer: increased

33. The increased agricultural pest population following the decline of frogs forced farmers to use more synthetic __________.
Answer: pesticides
34. If human-made ecosystems such as farms and parks are not properly cared for, they may not function effectively because such ecosystems require human __________.
Answer: management
35. A farm that reduces synthetic fertilisers and adopts organic or natural methods is likely to cause __________ interference with natural ecosystems.
Answer: minimal / less
36. If excessive groundwater extraction continues for farming, the farming system may eventually become __________.
Answer: unsustainable
37. If a habitat loses both food and shelter because of deforestation, animals may be forced to __________ to other areas.
Answer: move / migrate
38. If pollinators disappear from an ecosystem, the production of fruits and seeds in many flowering plants may __________.
Answer: decrease
39. Since producers form the first trophic level, a major decline in producers would affect organisms at __________ trophic levels.
Answer: higher
40. Because biotic and abiotic components continuously influence one another, disturbing one component can affect the __________ ecosystem.
Answer: entire / whole

12.5 One-mark questions with Answers of LOTS Type: (50 Questions)

The following questions are based directly on the Grade 8 chapter 12 and focus mainly on **remembering and understanding** concepts.

1. **What is a habitat?**
Answer: A habitat is a place where an organism lives and gets the conditions needed for its survival and growth.
2. **What are biotic components of a habitat?**
Answer: The living components such as plants, animals, and microorganisms are called biotic components.
3. **What are abiotic components of a habitat?**
Answer: Non-living components such as air, water, soil, sunlight, and temperature are called abiotic components.
4. **What is a population?**
Answer: A population is a group of organisms of the same type living in a habitat at a given time.
5. **What is a community?**
Answer: A community consists of different populations of organisms sharing the same habitat.
6. **Why do organisms living in the same habitat not always use resources in the same way?**
Answer: Different organisms have different needs and adaptations and therefore use the available resources differently.
7. **What is pollination?**
Answer: Pollination is the transfer of pollen from the stamens to the carpels of the same or different flowers.

8. **Why is pollination important to plants?**
   Answer: Pollination is essential for the formation of fruits and seeds.
9. **Name any two agents of pollination mentioned in the chapter.**
   Answer: Wind and insects are two agents of pollination.
10. **What is an ecosystem?**
    Answer: An ecosystem is formed by the interactions between biotic and abiotic components in a habitat.
11. **Name the two main types of natural ecosystems.**
    Answer: The two main types are aquatic ecosystems and terrestrial ecosystems.
12. **Give two examples of aquatic ecosystems.**
    Answer: Ponds and rivers are examples of aquatic ecosystems.
13. **Give two examples of terrestrial ecosystems.**
    Answer: Forests and grasslands are examples of terrestrial ecosystems.
14. **What are producers or autotrophs?**
    Answer: Organisms such as green plants that make their own food through photosynthesis are called producers or autotrophs.
15. **What are consumers or heterotrophs?**
    Answer: Organisms that cannot produce their own food and depend on other organisms for food are called consumers or heterotrophs.
16. **What are herbivores?**
    Answer: Animals that eat only plants and plant products are called herbivores.
17. **What are carnivores?**
    Answer: Animals that eat other animals are called carnivores.
18. **What are omnivores?**
    Answer: Animals that eat both plants and animals are called omnivores.
19. **What is a food chain?**
    Answer: A food chain is a simple sequence showing who eats whom in an ecosystem.
20. **What is a trophic level?**
    Answer: The specific position occupied by an organism in a food chain is called its trophic level.
21. **Which organisms occupy the first trophic level?**
    Answer: Producers such as green plants occupy the first trophic level.
22. **Which organisms occupy the second trophic level?**
    Answer: Herbivores such as hares and deer occupy the second trophic level.
23. **Give one example of a food chain from the chapter.**
    Answer: Grass → Grasshopper → Frog → Snake → Eagle is an example of a food chain.
24. **What is a food web?**
    Answer: A food web is a network formed by several interconnected food chains in an ecosystem.
25. **What are decomposers?**
    Answer: Decomposers are organisms that break down complex substances in dead matter into simpler substances.
26. **Name two common decomposers.**
    Answer: Fungi and bacteria are common decomposers.
27. **What is decomposition?**
    Answer: Decomposition is the process by which dead matter is broken down and nutrients are recycled into the environment.

28. **Why are decomposers important in nature?**
Answer: Decomposers are important because they recycle nutrients from dead matter back into the environment.
29. **What is mutualism?**
Answer: Mutualism is a relationship in which both organisms benefit.
30. **Give one example of mutualism.**
Answer: The relationship between honeybees and flowers is an example of mutualism.
31. **What is commensalism?**
Answer: Commensalism is a relationship in which one organism benefits while the other is unaffected.
32. **Give one example of commensalism.**
Answer: An orchid growing on a tree is an example of commensalism.
33. **What is parasitism?**
Answer: Parasitism is a relationship in which one organism benefits while the other is harmed.
34. **Give one example of parasitism.**
Answer: A tick feeding on the blood of a dog is an example of parasitism.
35. **How does competition help maintain balance in an ecosystem?**
Answer: Competition controls population size and prevents one species from multiplying excessively.
36. **What are wildlife corridors?**
Answer: Wildlife corridors are connected areas that allow animals to move safely between forest habitats.
37. **Why do elephants sometimes enter farms and villages?**
Answer: Elephants may enter farms and villages when vegetation and water become scarce in their natural habitats.
38. **What benefits do forests provide to humans?**
Answer: Forests provide fresh air, fertile soil, food, fibres, timber, and medicines.
39. **Where are the Sundarbans located?**
Answer: The Sundarbans are located where the Ganges and Brahmaputra Rivers meet between India and Bangladesh.
40. **How do the Sundarbans protect coastal areas?**
Answer: The Sundarbans help protect coastal areas by slowing down strong winds and waves during storms and floods.
41. **What are protected areas?**
Answer: Protected areas are parts of land or water set aside to conserve wildlife and their habitats.
42. **Name any two types of protected areas in India.**
Answer: National parks and wildlife sanctuaries are two types of protected areas.
43. **What are human-made ecosystems?**
Answer: Human-made ecosystems are artificial ecosystems created by humans to meet their needs.
44. **Give two examples of human-made ecosystems.**
Answer: Farms and parks are examples of human-made ecosystems.
45. **Why do human-made ecosystems require human care?**
Answer: Human-made ecosystems require human care and management to maintain their functioning.

46. **What is monoculture?**
    Answer: Monoculture is the practice of repeatedly growing the same crop on the same land.
47. **What effect can monoculture have on biodiversity?**
    Answer: Monoculture can reduce biodiversity and negatively affect pollinators.
48. **How can excessive use of synthetic fertilisers affect soil?**
    Answer: Excessive use of synthetic fertilisers can reduce soil fertility by decreasing beneficial microorganisms and humus.
49. **What are organic and natural farming methods intended to reduce?**
    Answer: They aim to reduce the use of synthetic fertilisers and minimise interference with natural ecosystems.
50. **What does *Vrikshayurveda* emphasise regarding farming?**
    Answer: *Vrikshayurveda* emphasises soil health and continuous nourishment of soil using organic manure and composted materials.

12.6 One-mark questions with Answers of HOTS Type: (40 Questions)

These questions require students to **apply, analyse, infer, predict, or give reasons** using concepts from the chapter. The chapter itself emphasises how a change in one component of an ecosystem can produce cascading effects in other components.

1. **Why might elephants enter farms when forest vegetation becomes scarce?**
   Answer: Elephants may enter farms because loss of vegetation forces them to search for food and water outside their natural habitat.
2. **How can wildlife corridors reduce human–animal conflict?**
   Answer: Wildlife corridors allow animals to move safely between forest habitats without entering human settlements.
3. **Why can a pond support fish while a dry field cannot?**
   Answer: A pond provides fish with suitable conditions such as water, dissolved oxygen, food, shelter, and space for survival.
4. **Why can a snake and a rodent live in the same habitat without always competing directly?**
   Answer: They may use the habitat at different times and in different ways, reducing direct competition for resources.
5. **What may happen if a habitat contains only one type of organism?**
   Answer: The organisms may compete strongly for the same food, water, and space, causing resource scarcity.
6. **Why might flowering plants near a pond with fish produce more seeds?**
   Answer: Fish reduce dragonfly larvae, allowing more pollinating insects such as bees and butterflies to survive and pollinate flowers.
7. **What might happen to pollinating insects if the fish population in a pond decreases greatly?**
   Answer: Pollinating insects may decrease because more dragonflies may survive and prey upon them.
8. **Why can overfishing disturb organisms living outside the pond also?**
   Answer: Overfishing can alter interconnected food relationships and indirectly affect insects and nearby flowering plants.
9. **Why are plants considered an important link between biotic and abiotic components?**
   Answer: Plants use abiotic resources such as sunlight, water, and carbon dioxide to produce food that supports other organisms.

10. **How can removing plants increase soil erosion?**
    Answer: Removing plants exposes the soil because their roots are no longer present to hold soil particles in place.
11. **Why would a decrease in grass affect animals at several trophic levels?**
    Answer: Less grass means less food for herbivores, which in turn reduces food availability for carnivores.
12. **If grasshoppers disappeared from the food chain Grass → Grasshopper → Frog → Snake → Eagle, which organism would be affected first?**
    Answer: Frogs would be affected first because grasshoppers are their immediate source of food.
13. **Why is a food web more realistic than a single food chain?**
    Answer: A food web is more realistic because most organisms have feeding relationships with more than one type of organism.
14. **What would happen to soil nutrients if decomposers disappeared?**
    Answer: Soil nutrients would gradually decrease because dead matter would not be broken down and recycled.
15. **Why are mushrooms growing on dead matter useful to an ecosystem?**
    Answer: Mushrooms help decompose dead matter and return nutrients to the environment.
16. **How does decomposition support the growth of new plants?**
    Answer: Decomposition releases nutrients from dead matter back into the soil for plants to absorb.
17. **Why can migratory birds be beneficial to farmers?**
    Answer: Migratory birds can control insect pests and also contribute to pollination and seed dispersal.
18. **What may happen to fish if pollution causes many aquatic plants to die?**
    Answer: Fish populations may decline because fewer aquatic plants result in less oxygen in the water.
19. **Why did the decline of frogs lead to an increase in agricultural pests?**
    Answer: Agricultural pests increased because fewer frogs were available to feed on insects.
20. **How can excessive harvesting of one animal indirectly increase pesticide use?**
    Answer: If the harvested animal is a natural predator of pests, its decline can increase pests and force farmers to use more pesticides.
21. **Why is competition necessary for maintaining balance in an ecosystem?**
    Answer: Competition limits excessive population growth by controlling access to resources such as food, water, space, and sunlight.
22. **A bee collects nectar from a flower while pollinating it; why is this mutualism?**
    Answer: It is mutualism because the bee gets nectar while the flower benefits through pollination.
23. **Why does an orchid growing on a tree not represent parasitism?**
    Answer: It is not parasitism because the orchid gains physical support while the tree is neither helped nor harmed.
24. **Why is the relationship between a tick and a dog harmful to only one partner?**
    Answer: The tick obtains blood as food while the dog suffers harm such as skin irritation.
25. **Why would a decline in deer populations threaten predators such as tigers and leopards?**
    Answer: A decline in deer would reduce the prey available as food for predators such as tigers and leopards.

26. **How can mangrove forests reduce damage caused by storms and floods?**
    Answer: Mangrove forests reduce damage by slowing down strong winds and waves before they reach inland areas.
27. **Why can cutting mangroves affect both humans and wildlife?**
    Answer: Cutting mangroves destroys wildlife habitat and reduces the natural protection they provide to coastal communities.
28. **Why are protected areas important for maintaining biodiversity?**
    Answer: Protected areas conserve habitats where endangered animals, birds, and rare plants can survive.
29. **Why do human-made ecosystems generally require more management than natural ecosystems?**
    Answer: Human-made ecosystems require regular human care because they are artificially created and maintained to meet specific needs.
30. **Why can repeated use of the same pesticide make pest control difficult?**
    Answer: Repeated pesticide use can cause some pests to develop resistance, making the pesticide less effective.
31. **How can excessive use of synthetic fertilisers make soil more prone to erosion?**
    Answer: Excessive fertiliser use can reduce microorganisms and humus, weakening the soil structure and making it more prone to erosion.
32. **Why can monoculture negatively affect pollinators?**
    Answer: Monoculture reduces plant diversity and therefore may reduce the variety of food and habitat available to pollinators.
33. **Why are natural predators such as beetles useful to farmers?**
    Answer: Natural predators such as beetles feed on crop pests and help control their populations without excessive pesticide use.
34. **How can heavy irrigation and repeated ploughing disturb ecosystem balance?**
    Answer: Heavy irrigation and repeated ploughing can disturb useful soil organisms such as earthworms and snails.
35. **Why can organic manure contribute to sustainable farming?**
    Answer: Organic manure nourishes the soil while reducing dependence on synthetic fertilisers and supporting soil health.
36. **If all decomposers suddenly disappeared from a forest, what would you expect to observe?**
    Answer: Dead matter would accumulate and nutrient recycling would decline, eventually affecting plant growth.
37. **In the food chain Grass → Grasshopper → Frog → Snake, what may happen if frogs disappear?**
    Answer: Grasshoppers would likely increase while snakes would decrease because their feeding relationships would be disturbed.
38. **Why is an ecosystem with only producers unlikely to remain balanced?**
    Answer: Without consumers and decomposers, feeding relationships and nutrient recycling necessary for ecosystem balance would be disrupted.
39. **If the hare population suddenly decreases, how might foxes and eagles be affected?**
    Answer: Foxes and eagles may decrease or depend more on alternative prey because less hare is available as food.
40. **Why does protecting an ecosystem ultimately help human beings?**
    Answer: Protecting ecosystems helps humans by maintaining essential benefits such as clean air, water, food, medicines, fertile soil, and climate regulation.

12.7 Two-mark questions with Answers of LOTS Type: (30 Questions)

1. **What is a habitat? What does it provide to an organism?**
   Answer:
   - A habitat is a place where an organism lives.
   - It provides suitable conditions such as food, water, oxygen, shelter, and space for survival.
2. **Differentiate between biotic and abiotic components of a habitat.**
   Answer:
   - Biotic components are living organisms such as plants, animals, and microorganisms.
   - Abiotic components are non-living factors such as air, water, soil, sunlight, and temperature.
3. **What is a population? Give an example.**
   Answer:
   - A population is a group of the same type of organisms living in a habitat at a given time.
   - For example, all fish of the same kind living together in a pond form a population.
4. **What is a community in an ecosystem?**
   Answer:
   - A community consists of different populations sharing the same habitat.
   - Plants, animals, and microorganisms living together form the biotic community of a habitat.
5. **What is pollination? Why is it important?**
   Answer:
   - Pollination is the transfer of pollen from the stamens to the carpels of the same or different flowers.
   - It is essential for the formation of fruits and seeds.
6. **What is an ecosystem? Name its two main types.**
   Answer:
   - An ecosystem is formed by the interaction of biotic and abiotic components in a habitat.
   - The two main types are aquatic ecosystems and terrestrial ecosystems.
7. **Give two examples each of aquatic and terrestrial ecosystems.**
   Answer:
   - Ponds and rivers are examples of aquatic ecosystems.
   - Forests and farms are examples of terrestrial ecosystems.
8. **What are producers and consumers?**
   Answer:
   - Producers or autotrophs are organisms such as green plants that make their own food through photosynthesis.
   - Consumers or heterotrophs cannot make their own food and depend on other organisms for food.
9. **Differentiate between herbivores and carnivores with examples.**
   Answer:
   - Herbivores eat only plants and plant products; deer and hare are examples.
   - Carnivores eat other animals; the leopard is an example.

10. **What are omnivores? Give two examples.**
    Answer:
    - Omnivores are organisms that eat both plants and animals.
    - Crows, foxes, and mice are examples of omnivores.
11. **What is a food chain? Give one example from a grassland ecosystem.**
    Answer:
    - A food chain is a simple sequence that shows "who eats whom" in an ecosystem.
    - An example is **Grass → Grasshopper → Frog → Snake → Eagle**.
12. **What is meant by a trophic level? Name the first two trophic levels.**
    Answer:
    - The specific position occupied by an organism in a food chain is called its trophic level.
    - Producers occupy the first trophic level, while herbivores occupy the second trophic level.
13. **What is a food web? How is it formed?**
    Answer:
    - A food web is a network of interconnected food chains in an ecosystem.
    - It is formed when organisms are connected to two or more other organisms through feeding relationships.
14. **What is decomposition? Name the organisms responsible for it.**
    Answer:
    - Decomposition is the process by which dead matter is broken down into simpler substances.
    - Organisms such as fungi and bacteria that carry out this process are called decomposers or saprotrophs.
15. **State two roles of decomposers in an ecosystem.**
    Answer:
    - Decomposers break down dead plants, animals, and organic waste into simpler substances.
    - They return important nutrients to the soil and help in nutrient recycling.
16. **What is mutualism? Give an example.**
    Answer:
    - Mutualism is an interaction in which both organisms benefit from each other.
    - The relationship between honeybees and flowers is an example of mutualism.
17. **What is commensalism? Give an example.**
    Answer:
    - Commensalism is a relationship in which one organism benefits while the other is unaffected.
    - An orchid growing on a tree is an example of commensalism.
18. **What is parasitism? Give an example.**
    Answer:
    - Parasitism is a relationship in which one organism benefits while the other organism is harmed.
    - A tick feeding on the blood of a dog is an example of parasitism.
19. **Mention two benefits that humans obtain from forest ecosystems.**
    Answer:
    - Forest ecosystems provide fresh air, fertile soil, food, fibres, timber, and medicines.

- They also provide aesthetic and recreational benefits that support human well-being.

20. **State two important functions of the Sundarbans mangrove forests.**
Answer:
    - The Sundarbans slow down strong winds and waves during storms and floods.
    - Mangrove trees absorb carbon dioxide and release oxygen.
21. **What are protected areas? Give two examples of types of protected areas in India.**
Answer:
    - Protected areas are parts of land or water set aside for conserving wildlife and their habitats.
    - National parks and wildlife sanctuaries are two types of protected areas.
22. **What are human-made ecosystems? Give two examples.**
Answer:
    - Human-made ecosystems are artificial ecosystems created and managed by humans to meet their needs.
    - Fish ponds, farms, and parks are examples of human-made ecosystems.
23. **What was the Green Revolution? Mention one feature of it.**
Answer:
    - The period when modern agricultural methods helped increase India's food production is known as the Green Revolution.
    - It involved the increased use of tractors, machines, synthetic fertilisers, and pesticides.
24. **Mention two harmful effects of the excessive use of synthetic fertilisers.**
Answer:
    - Excessive use of synthetic fertilisers may reduce friendly microorganisms and organic matter in the soil.
    - Reduction in humus makes the soil more prone to erosion.
25. **What is monoculture? Mention one harmful effect of it.**
Answer:
    - Monoculture is the practice of repeatedly growing the same crop on the same land.
    - It can reduce biodiversity and adversely affect pollinators that are important for food production.
26. **What are wildlife corridors? Why are they created?**
Answer:
    - Wildlife corridors are passages that connect different forest habitats.
    - They enable animals such as elephants to move safely between forests without coming into conflict with human settlements.
27. **How do plants influence the abiotic components of an ecosystem?**
Answer:
    - Plants release oxygen during photosynthesis and their roots hold the soil in place, preventing erosion.
    - They also retain soil moisture and help cool the atmosphere.
28. **Mention two ecological roles of migratory birds.**
Answer:
    - Migratory birds act as pollinators and seed dispersers and help connect different habitats.
    - They also feed on insect pests and thereby help farmers control pest populations.

29. **How does competition help maintain balance in an ecosystem?**
    Answer:
    - Organisms compete for common resources such as food, water, physical space, and sunlight.
    - This competition controls population size and prevents one species from multiplying excessively.
30. **Mention any two human activities that threaten ecosystems.**
    Answer:
    - Deforestation, pollution, habitat loss, and overexploitation of natural resources threaten ecosystems.
    - Such activities disturb ecosystem balance and damage habitats and biodiversity.

12.8. Two-mark questions with Answers of HOTS Type: (30 Questions)

These questions require students to **apply, analyse, infer, predict, or justify** ideas from the chapter. Each answer is limited to **two points/sentences**, suitable for **2 marks**. The chapter itself emphasizes interconnectedness among organisms, abiotic factors, food relationships, and ecosystem balance.

1. **A pond suddenly loses most of its aquatic plants due to pollution. Predict two effects on the pond ecosystem.**
   Answer:
   - The amount of oxygen in the water will decrease because fewer plants will carry out photosynthesis.
   - The fish population may decline, causing further changes in the populations of other organisms.
2. **If all decomposers disappeared from a forest, how would the ecosystem be affected?**
   Answer:
   - Dead plants, animals, and organic wastes would accumulate because decomposition would not occur properly.
   - Nutrient recycling would decrease, reducing the nutrients available in the soil for plant growth.
3. **Why might cutting trees near an elephant habitat increase human–elephant conflict?**
   Answer:
   - Cutting trees shrinks the elephants' natural habitat and reduces the availability of food and water.
   - Elephants may therefore enter farms and villages in search of resources, increasing conflict with humans.
4. **Two ponds are similar, but one has fish while the other does not. Why might more seeds be produced by plants near the pond containing fish?**
   Answer:
   - Fish eat dragonfly larvae, resulting in fewer dragonflies that prey on bees and butterflies.
   - More bees and butterflies can therefore pollinate flowers, leading to greater seed production.
5. **In the food chain Grass → Grasshopper → Frog → Snake, what may happen if frogs suddenly disappear?**
   Answer:

   - Grasshopper numbers may increase because fewer frogs are available to eat them.
   - Snake numbers may decrease because one of their food sources, the frog, has disappeared.
6. **Why can an ecosystem not function properly with only producers and no consumers or decomposers?**
   Answer:
   - Consumers are necessary for feeding relationships and the transfer of food through different trophic levels.
   - Decomposers are essential for breaking down dead matter and returning nutrients to the ecosystem.
7. **A farmer repeatedly grows only one crop on the same land. Predict two possible ecological problems.**
   Answer:
   - Monoculture can reduce biodiversity and negatively affect important pollinators.
   - Reduced biodiversity can disturb natural ecosystem interactions needed for sustainable food production.
8. **Why would a decrease in the frog population result in an increase in agricultural pests?**
   Answer:
   - Frogs naturally feed on many insects, including agricultural pests.
   - When frog numbers decrease, pest populations can increase because there are fewer predators to control them.
9. **Why can excessive use of synthetic fertilisers eventually make soil more prone to erosion?**
   Answer:
   - Excessive fertiliser use may reduce friendly microorganisms and lower the amount of organic matter or humus in the soil.
   - Since humus helps bind soil particles, its reduction makes the soil more vulnerable to erosion.
10. **A forest has plenty of plants but very few herbivores. How might this affect carnivores living there?**
    Answer:
    - Carnivores may face a shortage of prey because herbivores form an important food source for them.
    - Their population may therefore decline or they may move elsewhere in search of food.
11. **Why are wildlife corridors an effective way of reducing conflict between elephants and humans?**
    Answer:
    - Wildlife corridors connect separated forest habitats and allow elephants to move safely between them.
    - This reduces the need for elephants to pass through farms and human settlements while searching for resources.
12. **A large number of pollinating insects disappear from an area. How might this affect flowering plants?**
    Answer:
    - Less pollen would be transferred from stamens to carpels because fewer insects would be available for pollination.

  - As a result, the formation of fruits and seeds in many flowering plants could decrease.

13. **Why can the disappearance of one species disturb several food chains at the same time?**
    Answer:
    - Food chains in an ecosystem are interconnected to form a food web, and one organism may be linked to several others.
    - Therefore, the disappearance of one species can affect both its predators and its food organisms.
14. **Why is competition among organisms necessary for maintaining ecosystem balance?**
    Answer:
    - Competition for food, water, space, and sunlight helps control the population sizes of organisms.
    - Without competition, one species may multiply excessively and disturb the balance of the ecosystem.
15. **Mangrove forests are removed from a coastal village. Why might the village become more vulnerable to storms and floods?**
    Answer:
    - Mangrove forests naturally slow down strong winds and waves during storms and floods.
    - Removing them reduces this natural protection and exposes coastal settlements to greater damage.
16. **If bees disappear from a forest, how would both bees and flowering plants be affected?**
    Answer:
    - Bees would lose flowers as an important source of nectar.
    - Flowering plants would lose an important pollinator, which could reduce their production of fruits and seeds.
17. **Why might excessive use of pesticides make pest control more difficult in the long run?**
    Answer:
    - Some pests may develop resistance to pesticides and become difficult to control.
    - Pesticide use can also reduce natural predators, indirectly allowing pest populations to increase.
18. **A farmer finds many beetles that feed on crop pests. Why should the farmer avoid unnecessarily killing these beetles?**
    Answer:
    - The beetles act as natural predators and help control the population of crop pests.
    - Protecting them can reduce dependence on synthetic pesticides and help maintain ecological balance.
19. **Why are migratory birds important even though they stay in a habitat only for part of the year?**
    Answer:
    - They act as pollinators and seed dispersers and can connect different habitats during migration.
    - They also prey on insect pests and thereby indirectly support healthy crop growth.

20. **Why can overfishing in a pond affect plants growing around the pond?**
    Answer:
    - A reduction in fish may allow dragonfly populations to increase because fewer fish are available to eat their larvae.
    - More dragonflies may reduce pollinating insects such as bees and butterflies, indirectly reducing pollination and seed production.
21. **A snake and a rodent live in the same forest but are active at different times. How can this help organisms coexist?**
    Answer:
    - Using the same habitat at different times can reduce direct competition for space and other resources.
    - Such differences in activity allow organisms to experience and use the conditions of the same habitat differently.
22. **Why is a food web generally more realistic than a single food chain for representing an ecosystem?**
    Answer:
    - Most organisms are connected with more than one organism through feeding relationships.
    - Therefore, interconnected food chains forming a food web better represent the complex feeding relationships in nature.
23. **How can plants influence abiotic components even though plants themselves are biotic components?**
    Answer:
    - Plant roots hold soil in place, prevent erosion, and help retain soil moisture.
    - Plants also release oxygen during photosynthesis and help cool the atmosphere.
24. **Why is an agricultural field considered an ecosystem even though it is created and managed by humans?**
    Answer:
    - It contains living organisms interacting with non-living components such as soil, water, air, and sunlight.
    - It is therefore a human-made ecosystem that requires human care and management to function effectively.
25. **Why should protected areas conserve whole habitats rather than only individual endangered animals?**
    Answer:
    - Animals depend on plants, prey, water, shelter, and other components of their habitat for survival.
    - Conserving the entire habitat protects these interconnected components and supports many species simultaneously.
26. **The Green Revolution increased food production, yet some of its practices are considered unsustainable. Why?**
    Answer:
    - Intensive farming increased production through machinery, synthetic fertilisers, pesticides, and other modern methods.
    - Overuse of chemicals, excessive groundwater extraction, and monoculture can damage soil and ecosystems over time.
27. **If a disease greatly reduces the hare population, how could foxes or eagles be affected?**
    Answer:

- Foxes and eagles would have fewer hares available as prey and could face food shortage.
- Their populations may decrease or they may depend more heavily on other available prey.

28. **Why can pollution in one part of an ecosystem produce a chain of effects in other parts?**
    Answer:
    - Biotic and abiotic components are interconnected, so a change in one component can affect several others.
    - For example, pollution can kill plants, reduce oxygen, decrease fish populations, and ultimately increase insect populations.
29. **Why is ecosystem balance described as dynamic rather than fixed?**
    Answer:
    - Populations, resources, and interactions among organisms continually change while maintaining an overall balance.
    - Natural events and human activities can alter these interactions and disturb the existing balance.
30. **"Human survival depends on healthy ecosystems." Justify the statement with two reasons.**
    Answer:
    - Ecosystems provide essential resources such as clean air, water, food, fertile soil, fibres, timber, and medicines.
    - They also provide climate-related, recreational, and other benefits that support human well-being.

12.9. Three-mark questions with Answers of LOTS Type: (25 Questions)

The following questions focus mainly on **remembering, understanding, describing, listing, and explaining** the concepts given in the chapter. Each answer contains **three clear points/sentences**, suitable for **3 marks**.

1. What is a habitat? Explain the conditions provided by a habitat for the survival of organisms.
Answer:
1. A habitat is a place where an organism lives and grows.
2. It provides essential requirements such as food, oxygen, shelter, and space.
3. Different habitats provide different living conditions suitable for different organisms.

2. Differentiate between biotic and abiotic components of a habitat with examples.
Answer:
1. **Biotic components** are the living components of a habitat, such as plants, animals, and microorganisms.
2. **Abiotic components** are the non-living components, such as air, water, soil, sunlight, and temperature.
3. Both biotic and abiotic components interact with one another and are necessary for the survival of organisms.

3. What is a population? Give an example and state how it can be studied.
Answer:
1. A population is a group of organisms of the same type living in a habitat at a given time.
2. For example, all the fish of the same kind living together in a pond form a population.

3. The population can be studied by counting the number of individuals of that organism in a given place and at a given time.

4. What is a community? Explain its main features.

Answer:

1. A community consists of different populations sharing the same habitat.
2. Plants, animals, and microorganisms living together form the biotic community of a habitat.
3. The organisms in a community interact with and depend on one another for their survival.

5. What is pollination? Mention the agents of pollination and its importance.

Answer:

1. Pollination is the transfer of pollen grains from the stamens to the carpels of the same or different flowers.
2. Wind, water, insects, bats, and birds can act as agents of pollination.
3. Pollination is essential for the formation of fruits and seeds in flowering plants.

6. What is an ecosystem? Name its two main types with examples.

Answer:

1. An ecosystem is formed by the interaction of biotic and abiotic components in a habitat.
2. Aquatic ecosystems include ponds, rivers, and lakes.
3. Terrestrial ecosystems include forests, farms, grasslands, and even large trees.

7. Explain three ways in which plants depend on abiotic components.

Answer:

1. Plants use sunlight, carbon dioxide, and water to prepare food through photosynthesis.
2. Soil provides a medium for growth and supplies essential nutrients.
3. Air provides oxygen for respiration, while water is essential for various life processes.

8. How do plants influence the abiotic components of an ecosystem?

Answer:

1. Plants release oxygen into the atmosphere during photosynthesis.
2. Their roots hold the soil firmly and help prevent soil erosion.
3. Plants retain soil moisture and also help in cooling the atmosphere.

9. Define producers, consumers, and decomposers.

Answer:

1. **Producers** are organisms such as green plants that prepare their own food through photosynthesis.
2. **Consumers** cannot produce their own food and depend on other organisms for food.
3. **Decomposers**, such as bacteria and fungi, break down dead matter and help recycle nutrients.

10. Distinguish between herbivores, carnivores, and omnivores with examples.

Answer:

1. **Herbivores** eat only plants and plant products; examples include deer and hare.
2. **Carnivores** eat other animals; the leopard is an example.
3. **Omnivores** eat both plants and animals; examples include crows, foxes, and mice.

11. What is a food chain? Explain it with an example.

Answer:

1. A food chain is a simple sequence that shows "who eats whom" in an ecosystem.
2. It represents the feeding relationship among organisms in a linear form.
3. An example of a grassland food chain is **Grass → Grasshopper → Frog → Snake → Eagle**.

12. What are trophic levels? Describe the first three trophic levels.

Answer:
1. The specific positions occupied by organisms in a food chain are called **trophic levels**.
2. Producers such as green plants occupy the first trophic level, while herbivores such as deer and hares occupy the second level.
3. Small carnivores such as frogs occupy the third trophic level.

13. What is a food web? How is it formed?
Answer:
1. A food web is a network of interconnected food chains in an ecosystem.
2. An organism may be eaten by two or more different types of organisms.
3. Therefore, several food chains become linked with one another to form a food web.

14. What is decomposition? Explain the role of decomposers in nature.
Answer:
1. Decomposition is the process in which dead plants, animals, and wastes are broken down into simpler substances.
2. Fungi, bacteria, and certain small organisms carry out decomposition and are called decomposers or saprotrophs.
3. They return important nutrients to the soil and thereby help in recycling nutrients in nature.

15. Explain the importance of migratory birds in maintaining ecosystem balance.
Answer:
1. Migratory birds can act as pollinators and seed dispersers as they travel between habitats.
2. They act as predators of insect pests and help farmers control pest populations.
3. By moving between different regions, migratory birds also help link different habitats.

16. Describe the role of competition in maintaining ecosystem balance.
Answer:
1. Organisms compete for common resources such as food, water, physical space, and sunlight.
2. Competition helps control the population size of different organisms.
3. It prevents one species from multiplying excessively and thereby helps maintain ecosystem balance.

17. Explain mutualism, commensalism, and parasitism with examples.
Answer:
1. **Mutualism** is an interaction in which both organisms benefit, as in honeybees and flowers.
2. **Commensalism** is an interaction in which one organism benefits while the other remains unaffected, as in orchids growing on trees.
3. **Parasitism** is an interaction in which one organism benefits while the other is harmed, as in ticks feeding on dogs.

18. State three benefits that humans obtain from ecosystems.
Answer:
1. Forest ecosystems provide fresh air, fertile soil, food, fibres, timber, and medicines.
2. Aquatic ecosystems provide important resources such as water and food.
3. Ecosystems also provide aesthetic and recreational benefits that support human well-being.

19. Describe three important features of the Sundarbans ecosystem.
Answer:
1. The Sundarbans contain the world's largest mangrove forests and are located where the Ganges and Brahmaputra rivers meet between India and Bangladesh.

2. They provide habitat for diverse flora and fauna, including many endangered species.
3. Mangroves slow down strong winds and waves during storms and floods and also absorb carbon dioxide and release oxygen.

20. What are protected areas? Give examples and state their importance.
Answer:
1. Protected areas are parts of land or water set aside for conserving wildlife and their habitats.
2. They include national parks, wildlife sanctuaries, biosphere reserves, and community-conserved areas.
3. They protect endangered animals, birds, rare plants, and entire habitats for future generations.

21. What are human-made ecosystems? Give examples and mention their special requirement.
Answer:
1. Human-made ecosystems are artificial ecosystems created by humans to meet their needs.
2. Fish ponds, farms, and parks are examples of human-made ecosystems.
3. Unlike natural ecosystems, they require regular human care and management.

22. What was the Green Revolution? Mention the major methods used during it.
Answer:
1. The Green Revolution was a period during which modern agricultural methods were used to increase food production.
2. Tractors, machines, synthetic fertilisers, and pesticides were extensively used to improve agricultural production.
3. These methods helped India increase food production, although some are now considered unsustainable when overused.

23. State three harmful effects of the excessive use of synthetic fertilisers and pesticides.
Answer:
1. Overuse of synthetic fertilisers can decrease friendly soil microorganisms and reduce organic matter or humus.
2. Reduction of humus can lower soil fertility and make soil more prone to erosion.
3. Pesticides can reduce natural predators, while some pests may develop resistance and become difficult to control.

24. What is monoculture? State its effects on an ecosystem.
Answer:
1. Monoculture is the practice of repeatedly growing the same type of crop on the same land.
2. It can reduce biodiversity in agricultural ecosystems.
3. It can also negatively affect pollinators that are important for food production.

25. Explain the importance of organic and natural farming.
Answer:
1. Organic and natural farming methods aim to reduce the use of synthetic fertilisers.
2. They support sustainable farming with minimum interference in natural ecosystems.
3. Traditional practices such as using organic manure and composted materials help nourish and maintain healthy soil.

12.10. Three-mark questions with Answers of HOTS Type: (20 Questions)

These questions are designed to test **application, analysis, prediction, reasoning, cause-and-effect relationships, and problem-solving** based on the chapter. The chapter itself emphasizes how changes in one part of an ecosystem can produce effects throughout the system.

1. A pond has many fish and flowering plants around it. What may happen to the flowering plants if most of the fish are removed? Explain.

Answer:

1. Without enough fish, the number of dragonfly larvae and consequently dragonflies may increase.
2. More dragonflies may feed on bees, butterflies, and other pollinating insects, reducing their numbers.
3. With fewer pollinators, pollination and seed production in the nearby flowering plants may decrease.

2. If all the decomposers suddenly disappeared from a forest, predict three consequences.

Answer:

1. Dead plants, animals, and organic wastes would accumulate because they would not be properly decomposed.
2. Nutrients present in dead matter would not be efficiently returned to the soil.
3. Soil nutrient availability would decrease, affecting plant growth and eventually disturbing the entire food web.

3. Consider the food chain: Grass → Grasshopper → Frog → Snake. What would happen if frogs suddenly disappeared?

Answer:

1. The grasshopper population would increase because fewer frogs would be available to eat them.
2. The increased number of grasshoppers would consume more grass and could reduce the amount of vegetation.
3. The snake population may decrease because frogs, one of their food sources in this chain, would no longer be available.

4. Why can an ecosystem not function properly with only producers and no consumers or decomposers?

Answer:

1. Without consumers, the feeding relationships and transfer of food through different trophic levels would be disrupted.
2. Without decomposers, dead organisms and wastes would not be broken down effectively.
3. Nutrients would not be properly recycled back into the environment, disturbing the balance of the ecosystem.

5. A farmer repeatedly grows only one crop and uses large amounts of pesticides. Predict three possible long-term effects.

Answer:

1. Repeatedly growing the same crop, called monoculture, may reduce biodiversity and affect important pollinators.
2. Some pests may develop resistance to pesticides and become more difficult to control.
3. The farming ecosystem may become less sustainable because excessive chemical use can negatively affect soil health and useful organisms.

6. A forest near a village is cleared to build roads and buildings. How could this increase human–elephant conflict?

Answer:

1. Cutting trees reduces and fragments the natural forest habitat available to elephants.

2. When food, vegetation, and water become scarce, elephants may move into nearby farms and villages searching for resources.
3. Their movement into human settlements can cause crop damage and increase conflict between people and elephants.

7. A polluted pond begins losing most of its aquatic plants. Explain how this single change could eventually affect nearby farms.

Answer:

1. Fewer aquatic plants would result in less oxygen in the water, which could reduce the fish population.
2. A reduction in fish could result in an increase in insects in and around the pond.
3. These insects may spread to nearby farms, damage crops, and compel farmers to use more pesticides.

8. Why might a village protected by mangrove forests suffer less damage during a severe coastal storm than a village without mangroves?

Answer:

1. Mangrove forests can slow down strong winds and waves during storms and floods.
2. Therefore, they act as a natural protective barrier between coastal settlements and powerful waves.
3. Removing mangroves could consequently make coastal communities more vulnerable to storm and flood damage.

9. Suppose the number of natural predators such as beetles decreases greatly in a farm. What could happen?

Answer:

1. The population of insect pests could increase because fewer natural predators would be available to control them.
2. Increased pest populations could cause greater damage to crops.
3. Farmers might become more dependent on pesticides, which could further disturb the ecological balance of the farm.

10. An Indian hare population suddenly decreases because of a disease. How might this affect other organisms in its food web?

Answer:

1. Predators such as foxes and eagles that feed on hares may have less food available.
2. These predators may decline in number or depend more on alternative prey.
3. Plants eaten by hares may experience less feeding pressure, showing how a change in one population can affect several organisms in a food web.

11. Why is a food web generally a better representation of feeding relationships in nature than a single food chain?

Answer:

1. A food chain represents only a simple linear sequence of "who eats whom."
2. In a real ecosystem, an organism may eat or be eaten by more than one type of organism.
3. Therefore, interconnected food chains forming a food web represent the complex feeding relationships of an ecosystem more realistically.

12. Two species of birds depend on the same fruit for food. What may happen if the supply of that fruit becomes very limited?

Answer:

1. The two bird species would compete more strongly because they require the same limited food resource.
2. Increased competition could restrict the population growth of one or both species.

3. The birds may have to use other food resources or change their feeding patterns to reduce competition.

13. A student says, "Abiotic components affect living organisms, but living organisms cannot affect abiotic components." How would you correct this statement?

Answer:

1. The statement is incorrect because interactions between biotic and abiotic components work in both directions.
2. For example, plants release oxygen during photosynthesis, and their roots hold the soil and help prevent erosion.
3. Plants can also retain soil moisture and cool the atmosphere, showing that living organisms influence non-living components.

14. Why can excessive use of synthetic fertilisers eventually reduce soil quality even though they initially improve crop production?

Answer:

1. Synthetic fertilisers can improve crop production, but their overuse may reduce beneficial microorganisms in the soil.
2. Their excessive use can also lower organic matter or humus, which helps bind soil particles.
3. With less humus, soil becomes more prone to erosion and may lose its fertility over time.

15. A farmer wants to increase production without seriously disturbing the farm ecosystem. Suggest three practices based on the chapter.

Answer:

1. The farmer can reduce excessive dependence on synthetic fertilisers and adopt organic or natural farming methods.
2. Organic manure, composted materials, and preparations such as Kunapa Jala can be used to nourish the soil.
3. The farmer should avoid practices such as excessive pesticide use and repeated monoculture that reduce biodiversity and harm beneficial organisms.

16. Why can the disappearance of migratory birds affect agricultural ecosystems?

Answer:

1. Some migratory birds act as predators of insect pests and therefore help control pest populations.
2. They may also function as pollinators and seed dispersers while moving between different habitats.
3. Their disappearance could therefore affect pest control, plant reproduction, and the ecological connections between habitats.

17. The government creates a wildlife corridor between two forest areas. Explain how this can help both animals and humans.

Answer:

1. Wildlife corridors connect forest habitats and provide animals with safer routes for movement.
2. Animals such as elephants can move between large forest areas in search of necessary resources.
3. This can reduce their need to enter farms and human settlements and thereby reduce human–wildlife conflict.

18. Why would removing all competition from an ecosystem not necessarily benefit the organisms living there?

Answer:

1. Competition for resources such as food, water, space, and sunlight helps regulate population sizes.
2. Without competition, one species could multiply excessively and consume a disproportionate share of available resources.
3. This could create an imbalance and negatively affect other organisms in the ecosystem.

19. A city plans to replace a natural wetland completely with an artificial park. Why should environmental impacts be carefully considered?
Answer:
1. Natural ecosystems contain interconnected biotic and abiotic components that support different communities of organisms.
2. Human-made ecosystems such as parks can support biodiversity and recreation, but they require regular human care and management.
3. Therefore, replacing a natural ecosystem may disturb existing interactions and should be evaluated carefully rather than assuming an artificial ecosystem can perform exactly the same functions.

20. "A small change in an ecosystem can produce a chain of much larger changes." Justify this statement with an example.
Answer:
1. If pollution causes pond plants to die, oxygen levels in the water may decrease and fish populations may fall.
2. Fewer fish can result in an increase in insects, which may then spread to nearby agricultural fields and damage crops.
3. Farmers may respond by using more pesticides, causing further environmental effects and demonstrating a cascading chain of changes.

12.11 Five-mark questions with Answers of LOTS Type: (10 Questions)

1. What is a habitat? Explain its biotic and abiotic components with examples.
Answer:
1. A **habitat** is a place where an organism lives and gets the conditions necessary for its survival.
2. Every habitat contains both **living and non-living components**.
3. Living components such as plants, animals and microorganisms are called **biotic components**.
4. Non-living components such as air, water, soil, sunlight and temperature are called **abiotic components**.
5. For example, in a pond, fish and aquatic plants are biotic components, while water, sunlight and temperature are abiotic components.

2. Define population and community. Explain how they are related.
Answer:
1. A **population** is a group of organisms of the same type living in a particular habitat at a given time.
2. For example, all the fish of the same kind living in a pond form a population.
3. A **community** consists of different populations living together in the same habitat.
4. Plants, animals and microorganisms living together form the biotic community of a habitat.
5. Thus, several populations together form a community, and the organisms in a community interact with and depend on one another.

3. What is an ecosystem? Name and explain its two main types.

Answer:

1. An **ecosystem** is formed by the interaction of biotic and abiotic components in a habitat.
2. Its biotic components include plants, animals and microorganisms, while abiotic components include air, water, soil, sunlight and temperature.
3. There are two main types of natural ecosystems—**aquatic ecosystems and terrestrial ecosystems**.
4. Aquatic ecosystems include ponds, rivers and lakes.
5. Terrestrial ecosystems include forests, grasslands, farms and even large trees that support different organisms.

4. Explain producers, consumers and decomposers in an ecosystem.

Answer:

1. **Producers** are organisms such as green plants that prepare their own food through photosynthesis.
2. Organisms that cannot prepare their own food and depend on other organisms are called **consumers**.
3. Consumers include herbivores, carnivores and omnivores depending on their feeding habits.
4. **Decomposers**, such as bacteria and fungi, break down dead plants, animals and organic matter into simpler substances.
5. Decomposers return important nutrients to the soil and help in recycling nutrients in nature.

5. What is a food chain? Explain trophic levels with an example.

Answer:

1. A **food chain** is a simple sequence showing "who eats whom" in an ecosystem.
2. An example of a grassland food chain is **Grass → Grasshopper → Frog → Snake → Eagle**.
3. Each organism occupies a particular position in a food chain called a **trophic level**.
4. Producers such as green plants occupy the first trophic level, while herbivores occupy the second trophic level.
5. Small carnivores occupy the third level, followed by larger carnivores at higher trophic levels.

6. What is a food web? How is it formed in an ecosystem?

Answer:

1. Organisms in an ecosystem usually have more than one feeding relationship.
2. An organism may be eaten by two or more different kinds of organisms.
3. Therefore, different food chains in an ecosystem are interconnected with one another.
4. This interconnected network of food chains is called a **food web**.
5. A food web represents the various feeding relationships among organisms in an ecosystem.

7. Explain the process of decomposition and the importance of decomposers.

Answer:

1. Dead plants, animals and other organic wastes are broken down naturally by certain organisms.
2. Microorganisms such as **fungi and bacteria** break complex substances in dead matter into simpler substances.
3. This process of breaking down dead organic matter is called **decomposition**.
4. Organisms that carry out decomposition are called **decomposers or saprotrophs**.
5. Decomposition returns important nutrients to the soil and helps in the recycling of nutrients in nature.

8. Describe the three types of relationships among organisms—mutualism, commensalism and parasitism.
Answer:
1. **Mutualism** is a relationship in which both organisms benefit from each other.
2. Honeybees and flowers show mutualism because bees get nectar while flowers get pollinated.
3. **Commensalism** is a relationship in which one organism benefits while the other remains unaffected, as seen in orchids growing on trees.
4. **Parasitism** is a relationship in which one organism benefits while the other organism is harmed.
5. Ticks living on dogs show parasitism because ticks obtain food from the dog's blood while the dog may suffer skin irritation.

9. Explain any five benefits that humans obtain from ecosystems.
Answer:
1. Forest ecosystems provide **fresh air** and help maintain suitable conditions for life.
2. They provide useful resources such as **food, fibres and timber**.
3. Forests also provide **medicines and fertile soil**.
4. Aquatic ecosystems provide humans with important resources such as **water and food**.
5. Ecosystems also provide **aesthetic and recreational value**, thereby supporting human well-being.

10. Describe the importance of the Sundarbans ecosystem and the threats it faces.
Answer:
1. The **Sundarbans** contain the largest mangrove forests in the world and are home to diverse flora and fauna.
2. Mangroves protect coastal areas by slowing down strong winds and waves during storms and floods.
3. The trees absorb carbon dioxide and release oxygen, thereby providing important environmental benefits.
4. Cutting mangrove trees for fuelwood and farming, illegal hunting and overuse of forest resources threaten this ecosystem.
5. Industrial waste and untreated sewage also pollute the rivers and damage the habitat and wildlife of the Sundarbans.

12.12 Five-mark questions with Answers of HOTS Type: (10 Questions)

1. Suppose all the decomposers suddenly disappear from a forest ecosystem. Predict five consequences.
Answer:
1. Dead plants, animals and organic wastes would begin to accumulate because there would be no decomposers to break them down.
2. Nutrients present in dead matter would not be returned effectively to the soil.
3. The availability of nutrients for plants would gradually decrease, affecting their growth.
4. A decline in plant growth would indirectly affect herbivores and the carnivores that depend on them.
5. Thus, the disappearance of decomposers would disturb nutrient recycling and eventually upset the balance of the entire ecosystem.

2. Consider the food chain: Grass → Grasshopper → Frog → Snake. What would happen if frogs disappeared? Analyse the consequences.
Answer:

1. If frogs disappeared, the number of grasshoppers would increase because one of their predators would be absent.
2. The increased grasshopper population would consume more grass and other plant material.
3. As a result, the amount of vegetation in the ecosystem could decrease.
4. The snake population could decline because snakes would have fewer frogs available as food.
5. Therefore, the disappearance of frogs could cause changes at several trophic levels and disturb the balance of the ecosystem.

3. A pond becomes polluted and many aquatic plants begin to die. Analyse how this one change can affect the pond and nearby farmland.

Answer:

1. When aquatic plants die, less oxygen is produced in the pond water.
2. Reduced oxygen can cause a decline in the fish population.
3. With fewer fish and other consumers, the number of certain insects may increase.
4. These insects may spread to nearby farmlands and damage crops.
5. Farmers may then use more pesticides, which can further harm the environment, showing how one ecological change can trigger several others.

4. A farmer uses synthetic fertilisers and pesticides continuously for many years. Predict five possible effects on the farm ecosystem.

Answer:

1. Long-term overuse of synthetic fertilisers can reduce friendly microorganisms and organic matter in the soil.
2. Reduction in humus can make the soil more prone to erosion.
3. Pesticides may reduce natural predators, which can eventually result in an increase in pest populations.
4. Some pests may develop resistance to pesticides and become more difficult to control.
5. Therefore, excessive dependence on synthetic fertilisers and pesticides can reduce soil health and disturb the ecological balance of the farm.

5. Why might the destruction of forests force elephants to enter farms and villages? Analyse the situation.

Answer:

1. Forests provide elephants with essential resources such as food, water, shelter and space.
2. Changes in rainfall and temperature can reduce vegetation and dry up water sources in their natural habitat.
3. Cutting trees for roads and buildings further shrinks and fragments the forest habitat.
4. Elephants may then move into nearby farms and plantations in search of food such as bananas and sugarcane.
5. Protecting forest habitats and maintaining wildlife corridors can therefore reduce conflict between elephants and human settlements.

6. A pond has many fish, while another similar pond has no fish. Predict how this difference could affect flowering plants around the two ponds.

Answer:

1. Fish eat dragonfly larvae, so a pond containing fish may have fewer dragonflies.
2. Dragonflies feed on insects such as bees, flies and butterflies.
3. When there are fewer dragonflies, the population of these pollinating insects can increase.
4. More pollinators can transfer more pollen between flowers and improve seed production.

5. Therefore, flowering plants around the pond with fish may produce more seeds than those around the pond without fish.

7. A village near the sea has a thick mangrove forest, while a neighbouring village has lost most of its mangroves. Which village is likely to be safer during a severe coastal storm? Justify your answer.

Answer:

1. The village surrounded by a healthy mangrove forest is likely to receive greater natural protection.
2. Mangroves help slow down strong winds and waves during storms and floods.
3. Therefore, they can reduce the direct impact of severe coastal conditions on settlements.
4. Removing mangroves weakens this natural protective function and also damages the habitat of many organisms.
5. Hence, conserving mangrove forests is important both for protecting coastal communities and maintaining biodiversity.

8. In the 1980s, large numbers of Indian bullfrogs were harvested for export. Explain how reducing the frog population could ultimately affect farmers and the environment.

Answer:

1. Frogs naturally feed on many insects, including agricultural pests.
2. When frog populations decline, fewer insects are eaten and pest populations can increase.
3. Increased pests can damage agricultural crops and create problems for farmers.
4. Farmers may respond by using larger quantities of synthetic pesticides.
5. Such pesticide use can harm soil and water quality, showing how removing one organism can produce wider ecological consequences.

9. Why would an ecosystem containing only producers and no consumers or decomposers fail to remain balanced?

Answer:

1. Producers can make their own food, but they are only one part of the feeding relationships in an ecosystem.
2. Without consumers, normal food chains and interactions among different trophic levels would be disrupted.
3. Without decomposers, dead plants and other organic matter would not be properly broken down.
4. Nutrients would not be efficiently recycled back into the soil for use by producers.
5. Therefore, producers, consumers and decomposers have interconnected roles that help maintain the functioning and balance of an ecosystem.

10. A farmer grows only one type of crop on the same land year after year. Why might this practice become harmful in the long run? Suggest how the situation could be improved.

Answer:

1. Growing the same crop repeatedly is called **monoculture**, and it can reduce biodiversity on the farm.
2. Reduced biodiversity may negatively affect pollinators that are important for food production.
3. Repeated use of intensive farming practices can also contribute to soil degradation.
4. Farmers can reduce their dependence on synthetic fertilisers by adopting organic and natural farming methods.
5. Sustainable farming practices that protect soil organisms and minimise interference with natural ecosystems can help maintain long-term food security.

12.13 Five-mark questions with Answers of Applied Type: (10 Questions)

1. A farmer notices that the number of earthworms in his field has greatly decreased after years of heavy irrigation, repeated ploughing and chemical use. How can this affect the farm? Suggest suitable measures.

Answer:

1. Earthworms are important soil organisms that contribute to maintaining ecological balance.
2. Heavy irrigation and repeated ploughing can disturb earthworms and other useful soil organisms.
3. Excessive use of synthetic fertilisers may also reduce friendly microorganisms and organic matter in the soil.
4. The farmer should reduce excessive chemical inputs and adopt organic or natural farming methods.
5. Adding compost and organic manure can help improve soil health and make farming more sustainable.

2. Your school wants to develop a small pond as an ecosystem. What components should be included or maintained so that the pond functions as a balanced ecosystem?

Answer:

1. The pond should contain producers such as algae, duckweeds and other aquatic plants.
2. Consumers such as fish, frogs, snails and insects can form feeding relationships within the pond.
3. Decomposers such as bacteria and fungi are necessary to break down dead matter and recycle nutrients.
4. Abiotic components such as water, sunlight, oxygen, suitable temperature and nutrients must also be available.
5. All these biotic and abiotic components should be allowed to interact naturally to maintain a functional pond ecosystem.

3. A village near a forest frequently experiences elephants entering farms and damaging crops. Apply your knowledge of habitats to suggest ways of reducing this problem.

Answer:

1. The villagers should understand that elephants may enter farms when vegetation and water become scarce in their natural habitat.
2. Further destruction of forests for roads and buildings should be reduced because it causes habitat loss.
3. Natural water and food resources inside or around forest habitats should be protected.
4. Wildlife corridors should be maintained so that elephants can move safely between forest areas.
5. Protecting and connecting forest habitats can reduce encounters and conflict between elephants and human settlements.

4. Students find that the number of butterflies in their school garden has decreased. Using your knowledge of ecosystems, suggest five practical steps that could help support butterflies and pollination.

Answer:

1. Students can grow more flowering plants in the school garden to provide food resources for pollinating insects.
2. They should protect the plants and habitats used by butterflies and other insects.
3. Unnecessary use of pesticides should be avoided because excessive pesticide use can disturb ecological interactions.

4. The garden should be maintained as a diverse habitat rather than growing only one type of plant.
5. Supporting pollinating insects is important because pollination helps flowering plants produce fruits and seeds.

5. A crop field has the food chain: Millet → Mouse → Eagle. If farmers kill most of the mice using pesticides, how could this affect the food chain?

Answer:

1. Millet acts as the producer and occupies the first trophic level.
2. Mice consume the millet and act as consumers in the food chain.
3. Eagles depend on animals such as mice for food in this feeding relationship.
4. If most mice are killed, the amount of food available to eagles will decrease.
5. Therefore, disturbing one trophic level can affect organisms at other levels and alter the balance of the crop-field ecosystem.

6. A family has a garden where fallen leaves and other plant remains are collected every day. Instead of throwing them away, how can the family use them in an environmentally useful way?

Answer:

1. The family can collect fallen leaves and biodegradable plant remains for composting.
2. Fungi, bacteria and other decomposers naturally break down dead organic matter into simpler substances.
3. During decomposition, important nutrients are returned to the environment.
4. The resulting organic material can help nourish the soil and support plant growth.
5. This practice applies nature's principle of recycling, where dead matter is decomposed and its nutrients are reused.

7. A coastal community is planning to remove mangrove forests to create more land for human use. How would you use your knowledge of ecosystems to advise the community?

Answer:

1. The community should avoid large-scale removal of mangroves because they provide habitats for diverse plants and animals.
2. Mangroves help protect coastal regions by slowing strong winds and waves during storms and floods.
3. Mangrove trees also absorb carbon dioxide and release oxygen.
4. Cutting them for fuelwood or farming can disturb wildlife and the functioning of the ecosystem.
5. The community should therefore conserve and sustainably use mangrove resources instead of destroying the habitat.

8. A farmer finds that pests are becoming resistant to the pesticide used every season. What changes in farming practices would you recommend?

Answer:

1. The farmer should reduce excessive and repeated dependence on synthetic pesticides.
2. Natural predators such as beetles should be protected because they can help control pest populations naturally.
3. Organic and natural farming methods can be adopted to reduce the use of synthetic chemicals.
4. Repeated monoculture should be avoided because it can reduce biodiversity and affect important pollinators.
5. Organic manure, composted materials and practices that maintain soil organisms can support more sustainable farming.

9. A pond near agricultural land becomes polluted, causing many aquatic plants to die. As a member of the local eco-club, explain why the pollution should be controlled immediately.

Answer:

1. When aquatic plants die, less oxygen is produced in the pond water.
2. Reduced oxygen can lead to a decrease in the fish population.
3. Fewer fish can result in an increase in the number of insects.
4. These insects may spread to nearby farms and damage crops, encouraging farmers to use more pesticides.
5. Therefore, controlling pond pollution can prevent a chain of ecological problems affecting both the pond and nearby farmland.

10. Your school plans to convert an unused area into a human-made ecosystem. How would you design and maintain it?

Answer:

1. The school could develop the area into a garden, park or small artificial pond.
2. Different plants should be included to support biodiversity and provide habitats for other organisms.
3. The area should be managed in a way that reduces pollution and unnecessary disturbance.
4. Suitable abiotic resources such as water, soil and sunlight should be maintained for the organisms.
5. Since human-made ecosystems require human care and management, students can regularly observe and maintain the area as an environmental activity.

12.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams: (20 MCQs of LOTS & 20 MCQs of HOTS Type)

Olympiad-Type Multiple Choice Questions:

1. A pond contains algae, fish, frogs, bacteria, water, dissolved oxygen and minerals. Which statement best explains why the pond is considered an ecosystem?

A. It contains more animals than plants.
B. It contains only aquatic organisms.
C. Its biotic and abiotic components interact with one another.
D. All organisms in it belong to the same population.

Answer: C. Its biotic and abiotic components interact with one another.

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2. Consider the food chain:

Grass → Grasshopper → Frog → Snake → Eagle

If the frog population suddenly decreases greatly, which change is most likely to occur initially?

A. Grasshoppers decrease and snakes increase.
B. Grasshoppers increase and snakes decrease.
C. Grass increases and snakes increase.
D. Eagles increase and grasshoppers decrease.

Answer: B. Grasshoppers increase and snakes decrease.

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3. In a pond, fish feed on dragonfly larvae. Adult dragonflies feed on bees and butterflies. Bees and butterflies pollinate nearby flowers. If the fish population increases, which sequence is most likely?

A. More dragonflies → more pollinators → fewer seeds
B. Fewer dragonflies → more pollinators → more seed production

C. Fewer dragonflies → fewer pollinators → more seed production
D. More dragonflies → fewer pollinators → more seed production
Answer: B. Fewer dragonflies → more pollinators → more seed production.

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4. Four students make the following statements:
P: All organisms of the same kind living in a habitat at a given time form a population.
Q: Different populations living together form a community.
R: A community together with interacting abiotic components forms an ecosystem.
S: An ecosystem is always smaller than a population.
Which statements are correct?
A. P and Q only
B. P, Q and R only
C. Q, R and S only
D. P, Q, R and S
Answer: B. P, Q and R only.

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5. A forest contains 50 deer, 15 wild boars, 6 leopards, trees, fungi, soil, water and sunlight. Which of the following represents a **population**?
A. All animals in the forest
B. 50 deer
C. Deer, wild boars and leopards together
D. All living and non-living components
Answer: B. 50 deer.

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6. Which pair represents an interaction specifically between a **biotic and an abiotic component**?
A. Frog eating an insect
B. Snake eating a fish
C. Earthworm living in moist soil
D. Frog competing with fish
Answer: C. Earthworm living in moist soil.

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7. A student classifies organisms into three groups:
I. Producers
II. Consumers
III. Decomposers
Which combination is correctly matched?
A. Grass—I; Deer—II; Fungi—III
B. Grass—II; Deer—I; Fungi—III
C. Grass—I; Deer—III; Fungi—II
D. Grass—III; Deer—II; Fungi—I
Answer: A. Grass—I; Deer—II; Fungi—III.

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8. Which statement correctly distinguishes a **food web** from a **food chain**?
A. A food web contains only producers.
B. A food chain contains several interconnected food webs.
C. A food web consists of interconnected food chains.
D. Food webs occur only in aquatic ecosystems.
Answer: C. A food web consists of interconnected food chains.

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9. In the food chain:
Grass → Grasshopper → Frog → Snake
Which organism occupies the **third trophic level**?
A. Grass
B. Grasshopper
C. Frog
D. Snake
Answer: C. Frog.

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10. Suppose all decomposers suddenly disappear from a forest. Which consequence is most likely over time?
A. Dead organic matter will accumulate and nutrient recycling will decline.
B. Plants will receive more nutrients from dead matter.
C. Consumers will begin photosynthesis.
D. Producers will immediately become decomposers.
Answer: A. Dead organic matter will accumulate and nutrient recycling will decline.

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11. Mushrooms growing on dead plant material perform an important ecological function because they:
A. convert consumers into producers.
B. break down dead matter and return nutrients to the environment.
C. prevent plants from absorbing minerals.
D. increase the amount of non-biodegradable waste.
Answer: B. Break down dead matter and return nutrients to the environment.

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12. Consider the following relationships:
1. Honeybee and flower
2. Orchid growing on a tree
3. Tick feeding on a dog

Which sequence correctly identifies these relationships?
A. Parasitism, Mutualism, Commensalism
B. Mutualism, Commensalism, Parasitism
C. Commensalism, Parasitism, Mutualism
D. Mutualism, Parasitism, Commensalism
Answer: B. Mutualism, Commensalism, Parasitism.

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13. A bee receives nectar from a flower while helping in pollination. This interaction differs from parasitism because:
A. neither organism benefits.
B. only the bee benefits.
C. both organisms benefit.
D. one organism benefits while the other is harmed.
Answer: C. Both organisms benefit.

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14. Which of the following is the best example of **commensalism** according to the chapter?
A. Tick and dog
B. Honeybee and flower
C. Orchid growing on a tree
D. Frog eating an insect
Answer: C. Orchid growing on a tree.

15. Large numbers of frogs are removed from an agricultural region. Which chain of events is most consistent with the chapter?
A. Fewer frogs → fewer insects → less pesticide use
B. Fewer frogs → more insect pests → greater pesticide use
C. Fewer frogs → more predators → fewer crops
D. Fewer frogs → fewer pests → poorer soil
Answer: B. Fewer frogs → more insect pests → greater pesticide use.

16. Pollution causes many plants in a pond to die. Which sequence correctly represents a possible cascading effect?
A. Plants die → oxygen increases → fish increase → insects decrease
B. Plants die → oxygen decreases → fish decrease → insects increase
C. Plants die → oxygen decreases → fish increase → insects decrease
D. Plants die → oxygen increases → fish decrease → insects increase
Answer: B. Plants die → oxygen decreases → fish decrease → insects increase.

17. Competition between organisms can help maintain ecosystem balance because it:
A. ensures that every species has unlimited resources.
B. prevents any interaction between species.
C. helps control population size when resources are limited.
D. completely eliminates weaker species.
Answer: C. Helps control population size when resources are limited.

18. Two animals live in the same forest. One is active mainly during the day, while the other comes out at night. What is the best inference?
A. Organisms in the same habitat must use resources identically.
B. Different organisms can use the same habitat under different conditions.
C. One of the animals does not belong to the forest ecosystem.
D. No competition can ever occur between them.
Answer: B. Different organisms can use the same habitat under different conditions.

19. Which human action would most directly increase human–elephant conflict?
A. Protecting wildlife corridors
B. Connecting fragmented forest habitats
C. Cutting forests for roads and buildings
D. Conserving natural waterholes
Answer: C. Cutting forests for roads and buildings.

20. Wildlife corridors are particularly important because they:
A. prevent all animals from leaving one forest.
B. connect forest habitats and allow safer movement of wildlife.
C. increase the use of farmland by wild animals.
D. separate populations permanently.
Answer: B. Connect forest habitats and allow safer movement of wildlife.

21. Mangrove forests can reduce damage caused by coastal storms primarily because they:
A. increase the speed of waves.
B. slow down strong winds and waves.

C. remove all salt from seawater.
D. prevent rainfall in coastal areas.
Answer: B. Slow down strong winds and waves.

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22. Which combination consists entirely of threats to ecosystems mentioned in the chapter?
A. Deforestation, pollution, invasive species and overuse of resources
B. Pollination, decomposition, afforestation and seed dispersal
C. Photosynthesis, respiration, rainfall and decomposition
D. Wildlife corridors, national parks, sanctuaries and biosphere reserves
Answer: A. Deforestation, pollution, invasive species and overuse of resources.

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23. A farmer repeatedly grows the same crop on the same land and uses large quantities of synthetic pesticides. Which outcome is most consistent with the chapter?
A. Increased biodiversity and increased pollinator population
B. Reduced biodiversity and possible pesticide resistance in pests
C. Permanent increase in soil fertility
D. Complete elimination of all agricultural pests
Answer: B. Reduced biodiversity and possible pesticide resistance in pests.

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24. Which of the following practices would be **most suitable for sustainable farming**?
A. Repeated monoculture and excessive groundwater extraction
B. Increasing synthetic pesticide use every year
C. Using organic manure and reducing unnecessary synthetic inputs
D. Removing earthworms and natural predators from fields
Answer: C. Using organic manure and reducing unnecessary synthetic inputs.

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25. Study the statements:
Assertion (A): Earthworms and other soil organisms are important for ecological balance. **Reason (R):** Heavy irrigation and repeated ploughing can disturb soil organisms.
Choose the correct option:
A. Both A and R are true.
B. A is true, but R is false.
C. A is false, but R is true.
D. Both A and R are false.
Answer: A. Both A and R are true.
Answer Key

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.
1	C	6	C	11	B	16	B	21	B
2	B	7	A	12	B	17	C	22	A
3	B	8	C	13	C	18	B	23	B
4	B	9	C	14	C	19	C	24	C
5	B	10	A	15	B	20	B	25	A

12.15 Best Practices Opportunity List from the Chapter: (10 Ideas)

For Chapter 12, **"How Nature Works in Harmony,"** the following can be presented as **Best Practices Opportunities**. The chapter itself strongly supports experiential, observation-based and interdisciplinary learning through habitat exploration, population studies, food-web activities, environmental case studies and field-based projects.

Best Practices Opportunities:

(1) **School Campus as a Living Laboratory:**
Take students outside the classroom to observe a garden, pond, large tree or nearby natural area. Students can identify **biotic and abiotic components**, classify organisms and record interactions. This converts the chapter into experiential learning rather than textbook memorisation.

(2) **Build-a-Food-Web Collaborative Activity:**
Give students organism cards such as grass, grasshopper, frog, snake, eagle, mouse and owl. Using strings or arrows, students physically construct interconnected **food chains and food webs**, and then predict what happens when one organism is removed. This develops systems thinking and cause-and-effect reasoning. The chapter specifically introduces interconnected food chains and trophic levels.

(3) **"One Change Leads to Another" Problem-Solving Challenge:**
Give groups situations such as *"frogs disappear," "a pond becomes polluted," "trees are cut down,"* or *"pollinators decrease."* Students construct a **cause** → **effect** → **consequence** → **solution** chain and present it to the class. This is especially suitable for Olympiad-style higher-order thinking.

(4) **Young Ecologist / Citizen Scientist Project:**
Each student or group can **adopt a tree** on the school campus and observe it weekly for four weeks, recording new leaves, flowers, fruits, insects and visiting birds. The chapter itself recommends this citizen-science approach.

(5) **Eco-Audit and Conservation Action Project:**
Students conduct a simple **school ecosystem audit**—waste generation, biodiversity, water use, greenery and pollution—and identify one environmental problem. They then propose and implement a small solution such as composting, planting pollinator-friendly plants or conducting a clean-up campaign. The chapter specifically proposes a school/park clean-up and discussion on reducing waste.

(6) **Farmer Interaction and Sustainable Farming Study:**
Organise interaction with a local farmer to investigate traditional and modern farming practices, fertilisers, pesticides, soil health and biodiversity. Students can compare these practices and prepare a **"Sustainable Farm Model."** The chapter recommends farmer surveys and report preparation as an activity.

(7) **Create a School Herbal/Natural Garden:**
Develop a small **eco-friendly herbal garden or natural farm** maintained by students. They can practise composting, organic manure application, biodiversity conservation and natural pest management while maintaining an observation diary. This is directly suggested as an interdisciplinary group activity in the chapter.

(8) **Case Study + Debate: "Humans—Protectors or Disturbers of Ecosystems?":**
Use chapter examples such as **elephant corridors, the Sundarbans, frog-population decline, pollution and pesticide use** for group discussions and debates. Students should defend their arguments using ecological evidence rather than merely expressing opinions.

(9) **Eco-Detective Challenge:**
Give students an ecosystem mystery—for example, *"Butterflies in the school garden have suddenly decreased."* Teams investigate possible causes involving food availability, pollution, pesticides, habitat changes and predators, and recommend solutions. The textbook itself asks students to investigate why butterflies may decline and how they could be encouraged on campus.

(10) **Indian Knowledge Systems (IKS) Integration:**

Connect modern sustainable agriculture with **Vrikshayurveda**. Students can study the chapter's reference to soil nourishment using organic manure such as **Kunapa Jala** and compare the underlying principles with present-day composting and organic farming. This provides an excellent **Science + IKS + Sustainability** interdisciplinary opportunity.

For a school lesson plan or academic audit, the strongest **five "Best Practices"** to highlight would be: **Campus as a Living Laboratory, Build-a-Food-Web, Young Citizen Scientist, Eco-Audit & Conservation Action, and IKS Integration through Vrikshayurveda.**

12.16 Innovations Opportunity List from the Chapter: (10 Ideas)

For the Grade 8 Science chapter **"How Nature Works in Harmony,"** the "Innovations" opportunity can focus on moving beyond conventional explanation and introducing **technology, simulation, design thinking, gamification, and student-created learning resources**. The chapter covers ecosystems, biotic–abiotic interactions, food chains/webs, ecological balance, conservation and sustainable farming, making it particularly suitable for innovative teaching-learning approaches.

Innovations Opportunities in Teaching–Learning

(1) **Digital Ecosystem Simulation – "What If?" Lab:**
Students create or use a simple digital model of an ecosystem and experiment with situations such as *"What if frogs disappear?", "What if rainfall decreases?"* or *"What if pollution kills pond plants?"* They predict and visually map the cascading effects. This directly extends the chapter's concept that **one ecological change can trigger several others**.

(2) **QR-Code Ecosystem Trail Around the School:**
Create an **Eco-Trail** by placing QR codes near selected trees, flowering plants, soil patches, ponds or gardens. Scanning each code can reveal student-created information about the organism, its habitat, food relationships, ecological role and interactions. Thus, the **school campus becomes an interactive digital textbook**.

(3) **AR/3D Food-Web Learning:**
Instead of drawing only conventional food chains, students can create an interactive **3D food web** using cards, models or simple augmented-reality/digital tools. Clicking or scanning an organism can reveal its predators, prey and trophic level. The chapter specifically progresses from linear food chains to interconnected food webs.

(4) **"Design Your Own Ecosystem" Challenge:**
Give student teams a hypothetical piece of land and ask them to design a **self-sustaining miniature ecosystem**. They must select producers, consumers, decomposers and abiotic components and justify how their ecosystem will remain balanced. Other teams can then introduce a disturbance—drought, pollution, loss of a predator, etc.—and challenge the designers to find a solution.

(5) **AI-Assisted Young Ecologist Project:**
Students photograph plants, insects and birds found on the campus and use suitable digital identification tools under teacher supervision to identify and classify them. They then prepare a **digital biodiversity register** showing *organism → habitat → role → interaction*. This extends the textbook's emphasis on observing local ecosystems and becoming a young citizen scientist.

(6) **Gamification – "Ecosystem Survival Game":**
Assign each student the role of **Sun, water, soil, plant, grasshopper, frog, snake, eagle, decomposer, pollinator**, etc. Introduce event cards such as *drought, pesticide*

use, deforestation, increased rainfall, or *loss of pollinators*. Students must determine who survives, who declines and how the entire food web changes. Science learning thus becomes a **strategy and decision-making game**.

(7) **Design-Thinking Challenge: "Save Our Ecosystem":**
Present a local environmental problem—plastic waste, declining butterflies, polluted water, soil degradation or loss of trees. Students follow **Identify → Investigate → Imagine → Design → Test → Improve**, ultimately developing a prototype or action plan. The textbook itself asks students to investigate declining butterflies and propose ways of increasing their population on campus.

(8) **Student-Created Micro-Documentaries / Eco-Reels:**
Groups create 2–3 minute educational videos on topics such as **"Who Eats Whom?", "A Day in the Life of a Decomposer", "Why Pollinators Matter", "If Frogs Disappeared"** or **"Journey Through a Food Web."** Students become content creators rather than passive recipients of information.

(9) **Smart Sustainable Farm Model – STEM + IKS Innovation:**
Students design a model farm combining **modern sustainable practices with traditional Indian knowledge**—composting, natural pest control, water conservation and organic manure. The chapter's reference to *Vrikshayurveda* and **Kunapa Jala** provides an excellent basis for integrating IKS with contemporary sustainability concepts.

(10) **"Eco Newsroom" – Student Science Journalism:**
Convert the classroom into a newsroom. Teams become **environment reporters, wildlife scientists, farmers, conservationists and community representatives** and prepare a news bulletin about an ecological crisis such as deforestation, mangrove destruction or human–wildlife conflict. This can integrate **Science + Language + ICT + Social Science**.

Five strongest ideas to record under "Innovations":
For a lesson plan/teacher handbook, I would recommend highlighting these five:
1. Digital "What If?" Ecosystem Simulation
2. QR-Code School Ecosystem Trail
3. Gamified Ecosystem Survival Challenge
4. AI-Assisted Campus Biodiversity Mapping
5. STEM + IKS Sustainable Farm Design Challenge

These make the chapter **technology-enabled, experiential, inquiry-driven, interdisciplinary and student-centred**, rather than merely adding more classroom activities.

12.17: Practicing Questions/Question Bank

A. Fill in the Blanks — 1 Mark Each:

1. The place where an organism lives is called its __________.
2. Living components of a habitat are called __________ components.
3. Non-living components of a habitat are called __________ components.
4. A group of the same type of organisms living in a habitat at a given time is called a __________.
5. Different populations sharing the same habitat form a __________.

6. The interaction between biotic and abiotic components in an area forms an __________.
7. Ponds, rivers and lakes are examples of __________ ecosystems.
8. Forests and grasslands are examples of __________ ecosystems.
9. Organisms that make their own food are called __________ or autotrophs.
10. Organisms that depend on other organisms for food are called __________ or heterotrophs.
11. Animals that feed only on plants are called __________.
12. Animals that feed only on other animals are called __________.
13. Animals that eat both plants and animals are called __________.
14. A simple sequence showing "who eats whom" in an ecosystem is called a __________.
15. The specific position occupied by an organism in a food chain is called a __________ level.
16. Interconnected food chains in an ecosystem form a __________.
17. The breaking down of dead organic matter into simpler substances is called __________.
18. Organisms such as bacteria and fungi that break down dead matter are called __________.
19. A relationship in which both organisms benefit is called __________.
20. The relationship between an orchid and a tree is an example of __________.
21. The relationship between a tick and a dog is an example of __________.
22. Growing the same crop repeatedly on the same land is known as __________.
23. The ancient text __________ emphasises the importance of soil health and nourishment.
24. __________ is a liquid fertiliser made from animal and plant waste through fermentation.
25. The Sundarbans were declared a World Heritage Site by UNESCO in __________.

The chapter specifically classifies organisms as producers, consumers and decomposers and explains food chains, food webs and trophic levels.

B. One-Mark Questions:

1. What is a habitat?
2. What are biotic components?
3. What are abiotic components?
4. Define population.
5. What is a community?
6. Define an ecosystem.
7. Name the two main types of ecosystems.
8. Give two examples of aquatic ecosystems.
9. Give two examples of terrestrial ecosystems.

10. What are producers?
11. What are consumers?
12. What are herbivores? Give one example.
13. What are carnivores? Give one example.
14. What are omnivores? Give one example.
15. Define a food chain.
16. What is a trophic level?
17. What is a food web?
18. What is decomposition?
19. What are decomposers?
20. Name two organisms that act as decomposers.
21. What is mutualism?
22. Give one example of mutualism.
23. What is commensalism?
24. Give one example of commensalism.
25. What is parasitism?
26. Give one example of parasitism.
27. What is meant by monoculture?
28. Give two examples of human-made ecosystems.
29. What is Kunapa Jala?
30. Who was A.J.T. Johnsingh?
31. Name any two protected areas mentioned in the chapter.
32. Why are wildlife corridors created?
33. What is pollination?
34. Name any two agents of pollination.
35. What is meant by ecological balance?

The textbook defines a population as organisms of the same type in a habitat at a given time and a community as different populations sharing the same habitat.

C. Two-Mark Questions:

1. Differentiate between biotic and abiotic components with examples.
2. Differentiate between population and community.
3. Distinguish between aquatic and terrestrial ecosystems with examples.

4. How does a pond provide the conditions necessary for the survival of fish?
5. Why do different organisms living in the same habitat use resources differently?
6. Differentiate between producers and consumers.
7. Distinguish between herbivores and carnivores with examples.
8. What is a food chain? Give one example from a grassland ecosystem.
9. What is a food web? How is it formed?
10. State any two differences between a food chain and a food web.
11. Why are decomposers important in an ecosystem?
12. Why are fungi and bacteria called saprotrophs?
13. Differentiate between mutualism and parasitism with examples.
14. Explain commensalism with a suitable example.
15. State any two benefits humans obtain from forest ecosystems.
16. Mention two ways in which plants influence abiotic components.
17. Why do elephants sometimes enter human farms and villages?
18. What is the importance of wildlife corridors?
19. Mention any two threats faced by the Sundarbans.
20. What are protected areas? Give two examples.
21. Why do human-made ecosystems require human care and management?
22. Mention two harmful effects of the excessive use of synthetic fertilisers.
23. What is monoculture? Mention one harmful effect of it.
24. Why are pollinators important in an ecosystem?
25. State two ways in which migratory birds help maintain ecosystem balance.

The chapter explains, for example, that decomposers break down dead matter and recycle important nutrients back into the environment.

D. Three-Mark Descriptive Questions:

1. Explain the terms **individual, population and community** with suitable examples.
2. Explain how biotic and abiotic components interact in an ecosystem.
3. Explain the roles of **producers, consumers and decomposers** in an ecosystem.
4. Differentiate between herbivores, carnivores and omnivores with suitable examples.
5. What is a food chain? Explain with a suitable example.
6. Explain the different trophic levels in a food chain.
7. What is a food web? Explain its importance in an ecosystem.

8. Explain the role of decomposers in nutrient recycling.
9. Explain **mutualism, commensalism and parasitism** with one example each.
10. Explain any three ways in which plants influence abiotic components of an ecosystem.
11. How do fish in a pond indirectly influence seed production in nearby flowering plants?
12. How does competition among organisms help maintain ecological balance?
13. Why is ecosystem balance said to be dynamic rather than fixed?
14. Explain any three benefits that forests provide to humans.
15. How do mangrove forests help protect coastal regions?
16. Mention and explain any three threats faced by the Sundarbans ecosystem.
17. Explain three ways in which protected areas help conserve biodiversity.
18. Explain any three harmful effects of excessive use of synthetic fertilisers.
19. How can excessive pesticide use disturb the balance of an ecosystem?
20. Explain how monoculture can affect biodiversity and pollinators.
21. State three ways in which organic and natural farming can help maintain ecological balance.
22. Explain the importance of Kunapa Jala as described in *Vrikshayurveda*.
23. How do migratory birds contribute to maintaining ecological balance?
24. Explain how loss of forest habitat can result in human–wildlife conflict.

The chapter gives honeybees and flowers as mutualism, orchids on trees as commensalism, and ticks on dogs as parasitism.

E. Five-Mark Descriptive Questions:

1. **What is an ecosystem?** Explain the interactions between biotic and abiotic components of an ecosystem with suitable examples.
2. Describe the levels of organisation in nature—**individual, population, community and ecosystem**—with suitable examples.
3. Explain the feeding relationships in an ecosystem under the headings **producers, consumers, decomposers, food chain and food web**.
4. Draw a suitable food chain and explain its different **trophic levels**.
5. **"In nature, nothing is wasted—everything is reused."** Justify this statement by explaining decomposition and nutrient recycling.
6. Explain **mutualism, commensalism and parasitism**. Give suitable examples and state how each organism involved is affected.
7. **"One small change in an ecosystem can lead to many other changes."** Explain this statement using the example of pollution in a pond.
8. Explain how the large-scale harvesting of frogs in India affected the **frog population, agricultural pests, pesticide use, soil, water and environmental health**.

9. Explain how the presence of fish in a pond can indirectly influence the production of seeds in flowering plants growing nearby.
10. Describe the **Sundarbans ecosystem**. Explain its importance and the major threats it faces.
11. What are protected areas? Explain their importance in conserving ecosystems and biodiversity with suitable examples.
12. **"Human survival and well-being depend on healthy ecosystems."** Justify the statement by explaining five benefits provided by ecosystems.
13. What are **human-made ecosystems**? Explain their benefits and why they require proper human management.
14. What was the **Green Revolution**? Explain why some intensive agricultural practices associated with it are now considered unsustainable.
15. Explain the long-term effects of excessive use of **synthetic fertilisers and pesticides** on soil, organisms and ecosystem balance.
16. What is sustainable farming? Suggest five farming practices that can help protect **soil, biodiversity, the environment and food security**.
17. Explain the importance of the ideas presented in **Vrikshayurveda** for sustainable agriculture, with special reference to Kunapa Jala.
18. **"Human activities can disturb the delicate balance of ecosystems."** Explain with five suitable examples from the chapter.

The Sundarbans section is especially suitable for long-answer questions: the chapter discusses mangroves' protection against storms and floods, carbon dioxide absorption, biodiversity, and threats from cutting, hunting, resource overuse, industrial waste and untreated sewage.

F. Application / Competency-Based Questions:

These can be included particularly under the **3-mark and 5-mark sections** to test reasoning rather than memorisation.

1. (3 Marks) Consider the food chain:
Grass → Grasshopper → Frog → Snake
If frogs suddenly disappear, predict what would happen to the populations of grasshoppers and snakes. Give reasons.

2. (3 Marks) A pond is polluted and many aquatic plants die. Explain three changes that may occur subsequently in the pond ecosystem.

3. (3 Marks) Students observe that butterflies in their school garden have decreased considerably. Suggest three possible reasons and measures to increase their population.

4. (5 Marks) A farmer has been growing the same crop for many years and regularly uses synthetic fertilisers and pesticides. The soil has become less fertile, pests have increased and fewer pollinators are seen. Explain the possible causes and suggest sustainable solutions.

5. (5 Marks) A large area of forest is cleared for roads and buildings. Explain how this can affect **animal habitats, availability of food and water, wildlife movement, ecosystem balance and human–wildlife conflict**. The chapter begins with this interconnected issue through the example of elephants entering farms and villages when habitats shrink and resources become scarce.

6. (5 Marks) "An ecosystem cannot function properly with only producers and without consumers or decomposers." Justify the statement using your understanding of food relationships and nutrient recycling.

7. (5 Marks) A coastal village with dense mangrove vegetation suffers less damage during a severe storm than a nearby village where mangroves have been removed. Explain scientifically why this may happen.

This set can serve as a **comprehensive Grade 8 question bank**, with straightforward recall questions at the 1-mark level and progressively more explanation, reasoning, cause-and-effect analysis, and real-life application at the 2-, 3-, and 5-mark levels.

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8th Standard Science Book Chapter 13

Chapter 13: Our Home: Earth, a Unique Life Sustaining Planet

13.1 Summary of the Chapter:

Summary – Chapter 13: Our Home: Earth, a Unique Life Sustaining Planet

(1) **Earth is a unique planet** because it has the right conditions to support and sustain a great diversity of life. Its life-supporting region is only a thin layer compared with the overall size of the planet.

(2) **Earth lies at the right distance from the Sun**, allowing temperatures suitable for liquid water. This region around a star is called the **habitable zone or Goldilocks zone**.

(3) **Earth's nearly circular orbit and suitable size** help maintain favourable conditions. Its gravity is strong enough to retain the atmosphere without being so strong that it makes life difficult.

(4) **Earth's atmosphere is essential for life.** Oxygen supports respiration, while the **ozone layer** protects living organisms from harmful ultraviolet (UV) radiation from the Sun.

(5) The **greenhouse effect** helps maintain a suitable temperature on Earth by trapping some heat. Unlike Earth, Venus has a very strong greenhouse effect because of its carbon-dioxide-rich atmosphere, making it extremely hot.

(6) **Earth's magnetic field acts as a protective shield**, deflecting many harmful high-energy particles such as cosmic rays and particles from the solar wind.

(7) Four major Earth systems work together to sustain life: the **atmosphere** (air), **hydrosphere** (water), **geosphere** (solid Earth—rocks, soil and minerals), and **biosphere** (living organisms).

(8) **Air, water, sunlight, soil and minerals support life in interconnected ways.** Plants use sunlight, carbon dioxide and water for photosynthesis; water supports vital processes in plants and animals; and soil provides nutrients necessary for plant growth.

(9) **Reproduction ensures the continuity of life.** Genetic material or genes carry instructions from parents to offspring and help organisms inherit characteristics while also allowing variations to arise.

(10) **Reproduction can be asexual or sexual.** In asexual reproduction, a single parent produces offspring that are essentially copies, while sexual reproduction involves genetic material from two parents and produces variation. Vegetative propagation is an example of asexual reproduction in plants.

(11) In **sexual reproduction**, male and female gametes combine during fertilisation to form a **zygote**. In flowering plants, pollination helps transfer pollen, while in animals the development of the embryo may occur inside or outside the female's body.

(12) Life on Earth is threatened by **climate change, biodiversity loss and pollution**, together called the **triple planetary crisis**. Protecting Earth requires reducing greenhouse-gas emissions and pollution, conserving biodiversity, using renewable energy, saving resources, and practising reuse, repair and recycling.

13.2 Important Formulas:

Important Formulas / Quantitative Relationships:

No.	Concept	Formula	Use
1	Percentage	**Percentage = (Part ÷ Total) × 100**	Water coverage, atmospheric composition, survival rate, etc.

No.	Concept	Formula	Use
2	Finding a part from percentage	**Part = (Percentage ÷ 100) × Total**	Finding water-covered area or other quantities expressed as percentages
3	Percentage change	**% Change = [(New value − Original value) ÷ Original value] × 100**	Change in temperature, rainfall, pollution, population, etc.
4	Average	**Average = Sum of observations ÷ Number of observations**	Average planetary temperature, rainfall, growth time, etc.
5	Temperature difference	$\Delta T = T_2 - T_1$	Comparing temperatures of planets or changes in Earth's temperature
6	Radius comparison	**Relative radius = Radius of planet ÷ Radius of Earth**	Comparing sizes of planets with Earth
7	Actual planetary radius	**Planet radius = Relative radius × Earth's radius**	Finding actual radius when relative radius is given
8	Diameter	**Diameter = 2 × Radius**	Finding diameter of Earth or another planet
9	Surface area of a sphere	$A = 4\pi r^2$	Approximate surface area of Earth or another planet
10	Volume of a sphere	$V = 4/3\ \pi r^3$	Comparing volumes of Earth and other planets
11	Density	**Density = Mass ÷ Volume** or $\rho = m/V$	Useful for problems involving planets of the same density
12	Weight	**Weight = Mass × gravitational acceleration** or $W = mg$	Understanding the effect of planetary gravity
13	Gravitational force	$F = Gm_1m_2/r^2$	Extension formula for comparing planetary gravitational attraction
14	Surface gravity	$g = GM/R^2$	Comparing gravity on planets of different mass and radius
15	Rate	**Rate = Change in quantity ÷ Time taken**	Rate of temperature rise, rainfall change, growth, pollution, etc.
16	Growth/observation time	**Time taken = Final day/time − Initial day/time**	Activities involving appearance of roots, stems and leaves
17	Survival percentage	**Survival % = (Number surviving ÷ Total number) × 100**	Reproduction and survival-based numerical questions
18	Increase/Decrease	**Change = Final value − Initial value**	Climate, temperature, rainfall or environmental-data problems

The chapter specifically gives **Earth's average temperature as 15°C**, compares planetary radii with Earth's radius, and asks students to collect and compare planetary temperature and size data, making formulas 4–10 particularly relevant.

Particularly important facts for numerical questions

The following values/relationships from the chapter should also be remembered:

- **Water covers about 70% of Earth's surface.**
- **Earth's relative radius = 1** and **Venus's relative radius = 0.95**.
- **Average temperature of Earth = 15°C.**
- **Average temperature of Venus = 450°C.**
- **Average temperature of Mercury = 170°C.**
- **Mars's atmosphere is about 100 times thinner than Earth's atmosphere.**
- The **Paris Agreement aims to limit global warming to below 1.5°C**, a useful value for temperature-change problems.

For Grade 8 examination purposes, the most useful formulas are: Percentage, percentage change, average, temperature difference, radius/diameter, surface area, volume, density, weight, and rate.

Note: formulas such as $F = Gm_1m_2/r^2$and $g = GM/R^2$are useful extensions for quantitative problems related to the chapter's discussion of gravity, but they are **not explicitly taught as formulas in Chapter 13 itself**. The chapter discusses gravity qualitatively—particularly how Earth's size allows it to retain its atmosphere.

13.3 Fill-Up the Blank LOTS type questions with Answers: (58 Questions)

1. Earth is the only known planet where ________ exists and thrives in all its forms.
   Answer: life
2. The thin outer layer of the Earth where life exists is called the ________.
   Answer: crust
3. Our solar system has ________ planets.
   Answer: eight
4. Mercury, Venus, Earth, and Mars are relatively small and ________ planets.
   Answer: rocky
5. Jupiter, Saturn, Uranus, and Neptune are large planets mostly made of ________.
   Answer: gases
6. The hottest planet in our solar system is ________.
   Answer: Venus
7. The atmosphere of Venus is almost entirely made up of ________ gas.
   Answer: carbon dioxide
8. The trapping of heat by gases in a planet's atmosphere is called the ________ effect.
   Answer: greenhouse
9. The range of distances from a star where water can remain liquid is called the ________ zone.
   Answer: habitable
10. The habitable zone is also known as the ________ zone.
    Answer: Goldilocks
11. Earth is known as the ________ Planet because of the vast amount of water on its surface.
    Answer: Blue
12. The layer of gases surrounding the Earth is called the ________.
    Answer: atmosphere
13. The atmosphere of Mars is about ________ times thinner than that of Earth.
    Answer: 100

14. The force that helps Earth retain its atmosphere is ________.
    Answer: gravity
15. A three-atom oxygen molecule is called ________.
    Answer: ozone
16. The ozone layer protects living organisms from harmful ________ rays from the Sun.
    Answer: ultraviolet (UV)
17. India's Mars Orbiter Mission is popularly known as ________.
    Answer: Mangalyaan
18. Mangalyaan was launched in the year ________.
    Answer: 2013
19. Earth behaves like a giant ________.
    Answer: magnet
20. High-energy particles coming from far across the universe are called ________ rays.
    Answer: cosmic
21. Particles coming from the Sun are called the solar ________.
    Answer: wind
22. Earth's ________ field acts like a protective shield against many harmful high-energy particles.
    Answer: magnetic
23. Plants prepare their food by the process of ________.
    Answer: photosynthesis
24. Water covers about ________ per cent of Earth's surface.
    Answer: 70
25. All the water present on Earth together forms the ________.
    Answer: hydrosphere
26. The solid parts of Earth, including rocks, soils, and minerals, are known as the ________.
    Answer: geosphere
27. Soil contains nutrients such as nitrogen and ________ that plants need for growth.
    Answer: potassium
28. The variety of landforms, rocks, soils, and the processes that shape them is called ________.
    Answer: geodiversity
29. All living beings, along with the places where they live, make up the ________.
    Answer: biosphere
30. Organisms that break down dead matter and return nutrients to the soil are called ________.
    Answer: decomposers
31. ________ ensures the continuity of life on Earth.
    Answer: Reproduction
32. The instructions passed from parents to offspring are called genetic material or ________.
    Answer: genes
33. Reproduction involving a single parent is called ________ reproduction.
    Answer: asexual
34. Reproduction involving two parents is called ________ reproduction.
    Answer: sexual
35. Reproduction in which a new plant develops from its leaf, stem, or root is called ________ propagation.
    Answer: vegetative

36. Bacteria and amoeba reproduce asexually by dividing into ________ identical individuals.
    Answer: two
37. Hydra reproduces asexually by developing tiny ________ on its body.
    Answer: buds
38. ________ is a flatworm that can regrow from a fragment of its body.
    Answer: Planaria
39. Specialised reproductive cells are called ________.
    Answer: gametes
40. Gametes carry ________ of the parent's genetic material.
    Answer: half
41. Pollen grains are found inside the ________ of a flower.
    Answer: anther
42. The female gametes of a flower are found in the ________.
    Answer: ovules
43. The transfer of pollen by wind, insects, or animals is called ________.
    Answer: pollination
44. The combining of male and female gametes is called ________.
    Answer: fertilisation
45. Fertilisation results in the formation of a ________.
    Answer: zygote
46. The male gamete in animals is called ________.
    Answer: sperm
47. The female gamete in animals is called an ________.
    Answer: egg
48. In most mammals, the zygote develops into an embryo inside the body of the ________.
    Answer: female
49. Climate change, biodiversity loss, and pollution together are called the ________ planetary crisis.
    Answer: triple
50. Burning fossil fuels releases greenhouse gases such as carbon dioxide and ________.
    Answer: methane
51. Long-term changes in temperature, rainfall, and weather patterns are called ________.
    Answer: climate change
52. The Montreal Protocol was adopted in the year ________.
    Answer: 1987
53. The Earth Summit was held in the year ________.
    Answer: 1992
54. The Paris Agreement was adopted in the year ________.
    Answer: 2015
55. The Paris Agreement set a goal to limit global warming to below ________ °C.
    Answer: 1.5 °C
56. Solar and wind are examples of ________ energy.
    Answer: renewable
57. Reusing, repairing, and ________ items can help reduce pollution and waste.
    Answer: recycling
58. The four major interconnected Earth systems discussed in the chapter are atmosphere, hydrosphere, geosphere, and ________.
    Answer: biosphere

13.4 Fill-Up the Blank HOTS type questions with Answers: (50 Questions)

1. If Earth moved much closer to the Sun, most of its liquid water would ________, making survival difficult for most life forms.
   Answer: evaporate
2. If Earth moved much farther away from the Sun, most surface water would ________.
   Answer: freeze
3. A planet located at the correct distance from its star but having very weak gravity may still be unsuitable for life because its ________ could escape into space.
   Answer: atmosphere
4. If Earth were much smaller but retained the same average density, its weaker ________ would make it difficult to hold atmospheric gases.
   Answer: gravity
5. Venus is farther from the Sun than Mercury but is hotter because its thick carbon-dioxide atmosphere produces a strong ________.
   Answer: greenhouse effect
6. If Earth had no greenhouse effect at all, it would lose more heat to space and become too ________ for liquid water to remain widely available.
   Answer: cold
7. If Earth's ozone layer became much thinner, more harmful ________ rays would reach living organisms.
   Answer: ultraviolet (UV)
8. If Earth's magnetic field suddenly disappeared, harmful particles from space could cause greater damage to the atmosphere and the ________ layer.
   Answer: ozone
9. The magnetic field indirectly protects life because it deflects many harmful particles such as cosmic rays and the solar ________.
   Answer: wind
10. If plants stopped carrying out photosynthesis on a large scale, the amount of ________ available for respiration would eventually decrease.
    Answer: oxygen
11. If rainfall in a region decreased drastically for many years, the availability of freshwater and the types of ________ and animals living there would be affected.
    Answer: plants
12. If decomposers disappeared from an ecosystem, nutrients from dead organisms would not be efficiently returned to the ________.
    Answer: soil
13. Cutting down a large forest may affect rainfall, soil, air quality, and animals because Earth's living and non-living systems are ________.
    Answer: interconnected
14. If grasses disappeared from an ecosystem, deer and grasshoppers would struggle first because they depend on grasses for ________.
    Answer: food
15. If herbivores such as deer declined greatly, predators such as tigers could also decline because their ________ would become scarce.
    Answer: food / prey
16. A potato grows into a new plant from its "eyes" without the fusion of gametes. Therefore, this is an example of ________ reproduction.
    Answer: asexual

17. If a gardener wants to produce new plants genetically very similar to a parent plant, ________ propagation would be a suitable method.
    Answer: vegetative
18. A Hydra develops a small outgrowth that separates and becomes a new individual. From this observation, we can infer that Hydra reproduces ________.
    Answer: asexually
19. Brothers and sisters can have different combinations of characteristics because each receives a different mixture of ________ information from the parents.
    Answer: genetic
20. Sexual reproduction produces greater variation because genetic information from ________ parents combines in the offspring.
    Answer: two
21. If each gamete carried the parent's complete genetic material, the amount of genetic material would keep ________ in successive generations.
    Answer: doubling
22. To prevent this doubling, each gamete normally carries only ________ of the parent's genetic material.
    Answer: half
23. If insects, wind, and other pollinating agents could no longer transfer pollen between flowers, ________ in many flowering plants would be affected.
    Answer: pollination
24. Bright colours and pleasant smells in flowers can increase their chances of reproduction by attracting ________.
    Answer: pollinators
25. If a bird eats a fruit and later drops or excretes its seed far away, the bird has helped in seed ________.
    Answer: dispersal
26. Fish and frogs release their sperm and eggs into water; therefore, their fertilisation can take place ________ the body.
    Answer: outside
27. A bird's egg must contain sufficient stored food because the developing ________ depends on it for nutrition until hatching.
    Answer: embryo
28. In most mammals, the developing embryo receives food and oxygen from the ________ rather than relying entirely on food stored in an egg.
    Answer: mother
29. If fossil-fuel burning increases, additional carbon dioxide and methane can trap more ________ in Earth's atmosphere.
    Answer: heat
30. Increased global temperatures can melt ice caps and cause ________ levels to rise, threatening coastal cities.
    Answer: sea
31. If forests are destroyed while fossil-fuel use increases, atmospheric carbon dioxide may rise faster because fewer ________ are available to absorb it.
    Answer: trees / plants
32. If factory waste enters a lake, aquatic organisms may be harmed because the ________ becomes polluted.
    Answer: water

33. Excessive fertiliser use can eventually affect organisms beyond the soil because harmful substances can move through the ________.
Answer: food chain
34. Replacing fossil fuels with solar and wind energy would help reduce ________ gas emissions.
Answer: greenhouse
35. Since the atmosphere, hydrosphere, geosphere, and biosphere are connected, serious damage to one system can ________ the others.
Answer: affect
36. If Earth's biodiversity decreases greatly, ecosystems may become less strong and less ________.
Answer: balanced
37. Reusing, repairing, and recycling products can reduce both waste and ________.
Answer: pollution
38. A Mars settlement would need more than soil and water because humans would also require a suitable atmosphere containing ________ for respiration.
Answer: oxygen
39. Even though Mars lies near the edge of the habitable zone, the absence of stable liquid water and its very thin ________ make present-day Earth-like life difficult.
Answer: atmosphere
40. Earth's ability to sustain life cannot be attributed to a single factor; it results from the interaction and ________ among several natural systems.
Answer: balance

Additional Challenging HOTS Fill-Ups

41. If Earth's gravity became extremely strong, living organisms could experience excessive downward ________.
Answer: force
42. If Earth's orbit caused extreme changes in its distance from the Sun during the year, seasonal temperatures could become more ________.
Answer: extreme
43. A new planet with liquid water but no protection from harmful high-energy particles would benefit from having a strong ________ field.
Answer: magnetic
44. If reproduction completely stopped in a species, that species would eventually ________.
Answer: disappear / become extinct
45. Small inherited changes that improve survival can accumulate over many ________, producing larger differences in organisms.
Answer: generations
46. A rise in temperature accompanied by unpredictable rainfall over many years indicates a long-term change in ________.
Answer: climate
47. Protecting forests can help both biodiversity and climate because forests provide habitats and absorb ________ dioxide.
Answer: carbon
48. If the hydrosphere becomes heavily polluted, the biosphere can also suffer, demonstrating the ________ of Earth's systems.
Answer: interdependence / interconnectedness
49. A planet with the right temperature but without liquid water would still be unsuitable for most known life because liquid water is considered ________ for life's

development and sustenance.
Answer: essential

50. Earth's habitability results from its suitable distance from the Sun, appropriate size, atmosphere, magnetic field, and the ________ among its natural systems.
Answer: balance

13.5 One-mark questions with Answers of LOTS Type: (20 Questions)

1. **Why is Earth called a unique planet?**
Answer: Earth is unique because it is the only known planet where life exists and thrives in many forms.
2. **Why is Earth called the Blue Planet?**
Answer: Earth is called the Blue Planet because most of its surface is covered with water.
3. **What is the habitable zone?**
Answer: The habitable zone is the range of distances from a star where water can remain in liquid form.
4. **Why is Earth's distance from the Sun suitable for life?**
Answer: Earth's distance from the Sun provides a suitable temperature for water to remain mostly in liquid form.
5. **What is the greenhouse effect?**
Answer: The greenhouse effect is the trapping of heat by gases such as carbon dioxide in a planet's atmosphere.
6. **Why is Venus hotter than Mercury?**
Answer: Venus is hotter than Mercury because its thick carbon-dioxide atmosphere traps a large amount of heat.
7. **What is the atmosphere?**
Answer: The atmosphere is the layer of gases that surrounds the Earth.
8. **How does Earth's gravity help maintain its atmosphere?**
Answer: Earth's gravity prevents the gases of the atmosphere from escaping into space.
9. **What is ozone?**
Answer: Ozone is a form of oxygen made up of three oxygen atoms.
10. **What is the function of the ozone layer?**
Answer: The ozone layer protects living organisms by blocking harmful ultraviolet rays from the Sun.
11. **What are cosmic rays?**
Answer: Cosmic rays are tiny high-energy particles that come to Earth from far across the universe.
12. **What is solar wind?**
Answer: Solar wind consists of high-energy particles that come from the Sun.
13. **How does Earth's magnetic field protect life?**
Answer: Earth's magnetic field pushes away many harmful high-energy particles coming from space.
14. **What is the hydrosphere?**
Answer: The hydrosphere consists of all the water present on Earth.
15. **What is the geosphere?**
Answer: The geosphere consists of the solid parts of Earth, including rocks, soil, and minerals.

16. **What is geodiversity?**
    Answer: Geodiversity is the variety of landforms, rocks, soils, and the processes that shape and alter them.
17. **What is the biosphere?**
    Answer: The biosphere consists of all living beings and the places where they live.
18. **What role do decomposers play in nature?**
    Answer: Decomposers break down dead matter and return nutrients to the soil.
19. **Why is balance important for sustaining life on Earth?**
    Answer: Balance is important because land, air, water, and living organisms depend on and affect one another.
20. **Why is reproduction essential for living organisms?**
    Answer: Reproduction ensures the continuity of each type of organism and prevents life from disappearing.
21. **What are genes?**
    Answer: Genes are genetic instructions stored inside the cells of living organisms.
22. **What is asexual reproduction?**
    Answer: Asexual reproduction is a type of reproduction in which a single parent produces new individuals that are copies of itself.
23. **What is vegetative propagation?**
    Answer: Vegetative propagation is a type of asexual reproduction in which a new plant develops from a leaf, stem, or root of the parent plant.
24. **How does Hydra reproduce asexually?**
    Answer: Hydra reproduces by forming tiny buds on its body that break off and grow into new individuals.
25. **What is sexual reproduction?**
    Answer: Sexual reproduction is a type of reproduction in which genetic information from two parents combines to produce offspring.
26. **What are gametes?**
    Answer: Gametes are specialised reproductive cells that carry half of the parent's genetic material.
27. **What is pollination?**
    Answer: Pollination is the transfer of pollen from one flower to another by wind, insects, or animals.
28. **What is fertilisation?**
    Answer: Fertilisation is the process in which male and female gametes combine to form a zygote.
29. **What are the three major environmental challenges threatening life on Earth?**
    Answer: Climate change, biodiversity loss, and pollution are the three major environmental challenges threatening life on Earth.
30. **What is the triple planetary crisis?**
    Answer: The combined threats of climate change, biodiversity loss, and pollution are known as the triple planetary crisis.

13.6 One-mark questions with Answers of HOTS Type: (30 Questions)

1. **Why would life become difficult if Earth were much closer to the Sun?**
   Answer: Earth would become too hot for liquid water to remain available for most forms of life.
2. **What would happen to most of Earth’s water if the planet were much farther from the Sun?**

Answer: Most of Earth's water would freeze because of the extremely low temperature.

3. **Why can Venus be hotter than Mercury even though Mercury is closer to the Sun?**
   Answer: Venus is hotter because its thick carbon-dioxide atmosphere traps large amounts of heat through the greenhouse effect.
4. **What would happen to Earth's atmosphere if Earth were much smaller but had the same average density?**
   Answer: Its weaker gravity would allow atmospheric gases to escape into space.
5. **Why would an extremely large Earth make survival difficult for humans?**
   Answer: Its much stronger gravity could exert such a large force that human bodies and bones might not withstand it.
6. **Predict one consequence if Earth suddenly lost its ozone layer.**
   Answer: More harmful ultraviolet radiation would reach Earth's surface and damage living cells.
7. **Why would the disappearance of Earth's magnetic field threaten life?**
   Answer: Harmful high-energy particles from space could damage the atmosphere and increase exposure to harmful radiation.
8. **Why is the presence of soil and water alone not enough for plants to grow on Mars?**
   Answer: Plants would also require suitable temperature, atmosphere, air, sunlight, and other favourable conditions for growth.
9. **Why would Earth become much colder if it had no atmosphere?**
   Answer: Without an atmosphere, much of Earth's heat would escape into space instead of being trapped by the greenhouse effect.
10. **Why is a moderate greenhouse effect beneficial to life on Earth?**
    Answer: A moderate greenhouse effect keeps Earth warm enough for water to remain in liquid form.
11. **Why might cutting down a large forest reduce local biodiversity?**
    Answer: Deforestation destroys habitats and disrupts the food and environmental resources required by many organisms.
12. **How can cutting down forests indirectly affect rainfall in an area?**
    Answer: Removing forests disturbs the interconnected balance among plants, air, water, and weather that influences rainfall.
13. **What might happen to predators if the population of herbivores decreases drastically?**
    Answer: Predator populations may decline because their main source of food becomes scarce.
14. **Why can the loss of even a few species weaken an ecosystem?**
    Answer: Each species has a role in the ecosystem, so its loss can disturb the interdependence among organisms.
15. **Why are decomposers essential for continued plant growth?**
    Answer: Decomposers return nutrients from dead matter to the soil, making them available again to plants.
16. **A tiny plant appears in a crack in a wall after rain; how might its seed have reached there?**
    Answer: The seed may have been carried or dropped there by a bird or another animal after eating a fruit.
17. **Why can two children of the same parents look different from each other?**
    Answer: Each child receives a different combination of genetic information from the two parents.

18. **Why does sexual reproduction produce more variation than asexual reproduction?**
    Answer: Sexual reproduction combines genetic information from two parents, producing new combinations of traits.
19. **Why are gametes required to contain only half the genetic material of a parent?**
    Answer: This ensures that fertilisation restores a complete set of genetic information instead of doubling it in every generation.
20. **Why can a potato grow into a new plant without producing a seed?**
    Answer: A potato can reproduce asexually through vegetative propagation using its sprouting eyes.
21. **A Hydra develops a small bud on its body; what can you predict will happen to the bud?**
    Answer: The bud can detach from the parent and grow into a new Hydra.
22. **Why does pollination have to occur before fertilisation in flowering plants?**
    Answer: Pollination brings the pollen containing male gametes to the flower so that male and female gametes can combine.
23. **How do brightly coloured flowers indirectly help plants reproduce?**
    Answer: Their bright colours can attract animals or insects that help transfer pollen between flowers.
24. **Why can fruit-eating birds help plants spread to new places?**
    Answer: Birds can carry and later drop or excrete seeds far away from the parent plant.
25. **Why must a bird's egg contain enough stored food for the developing embryo?**
    Answer: The embryo develops outside the mother's body and depends on the food stored inside the egg until hatching.
26. **Why can excessive burning of fossil fuels cause global warming?**
    Answer: Burning fossil fuels releases additional greenhouse gases that trap more heat in Earth's atmosphere.
27. **How can global warming threaten people living in coastal cities?**
    Answer: Global warming can melt ice caps and raise sea levels, increasing the risk of coastal flooding.
28. **Why can excessive use of fertilisers eventually affect organisms beyond the soil?**
    Answer: Harmful substances from polluted soil can enter and spread through the food chain.
29. **Why can damage to the hydrosphere eventually affect the biosphere?**
    Answer: The Earth's systems are interconnected, so polluted or reduced water resources can harm the living organisms that depend on them.
30. **Why can small individual actions such as saving water, saving energy, and recycling help protect Earth?**
    Answer: When practised widely, these actions reduce resource use, pollution, waste, and environmental damage.

13.7 Two-mark questions with Answers of LOTS Type: (20 Questions)

Here are **20 LOTS-type questions**, focusing mainly on **remembering, understanding, identifying, describing, and explaining**. Each answer is given in **two clear points/sentences** suitable for **2 marks**.

1. Why is Earth called a unique planet?
Answer:

1. Earth has suitable conditions such as liquid water, air, and moderate temperature to support life.
2. Its atmosphere and magnetic field also provide protection and help living organisms survive.

2. What is the greenhouse effect? State its importance to Earth.
Answer:
1. The greenhouse effect is the trapping of heat by gases such as carbon dioxide in the atmosphere.
2. It helps maintain the right temperature on Earth for life to survive.

3. What is the habitable zone or Goldilocks zone? Why is it important?
Answer:
1. The habitable zone is the range of distances from a star where water can remain in liquid form.
2. Earth lies in this zone, which provides suitable conditions for the development and sustenance of life.

4. Why is Earth known as the Blue Planet?
Answer:
1. Most of Earth's surface is covered with water.
2. Therefore, Earth appears blue when viewed from space.

5. How does Earth's size help it support life?
Answer:
1. Earth's size provides enough gravity to prevent its atmosphere from escaping into space.
2. Its gravity is also not so strong that living organisms would be crushed by their own weight.

6. State two important functions of Earth's atmosphere.
Answer:
1. The atmosphere provides oxygen required by almost all forms of life.
2. It also helps maintain a suitable temperature by trapping some of Earth's heat.

7. What is the ozone layer? How does it protect life?
Answer:
1. The ozone layer is a part of the atmosphere containing ozone, a three-atom oxygen molecule.
2. It acts as a shield by blocking harmful ultraviolet rays from the Sun.

8. What is Earth's magnetic field? How does it protect Earth?
Answer:
1. Earth behaves like a giant magnet and has a magnetic field around it.
2. This field pushes away many harmful high-energy particles coming from the Sun and space.

9. What are cosmic rays and solar wind?
Answer:
1. Cosmic rays are high-energy particles that come from far across the universe.
2. Solar wind consists of particles coming from the Sun that can harm Earth's atmosphere.

10. What is the hydrosphere? Mention one importance of water to living organisms.
Answer:
1. All the water present on Earth in oceans, rivers, lakes, groundwater and other sources forms the hydrosphere.
2. Water is essential for processes such as transporting nutrients in plants and regulating body temperature in animals.

11. What is the geosphere? How does it support life?
Answer:
1. The geosphere consists of the solid parts of Earth, including rocks, soil, and minerals.
2. It provides soil for plant growth and useful resources such as minerals and metals.

12. Define geodiversity and state its importance.
Answer:
1. Geodiversity is the variety of landforms, rocks, soils, and the processes that shape and alter them.
2. It helps create different habitats in which various forms of life can thrive.

13. What is the biosphere? Mention its main components.
Answer:
1. The biosphere consists of all living beings along with the places where they live.
2. It includes parts of land, water, and air where organisms interact with their surroundings.

14. How do plants and decomposers help maintain life on Earth?
Answer:
1. Plants prepare food through photosynthesis and form an important source of food for other organisms.
2. Decomposers break down dead matter and return nutrients to the soil.

15. Why is reproduction important for the continuity of life?
Answer:
1. Reproduction produces new individuals and ensures that each type of organism continues to exist.
2. Without reproduction, plants and animals would eventually disappear from Earth.

16. Differentiate between asexual and sexual reproduction.
Answer:
1. In asexual reproduction, a single parent produces new individuals that are almost exact copies of itself.
2. In sexual reproduction, genetic information from two parents combines, producing offspring with similarities and differences.

17. What is vegetative propagation? Give two examples.
Answer:
1. Vegetative propagation is a type of asexual reproduction in which a new plant develops from the leaf, stem, or root of a parent plant.
2. Potato and ginger are examples of plants that reproduce through vegetative propagation.

18. What are gametes? What happens when male and female gametes join?
Answer:
1. Gametes are specialised reproductive cells carrying half of the parent's genetic material.
2. When male and female gametes join, they form a new cell with a complete set of genetic information.

19. Explain pollination and fertilisation in flowering plants.
Answer:
1. Pollination is the transfer of pollen to another flower by agents such as wind, insects, or animals.
2. Fertilisation occurs when male and female gametes combine to form a zygote, which later becomes the seed.

20. What is the triple planetary crisis? Name its three components.
Answer:

1. The triple planetary crisis refers to the three major environmental challenges threatening life on Earth.
2. They are **climate change, biodiversity loss, and pollution**.

13.8. Two-mark questions with Answers of HOTS Type: (20 Questions)

Below are **20 Higher Order Thinking Skills (HOTS)** questions based on the chapter 13. They focus on **application, analysis, reasoning, prediction, cause-and-effect, and inference**. Each answer is restricted to **two points/sentences**, suitable for **2 marks**.

1. What would happen to life on Earth if Earth were much closer to the Sun? Give reasons.

Answer:

1. Earth would become much hotter, causing most liquid water to evaporate.
2. The absence of sufficient liquid water and extreme temperatures would make survival difficult for most forms of life.

2. If Earth were much smaller but had the same average density, how would this affect its atmosphere and life?

Answer:

1. A smaller Earth would have weaker gravity, allowing atmospheric gases to escape into space.
2. Without a sufficient atmosphere, Earth would lose many of the conditions necessary to support life.

3. Venus is farther from the Sun than Mercury, yet Venus is hotter. How can you explain this?

Answer:

1. Venus has a thick atmosphere containing mostly carbon dioxide, which traps large amounts of heat.
2. This strong greenhouse effect makes Venus hotter than Mercury even though Mercury is closer to the Sun.

4. Suppose Earth's atmosphere suddenly disappeared. Predict two major consequences for life.

Answer:

1. Earth would lose heat rapidly to space and become too cold, affecting the presence of liquid water.
2. Living organisms would also lose atmospheric oxygen and protection from harmful radiation.

5. What might happen to life if Earth's magnetic field suddenly disappeared?

Answer:

1. More harmful cosmic rays and solar-wind particles could reach Earth and damage its atmosphere and ozone layer.
2. Increased harmful UV radiation could then reach the surface and adversely affect living organisms.

6. A planet has liquid water but no atmosphere. Can we conclude that it is suitable for life? Justify your answer.

Answer:

1. No, liquid water alone is not sufficient because an atmosphere helps maintain temperature and provides gases necessary for life.
2. Earth's habitability results from several factors working together, including water, atmosphere, suitable size, position, and magnetic field.

7. A large forest near a city is cut down. How could this affect the surrounding environment?
Answer:
1. Cutting down the forest can affect rainfall, soil, air quality, and the habitats of animals.
2. Since Earth's living and non-living components are interconnected, disturbance to one component can affect several others.

8. Why would the disappearance of decomposers eventually affect plants and animals?
Answer:
1. Without decomposers, nutrients from dead organisms would not be efficiently returned to the soil.
2. This would reduce nutrient availability to plants and eventually disturb the food relationships involving animals.

9. A region receives very little rainfall for several years. Predict how this could affect its plants, animals, and people.
Answer:
1. Reduced rainfall would decrease water availability and affect the types and growth of plants and animals in the region.
2. It could also reduce water available for farming and people, thereby affecting food production and daily life.

10. Two children born to the same parents may not look exactly alike. Why?
Answer:
1. In sexual reproduction, each child receives a different combination of genetic information from both parents through gametes.
2. These different combinations produce variations in characteristics such as eye colour, hair type, and other features.

11. If an organism reproduced only asexually, how would its offspring compare with those produced sexually?
Answer:
1. Asexual reproduction generally produces offspring that are copies of the single parent in terms of genetic instructions.
2. Sexual reproduction combines instructions from two parents and therefore produces greater variation among offspring.

12. A gardener wants to produce several new plants with characteristics similar to one healthy parent plant. Which method would be useful and why?
Answer:
1. Vegetative propagation would be useful because new plants can develop from the stem, root, or other suitable parts of a parent plant.
2. Since it is a form of asexual reproduction, the new plants retain the same genetic instructions as the parent.

13. Why do birds and mammals provide nutrition to their developing young in different ways?
Answer:
1. In birds, the egg contains food needed by the embryo because development continues after the egg is laid.
2. In most mammals, the embryo develops inside the female's body and receives the food and oxygen needed for growth from the mother.

14. If grasses disappeared from an ecosystem, how could predators such as tigers or foxes eventually be affected?
Answer:

1. Herbivores such as deer and grasshoppers would struggle to survive because an important source of food would disappear.
2. As herbivore populations decline, predators would also face food shortages, disturbing the entire ecosystem.

15. Burning fossil fuels adds carbon dioxide to the atmosphere. Explain how this can eventually cause sea levels to rise.
Answer:
1. Additional carbon dioxide traps more heat in the atmosphere, leading to global warming.
2. Rising temperatures can melt ice caps, causing sea levels to rise and increasing the risk of flooding in coastal areas.

16. Why can pollution of a river affect organisms that do not live directly in the river?
Answer:
1. Polluted water can harm aquatic organisms and introduce harmful substances into food chains.
2. Since the hydrosphere, biosphere, atmosphere, and geosphere are interconnected, damage to one Earth system can affect the others.

17. A farmer uses excessive fertilisers continuously. Predict two possible long-term effects.
Answer:
1. Excess fertilisers can pollute the soil and eventually reduce crop yield.
2. Harmful substances may also enter water bodies or pass through the food chain, affecting other organisms.

18. Why would protecting biodiversity make an ecosystem better able to withstand environmental changes?
Answer:
1. Different organisms perform different roles and depend on one another within an ecosystem.
2. Therefore, diverse ecosystems are generally stronger and more balanced, while the loss of species weakens nature's ability to support life.

19. A student says, "Only governments can protect Earth; individual actions do not matter." How would you respond?
Answer:
1. Individuals can reduce pollution and waste by reusing, repairing, recycling, and conserving water and energy.
2. When such small actions are practised by many people, they collectively contribute to protecting Earth's natural systems.

20. Imagine humans plan to establish a settlement on Mars. Why would carrying only soil and water from Earth not be enough to sustain life?
Answer:
1. Life requires more than soil and water; suitable temperature, atmospheric gases, sunlight, and other favourable environmental conditions are also necessary.
2. Mars has a much thinner atmosphere than Earth, so creating Earth-like life-supporting conditions would require recreating several interconnected conditions.

13.9. Three-mark questions with Answers of LOTS Type: (15 Questions)

Here are **15 LOTS (Lower Order Thinking Skills)** questions based directly on the chapter. They focus mainly on **remembering, understanding, identifying, describing, and explaining**, with **three points/sentences for each answer**.

1. What are the three important conditions that make Earth suitable for life?
Answer:
1. Earth is at the right distance from the Sun, allowing water to remain in liquid form.
2. Earth is the right size to hold an atmosphere around it.
3. Its atmosphere and magnetic field help protect and sustain life.

2. What is the habitable zone? Why is Earth located in this zone?
Answer:
1. The habitable zone is the range of distances from a star where water can remain in liquid form.
2. It is also called the **Goldilocks zone** because conditions are neither too hot nor too cold.
3. Earth lies in this zone at the right distance from the Sun and therefore has abundant liquid water.

3. Explain the importance of Earth's atmosphere in supporting life.
Answer:
1. The atmosphere contains oxygen required by humans, animals, and many other organisms for respiration.
2. It helps maintain a suitable temperature by trapping some of the heat through the greenhouse effect.
3. The ozone layer in the atmosphere blocks harmful ultraviolet rays from the Sun.

4. What is the greenhouse effect? State its importance to Earth.
Answer:
1. Greenhouse gases such as carbon dioxide absorb some of the radiation given off by the warmed Earth.
2. This process traps some heat in the atmosphere and is called the **greenhouse effect**.
3. The mild greenhouse effect keeps Earth warm enough for water to remain in liquid form.

5. Describe the role of Earth's magnetic field in protecting life.
Answer:
1. Earth behaves like a giant magnet and has a magnetic field around it.
2. The magnetic field pushes away many harmful high-energy particles from the Sun and space.
3. It therefore protects Earth's atmosphere and helps keep life on the planet safe.

6. State three important functions of water in supporting life on Earth.
Answer:
1. Water transports nutrients from the soil to the leaves in plants.
2. In animals, water helps regulate body temperature, aids digestion, and maintains hydration.
3. Water bodies also provide habitats for millions of aquatic organisms.

7. What is the geosphere? Explain its importance.
Answer:
1. The geosphere consists of the solid parts of Earth, including rocks, soil, and minerals.
2. Soil contains nutrients such as nitrogen and potassium that plants need for growth.
3. The geosphere also provides useful resources such as salt, coal, oil, iron, and copper.

8. What is the biosphere? Describe how living organisms depend on one another.
Answer:
1. The biosphere includes all living beings along with the places where they live.
2. Plants prepare food through photosynthesis, while animals obtain food by eating plants or other animals.
3. Decomposers break down dead matter and return nutrients to the soil.

9. What is reproduction? Why is it important for the continuity of life?

Answer:

1. Reproduction is the process by which living organisms produce new individuals of their own kind.
2. It ensures that each type of organism continues to exist from one generation to another.
3. Without reproduction, plants and animals would eventually disappear from Earth.

10. Differentiate between asexual and sexual reproduction.

Answer:

1. In asexual reproduction, a single parent produces new individuals that are almost exact copies of itself.
2. In sexual reproduction, genetic instructions from two parents combine to produce offspring.
3. Sexual reproduction produces variations, whereas asexual reproduction generally produces very similar offspring.

11. Explain vegetative propagation with suitable examples.

Answer:

1. Vegetative propagation is a type of asexual reproduction in which new plants develop from parts such as roots, stems, or leaves.
2. A money plant can grow from a stem cutting, while potato can grow from its sprouted 'eyes'.
3. Ginger can also produce a new plant when a suitable piece is planted in moist soil.

12. Describe sexual reproduction in flowering plants.

Answer:

1. Pollen grains in the anther contain the male gametes, while ovules contain the female gametes.
2. Pollination transfers pollen to another flower, after which male and female gametes combine during fertilisation.
3. Fertilisation forms a zygote that develops into a seed, while the fleshy part around the ovule develops into a fruit.

13. Explain how fertilisation and development occur in animals.

Answer:

1. In animals, the male gamete is called sperm and the female gamete is called an egg.
2. The sperm and egg combine during fertilisation to form a zygote.
3. In some animals the embryo develops outside the female's body, while in most mammals it develops inside the female's body.

14. What is the triple planetary crisis? Explain its three components.

Answer:

1. The three major environmental challenges together are called the **triple planetary crisis**.
2. They are **climate change, biodiversity loss, and pollution**.
3. These problems disturb the delicate balance between Earth's living and non-living systems and threaten life.

15. Mention three ways in which people can help protect life on Earth.

Answer:

1. People can reduce pollution by reusing, repairing, and recycling materials such as clothes and plastics.
2. They can conserve important resources by saving water and energy.
3. People can learn about environmental issues, share their knowledge, and encourage others to act responsibly.

13.10. Three-mark questions with Answers of HOTS Type: (18 Questions)

1. Suppose Earth suddenly became much smaller while maintaining the same density. How would this affect life on Earth?
Answer:
1. A smaller Earth would have weaker gravity and would not be able to hold its atmosphere effectively.
2. Atmospheric gases could gradually escape into space, as the chapter explains while comparing Earth with Mars and Mercury.
3. Without a suitable atmosphere, conditions necessary for sustaining most forms of life would be disturbed.

2. Imagine Earth moved much closer to the Sun. Predict three major effects on life.
Answer:
1. Earth's temperature would rise because it would receive more heat from the Sun.
2. Much of the liquid water could evaporate, making water unavailable to living organisms.
3. Such extreme conditions would make it difficult for most plants, animals, and humans to survive.

3. Venus is farther from the Sun than Mercury, yet Venus is hotter. How can you explain this?
Answer:
1. Venus has a thick atmosphere containing mostly carbon dioxide, whereas Mercury has no atmosphere.
2. Carbon dioxide traps heat through the greenhouse effect and prevents heat from escaping easily.
3. Therefore, the nature of a planet's atmosphere can influence its temperature more strongly than its distance from the Sun alone.

4. What might happen to life on Earth if its magnetic field suddenly disappeared?
Answer:
1. More high-energy particles from the solar wind and cosmic rays could reach Earth.
2. These particles could damage the atmosphere and reduce the protective ozone layer.
3. More harmful UV radiation could then reach Earth and negatively affect living organisms.

5. A large forest near a city is cleared for construction. Predict three possible environmental consequences.
Answer:
1. Cutting down the forest could affect local rainfall and air quality.
2. Animals and plants that depend on the forest could lose their habitats, leading to biodiversity loss.
3. Changes in vegetation could also affect soil and disturb the balance among Earth's interconnected natural systems.

6. A planet has plenty of water but no atmosphere. Can it support life like Earth? Justify your answer.
Answer:
1. Water alone is not sufficient because an atmosphere provides gases such as oxygen needed by many living organisms.
2. Without an atmosphere, the planet would lose heat to space and become very cold.
3. It would also lack the atmospheric protection and suitable conditions that help sustain life on Earth.

7. Tiny plants are found growing in cracks in a wall after the rainy season. Explain how they might have grown there.
Answer:

1. Seeds may have been carried to the wall by birds or other animals after they ate fruits.
2. Rainwater could provide the moisture needed for the seeds to germinate.
3. Using stored nutrients, the seeds could develop roots and shoots and grow into young plants.

8. Why would removing one group of organisms from a food chain affect several other organisms? Explain with an example.

Answer:

1. Organisms in an ecosystem depend on one another for food and survival.
2. If grasses disappear, herbivores such as deer and grasshoppers may struggle to survive.
3. The decline of herbivores would then reduce food available to predators such as tigers and foxes.

9. Two children born to the same parents may look different from each other. How can this be explained scientifically?

Answer:

1. In sexual reproduction, each child receives genetic information from both parents through gametes.
2. These genetic instructions combine in different ways during fertilisation.
3. Therefore, siblings may inherit different combinations of features such as eye colour, hair type, and other characteristics.

10. If all organisms reproduced only asexually, how might this affect variation among their offspring?

Answer:

1. In asexual reproduction, a single parent produces offspring that are essentially copies of itself.
2. Sexual reproduction, in contrast, mixes genetic instructions from two parents and produces differences among offspring.
3. Therefore, if reproduction were only asexual, there would generally be much less variation produced through reproduction.

11. A farmer repeatedly throws away pieces of sprouted potatoes and ginger. How could these plant parts be used instead?

Answer:

1. The sprouted 'eyes' of potatoes and pieces of ginger can be planted in moist soil.
2. Under suitable conditions of water, air, and sunlight, these parts can develop roots, stems, and leaves.
3. Thus, the farmer can use vegetative propagation to produce new plants without relying on seeds.

12. Why is Earth's greenhouse effect necessary for life, even though excessive greenhouse gases cause global warming?

Answer:

1. Earth's natural greenhouse effect traps some heat and prevents the planet from becoming too cold.
2. This mild warming helps maintain temperatures at which water can remain liquid.
3. However, additional greenhouse gases from human activities trap extra heat and contribute to global warming.

13. A village experiences increasing temperatures and unpredictable rainfall. Suggest how these changes could affect village life.

Answer:

1. Unpredictable rainfall can affect the availability of water for people and agriculture.
2. Rising temperatures and altered rainfall patterns can affect crop growth and local ecosystems.

3. The village could respond by conserving water, using resources carefully, and adopting environmentally responsible practices.

14. Why can damage to the hydrosphere eventually affect the biosphere and geosphere?
Answer:
1. The hydrosphere, biosphere, atmosphere, and geosphere are interconnected Earth systems.
2. Polluted water can harm aquatic organisms and make water unsafe, thereby affecting the biosphere.
3. Pollutants can also affect soil and move through food chains, showing that damage to one Earth system can influence others.

15. If you were designing a human settlement on Mars, what three essential Earth-like conditions would you try to provide?
Answer:
1. A reliable supply of liquid water would be needed for drinking and other life processes.
2. A suitable artificial atmosphere would be required to provide breathable air and help maintain temperature.
3. The settlement would also need protection from harmful radiation and high-energy particles reaching the planet's surface.

16. Why might biodiversity loss make an ecosystem less stable?
Answer:
1. Different organisms perform different roles and depend on one another within an ecosystem.
2. Loss of some organisms can affect food relationships and weaken the ability of the ecosystem to support other life.
3. Therefore, ecosystems with greater biodiversity tend to be stronger and more balanced.

17. Why is protecting only one component—such as water—not enough to protect life on Earth?
Answer:
1. Life depends on interactions among the atmosphere, hydrosphere, geosphere, and biosphere.
2. A change in one component can influence others; for example, forest loss can affect rainfall, soil, air quality, and animals.
3. Therefore, protecting Earth requires maintaining the balance of all its interconnected living and non-living systems.

18. Burning fossil fuels releases carbon that was stored underground for millions of years. Why does this disturb Earth's balance?
Answer:
1. Burning coal and oil releases additional carbon dioxide and other greenhouse gases into the atmosphere.
2. Earth's plants and ocean plankton cannot absorb this extra carbon quickly enough.
3. As a result, more heat is trapped, contributing to global warming and long-term climate change.

13.11 Five-mark questions with Answers of LOTS Type: (10 Questions)

1. Explain five important factors that make Earth suitable for life.
Answer:
1. Earth is at the right distance from the Sun, so its temperature is neither extremely hot nor extremely cold.

2. This suitable temperature allows water to remain mostly in the **liquid state**, which is essential for life.
3. Earth is of the right size and has sufficient gravity to hold its **atmosphere**.
4. The **ozone layer** protects living organisms from harmful ultraviolet rays from the Sun.
5. Earth's **magnetic field** protects the planet from harmful high-energy particles coming from space.

2. Describe the importance of water in sustaining life on Earth.
Answer:
1. Water covers about **70 per cent of Earth's surface** and forms the hydrosphere.
2. Water acts as a good solvent and helps plants absorb and transport nutrients from the soil.
3. In animals, water helps regulate body temperature, aids digestion, and maintains hydration.
4. Oceans, rivers, lakes, and other water bodies provide habitats for millions of aquatic organisms.
5. Water vapour forms clouds and produces rain or snow, which replenishes rivers, lakes, and groundwater.

3. Explain the role of soil, rocks, and minerals in supporting life on Earth.
Answer:
1. Earth's crust is made up of **rocks, soil, and minerals**, which together form part of the geosphere.
2. Soil provides nutrients such as nitrogen and potassium that plants need for their growth.
3. These nutrients are formed through the slow breakdown of rocks and the remains of plants and animals.
4. Minerals provide useful resources such as salt, coal, oil, iron, and copper.
5. The variety of landforms, rocks, and soils, called **geodiversity**, creates different habitats in which various forms of life can thrive.

4. What is asexual reproduction? Explain it with suitable examples.
Answer:
1. **Asexual reproduction** is a type of reproduction in which only one parent is involved.
2. The new individuals produced are essentially copies of their parent in terms of the instructions inside their cells.
3. In plants, vegetative propagation is a form of asexual reproduction in which new plants can develop from parts such as stems, roots, or leaves.
4. Potato, ginger, and money plant can produce new plants through vegetative propagation.
5. Bacteria and amoeba reproduce by dividing into two, while Hydra reproduces by forming buds on its body.

5. Explain sexual reproduction and the role of gametes.
Answer:
1. **Sexual reproduction** generally involves two parents, called male and female.
2. Each parent produces specialised reproductive cells known as **gametes**.
3. Each gamete carries only half of the parent's genetic material.
4. The male and female gametes join during **fertilisation** to form a new cell called the zygote.
5. The zygote receives a complete set of genetic instructions, half from each parent.

6. Describe the process of sexual reproduction in flowering plants.
Answer:
1. Flowers contain reproductive parts that produce male and female gametes.

2. Pollen grains found in the **anther** represent the male reproductive component, while **ovules** contain the female reproductive component.
3. The transfer of pollen by wind, insects, or animals is called **pollination**.
4. The joining of the male and female gametes is called **fertilisation**, which results in the formation of a zygote that develops into the seed.
5. The fleshy part of the flower surrounding the ovule develops into a **fruit**.

7. Describe sexual reproduction in animals.
Answer:
1. In animals, the male gamete is called **sperm**, while the female gamete is called the **egg**.
2. The sperm and egg combine during fertilisation to form a **zygote**.
3. In animals such as fish and frogs, fertilisation and the development of the embryo can take place in water.
4. In birds, the fertilised egg is laid by the female, and the embryo develops inside the egg before hatching.
5. In most mammals, the embryo develops inside the mother's body, which supplies it with food and oxygen until birth.

8. Explain the role of Earth's magnetic field in protecting life.
Answer:
1. Earth behaves like a giant magnet and has its own **magnetic field**.
2. Its magnetic field is believed to originate from the movement of molten iron in Earth's core.
3. Earth is continuously exposed to high-energy particles such as **cosmic rays** and **solar wind**.
4. These particles can damage the atmosphere, reduce the ozone layer, and allow more harmful UV rays to reach Earth.
5. Earth's magnetic field acts as a protective shield by pushing many of these harmful particles away from the planet.

9. What is the triple planetary crisis? Describe its three major components.
Answer:
1. The three major environmental challenges facing Earth are together called the **triple planetary crisis**.
2. **Climate change** occurs due to long-term changes in temperature, rainfall, and weather patterns.
3. **Biodiversity loss** occurs when habitats are destroyed and plants and animals disappear.
4. **Pollution** of air, water, and soil harms humans, other organisms, and the environment.
5. These three problems disturb the delicate balance of Earth's natural systems and threaten life on the planet.

10. Describe five ways in which people can help protect Earth and sustain life.
Answer:
1. We can reduce greenhouse gas emissions by using **renewable energy** such as solar and wind energy.
2. We can choose environmentally friendly methods of transportation and use energy efficiently.
3. We should protect biodiversity because diverse ecosystems are stronger and more balanced.
4. We can reduce pollution and waste by **reusing, repairing, and recycling** materials such as clothes and plastics.
5. We can conserve water and energy and encourage others to use natural resources responsibly.

13.12 Five-mark questions with Answers of HOTS Type: (10 Questions)

1. Suppose Earth were much smaller than its present size. Analyse how this could affect life on Earth.
Answer:
1. If Earth were much smaller, its gravitational force would become weaker.
2. Weaker gravity might not be able to hold the gases of the atmosphere, causing them to escape into space.
3. Loss of atmosphere would reduce the availability of oxygen required by most living organisms.
4. Earth would also lose more heat to space, making conditions unsuitable for maintaining liquid water.
5. Therefore, Earth's present size and gravity are important for maintaining the atmosphere and conditions necessary for life.

2. Imagine that Earth's magnetic field suddenly disappeared. Predict the possible consequences for life.
Answer:
1. Without Earth's magnetic field, more high-energy particles from space and the Sun could reach the planet.
2. Cosmic rays and solar wind could cause greater damage to Earth's atmosphere.
3. These particles could contribute to the reduction of the protective ozone layer.
4. As a result, more harmful ultraviolet radiation could reach Earth's surface and damage living cells.
5. Thus, disappearance of the magnetic field could seriously threaten Earth's atmosphere and the survival of life.

3. A large forest near a city is cleared for roads and buildings. Analyse how this action could disturb the natural balance of the area.
Answer:
1. Cutting down the forest destroys habitats and may reduce the number and variety of plants and animals.
2. With fewer plants, the relationships among producers, herbivores, predators, and decomposers may be disturbed.
3. Forest loss can affect rainfall and the availability of water in the region.
4. Removal of vegetation can also affect soil and air quality and disturb the local environment.
5. Therefore, deforestation can affect several interconnected parts of Earth's system and weaken the natural balance necessary for life.

4. A scientist discovers a planet at the right distance from its star for liquid water to exist. Can we immediately conclude that the planet can support life? Justify your answer.
Answer:
1. No, being in the habitable zone alone does not guarantee that a planet can support life.
2. The planet should have suitable gravity to retain an atmosphere.
3. Its atmosphere should provide suitable gases and help maintain an appropriate temperature.
4. Protective mechanisms similar to Earth's ozone layer and magnetic field would also be important for shielding life from harmful radiation and particles.
5. Therefore, habitability depends on several interacting conditions and not merely on the planet's distance from its star.

5. Why would Earth become unsuitable for most forms of life if it moved much closer to or farther away from the Sun? Analyse.

Answer:

1. Earth's present distance from the Sun allows temperatures suitable for liquid water.
2. If Earth moved much closer to the Sun, temperatures would rise considerably and water could evaporate.
3. If Earth moved much farther away, temperatures would fall and much of the water could freeze.
4. The absence of sufficient liquid water would make survival difficult for most plants, animals, and humans.
5. Hence, Earth's position in the Sun's habitable or **Goldilocks zone** is an important factor in sustaining life.

6. A village has experienced rising temperatures and unpredictable rainfall for several years. Analyse the possible cause and suggest suitable measures.

Answer:

1. Increasing temperature and changing rainfall patterns may be signs of climate change.
2. Increased greenhouse gases from activities such as burning coal and oil can trap additional heat in the atmosphere.
3. The village can reduce its contribution to the problem by conserving energy and encouraging the use of renewable sources such as solar and wind energy.
4. Water should be conserved carefully because unpredictable rainfall can affect local water availability and agriculture.
5. The community can also protect biodiversity, reduce waste, recycle materials, and use natural resources sustainably.

7. Explain why the disappearance of grasses from an ecosystem could eventually affect predators such as tigers or foxes.

Answer:

1. Grasses act as food for herbivores such as deer and grasshoppers.
2. If grasses disappear, these herbivores would have less food and their populations could decline.
3. Predators depend directly or indirectly on such animals for their food.
4. A reduction in herbivores would therefore reduce the food available to predators such as tigers or foxes.
5. This shows that organisms in an ecosystem are interconnected and that the loss of even some species can weaken the entire ecosystem.

8. Two children of the same parents may look different from each other. Use your knowledge of sexual reproduction to explain why.

Answer:

1. In sexual reproduction, offspring receive genetic information from both parents.
2. Each parent produces specialised reproductive cells called gametes containing half of the parent's genetic material.
3. Different gametes can carry different combinations of instructions for characteristics such as eye colour and hair type.
4. When male and female gametes combine, these genetic instructions mix in different ways.
5. Therefore, siblings can share characteristics with their parents and with each other while still having their own unique features.

9. Why can excessive use of fertilisers eventually affect organisms beyond the agricultural field? Analyse.

Answer:

1. Excess fertilisers can pollute the soil and reduce its quality.
2. Pollutants from farms may also enter nearby water bodies and harm aquatic organisms.

3. Harmful substances present in polluted soil and water can enter living organisms.
4. These substances may then spread through the food chain as organisms consume one another.
5. Therefore, poor agricultural practices can affect soil, water, plants, animals, and ultimately the wider ecosystem.

10. If there were no atmosphere on Earth, analyse its effects on temperature, water, and living organisms.

Answer:

1. Without an atmosphere, Earth would lose more heat to space and become much colder.
2. The greenhouse effect that presently helps maintain a suitable temperature would be absent.
3. Conditions necessary for maintaining liquid water would be seriously disturbed.
4. Living organisms would lose the atmospheric oxygen required by most forms of life for respiration.
5. There would also be no atmospheric ozone layer to protect organisms from harmful ultraviolet radiation from the Sun.

13.13 Five-mark questions with Answers of Applied Type: (10 Questions)

1. A farmer notices that rainfall in his village has become irregular and summers are becoming hotter. How can he apply his knowledge of climate change to deal with this situation?

Answer:

1. The farmer can conserve rainwater through rainwater harvesting for use during dry periods.
2. He can use water carefully and adopt methods that reduce unnecessary wastage.
3. The village can reduce dependence on fossil fuels and encourage renewable sources such as solar and wind energy.
4. Protecting trees and biodiversity can help maintain healthier and more balanced ecosystems.
5. Sustainable use of natural resources and collective community action can help people adapt to changing climatic conditions.

2. You are asked to grow new money plants without using seeds. How would you apply the method of vegetative propagation?

Answer:

1. I would take a healthy stem cutting from a money plant.
2. I would place the cutting in moist soil or in a glass container containing water.
3. I would provide the cutting with suitable conditions such as water, air, and sunlight.
4. I would observe it every day for the appearance of roots, stems, and new leaves.
5. The development of a new plant from the stem cutting demonstrates **vegetative propagation**, a form of asexual reproduction.

3. Your school plans to cut several trees to construct a new building. Apply your knowledge of Earth's interconnected systems to explain why some trees should be conserved.

Answer:

1. Trees are part of the biosphere and interact with air, water, and soil.
2. Plants use carbon dioxide and release oxygen during photosynthesis.
3. Removing many trees can affect local rainfall, soil conditions, and air quality.
4. Cutting trees also destroys habitats and can reduce the biodiversity of the area.

5. Therefore, conserving trees is important because changes in one part of Earth's system can affect many other parts.

4. A factory near a village is releasing waste into a river. What measures would you suggest to protect life in and around the river?

Answer:

1. Factory waste should not be released directly into the river because it can harm aquatic organisms.
2. Waste should be properly managed so that harmful substances do not contaminate water.
3. The community should reduce plastic and other wastes entering the river.
4. Sustainable practices should also be followed in nearby farms to reduce pollution from excess fertilisers.
5. Protecting water is essential because damage to the hydrosphere can also affect the biosphere and other interconnected Earth systems.

5. Suppose you are planning a human settlement on another planet. What five Earth-like conditions would you try to provide to make human survival possible?

Answer:

1. I would ensure the availability of **liquid water**, which is essential for life.
2. I would provide an atmosphere containing sufficient oxygen for respiration.
3. A suitable temperature would have to be maintained so that water remains in liquid form.
4. Protection from harmful radiation and high-energy particles would also be necessary.
5. Suitable soil, nutrients, water, air, and sunlight would be needed to grow plants for food and oxygen.

6. You observe tiny plants growing in cracks in a school wall after the rainy season. Apply your knowledge of seed dispersal and germination to explain how they could have grown there.

Answer:

1. Birds or other animals may have carried fruits and seeds to the area.
2. After eating fruits, birds may have dropped or excreted seeds into cracks in the wall.
3. Rainwater would provide the moisture required for the seeds to germinate.
4. The seeds would use their stored nutrients to begin producing roots and shoots.
5. With sufficient water and suitable conditions, the seedlings could continue growing in the cracks.

7. Your family wants to reduce its contribution to pollution and climate change. Suggest five actions you can practise at home.

Answer:

1. We can save electricity and reduce unnecessary energy consumption.
2. We can conserve water and avoid wasting it in daily activities.
3. We can reuse and repair useful items instead of immediately throwing them away.
4. Materials such as clothes and plastics can be reused or recycled to reduce waste and pollution.
5. We can encourage environmentally responsible choices and share awareness about protecting Earth's resources with others.

8. A gardener wants to increase the number of ginger and potato plants in a garden. How can the gardener apply asexual reproduction to do this?

Answer:

1. The gardener can use vegetative propagation instead of depending only on seeds.
2. A piece of ginger containing a suitable growing part can be planted in moist soil.
3. A sprouted potato containing an **"eye"** can also be planted in soil.

4. Water, air, and sunlight should be provided so that the planted parts can grow properly.
5. New roots, shoots, stems, and leaves can then develop from these plant parts to form new plants.

9. A town has heavy traffic and many factories, resulting in poor air quality. Apply what you have learnt to suggest ways to improve the situation.
Answer:
1. The town should reduce air pollution produced by vehicles, factories, and the burning of fuels.
2. Cleaner sources of energy should be encouraged to reduce the release of pollutants.
3. Environmentally friendly methods of transportation can help reduce pollution from vehicles.
4. Energy should be used efficiently so that less fuel needs to be burned.
5. These measures are important because air pollution can cause breathing problems, damage crops, and contribute to smog and acid rain.

10. Imagine you have to prepare an "Earth Survival Kit" for establishing life on another planet. What would you include and why?
Answer:
1. I would include a reliable source of **water** because water is essential for all known forms of life.
2. I would include plants because they can prepare food through photosynthesis and release oxygen.
3. I would provide suitable air containing gases required for respiration and photosynthesis.
4. I would include nutrient-rich soil or another suitable growing medium to support plant growth.
5. I would also provide suitable light and temperature conditions because living organisms require a favourable environment to survive and grow.

These questions are **Applied Type** because they require students to use concepts from the chapter in **real-life or new situations**, rather than merely recalling definitions and facts.

13.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams:

Olympiad-Type Multiple Choice Questions

1. Suppose Earth suddenly became much smaller while maintaining the same average density. Which consequence would most directly threaten life?
A) Its magnetic field would necessarily become stronger
B) Its gravity might become too weak to retain the atmosphere
C) All water would immediately turn into ice
D) The amount of sunlight reaching Earth would increase
Answer: B) Its gravity might become too weak to retain the atmosphere
Earth's size provides sufficient gravity to hold atmospheric gases. A much smaller Earth would have weaker gravity, allowing gases to escape into space.

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2. Venus is farther from the Sun than Mercury but has a higher average temperature. Which explanation best accounts for this?
A) Venus produces its own heat
B) Venus has a thick atmosphere that traps heat
C) Mercury reflects all sunlight
D) Venus has no atmosphere

Answer: B) Venus has a thick atmosphere that traps heat
Venus's atmosphere is largely carbon dioxide and produces a strong greenhouse effect.

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3. Consider the following conditions:
P. Presence of liquid water
Q. Suitable atmosphere
R. Protective magnetic field
S. Suitable distance from the Sun
Which combination best explains Earth's ability to sustain life?
A) P and Q only
B) P, Q and S only
C) Q and R only
D) P, Q, R and S
Answer: D) P, Q, R and S

---

4. If Earth's ozone layer became significantly thinner while all other conditions remained unchanged, which would be the most direct consequence?
A) More harmful ultraviolet radiation would reach Earth's surface
B) Earth's gravity would decrease
C) Photosynthesis would stop immediately
D) Earth's magnetic field would disappear
Answer: A) More harmful ultraviolet radiation would reach Earth's surface
The ozone layer acts as a shield against harmful UV radiation.

---

5. An imaginary planet is located in the habitable zone of its star but has almost no atmosphere. Which conclusion is scientifically most appropriate according to the chapter?
A) It must support life because it lies in the habitable zone.
B) It cannot have gravity.
C) Being in the habitable zone alone does not guarantee conditions suitable for life.
D) Its surface must be covered with liquid water.
Answer: C) Being in the habitable zone alone does not guarantee conditions suitable for life.
Earth's habitability depends not only on its distance from the Sun but also on factors such as size, atmosphere and magnetic field.

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6. Why is Earth's nearly circular orbit important for habitability?
A) It prevents Earth from rotating.
B) It keeps the amount of sunlight and heat relatively steady throughout the year.
C) It creates Earth's magnetic field.
D) It prevents solar radiation from reaching Earth.
Answer: B) It keeps the amount of sunlight and heat relatively steady throughout the year.

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7. Which sequence correctly represents one important relationship between Earth's atmosphere and life?
A) Ozone → oxygen → UV rays → respiration
B) Oxygen → ozone → reduced harmful UV radiation → protection of living cells
C) Carbon dioxide → ozone → photosynthesis → gravity
D) Oxygen → magnetic field → ozone → rainfall

Answer: B) Oxygen → ozone → reduced harmful UV radiation → protection of living cells

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8. Earth's magnetic field suddenly weakens considerably. Which combination of effects would be most likely?

1. Greater exposure to high-energy particles
2. Increased risk of atmospheric damage
3. Possible reduction of the ozone layer
4. Complete loss of Earth's gravity

A) 1 and 2 only
B) 1, 2 and 3 only
C) 2, 3 and 4 only
D) 1, 2, 3 and 4
Answer: B) 1, 2 and 3 only
The magnetic field deflects many harmful cosmic and solar particles; gravity is not produced by the magnetic field.

---

9. Which pair is **incorrectly matched**?
A) Hydrosphere — Earth's water
B) Biosphere — living beings and places where they live
C) Geosphere — rocks, soils and minerals
D) Atmosphere — only oxygen surrounding Earth
Answer: D) Atmosphere — only oxygen surrounding Earth
The atmosphere is a layer of gases surrounding Earth, not oxygen alone.

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10. A large forest is removed from an area. Which chain of effects is most consistent with the chapter?
A) Only animals are affected; non-living systems remain unchanged.
B) Rainfall, soil, air quality and animal life may all be affected.
C) Only soil fertility changes.
D) Earth's gravity decreases.
Answer: B) Rainfall, soil, air quality and animal life may all be affected.
Earth's systems are interconnected, so a change in one component can affect several others.

---

11. Which observation best illustrates **geodiversity**?
A) Several species of birds living in one forest
B) Mountains, valleys, deserts and different rock formations occurring across a region
C) Different varieties of mango trees
D) Different insects pollinating flowers
Answer: B) Mountains, valleys, deserts and different rock formations occurring across a region

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12. A student says, "Because about 70% of Earth's surface is covered with water, shortage of freshwater cannot occur." Which fact best disproves this reasoning?
A) Water is a good solvent.
B) Freshwater is specifically required for crops and people, while Earth's water occurs in many different reservoirs.
C) Oceans contain living organisms.
D) Water vapour forms clouds.

Answer: B) Freshwater is specifically required for crops and people, while Earth's water occurs in many different reservoirs.

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13. Consider the following:
Assertion (A): Reproduction is essential for the continuity of life.
Reason (R): Without reproduction, populations would eventually disappear.
Choose the correct option:
A) Both A and R are true, and R correctly explains A.
B) Both A and R are true, but R does not explain A.
C) A is true, but R is false.
D) A is false, but R is true.
Answer: A) Both A and R are true, and R correctly explains A.

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14. Two offspring produced by sexual reproduction differ from each other even though they have the same parents. What is the best explanation?
A) Each offspring receives genetic information only from its mother.
B) Each offspring receives a different mixture of genetic information from both parents.
C) Genetic information develops only after birth.
D) Offspring do not inherit information from parents.
Answer: B) Each offspring receives a different mixture of genetic information from both parents.

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15. Which characteristic most clearly distinguishes sexual reproduction from asexual reproduction?
A) Sexual reproduction always produces more offspring.
B) Sexual reproduction involves the combination of genetic information from two parents.
C) Asexual reproduction occurs only in microorganisms.
D) Sexual reproduction never occurs in plants.
Answer: B) Sexual reproduction involves the combination of genetic information from two parents.

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16. A student plants four materials in suitable moist soil:
P. Potato with an "eye"
Q. Piece of ginger
R. Money-plant stem cutting
S. Small stone
Which are expected to demonstrate vegetative propagation?
A) P and Q only
B) Q and R only
C) P, Q and R
D) P, Q, R and S
Answer: C) P, Q and R

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17. Which organism-reproductive method pair is **incorrect**?
A) Hydra — budding
B) Planaria — regeneration from a body fragment
C) Amoeba — division into two individuals
D) Potato — pollination through its "eyes"
Answer: D) Potato — pollination through its "eyes"
Potato can reproduce vegetatively from its sprouted "eyes."

18. Why do gametes carry only half of a parent's genetic material?
A) To prevent genetic material from doubling in every generation
B) Because gametes have no genes
C) To ensure that offspring are identical to one parent
D) Because half the genetic material is destroyed during reproduction
Answer: A) To prevent genetic material from doubling in every generation
When male and female gametes combine, the resulting cell receives a complete set—half from each parent.

19. Arrange the following events in the correct sequence for sexual reproduction in flowering plants:

1. Fertilisation
2. Pollination
3. Formation of zygote
4. Development of seed

A) 1 → 2 → 4 → 3
B) 2 → 1 → 3 → 4
C) 2 → 3 → 1 → 4
D) 3 → 2 → 1 → 4
Answer: B) 2 → 1 → 3 → 4

20. A banyan plant appears in a crack high on an old wall after the rainy season. Which sequence most reasonably explains this?
A) Wind forms seed → rain fertilises it → plant grows
B) Bird disperses seed → rain supplies water → seed germinates
C) Wall produces seed → sunlight causes fertilisation
D) Rain produces seed → bird pollinates it
Answer: B) Bird disperses seed → rain supplies water → seed germinates

21. Which comparison between birds and most mammals is correct?
A) Fertilisation is external in both.
B) In birds the embryo develops after the egg is laid, while in most mammals it develops inside the female's body.
C) Mammals do not form zygotes.
D) Bird embryos receive food directly from the mother's body until hatching.
Answer: B) In birds the embryo develops after the egg is laid, while in most mammals it develops inside the female's body.

22. Which of the following represents the **triple planetary crisis**?
A) Earthquakes, volcanoes and cyclones
B) Climate change, biodiversity loss and pollution
C) Global warming, gravity and ozone
D) Deforestation, reproduction and soil formation
Answer: B) Climate change, biodiversity loss and pollution

23. Suppose grasses disappear from an ecosystem. Which sequence is most likely?
A) Herbivores increase → predators increase
B) Herbivores struggle to survive → predators may lose food → ecosystem becomes weaker

C) Predators increase → grasses recover immediately
D) Only microorganisms are affected
Answer: B) Herbivores struggle to survive → predators may lose food → ecosystem becomes weaker

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24. Burning large amounts of coal and oil contributes to global warming mainly because it:
A) destroys Earth's gravity.
B) releases additional greenhouse gases that trap heat.
C) removes all oxygen from the atmosphere.
D) causes Earth to move closer to the Sun.
Answer: B) releases additional greenhouse gases that trap heat.

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25. Four students suggest ways of protecting Earth's life-supporting systems:

- **Riya:** Increase the use of renewable energy.
- **Aman:** Protect biodiversity.
- **Sara:** Improve waste management.
- **Kabir:** Increase fossil-fuel burning.

Whose suggestion is inconsistent with the chapter?
A) Riya
B) Aman
C) Sara
D) Kabir
Answer: D) Kabir
The chapter recommends renewable energy, improved energy use, sustainable resource use, biodiversity protection, and better waste management.

Answer Key

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.
1	**B**	6	**B**	11	**B**	16	**C**	21	**B**
2	**B**	7	**B**	12	**B**	17	**D**	22	**B**
3	**D**	8	**B**	13	**A**	18	**A**	23	**B**
4	**A**	9	**D**	14	**B**	19	**B**	24	**B**
5	**C**	10	**B**	15	**B**	20	**B**	25	**D**

These questions intentionally cover the chapter's major concepts while testing **cause-and-effect reasoning, application, sequencing, assertion–reason, elimination, and interpretation**, which makes them more suitable for **Olympiad and competitive-exam preparation** than direct recall MCQs.

13.15 Best Practices Opportunity List from the Chapter: (10 Ideas)

For the Grade 8 Science chapter **“Our Home: Earth, a Unique Life Sustaining Planet,”** the “Best Practices” can focus on **inquiry, experimentation, interdisciplinary learning, environmental responsibility, and student-led discovery**. This fits particularly well with the chapter’s emphasis on asking deeper questions, designing investigations, and thinking scientifically.
Suggested Best Practices:

No.	Best Practice	Suggested Classroom Implementation
1	**Inquiry-Based Learning – “Why is Earth Unique?”**	Begin the chapter with a student-driven inquiry: *“If we had to choose another planet to live on, what conditions would we need?”* Students develop hypotheses about water, atmosphere, temperature, gravity and magnetic field before learning the textbook explanations.
2	**Earth Survival Kit – Design Thinking Activity**	Divide students into teams and ask them to design an **“Earth Survival Kit”** for establishing life on another planet. They must select essential features—air, liquid water, suitable temperature, soil/nutrients, protection from radiation, etc.—and justify every choice. This directly extends the project proposed in the chapter.
3	**Hands-on Vegetative Propagation Lab**	Students grow a money-plant cutting, sprouted potato “eye,” or piece of ginger and maintain a **7–14 day observation diary** recording root, shoot and leaf development. This converts the textbook activity into a simple longitudinal scientific investigation.
4	**“Planet Detective” Comparative Investigation**	Teams represent Mercury, Venus, Earth and Mars and compare temperature, size, atmosphere, water and suitability for life. Each team then argues whether its planet could support life. The activity can culminate in the question: **“Why Earth and not the others?”**
5	**Systems-Thinking Concept Map**	Students construct a large interconnected concept map linking the **atmosphere, hydrosphere, geosphere and biosphere**. They then predict what happens to the other three systems if one is disturbed—for example, through deforestation or water pollution. The chapter explicitly stresses that these systems interact to sustain life.
6	**Local Environmental Audit – Science Beyond the Classroom**	Students conduct a mini **school/campus environmental audit** covering water wastage, plastic waste, biodiversity, energy consumption and pollution. Each group identifies one problem and proposes a realistic solution. This connects the chapter's triple planetary crisis with students' immediate surroundings.
7	**Debate and Scientific Argumentation**	Conduct debates such as **“Can humans make Mars another Earth?”**, **“Which is more important for life—water or atmosphere?”**, or **“Can individual actions really reduce climate change?”** Students must support arguments using concepts learned in the chapter rather than merely expressing opinions.
8	**Model-Making: Build a Habitable Planet**	Groups create a 3-D/model planet and decide its distance from its star, size, atmosphere, water availability and protective mechanisms. Each group presents why its planet should—or should not—support life. This develops application and higher-order thinking around the chapter's habitability concepts.
9	**Student Question Bank – “Curiosity Wall”**	Maintain a classroom **Curiosity Wall** throughout the chapter. Every student contributes at least one *Why?*, *What if?*, or *How?* question—for example, *“What if Earth had no magnetic*

No.	Best Practice	Suggested Classroom Implementation
		field?" Students investigate selected questions in groups. This mirrors the textbook's own inquiry approach.
10	**Green Action Challenge**	End the chapter with a **7-day Earth Action Challenge** in which students practise and document actions such as saving water/electricity, avoiding single-use plastic, reusing materials or protecting plants. Students then calculate or discuss the collective impact of the class. The chapter itself emphasizes reuse, repair, recycling and conservation as individual contributions.

For a school **lesson plan/academic documentation**, we would particularly recommend highlighting **five flagship Best Practices**: **Inquiry-Based Learning, Earth Survival Kit Design Challenge, Hands-on Vegetative Propagation Lab, Earth Systems Concept Mapping, and Local Environmental Audit.** Together, they shift the chapter from textbook teaching to **experiential, competency-based and student-centred learning**.

13.16 Innovations Opportunity List from the Chapter: (10 Ideas)

For the Grade 8 Science chapter **"Our Home: Earth, a Unique Life Sustaining Planet,"** the **"Innovations"** opportunity can focus on using technology, simulation, gamification, student-created digital resources, and interdisciplinary problem-solving. The chapter itself encourages students to move beyond recall by **designing, investigating and debating** questions such as creating an "Earth Survival Kit" or planning conditions for life beyond Earth.

Suggested Innovations in Teaching–Learning:

No.	Innovative Idea	How it can be implemented
1.	**Virtual Space Mission – "Mission: Find Earth 2.0"**	Convert the classroom into a **space research centre**. Student teams become scientists searching for a habitable planet. Give each team data on temperature, atmosphere, water, gravity and distance from a star. They analyse the data and decide whether their planet could support life. This reinforces the chapter's concepts of the **habitable/Goldilocks zone, atmosphere and planetary size**.
2.	**AR/VR Solar System Exploration**	Use suitable **Augmented Reality or Virtual Reality resources** to let students virtually explore Earth, Mars and other planets. Students compare their size, surface, atmosphere and position relative to the Sun and prepare a digital observation sheet explaining **why Earth is uniquely suitable for life**.
3.	**"What If Earth Changed?" Digital Simulation**	Give groups different scenarios: *Earth loses its atmosphere*, *Earth's magnetic field disappears*, *Earth moves closer to the Sun*, *Earth becomes half its present size*, etc. Students create a digital presentation/animation showing the chain of consequences for water, temperature, atmosphere and living organisms. The textbook itself asks students to predict what would happen without Earth's magnetic field or atmosphere.
4.	**AI-Assisted "Ask Planet Earth" Classroom**	Students frame questions such as *"Why is Venus hotter than Mercury?"*, *"Could plants grow on Mars?"* or *"Why does Earth need a magnetic field?"* They use a teacher-supervised AI tool to generate initial explanations, then **verify the AI responses against**

No.	Innovative Idea	How it can be implemented
		the textbook and identify inaccuracies. This develops AI literacy along with scientific reasoning rather than simply using AI to obtain answers.
5.	**Digital Earth Systems Dashboard**	Students create a simple interactive/digital dashboard representing the **atmosphere, hydrosphere, geosphere and biosphere**. Clicking/selecting one system shows its role and connections with the others. They can then simulate disturbances such as deforestation or water pollution to understand how one change affects the whole Earth system. The chapter emphasizes that all four systems interact to sustain life.
6.	**QR-Code Science Trail Around the School**	Create QR stations around the campus: **Atmosphere Station, Water Station, Soil/Geosphere Station, Biodiversity Station, Pollution Station**, etc. Students scan each QR code, complete a mini-task or solve a challenge, and collect points. This turns the entire school campus into an **interactive science laboratory**.
7.	**Time-Lapse Vegetative Propagation Experiment**	Instead of merely observing money plant, potato or ginger propagation, students photograph the specimen every day from the same position. At the end, the photographs are converted into a **time-lapse video** showing root, shoot and leaf development. This digitally enhances Activity 13.3, which asks students to observe these changes daily.
8.	**Gamified "Save Planet Earth" Challenge**	Create a points-based classroom game based on the chapter's **triple planetary crisis—climate change, biodiversity loss and pollution**. Teams receive environmental crisis cards and must propose solutions. Scientifically valid and practical solutions earn "Earth Points."
9.	**Student Science Podcast / Newsroom**	Groups create 2–3 minute **"Earth News"** episodes on topics such as *Breaking News: Earth Loses Its Magnetic Shield*, *Why Venus Became So Hot*, *Mars—Was There Ever Life?*, or *Triple Planetary Crisis*. Students become presenters, scientists and reporters, combining science with communication skills.
10.	**Design-a-Planet STEM Challenge**	Students use clay, recycled materials or simple digital design tools to **invent their own life-sustaining planet**. They must decide its size, atmosphere, water availability, magnetic field, distance from its star and biodiversity. The final model must be defended before a student "Space Science Committee."

Five strong innovations for school documentation
If you need to enter **only five concise points** under an **"Innovations in Teaching–Learning"** column, I suggest:

1. **AR/VR-based virtual exploration of the Solar System and habitable planets.**
2. **AI-assisted inquiry with textbook-based verification of AI-generated scientific explanations.**
3. **Digital simulation of "What If Earth Changed?" scenarios to develop cause-and-effect reasoning.**
4. **QR-code-based interactive Science Trail covering Earth's four interconnected systems.**

5. **Time-lapse digital documentation of vegetative propagation to integrate experimentation with technology.**

These would be clearly distinguishable from **"Best Practices"** because the emphasis here is specifically on **new technology, digital pedagogy, simulation, gamification and innovative learning experiences**.

13.17: Practicing Questions/Question Bank

A. Fill in the Blanks:

1. Earth is the only known planet where ________ exists and thrives in all its forms.
   Answer: life
2. The range of distances from a star where water can remain liquid is called the ________ zone.
   Answer: habitable / Goldilocks
3. Earth is known as the ________ Planet because of the vast amount of water on its surface.
   Answer: Blue
4. The thick atmosphere of Venus traps heat due to the ________ effect.
   Answer: greenhouse
5. The layer that protects living organisms from harmful ultraviolet rays is the ________ layer.
   Answer: ozone
6. Earth behaves like a giant ________.
   Answer: magnet
7. High-energy particles coming from the Sun are called ________.
   Answer: solar wind
8. All the water present on Earth together forms the ________.
   Answer: hydrosphere
9. The solid parts of Earth, including rocks, soil and minerals, are called the ________.
   Answer: geosphere
10. All living beings along with the places where they live make up the ________.
    Answer: biosphere
11. The variety of landforms, rocks and soils on Earth is called ________.
    Answer: geodiversity
12. The instructions passed from parents to offspring are called genetic material or ________.
    Answer: genes
13. Reproduction involving only one parent is called ________ reproduction.
    Answer: asexual
14. The specialised reproductive cells are called ________.
    Answer: gametes
15. The transfer of pollen from one flower to another is called ________.
    Answer: pollination
16. The fusion of male and female gametes is called ________.
    Answer: fertilisation

17. The cell formed after fertilisation is called a ________.
    Answer: zygote

18. Climate change, biodiversity loss and pollution together are called the ________.
    Answer: triple planetary crisis

These terms and concepts closely follow the chapter's summary.

B. 1-Mark Questions:

1. Why is Earth called the Blue Planet?
2. What is meant by the habitable zone?
3. Name the hottest planet in our solar system.
4. Why is Venus hotter than Mercury?
5. What is the greenhouse effect?
6. State one function of the ozone layer.
7. What is the hydrosphere?
8. Define geosphere.
9. What is geodiversity?
10. Define biosphere.
11. What are cosmic rays?
12. What is solar wind?
13. State one function of Earth's magnetic field.
14. Why is reproduction necessary for living organisms?
15. What is vegetative propagation?
16. Give one example of a plant that reproduces by vegetative propagation.
17. What are gametes?
18. Define pollination.
19. What is fertilisation?
20. What is a zygote?
21. Name the male and female gametes in animals.
22. Name the male and female reproductive structures mentioned in a flower.
23. What is asexual reproduction?
24. What is sexual reproduction?
25. Name the three environmental problems collectively called the triple planetary crisis.

C. 2-Mark Questions:

1. Give **two reasons** why Earth's position from the Sun makes it suitable for life.

2. Why would life be difficult if Earth were much closer to or farther away from the Sun?
3. Mention **two ways** in which Earth's atmosphere supports life.
4. Explain why Earth's size is important for maintaining its atmosphere.
5. State **two ways** in which Earth's magnetic field protects life.
6. Differentiate between the **hydrosphere and geosphere**.
7. Mention two important roles of water in sustaining life.
8. How do plants and animals depend on one another for the continuation of life?
9. Why is reproduction important for the continuity and adaptation of life?
10. Differentiate between **asexual and sexual reproduction**.
11. Give two examples of asexual reproduction mentioned in the chapter.
12. How does vegetative propagation occur in potato and ginger?
13. Differentiate between **pollination and fertilisation**.
14. Why do brothers and sisters from the same parents not look exactly alike?
15. How does fertilisation occur in fish or frogs?
16. State two differences between the development of embryos in birds and mammals.
17. How does burning fossil fuels contribute to global warming?
18. Mention any two consequences of climate change.
19. How does habitat destruction lead to biodiversity loss?
20. Suggest two individual actions students can take to protect Earth.

The chapter specifically connects Earth's position, size, atmosphere and magnetic field with its ability to sustain life.

D. 3-Mark Questions:

1. Explain **three conditions** that make Earth suitable for life.
2. Explain how Earth's **right size and gravity** help it retain an atmosphere.
3. Describe three important functions of Earth's atmosphere in sustaining life.
4. Explain the role of Earth's magnetic field in protecting life from harmful particles from space.
5. Explain the importance of the **atmosphere, hydrosphere and geosphere** in sustaining life.
6. Explain with an example how the atmosphere, hydrosphere, geosphere and biosphere are interconnected.
7. Describe the importance of balance among living and non-living components of Earth.
8. Explain how reproduction contributes to **continuity, similarity and variation** among living organisms.
9. Describe vegetative propagation with any three examples.

10. Explain asexual reproduction in **bacteria/Amoeba, Hydra and Planaria**.
11. Describe the process of sexual reproduction in flowering plants from pollination to seed formation.
12. Explain how sexual reproduction produces variations among offspring.
13. Describe fertilisation and embryo development in fish or frogs.
14. Compare embryo development in **birds and mammals**.
15. Explain the three components of the **triple planetary crisis**.
16. Explain three harmful effects of global warming.
17. Explain how the destruction of a forest can affect **rainfall, biodiversity and soil**.
18. Explain three ways pollution threatens life on Earth.
19. Suggest three measures that can help protect Earth's natural systems.
20. "Everything on Earth works together in balance." Explain with three suitable examples.

The text particularly emphasizes that even a change such as cutting down a forest can affect rainfall, soil, air quality and animals.

E. 5-Mark Descriptive / Long-Answer Questions:

1. **Explain five major factors that make Earth a unique life-sustaining planet.**
2. Explain how Earth's **position, size, atmosphere, ozone layer and magnetic field** together make the planet suitable for life.
3. "Earth's habitability depends not on a single factor but on the interaction of several factors." Justify the statement.
4. Describe the roles of the **atmosphere, hydrosphere, geosphere and biosphere** in sustaining life on Earth. Explain how these systems are interconnected.
5. Explain the importance of air, water, sunlight, soil, rocks and minerals in sustaining life on Earth.
6. Describe **asexual reproduction** in living organisms. Explain vegetative propagation and give suitable examples from the chapter.
7. Compare **asexual and sexual reproduction** with respect to number of parents, gametes, similarity of offspring, variation and importance.
8. Explain sexual reproduction in flowering plants under the following stages: **formation of gametes, pollination, fertilisation, zygote formation and development of seed/fruit**.
9. Describe sexual reproduction in animals and compare the development of the embryo in **fish/frogs, birds and mammals**.
10. Explain how reproduction ensures both the **continuity and diversity of life** on Earth.
11. What is the **triple planetary crisis**? Explain its three components and suggest measures to reduce their impact.
12. Explain how burning fossil fuels can lead to a chain of environmental effects beginning with increased greenhouse gases and ending in threats to living organisms.

13. “Human activities are disturbing the delicate balance that sustains life on Earth.” Explain with five suitable examples.

14. Imagine Earth's magnetic field suddenly disappeared. Explain the possible consequences for the **atmosphere, ozone layer and living organisms**. This extends a question given in the textbook itself.

15. **If Earth had no atmosphere, how would it affect temperature, water and living organisms? Explain in detail.** This is also directly aligned with the chapter-end exercise.

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