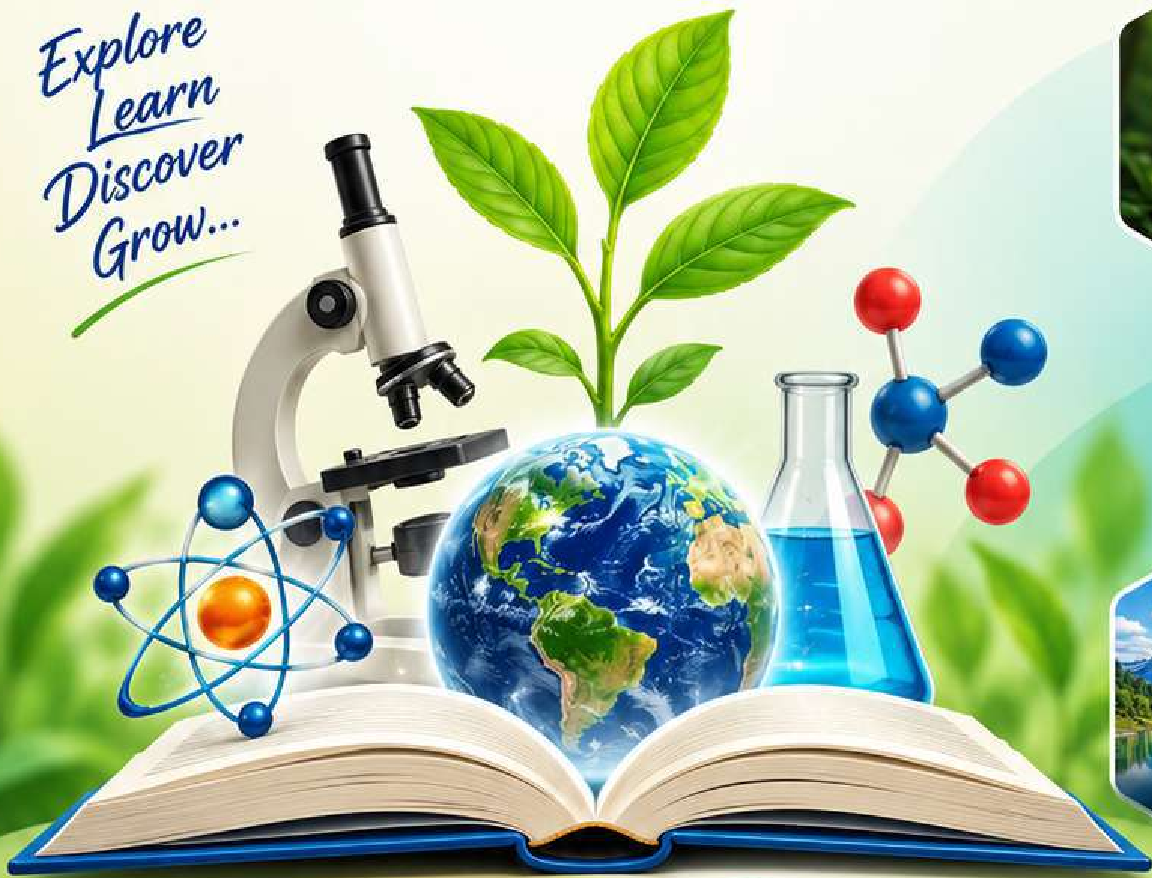
Super Power Series Book

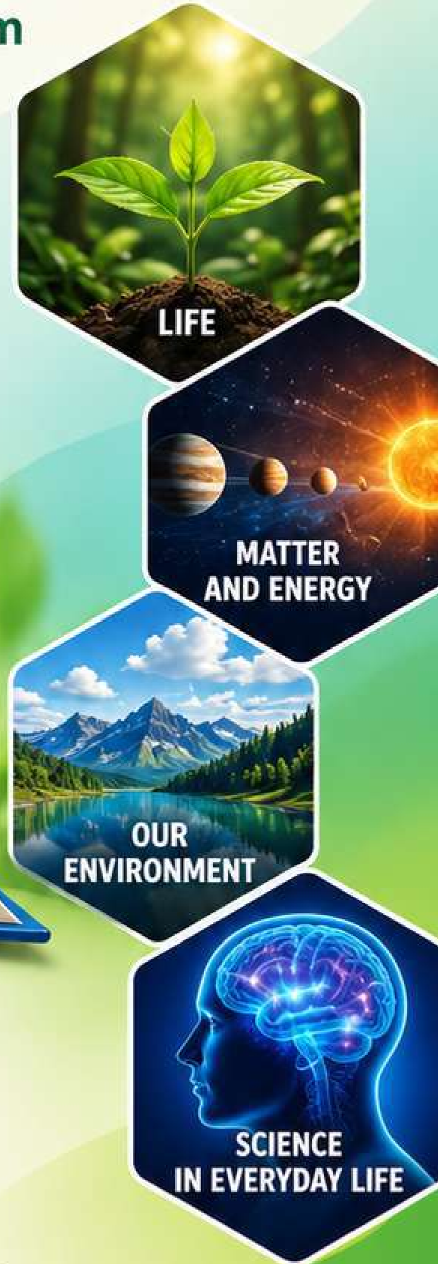
CURIOSITY FOR YOUNG THINKERS

Study Material BOOK for 7th Standard Science Subject

Based on NCERT/CBSE Curriculum

Explore Learn Discover Grow...





Compiled By: Dr. P. S. Aithal
Alevoor Poornaprajna Public School, Udupi
www.alevoorpps.in

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A Brighter Tomorrow with Curious Minds...

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Study Material BOOK for 7th Standard Science Subject

(Prepared as per Poornaprajna Integrated Student Support Model)

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PREFACE

Curiosity for Young Thinkers – Study Material Book for 7th Standard Science has been developed in accordance with the **NCERT/CBSE Curriculum** to make science learning systematic, engaging, and examination-oriented. The book is prepared with the help of AI-driven GPTs, aims to strengthen students' conceptual understanding while nurturing **curiosity, observation, experimentation, questioning, reasoning, and scientific thinking**.

The book is prepared in accordance with the **Poornaprajna Integrated Student Service Model**, providing chapter summaries and a structured variety of **fill-in-the-blanks, one-mark, two-mark, three-mark, five-mark, and applied questions**. It also includes **Multiple Choice Questions for Olympiad examinations** and promotes practical and experiential approaches to learning. Through a balanced combination of **LOTS and HOTS questions**, students are encouraged to progress from remembering and understanding concepts to applying, analysing, predicting, and reasoning scientifically.

This book is intended to serve as a useful companion for students in preparing confidently for both **CBSE school examinations and competitive examinations such as Olympiads**. By combining curriculum-based learning with application-oriented and competitive-exam practice, *Curiosity for Young Thinkers* seeks to develop confident, independent, and inquisitive learners who are prepared not merely to answer questions, but to **think, explore, experiment, and discover like young scientists**.

Dr. P. S. Aithal
(www.psaithal.in)

7th Standard Science Book Chapter 1

Chapter 1: The Ever-Evolving World of Science

1.1 Summary of the Chapter:

Summary of Chapter 1: *The Ever-Evolving World of Science*

(1) **Science is a journey of curiosity and exploration.** It is not merely about learning facts; it encourages us to ask questions, perform experiments, observe the world, and make discoveries.

(2) **Scientific learning begins with questions.** In Grade 7, students are encouraged to ask deeper questions such as *How do things work?*, *Why do things happen?*, and *What can we learn from patterns in nature?*

(3) **Experiments and real-world experiences are important.** Science should be explored beyond the textbook and classroom through activities, observations, and experiments that help us understand our environment.

(4) **Different branches of science are interconnected.** Physics, chemistry, biology, and earth science may appear to be separate subjects, but discoveries and ideas in one field often help us understand another.

(5) **Materials have different properties.** By experimenting with batteries, lamps, and wires, students can investigate materials and classify them, including learning about **metals and non-metals**.

(6) **Changes occur continuously around us.** Some changes are reversible while others are irreversible. Examples include melting ice, ripening fruits, breaking rocks, and batteries running out. Heat also plays an important role in many changes.

(7) **Living organisms undergo important life processes.** Humans, animals, and plants grow and survive through processes such as nutrition, breathing, and circulation. The chapter encourages students to explore how these processes work in different living organisms.

(8) **Time, light, and shadows help us understand the natural world.** Early humans used shadows to tell time. Studying light and shadows also helps us understand phenomena such as day and night and eclipses.

(9) **Earth and space are connected through movement.** The rotation of the Earth, the Moon's movement around the Earth, and the Earth's movement around the Sun help explain important natural phenomena.

(10) **Thinking like a scientist means asking creative questions.** The chapter ends by encouraging students not only to find answers but also to frame interesting and imaginative questions. Scientific experiments often lead to **more questions and further discoveries**.

1.2 Important Formulas:

Important Formulas for Chapter 1 – *The Ever-Evolving World of Science:*

There are essentially no prescribed mathematical or scientific formulas in this chapter. It is an introductory chapter intended to develop curiosity, observation, experimentation, and scientific thinking.

The chapter introduces topics that will be studied quantitatively in later chapters—particularly **time, speed, heat, electricity, and movements of the Earth and Moon**. For example, it explicitly asks how time is measured and "how fast does something happen?"

Therefore, the following may be kept as **supporting/basic formulas for future quantitative problems**, but they are **not formulas actually taught in Chapter 1**:

No.	Concept	Formula	Unit
1	Speed	**Speed = Distance ÷ Time**	m/s or km/h
2	Distance	**Distance = Speed × Time**	m or km
3	Time	**Time = Distance ÷ Speed**	s, min, h
4	Time conversion	**1 min = 60 s**	—
5	Time conversion	**1 h = 60 min = 3600 s**	—
6	Length conversion	**1 km = 1000 m**	—
7	Average speed	**Average Speed = Total Distance ÷ Total Time**	m/s or km/h
8	Percentage	**Percentage = (Part ÷ Total) × 100**	%
9	Average	**Average = Sum of observations ÷ Number of observations**	Depends on quantity
10	Difference/Change	**Change = Final value − Initial value**	Depends on quantity

Formula Triangle for Speed
Distance = Speed × Time
Therefore:
Speed = Distance / Time
Time = Distance / Speed

Important note for examination preparation:
Chapter 1 itself is **mainly conceptual rather than numerical**. It introduces materials and their properties, reversible and irreversible changes, heat, water, life processes, time, light, shadows, eclipses, and movements of the Earth and Moon.
Hence, I would **not expect formula-based quantitative problems directly from this six-page Chapter 1**. The focus should instead be on **conceptual questions, observations, reasoning, application questions, and scientific inquiry**.

1.3 Fill-Up the Blank LOTS type questions with Answers: (58 Questions)

The following questions are based directly on the chapter 1 and focus mainly on **Remembering and Understanding (LOTS)**. The chapter presents science as a process involving curiosity, questioning, observation, activities, and experiments.

1. Science is a process that welcomes __________.
   Answer: curiosity
2. The world of science covers everything—small and __________.
   Answer: large
3. Tiny __________ can be observed inside a leaf.
   Answer: cells
4. A simple paper plane inspired scientific explorations of __________.
   Answer: flight
5. Early inventors studied the wings of __________ to understand flight.
   Answer: birds
6. Modern engineers design __________.
   Answer: aircraft
7. Science is an ongoing process of __________.
   Answer: discovery

8. Activities and __________ help us experience and understand the world scientifically.
   Answer: experiments
9. Science can help address __________ challenges.
   Answer: environmental
10. Physics, chemistry, biology and __________ sciences are different fields of science.
    Answer: earth
11. Different fields of science are __________ with one another.
    Answer: interconnected
12. Materials can be classified based on their __________.
    Answer: properties
13. Materials are studied as metals and __________.
    Answer: non-metals
14. A torch __________ eventually runs out and cannot be used again.
    Answer: battery
15. Ice melts into __________.
    Answer: water
16. Some changes can be reversed, while others __________ be reversed.
    Answer: cannot
17. Some changes happen faster when things are __________.
    Answer: heated
18. Water evaporates from the seas due to heat from the __________.
    Answer: Sun
19. Blood circulates __________ from food throughout the body.
    Answer: nutrients
20. Humans and other animals need to eat and __________ to grow.
    Answer: breathe
21. Early humans observed the __________ of objects in sunlight to tell time.
    Answer: shadows
22. Light helps us to __________.
    Answer: see
23. The Earth and Moon can cast __________.
    Answer: shadows
24. Shadows of the Earth and Moon can lead to the phenomenon of __________.
    Answer: eclipses
25. The Earth rotates around its __________.
    Answer: axis
26. The Moon goes around the __________.
    Answer: Earth
27. The Earth moves around the __________.
    Answer: Sun
28. Day and night depend on receiving light from the __________.
    Answer: Sun
29. Each chapter encourages students to think like a __________.
    Answer: scientist
30. Experiments may lead to additional __________.
    Answer: questions
31. Great scientists do not just answer questions; they also ask __________ ones.
    Answer: amazing
32. To think like a scientist, it is important to ask interesting __________.
    Answer: questions

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

Unlike LOTS questions, these require students to **apply, analyse, infer, predict, or connect ideas** from the chapter. This matches the chapter's emphasis on asking deeper questions, recognising patterns, experimenting, and understanding why events happen.

1. A student observes birds before designing a model aircraft. This shows that scientific ideas can begin with careful __________.
   Answer: observations
2. If a student wants to know why one paper plane flies farther than another, the best scientific approach is to perform an __________.
   Answer: experiment
3. When an experiment produces an unexpected result, a scientist should ask more __________ instead of ignoring the result.
   Answer: questions
4. If two materials are connected separately in a circuit and only one makes the lamp glow, they can be classified according to their __________.
   Answer: properties
5. A material that allows a lamp to glow in the circuit demonstrates a particular __________ property.
   Answer: electrical
6. When ice is heated and becomes water, the change can be __________ by cooling it again.
   Answer: reversed
7. When a fruit ripens, returning it to its original unripe condition is generally __________.
   Answer: impossible
8. If an ice cube and a glacier both melt due to heat, they demonstrate the same basic process of __________.
   Answer: melting
9. If water from the sea receives sufficient heat from the Sun, it changes into water vapour through __________.
   Answer: evaporation
10. If the Sun provided less heat to seawater, the rate of __________ would likely decrease.
    Answer: evaporation
11. A student comparing melting ice and ripening fruit should conclude that the first is reversible while the second is __________.
    Answer: irreversible
12. If blood failed to circulate properly, nutrients from food would not reach all parts of the __________.
    Answer: body
13. Since both plants and animals grow, a scientist may investigate how both obtain the __________ needed for growth.
    Answer: food
14. Before clocks were invented, a person could estimate time during a sunny day by observing the position of __________.
    Answer: shadows
15. If the position of the Sun changes in the sky, the position of an object's __________ will also change.
    Answer: shadow

16. If there were no light, our ability to __________ objects would be affected.
    Answer: see
17. Since both the Earth and Moon can block light and cast shadows, their movements can produce __________.
    Answer: eclipses
18. To understand day and night scientifically, we need to study the __________ of the Earth around its axis.
    Answer: rotation
19. To understand eclipses, we must consider the relative positions of the Sun, Earth and __________.
    Answer: Moon
20. If the Earth did not receive light from the Sun, the familiar pattern of __________ and night would be affected.
    Answer: day
21. When a scientific idea in physics helps answer a question in earth science, it demonstrates that different fields of science are __________.
    Answer: interconnected
22. Studying the effects of human activities on nature can help science contribute towards a more __________ world.
    Answer: sustainable
23. If the result of an experiment agrees with a prediction, a scientist may still conduct further experiments to investigate additional __________.
    Answer: questions
24. A learner who observes, questions, experiments and analyses results is beginning to think like a __________.
    Answer: scientist
25. The activity **"Question the Answer"** develops the learner's ability to frame __________ and creative questions.
    Answer: curious
26. If several different questions can lead to the same answer, it shows that scientific thinking should be open to different __________.
    Answer: possibilities
27. An experiment that raises a new question rather than giving a final answer shows that science is an ongoing process of __________.
    Answer: discovery
28. When students test an idea instead of simply accepting it as true, they are developing __________ thinking.
    Answer: scientific
29. Asking "Why did this happen?" after observing an unexpected result demonstrates scientific __________.
    Answer: curiosity
30. A learner who uses previous knowledge to investigate a new problem is applying knowledge like a __________.
    Answer: scientist

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

These questions focus on **remembering and basic understanding** of the concepts presented in the chapter 1. The chapter introduces science as a process of questioning, experimenting, observing, and exploring.

1. **What does the world of science cover?**
   Answer: The world of science covers everything, whether small or large, near or far.
2. **What makes learning take flight?**
   Answer: Learning takes flight when curiosity leads the way.
3. **What inspired scientific explorations of flight?**
   Answer: Simple observations such as the flight of birds and paper planes inspired scientific explorations of flight.
4. **What did early inventors study to understand flight?**
   Answer: Early inventors studied bird wings to understand flight.
5. **What is science described as in the chapter?**
   Answer: Science is described as a process and a way of thinking that welcomes curiosity and questions.
6. **How can students experience the world scientifically?**
   Answer: Students can experience the world scientifically through activities and experiments.
7. **Why are activities and experiments important in science?**
   Answer: Activities and experiments help us develop a deeper understanding of our environment.
8. **How can science help in creating a sustainable world?**
   Answer: Science can help address environmental challenges and contribute to a more sustainable world.
9. **Name the four fields of science mentioned in the chapter.**
   Answer: Physics, chemistry, biology, and earth sciences are the four fields mentioned.
10. **How are different fields of science related?**
    Answer: Different fields of science are interconnected, and ideas in one field can inspire discoveries in another.
11. **On what basis can materials be classified?**
    Answer: Materials can be classified based on their properties.
12. **What two groups of materials are mentioned in the chapter?**
    Answer: Metals and non-metals are the two groups of materials mentioned.
13. **What happens to a torch battery after prolonged use?**
    Answer: A torch battery eventually runs out and cannot be used again.
14. **What happens when ice is heated?**
    Answer: Ice melts into water when it receives heat.
15. **What are the two types of changes mentioned in the chapter?**
    Answer: The chapter mentions changes that can be reversed and changes that cannot be reversed.
16. **What happens to water in the seas due to the Sun's heat?**
    Answer: Water evaporates from the seas due to the heat of the Sun.
17. **What are two essential activities needed for animals to grow?**
    Answer: Animals need to eat and breathe in order to grow.
18. **What is the role of blood in the body as mentioned in the chapter?**
    Answer: Blood circulates nutrients from food throughout the body.
19. **How did early humans tell time?**
    Answer: Early humans observed the position of shadows formed by objects in sunlight to tell time.
20. **What is one important function of light?**
    Answer: Light helps us to see objects around us.

21. **What natural phenomenon can occur due to the shadows of the Earth and Moon?**
    Answer: The shadows of the Earth and Moon can lead to eclipses.
22. **Around what does the Earth rotate?**
    Answer: The Earth rotates around its axis.
23. **Around what does the Moon move?**
    Answer: The Moon moves around the Earth.
24. **Around what does the Earth move?**
    Answer: The Earth moves around the Sun.
25. **What does day and night depend on?**
    Answer: Day and night depend on the Earth's relationship with the light received from the Sun.
26. **What does each chapter encourage students to do?**
    Answer: Each chapter encourages students to ask questions, explore, experiment, and think like scientists.
27. **What can happen even when an experiment confirms our expectations?**
    Answer: An experiment that confirms our expectations may still lead to additional questions.
28. **What is the name of Activity 1.1?**
    Answer: Activity 1.1 is called **"Question the Answer."**
29. **What do great scientists do besides answering questions?**
    Answer: Great scientists also ask interesting and amazing questions.
30. **Why is asking questions important in science?**
    Answer: Asking questions encourages curiosity, exploration, and further scientific investigation.

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

The following questions require students to **apply, analyse, infer, predict, or reason** using ideas from the chapter rather than merely recall facts. The chapter itself encourages learners to question, experiment, explore, and make discoveries.

1. **Why should a student ask questions while learning science?**
   Answer: Asking questions helps a student explore ideas and develop a deeper understanding of the world.
2. **How can observing birds help in designing an aircraft?**
   Answer: Observing the structure and flight of birds can provide ideas for understanding and designing flight.
3. **Why are experiments more useful than simply memorising scientific facts?**
   Answer: Experiments allow students to test ideas and understand how and why things happen.
4. **What should you do if your observation does not match your prediction?**
   Answer: You should investigate further by asking new questions and conducting more experiments.
5. **Why should science learning extend beyond the classroom?**
   Answer: Learning beyond the classroom allows students to observe and investigate scientific ideas in the real world.
6. **How can scientific knowledge help protect the environment?**
   Answer: Scientific knowledge can help us understand environmental problems and develop more sustainable solutions.

7. **Why are different branches of science considered interconnected?**
   Answer: They are interconnected because ideas and discoveries in one branch can help explain or investigate another.
8. **Why is curiosity important for scientific discovery?**
   Answer: Curiosity encourages us to ask questions and investigate things that we do not yet understand.
9. **How could you determine whether two materials have different electrical properties?**
   Answer: We could test each material in an electric circuit and observe whether the lamp glows.
10. **Why can melting ice be considered different from the running out of a battery?**
    Answer: Melting ice can be reversed by freezing, whereas a used-up battery cannot simply be restored to its original state.
11. **What can you infer if an ice cube melts faster when heated?**
    Answer: We can infer that heat can increase the rate at which some changes occur.
12. **What may happen to evaporation from the sea if the Sun provides more heat?**
    Answer: Evaporation from the sea may occur faster when more heat is received.
13. **How are evaporation and rainfall connected?**
    Answer: Water evaporated from the seas eventually contributes to water returning to Earth as rain.
14. **Why is blood circulation important for the growth of the body?**
    Answer: Blood circulation is important because it carries nutrients from food to different parts of the body.
15. **Why can plants and animals both be studied when investigating life processes?**
    Answer: Both plants and animals perform essential life processes needed for their growth and survival.
16. **How could early humans estimate time without a clock?**
    Answer: Early humans could estimate time by observing changes in the position of shadows during the day.
17. **What would happen to a shadow if the position of the light source changed?**
    Answer: The position of the shadow would also change.
18. **Why do we need artificial sources of light at night?**
    Answer: We need artificial light at night because sunlight is unavailable for us to see and perform activities.
19. **Why is understanding the Earth's rotation important for explaining day and night?**
    Answer: Earth's rotation changes which part of the Earth receives sunlight, helping us understand day and night.
20. **How are shadows connected with eclipses?**
    Answer: Eclipses occur when the movements and positions of the Earth and Moon cause one body to cast a shadow.
21. **Why must we study the movements of the Earth and Moon to understand eclipses?**
    Answer: Their movements change their positions relative to the Sun and determine when shadows produce eclipses.
22. **What can you infer about the importance of sunlight for life on Earth?**
    Answer: Sunlight is important because it influences natural phenomena and conditions that affect life on Earth.

23. **Why can a successful experiment still lead to more questions?**
    Answer: A successful experiment may reveal new observations or possibilities that require further investigation.
24. **How does hands-on experimentation help a student think like a scientist?**
    Answer: Hands-on experimentation helps a student observe, test ideas, analyse results, and ask further questions.
25. **What should a scientist do when an experiment raises a new question?**
    Answer: A scientist should investigate the new question through further observations or experiments.
26. **Why is science described as an ongoing process of discovery?**
    Answer: Science is ongoing because answers to one question can lead to new questions and further investigations.
27. **Why does the activity "Question the Answer" encourage creative thinking?**
    Answer: It encourages students to imagine different questions or situations that could lead to the same answer.
28. **What does the statement "Great scientists don't just answer questions—they ask amazing ones" suggest?**
    Answer: It suggests that asking meaningful and creative questions is an important part of scientific thinking.
29. **Why can several different questions sometimes have the same answer?**
    Answer: Different situations can involve similar ideas and therefore lead to the same answer.
30. **How can imagination contribute to scientific learning?**
    Answer: Imagination helps learners develop new questions, possibilities, and ways of investigating the world.

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

The following questions are based directly on the chapter 1. Each answer contains **two simple points/sentences**, suitable for **2-mark LOTS (Remembering and Understanding)** questions. The chapter introduces science through questioning, experiments, exploration, and observation.

1. What does the world of science include?
Answer:
1. The world of science includes everything that is small and large, near and far.
2. It includes the study of tiny cells, materials, water, the Sun, stars, and many other things around us.

2. How did the study of flight develop from simple observations?
Answer:
1. Early inventors studied the wings of birds to understand how they fly.
2. These observations and experiments eventually contributed to the designing of modern aircraft.

3. What is meant by science as a process?
Answer:
1. Science is a way of thinking that welcomes curiosity and asks questions.
2. It also encourages us to remain open to the unknown and investigate how and why things happen.

4. How do activities and experiments help in learning science?
Answer:

1. Activities and experiments allow us to experience and investigate the world around us.
2. They help us develop a deeper understanding of our environment.

5. How are science and responsibility connected?
Answer:
1. Science helps us understand how human activities are linked with the natural world.
2. It can help address environmental challenges and create a more sustainable world.

6. Name the different fields of science mentioned in the chapter and explain their relationship.
Answer:
1. Physics, chemistry, biology, and earth sciences are the fields mentioned in the chapter.
2. These fields are interconnected because ideas in one field can inspire discoveries in another.

7. How can materials be classified according to the chapter?
Answer:
1. Materials can be classified by studying their different properties.
2. The chapter introduces the classification of materials into metals and non-metals.

8. What does the chapter say about reversible and irreversible changes?
Answer:
1. Some changes occurring around us can be reversed.
2. Other changes cannot be reversed and return to their original condition.

9. Give two examples of changes mentioned in the chapter.
Answer:
1. Ice melting into water is one example of a change.
2. Fruits ripening and rocks breaking into pebbles are other examples.

10. What effect can heat have on changes around us?
Answer:
1. Some changes occur or happen faster when things are heated.
2. Examples include the melting of an ice cube and the melting of a glacier.

11. What happens to water due to the heat of the Sun?
Answer:
1. Water evaporates from the seas because of the Sun's heat.
2. It later falls as rain and may trickle down into the ground.

12. What life processes are mentioned as essential for animals?
Answer:
1. Animals need to eat and breathe for their growth and survival.
2. Blood circulates nutrients from food throughout the body.

13. What questions about plants are raised in the chapter?
Answer:
1. The chapter asks how plants obtain the food they need for growth.
2. It also asks whether plants breathe and how they do so.

14. How did early humans use shadows to tell time?
Answer:
1. Early humans observed the shadows formed by objects in sunlight.
2. They used the changing positions of these shadows to tell time.

15. State two uses or importance of light mentioned in the chapter.
Answer:
1. Light helps us to see the objects around us.
2. Artificial sources of light allow us to perform activities such as reading at night.

16. How are light and shadows related to eclipses?
Answer:
1. The Earth and the Moon can cast shadows when light is blocked.
2. These shadows can lead to the natural phenomena called eclipses.

17. What movements of the Earth and Moon are mentioned in the chapter?
Answer:
1. The Earth rotates around its axis and moves around the Sun.
2. The Moon moves around the Earth.

18. What does the chapter say about day and night?
Answer:
1. Day and night depend on receiving light from the Sun.
2. Understanding Earth's rotation around its axis helps us understand this phenomenon.

19. How does the book encourage students to think like scientists?
Answer:
1. It encourages students to make observations, ask questions, and explore different ideas.
2. It also encourages them to perform hands-on experiments and think carefully about the results.

20. Why can an experiment lead to more experiments?
Answer:
1. An experiment may produce observations that lead to additional questions.
2. These new questions may require further experiments to investigate them.

21. What is the purpose of Activity 1.1, "Question the Answer"?
Answer:
1. The activity asks students to create interesting questions for answers already given.
2. It develops curiosity, creativity, imagination, and scientific questioning.

22. What does the chapter say about the importance of asking questions?
Answer:
1. Asking interesting questions is an important part of thinking like a scientist.
2. Great scientists not only answer questions but also ask amazing and creative questions.

1.8. Two-mark questions with Answers of HOTS Type: (22 Questions)

The following questions are designed to assess **application, analysis, reasoning, prediction, and inference**. They reflect the chapter's central idea that science involves questioning, experimenting, exploring, and making discoveries rather than merely memorising facts.

1. A student makes different paper planes and finds that some fly farther than others. How can the student investigate the reason scientifically?
Answer:
1. The student can change one feature of the paper plane at a time and observe how far it flies.
2. By comparing the results, the student can identify which features affect its flight.

2. Why can observation of nature lead to important scientific discoveries?
Answer:
1. Careful observation helps us notice patterns and features that raise scientific questions.
2. For example, studying bird wings contributed to ideas about flight and aircraft design.

3. A student says, "Science can be learned completely by reading textbooks." Do you agree? Give reasons.
Answer:
1. No, science also requires activities, observations, experiments, and experiences outside the textbook.
2. Such experiences help students develop a deeper understanding of the world around them.

4. Why is asking "Why?" and "How?" important in learning science?
Answer:
1. Such questions encourage students to investigate the reasons behind natural events.
2. They help learners move from simply knowing facts to understanding how things work.

5. How can scientific knowledge help us become more responsible towards the environment?
Answer:
1. Science helps us understand how human activities affect the natural world.
2. This understanding can guide us in addressing environmental challenges and creating a sustainable world.

6. Why should physics, chemistry, biology, and earth sciences not always be studied separately?
Answer:
1. Different branches of science are interconnected and often deal with related phenomena.
2. An idea or discovery in one field may help us ask questions or make discoveries in another.

7. How could you use a battery, lamp, and wires to compare different materials?
Answer:
1. Each material can be placed in the circuit and tested to see whether the lamp glows.
2. The observations can then be used to compare and classify materials according to their properties.

8. How is melting ice different from the running out of a torch battery?
Answer:
1. Melted ice can be changed back into ice by suitable cooling, making the change reversible.
2. A battery that has run out cannot simply return to its original usable condition, so the change is not similarly reversible.

9. What would you predict about an ice cube kept in a warm place compared with one kept in a cool place? Why?
Answer:
1. The ice cube in the warm place would be expected to melt faster.
2. This is because the chapter explains that some changes happen faster when things are heated.

10. How are the Sun, evaporation, and rainfall connected?
Answer:
1. Heat from the Sun causes water from the seas to evaporate.
2. The water later returns to the Earth as rain and may trickle into the ground.

11. What might happen to the body if blood did not circulate properly? Explain.
Answer:
1. Nutrients from food would not be distributed properly throughout the body.
2. This could affect the body's growth and normal life processes.

12. Plants cannot move from place to place to search for food like animals. What scientific question does this observation raise?
Answer:
1. It raises the question of how plants obtain the food needed for their growth.
2. It can also lead us to investigate whether and how plants breathe.

13. If you had no clock or watch, how could you roughly estimate time during a sunny day?
Answer:
1. You could observe the position and changes in the shadow of an object.
2. This method is based on the way early humans used shadows to tell time.

14. Why does the position of a shadow change during the day?
Answer:
1. The position of a shadow is related to the direction from which sunlight reaches an object.
2. Therefore, changes in the apparent position of the Sun are accompanied by changes in the shadow.

15. How can the study of ordinary shadows help us understand eclipses?
Answer:
1. Ordinary shadows demonstrate that an object can block light and produce a shadow.
2. Similarly, the Earth and Moon can cast shadows, producing the phenomenon of eclipses.

16. Why must the movements of the Earth and Moon be studied to understand day, night, and eclipses?
Answer:
1. Earth's rotation is connected with the pattern of day and night as different regions receive sunlight.
2. The relative movements of the Earth and Moon are important for understanding how their shadows can produce eclipses.

17. Suppose the Earth did not rotate around its axis. Which familiar phenomenon discussed in the chapter would be affected? Explain.
Answer:
1. The familiar pattern of day and night would be affected.
2. Earth's rotation changes which parts of the planet receive light from the Sun.

18. Why should a student continue investigating even when an experiment gives the expected result?
Answer:
1. An expected result may still lead to new observations and additional questions.
2. These questions may require further experiments and deeper investigation.

19. How does hands-on experimentation develop scientific thinking?
Answer:
1. Hands-on experiments allow students to observe and test ideas themselves.
2. The results encourage them to analyse what happened and ask further questions.

20. An experiment gives a result different from what you expected. What should you do next?
Answer:
1. You should carefully examine the result and think of possible reasons for the difference.
2. You can then frame new questions and perform further experiments to investigate them.

21. Why is "Question the Answer" a useful activity for developing scientific thinking?
Answer:
1. It makes students think of different questions or situations that could produce a given answer.
2. This develops curiosity, imagination, creativity, and the ability to frame meaningful questions.

22. Explain the idea: "Great scientists don't just answer questions—they ask amazing ones."
Answer:
1. Scientific discovery often begins when someone asks an interesting question about something that is not fully understood.
2. Good questions encourage investigation, experimentation, and the discovery of new knowledge.

1.9. Three-mark questions with Answers of LOTS Type: (17 Questions)

1. Explain how curiosity and observation contribute to learning science.
Answer:
1. Curiosity encourages us to ask questions about the things we observe around us.
2. Observation helps us notice patterns and understand how things work.
3. Together, curiosity and observation can lead to experiments and new discoveries.

2. Describe science as a process of exploration.
Answer:
1. Science is a way of thinking that welcomes curiosity and questions.
2. It encourages us to explore how things work and why events happen.
3. Activities and experiments help us develop a deeper understanding of the world.

3. Explain the role of activities and experiments in learning science.
Answer:
1. Activities and experiments allow students to experience science beyond the textbook.
2. They help students observe and investigate phenomena in the world around them.
3. Such experiences lead to a deeper understanding of the environment.

4. How are science, human activities, and the environment connected?
Answer:
1. Human activities are linked to changes occurring in the natural world.
2. Science helps us understand the effects of these activities on our environment.
3. Scientific understanding can help address environmental challenges and create a more sustainable world.

5. Explain how different fields of science are interconnected.
Answer:
1. Science includes fields such as physics, chemistry, biology, and earth sciences.
2. Although they are studied as different fields, they are interconnected.
3. Scientific ideas in one field can inspire discoveries or questions in another field.

6. What does the chapter tell us about the properties and classification of materials?
Answer:
1. Materials around us have different properties that can be investigated.
2. Batteries, lamps, and wires can be used to explore some properties of materials.
3. Based on their properties, materials can be classified into groups such as metals and non-metals.

7. Describe the different changes around us mentioned in the chapter.
Answer:

1. Some changes occurring around us can be reversed, while others cannot be reversed.
2. Examples include a battery running out, ice melting, fruits ripening, and rocks breaking into pebbles.
3. Some of these changes happen or happen faster when things are heated.

8. Explain the role of heat in the changes mentioned in the chapter.
Answer:
1. Heat can cause some changes to occur or make them happen faster.
2. Heat causes an ice cube or even a glacier to melt.
3. Heat from the Sun also causes water in the seas to evaporate.

9. Describe the movement of water mentioned in the chapter.
Answer:
1. Heat from the Sun causes water from the seas to evaporate.
2. The water later falls back to the Earth as rain.
3. Some rainwater may trickle down into the ground.

10. Describe the important life processes mentioned in the chapter.
Answer:
1. Animals need to eat and breathe in order to grow and survive.
2. Blood circulates nutrients obtained from food throughout the body.
3. Plants also need food for growth and carry out essential life processes.

11. Explain how early humans used shadows to measure time.
Answer:
1. Early humans did not have electric clocks or digital watches.
2. They observed the shadows formed by objects in sunlight.
3. They used the changing positions of these shadows to tell time.

12. State three important ideas about light and shadows mentioned in the chapter.
Answer:
1. Light enables us to see the objects around us.
2. Shadows can be used to tell time, as early humans did.
3. The shadows cast by the Earth and Moon can lead to eclipses.

13. Describe the movements of the Earth and Moon mentioned in the chapter.
Answer:
1. The Earth rotates around its own axis.
2. The Moon moves around the Earth.
3. The Earth moves around the Sun.

14. How does the book encourage students to think like scientists?
Answer:
1. Students are encouraged to make simple observations and perform experiments.
2. They are encouraged to ask questions, explore ideas, and participate in hands-on activities.
3. They are also encouraged to think carefully and use their existing knowledge to understand new topics.

15. Why does scientific exploration often continue even after an experiment?
Answer:
1. An experiment may confirm what we expected to happen.
2. However, its results may lead to additional questions.
3. These new questions may require further experiments and investigations.

16. Explain the purpose of Activity 1.1, "Question the Answer."
Answer:
1. In this activity, students are given answers and asked to frame suitable questions.
2. They are encouraged to create curious, creative, and interesting questions or situations.

3. The activity develops imagination and teaches students that asking good questions is an important part of scientific thinking.

17. What qualities of a scientific learner are emphasised in this chapter?

Answer:

1. A scientific learner should be curious and willing to ask questions.
2. The learner should observe, explore, and perform experiments.
3. The learner should remain open to new questions and continue investigating the unknown.

1.10. Three-mark questions with Answers of HOTS Type: (16 Questions)

1. A student notices that different paper planes travel different distances. How can the student investigate this scientifically?

Answer:

1. The student can make paper planes with different shapes or sizes and fly them under similar conditions.
2. The distance travelled by each plane can be observed and compared.
3. From the observations, the student can identify which features may influence the flight of a paper plane.

2. Why is asking questions as important as finding answers in science?

Answer:

1. Asking questions helps us identify things that we do not fully understand.
2. Questions encourage observations, experiments, and further exploration.
3. New questions can therefore lead to new scientific discoveries.

3. A student says that science can be completely learned inside the classroom. Do you agree? Give three reasons.

Answer:

1. No, science also requires us to observe and experience the world around us.
2. Activities and experiments outside the textbook help us test scientific ideas.
3. Such experiences develop a deeper understanding of our environment.

4. How can studying different branches of science together improve our understanding of nature?

Answer:

1. Physics, chemistry, biology, and earth sciences deal with different aspects of the natural world.
2. These fields are interconnected, so an idea in one field may help explain something in another.
3. Connecting different fields can therefore lead to new questions and discoveries.

5. You are given a battery, a lamp, wires, and different materials. How would you use them to investigate the properties of the materials?

Answer:

1. I would connect each material separately in a circuit containing the battery, lamp, and wires.
2. I would observe whether the lamp glows when each material is used.
3. I would compare the observations to classify the materials according to their properties.

6. Compare melting ice with the running out of a torch battery.

Answer:

1. Ice melting into water is a change that can be reversed by suitable cooling.
2. A torch battery that has run out cannot simply be changed back to its original usable condition.

3. These examples show that some changes are reversible while others are not.

7. An ice cube is kept in sunlight while another is kept in a cool room. Predict what will happen and explain why.

Answer:

1. The ice cube kept in sunlight is expected to melt faster.
2. It receives more heat than the ice cube kept in the cool room.
3. This demonstrates that some changes occur faster when substances are heated.

8. Explain how heat from the Sun can eventually result in water entering the ground.

Answer:

1. Heat from the Sun causes water from the seas to evaporate.
2. The water later returns to the Earth's surface in the form of rain.
3. Some of this rainwater trickles down into the ground.

9. What could happen if blood failed to circulate nutrients properly throughout the body?

Answer:

1. Nutrients obtained from food would not reach different parts of the body properly.
2. This could interfere with the life processes required for normal growth and survival.
3. Therefore, proper blood circulation is essential for distributing nutrients throughout the body.

10. Imagine that clocks and watches did not exist. How could you estimate time during the daytime?

Answer:

1. I could place an object in sunlight and observe the shadow it produces.
2. I could note how the position of the shadow changes as the day progresses.
3. The changing position of the shadow could then be used to estimate time, as early humans did.

11. How can studying ordinary shadows help us understand eclipses?

Answer:

1. An ordinary shadow shows that an object can block light and form a dark region behind it.
2. The Earth and Moon can similarly cast shadows when they block light.
3. Therefore, understanding light and shadows helps us understand the phenomenon of eclipses.

12. Why are the movements of the Earth and Moon important for understanding natural phenomena?

Answer:

1. The Earth rotates around its axis, while the Moon moves around the Earth.
2. The Earth also moves around the Sun, changing the relative positions of these bodies.
3. Understanding these movements helps us study phenomena such as day, night, and eclipses.

13. An experiment gives exactly the result you predicted. Why should you still continue investigating?

Answer:

1. A result that matches a prediction may still reveal new observations.
2. These observations may raise additional questions that were not considered earlier.
3. Further experiments can then be performed to investigate those new questions.

14. How does hands-on experimentation help a learner think like a scientist?

Answer:

1. Hands-on experiments allow learners to observe phenomena and test ideas themselves.
2. Learners can compare what they expected with what actually happened.

3. The results encourage them to ask further questions and carry out additional investigations.

15. How can science contribute to creating a more sustainable world?
Answer:
1. Science helps us understand the connection between human activities and the natural environment.
2. Scientific investigation can help identify environmental challenges and their possible causes.
3. This knowledge can guide responsible actions for creating a more sustainable world.

16. Why is the activity "Question the Answer" useful for developing higher-order thinking?
Answer:
1. The activity requires students to create questions instead of simply recalling answers.
2. A single answer can lead students to imagine several different questions and situations.
3. This develops curiosity, creativity, imagination, and the ability to think like a scientist.

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

1. Explain how science encourages curiosity, exploration, and discovery.
Answer:
1. Science encourages us to be curious about the world around us.
2. It motivates us to ask questions about how things work and why events happen.
3. Activities and experiments help us explore scientific ideas practically.
4. Observations and experiments help us develop a deeper understanding of our environment.
5. Thus, science is an ongoing process of exploration and discovery.

2. Explain the relationship between science, human activities, the environment, and sustainability.
Answer:
1. Science helps us understand the natural world and our place on the planet.
2. Human activities are closely linked to changes occurring in nature.
3. Human activities are also connected with the society in which we live.
4. Science can help us understand and address environmental challenges.
5. Scientific knowledge can therefore contribute to creating a more sustainable world.

3. Describe the different topics related to materials and changes introduced in the chapter.
Answer:
1. Materials around us have different properties that can be studied and compared.
2. Batteries, lamps, and wires can be used to explore some properties of materials.
3. Materials can be classified based on their properties into groups such as metals and non-metals.
4. Changes around us include batteries running out, ice melting, fruits ripening, and rocks breaking into pebbles.
5. Some changes can be reversed, while others cannot be reversed.

4. Explain the role of heat and water in the natural processes introduced in the chapter.
Answer:
1. Heat can cause some changes to occur or make them happen faster.
2. An ice cube melts when it receives sufficient heat.
3. Heat can also cause large masses of ice, such as glaciers, to melt.
4. Heat from the Sun causes water from the seas to evaporate.
5. The water later falls as rain and may trickle down into the ground.

5. Describe the life processes and changes in living organisms discussed in the chapter.
Answer:
1. Our bodies undergo changes as we grow, especially during the middle-school years.
2. Animals carry out essential life processes for their survival.
3. Animals need to eat and breathe in order to grow.
4. Blood circulates nutrients obtained from food throughout the body.
5. Plants also need food for growth and carry out essential life processes.

6. Explain the importance of time, light, and shadows as discussed in the chapter.
Answer:
1. Clocks and wristwatches are commonly used to tell and measure time.
2. Early humans used the position of shadows formed by objects in sunlight to tell time.
3. Light enables us to see the objects around us.
4. Artificial sources of light allow us to perform activities such as reading at night.
5. The study of light and shadows also helps us understand important natural phenomena.

7. Describe the movements of the Earth and Moon and their connection with natural phenomena.
Answer:
1. The Earth rotates around its own axis.
2. The Moon moves around the Earth.
3. The Earth moves around the Sun.
4. Day and night are related to the Earth receiving light from the Sun.
5. The shadows cast by the Earth and Moon can lead to the phenomenon of eclipses.

8. Explain how different branches of science are interconnected.
Answer:
1. Science includes different fields such as physics, chemistry, biology, and earth sciences.
2. These fields may appear as separate topics or chapters.
3. However, all these fields of science are interconnected.
4. Scientific ideas from one field can inspire discoveries in another field.
5. An idea from one area can also help us ask new questions in another area.

9. Explain how the textbook encourages students to think like scientists.
Answer:
1. The textbook encourages students to make simple observations.
2. It provides opportunities to perform interesting and hands-on experiments.
3. Students are encouraged to ask questions and explore different ideas.
4. Each chapter builds upon the knowledge students already possess.
5. Experiments can lead to additional questions and further investigations.

10. Explain the purpose and importance of the activity "Question the Answer."
Answer:
1. The activity reverses the usual process of being given questions and finding answers.
2. Students are instead given answers and asked to create suitable questions.
3. They are encouraged to frame curious, creative, and interesting questions or situations.
4. The activity shows that different questions can sometimes lead to the same answer.
5. It develops imagination and reinforces the idea that good scientists ask interesting questions.

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

1. "Curiosity is the starting point of scientific discovery." Explain this statement with reference to the chapter.
Answer:

1. Curiosity encourages us to ask questions about things we observe around us.
2. Questions such as “How does it work?” and “Why does it happen?” lead to scientific investigation.
3. Careful observations can provide ideas that can be tested through experiments.
4. For example, observations of bird wings contributed to scientific explorations of flight and eventually to aircraft design.
5. Thus, curiosity, questioning, observation, and experimentation together promote scientific discovery.

2. A student claims, “Everything important in science can be learned from a textbook.” Evaluate this statement.

Answer:

1. The statement is not correct because science involves much more than learning facts from a textbook.
2. Students need to observe objects and events occurring in the real world.
3. Activities and experiments allow them to test ideas and gain practical experience.
4. Such experiences help them develop a deeper understanding of their environment and their place on Earth.
5. Therefore, scientific learning should combine reading, questioning, observation, experimentation, and exploration.

3. You are given a battery, a lamp, wires, and different materials. Design a simple investigation to classify the materials according to their electrical properties.

Answer:

1. First, connect the battery, lamp, and wires to form a simple testing circuit.
2. Place one of the given materials in the circuit and observe whether the lamp glows.
3. Repeat the same procedure separately with all the other materials.
4. Record and compare the observations obtained for each material.
5. The results can then be used to group the materials according to the property being tested.

4. Analyse the changes occurring in a melting ice cube, a ripening fruit, a breaking rock, and a used-up battery.

Answer:

1. An ice cube melts into water when it receives heat.
2. The melting of ice can be reversed under suitable conditions, whereas ripening of fruit cannot simply be reversed.
3. A rock breaking into pebbles is another example of a change that cannot easily be restored to its original form.
4. A torch battery eventually runs out and cannot simply be used again in the same way.
5. These examples demonstrate that changes around us may be reversible or irreversible and that heat can influence some changes.

5. Explain how you could investigate the effect of heat on the melting of ice.

Answer:

1. Take two similar ice cubes and place them under different temperature conditions.
2. Keep one ice cube in a warmer place and the other in a cooler place.
3. Observe both ice cubes at regular intervals and compare their melting.
4. The ice cube receiving more heat would be expected to melt faster.
5. The investigation would demonstrate the chapter's idea that some changes occur faster when things are heated.

6. Explain how sunlight, evaporation, rainfall, and groundwater are connected.

Answer:

1. Heat from the Sun causes water present in the seas to evaporate.

2. The evaporated water eventually contributes to water returning to Earth as rain.
3. Rainwater reaches the land and other parts of the Earth's surface.
4. Some of this water may trickle down into the ground.
5. Thus, the Sun's heat connects evaporation, rainfall, and the movement of water into the ground.

7. Imagine that clocks and watches do not exist. Design a simple method to estimate time using sunlight.

Answer:

1. Place a vertical object in an open area that receives sunlight throughout the day.
2. Observe the shadow formed by the object at different times.
3. Mark the position of the shadow at regular intervals.
4. Compare the position of the shadow with the previously recorded markings to estimate the time.
5. This method applies the principle used by early humans, who observed the position of shadows to tell time.

8. Explain how the study of light and shadows can help us understand day, night, and eclipses.

Answer:

1. Light enables us to see, while an object blocking light can produce a shadow.
2. The Earth and Moon are also capable of casting shadows.
3. Their relative movements can therefore result in the phenomenon of eclipses.
4. Day and night are connected with the Earth receiving light from the Sun and the Earth's rotation around its axis.
5. Hence, understanding light, shadows, and the movements of the Earth and Moon helps explain these natural phenomena.

9. An experiment gives exactly the result a student expected. Should the investigation end there? Justify your answer.

Answer:

1. No, getting the expected result does not necessarily mean that scientific investigation should end.
2. The result may reveal new observations that were not considered earlier.
3. These observations may lead the student to ask additional questions.
4. New questions may require further experiments to obtain answers.
5. Therefore, science should be viewed as an ongoing process of questioning, experimentation, and discovery.

10. How does the activity "Question the Answer" develop higher-order scientific thinking among students?

Answer:

1. The activity reverses the normal practice of giving students questions and asking them to find answers.
2. Students must analyse a given answer and imagine different questions that could lead to it.
3. A single answer may produce several different and creative questions.
4. This encourages curiosity, imagination, flexible thinking, and the ability to consider different possibilities.
5. Therefore, the activity develops an important scientific habit—asking meaningful and interesting questions.

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

1. Your teacher gives you a battery, a small lamp, wires, a metal spoon, a plastic ruler, a coin, and a wooden stick. How would you investigate the properties of these materials?
Answer:
1. I would first make a simple circuit using the battery, lamp, and wires.
2. I would place each given material separately in the gap in the circuit.
3. I would observe whether the lamp glows when each material is connected.
4. I would record and compare the results obtained for the spoon, ruler, coin, and wooden stick.
5. Based on these observations, I could group the materials according to the electrical property being tested.

2. During a picnic, you notice that an ice cube kept in sunlight melts faster than one kept in the shade. How would you explain and investigate this observation?
Answer:
1. I would predict that the ice cube in sunlight melts faster because it receives more heat.
2. I would take two similar ice cubes and keep one in sunlight and the other in shade.
3. I would observe both ice cubes for the same period of time.
4. I would compare how quickly each ice cube melts.
5. The observation would demonstrate that heat can make certain changes occur faster.

3. You are camping outdoors without a clock, watch, or mobile phone. How could you use the ideas in the chapter to estimate time during the day?
Answer:
1. I would place a straight stick vertically in an open area receiving sunlight.
2. The stick would form a shadow on the ground.
3. I would observe how the position of the shadow changes during the day.
4. I could mark and compare the shadow positions at different times.
5. This applies the same principle used by early humans, who observed shadows to tell time.

4. Suppose you observe water disappearing slowly from a shallow container kept outside on a sunny day. Apply the ideas from the chapter to explain what is happening.
Answer:
1. The water is receiving heat from the Sun.
2. Due to this heat, some of the water changes into water vapour through evaporation.
3. Therefore, the amount of liquid water in the container gradually decreases.
4. A similar process occurs when heat from the Sun causes water to evaporate from the seas.
5. The evaporated water can eventually contribute to rain, which may later trickle into the ground.

5. Your younger brother asks why he can read outside during the day but needs a lamp to read at night. How would you explain this using the chapter?
Answer:
1. During the daytime, sunlight provides the light needed to see objects clearly.
2. Light reflected from the book enables our eyes to see the words and pictures.
3. At night, sunlight is not available at our location.
4. Therefore, an artificial source such as a lamp provides the necessary light.
5. This demonstrates the practical importance of natural and artificial sources of light in our daily life.

6. A student observes that the position and length of a tree's shadow change during the school day. How can this observation be used scientifically?
Answer:
1. The student can observe the tree's shadow at regular intervals during the day.

2. The position of the end of the shadow can be marked on the ground each time.
3. The student can compare the direction and length of the shadow at different times.
4. A pattern can then be identified between time of day and the position of the shadow.
5. This applies the chapter's idea that the position of shadows can be used to tell time.

7. During an eclipse, a student asks how such a large shadow can occur in space. Explain using the ideas given in the chapter.

Answer:

1. A shadow is produced when an object blocks light.
2. Shadows are not limited to small objects that we observe around us.
3. Large celestial bodies such as the Earth and Moon can also cast shadows.
4. Their movements change their positions relative to each other and the Sun.
5. Therefore, the shadows produced by the Earth and Moon can lead to eclipses.

8. Your science experiment gives the result you predicted. How should you proceed if you want to behave like a scientist?

Answer:

1. I would carefully record the result instead of immediately ending the investigation.
2. I would compare the observation with my original prediction.
3. I would think about whether the result raises any additional questions.
4. I could modify the experiment or perform another experiment to investigate those questions.
5. This approach reflects the chapter's idea that even expected results can lead to more questions and experiments.

9. Your school wants students to help make the campus more environmentally responsible. How could you apply the scientific approach described in the chapter?

Answer:

1. Students could first observe activities in the school that affect the surrounding environment.
2. They could ask questions about the causes and effects of the environmental problems they notice.
3. They could collect information or conduct simple investigations to understand the problems better.
4. Based on their findings, they could suggest responsible actions for improving the school environment.
5. This applies the chapter's idea that science can help address environmental challenges and contribute to a more sustainable world.

10. A paper plane made by your friend flies farther than yours. How would you use scientific thinking to find out why?

Answer:

1. I would carefully compare the shape, size, folds, and other features of the two paper planes.
2. I would identify one feature that might be responsible for the difference in flight.
3. I would make similar planes while changing only that feature and fly them under similar conditions.
4. I would observe and compare the distances travelled by the planes.
5. From the results, I could form a better explanation and conduct further experiments if new questions arise.

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

Multiple Choice Questions with Answers – Olympiad / Competitive Exam Type:

The following questions are designed at a **competitive/Olympiad level**, with emphasis on **conceptual understanding, application, logical reasoning, inference, and scientific thinking** rather than simple recall. The chapter presents science as a process of questioning, experimentation, exploration, and discovery.

1. Which sequence best represents the scientific approach encouraged in the chapter?
A. Memorise → Repeat → Accept → Stop
B. Observe → Question → Investigate → Discover
C. Read → Copy → Memorise → Reproduce
D. Predict → Accept → Ignore → Conclude
Answer: B. Observe → Question → Investigate → Discover

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2. Early inventors studying bird wings before designing flying machines best illustrates that:
A. scientific ideas always begin in laboratories.
B. technology develops independently of nature.
C. observations of nature can inspire scientific and technological developments.
D. birds and aircraft work in exactly the same way.
Answer: C. Observations of nature can inspire scientific and technological developments.

---

3. Which of the following best describes science according to the chapter?
A. A collection of facts that never change
B. A process of thinking involving curiosity and questioning
C. A subject concerned only with laboratory experiments
D. A method of memorising explanations of nature
Answer: B. A process of thinking involving curiosity and questioning

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4. A student's experiment gives the expected result. What is the most scientific next step?
A. Stop experimenting because the answer is known.
B. Ignore the result because it was expected.
C. Look for new questions raised by the result.
D. Change the result to make the experiment interesting.
Answer: C. Look for new questions raised by the result.
The chapter stresses that even experiments confirming expectations may generate additional questions requiring further investigation.

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5. Consider the following statements:
Statement I: Different branches of science are completely independent.
Statement II: An idea from one field of science may inspire discoveries in another.
Which option is correct?
A. Only Statement I is correct.
B. Only Statement II is correct.
C. Both statements are correct.
D. Neither statement is correct.
Answer: B. Only Statement II is correct.

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6. A battery, lamp, and wires are used to test materials X and Y. The lamp glows with X but not with Y. What is the most appropriate conclusion?
A. X and Y must have identical properties.
B. X and Y differ in the electrical property being tested.

C. Y must be heavier than X.
D. X must always be a metal.
Answer: B. X and Y differ in the electrical property being tested.

---

7. Which pair best illustrates one reversible and one irreversible change, respectively?
A. Ice melting; fruit ripening
B. Fruit ripening; ice melting
C. Rock breaking; ice freezing
D. Battery running out; ice melting
Answer: A. Ice melting; fruit ripening

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8. Two identical ice cubes are kept under different conditions. Cube P is kept in a warmer place and Cube Q in a cooler place. Which prediction is most reasonable?
A. Q will always melt first.
B. P will probably melt faster.
C. Both must remain unchanged.
D. Temperature cannot affect melting.
Answer: B. P will probably melt faster.

---

9. Which sequence correctly represents the movement of water described in the chapter?
A. Rain → Sun → evaporation → sea
B. Sea water → heating by Sun → evaporation → rain → water entering ground
C. Groundwater → rain → Sun → sea
D. Evaporation → sea → sunlight → ice
Answer: B. Sea water → heating by Sun → evaporation → rain → water entering ground

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10. Which observation would provide the strongest evidence that heat affects the rate of melting?
A. Two different-sized ice cubes melt at different rates.
B. Identical ice cubes kept at different temperatures melt at different rates.
C. An ice cube and a fruit change differently.
D. A battery eventually runs out.
Answer: B. Identical ice cubes kept at different temperatures melt at different rates.

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11. A student wants to test only the effect of temperature on ice melting. Which experiment is best designed?
A. Use different-sized ice cubes at different temperatures.
B. Use identical ice cubes at different temperatures.
C. Use an ice cube and a rock at the same temperature.
D. Use ice cubes of different sizes in different containers.
Answer: B. Use identical ice cubes at different temperatures.

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12. Blood circulation is important for growth mainly because, according to the chapter, blood:
A. produces sunlight.
B. measures time.
C. circulates nutrients from food throughout the body.
D. causes evaporation.
Answer: C. Circulates nutrients from food throughout the body.

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13. A learner asks, "Animals eat food, but how do plants obtain the food they need to grow?" This question best demonstrates:
A. memorisation.
B. scientific curiosity.
C. measurement error.
D. classification.
Answer: B. Scientific curiosity.

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14. Before modern clocks, early humans could estimate time by observing:
A. the colour of leaves.
B. the position of shadows.
C. the amount of rainfall.
D. the melting of ice.
Answer: B. The position of shadows.

---

15. A vertical stick casts shadows in different positions at 9 a.m., noon, and 4 p.m. What is the most useful inference?
A. The stick changes its material during the day.
B. Shadow position can provide information about time.
C. The Sun produces no light at noon.
D. Shadows are independent of sunlight.
Answer: B. Shadow position can provide information about time.

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16. Which observation best demonstrates the importance of artificial light?
A. Ice melts in sunlight.
B. We can read a book at night using a lamp.
C. Fruits ripen naturally.
D. Water enters the ground after rain.
Answer: B. We can read a book at night using a lamp.

---

17. Which combination is most directly needed to understand eclipses according to the chapter?
A. Heat, batteries and metals
B. Food, breathing and circulation
C. Light, shadows and movements of celestial bodies
D. Rainfall, groundwater and evaporation only
Answer: C. Light, shadows and movements of celestial bodies

---

18. Which statement correctly matches the movements described in the chapter?
A. Earth revolves around the Moon.
B. Moon revolves around the Sun only.
C. Earth rotates around its axis, Moon moves around Earth, and Earth moves around Sun.
D. Sun revolves around Earth once every day.
Answer: C. Earth rotates around its axis, Moon moves around Earth, and Earth moves around Sun.

---

19. Day and night are most directly connected with:
A. Earth's rotation and sunlight.
B. rainfall and groundwater.

C. fruit ripening.
D. electrical conductivity.
Answer: A. Earth's rotation and sunlight.

---

20. Consider the following:

1. Earth can cast a shadow.
2. Moon can cast a shadow.
3. Shadows of celestial bodies can produce eclipses.
4. Shadows occur only on Earth's surface.

Which statements agree with the chapter?
A. 1 and 2 only
B. 2 and 4 only
C. 1, 2 and 3 only
D. 1, 2, 3 and 4
Answer: C. 1, 2 and 3 only

---

21. Which student is behaving most like a scientist?
A. Ravi accepts every observation without asking questions.
B. Meera memorises the expected result before an experiment.
C. Anita observes a result, asks why it happened, and designs another experiment.
D. Rohan ignores unexpected results.
Answer: C. Anita observes a result, asks why it happened, and designs another experiment.

---

22. A scientist notices an unexpected result during an experiment. Which action is LEAST appropriate?
A. Check the observation again.
B. Ask why the result occurred.
C. Design another investigation.
D. Discard the result only because it was unexpected.
Answer: D. Discard the result only because it was unexpected.

---

23. Which situation best demonstrates the interconnectedness of science?
A. Using an idea from physics to investigate a question related to earth science
B. Studying each scientific field without considering another
C. Memorising definitions without asking questions
D. Avoiding experiments involving more than one concept
Answer: A. Using an idea from physics to investigate a question related to earth science.

---

24. A student observes an environmental problem near her school. Which sequence best follows the approach promoted in the chapter?
A. Ignore → Assume → Forget
B. Observe → Question → Investigate → Consider responsible solutions
C. Memorise → Copy → Repeat → Stop
D. Predict → Accept → Avoid evidence
Answer: B. Observe → Question → Investigate → Consider responsible solutions.
Science is presented not only as discovery but also as responsibility, including addressing environmental challenges and contributing to sustainability.

---

25. Which of the following best explains why the chapter calls science an "ongoing process of discovery"?
A. Every scientific experiment must fail.
B. Scientific questions have no answers.
C. Answers and observations can generate new questions and investigations.
D. Scientists repeatedly perform exactly the same experiment without reason.
Answer: C. Answers and observations can generate new questions and investigations.

---

26. In the activity "Question the Answer," students are given an answer and asked to frame possible questions. Which skill is primarily being developed?
A. Mechanical memorisation
B. Creative scientific questioning
C. Handwriting speed
D. Numerical calculation
Answer: B. Creative scientific questioning.

---

27. Four students make the following statements:

- **P:** Science requires curiosity.
- **Q:** Science requires us to remain open to the unknown.
- **R:** Scientific fields are completely unrelated.
- **S:** Experiments may generate new questions.

Which students 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.

---

28. Which of the following is the best example of observation leading to technological development from the chapter?
A. Watching rainfall and going indoors
B. Studying bird wings and developing ideas about aircraft
C. Looking at a clock to know the time
D. Watching ice melt without asking questions
Answer: B. Studying bird wings and developing ideas about aircraft.

---

29. Which statement best captures the relationship between science and sustainability presented in the chapter?
A. Science is unrelated to environmental problems.
B. Science only describes environmental problems but cannot help address them.
C. Scientific understanding can help address environmental challenges and support a sustainable world.
D. Sustainability belongs only to biology.
Answer: C. Scientific understanding can help address environmental challenges and support a sustainable world.

---

30. Which of the following best represents the central message of Chapter 1?
A. A good science student should memorise every fact.
B. Science is mainly about using complicated instruments.
C. Scientific learning involves curiosity, observation, questioning, experimentation, and

continued exploration.
D. Science provides final answers that should never be questioned.
Answer: C. Scientific learning involves curiosity, observation, questioning, experimentation, and continued exploration.
Answer Key

Q.	Ans.	Q.	Ans.	Q.	Ans.
1	B	11	B	21	C
2	C	12	C	22	D
3	B	13	B	23	A
4	C	14	B	24	B
5	B	15	B	25	C
6	B	16	B	26	B
7	A	17	C	27	B
8	B	18	C	28	B
9	B	19	A	29	C
10	B	20	C	30	C

1.15 Best Practices Opportunity List from the Chapter: (5 Ideas)

Best Practices Opportunities for Teaching Chapter 1: *The Ever-Evolving World of Science*
Since the chapter explicitly presents science as more than a collection of facts and encourages **questioning, experimentation, exploration, and independent discovery**, it provides excellent opportunities for activity-based teaching.

(1) Inquiry-Based Learning – "Question First, Answer Later":
Begin the lesson with familiar observations such as *Why are some fruits sour?*, *Why does ice melt?*, or *Why do shadows change?* Encourage students to frame hypotheses before providing explanations. This develops curiosity and scientific questioning, which the chapter identifies as central to science.

(2) Learning by Doing – Mini Experiment Stations:
Create small activity stations where groups investigate simple phenomena: testing materials using a battery–lamp circuit, observing melting ice, studying evaporation, and experimenting with light and shadows. Students should follow an **Observe** → **Predict** → **Experiment** → **Record** → **Conclude** cycle. This directly supports the chapter's emphasis on hands-on experimentation.

(3) Paper-Plane STEM Challenge:
Ask students to design different paper planes, predict which will travel farther, test them, measure their flight distances, and improve their designs. Connect their observations with the chapter's example of bird wings inspiring explorations of flight and eventually aircraft design. This combines **science, engineering, creativity, measurement, and teamwork**.

(4) Outdoor Science – Shadow and Time Investigation:
Take students outside at different times and let them mark the position and length of the shadow of a vertical stick. They can compare their observations and relate them to how early humans used shadows to tell time. This turns an idea from the textbook into a real-world scientific investigation.

(5) Think Like a Scientist – "Question the Answer" Classroom Game:
Adapt the chapter's Activity 1.1 by giving students unusual answers and asking teams to generate as many meaningful questions as possible. Award points for the **most**

scientific, most creative, and most thought-provoking question, rather than only for a correct answer. This reinforces the chapter's message that great scientists ask interesting questions.

(6) **Interdisciplinary Concept-Mapping:**
Ask groups to prepare a concept map connecting **physics, chemistry, biology, and earth science** through examples from the chapter—light, heat, materials, living organisms, water, Earth, and Moon. This helps students understand that branches of science are interconnected rather than isolated subjects.

(7) **Science from Daily Life – Observation Diary:**
Students can maintain a one-week **"Young Scientist Diary"** recording one scientific observation each day—for example, melting, evaporation, shadows, plant growth, weather, or changes in materials. For every observation, they should write **"What I observed – Why I think it happened – One question I want to investigate."**

(8) **Sustainability-Based Local Problem Solving:**
Ask students to identify one environmental issue in their school or neighbourhood, such as water wastage, excessive plastic, littering, or energy wastage. They can observe the problem, collect simple evidence, discuss possible causes, and propose practical solutions. This connects scientific learning with the chapter's emphasis on **responsibility and sustainability**.

(9) **Student-Led Demonstration and Peer Teaching:**
Divide students into groups and assign themes such as **materials, changes, heat, water, life processes, time, light and shadows, or Earth–Moon movements**. Each group can conduct a simple demonstration or prepare a model and explain the concept to classmates, making students active participants rather than passive listeners.

(10) **End Every Lesson with a "New Question":**
Instead of ending the class only with "What did you learn?", ask every student to write **one new question that today's lesson created in their mind**. A "Question Wall" can display the best questions for later investigation. This is particularly appropriate because the chapter explains that even experiments confirming our expectations can generate additional questions and further experiments.

Five Best Practices to Highlight in a Lesson Plan:
For a concise **Best Practices** section in the teacher's lesson plan, I suggest highlighting: **Inquiry-Based Learning, Hands-on Mini Experiments, Paper-Plane STEM Challenge, Outdoor Shadow Investigation, and Question-the-Answer Scientific Thinking Activity.** Together, these shift the chapter from *teaching about science* to **students actually practising how scientists think and investigate**.

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

This introductory chapter presents science not merely as a collection of facts, but as a **process of questioning, experimenting, exploring, observing patterns, and making discoveries**. It also encourages students to move beyond the textbook and classroom and experience science through activities.

1. "Question the Answer" Reverse-Questioning Lab:
Instead of giving students questions, provide them with unusual answers and ask them to invent as many scientific questions as possible that could lead to those answers. Students can then vote for the **most creative, most scientific, and most unexpected question**. This directly extends the chapter's *Question the Answer* activity, which stresses that scientists need to ask interesting questions, not merely answer them.

2. Student "Curiosity Wall":
Create a permanent classroom wall titled **"I Wonder Why…"**. Students can regularly post questions arising from everyday observations—for example, *Why are some fruits sour? Why does ice melt? Why do shadows change? Why does a torch battery eventually stop working?* Each week, one or two questions can become mini-investigations. These themes are introduced throughout the chapter.
3. "Science Detective" Investigation Stations:
Set up small learning stations containing simple materials such as a **battery, bulb, wires, metal/non-metal objects, ice cubes, water, magnets, and everyday materials**. Instead of giving procedures immediately, provide a challenge at each station and let students predict, test, observe, and explain. This develops the chapter's emphasis on hands-on experiments and thinking like scientists.
4. Paper-Plane STEM Design Challenge:
Using the paper-plane theme shown prominently on page 1, students can design different paper aeroplanes, predict which will travel farthest, test them, measure flight distance, modify their designs, and retest. They can investigate questions such as whether wing shape, paper size, or folds influence flight. This creatively develops the chapter's example of how simple observations of flight can inspire scientific exploration.
5. "Reversible or Irreversible?" Experiment Gallery:
Students can investigate everyday changes such as **melting ice, ripening fruit, breaking materials, or running down a battery** and classify the changes according to whether they can be reversed. Groups can present their evidence through photographs, drawings, observation tables, or demonstrations. The chapter explicitly introduces reversible and irreversible changes through such examples.
6. Build a Mini Sundial – Science Meets History:
Students can place a stick vertically outdoors, record the direction and length of its shadow at different times, and construct a simple sundial. They can compare their observations with a clock and discuss how early humans used shadows to tell time. This turns the chapter's discussion of early time measurement into an experiential investigation.
7. "One Phenomenon–Many Sciences" Concept Web:
Give students a phenomenon such as **rain, plant growth, a melting glacier, human growth, or an eclipse**. Ask teams to identify how physics, chemistry, biology, Earth science, and environmental science may connect with it. This develops the chapter's important idea that different fields of science are interconnected and that discoveries in one area can inspire questions in another.
8. Shadow-to-Eclipse Model Challenge:
Beginning with ordinary classroom shadows, students can use a torch and balls to explore how shadows form and then develop a simple model involving the Sun, Earth, and Moon. They can use the model to generate questions about day and night and eclipses. The chapter connects ordinary light and shadows with the much larger-scale movements of the Earth and Moon.
9. "Science Outside the Classroom" Observation Safari:
Take students on a short supervised walk around the school campus and ask each group to identify **five scientific phenomena**—for example, plant growth, shadows, evaporation, insects, weather, materials, soil, water movement, or human activities. They should frame one scientific question about each observation. This directly implements the chapter's suggestion that learners should step beyond the book and classroom to experience the world through activities and experiments.
10. Young Scientist Digital Portfolio:
Each student can maintain a simple **"My Science Discovery Journal"** in paper or digital form with five sections: **I Observed → I Wonder → I Predict → I Investigated → I Discovered**.

Students can add photographs, drawings, experimental observations, new questions, and conclusions throughout the year. This reinforces the chapter's central message that even an experiment that confirms an expectation can lead to additional questions and further experiments.

Recommended Innovation Model: "Curiosity → Question → Prediction → Experiment → Observation → Explanation → New Question"

This cycle can be adopted as a recurring classroom model throughout Grade 7 Science. It closely reflects the chapter's central philosophy that the textbook is an invitation **"to question, to perform experiments, and to explore"**, enabling students to become explorers who make discoveries for themselves.

1.17: Practicing Questions/Question Bank

A. Fill in the Blanks – 1 Mark Each:

1. Science is a process that welcomes ________, asks questions, and is open to the unknown.
   Answer: curiosity
2. Learning takes flight when ________ leads the way.
   Answer: curiosity
3. Early inventors studied the wings of ________ while exploring the possibility of flight.
   Answer: birds
4. Physics, chemistry, biology, and ________ sciences are interconnected fields of science.
   Answer: earth
5. Materials can be classified according to their ________.
   Answer: properties
6. Some changes can be reversed, while others ________ be reversed.
   Answer: cannot
7. An ice cube melts into ________ when heated.
   Answer: water
8. Heat from the Sun causes water from the seas to ________.
   Answer: evaporate
9. Blood circulates ________ obtained from food throughout the body.
   Answer: nutrients
10. Early humans used the position of ________ to tell time.
    Answer: shadows
11. ________ helps us to see objects around us.
    Answer: Light
12. The Earth rotates around its own ________.
    Answer: axis
13. The Moon moves around the ________.
    Answer: Earth
14. The Earth moves around the ________.
    Answer: Sun

15. The shadows cast by the Earth and Moon can lead to ________.
Answer: eclipses

The chapter introduces these ideas through materials, changes, heat, water, life processes, light, shadows, and celestial movements.

B. One-Mark Descriptive Questions:

1. **What is science described as in the chapter?**
Answer: Science is a process and a way of thinking that welcomes curiosity, questions, and exploration.
2. **Why are activities and experiments important in science?**
Answer: They help us experience the world and develop a deeper understanding of it.
3. **What inspired early scientific explorations of flight?**
Answer: Simple observations such as the flight of birds and their wings inspired explorations of flight.
4. **Name any two fields of science mentioned in the chapter.**
Answer: Physics and chemistry.
5. **Give one example of a reversible change.**
Answer: Melting of ice into water is a reversible change.
6. **Give one example of a change that cannot be easily reversed.**
Answer: Ripening of a fruit is a change that cannot be easily reversed.
7. **What happens to seawater due to heat from the Sun?**
Answer: Seawater evaporates due to heat from the Sun.
8. **How did early humans tell time?**
Answer: Early humans observed the positions of shadows formed by objects in sunlight.
9. **Why is light important to us?**
Answer: Light enables us to see objects around us.
10. **What causes eclipses according to the chapter?**
Answer: The shadows cast by the Earth and Moon can lead to eclipses.
11. **How does the Moon move?**
Answer: The Moon moves around the Earth.
12. **What is one important characteristic of a scientist?**
Answer: A scientist asks interesting questions and investigates them.

The chapter specifically encourages learners to ask deeper questions about how and why phenomena occur.

C. Two-Mark Descriptive Questions:

1. Why is curiosity important in science?

Answer:

1. Curiosity encourages us to ask questions about the world around us.
2. These questions can lead to observations, experiments, and discoveries.

2. How are different fields of science interconnected?

Answer:

1. Physics, chemistry, biology, and earth sciences deal with different aspects of the natural world.
2. Ideas in one field can inspire discoveries or new questions in another field.

3. Differentiate between reversible and irreversible changes with examples.

Answer:

1. A reversible change can be changed back, such as melted water being frozen into ice.
2. An irreversible change cannot easily be changed back, such as the ripening of a fruit.

4. How does heat influence changes around us?

Answer:

1. Heat can cause certain changes or make them occur faster.
2. For example, heat causes ice to melt and seawater to evaporate.

5. How is blood circulation connected with nutrition?

Answer:

1. Food provides nutrients required by our body.
2. Blood circulates these nutrients throughout the body.

6. How were shadows useful to early humans?

Answer:

1. Early humans observed shadows formed by objects in sunlight.
2. They used changes in the position of shadows to tell time.

7. Why are light and shadows important in understanding eclipses?

Answer:

1. Objects blocking light can produce shadows.
2. The Earth and Moon can also cast shadows, which can lead to eclipses.

8. Why should an experiment sometimes be repeated even after getting the expected result?

Answer:

1. An expected result may still generate additional scientific questions.
2. These questions may require further experiments and investigations.

D. Three-Mark Descriptive Questions:

1. Explain how observation can lead to scientific and technological development.

Answer:

1. Observation helps us notice interesting patterns and phenomena in nature.
2. These observations encourage questions and experiments.
3. For example, studying bird wings contributed to scientific explorations that eventually helped in aircraft design.

2. Explain the role of science in creating a sustainable world.

Answer:

1. Science helps us understand how human activities affect the natural world.
2. Scientific investigations help us understand environmental challenges.
3. Scientific knowledge can guide responsible actions towards sustainability.

3. Explain how heat from the Sun is connected with rainfall and groundwater.

Answer:

1. Heat from the Sun causes seawater to evaporate.
2. Water eventually returns to Earth in the form of rain.
3. Some rainwater trickles down into the ground.

4. Explain the importance of food, breathing, and blood circulation in animals.

Answer:

1. Animals require food for nutrients needed for growth and survival.
2. Breathing is an essential life process.
3. Blood circulates nutrients from food throughout the body.

5. Describe three movements related to the Earth and Moon.

Answer:

1. The Earth rotates around its own axis.
2. The Moon moves around the Earth.
3. The Earth moves around the Sun.

6. How does hands-on experimentation help students think like scientists?

Answer:

1. Experiments allow students to test their ideas practically.
2. They can compare predictions with actual observations.
3. The results may generate new questions for further investigation.

7. A student notices that an ice cube melts faster in sunlight than in shade. How could the student investigate this scientifically?

Answer:

1. Take two similar ice cubes and keep one in sunlight and the other in shade.
2. Observe and record the time taken by each ice cube to melt.
3. Compare the observations to determine how heating influences melting.

8. Why is asking good questions an important part of science?

Answer:

1. Good questions identify things that we do not fully understand.
2. They encourage observation, experimentation, and investigation.
3. They can eventually lead to new scientific knowledge and discoveries.

E. Five-Mark Descriptive Questions:

1. Explain why science should be considered a process of exploration rather than merely a collection of facts.

Answer:

1. Science encourages curiosity about the natural world.
2. It motivates us to ask how and why things happen.
3. Observations help us recognise patterns and formulate questions.
4. Activities and experiments allow us to investigate these questions.
5. The results of investigations may generate further questions, making science an ongoing process of discovery.

2. Describe the different scientific ideas introduced through everyday examples in the chapter.

Answer:

1. Materials can be investigated and classified according to their properties.
2. Changes such as melting ice, ripening fruits, and breaking rocks can be studied as reversible or irreversible changes.
3. Heat affects processes such as melting and evaporation.
4. Living organisms perform essential life processes such as nutrition and breathing.
5. Light, shadows, and movements of the Earth and Moon help us understand time, day and night, and eclipses.

3. “Scientific fields are interconnected.” Explain with five points.

Answer:

1. Science includes fields such as physics, chemistry, biology, and earth sciences.

2. These fields study different aspects of the same natural world.
3. Concepts from one field can help us understand phenomena studied in another.
4. Scientific ideas in one area can inspire discoveries in another area.
5. Therefore, connecting different scientific fields provides a broader understanding of nature.

4. Explain how the study of light and shadows can lead from an everyday observation to understanding astronomical phenomena.

Answer:

1. We observe shadows when objects block light.
2. Early humans used changing shadow positions to tell time.
3. Light from the Sun is also responsible for day and night.
4. Large celestial bodies such as the Earth and Moon can cast shadows.
5. Understanding these shadows together with the movements of the Earth and Moon helps us understand eclipses.

5. How can a student develop the habit of "thinking like a scientist"?

Answer:

1. A student should carefully observe objects and events occurring around them.
2. They should ask meaningful questions about how and why things happen.
3. They should make predictions and test them through suitable experiments.
4. They should analyse results rather than simply accepting expected answers.
5. They should use each result to frame new questions and continue exploring.

6. Explain the importance of the activity "Question the Answer" in developing scientific thinking.

Answer:

1. The activity gives students answers and asks them to create possible questions.
2. Students have to think beyond obvious or routine questions.
3. One answer can lead to several different questions or situations.
4. The activity develops imagination, curiosity, creativity, and flexible thinking.
5. It reinforces the chapter's message that good scientists not only find answers but also ask meaningful questions.

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7th Standard Science Book Chapter 2

Chapter 2: Exploring Substances: Acidic, Basic, and Neutral

2.1 Summary of the Chapter:

Summary of Chapter 2: *Exploring Substances: Acidic, Basic, and Neutral:*

(1) **Classification of Substances:** Substances around us can be classified as **acidic, basic, or neutral** based on their properties and their behaviour with indicators.

(2) **Litmus as an Indicator:** Litmus is a **natural substance obtained from lichens** and is available as red and blue litmus paper. **Acids turn blue litmus red**, while **bases turn red litmus blue**; neutral substances do not affect either.

(3) **Common Acids and Bases:** Lemon juice, amla juice, tamarind water, and vinegar are **acidic**, whereas soap solution, baking soda solution, lime water, and washing powder solution are **basic**. Tap water, sugar solution, and salt solution are described as **neutral**.

(4) **General Properties:** Edible acidic substances generally have a **sour taste**, while bases generally taste **bitter** and feel **soapy or slippery**. However, students are cautioned never to taste unknown substances.

(5) **Natural Acid–Base Indicators:** Apart from litmus, natural substances such as **red rose, red hibiscus, purple cabbage, turmeric, beetroot, and jamun** can act as acid–base indicators. These indicators show characteristic changes when exposed to acids or bases.

(6) **Red Rose and Turmeric Indicators:** Red rose extract gives a **red colour in acidic solutions** and a **green colour in basic solutions**. Yellow turmeric turns **red in basic solutions**, but remains unchanged in acidic and neutral solutions; therefore, turmeric cannot distinguish between acidic and neutral substances.

(7) **Olfactory Indicators:** Some substances show changes in their **odour** in acidic or basic media and are called **olfactory indicators**. The chapter uses onion-treated strips to investigate this property.

(8) **Neutralisation Reaction:** When an acid and a base are mixed in sufficient quantities, they neutralise each other and form **salt and water with the release of heat**. The chapter represents this as: **Acid + Base → Salt + Water + Heat**.

(9) **Neutralisation in Daily Life:** Neutralisation has several practical applications. **Baking soda** can neutralise the acid from an ant bite; **lime** can treat acidic soil; organic matter such as manure and composted leaves can help neutralise basic soil; and acidic industrial waste can be treated with suitable basic substances before release.

(10) **Learning Through Investigation:** The chapter promotes hands-on scientific learning through experiments involving **litmus, red rose extract, turmeric paper, neutralisation, soil testing, and testing water from different sources**. It encourages students to observe colour or odour changes, analyse evidence, classify substances, and apply their understanding to real-life situations.

2.2 Important Formulas:

Exploring Substances: Acidic, Basic, and Neutral:

This chapter is mainly **conceptual and experimental**. It does **not contain conventional mathematical formulae or numerical calculations**. The principal equation given in the chapter is the neutralisation relationship.

1. Neutralisation Reaction

$$\boxed{\text{Acid} + \text{Base} \rightarrow \text{Salt} + \text{Water} + \text{Heat}}$$

When an acid reacts with a sufficient quantity of a base, they neutralise each other. Salt and water are formed and heat is released.

2. Acid + Base → Neutralisation

$$\boxed{\text{Acidic solution + Basic solution} \rightarrow \text{Neutral solution}}$$

This conceptual relationship can be used to solve reasoning problems in which an acidic substance is treated with a suitable base or vice versa.

3. Acidic Substance + Blue Litmus

$$\boxed{\text{Blue Litmus} \xrightarrow{\text{Acid}} \text{Red}}$$

Thus, if a substance changes **blue litmus to red**, it can be identified as acidic.

4. Basic Substance + Red Litmus

$$\boxed{\text{Red Litmus} \xrightarrow{\text{Base}} \text{Blue}}$$

A substance that changes **red litmus to blue** is basic.

5. Neutral Substance + Litmus

$$\boxed{\text{Neutral substance + Red/Blue Litmus} \rightarrow \text{No colour change}}$$

Tap water, sugar solution, and salt solution are examples given in the chapter that do not change either red or blue litmus.

6. Red Rose Indicator + Acid

$$\boxed{\text{Red Rose Extract + Acid} \rightarrow \text{Red shade}}$$

Red rose extract gives a shade of **red** in an acidic solution.

7. Red Rose Indicator + Base

$$\boxed{\text{Red Rose Extract + Base} \rightarrow \text{Green shade}}$$

Therefore, a solution that turns red rose extract green can be identified as **basic**.

8. Turmeric Indicator + Base

$$\boxed{\text{Yellow Turmeric + Base} \rightarrow \text{Red}}$$

Turmeric paper is particularly useful for identifying **basic substances**.

9. Turmeric Indicator + Acid/Neutral Substance

$$\boxed{\text{Yellow Turmeric + Acid/Neutral} \rightarrow \text{No colour change}}$$

Hence, turmeric alone **cannot distinguish an acidic substance from a neutral substance**.

10. Neutralisation of an Ant Bite

$$\boxed{\text{Formic Acid + Baking Soda (Base)} \rightarrow \text{Neutralisation}}$$

A red ant injects an acidic liquid containing **formic acid**. Moist baking soda, being basic, can neutralise its acidic effect.

11. Treatment of Acidic Soil

$$\boxed{\text{Acidic Soil + Lime (Base)} \rightarrow \text{Neutralisation}}$$

Acidic soil can be treated using **lime**, which is basic in nature.

12. Treatment of Basic Soil

$$\boxed{\text{Basic Soil + Organic Matter} \rightarrow \text{Neutralisation}}$$

Manure and composted leaves release acids that help neutralise basic soil.

13. Treatment of Acidic Industrial Waste

$$\boxed{\text{Acidic Industrial Waste + Basic Substance} \rightarrow \text{Neutralisation}}$$

The chapter explains that acidic factory waste can be neutralised using basic substances before it is released into a lake.

Quick Revision Table

Situation/Test	Relationship to Remember
Neutralisation	**Acid + Base → Salt + Water + Heat**
Acid + blue litmus	**Blue → Red**
Base + red litmus	**Red → Blue**

Situation/Test	Relationship to Remember
Neutral + litmus	**No change**
Acid + red rose extract	**Red shade**
Base + red rose extract	**Green shade**
Base + turmeric	**Yellow → Red**
Acid/neutral + turmeric	**No change**
Acidic soil + lime	**Neutralisation**
Basic soil + organic matter	**Neutralisation**

Note for the Question Bank: Since Chapter 2 does not introduce mathematical formulae, **numerical quantitative problems are not directly applicable**. Instead, formula-based questions should focus on the **neutralisation equation, indicator colour-change relationships, identification of unknown solutions, and application-based acid–base reasoning**.

2.3 Fill-Up the Blank LOTS type questions with Answers: (35 Questions)

The following questions focus mainly on **Remembering and Understanding (LOTS)** and are based directly on the uploaded chapter.

1. Substances that turn blue litmus paper red are __________ in nature.
   Answer: Acidic
2. Substances that turn red litmus paper blue are __________ in nature.
   Answer: Basic
3. Substances that are neither acidic nor basic are called __________ substances.
   Answer: Neutral
4. Litmus is a natural substance obtained from __________.
   Answer: Lichens
5. Litmus paper is commonly available in __________ and __________ colours.
   Answer: Red and blue
6. A substance that shows different colours in acidic and basic solutions is called an __________.
   Answer: Acid-base indicator
7. Lemon juice is __________ in nature.
   Answer: Acidic
8. Soap solution is __________ in nature.
   Answer: Basic
9. Tap water is classified as __________ in the activity given in the chapter.
   Answer: Neutral
10. Basic substances are generally __________ to touch.
    Answer: Slippery
11. Bases generally taste __________.
    Answer: Bitter
12. Edible substances containing acids generally taste __________.
    Answer: Sour
13. Red rose extract gives a __________ colour in an acidic solution.
    Answer: Red
14. Red rose extract gives a __________ colour in a basic solution.
    Answer: Green

15. Beetroot, purple cabbage and red hibiscus can act as __________ indicators.
    Answer: Acid-base
16. In acidic soil, hydrangea produces __________-coloured flowers.
    Answer: Blue
17. In basic soil, hydrangea flowers are __________ or red.
    Answer: Pink
18. Yellow turmeric turns __________ in a basic solution.
    Answer: Red
19. Turmeric paper cannot differentiate between __________ and neutral substances.
    Answer: Acidic
20. Substances whose odours change in acidic or basic media are called __________ indicators.
    Answer: Olfactory
21. When an acid and a base react in sufficient quantities, the reaction is called a __________ reaction.
    Answer: Neutralisation
22. A neutralisation reaction produces salt and __________.
    Answer: Water
23. During a neutralisation reaction, __________ is released.
    Answer: Heat
24. The general relationship for neutralisation is: Acid + Base → Salt + Water + __________.
    Answer: Heat
25. A red ant injects an acidic liquid containing __________ acid into the skin.
    Answer: Formic
26. The effect of an ant bite can be neutralised using moist __________.
    Answer: Baking soda
27. Baking soda is __________ in nature.
    Answer: Basic
28. Acidic soil can be treated with __________, which is a base.
    Answer: Lime
29. Basic soil can be treated by adding organic matter such as manure and __________ leaves.
    Answer: Composted
30. Organic matter releases __________ that help neutralise basic soil.
    Answer: Acids
31. Acidic factory waste can be neutralised by adding __________ substances before releasing it into a lake.
    Answer: Basic
32. Lime water is a solution of __________ hydroxide in water.
    Answer: Calcium
33. Lime or *chuna* is chemically known as __________ oxide.
    Answer: Calcium
34. Acharya Prafulla Chandra Ray is known as the "Father of Modern Indian __________."
    Answer: Chemistry
35. P. C. Ray established India's first __________ company in 1901.
    Answer: Pharmaceutical

Quick Answer Key:

1. Acidic | **2.** Basic | **3.** Neutral | **4.** Lichens | **5.** Red and blue | **6.** Acid-base indicator | **7.** Acidic | **8.** Basic | **9.** Neutral | **10.** Slippery | **11.** Bitter | **12.** Sour | **13.** Red | **14.** Green | **15.** Acid-base | **16.** Blue | **17.** Pink | **18.** Red | **19.** Acidic | **20.** Olfactory | **21.** Neutralisation | **22.** Water | **23.** Heat | **24.** Heat | **25.** Formic | **26.** Baking soda | **27.** Basic | **28.** Lime | **29.** Composted | **30.** Acids | **31.** Basic | **32.** Calcium | **33.** Calcium | **34.** Chemistry | **35.** Pharmaceutical

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

The following questions require students to **apply, analyse, predict, compare, and infer** using concepts from the chapter rather than merely recall facts.

1. An unknown solution turns blue litmus paper red. Therefore, the solution can be inferred to be __________ in nature.
   Answer: Acidic
2. An unknown solution turns red litmus paper blue but does not turn blue litmus red. The solution is most likely __________.
   Answer: Basic
3. A solution does not change either red or blue litmus paper. Based on the chapter's classification, it can be considered __________.
   Answer: Neutral
4. A student adds red rose extract to an unknown solution and observes a green colour. The unknown solution must be __________ in nature.
   Answer: Basic
5. If red rose extract produces a red colour when added to an unknown liquid, the liquid can be classified as __________.
   Answer: Acidic
6. A yellow turmeric stain on a shirt changes colour after soap is applied. This indicates that soap is __________ in nature.
   Answer: Basic
7. An unknown solution produces no colour change with turmeric paper. From this test alone, it may be either __________ or neutral.
   Answer: Acidic
8. To distinguish an acidic solution from a neutral solution when turmeric gives no colour change, a student should use __________ paper instead.
   Answer: Blue litmus
9. A gardener observes blue hydrangea flowers. Based on the chapter, the soil is likely to be __________ in nature.
   Answer: Acidic
10. If the same hydrangea plant produces pink or red flowers, the soil is likely to be __________ in nature.
    Answer: Basic
11. A farmer finds that excessive use of chemical fertilisers has made the soil acidic. To improve the soil, the farmer should add __________.
    Answer: Lime
12. If soil is found to be basic, adding manure and composted leaves can help because organic matter releases __________.
    Answer: Acids
13. A child is bitten by a red ant. Applying moist baking soda helps because the acidic substance injected by the ant is __________ by the base.
    Answer: Neutralised
14. The acid injected into the skin during a red ant bite is __________ acid.
    Answer: Formic

15. If an acidic factory waste is to be safely treated before release into a lake, a suitable __________ substance should be added to neutralise it.
    Answer: Basic
16. Lemon juice turns blue litmus solution red. On adding sufficient lime water, the effect of the acid is __________.
    Answer: Neutralised
17. When sufficient quantities of an acid and a base are mixed, the resulting solution becomes neither acidic nor basic because a __________ reaction has occurred.
    Answer: Neutralisation
18. If a test tube becomes warm when an acid and a base are mixed, this supports the conclusion that __________ has been released.
    Answer: Heat
19. A student mixes an acid and a base in sufficient quantities. Besides water, the other substance formed is __________.
    Answer: Salt
20. In the reaction **Acid + Base → Salt + Water + Heat**, if one reactant is known to be an acid, the other reactant must be a __________.
    Answer: Base
21. A secret message is written with soap solution on turmeric-treated paper. The writing will appear because turmeric changes colour in the presence of a __________ substance.
    Answer: Basic
22. If grape juice gives a red tint with red rose extract, grape juice can be inferred to be __________ in nature.
    Answer: Acidic
23. If sufficient baking soda is added to an acidic liquid, the acidity of the liquid will be reduced due to __________.
    Answer: Neutralisation
24. A student has vinegar, baking soda solution, and sugar solution but only turmeric paper. The baking soda solution can be identified because it causes a __________ change in turmeric paper.
    Answer: Colour
25. Using turmeric paper alone, vinegar and sugar solution cannot be distinguished because turmeric remains unchanged in both __________ and neutral solutions.
    Answer: Acidic
26. An unknown liquid does not change red litmus, turns blue litmus red, and causes no change in turmeric. The liquid is __________.
    Answer: Acidic
27. Three unknown liquids A, B, and C all turn red rose extract green. We can infer that all three liquids are __________ in nature.
    Answer: Basic
28. If a basic solution is treated with an excess of an acidic solution, its basic effect will first be reduced through the process of __________.
    Answer: Neutralisation
29. A student wants to identify an acidic and a basic solution without depending on colour changes. An __________ indicator would be more suitable because it works through changes in smell.
    Answer: Olfactory

30. A plant continues to show poor health even though its soil is neutral. According to the chapter, a possible reason is a deficiency of __________ in the soil.
    Answer: Nutrients
31. If a liquid changes red litmus to blue and red rose extract to green, both observations confirm that the liquid is __________.
    Answer: Basic
32. A solution turns turmeric paper red and red litmus paper blue. These two observations together provide evidence that the solution is __________.
    Answer: Basic
33. If an acidic solution is accidentally mixed with a suitable base in sufficient quantity, its acidic character will __________.
    Answer: Disappear / be neutralised
34. A lake receiving acidic factory waste may be protected by treating the waste with basic substances __________ releasing it into the lake.
    Answer: Before
35. The appearance of a hidden message written with soap solution after turmeric solution is sprayed demonstrates the use of an acid-base __________.
    Answer: Indicator

Answer Key

1. Acidic | **2.** Basic | **3.** Neutral | **4.** Basic | **5.** Acidic | **6.** Basic | **7.** Acidic | **8.** Blue litmus | **9.** Acidic | **10.** Basic | **11.** Lime | **12.** Acids | **13.** Neutralised | **14.** Formic | **15.** Basic | **16.** Neutralised | **17.** Neutralisation | **18.** Heat | **19.** Salt | **20.** Base | **21.** Basic | **22.** Acidic | **23.** Neutralisation | **24.** Colour | **25.** Acidic | **26.** Acidic | **27.** Basic | **28.** Neutralisation | **29.** Olfactory | **30.** Nutrients | **31.** Basic | **32.** Basic | **33.** Disappear/Be neutralised | **34.** Before | **35.** Indicator

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

These questions focus on **Remembering and Understanding** and each answer is limited to **one sentence**.

1. **What are acidic substances?**
   Answer: Substances that turn blue litmus paper red are called acidic substances.
2. **What are basic substances?**
   Answer: Substances that turn red litmus paper blue are called basic substances.
3. **What are neutral substances?**
   Answer: Substances that are neither acidic nor basic are called neutral substances.
4. **What is litmus?**
   Answer: Litmus is a natural substance obtained from lichens and used as an acid-base indicator.
5. **In which two colours is litmus paper available?**
   Answer: Litmus paper is available in red and blue colours.
6. **What is an acid-base indicator?**
   Answer: A substance that shows different colours in acidic and basic solutions is called an acid-base indicator.
7. **Name any two acidic substances mentioned in the chapter.**
   Answer: Lemon juice and vinegar are two acidic substances.
8. **Name any two basic substances mentioned in the chapter.**
   Answer: Baking soda solution and lime water are two basic substances.
9. **Name any two neutral substances mentioned in the chapter.**
   Answer: Sugar solution and salt solution are neutral substances.
10. **What is the general taste of edible acidic substances?**
    Answer: Edible acidic substances generally taste sour.

11. **How do basic substances generally feel to touch?**
    Answer: Basic substances generally feel soapy or slippery to touch.
12. **What is the general taste of bases?**
    Answer: Bases generally taste bitter, although everything that tastes bitter is not necessarily basic.
13. **What colour does red rose extract give in an acidic solution?**
    Answer: Red rose extract gives a red colour in an acidic solution.
14. **What colour does red rose extract give in a basic solution?**
    Answer: Red rose extract gives a green colour in a basic solution.
15. **Name any two natural materials that can act as acid-base indicators.**
    Answer: Purple cabbage and red hibiscus can act as natural acid-base indicators.
16. **What colour does turmeric turn in a basic solution?**
    Answer: Yellow turmeric turns red in a basic solution.
17. **Why cannot turmeric paper distinguish an acid from a neutral substance?**
    Answer: Turmeric paper cannot distinguish them because its yellow colour remains unchanged in both acidic and neutral substances.
18. **What are olfactory indicators?**
    Answer: Substances whose odours change in acidic or basic media are called olfactory indicators.
19. **Name one olfactory indicator investigated in the chapter.**
    Answer: Onion is investigated as an olfactory indicator in the chapter.
20. **What is a neutralisation reaction?**
    Answer: A reaction in which an acid and a base in sufficient quantities form a solution that is neither acidic nor basic is called a neutralisation reaction.
21. **What substances are formed during a neutralisation reaction?**
    Answer: Salt and water are formed during a neutralisation reaction.
22. **What happens to heat during neutralisation?**
    Answer: Heat is released during a neutralisation reaction.
23. **Write the general equation for a neutralisation reaction.**
    Answer: Acid + Base → Salt + Water + Heat.
24. **Which acid is injected into the skin by a red ant?**
    Answer: A red ant injects formic acid into the skin.
25. **How can the effect of a red ant bite be neutralised?**
    Answer: The effect of a red ant bite can be neutralised by applying moist baking soda.
26. **How can acidic soil be treated?**
    Answer: Acidic soil can be treated by adding lime, which is a base.
27. **How can basic soil be treated?**
    Answer: Basic soil can be treated by adding organic matter such as manure and composted leaves.
28. **How can acidic factory waste be treated before being released into a lake?**
    Answer: Acidic factory waste can be neutralised by adding basic substances before releasing it into the lake.
29. **What is lime water?**
    Answer: Lime water is a solution of calcium hydroxide in water.
30. **How is lime water prepared?**
    Answer: Lime water is prepared by mixing lime in water, allowing it to stand, and filtering the liquid.
31. **What colour flowers does hydrangea produce in acidic soil?**
    Answer: Hydrangea produces blue-coloured flowers in acidic soil.

32. **What colour flowers does hydrangea produce in basic soil?**
    Answer: Hydrangea produces pink or red flowers in basic soil.
33. **Who is known as the 'Father of Modern Indian Chemistry'?**
    Answer: Acharya Prafulla Chandra Ray is known as the 'Father of Modern Indian Chemistry'.
34. **What important company did P. C. Ray establish in 1901?**
    Answer: P. C. Ray established India's first pharmaceutical company in 1901.
35. **What may cause plants to grow poorly even when the soil is neutral?**
    Answer: A deficiency of nutrients in the soil may cause plants to grow poorly even when the soil is neutral.

2.6 One-mark questions with Answers of HOTS Type: (40 Questions)

The following questions are designed to test **application, analysis, prediction, inference, and reasoning**. Each answer is restricted to **one sentence**, making them suitable for **one-mark questions**.

1. **A liquid turns blue litmus paper red; what can you infer about the liquid?**
   Answer: The liquid is acidic in nature because acids turn blue litmus paper red.
2. **A solution turns red litmus paper blue; what does this observation indicate?**
   Answer: The solution is basic in nature because bases turn red litmus paper blue.
3. **A solution does not change either red or blue litmus paper; what can you conclude?**
   Answer: The solution is neutral because it affects neither red nor blue litmus paper.
4. **A student tests lemon juice with red litmus paper and observes no change; can the student conclude that it is neutral?**
   Answer: No, because an acidic substance does not change red litmus paper and should also be tested with blue litmus paper.
5. **An unknown solution changes red rose extract to green; what can you infer?**
   Answer: The solution is basic because red rose extract gives a green colour in a basic solution.
6. **Red rose extract turns red when mixed with an unknown liquid; what does this indicate?**
   Answer: The unknown liquid is acidic because red rose extract gives a red colour in acidic solutions.
7. **Why can red rose extract be used instead of litmus to identify acids and bases?**
   Answer: Red rose extract can identify them because it produces different colours in acidic and basic solutions.
8. **A yellow turmeric stain changes colour when soap is applied; what can you infer about soap?**
   Answer: Soap is basic because turmeric changes from yellow to red in the presence of a base.
9. **An unknown solution causes no change in turmeric paper; can you conclude that it is acidic?**
   Answer: No, because turmeric remains unchanged in both acidic and neutral solutions.
10. **Which indicator would you choose to distinguish between an acidic and a neutral solution—turmeric or litmus? Why?**
    Answer: Litmus should be chosen because turmeric cannot distinguish between acidic and neutral solutions.

11. **A student finds that an unknown solution is slippery to touch; what might this suggest about its nature?**
Answer: The slippery nature suggests that the solution may be basic.
12. **Can you conclude that every bitter-tasting substance is basic? Give a reason.**
Answer: No, because substances such as bitter gourd taste bitter but are not basic.
13. **Why should an unknown substance not be tasted to determine whether it is acidic or basic?**
Answer: An unknown substance should not be tasted because it may be unsafe or harmful.
14. **A hydrangea plant produces blue flowers; what can you infer about its soil?**
Answer: The soil is acidic because hydrangea produces blue flowers in acidic soil.
15. **A hydrangea plant produces pink or red flowers; what does this suggest about the soil?**
Answer: The soil is basic because hydrangea produces pink or red flowers in basic soil.
16. **A farmer finds that excessive fertiliser use has made the soil acidic; what should be added to the soil?**
Answer: Lime should be added because its basic nature helps neutralise acidic soil.
17. **What should a farmer add if the soil is too basic for healthy plant growth?**
Answer: The farmer should add manure or composted leaves because organic matter releases acids that neutralise basic soil.
18. **Plants are unhealthy even though the soil is neutral; what could be a possible reason?**
Answer: The plants may be unhealthy because the soil could be deficient in essential nutrients.
19. **Why does applying moist baking soda help relieve the effect of a red ant bite?**
Answer: Baking soda is basic and neutralises the formic acid injected during the ant bite.
20. **Would applying an acidic substance be suitable for neutralising a red ant bite? Why?**
Answer: No, because the ant injects an acid and a basic substance is needed to neutralise its effect.
21. **What would you expect to happen if sufficient lime water is added to an acidic lemon juice solution?**
Answer: Lime water will neutralise the acidic effect of the lemon juice.
22. **Why is heat observed when an acid and a base neutralise each other?**
Answer: Heat is observed because neutralisation is accompanied by the release of heat.
23. **What products would you expect when an acid reacts with a base in a neutralisation reaction?**
Answer: Salt and water are formed along with the release of heat.
24. **A lake receives acidic factory waste; what treatment could reduce its harmful effect?**
Answer: The acidic waste should be neutralised with suitable basic substances before it is released into the lake.
25. **Why should acidic industrial waste be treated before being released into a lake?**
Answer: It should be treated to neutralise its acidity and reduce possible harm to aquatic life.
26. **A secret message is written with soap solution on turmeric-treated paper; why does the message become visible?**

Answer: The message becomes visible because the basic soap solution changes the colour of turmeric.

27. **Could turmeric solution and soap solution explain the secret message shown at the beginning of the chapter?**
Answer: Yes, turmeric can act as the indicator while the basic soap solution causes the visible colour change.
28. **A student has vinegar, baking soda solution, and sugar solution; which one can be identified directly using turmeric paper?**
Answer: Baking soda solution can be identified because its basic nature causes a colour change in turmeric paper.
29. **Why can vinegar and sugar solution not be distinguished from each other using only turmeric paper?**
Answer: They cannot be distinguished because turmeric remains unchanged in both acidic vinegar and neutral sugar solution.
30. **Grape juice turns red rose extract red; what can you infer about grape juice?**
Answer: Grape juice is acidic because red rose extract becomes red in an acidic medium.
31. **If excess amla juice is added to a basic solution, what process would occur first?**
Answer: Neutralisation would occur as the acidic amla juice reacts with the basic solution.
32. **A blindfolded student cannot observe indicator colour changes; what type of indicator would be more useful?**
Answer: An olfactory indicator would be more useful because it can indicate changes through odour rather than colour.
33. **Why is using more than one indicator useful when identifying an unknown substance?**
Answer: Using more than one indicator provides additional evidence and helps identify the acidic, basic, or neutral nature more reliably.
34. **If red litmus remains unchanged but blue litmus turns red, what is the nature of the solution?**
Answer: The solution is acidic because acids change blue litmus to red while leaving red litmus unchanged.
35. **If red litmus turns blue and turmeric paper changes colour, what conclusion can be drawn?**
Answer: The solution is basic because both indicator observations show the characteristic behaviour of a base.
36. **Why does adding lime to acidic soil demonstrate neutralisation in daily life?**
Answer: Basic lime counteracts the acidic nature of the soil through neutralisation.
37. **If organic matter releases acids into basic soil, how does it help plants?**
Answer: The released acids neutralise the basic nature of the soil and make its condition more suitable for plant growth.
38. **Why would turmeric paper alone be insufficient for classifying all unknown substances?**
Answer: Turmeric paper detects basic substances but cannot distinguish between acidic and neutral substances.
39. **An unknown liquid changes blue litmus to red and red rose extract to red; what do the two observations confirm?**
Answer: Both observations confirm that the unknown liquid is acidic.

40. **An unknown liquid changes red litmus to blue and red rose extract to green; what do these results confirm?**
    Answer: Both results confirm that the unknown liquid is basic.

These questions particularly emphasize **"infer," "predict," "justify," "choose," "conclude," and "apply"**, making them appropriate as **HOTS-type one-mark questions** rather than simple factual-recall questions.

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

The following questions focus mainly on **remembering and understanding**. Each answer is given in **two sentences/points**, suitable for a **2-mark question bank**.

1. What are acidic and basic substances?
Answer:
1. Substances that turn blue litmus paper red are called **acidic substances**.
2. Substances that turn red litmus paper blue are called **basic substances**.

2. What are neutral substances? Give two examples.
Answer:
1. Substances that are neither acidic nor basic are called **neutral substances**.
2. Tap water, sugar solution, and salt solution are examples of neutral substances.

3. What is litmus? Why is it called an acid-base indicator?
Answer:
1. Litmus is a natural substance obtained from lichens and is available as a solution or as red and blue paper strips.
2. It is called an acid-base indicator because it shows different colours in acidic and basic solutions.

4. State the effect of acids and bases on litmus paper.
Answer:
1. Acids turn **blue litmus paper red**.
2. Bases turn **red litmus paper blue**.

5. Give two examples each of acidic and basic substances.
Answer:
1. Lemon juice and vinegar are examples of **acidic substances**.
2. Soap solution and baking soda solution are examples of **basic substances**.

6. Mention two general properties of acidic substances.
Answer:
1. Edible acidic substances generally have a **sour taste**.
2. Acidic substances turn **blue litmus paper red**.

7. Mention two general properties of basic substances.
Answer:
1. Basic substances are generally **slippery or soapy to touch**.
2. Bases generally taste bitter, though not every bitter substance is basic.

8. How is lime water prepared?
Answer:
1. Lime (chuna) is mixed with water and the mixture is left undisturbed for some time.
2. The liquid is then filtered into another container and used as lime water.

9. What is a natural indicator? Give two examples.
Answer:
1. A natural indicator is a naturally obtained substance that can indicate the acidic or basic nature of substances through observable changes.
2. Litmus and red rose extract are examples of natural acid-base indicators.

10. How does red rose extract behave in acidic and basic solutions?
Answer:
1. Red rose extract gives a **red colour in an acidic solution**.
2. It gives a **green colour in a basic solution**.

11. Name four natural materials that can be used as acid-base indicators.
Answer:
1. Beetroot and purple cabbage can be used as natural acid-base indicators.
2. Turmeric and red hibiscus can also be used as natural acid-base indicators.

12. How is turmeric paper prepared?
Answer:
1. Turmeric is mixed with a little water to make a paste, and filter paper is dipped into it until it becomes yellow.
2. The paper is dried and cut into thin strips to obtain **turmeric paper**.

13. How does turmeric paper behave with acidic, basic, and neutral substances?
Answer:
1. Yellow turmeric paper turns **red in basic substances**.
2. It remains unchanged in acidic and neutral substances and therefore cannot distinguish between them.

14. What are olfactory indicators? Give an example from the chapter.
Answer:
1. Substances whose odours change in an acidic or basic medium are called **olfactory indicators**.
2. Onion is used in the chapter to investigate changes in odour in acidic and basic media.

15. What is a neutralisation reaction? Name the products formed.
Answer:
1. A reaction in which an acid and a base in sufficient quantities produce a solution that is neither acidic nor basic is called **neutralisation**.
2. **Salt and water** are formed during neutralisation, along with the release of heat.

16. Write the general equation for neutralisation and state what happens to heat.
Answer:
1. The general equation is: **Acid + Base → Salt + Water + Heat**.
2. Heat is **released** during the neutralisation reaction.

17. Explain the use of neutralisation in treating a red ant bite.
Answer:
1. A red ant injects an acidic liquid called **formic acid** into the skin.
2. Moist baking soda, which is basic, can be applied to neutralise the effect of the acid.

18. How can acidic soil be treated?
Answer:
1. Excessive use of chemical fertilisers may make soil acidic and affect plant growth.
2. Acidic soil can be treated with **lime**, which is basic in nature.

19. How can basic soil be treated?
Answer:
1. Basic soil can be treated by adding organic matter such as **manure and composted leaves**.
2. Organic matter releases acids that neutralise the basic nature of the soil.

20. How can neutralisation help in controlling acidic industrial waste?
Answer:
1. Acidic factory waste may harm aquatic organisms when released directly into water bodies.

2. It can be neutralised by adding suitable basic substances before releasing it into a lake.

21. What happens when lime water is added to lemon juice solution containing blue litmus solution?

Answer:

1. Blue litmus solution initially turns red in lemon juice because the solution is acidic.
2. On adding sufficient lime water, the acidic effect is neutralised and the colour eventually changes from red to blue.

22. Write two facts about Acharya Prafulla Chandra Ray.

Answer:

1. Acharya Prafulla Chandra Ray is known as the **'Father of Modern Indian Chemistry'** and contributed to scientific research in India.
2. He established India's first pharmaceutical company in **1901**.

23. What do the flower colours of hydrangea indicate about soil?

Answer:

1. Hydrangea produces **blue-coloured flowers in acidic soil**.
2. It produces **pink or red flowers in basic soil**.

24. What precautions should be taken while identifying acidic or basic substances by taste?

Answer:

1. Unknown substances should **never be tasted** to identify their acidic or basic nature.
2. A substance should be tasted only when specifically instructed and when it is known to be safe.

25. Mention two important uses of neutralisation in daily life.

Answer:

1. Neutralisation is used to reduce the effect of **formic acid from an ant bite** by applying moist baking soda.
2. It is also used to correct **acidic or basic soil** and to treat acidic industrial waste.

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

The following questions require **application, analysis, prediction, comparison, and reasoning**. Each answer is given in **two sentences/points**, suitable for 2 marks.

1. An unknown solution turns blue litmus paper red but does not change turmeric paper. What can you conclude about the solution? Justify.

Answer:

1. The solution is **acidic** because it turns blue litmus paper red.
2. Turmeric remains unchanged in acidic solutions, supporting this conclusion.

2. A liquid turns red litmus paper blue and turmeric paper red. Predict its nature and explain your reasoning.

Answer:

1. The liquid is **basic** because bases turn red litmus paper blue.
2. The red colour produced on turmeric paper further confirms that it is basic.

3. A student tests sugar solution with both red and blue litmus papers, but neither changes colour. What conclusion should the student draw?

Answer:

1. The sugar solution is **neutral** because it does not change either red or blue litmus paper.
2. Therefore, it is neither acidic nor basic.

4. Why is turmeric paper alone insufficient to distinguish between lemon juice and sugar solution?
Answer:
1. Turmeric paper does not change colour with either acidic or neutral substances.
2. Since lemon juice is acidic and sugar solution is neutral, turmeric paper cannot distinguish between them.

5. Red rose extract turns green when added to an unknown solution. What can you infer, and how could you confirm it using litmus?
Answer:
1. The unknown solution is **basic** because red rose extract gives a green colour in basic solutions.
2. It can be confirmed because the solution should turn **red litmus paper blue**.

6. A curry stain on a white shirt changes colour when soap is applied. Explain why.
Answer:
1. Curry containing turmeric acts as a natural indicator, while soap solution is basic.
2. Turmeric changes from yellow to red in the presence of a basic substance such as soap.

7. A student says, "All bitter substances are basic." Is this statement correct? Give a reason.
Answer:
1. No, the statement is incorrect because everything that tastes bitter need not contain a base.
2. For example, bitter gourd tastes bitter but is not basic in nature.

8. Why should you not identify an unknown acid or base by tasting it? Suggest a safer method.
Answer:
1. Unknown substances should never be tasted because the chapter specifically cautions against doing so.
2. Their nature can instead be tested safely using indicators such as litmus, red rose extract, or turmeric.

9. A farmer finds that excessive use of chemical fertilisers has made the soil acidic. What should be added, and why?
Answer:
1. The farmer should treat the acidic soil with **lime**, which is basic.
2. The base helps neutralise the acidic nature of the soil and can improve conditions for plant growth.

10. A garden has basic soil. Would adding lime be suitable? Explain.
Answer:
1. No, lime should not be added because it is basic and would not neutralise basic soil.
2. Organic matter such as manure or composted leaves should be added because it releases acids that neutralise the basic soil.

11. Why does applying moist baking soda reduce the stinging pain caused by a red ant bite?
Answer:
1. A red ant injects **formic acid**, an acidic liquid, into the skin.
2. Baking soda is basic and neutralises the acidic effect, thereby providing relief.

12. Lemon juice containing blue litmus solution appears red. What would happen if sufficient lime water were gradually added? Why?
Answer:
1. The solution would eventually change from red to blue as lime water is added.

2. This occurs because basic lime water neutralises the acidic effect of the lemon juice.

13. A factory releases acidic waste into a nearby lake. Suggest a scientific method to reduce its harmful effect.

Answer:

1. The acidic factory waste should be treated with suitable **basic substances before being released** into the lake.
2. The basic substances neutralise the acidic waste and can help protect aquatic life.

14. A student wants to write a secret message on turmeric-coated paper. Should the student use soap solution or lemon juice? Explain.

Answer:

1. The student should use **soap solution** because it is basic.
2. A basic solution changes yellow turmeric to red, making the writing visible.

15. Red rose extract added to grape juice develops a reddish tint. What does this indicate? What may happen if baking soda is added?

Answer:

1. The reddish tint indicates that the grape juice is **acidic**, since red rose extract gives a red shade in acidic solutions.
2. Adding sufficient basic baking soda would counteract the acidic nature and the indicator colour would change as the medium becomes less acidic/basic.

16. Two colourless liquids are vinegar and baking soda solution. How can litmus paper distinguish between them?

Answer:

1. Vinegar will turn **blue litmus red**, showing that it is acidic.
2. Baking soda solution will turn **red litmus blue**, showing that it is basic.

17. Why is red rose extract more useful than turmeric for distinguishing acidic and basic substances?

Answer:

1. Red rose extract produces different colours—red in acidic solutions and green in basic solutions.
2. Turmeric detects basic substances but cannot distinguish acidic substances from neutral ones.

18. Hydrangea flowers in a garden are blue. What can you infer about the soil? What colour might they show in basic soil?

Answer:

1. Blue hydrangea flowers indicate that the soil is **acidic**.
2. According to the chapter, hydrangea flowers may be **pink or red in basic soil**.

19. A student mixes an acid and a base in sufficient quantities and notices that the mixture becomes warm. Explain both observations.

Answer:

1. The acid and base neutralise each other to form **salt and water**.
2. The mixture becomes warm because **heat is released during neutralisation**.

20. Plants are unhealthy even though testing shows that the soil is neutral. What other cause should be investigated?

Answer:

1. Poor plant health does not always mean that the soil is acidic or basic.
2. If the soil is neutral, the plants may be suffering from a **deficiency of nutrients** in the soil.

21. An unknown liquid does not change red litmus paper, but turns blue litmus paper red. Is the first observation enough to call it neutral? Explain.

Answer:

1. No, absence of change in red litmus alone is not sufficient to conclude that the liquid is neutral.
2. Since it turns blue litmus red, the liquid must be **acidic**.

22. Why would using both red and blue litmus papers give more reliable information than using only one?
Answer:
1. Blue litmus detects acids by turning red, while red litmus detects bases by turning blue.
2. Using both therefore helps distinguish **acidic, basic, and neutral** substances more effectively.

23. A solution initially turns red litmus blue. If excess vinegar is added, predict what may happen and explain.
Answer:
1. The original solution is basic, while vinegar is acidic.
2. Sufficient or excess vinegar can neutralise and then overcome the basic effect, reversing the indicator behaviour toward that of an acidic solution.

24. Why might a scientist prefer an indicator rather than taste or touch when testing an unknown household liquid?
Answer:
1. Tasting an unknown substance is unsafe, and properties such as bitterness or slipperiness are not sufficient for reliable identification.
2. Indicators provide observable colour or odour changes that can be used to determine whether a substance is acidic or basic.

25. At the science fair, words appeared on paper only after a liquid was sprayed over it. Suggest a possible acid-base explanation.
Answer:
1. The hidden message could have been written with **soap solution**, which is basic, and the paper could then be sprayed with a turmeric-based indicator.
2. Turmeric changes colour in contact with a basic substance, causing the previously invisible writing to become visible.

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

Below are **15 LOTS (Lower Order Thinking Skills)** questions based directly on the chapter 2. Each answer contains **three sentences/points**, suitable for **3 marks**.

1. What is litmus? Explain how it is used to identify acidic and basic substances.
Answer:
1. Litmus is a natural substance obtained from **lichens** and is available as a solution or as red and blue paper strips.
2. Acidic substances turn **blue litmus paper red**.
3. Basic substances turn **red litmus paper blue**.

2. Classify substances as acidic, basic, and neutral with examples.
Answer:
1. **Acidic substances** turn blue litmus red; examples are lemon juice, amla juice, tamarind water, and vinegar.
2. **Basic substances** turn red litmus blue; examples are soap solution, baking soda solution, lime water, and washing powder solution.
3. **Neutral substances** do not change either litmus paper; examples are tap water, sugar solution, and salt solution.

3. State three characteristics of acidic substances.

Answer:

1. Acidic substances turn **blue litmus paper red**.
2. Edible acidic substances generally have a **sour taste**.
3. Examples of acidic substances include lemon juice, amla juice, tamarind water, and vinegar.

4. State three characteristics of basic substances.

Answer:

1. Basic substances turn **red litmus paper blue**.
2. They are generally **slippery or soapy to touch**.
3. Bases generally taste bitter, although every bitter substance is not necessarily basic.

5. Explain how red rose extract is prepared as a natural indicator.

Answer:

1. Collect fallen red rose petals, wash them, and crush them using a mortar and pestle.
2. Immerse the crushed petals in hot water and keep the tumbler covered for about **5–10 minutes** until the water becomes coloured.
3. Filter the mixture; the filtrate obtained is the **red rose extract**, which can be used as an acid-base indicator.

6. How does red rose extract help identify acidic and basic substances?

Answer:

1. Red rose extract acts as a **natural acid-base indicator**.
2. It gives a **red colour or shade of red** in acidic solutions.
3. It gives a **green colour** in basic solutions.

7. Explain how turmeric paper is prepared.

Answer:

1. A spoonful of turmeric is mixed with a little water to prepare a paste.
2. Filter paper is dipped in the turmeric paste until it becomes yellow and is then allowed to dry.
3. The dried yellow paper is cut into thin strips to obtain **turmeric paper**.

8. Explain how turmeric acts as an indicator.

Answer:

1. Turmeric is a natural indicator that can be used to test **basic substances**.
2. Its yellow colour turns **red in a basic solution**.
3. It remains unchanged in acidic and neutral solutions and therefore cannot distinguish between them.

9. What are olfactory indicators? Describe the onion-strip activity.

Answer:

1. Substances whose odours change in an acidic or basic medium are called **olfactory indicators**.
2. Onion-exposed cloth or filter-paper strips can be treated separately with an acidic substance such as tamarind water and a basic substance such as baking soda solution.
3. The odour is checked before and after treatment to observe the effect of acidic and basic substances.

10. What is a neutralisation reaction? Write its general word equation.

Answer:

1. When an acid solution is mixed with a sufficient quantity of a base solution, the resulting solution becomes neither acidic nor basic.
2. This process is called a **neutralisation reaction**, and salt and water are formed with the release of heat.
3. The general equation is: **Acid + Base → Salt + Water + Heat**.

11. Describe the neutralisation experiment using lemon juice and lime water.

Answer:
1. Diluted lemon juice turns red when blue litmus solution is added, indicating its acidic nature.
2. When lime water is gradually added, the colour eventually changes from red to blue because lime water neutralises the acid.
3. This demonstrates that an acidic substance can be neutralised by a basic substance.

12. Explain the role of neutralisation in treating an ant bite.
Answer:
1. When a red ant bites, it injects an acidic liquid called **formic acid** into the skin.
2. Moist baking soda can be applied to the affected area because baking soda is basic.
3. The base neutralises the acidic effect and helps relieve the stinging pain.

13. Explain how acidic and basic soils can be treated.
Answer:
1. Excessive use of chemical fertilisers may make soil acidic, and acidic soil can be treated with **lime**, which is basic.
2. If soil is basic, **manure or composted leaves** can be added to it.
3. Organic matter releases acids that help neutralise the basic nature of the soil.

14. Explain how neutralisation can help control the harmful effects of acidic industrial waste.
Answer:
1. Factory waste released into lakes may sometimes be acidic and can harm aquatic organisms.
2. Acidic factory waste can be treated by adding suitable **basic substances**.
3. It should be neutralised before being released into the lake to reduce its harmful effects on aquatic life.

15. Name three types of natural acid-base indicators and state their behaviour.
Answer:
1. **Litmus** turns red in acidic substances and blue in basic substances.
2. **Red rose extract** gives a red colour in acidic solutions and a green colour in basic solutions.
3. **Turmeric** turns red in basic solutions but remains yellow/unchanged in acidic and neutral solutions.

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

The following questions focus on **analysis, reasoning, prediction, comparison, and application**. Each answer contains **three points/sentences suitable for 3 marks**.

1. An unknown solution turns blue litmus red but does not change turmeric paper. What can you conclude? Justify your answer.
Answer:
1. The solution is **acidic** because it turns blue litmus paper red.
2. Turmeric remaining unchanged is consistent with an acidic solution because turmeric changes colour mainly in basic substances.
3. Therefore, the observations together support the conclusion that the unknown solution is acidic.

2. A student has vinegar, baking soda solution, and sugar solution. How can the student identify all three using indicators?
Answer:
1. Blue litmus turns red with **vinegar**, identifying it as acidic.

2. Red litmus turns blue with **baking soda solution**, identifying it as basic.
3. **Sugar solution** changes neither red nor blue litmus and is therefore neutral.

3. Why is turmeric paper alone insufficient to distinguish an acidic substance from a neutral substance?

Answer:

1. Turmeric paper changes from yellow to red when it comes in contact with a **basic substance**.
2. Both acidic and neutral substances leave the turmeric colour unchanged.
3. Therefore, another indicator such as litmus is needed to distinguish an acid from a neutral substance.

4. A student adds red rose extract to an unknown liquid and it turns green. What can be inferred, and what might happen if sufficient acidic solution is added?

Answer:

1. The green colour indicates that the unknown liquid is **basic**.
2. If sufficient acid is added, the acid and base will neutralise each other.
3. The resulting solution can become neither acidic nor basic, with salt and water being formed and heat released.

5. A farmer finds that his soil has become acidic due to excessive use of chemical fertilisers. What should he do and why?

Answer:

1. The farmer should treat the acidic soil with **lime**, which is basic in nature.
2. The base helps neutralise the excessive acidic nature of the soil.
3. This can help restore conditions more suitable for plant growth.

6. Another farmer finds that the soil is basic. Would adding lime be a suitable treatment? Explain.

Answer:

1. No, adding lime would not be suitable because lime itself is **basic**.
2. Basic soil can instead be treated with organic matter such as manure and composted leaves.
3. The organic matter releases acids that help neutralise the basic nature of the soil.

7. A child gets a red-ant bite and experiences a stinging sensation. Why can moist baking soda provide relief?

Answer:

1. A red ant injects an acidic liquid containing **formic acid** into the skin.
2. Baking soda is basic and can neutralise the effect of the acid.
3. Hence, applying moist baking soda can help reduce the stinging effect of the ant bite.

8. A turmeric stain on a white shirt changes colour when soap is applied. Explain the observation.

Answer:

1. Turmeric acts as a **natural acid-base indicator**.
2. Soap solution is basic, and turmeric changes from yellow towards red in a basic medium.
3. Therefore, the colour change of the turmeric stain indicates the basic nature of the soap solution.

9. Why is tasting an unknown substance not a suitable method for deciding whether it is acidic or basic?

Answer:

1. Although edible acidic substances tend to taste sour and bases generally taste bitter, taste alone is not a reliable test.
2. For example, bitter gourd tastes bitter but is not basic in nature.

3. Unknown substances should never be tasted; indicators should be used instead for safe testing.

10. Acidic industrial waste is entering a lake and the fish population is declining. Suggest a scientific solution.

Answer:

1. The acidic factory waste may disturb the conditions of the lake and harm aquatic organisms.
2. The waste can be treated with suitable **basic substances** to neutralise its acidic nature.
3. It should be neutralised before being released into the lake to reduce its harmful effects.

11. A gardener observes blue hydrangea flowers in one area and pink or red flowers in another. What can the gardener infer?

Answer:

1. According to the chapter, hydrangea flowers can show different colours depending on the nature of the soil.
2. **Acidic soil** produces blue-coloured flowers, whereas **basic soil** produces pink or red flowers.
3. Therefore, the flower colours can provide clues about whether the soil is acidic or basic.

12. Explain how a "secret message" can be created using turmeric and soap solution.

Answer:

1. A sheet of paper can be coated with turmeric and allowed to dry.
2. A message written using soap solution becomes visible because soap is basic and causes turmeric to change colour.
3. Thus, the colour-changing property of a natural indicator can be creatively used to reveal a hidden message.

13. Why does adding lime water gradually to acidic lemon juice eventually change the indicator colour?

Answer:

1. Lemon juice is acidic, while lime water is basic.
2. As lime water is added, it gradually **neutralises the acidic effect** of lemon juice.
3. With sufficient lime water, the solution is no longer acidic, explaining the observed change in indicator colour.

14. A plant growing in neutral soil is unhealthy. Can you conclude that soil acidity or basicity is responsible? Give reasons.

Answer:

1. No, poor plant health does not always mean that the soil is acidic or basic.
2. The chapter states that plants may grow poorly even when the soil is neutral.
3. In such a case, the problem may be due to a **deficiency of nutrients** in the soil.

15. Red rose extract and turmeric paper are both natural indicators. Why might red rose extract be more useful for distinguishing acids from bases?

Answer:

1. Red rose extract gives a **red shade in acidic solutions** and a **green colour in basic solutions**.
2. Turmeric turns red in basic solutions but remains unchanged in both acidic and neutral solutions.
3. Therefore, red rose extract provides more distinct colour responses for differentiating acidic and basic substances.

2.11 Five-mark questions with Answers of LOTS Type: (8 Questions)

1. Explain how substances can be classified as acidic, basic, and neutral using litmus paper.

Answer:

1. Litmus is a natural acid-base indicator obtained from **lichens** and is available as red and blue litmus paper.
2. A substance that turns **blue litmus paper red** is classified as acidic.
3. Lemon juice, amla juice, tamarind water, and vinegar are examples of acidic substances.
4. A substance that turns **red litmus paper blue** is classified as basic; soap solution, baking soda solution, lime water, and washing powder solution are examples.
5. Substances such as tap water, sugar solution, and salt solution that change neither red nor blue litmus are classified as **neutral**.

2. Describe the preparation and use of red rose extract as a natural acid-base indicator.

Answer:

1. Collect fallen red rose petals, wash them with water, and crush them using a mortar and pestle.
2. Place the crushed petals in a glass tumbler, add hot water until they are completely immersed, cover it, and wait for about **5–10 minutes**.
3. Filter the coloured mixture; the filtrate obtained is the **red rose extract** used as an indicator.
4. The red rose extract gives a **red colour or shade of red in acidic solutions**.
5. It gives a **green colour in basic solutions**, and hence it can be used to test the nature of substances.

3. Explain the preparation and use of turmeric paper as an indicator.

Answer:

1. Take a spoonful of turmeric and mix it with a little water to prepare a paste.
2. Dip a piece of filter paper carefully into the turmeric paste until it becomes yellow.
3. Remove the paper, allow it to dry, and cut it into thin strips called **turmeric paper**.
4. Turmeric paper changes colour when it comes in contact with a **basic substance**.
5. However, turmeric paper cannot differentiate between acidic and neutral substances because both leave its colour unchanged.

4. What is a neutralisation reaction? Explain it with the experiment involving lemon juice and lime water.

Answer:

1. Lemon juice is diluted with water, and blue litmus solution added to it turns **red**, showing its acidic nature.
2. Lime water, which is basic, is then slowly added to the lemon juice solution.
3. As sufficient lime water is added, it neutralises the effect of the acid and the solution is no longer acidic.
4. A reaction in which an acid and a base react in sufficient quantity so that the resulting solution is neither acidic nor basic is called a **neutralisation reaction**.
5. In neutralisation, salt and water are formed with the release of heat: **Acid + Base → Salt + Water + Heat**.

5. Explain the applications of neutralisation in daily life.

Answer:

1. Neutralisation is useful in several situations involving acidic and basic substances in everyday life.
2. An ant bite injects **formic acid**, whose effect can be neutralised using moist baking soda, which is basic.
3. Soil that has become too acidic can be treated with **lime**, which is a base.

4. Basic soil can be treated with manure or composted leaves because organic matter releases acids that neutralise its basic nature.
5. Acidic industrial waste can be neutralised by adding suitable basic substances before releasing it into water bodies.

6. Describe the important properties of acidic, basic, and neutral substances.
Answer:
1. Acidic substances turn **blue litmus paper red**, while basic substances turn **red litmus paper blue**.
2. Edible acidic substances generally taste sour and tend to contain acids.
3. Basic substances are generally **slippery to touch**, and bases generally taste bitter.
4. Neutral substances are neither acidic nor basic and do not change the colour of either red or blue litmus paper.
5. Indicators such as litmus, red rose extract, and turmeric can be used to distinguish substances based on their acidic, basic, or neutral nature.

7. Explain natural indicators and give examples of indicators discussed in the chapter.
Answer:
1. Acid-base indicators are substances that show different responses in acidic and basic solutions.
2. **Litmus**, obtained from lichens, is a natural indicator that turns red in acidic substances and blue in basic substances.
3. **Red rose extract** gives a red colour in acidic solutions and a green colour in basic solutions.
4. **Turmeric** turns red in basic solutions but remains unchanged in acidic and neutral solutions.
5. Other natural materials such as beetroot, purple cabbage, Indian blackberry (jamun), and red hibiscus can also act as acid-base indicators.

8. Explain how acidic and basic nature of soil affects plants and how such soil can be treated.
Answer:
1. The acidic or basic nature of soil can affect the healthy growth of plants.
2. Excessive use of chemical fertilisers may make the soil acidic, causing plants to grow poorly.
3. Acidic soil can be treated with **lime**, which is basic and helps neutralise the soil.
4. Basic soil can be treated with **manure or composted leaves**, as organic matter releases acids that neutralise its basic nature.
5. However, plants may sometimes grow poorly even in neutral soil because of a **deficiency of nutrients**, so soil acidity or basicity is not always the cause.

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

1. Three unknown solutions A, B, and C are tested. A turns blue litmus red, B turns red litmus blue, and C changes neither litmus paper. Analyse the observations and classify the solutions.
Answer:
1. Solution A is **acidic** because acids turn blue litmus paper red.
2. Solution B is **basic** because bases turn red litmus paper blue.
3. Solution C is **neutral** because it does not change either red or blue litmus paper.
4. Thus, the three solutions can be classified as A—acidic, B—basic, and C—neutral.
5. This experiment demonstrates how indicators can be used to identify the nature of unknown substances without tasting them.

2. A student has vinegar, baking soda solution, and sugar solution but only turmeric paper and litmus paper. Design a method to identify all three liquids and explain your reasoning.
Answer:
1. First, test the liquids with turmeric paper; the one that shows the characteristic colour change for a base can be identified as **baking soda solution**.
2. Turmeric paper alone cannot distinguish vinegar from sugar solution because it cannot differentiate acidic and neutral substances.
3. Test the remaining two liquids using **blue litmus paper**.
4. The liquid that turns blue litmus red is **vinegar**, as it is acidic, while the one showing no change is the neutral **sugar solution**.
5. Thus, using the two indicators together allows all three liquids to be identified correctly.

3. A farmer observes poor plant growth and finds that excessive use of chemical fertilisers has made the soil acidic. Analyse the problem and suggest a scientific remedy.
Answer:
1. Excessive use of chemical fertilisers can make the soil **acidic**, which may adversely affect plant growth.
2. The acidic nature of the soil can be tested using a suitable acid-base indicator.
3. The farmer can add **lime**, which is basic, to the acidic soil.
4. The base helps neutralise the excessive acidic nature of the soil and improves conditions for plant growth.
5. However, if the soil is neutral and plants are still unhealthy, **nutrient deficiency** should also be considered as a possible cause.

4. A factory releases acidic waste into a nearby lake, and the fish population begins to decline. Analyse the situation and suggest how the problem can be managed.
Answer:
1. The decline in fish population may be related to factory waste entering the lake.
2. If the factory waste is acidic, it can disturb the conditions required by aquatic organisms.
3. The acidic nature of the waste should therefore be identified before it is released into the lake.
4. The acidic waste can be **neutralised by adding suitable basic substances** before discharge.
5. Thus, applying the principle of neutralisation can help reduce the harmful effect of acidic industrial waste on the lake.

5. Lemon juice containing blue litmus solution appears red. Lime water is then added gradually until the solution turns blue. Explain the changes scientifically.
Answer:
1. Lemon juice is acidic, so it changes the blue litmus solution to **red**.
2. Lime water is basic, and therefore its addition begins to neutralise the acid present in the lemon juice.
3. As more lime water is added, the acidic effect gradually decreases.
4. When sufficient base reacts with the acid, **neutralisation** occurs; salt and water are formed with the release of heat.
5. Further/basic excess is indicated when the litmus colour becomes blue, showing that the solution is no longer acidic.

6. A student claims that turmeric paper is the best indicator for identifying whether any unknown solution is acidic, basic, or neutral. Evaluate this claim.
Answer:
1. The claim is only partly correct because turmeric paper is useful for detecting **basic substances**.
2. Turmeric shows a colour change when it comes in contact with a basic solution.

3. However, its yellow colour remains unchanged in both **acidic and neutral solutions**.
4. Therefore, an unchanged turmeric paper cannot tell whether an unknown solution is acidic or neutral.
5. Litmus or another suitable indicator should be used along with turmeric when all three types of substances must be distinguished.

7. A child is bitten by a red ant and applies moist baking soda to the affected area. Explain why this treatment works using the concept of neutralisation.

Answer:

1. A red ant injects an **acidic liquid containing formic acid** into the skin when it bites.
2. The acid causes the stinging effect at the affected area.
3. Baking soda is **basic** in nature.
4. Applying moist baking soda helps neutralise the effect of the acid injected by the ant.
5. Therefore, the relief obtained from baking soda is an everyday application of the principle of **neutralisation**.

8. Ashwin wants to make a secret-message greeting card using turmeric-coated paper. Explain how he can make the message appear and the science behind it.

Answer:

1. Ashwin can first coat white paper with **turmeric paste** and allow it to dry.
2. He can write his message using a suitable **basic solution**, such as soap solution.
3. Turmeric acts as a natural acid-base indicator and changes colour in the presence of a base.
4. Hence, the writing becomes visible against the yellow turmeric-coated background.
5. The activity creatively applies the colour-changing property of turmeric to reveal a hidden message.

9. A gardener notices blue hydrangea flowers in one part of a garden and pink/red flowers in another. What can the gardener infer, and how could this observation be scientifically investigated?

Answer:

1. The different flower colours suggest that the nature of the soil may differ between the two areas.
2. According to the chapter, hydrangea produces **blue flowers in acidic soil**.
3. It produces **pink or red flowers in basic soil**.
4. The gardener can collect soil samples from the two areas and test their acidic or basic nature using suitable indicators.
5. Comparing the indicator results with the flower colours can help investigate the relationship between soil nature and hydrangea flower colour.

10. Compare litmus, red rose extract, and turmeric as indicators and decide which would be most useful when classifying unknown substances.

Answer:

1. Litmus distinguishes acids and bases because acids turn **blue litmus red**, while bases turn **red litmus blue**.
2. Red rose extract gives a **red shade in acidic solutions** and **green colour in basic solutions**.
3. Turmeric is particularly useful for detecting bases but cannot distinguish between acidic and neutral substances.
4. Therefore, relying on turmeric alone would not be sufficient when an unknown substance may be acidic, basic, or neutral.
5. Using more than one suitable indicator provides stronger evidence for correctly classifying an unknown substance.

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

1. Riya has three unlabelled bottles containing lemon juice, soap solution, and sugar solution. Explain how she can identify each liquid using red and blue litmus papers.

Answer:

1. Riya should place a drop of each liquid separately on pieces of red and blue litmus paper.
2. The liquid that turns **blue litmus red** is lemon juice because it is acidic.
3. The liquid that turns **red litmus blue** is soap solution because it is basic.
4. The liquid that produces no change in either red or blue litmus is sugar solution because it is neutral.
5. Thus, the colour changes of litmus paper can be applied to identify unknown acidic, basic, and neutral substances.

2. A farmer notices that his crops are not growing well. Testing shows that the soil has become acidic because of excessive use of chemical fertilisers. What should the farmer do? Explain scientifically.

Answer:

1. Excessive use of chemical fertilisers can make the soil acidic and affect plant growth.
2. The farmer should treat the acidic soil with **lime**, which is basic in nature.
3. The base helps neutralise the excessive acidic nature of the soil.
4. If the soil were basic instead, manure or composted leaves could be added because organic matter releases acids that neutralise basic soil.
5. Therefore, understanding neutralisation can help farmers manage the acidic or basic nature of soil for better plant growth.

3. While playing in a garden, a child is bitten by a red ant and experiences stinging pain. How can the concept of neutralisation be applied to provide relief?

Answer:

1. A red ant injects an acidic liquid containing **formic acid** into the skin during the bite.
2. The acidic substance causes the stinging effect at the affected area.
3. **Moist baking soda** can be applied because baking soda is basic in nature.
4. The base helps neutralise the effect of the acid injected by the ant.
5. This is a practical application of neutralisation in everyday life.

4. A factory near a lake releases acidic waste, and the fish population in the lake begins to decline. Apply your knowledge of acids, bases, and neutralisation to suggest a solution.

Answer:

1. Factory waste entering the lake may be responsible for conditions harmful to the fish.
2. The waste should first be tested to determine whether it is acidic in nature.
3. If it is acidic, it can be treated with suitable **basic substances** before being released.
4. The basic substances neutralise the acidic nature of the waste.
5. Therefore, neutralising acidic industrial waste before discharge can help protect the lake and its aquatic life.

5. You want to prepare a natural indicator at home or in the school laboratory using red rose petals. Describe how you would prepare and use it.

Answer:

1. Collect fallen red rose petals, wash them with water, and crush them using a mortar and pestle.
2. Place the crushed petals in a glass tumbler, add hot water, cover it, and wait for about **5–10 minutes** before filtering it.
3. The coloured filtrate obtained is the **red rose extract**, which can be used as an acid-base indicator.

4. When tested, the extract gives a **red colour or shade of red in acidic solutions**.
5. It gives a **green colour in basic solutions**, enabling us to identify the nature of different substances.

6. You are asked to design a "secret message" activity for a school science exhibition using turmeric and soap solution. Explain how you would conduct it.

Answer:

1. First, prepare turmeric paste, apply it uniformly on a white sheet of paper, and allow the paper to dry.
2. Write a secret message on the turmeric-coated paper using **soap solution**, which is basic.
3. Turmeric acts as a natural indicator and changes colour in the presence of a basic substance.
4. Therefore, the writing made using soap solution becomes visible against the turmeric background.
5. This activity demonstrates an interesting practical application of **natural acid-base indicators** and is similar to the hidden-message idea described in the chapter.

7. A student accidentally gets a turmeric curry stain on a white shirt. When soap is applied, the stain changes colour. Apply your knowledge of indicators to explain this observation.

Answer:

1. Turmeric present in the curry stain acts as a **natural indicator**.
2. Soap solution is basic in nature.
3. Turmeric changes colour when it comes into contact with a basic substance.
4. Therefore, applying soap causes the turmeric stain on the shirt to change colour.
5. This everyday observation demonstrates how the indicator property of turmeric can reveal the basic nature of a substance.

8. Your school wants students to investigate whether water collected from different sources is acidic, basic, or neutral. Design a simple investigation.

Answer:

1. Collect separate water samples from sources such as **rain, taps, and rivers**, as suggested in the chapter's exploratory project.
2. Label the samples carefully and place small quantities in separate clean containers.
3. Test each sample with red and blue litmus papers or another suitable acid-base indicator.
4. Classify a sample as acidic if it turns blue litmus red, basic if it turns red litmus blue, and neutral if neither litmus changes colour.
5. Record the observations in a table and compare the nature of water obtained from the different sources.

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

1. An unknown solution turns blue litmus paper red but produces no colour change with turmeric paper. The solution is most likely:

A. Basic
B. Acidic
C. Neutral
D. Either basic or neutral

Answer: B. Acidic

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2. Three solutions P, Q and R show the following results:

- P turns blue litmus red.

- Q turns red litmus blue.
- R changes neither red nor blue litmus.

Which sequence correctly represents P, Q and R?
A. Basic, acidic, neutral
B. Acidic, basic, neutral
C. Neutral, acidic, basic
D. Acidic, neutral, basic
Answer: B. Acidic, basic, neutral

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3. A student tests an unknown liquid with turmeric paper and observes no colour change. Which conclusion is scientifically correct?
A. The liquid must be acidic.
B. The liquid must be neutral.
C. The liquid cannot be basic, but it may be acidic or neutral.
D. The liquid must be basic.
Answer: C. The liquid cannot be basic, but it may be acidic or neutral.

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4. Red rose extract is added separately to solutions X and Y. X produces a shade of red while Y produces green. Which statement is correct?
A. X is basic and Y is acidic.
B. Both X and Y are acidic.
C. X is acidic and Y is basic.
D. Both X and Y are neutral.
Answer: C. X is acidic and Y is basic.

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5. Which group contains only substances classified as basic in the chapter?
A. Lemon juice, vinegar, lime water
B. Soap solution, baking soda solution, lime water
C. Amla juice, soap solution, vinegar
D. Sugar solution, baking soda solution, tap water
Answer: B. Soap solution, baking soda solution, lime water

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6. A student observes that substance X is sour. Which is the best conclusion?
A. X must always be a base.
B. X tends to contain an acid and may be acidic.
C. X must be neutral.
D. X must contain baking soda.
Answer: B. X tends to contain an acid and may be acidic.
The chapter specifically states that substances tasting sour **tend to contain acids**, while also warning students never to taste unknown substances.

---

7. Which observation provides the strongest evidence that an unknown solution is basic?
A. It tastes bitter.
B. It feels slippery.
C. It turns red litmus blue.
D. It does not affect blue litmus.
Answer: C. It turns red litmus blue.

---

8. A substance tastes bitter. A student immediately concludes that it is basic. Why might this conclusion be incorrect?

A. All acids are bitter.
B. All neutral substances are bitter.
C. Some bitter substances, such as bitter gourd, are not basic.
D. Bases are always sour.
Answer: C. Some bitter substances, such as bitter gourd, are not basic.

---

9. Four liquids are tested using red litmus paper. Which one is expected to turn it blue?
A. Vinegar
B. Lemon juice
C. Baking soda solution
D. Tamarind water
Answer: C. Baking soda solution

---

10. A yellow turmeric strip turns red when dipped into solution X. Which of the following could X be?
A. Lemon juice
B. Sugar solution
C. Soap solution
D. Amla juice
Answer: C. Soap solution

---

11. Consider the following statements:
Statement I: Turmeric can detect basic substances.
Statement II: Turmeric can always distinguish an acidic substance from a neutral substance.
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. I is true but II is false.

---

12. A solution turns red rose extract green and turmeric paper red. What can be concluded?
A. The solution is acidic.
B. The solution is basic.
C. The solution is neutral.
D. The observations contradict each other.
Answer: B. The solution is basic.
Both observations independently indicate a basic substance.

---

13. A gardener observes blue flowers on a hydrangea plant. According to the chapter, the soil is most likely:
A. Basic
B. Acidic
C. Always neutral
D. Impossible to infer
Answer: B. Acidic
The chapter notes that hydrangea produces blue flowers in acidic soil and pink or red flowers in basic soil.

---

14. Which pair represents an acid and a base respectively?
A. Vinegar and baking soda solution
B. Soap solution and lemon juice
C. Lime water and vinegar
D. Sugar solution and salt solution
Answer: A. Vinegar and baking soda solution

---

15. A student gradually adds lime water to lemon juice containing blue litmus solution. The solution eventually changes from red to blue. What is the best explanation?
A. Lime water increases the acidity.
B. Lime water neutralises the effect of the acid, and sufficient/excess base makes the indicator blue.
C. Lemon juice becomes more acidic.
D. Litmus permanently loses its indicator property.
Answer: B. Lime water neutralises the effect of the acid, and sufficient/excess base makes the indicator blue.

---

16. Which equation correctly represents the neutralisation reaction described in the chapter?
A. Acid + Base → Acid + Water
B. Acid + Water → Base + Heat
C. Acid + Base → Salt + Water + Heat
D. Base + Salt → Acid + Water
Answer: C. Acid + Base → Salt + Water + Heat

---

17. During neutralisation, which combination of products is formed according to the chapter?
A. Salt and water, with release of heat
B. Acid and water, with absorption of heat
C. Base and salt only
D. Water and oxygen only
Answer: A. Salt and water, with release of heat

---

18. A red ant bites a student. Which treatment best demonstrates neutralisation?
A. Applying lemon juice
B. Applying vinegar
C. Applying moist baking soda
D. Applying tamarind water
Answer: C. Applying moist baking soda
An ant bite introduces acidic formic acid, whose effect can be neutralised using basic baking soda.

---

19. A farmer finds that his soil is excessively acidic. Which treatment is most appropriate according to the chapter?
A. Add vinegar.
B. Add lemon juice.
C. Add lime.
D. Add more acidic fertiliser.
Answer: C. Add lime.

---

20. Another farmer finds that the soil is basic. Which treatment is suggested in the chapter?
A. Add more lime.
B. Add baking soda.
C. Add manure or composted leaves.
D. Add washing powder.
Answer: C. Add manure or composted leaves.
Organic matter releases acids that help neutralise basic soil.

---

21. A lake near an industrial area shows a declining fish population. Tests reveal that the factory waste is acidic. Which measure is scientifically appropriate?
A. Add more acidic substances to the waste.
B. Add suitable basic substances to neutralise the waste before discharge.
C. Add sugar solution to the lake.
D. Release the acidic waste directly into the lake after dilution only.
Answer: B. Add suitable basic substances to neutralise the waste before discharge.

---

22. Which of the following sets contains only substances mentioned in the chapter as possible natural acid-base indicators?
A. Red rose, turmeric, purple cabbage
B. Sugar, salt, soap
C. Vinegar, lime water, sugar
D. Baking soda, salt, lemon
Answer: A. Red rose, turmeric, purple cabbage
The chapter also mentions beetroot, jamun and red hibiscus as materials that can act as indicators.

---

23. An unknown solution X produces the following observations:
- Blue litmus → red
- Red litmus → no change
- Turmeric → no change

Which substance could X most likely be?
A. Lime water
B. Baking soda solution
C. Vinegar
D. Soap solution
Answer: C. Vinegar

---

24. Three solutions X, Y and Z are vinegar, baking soda solution and sugar solution respectively, but their labels have been removed. A student has only turmeric paper. Which statement is correct?
A. All three can definitely be identified.
B. Only the acidic solution can definitely be identified.
C. Baking soda solution can be identified, but vinegar and sugar solution cannot be distinguished from each other using turmeric alone.
D. Sugar solution will turn turmeric red.
Answer: C. Baking soda solution can be identified, but vinegar and sugar solution cannot be distinguished from each other using turmeric alone.

---

25. A student writes a hidden message on turmeric-coated paper using soap solution. Why does the message become visible?
A. Soap removes turmeric from the paper.
B. Soap is acidic and makes turmeric colourless.
C. Soap is basic, and turmeric changes colour in a basic medium.
D. Soap reacts with paper to produce ink.
Answer: C. Soap is basic, and turmeric changes colour in a basic medium.
This applies the same indicator principle used in the chapter's creative hidden-message activity.
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	C	12	B	17	A	22	A
3	C	8	C	13	B	18	C	23	C
4	C	9	C	14	A	19	C	24	C
5	B	10	C	15	B	20	C	25	C

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

The chapter is particularly suitable for **experiential, inquiry-based and activity-oriented teaching**, since it introduces acids, bases, neutral substances, indicators and neutralisation through familiar materials and experiments.

(1) Learning by Doing – "Test Your Household Substances":
Organise a hands-on laboratory activity in which students test safe everyday substances such as lemon juice, vinegar, baking soda solution, soap solution, salt solution and sugar solution using red and blue litmus paper. Students should observe, record and classify each substance as **acidic, basic or neutral**, following the investigative approach used in the chapter.

(2) DIY Natural Indicator Laboratory:
Encourage students to prepare their own natural indicators using locally available materials such as **red rose, turmeric, red hibiscus, purple cabbage, beetroot or jamun**. Groups can compare the colour changes produced by different acidic and basic substances and prepare an "Indicator Colour Chart."

(3) Inquiry-Based "Mystery Solution Challenge":
Give groups labelled but unidentified safe solutions and ask them to determine whether each is acidic, basic or neutral using suitable indicators. Instead of giving the procedure directly, require students to **select the indicator, predict the result, perform the test, record evidence and justify their conclusion**. This develops scientific reasoning and problem-solving skills.

(4) Concept-to-Life Neutralisation Case Studies:
Connect neutralisation to practical situations such as **ant bites, treatment of acidic/basic soil and neutralisation of acidic industrial waste**. Students can work in groups to identify the problem, determine whether an acid or base is involved, and recommend an appropriate neutralisation strategy.

(5) Science through Art – Secret Message/Indicator Art:
Students can create **secret messages, greeting cards or rangoli** using turmeric and suitable acidic/basic substances. This combines chemistry with creativity while reinforcing the principle that turmeric changes colour in a basic medium; the chapter itself extends this idea to greeting cards and indicator-based rangoli.

(6) Local Environment Investigation Project:
Ask students to collect safe samples of **tap water, rainwater, river/pond water or local soil** and investigate whether they are acidic, basic or neutral using appropriate indicators. Students can present their observations as tables, charts and short scientific reports, extending the exploratory projects suggested at the end of the chapter.

(7) Predict–Observe–Explain (POE) Method:
Before every indicator experiment, ask students to **Predict** the colour change, **Observe** the actual result, and **Explain** any difference between prediction and observation. This method is especially effective for comparing litmus, red rose and turmeric because turmeric cannot distinguish acidic from neutral substances.

(8) Collaborative "Acid–Base Classification Wall":
Create a permanent classroom chart with three columns—**Acidic, Basic and Neutral**. As students investigate new substances, they add the substance, indicator used, observed colour change and conclusion. This converts individual experiments into a continuously developing **class knowledge repository**.

(9) Scientific Safety as a Classroom Habit:
Integrate safety into every practical session: students should **never taste unknown substances**, use droppers instead of direct contact wherever appropriate, label samples clearly, and carry out hot-water activities under adult supervision. This makes laboratory safety part of scientific thinking rather than merely a set of instructions.

(10) Student Science Fair / Demonstration Day:
Conclude the chapter with a mini **"Colourful World of Substances" Science Fair**, echoing the opening situation of the chapter. Student teams can demonstrate natural indicators, mystery solutions, secret messages, neutralisation and soil/water testing to classmates or parents, thereby strengthening **conceptual understanding, communication, teamwork and scientific curiosity**.

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

The chapter provides excellent opportunities for innovative learning because it combines **colour changes, natural indicators, experimentation, neutralisation and real-life applications**.

(1) Acid–Base Detective Challenge:
Create a classroom "forensic laboratory" where students receive numbered mystery samples such as diluted lemon juice, vinegar, baking soda, soap, sugar and salt solutions. Using different indicators, teams must collect evidence, classify each mystery substance as acidic, basic or neutral, and defend their conclusions scientifically. The chapter provides the litmus-based classification principles needed for this investigation.

(2) Design Your Own Natural Indicator – Innovation Lab:
Instead of merely using the indicators given in the textbook, student teams can investigate locally available flowers, fruits and vegetables to discover potential indicators. They can prepare extracts, test them against known acidic/basic substances, create their own colour charts and nominate the most effective "Student-Designed Natural Indicator." The chapter itself suggests materials such as beetroot, purple cabbage, turmeric, jamun and red hibiscus for further exploration.

(3) Secret Chemistry Message Challenge:
Students can design invisible or colour-changing greeting cards using turmeric-coated paper and suitable solutions. Other groups must determine what indicator and substance were used to reveal the message. This creatively extends the chapter's turmeric greeting-card activity and its opening science-fair mystery.

(4) Digital Acid–Base Virtual Lab:
Develop a simple digital/interactive activity in which students virtually select an unknown substance and an indicator and then predict the colour change before seeing the simulated result. Points can be awarded for correctly identifying **acidic, basic and neutral substances**, converting experimentation into game-based learning.

(5) "Save the Lake" STEM Challenge:
Give students a simulated environmental problem: *"Fish are dying because acidic industrial waste is entering a lake. How can you solve the problem?"* Teams investigate the concept of neutralisation and design a poster/model showing how acidic waste could be neutralised before discharge. This directly extends the environmental application discussed in the chapter.

(6) Smart Garden – Soil Scientist Project:
Create a small school-garden investigation in which students collect soil samples, prepare soil-water mixtures, test their nature using indicators and suggest corrective measures. Students could design a **"Soil Health Card"** showing whether the sample is acidic, basic or neutral and recommending suitable treatment. The chapter explains that acidic soil may be treated with lime, while organic matter can help neutralise basic soil.

(7) Acid–Base Escape Room:
Transform assessment into a classroom escape-room game. Students solve a sequence of clues—for example, identify an unknown solution from litmus results, choose the correct natural indicator, predict a colour change, and solve a neutralisation problem—to obtain codes that unlock the next challenge.

(8) Indicator Rangoli – STEAM Innovation:
Integrate **Science + Art** by asking students to create rangoli or patterned artwork using natural indicators and safe acidic/basic solutions. The colours become part of the scientific investigation, with students explaining the chemistry behind each colour change. This builds directly on the chapter's exploratory project of creating rangoli with acidic/basic substances and natural indicators.

(9) Student-Made Acid–Base Learning Game:
Students can design their own board game, card game or digital quiz containing "Acid", "Base", "Neutral", "Indicator" and "Neutralisation" cards. For example, drawing **"Ant Bite"** would require the player to select "Baking Soda" and explain that the acidic effect of formic acid can be neutralised by a base.

(10) Young Innovator Mini-Project: "Chemistry Around My Home":
Students identify safe household materials and prepare a creative **Acid–Base Map of My Home**, classifying substances found in the kitchen, bathroom and garden. They can present their findings through a poster, infographic, short video, model or digital presentation, thereby moving learning from the textbook to the student's everyday environment.

2.17: Practicing Questions/Question Bank

The following questions are based on the chapter 2 and cover **acidic, basic and neutral substances; natural indicators; litmus; red rose and turmeric indicators; neutralisation; and applications of neutralisation in everyday life**.

A. Fill in the Blanks:

1. Litmus is a natural substance obtained from __________.
   Answer: Lichens

2. Substances that turn blue litmus paper red are __________ in nature.
   Answer: Acidic
3. Bases turn __________ litmus paper blue.
   Answer: Red
4. Substances that are neither acidic nor basic are called __________ substances.
   Answer: Neutral
5. Lemon juice, amla juice and vinegar are __________ in nature.
   Answer: Acidic
6. Soap solution and baking soda solution are __________ in nature.
   Answer: Basic
7. Red rose extract gives a shade of __________ in an acidic solution.
   Answer: Red
8. Red rose extract gives a shade of __________ in a basic solution.
   Answer: Green
9. Turmeric paper turns __________ when treated with a basic substance.
   Answer: Red
10. Substances whose odours change in acidic or basic media are called __________ **indicators**.
    Answer: Olfactory
11. The reaction between an acid and a base is called a __________ **reaction**.
    Answer: Neutralisation
12. During neutralisation, acid and base form salt, water and release __________.
    Answer: Heat
13. An ant bite injects __________ **acid** into the skin.
    Answer: Formic
14. Acidic soil can be treated with __________.
    Answer: Lime
15. Basic soil can be treated by adding organic matter such as manure and __________ **leaves**.
    Answer: Composted

These concepts and indicator colour changes are explicitly summarised in the chapter.

B. One-Mark Descriptive Questions:

1. **What is an acid-base indicator?**
   Answer: A substance that shows different colours in acidic and basic solutions is called an acid-base indicator.
2. **What is litmus?**
   Answer: Litmus is a natural acid-base indicator obtained from lichens.
3. **How does an acid affect blue litmus paper?**
   Answer: An acid turns blue litmus paper red.

4. **How does a base affect red litmus paper?**
   Answer: A base turns red litmus paper blue.

5. **What are neutral substances?**
   Answer: Substances that are neither acidic nor basic are called neutral substances.

6. **Give two examples of acidic substances.**
   Answer: Lemon juice and vinegar are acidic substances.

7. **Give two examples of basic substances.**
   Answer: Soap solution and baking soda solution are basic substances.

8. **Give two examples of neutral substances.**
   Answer: Sugar solution and salt solution are neutral substances.

9. **What colour does red rose extract show in an acidic solution?**
   Answer: Red rose extract gives a shade of red in an acidic solution.

10. **What colour does red rose extract show in a basic solution?**
    Answer: Red rose extract gives a green colour in a basic solution.

11. **What happens to turmeric paper in a basic solution?**
    Answer: Yellow turmeric paper turns red in a basic solution.

12. **What are olfactory indicators?**
    Answer: Substances whose odours change in an acidic or basic medium are called olfactory indicators.

13. **What is neutralisation?**
    Answer: Neutralisation is a reaction in which an acid and a base neutralise each other's effect.

14. **Name the acid injected during an ant bite.**
    Answer: Formic acid is injected during an ant bite.

15. **Write the word equation for neutralisation.**
    Answer: Acid + Base → Salt + Water + Heat.

C. Two-Mark Descriptive Questions:

1. Differentiate between acidic and basic substances.

Answer:

- Acidic substances turn blue litmus paper red.
- Basic substances turn red litmus paper blue.

2. What are neutral substances? Give two examples.

Answer:

- Neutral substances are neither acidic nor basic.
- Sugar solution and salt solution are examples.

3. Explain how red rose extract acts as an indicator.

Answer:

- Red rose extract gives a shade of red in acidic solutions.
- It gives green colour in basic solutions.

4. Why is turmeric useful as an indicator?

Answer:

- Yellow turmeric paper turns red when it comes in contact with a basic substance.
- However, it cannot differentiate between acidic and neutral substances.

5. Mention two general properties of bases.

Answer:

- Bases generally feel soapy or slippery.
- Bases generally taste bitter, although everything bitter is not necessarily basic.

6. What happens during neutralisation?

Answer:

- An acid and a base neutralise each other's effect when mixed in sufficient quantities.
- Salt and water are formed along with the release of heat.

7. Why is baking soda applied to an ant bite?

Answer:

- An ant bite injects acidic formic acid into the skin.
- Baking soda is basic and helps neutralise the acid.

8. How can acidic soil be treated?

Answer:

- Excessively acidic soil can affect plant growth.
- Lime, which is basic, can be added to neutralise acidic soil.

9. How can basic soil be treated?

Answer:

- Manure and composted leaves can be added to basic soil.
- Organic matter releases acids that neutralise its basic nature.

10. Why should unknown substances never be tasted?

Answer:

- Unknown substances may contain harmful materials.
- Therefore, substances should not be identified as acids or bases simply by tasting them.

D. Three-Mark Descriptive Questions:

1. Explain how substances can be classified using litmus paper.

Answer:

1. Acidic substances turn blue litmus paper red.
2. Basic substances turn red litmus paper blue.
3. Neutral substances do not change the colour of either red or blue litmus paper.

2. Explain how red rose extract is prepared as a natural indicator.

Answer:

1. Fallen red rose petals are washed and crushed using a mortar and pestle.
2. The crushed petals are immersed in hot water for about 5–10 minutes.
3. The coloured liquid is filtered, and the filtrate is used as an acid-base indicator.

3. Explain the use of turmeric as an acid-base indicator.

Answer:

1. Turmeric can be used to prepare yellow indicator paper.
2. The yellow turmeric paper turns red when a basic substance is added.
3. It remains unchanged with acidic and neutral substances and therefore cannot distinguish between them.

4. Explain neutralisation with its products.

Answer:

1. Neutralisation occurs when an acid reacts with a base in sufficient quantities.
2. The resulting solution becomes neither acidic nor basic.
3. Salt and water are formed with the release of heat: **Acid + Base → Salt + Water + Heat.**

5. Explain three applications of neutralisation in everyday life.

Answer:

1. Baking soda helps neutralise formic acid from an ant bite.
2. Lime can be used to neutralise acidic soil.
3. Acidic factory waste can be treated with basic substances before being released into water bodies.

6. How can you classify lemon juice, soap solution and sugar solution using litmus paper?

Answer:

1. Lemon juice turns blue litmus red and is therefore acidic.
2. Soap solution turns red litmus blue and is therefore basic.
3. Sugar solution does not affect either litmus paper and is therefore neutral.

7. Describe three natural indicators discussed or suggested in the chapter.

Answer:

1. Litmus obtained from lichens indicates acidic and basic substances.
2. Red rose extract changes to shades of red and green in acidic and basic solutions respectively.
3. Turmeric turns red in basic solutions.

E. Five-Mark Descriptive Questions:

1. Explain acids, bases and neutral substances with their properties and examples.

Answer:

1. Substances around us can be classified as acidic, basic or neutral.
2. Acids turn blue litmus paper red; lemon juice, amla juice, tamarind water and vinegar are examples.
3. Bases turn red litmus paper blue; soap solution, baking soda solution and lime water are examples.
4. Neutral substances do not change either red or blue litmus paper.
5. Tap water, sugar solution and salt solution are examples of neutral substances.

2. Explain natural acid-base indicators with suitable examples.

Answer:

1. Acid-base indicators help us determine whether substances are acidic or basic.
2. Litmus is a natural indicator obtained from lichens.
3. Red rose extract gives a shade of red in acidic solutions and green in basic solutions.
4. Turmeric turns from yellow to red in basic solutions but remains unchanged in acidic and neutral solutions.
5. Beetroot, purple cabbage, jamun and red hibiscus can also act as natural acid-base indicators.

3. Describe the neutralisation experiment using lemon juice and lime water.

Answer:

1. Lemon juice is diluted with water in a test tube.
2. Blue litmus solution added to it turns red, showing its acidic nature.
3. Lime water is slowly added to the solution and mixed.
4. With sufficient lime water, the acidic effect is neutralised and the indicator colour eventually changes.
5. The experiment demonstrates neutralisation, in which an acid and base form salt and water with the release of heat.

4. Explain the importance of neutralisation in daily life with suitable examples.

Answer:

1. Neutralisation has several important applications in our daily life.
2. Baking soda neutralises the acidic formic acid injected during an ant bite.
3. Acidic soil can be treated by adding lime.
4. Basic soil can be treated with organic matter such as manure and composted leaves.
5. Acidic industrial waste can be neutralised using basic substances before being released into lakes or other water bodies.

5. A student is given lemon juice, soap solution and salt solution. Explain how the student can identify their nature using different indicators.

Answer:

1. Test each solution separately using red and blue litmus papers.
2. The solution that turns blue litmus red is lemon juice and is acidic.
3. The solution that turns red litmus blue is soap solution and is basic.
4. The solution that changes neither litmus paper is salt solution and is neutral.
5. The conclusions can be cross-checked using red rose extract, which gives a shade of red with an acid and green with a base.

These questions provide a balanced **Grade 7 question bank**, progressing from recall-based fill-ups and one-mark questions to conceptual, experimental and application-oriented 3- and 5-mark questions.

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7th Standard Science Book Chapter 3

Chapter 3: Electricity: Circuits and their Components

3.1 Summary of the Chapter:

Summary – Chapter 3: *Electricity: Circuits and their Components*:

(1) **Electricity is an important part of everyday life** and is used for lighting, cooking, transportation, communication, entertainment, heating, cooling, and operating various machines and appliances. Electricity can be generated from sources such as wind, sunlight, falling water, natural gas, and coal.

(2) **An electric cell is a portable source of electrical energy.** Every electric cell has two terminals—a **positive (+) terminal** and a **negative (–) terminal**. The metal cap is the positive terminal, while the flat metal disc is the negative terminal.

(3) **A battery is a combination of two or more electric cells.** Cells are arranged so that the positive terminal of one cell is connected to the negative terminal of the next cell. Using more than one cell can provide energy for a longer time and/or more energy.

(4) **An incandescent electric lamp contains a thin wire called a filament.** When electric current passes through the filament, it becomes hot and glows, producing light. A broken filament prevents the flow of current, and such a lamp is said to be **fused**.

(5) **LED stands for Light Emitting Diode.** Unlike an incandescent lamp, an LED does not have a filament. It has a positive terminal connected to the longer wire and a negative terminal connected to the shorter wire.

(6) **Current can pass through an LED only in one direction.** An LED glows when its positive terminal is connected to the positive terminal of the battery and its negative terminal to the negative terminal.

(7) **An electrical circuit is a complete path through which electric current can flow.** A lamp glows only when the circuit is complete. The direction of electric current is taken to be from the positive terminal to the negative terminal of the electric cell.

(8) **An electric switch is used to complete or break an electrical circuit.** In the **ON position**, the circuit is closed and current flows, making the lamp glow. In the **OFF position**, the circuit is open and current cannot flow.

(9) **Electrical components can be represented using standard symbols.** Symbols are used for components such as cells, batteries, lamps, LEDs, switches, and wires. A representation of an electrical circuit using these symbols is called a **circuit diagram**.

(10) **Conductors are materials through which electric current can flow easily.** Metals are generally good conductors of electricity. Silver, copper, and gold are excellent conductors, while copper is commonly used for electrical wires because of its comparatively lower cost and abundant supply.

(11) **Insulators are materials through which electric current cannot pass easily.** Plastic, rubber, and ceramics are electrical insulators. They are used to cover wires, plugs, and switches to protect people from electric shocks.

(12) **Electrical safety is extremely important.** The human body conducts electricity, so electrical appliances must be handled carefully. We should never touch switches or plugs with wet hands, use electrical devices in wet areas, or handle equipment with damaged insulation or broken plugs.

3.2 Important Formulas:

Important Formulas / Quantitative Relationships

Chapter 3 – *Electricity: Circuits and their Components* – Grade 7

This chapter is **mainly conceptual and activity-based**. It does **not introduce standard numerical formulas** such as Ohm's law, electrical power, resistance, or electrical energy calculations. Its quantitative/problem-solving questions mainly involve the **number and arrangement of cells, circuit completeness, switches, and LED polarity**.

The following relationships are useful for solving chapter-related quantitative or logical problems:

No.	Concept	Formula / Relationship	Use
1	**Number of cells in a battery**	**Battery = 2 or more cells connected together**	To identify whether a group of cells forms a battery
2	**Cells connected in series**	**+ terminal of one cell → – terminal of next cell**	To determine the correct arrangement of cells
3	**Total voltage of cells in series***	**$V_{total} = V_1 + V_2 + V_3 + \dots$**	To calculate the combined voltage of cells
4	**Identical cells in series***	**$V_{total} = n \times V_{cell}$**	Where n = number of identical cells
5	**Number of cells required***	**$n = V_{required} \div V_{cell}$**	To estimate how many identical cells are needed
6	**Closed circuit**	**Complete path → Current flows → Lamp glows**	To predict whether a lamp will glow
7	**Open circuit**	**Broken path → No current → Lamp does not glow**	To analyse circuits with an OFF switch
8	**Switch ON**	**ON → Closed circuit → Current flows**	To solve switch-based circuit questions
9	**Switch OFF**	**OFF → Open circuit → No current flows**	To determine which lamps will remain OFF
10	**Direction of conventional current**	**Positive (+) → Negative (–)**	To trace current through a circuit
11	**LED connection**	**LED (+) → Battery (+); LED (–) → Battery (–)**	To decide whether an LED will glow
12	**LED polarity**	**Longer lead = + ; Shorter lead = –**	To identify LED terminals

The textbook specifically explains that a battery is formed by connecting cells so that the positive terminal of one cell connects to the negative terminal of the next. It also states that a lamp glows only when there is a **complete electrical circuit** through which current can flow, with conventional current taken from the positive to the negative terminal.

Important LED Relationship:

For an LED:

Longer wire = Positive terminal (+)

Shorter wire = Negative terminal (–)

Therefore,

Battery (+) → LED (+)

Battery (–) → LED (–)

The LED glows only with the correct polarity because current can pass through it in only one direction.

Important Switch Relationship

Switch ON → Circuit closed → Current flows → Lamp glows

Switch OFF → Circuit open → Current stops → Lamp does not glow
This relationship is particularly useful for solving circuit-diagram questions involving one or more switches and lamps.
Example of a Simple Quantitative Problem*
If **3 identical cells of 1.5 V each** are connected correctly in series:
Vtotal = n × Vcell
= 3 × 1.5
= **4.5 V**
So, the combined voltage would be **4.5 V**.
Note: The formulas marked with * are useful **extension formulas for quantitative practice**, but voltage calculation itself is **not explicitly taught in the uploaded Chapter 3**. The chapter focuses instead on cells and batteries, complete/open circuits, switches, LEDs, circuit diagrams, conductors, and insulators. This distinction is useful when preparing a question bank strictly according to the Grade 7 textbook.

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

The following questions are **LOTS (Lower Order Thinking Skills)** based, focusing mainly on recall, recognition, and basic understanding of concepts. The chapter covers electric cells, batteries, lamps, LEDs, circuits, switches, circuit diagrams, conductors, and insulators.

1. An electric cell is a portable source of __________ energy.
   Answer: Electrical
2. An electric cell has __________ terminals.
   Answer: Two
3. The two terminals of an electric cell are called __________ and __________ terminals.
   Answer: Positive and negative
4. The metal cap of an electric cell is its __________ terminal.
   Answer: Positive
5. The flat metal disc of an electric cell is its __________ terminal.
   Answer: Negative
6. A combination of two or more cells is called a __________.
   Answer: Battery
7. In a battery, the positive terminal of one cell is connected to the __________ terminal of the next cell.
   Answer: Negative
8. The thin wire inside an incandescent lamp is called the __________.
   Answer: Filament
9. The filament of an incandescent lamp becomes __________ and glows when electric current passes through it.
   Answer: Hot
10. LED stands for __________.
    Answer: Light Emitting Diode
11. Unlike an incandescent lamp, an LED does not have a __________.
    Answer: Filament
12. The longer wire of an LED is connected to its __________ terminal.
    Answer: Positive
13. The shorter wire of an LED is connected to its __________ terminal.
    Answer: Negative

14. Electric current can pass through an LED in __________ direction only.
    Answer: One
15. A complete path through which electric current can flow is called an electrical __________.
    Answer: Circuit
16. The direction of electric current in a circuit is taken from the __________ terminal to the __________ terminal of the electric cell.
    Answer: Positive; negative
17. An incandescent lamp with a broken filament is said to be __________.
    Answer: Fused
18. A __________ is a device used to complete or break an electrical circuit.
    Answer: Switch
19. When a switch is in the ON position, the circuit is said to be __________.
    Answer: Closed
20. When a switch is in the OFF position, the circuit is said to be __________.
    Answer: Open
21. In an open circuit, electric current __________ flow through the circuit.
    Answer: Cannot
22. A representation of an electrical circuit using symbols is called a __________.
    Answer: Circuit diagram
23. In the symbol of an electric cell, the longer line represents the __________ terminal.
    Answer: Positive
24. In the symbol of an electric cell, the shorter line represents the __________ terminal.
    Answer: Negative
25. Materials through which electric current can flow easily are called __________.
    Answer: Conductors
26. Materials through which electric current cannot pass are called __________.
    Answer: Insulators
27. Metals are generally good __________ of electricity.
    Answer: Conductors
28. Silver, copper, and __________ are among the best electrical conductors.
    Answer: Gold
29. __________ is mainly used for making electrical wires because of its comparatively lower cost and abundant supply.
    Answer: Copper
30. Plastic, rubber, and ceramics are electrical __________.
    Answer: Insulators
31. Electrical wires are generally covered with plastic or __________ for safety.
    Answer: Rubber
32. Insulators covering electrical wires help protect people from electric __________.
    Answer: Shocks
33. The human body is a __________ of electricity.
    Answer: Conductor
34. Electricity supplied by batteries is generally called __________ Current.
    Answer: Direct
35. The abbreviation for Direct Current is __________.
    Answer: DC
36. Electricity supplied to wall sockets from power plants is known as __________ Current.
    Answer: Alternating

37. The abbreviation for Alternating Current is __________.
    Answer: AC
38. Cylindrical batteries are commonly used in torchlights, clocks, remotes, and __________.
    Answer: Toys
39. Button cells are commonly used in watches and __________ aids.
    Answer: Hearing
40. Rechargeable batteries are commonly used in mobile phones, laptops, and electric __________.
    Answer: Vehicles

The chapter specifically emphasizes that cells have positive and negative terminals, LEDs work only with the correct polarity, switches open or close circuits, and materials can be classified as conductors or insulators.

3.4 Fill-Up the Blank HOTS type questions with Answers: (40 Questions)

These **HOTS (Higher Order Thinking Skills)** fill-ups require students to **apply, analyse, predict, infer, and reason** using concepts from the chapter rather than merely recall definitions. The chapter particularly encourages students to reason about incomplete circuits, faulty lamps, LED polarity, switches, and conductors/insulators.

1. If one terminal of a lamp is not connected to the cell, the lamp will not glow because the circuit is __________.
   Answer: incomplete/open
2. If the filament of an incandescent lamp breaks, the lamp will not glow because the path for electric current becomes __________.
   Answer: broken
3. A student reverses the connections of an incandescent lamp to a cell. If the circuit remains complete, the lamp will __________.
   Answer: glow
4. If an LED is connected in the reverse direction to a battery, it will __________.
   Answer: not glow
5. An LED glows when its longer wire is connected to the __________ terminal of the battery.
   Answer: positive
6. If the longer wire of an LED is connected to the negative terminal of a battery, current will __________ through the LED.
   Answer: not pass
7. A lamp connected to a working cell does not glow even though all connections are correct. One possible reason is that its filament is __________.
   Answer: broken
8. If the switch in a circuit is moved from ON to OFF, the lamp goes out because the circuit becomes __________.
   Answer: open
9. When the safety pin in the homemade switch touches both drawing pins, the gap in the circuit is __________.
   Answer: closed
10. If a switch is placed at a different position in the same simple circuit, it can still control the lamp because it can __________ the circuit.
    Answer: complete or break

11. A student makes a circuit but forgets to remove the plastic covering from the ends of the connecting wires. The lamp will __________.
    Answer: not glow
12. The plastic covering must be removed from the ends of connecting wires so that the exposed __________ can make electrical contact.
    Answer: metal
13. If a metal key is placed between two free ends of a conduction tester and the lamp glows, the key is acting as a __________.
    Answer: conductor
14. If a rubber eraser is placed between the free ends of a tester, the lamp is expected to __________.
    Answer: not glow
15. If an unknown material makes the tester lamp glow, we can infer that the material allows __________ to pass through it.
    Answer: electric current
16. If replacing a plastic strip with a metal strip completes a circuit and makes the lamp glow, the metal strip is a __________.
    Answer: conductor
17. Copper is preferred for making electrical wires over silver or gold mainly because it is comparatively less expensive and more __________.
    Answer: abundant
18. The outside of an electrical wire is covered with rubber or plastic mainly to protect users from electric __________.
    Answer: shocks
19. A damaged plastic covering on an electrical wire can be dangerous because the exposed __________ may conduct current to the human body.
    Answer: metal
20. Touching an electrical switch with wet hands is dangerous because the human body is a __________ of electricity.
    Answer: conductor
21. If two cells are to form a battery correctly, the positive terminal of one cell should be connected to the __________ terminal of the next cell.
    Answer: negative
22. If one cell in a two-cell battery is placed in the wrong direction, the connected device may fail to __________.
    Answer: work
23. If the '+' and '–' markings on an LED are unavailable, its longer wire can be used to identify the __________ terminal.
    Answer: positive
24. A student wants to test whether a coin conducts electricity. If inserting the coin into the gap makes the lamp glow, the coin is a __________.
    Answer: conductor
25. If a wooden stick is inserted into the gap of a working tester and the lamp remains off, the stick behaves as an __________.
    Answer: insulator
26. If a circuit contains a working cell and lamp but has a gap anywhere in the conducting path, electric current will __________.
    Answer: not flow

27. When a switch changes from OFF to ON, the circuit changes from an open circuit to a __________ circuit.
    Answer: closed
28. If all components of an electrical circuit are represented by standard symbols, the resulting representation is called a __________.
    Answer: circuit diagram
29. Standard electrical symbols make circuit diagrams easier for people from different countries to __________.
    Answer: understand
30. If a material is to be used for the conducting part of an electrical wire, it should allow electric current to flow __________ through it.
    Answer: easily
31. If the insulating covering of a wire is damaged, the wire should not be handled because the exposed conductor may cause an electric __________.
    Answer: shock
32. If a lamp glows when an unknown object is inserted into a conduction tester, the object can be classified as a good __________ of electricity.
    Answer: conductor
33. If the filament of one lamp breaks in a single-path circuit containing two lamps, the circuit becomes __________.
    Answer: open
34. A torch lamp stops glowing immediately when its switch is opened because the path of electric current has been __________.
    Answer: broken
35. If two cells are connected correctly instead of one, they can provide energy to the circuit for a longer time and/or provide __________ energy.
    Answer: more
36. A circuit made with a solar panel and a toy fan can operate because the solar panel acts as a source of __________ energy.
    Answer: electrical
37. A student testing several materials finds that metal objects make the lamp glow while rubber and plastic objects do not; the student can conclude that metals are generally __________.
    Answer: conductors
38. In an LED circuit, simply having a closed circuit is not sufficient; the LED must also be connected with the correct __________.
    Answer: polarity
39. If a battery-powered device stops working after the cells are reinserted, the first thing to check is whether the cells have been placed in the correct __________.
    Answer: direction/order
40. If the lamp in a conduction tester does not glow for an object, despite the cell, lamp, and connections working properly, the tested material is most likely an __________.
    Answer: insulator

These questions reflect the chapter's emphasis on applying circuit concepts to **fault finding, predicting whether lamps/LEDs will glow, identifying conductors and insulators, and determining correct cell and LED connections**.

3.5 One-mark questions with Answers of LOTS Type: (40 Questions)

The following questions focus on **Remembering and Understanding (LOTS)** and are based directly on the concepts covered in the chapter.

1. **What is an electric cell?**
   Answer: An electric cell is a portable source of electrical energy.
2. **How many terminals does an electric cell have?**
   Answer: An electric cell has two terminals—a positive terminal and a negative terminal.
3. **Which part of an electric cell is its positive terminal?**
   Answer: The protruding metal cap of an electric cell is its positive terminal.
4. **Which part of an electric cell is its negative terminal?**
   Answer: The flat metal disc of an electric cell is its negative terminal.
5. **What is a battery?**
   Answer: A combination of two or more cells connected together is called a battery.
6. **How are cells connected to form a battery?**
   Answer: The positive terminal of one cell is connected to the negative terminal of the next cell to form a battery.
7. **What is the filament of an incandescent lamp?**
   Answer: The filament is the thin wire inside an incandescent lamp that gets hot and glows when electric current passes through it.
8. **How does an incandescent lamp produce light?**
   Answer: An incandescent lamp produces light when its filament gets hot and glows due to the passage of electric current.
9. **What is the full form of LED?**
   Answer: LED stands for Light Emitting Diode.
10. **How can you identify the positive terminal of an LED?**
    Answer: The positive terminal of an LED is connected to its longer wire.
11. **How can you identify the negative terminal of an LED?**
    Answer: The negative terminal of an LED is connected to its shorter wire.
12. **Does an LED have a filament?**
    Answer: No, an LED does not have a filament.
13. **In how many directions can electric current pass through an LED?**
    Answer: Electric current can pass through an LED in only one direction.
14. **What is an electrical circuit?**
    Answer: An electrical circuit is a complete path through which electric current can flow.
15. **When does an electric lamp glow in a circuit?**
    Answer: An electric lamp glows when the circuit is complete and electric current passes through it.
16. **What is the conventional direction of electric current in a circuit?**
    Answer: Electric current is taken to flow from the positive terminal to the negative terminal of the electric cell.
17. **What is a fused incandescent lamp?**
    Answer: An incandescent lamp with a broken filament is usually called a fused lamp.
18. **What is an electric switch?**
    Answer: An electric switch is a simple device that completes or breaks an electrical circuit.
19. **What happens when a switch is in the ON position?**
    Answer: In the ON position, the circuit is closed and electric current can flow through it.

20. **What happens when a switch is in the OFF position?**
    Answer: In the OFF position, the circuit is open and electric current cannot flow through it.
21. **What is a closed circuit?**
    Answer: A closed circuit is a complete electrical path through which current can flow.
22. **What is an open circuit?**
    Answer: An open circuit is an incomplete electrical path through which current cannot flow.
23. **What is a circuit diagram?**
    Answer: A circuit diagram is a representation of an electrical circuit using standard symbols.
24. **Why are symbols used in circuit diagrams?**
    Answer: Symbols make electrical circuits easier to draw and understand.
25. **What does the long line in the symbol of an electric cell represent?**
    Answer: The long line represents the positive terminal of the electric cell.
26. **What does the short line in the symbol of an electric cell represent?**
    Answer: The short line represents the negative terminal of the electric cell.
27. **What are electrical conductors?**
    Answer: Materials through which electric current can flow easily are called electrical conductors.
28. **What are electrical insulators?**
    Answer: Materials through which electric current cannot pass are called electrical insulators or poor conductors.
29. **Give two examples of good electrical conductors.**
    Answer: Copper and silver are examples of good electrical conductors.
30. **Give two examples of electrical insulators.**
    Answer: Rubber and plastic are examples of electrical insulators.
31. **Why is copper commonly used for making electrical wires?**
    Answer: Copper is commonly used because it is a good conductor, comparatively inexpensive, and abundantly available.
32. **Why are electrical wires covered with plastic or rubber?**
    Answer: Electrical wires are covered with plastic or rubber to protect people from electric shocks.
33. **Why should electrical switches not be touched with wet hands?**
    Answer: Electrical switches should not be touched with wet hands because electric current may pass through the body and cause severe injury.
34. **Is the human body a conductor or an insulator of electricity?**
    Answer: The human body is a conductor of electricity.
35. **What type of current is usually supplied by batteries?**
    Answer: Batteries usually supply Direct Current (DC).
36. **What type of current is supplied through wall sockets?**
    Answer: Electricity supplied through wall sockets is Alternating Current (AC).
37. **Name one device that uses a cylindrical battery.**
    Answer: A torchlight is a device that can use a cylindrical battery.
38. **Name one device that uses a button cell.**
    Answer: A wristwatch can use a button cell.
39. **Name one device that uses a rechargeable battery.**
    Answer: A mobile phone uses a rechargeable battery.

40. **What is the purpose of a conduction tester?**
    Answer: A conduction tester is used to identify materials through which electric current can pass.

3.6 One-mark questions with Answers of HOTS Type: (40 Questions)

The following questions are designed as **Higher Order Thinking Skills (HOTS)** questions involving application, analysis, prediction, reasoning, and problem-solving. Each answer is limited to **one sentence**, suitable for a **one-mark question**. The chapter itself emphasizes predicting circuit behaviour, identifying faults, testing materials, and reasoning about circuit connections.

1. **A torch has two new cells, but one cell is placed in the wrong direction; why may the torch not glow?**
   Answer: The incorrect placement of one cell may prevent the battery from supplying current properly to the lamp.
2. **A lamp is connected to a cell by wires but does not glow; what should you check first?**
   Answer: We should first check whether the circuit forms a complete path for electric current.
3. **Why does an incandescent lamp stop glowing when its filament breaks?**
   Answer: A broken filament breaks the circuit and prevents electric current from passing through the lamp.
4. **What will happen if only one terminal of a lamp is connected to a cell?**
   Answer: The lamp will not glow because a complete path for electric current is not formed.
5. **A student reverses the connections of an incandescent lamp to a cell; will the lamp still glow?**
   Answer: Yes, the lamp will glow because an incandescent lamp works regardless of which terminal is connected to the positive or negative terminal of the cell.
6. **An LED does not glow even though the circuit is complete; what could be the reason?**
   Answer: The LED may have been connected with its positive and negative terminals reversed.
7. **Why does reversing an LED in a circuit prevent it from glowing?**
   Answer: Reversing an LED prevents it from glowing because electric current can pass through an LED in only one direction.
8. **How would you identify the positive terminal of an LED if the terminals are not marked?**
   Answer: The longer wire of the LED can be identified as its positive terminal.
9. **What would happen if a switch in a working circuit were moved from ON to OFF?**
   Answer: The circuit would become open, stopping the current and causing the lamp to go out.
10. **Why can a switch be placed at different positions in a simple circuit?**
    Answer: A switch can be placed anywhere in the circuit because breaking the path at any point stops the flow of current.
11. **A student connects a wooden stick between two open ends of a circuit; will the lamp glow? Why?**
    Answer: The lamp will not glow because wood does not allow electric current to pass through it easily.

12. **A metal key is inserted between the open ends of a conduction tester; what would you expect?**
Answer: The lamp should glow because the metal key acts as a conductor and completes the circuit.
13. **If a lamp glows when an unknown material is placed in a conduction tester, what can you conclude?**
Answer: We can conclude that the unknown material is a conductor of electricity.
14. **If the lamp does not glow while testing a material, what does this suggest about the material?**
Answer: It suggests that the material is an electrical insulator or poor conductor.
15. **Why would a plastic scale be unsuitable for making the conducting part of an electric wire?**
Answer: A plastic scale is unsuitable because plastic is an electrical insulator and does not allow current to pass through it.
16. **Why is copper preferred over silver for ordinary electrical wiring even though silver is an excellent conductor?**
Answer: Copper is preferred because it is a good conductor and is comparatively cheaper and more abundantly available.
17. **Why would making the entire outer covering of an electric wire from metal be unsafe?**
Answer: A metal covering would conduct electricity and could expose a person to electric shock.
18. **Why are both conductors and insulators required in an electrical appliance?**
Answer: Conductors carry electric current while insulators protect users from electric shocks.
19. **Why is touching an electrical switch with wet hands dangerous?**
Answer: It is dangerous because the human body conducts electricity and electric current through the body may cause severe injury.
20. **A student forgets to remove the plastic covering from the ends of connecting wires; will the lamp glow? Why?**
Answer: No, the lamp will not glow because the plastic covering prevents electrical contact and keeps the circuit incomplete.
21. **If a safety-pin switch does not touch the second drawing pin, why does the lamp remain off?**
Answer: The gap between the pins makes the circuit open and prevents current from flowing.
22. **How can you use a cell, lamp, and wires to determine whether an unknown object is a conductor?**
Answer: Place the object in the gap of a simple circuit and observe whether the lamp glows.
23. **A lamp glows when a coin is placed between the open ends of a tester; what does this observation indicate?**
Answer: The observation indicates that the material of the coin allows electric current to pass through it.
24. **Why should damaged electrical wires not be handled?**
Answer: Damaged insulation may expose conducting parts and increase the risk of electric shock.
25. **A torch lamp suddenly stops glowing although its cells are working; what is one likely cause?**
Answer: The lamp may have fused because its filament has broken.

26. **Two cells are required in a device; how should they generally be connected to form a battery?**
Answer: The positive terminal of one cell should be connected to the negative terminal of the next cell.
27. **Why might adding another properly connected cell help a device requiring more energy?**
Answer: Connecting more than one cell can provide more energy and/or supply energy to the circuit for a longer time.
28. **How can you test which of several given cells are working?**
Answer: Connect each cell separately to a working lamp in a complete circuit and identify the cells that make the lamp glow.
29. **If the '+' and '–' markings on a battery cannot be read, how could an LED help identify its terminals?**
Answer: Connect the LED both ways and the arrangement in which it glows identifies the battery terminal connected to the LED's longer wire as positive.
30. **Why are standard symbols preferable to drawings of actual components in circuit diagrams?**
Answer: Standard symbols make circuit diagrams simpler and easier for people everywhere to understand.
31. **If a circuit has a working cell and lamp but an open switch, what change is needed to make the lamp glow?**
Answer: The switch must be closed to complete the circuit and allow current to flow.
32. **If one connecting wire becomes detached while a torch is glowing, what will happen?**
Answer: The lamp will stop glowing because the detached wire breaks the electrical circuit.
33. **Why does a lamp glow when both its terminals are correctly connected to the two terminals of a cell?**
Answer: The connections form a complete path that allows electric current to flow through the lamp.
34. **Why would replacing a metal connecting wire with a rubber strip stop a lamp from glowing?**
Answer: Rubber is an insulator and therefore prevents electric current from completing the circuit.
35. **A circuit diagram shows a gap at the switch; what can you predict about the lamp?**
Answer: The lamp will not glow because the gap represents an open circuit.
36. **Why is a battery more useful than a single cell in some electrical devices?**
Answer: A battery can provide more energy and/or supply energy for a longer time than a single cell.
37. **A student wants to make a safe connecting wire; which combination of materials should be selected?**
Answer: The student should use a conducting metal such as copper inside and an insulating material such as plastic outside.
38. **Why is an electric cell suitable for experimenting with simple classroom circuits rather than a wall socket?**
Answer: Cells are suitable for such experiments because household power supply can be dangerous and should never be used for classroom electrical experiments.
39. **If a material completes a circuit and makes the tester lamp glow, how would you classify it?**

Answer: The material should be classified as an electrical conductor because it allows current to pass through it.

40. **If electricity supply in your area is disrupted for two days, why would many daily activities be affected?**
    Answer: Many daily activities would be affected because lighting, communication, cooking, cooling, and several other devices depend on electricity.

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

The following are **LOTS (Lower Order Thinking Skills)** questions focusing mainly on **remembering and understanding**. Each answer is given in **two clear sentences/points**, suitable for **2 marks**.

1. What is an electric cell? Name its two terminals.

Answer:

1. An electric cell is a portable source of electrical energy.
2. It has two terminals called the **positive (+ve) terminal** and **negative (–ve) terminal**.

2. What is a battery? How are the cells connected in a battery?

Answer:

1. A combination of two or more electric cells is called a **battery**.
2. The positive terminal of one cell is connected to the negative terminal of the next cell.

3. Why are two or more cells connected together in some devices?

Answer:

1. Some electrical devices require more energy than a single cell can provide.
2. Connecting more cells can provide energy for a longer time and/or provide more energy.

4. What is the filament of an incandescent lamp? What happens to it when current passes through it?

Answer:

1. The thin wire present inside the glass bulb of an incandescent lamp is called the **filament**.
2. The filament becomes hot and glows to produce light when electric current passes through it.

5. Name the two terminals of an incandescent lamp.

Answer:

1. One terminal of the lamp is the **metal case** at its base.
2. The other terminal is the **metal tip** at the centre of its base.

6. What is an LED? How can you identify its positive and negative terminals?

Answer:

1. LED stands for **Light Emitting Diode**, and it is used as a lamp in many modern torches.
2. Its longer wire is the positive terminal, while its shorter wire is the negative terminal.

7. State two differences between an LED and an incandescent lamp.

Answer:

1. An incandescent lamp contains a filament, whereas an LED does not have a filament.
2. Current can pass through an LED in only one direction, whereas an incandescent lamp can glow irrespective of which terminal is connected to the positive or negative terminal of the cell.

8. What is an electrical circuit? When does a lamp glow in a circuit?

Answer:

1. An electrical circuit is a complete path through which electric current can flow.

2. The lamp glows when the circuit is complete and current passes through the lamp.

9. What is the direction of electric current in an electrical circuit?

Answer:

1. The direction of electric current is taken to be from the **positive terminal to the negative terminal** of an electric cell.
2. In a complete circuit, the current passes through the lamp filament and makes it glow.

10. What is meant by a fused incandescent lamp? Why does it not glow?

Answer:

1. An incandescent lamp is usually said to be fused when its filament is broken.
2. The broken filament stops the flow of current and therefore the lamp does not glow.

11. What is an electric switch? State its function.

Answer:

1. An electric switch is a simple device that completes or breaks an electrical circuit.
2. It controls the flow of electric current by switching the circuit ON or OFF.

12. What happens when a switch is in the ON position?

Answer:

1. In the ON position, the switch closes the gap and completes the electrical circuit.
2. Electric current flows through the closed circuit and the lamp glows.

13. What happens when a switch is in the OFF position?

Answer:

1. In the OFF position, there is a gap in the electrical circuit and the circuit is open.
2. Current cannot flow through the circuit, so the lamp does not glow.

14. What is a circuit diagram? Why is it useful?

Answer:

1. A representation of an electrical circuit using symbols is called a **circuit diagram**.
2. Symbols make electrical circuits easier to draw and understand.

15. What do the long and short lines in the symbol of an electric cell represent?

Answer:

1. The long line in the symbol of an electric cell represents its **positive terminal**.
2. The short line represents its **negative terminal**.

16. What are electrical conductors? Give two examples.

Answer:

1. Materials through which electric current can flow easily are called **electrical conductors**.
2. Copper and silver are examples of good electrical conductors.

17. What are electrical insulators? Give two examples.

Answer:

1. Materials through which electric current cannot pass are called **electrical insulators or poor conductors**.
2. Plastic and rubber are examples of electrical insulators.

18. Why are metals used for making electrical wires? Why is copper commonly used?

Answer:

1. Metals are used for making electrical wires because they are good conductors of electricity.
2. Copper is commonly used because it is comparatively less expensive and abundantly available.

19. Why are electrical wires covered with plastic or rubber?

Answer:

1. Plastic and rubber are electrical insulators that do not allow electric current to pass through them easily.

2. They are used to cover electrical wires to protect people from electric shocks.

20. What is a conduction tester? What is it used for?

Answer:

1. A conduction tester can be made using an electric cell, a lamp and connecting wires with two free ends.
2. It is used to identify materials through which electric current can pass.

21. State two safety precautions to follow while using electricity.

Answer:

1. Never touch electrical switches or plugs with wet hands or use electrical devices in wet areas.
2. Never handle electrical equipment with damaged insulation or broken plugs.

22. What are DC and AC?

Answer:

1. Electricity from batteries that usually powers small devices is called **Direct Current (DC)**.
2. Electricity supplied from power plants to wall sockets is called **Alternating Current (AC)** and can run larger appliances.

23. Why should we use only cells or batteries for classroom experiments with electricity?

Answer:

1. Electricity from household power supplies and portable generators can be dangerous.
2. Therefore, only batteries or cells such as those used in torches, clocks, radios and remotes should be used for experiments.

24. Name any two ways in which electricity can be generated.

Answer:

1. Electricity can be generated using **wind energy** through windmills.
2. It can also be generated using **solar energy, falling water, natural gas or coal**.

25. Give two examples each of devices that use different types of cells or batteries.

Answer:

1. Cylindrical batteries are commonly used in **torchlights and clocks**, while button cells are used in **watches and hearing aids**.
2. Rechargeable batteries are used in devices such as **mobile phones, laptops and electric vehicles**.

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

The following questions are **HOTS (Higher Order Thinking Skills)** based, focusing on **application, analysis, reasoning, prediction, and problem-solving**. Each answer is restricted to **two sentences/points**, suitable for **2 marks**. The chapter itself emphasizes enquiry through "what if," "why," prediction, investigation, and troubleshooting activities.

1. A torch has two new cells, but one cell is placed in the reverse direction. Predict what will happen and explain why.

Answer:

1. The torch lamp may not glow because the cells are not connected in the required order.
2. For a proper battery arrangement, the positive terminal of one cell should be connected to the negative terminal of the next cell.

2. A bulb is connected to a cell, but only one terminal of the bulb is connected. Will it glow? Give a reason.

Answer:

1. No, the bulb will not glow because the electrical circuit is incomplete.

2. Both terminals of the bulb must be connected to the two terminals of the cell to provide a complete path for current.

3. A student reverses the connections of an incandescent lamp to a cell. Will the lamp still glow? Why?

Answer:

1. Yes, the incandescent lamp will still glow if the circuit remains complete.
2. It does not matter which terminal of an incandescent lamp is connected to the positive or negative terminal of the cell.

4. An LED does not glow when connected to a working battery. What should you check first? Why?

Answer:

1. Check whether the LED's longer wire is connected to the positive terminal and its shorter wire to the negative terminal of the battery.
2. An LED allows current to pass through it in only one direction.

5. A bulb does not glow even though the circuit appears complete. Give two possible reasons.

Answer:

1. The cell may be exhausted and unable to provide sufficient electrical energy.
2. The filament of the bulb may be broken, preventing current from flowing through it.

6. A student uses a plastic strip instead of a metal wire to complete a circuit. Predict what will happen and explain.

Answer:

1. The lamp will not glow because plastic does not allow electric current to pass through it.
2. Plastic is an electrical insulator and therefore cannot complete the conducting path of the circuit.

7. Why would a metal spoon complete a conduction tester circuit but a rubber eraser would not?

Answer:

1. A metal spoon is a conductor, so electric current can pass through it and make the lamp glow.
2. Rubber is an insulator, so it prevents current from passing through the circuit.

8. A student forgets to remove the plastic covering from the ends of connecting wires. Will the lamp glow? Justify your answer.

Answer:

1. The lamp will not glow because the plastic-covered ends will not provide proper conducting contact.
2. Plastic is an insulator, so the metal part of the wires must be exposed to complete the circuit.

9. Why is copper used inside an electrical wire while plastic is used outside it?

Answer:

1. Copper is a good conductor and allows electric current to flow through the wire.
2. Plastic is an insulator and covers the wire to help protect people from electric shocks.

10. A switch is placed near the cell in one circuit and near the lamp in another. Will both switches work? Explain.

Answer:

1. Yes, both switches will work because a switch can be placed anywhere in a circuit.
2. In either position, it controls current by completing or breaking the circuit.

11. A student closes a switch and observes that the lamp glows. What can you conclude about the circuit?
Answer:
1. The glowing lamp shows that the circuit forms a complete conducting path.
2. It also indicates that electric current is flowing through the lamp.

12. If the filament of an incandescent lamp breaks while it is glowing, what will happen? Explain.
Answer:
1. The lamp will stop glowing because the broken filament interrupts the conducting path.
2. As current can no longer pass through the filament, the lamp becomes fused.

13. Two incandescent lamps are connected one after another in a single circuit. If the filament of one lamp breaks, predict what will happen to the other lamp.
Answer:
1. The other lamp will also stop glowing because the broken filament makes the circuit incomplete.
2. Since there is no complete path, current cannot flow through either lamp.

14. You are given a wooden stick, a metal key, and a plastic scale. How would you identify the conductor without being told their materials?
Answer:
1. Place each object one at a time between the free ends of a conduction tester.
2. The object that makes the lamp glow allows current to pass through it and is therefore a conductor.

15. The '+' and '–' markings on a battery have faded. How can an LED help you identify the battery terminals?
Answer:
1. Connect the LED to the battery in one direction and then reverse the connections if it does not glow.
2. When it glows, the battery terminal connected to the LED's longer wire is positive and the terminal connected to its shorter wire is negative.

16. Why would replacing a copper connecting wire with a rubber strip cause a working circuit to fail?
Answer:
1. Copper conducts electricity and helps maintain a complete path for electric current.
2. Rubber is an insulator, so replacing copper with rubber interrupts the conducting path.

17. A student touches an electrical switch with wet hands. Why is this unsafe?
Answer:
1. The human body conducts electricity, and electric current passing through it can cause severe injury or even death.
2. Therefore, switches and plugs should never be touched with wet hands.

18. Why are conductors and insulators both necessary in an electrical appliance?
Answer:
1. Conductors are required in parts where electric current needs to flow, such as wires and connectors.
2. Insulators cover or surround conducting parts to help protect users from electric shocks.

19. You have six cells, but you do not know which ones are working. How could you identify the working cells?
Answer:

1. Connect each cell separately to a working lamp using wires to form a complete circuit.
2. A cell that makes the lamp glow is working, while one that fails to do so can be identified as non-working, provided the other components are working properly.

20. Why might adding another correctly connected cell make a device work better or for longer?

Answer:

1. Connecting more than one cell can provide more energy to the circuit and/or supply energy for a longer time.
2. Therefore, devices requiring greater or longer-lasting energy may use batteries made of multiple cells.

21. A circuit is complete, but an LED still does not glow. How is this situation different from an incandescent lamp?

Answer:

1. An LED may fail to glow if its terminals are connected in the wrong direction even though the circuit is complete.
2. An incandescent lamp does not have this directional restriction and can glow with either terminal orientation.

22. Why should a student never replace a cell with electricity from a wall socket while performing a circuit experiment?

Answer:

1. Electricity from household power supplies can be dangerous and can cause serious injury.
2. The chapter therefore instructs students to use only cells or batteries for such experiments.

23. A safety-pin switch is in the OFF position. What change must be made to light the lamp, and why?

Answer:

1. The safety pin must be moved until it touches the second drawing pin, putting the switch in the ON position.
2. This closes the gap, completes the circuit and allows current to flow through the lamp.

24. Why are standard circuit symbols more useful than drawing realistic pictures of every electrical component?

Answer:

1. Standard symbols make circuit diagrams simpler and easier to draw and understand.
2. Common symbols also allow people from different countries and industries to understand electrical diagrams consistently.

25. If a two-day power cut occurs in your area, how could it affect your daily activities? Give two examples based on the chapter.

Answer:

1. Activities depending on electrical lighting, fans, refrigerators, computers or other electrical appliances would be affected.
2. Communication and entertainment using electrically powered devices could also become difficult once their available battery power is exhausted.

3.9. Three-mark questions with Answers of LOTS Type: (18 Questions)

1. What is an electric cell? Describe its two terminals.

Answer:

1. An electric cell is a portable source of electrical energy.

2. It has two terminals called the **positive (+ve) terminal** and **negative (–ve) terminal**.
3. The metal cap is the positive terminal, while the flat metal disc is the negative terminal.

2. What is a battery? How are cells arranged to form a battery?

Answer:

1. A combination of two or more electric cells connected together is called a **battery**.
2. The positive terminal of one cell is connected to the negative terminal of the next cell.
3. Connecting more than one cell can provide energy to a circuit for a longer time and/or provide more energy.

3. Describe the structure and working of an incandescent lamp.

Answer:

1. An incandescent lamp contains a thin wire called a **filament** inside its glass bulb.
2. The filament is connected to two thicker wires leading to the two terminals of the lamp.
3. When electric current passes through the filament, it becomes hot and glows to produce light.

4. Write three features of an LED.

Answer:

1. An LED or **Light Emitting Diode** does not have a filament.
2. It has a positive terminal attached to the longer wire and a negative terminal attached to the shorter wire.
3. Electric current can pass through an LED in only one direction.

5. What is an electrical circuit? Explain how it makes an incandescent lamp glow.

Answer:

1. An electrical circuit is a complete path through which electric current can flow.
2. One terminal of the lamp is connected to one terminal of the cell and the other lamp terminal to the other cell terminal.
3. Current then passes through the filament of the incandescent lamp and makes it glow.

6. What is an electric switch? Explain its ON and OFF positions.

Answer:

1. A switch is a simple device that completes or breaks an electrical circuit.
2. In the **ON position**, the circuit is closed and current flows through it.
3. In the **OFF position**, there is a gap in the circuit, so current does not flow.

7. What is a circuit diagram? State its advantages.

Answer:

1. A circuit diagram is a representation of an electrical circuit using symbols.
2. Symbols make electrical circuits easier to draw and understand.
3. Standard symbols also help people from different countries and industries understand electrical circuits easily.

8. What are electrical conductors? Give examples and state their use.

Answer:

1. Materials through which electric current can flow easily are called **electrical conductors**.
2. Metals such as silver, copper and gold are good conductors of electricity.
3. Conductors are used for making electrical wires, switches, connectors of plugs and sockets.

9. What are electrical insulators? Give examples and state their importance.

Answer:

1. Materials through which electric current cannot pass are called **electrical insulators** or poor conductors.
2. Plastic, rubber and ceramics are examples of electrical insulators.

3. They are used to cover wires, plug tops and switches to protect people from electric shocks.

10. Explain how a conduction tester can be used to identify conductors and insulators.

Answer:

1. Connect an electric cell and a lamp with wires, leaving two wire ends free to make a tester.
2. Touch the two free ends of the tester to the object or material being tested.
3. If the lamp glows, the material conducts electricity; if it does not glow, the material is an insulator.

11. Explain how an LED should be connected to a battery to make it glow.

Answer:

1. The longer wire of the LED is its positive terminal and should be connected to the positive terminal of the battery.
2. The shorter wire is its negative terminal and should be connected to the negative terminal of the battery.
3. The LED glows only when connected correctly because current can pass through it in only one direction.

12. What is a fused incandescent lamp? Why does it not glow?

Answer:

1. An incandescent lamp with a broken filament is usually called a **fused lamp**.
2. The broken filament interrupts the path through which electric current flows.
3. Therefore, current cannot pass through the filament and the lamp does not glow.

13. Why are copper and plastic both used in electrical wires?

Answer:

1. Copper is a good conductor of electricity and allows electric current to pass through it.
2. Copper is commonly used for wires because it is comparatively less costly and abundantly available.
3. Plastic is an insulator and is used to cover the conducting wire to protect people from electric shocks.

14. Write three safety precautions to be followed while using electricity.

Answer:

1. Never perform electrical experiments using the power supply from home or school; use only cells or batteries for classroom experiments.
2. Never touch electrical switches or plugs with wet hands or use electrical devices in wet areas.
3. Never handle electrical equipment having damaged insulation or broken plugs.

15. Differentiate between Direct Current (DC) and Alternating Current (AC).

Answer:

1. Electricity supplied by batteries is generally of a type called **Direct Current (DC)**.
2. DC from batteries usually powers small devices, whereas electricity supplied from power plants to wall sockets is called **Alternating Current (AC)**.
3. AC supplied through wall sockets can operate larger electrical appliances.

16. Describe the direction of electric current in a simple electrical circuit.

Answer:

1. The direction of electric current in a closed circuit is taken from the **positive terminal to the negative terminal** of the electric cell.
2. The connecting wires provide a path for the current to pass through the circuit.
3. When the current passes through the filament of an incandescent lamp, the filament glows.

17. Explain why a torch uses two or more electric cells.

Answer:

1. Many electrical devices require more energy than a single cell can conveniently provide.
2. Therefore, two or more cells are connected together to form a battery.
3. Such a connection can provide energy for a longer time and/or provide more energy to the circuit.

18. Mention three different types of cells or batteries and their uses.

Answer:

1. Cylindrical batteries are commonly used in **torchlights, clocks, remotes and toys**.
2. Button cells are used in devices such as **watches and hearing aids**.
3. Rechargeable batteries are used in **mobile phones, laptops and electric vehicles**.

3.10. Three-mark questions with Answers of HOTS Type: (18 Questions)

1. A torch has two new cells, but its lamp does not glow. What could be the possible reasons?

Answer:

1. The cells may have been placed incorrectly, so the positive terminal of one cell is not properly connected to the negative terminal of the other.
2. The lamp may be fused because its filament is broken, which prevents current from flowing through it.
3. There may be a loose connection or an open circuit preventing a complete path for the current.

2. A student connects an LED to a battery, but it does not glow. The battery is working properly. What should the student check?

Answer:

1. The student should check whether the LED has been connected in the correct direction.
2. The longer positive wire of the LED should be connected to the positive terminal of the battery and the shorter negative wire to the negative terminal.
3. Reversing these connections prevents the LED from glowing because current passes through an LED in only one direction.

3. Why does an incandescent lamp glow even if its connections to the positive and negative terminals of a cell are reversed, while an LED may not?

Answer:

1. Current can pass through the filament of an incandescent lamp even when its connections to the cell terminals are reversed.
2. An LED allows current to pass through it in only one direction.
3. Therefore, an incandescent lamp can glow in either orientation, whereas an LED glows only when connected with the correct polarity.

4. A student makes a circuit correctly but forgets to remove the plastic covering from the ends of the connecting wires. Predict what will happen and explain why.

Answer:

1. The lamp will not glow even if the cell and lamp are working properly.
2. Plastic is an electrical insulator and does not allow electric current to pass through it.
3. The plastic covering must be removed from the wire ends so that the conducting metal can make electrical contact.

5. A safety-pin switch is in the OFF position. What will happen if the safety pin is moved to touch the second drawing pin? Explain.

Answer:

1. When the safety pin touches the second drawing pin, the gap in the circuit is closed.

2. This completes the path and allows electric current to flow through the circuit.
3. Therefore, the lamp will glow because the switch is now in the ON position.

6. You are given a metal spoon, rubber eraser and plastic scale. How would you identify which of them are conductors using a conduction tester?

Answer:

1. Place each object one at a time between the two free ends of the conduction tester.
2. If the lamp glows, the material allows current to pass and is therefore a conductor.
3. The metal spoon should conduct electricity, while the rubber eraser and plastic scale should act as insulators.

7. Why would it be unsafe to make the outer covering of an electrical wire from copper instead of plastic?

Answer:

1. Copper is a good conductor and allows electric current to pass through it easily.
2. If copper were exposed on the outside, a person touching the wire could come into electrical contact with the current.
3. Plastic or rubber is therefore used as an insulating covering to protect people from electric shocks.

8. A student replaces the copper connecting wires in a circuit with rubber strips. Predict what will happen and justify your answer.

Answer:

1. The lamp will not glow because rubber does not allow electric current to pass through it.
2. Rubber is an electrical insulator, whereas copper is a good conductor of electricity.
3. Therefore, replacing copper wires with rubber strips prevents the formation of a conducting path for current.

9. Why is copper commonly used for electrical wires even though silver and gold are also excellent conductors?

Answer:

1. Silver, copper and gold are among the best electrical conductors.
2. Copper is comparatively less costly and is abundantly available.
3. Therefore, copper is more practical for making electrical wires.

10. Two cells are placed in a torch with their positive terminals facing each other. Will the torch work properly? Explain.

Answer:

1. The torch is not expected to work properly because the cells are not arranged in the required order.
2. In a battery, the positive terminal of one cell should be connected to the negative terminal of the next cell.
3. Correct arrangement of the cells is necessary to supply electrical energy properly to the circuit.

11. A lamp stops glowing suddenly although the cell and connecting wires are working. How can you reason out the possible fault?

Answer:

1. The filament inside the incandescent lamp may have broken.
2. A broken filament interrupts the path of electric current through the lamp.
3. Such a lamp is called a fused lamp and should be replaced with a working lamp to test the circuit.

12. Why is it dangerous to touch an electrical switch with wet hands?

Answer:

1. The human body is a conductor of electricity, and electric current passing through it may cause severe injury or even death.
2. Wet conditions increase the danger of coming into electrical contact while operating switches or plugs.
3. Therefore, electrical switches and plugs should never be touched with wet hands.

13. You have six cells, but you do not know which ones are working. How would you identify the working cells?

Answer:

1. Make a simple testing circuit using a small lamp, connecting wires and a cell holder.
2. Test each cell separately by placing it in the circuit and completing the conducting path.
3. A cell that makes the lamp glow is working, while one that does not should be checked again and identified as non-working if the rest of the circuit is functioning correctly.

14. The '+' and '–' marks on a battery have become unreadable. How could an LED help you identify its terminals?

Answer:

1. Connect the LED to the battery in one direction and observe whether it glows.
2. If it does not glow, reverse the connections because an LED allows current to pass only in one direction.
3. When it glows, the battery terminal connected to the LED's longer wire is positive and the terminal connected to its shorter wire is negative.

15. Why are both conductors and insulators necessary in an electrical appliance?

Answer:

1. Conductors are required to carry electric current through wires, switches, plugs and other electrical connections.
2. Insulators are required around conducting parts to prevent unwanted contact with electric current.
3. Therefore, conductors make the appliance function, while insulators help make its use safer.

16. A student connects a cell, lamp and switch, but the lamp remains off even after the switch is closed. How should the student troubleshoot the circuit?

Answer:

1. First, the student should check whether all wires are properly connected and whether the circuit forms a complete path.
2. Next, the student should check whether the cell has sufficient energy and whether the lamp filament is intact.
3. Finally, the student should check whether the switch is making proper electrical contact when placed in the ON position.

17. Why does adding more than one cell to some electrical devices help them work effectively?

Answer:

1. Some devices require more electrical energy than a single cell can conveniently provide.
2. Two or more cells can be connected together to form a battery.
3. Connecting multiple cells can provide energy to the circuit for a longer time and/or provide more energy.

18. Suppose electricity supply to your home is disrupted for two days. How would this affect your daily activities?

Answer:

1. Electrical devices used for lighting, cooling, cooking and entertainment may not function from the household power supply.

2. Devices such as refrigerators, televisions and other appliances depending on wall-socket electricity would be affected.
3. Battery-operated devices could still be used for some purposes because cells and batteries are portable sources of electrical energy.

3.11 Five-mark questions with Answers of LOTS Type: (8 Questions)

1. Explain an electric cell and its terminals.
Answer:
1. An electric cell is a **portable source of electrical energy**.
2. Every electric cell has **two terminals**.
3. One terminal is called the **positive (+ve) terminal**.
4. The other terminal is called the **negative (–ve) terminal**.
5. In a typical electric cell, the metal cap is the positive terminal and the flat metal disc is the negative terminal.

2. What is a battery? Explain how cells are arranged in a battery.
Answer:
1. A combination of **two or more cells** connected together is called a battery.
2. The cells must be placed in a particular order for proper operation.
3. The **positive terminal of one cell** is connected to the **negative terminal of the next cell**.
4. Many electrical devices require more than one cell and therefore use batteries.
5. Connecting more than one cell can provide energy to a circuit for a longer time and/or provide more energy.

3. Describe the structure and working of an incandescent electric lamp.
Answer:
1. An incandescent lamp contains a thin wire called a **filament** inside its glass bulb.
2. The filament is attached to two thicker wires that support it.
3. One thick wire is connected to the metal case at the base of the lamp.
4. The other thick wire is connected to the metal tip at the centre of the base.
5. When electric current passes through the filament, it becomes hot and glows to produce light.

4. Explain the main features and working of an LED.
Answer:
1. LED stands for **Light Emitting Diode**, and many modern torches use LEDs instead of incandescent lamps.
2. Unlike an incandescent lamp, an LED **does not have a filament**.
3. An LED has two terminals—the longer wire is positive and the shorter wire is negative.
4. Electric current can pass through an LED in **only one direction**.
5. The LED glows when its positive terminal is connected to the positive terminal of the battery and its negative terminal to the negative terminal.

5. What is an electrical circuit? Explain how an incandescent lamp glows in a circuit.
Answer:
1. An **electrical circuit** provides a complete path for electric current to flow.
2. One terminal of the lamp is connected to one terminal of the electric cell.
3. The other terminal of the lamp is connected to the other terminal of the cell.
4. The direction of electric current is taken to be from the **positive to the negative terminal** of the cell.
5. When current passes through the filament of the incandescent lamp in a complete circuit, the filament glows.

6. What is an electric switch? Explain its ON and OFF positions.

Answer:

1. An electric switch is a simple device that **completes or breaks an electrical circuit**.
2. In the **ON position**, the switch completes the path for electric current.
3. The circuit is then called a **closed circuit**, and current flows through it.
4. In the **OFF position**, there is a gap in the circuit that prevents current from flowing.
5. The circuit is then called an **open circuit**, and the lamp does not glow.

7. What is a circuit diagram? Explain its importance.

Answer:

1. Electrical components can be represented using standard **symbols**.
2. A representation of an electrical circuit using these symbols is called a **circuit diagram**.
3. Symbols are used for components such as cells, batteries, lamps, LEDs, switches and wires.
4. Using symbols makes electrical circuits easier to **draw and understand**.
5. Standard symbols also help people from different countries and industries understand electrical and electronic circuits easily.

8. Explain electrical conductors and insulators with examples.

Answer:

1. Materials through which electric current can flow easily are called **electrical conductors**.
2. Metals are generally good conductors of electricity.
3. Silver, copper and gold are among the best electrical conductors.
4. Materials through which current cannot pass are called **insulators or poor conductors of electricity**.
5. Plastic, rubber and ceramics are examples of electrical insulators.

9. Describe an activity to identify conductors and insulators.

Answer:

1. Connect an electric cell and a lamp using wires, leaving two wire ends free to make a **conduction tester**.
2. Touch the two free ends momentarily to check whether the lamp glows and the tester is working.
3. Place different objects, one at a time, between the two free ends of the tester.
4. If the lamp glows, the material is identified as a **conductor of electricity**.
5. If the lamp does not glow, the material is identified as an **insulator or poor conductor**.

10. Explain the importance of conductors and insulators in electrical devices.

Answer:

1. Both conductors and insulators are important for the safe use of electricity.
2. Electrical wires, switches and connectors of plugs and sockets contain conducting materials.
3. Conductors allow electric current to flow through the required parts of a circuit.
4. Rubber, plastic and ceramics are used as insulating materials around electrical components.
5. These insulators help protect people from **electric shocks**.

11. Write five safety precautions to follow while handling electricity.

Answer:

1. Never perform experiments using the electrical power supply at home or school.
2. Use only cells or batteries for classroom experiments with electricity.
3. Never touch electrical switches or plugs with **wet hands**.
4. Do not use electrical devices in wet areas.
5. Never handle electrical equipment with damaged insulation or broken plugs.

12. Write five points about the uses and importance of electric cells and batteries.
Answer:
1. Electric cells and batteries are **compact and portable sources of electrical energy**.
2. They make the use of many portable electrical devices convenient.
3. Cylindrical batteries are commonly used in torchlights, clocks, remotes and toys.
4. Button cells are used in devices such as watches and hearing aids.
5. Rechargeable batteries are used in mobile phones, laptops and electric vehicles.

3.12 Five-mark questions with Answers of HOTS Type: (12 Questions)

1. A torch does not glow even after its switch is turned ON. Analyse five possible reasons for this problem.
Answer:
1. The cells may be **discharged or not working**.
2. The cells may have been placed incorrectly, so their terminals are not properly connected.
3. The filament of an incandescent lamp may be **broken or fused**.
4. There may be a loose or broken connection somewhere in the circuit.
5. The switch may not be closing the circuit properly, preventing current from flowing.

2. A student connects an LED to a battery, but it does not glow. The battery and LED are both working. What could be wrong? Explain how you would correct it.
Answer:
1. An LED allows electric current to pass through it in **only one direction**.
2. The student may have connected the LED terminals in the wrong direction.
3. The **longer wire** of the LED is its positive terminal.
4. The longer wire should be connected to the positive terminal of the battery and the shorter wire to the negative terminal.
5. Reversing the incorrect connections should make the LED glow.

3. Why are electrical wires made of metal but covered with plastic or rubber? Give reasons.
Answer:
1. Electric current needs a **conducting material** to travel through a wire.
2. Metals are good conductors and allow electric current to flow easily.
3. Therefore, metals such as copper are commonly used inside electrical wires.
4. Plastic and rubber are **electrical insulators** and do not allow current to pass easily.
5. Covering metal wires with these insulating materials helps protect people from electric shocks.

4. A student makes a circuit correctly but forgets to remove the plastic covering from the ends of the connecting wires. Predict what will happen and justify your answer.
Answer:
1. The lamp will **not glow** even if the cell and lamp are working properly.
2. The metal part of the connecting wire must make contact with the electrical components.
3. Plastic is an **electrical insulator**.
4. Therefore, the plastic covering will prevent electric current from passing through the connection.
5. Removing the plastic covering from the ends will expose the metal and help complete the circuit.

5. You are given a metal spoon, rubber eraser, plastic scale, key and wooden stick. How would you identify which are conductors and which are insulators?

Answer:

1. I would prepare a **conduction tester** using a cell, lamp and connecting wires.
2. I would leave two ends of the wires free and place each object between them one at a time.
3. If the lamp glows, the object allows electric current to pass and is therefore a **conductor**.
4. If the lamp does not glow, the object is an **insulator or poor conductor**.
5. Thus, the metal spoon and key should conduct electricity, while the rubber eraser, plastic scale and wooden stick should not.

6. Suppose the '+' and '–' signs on a battery are erased. How could you identify its positive and negative terminals using an LED?

Answer:

1. Take a working LED and connect its two terminals to the unknown battery terminals.
2. Observe whether the LED glows in this arrangement.
3. If it does not glow, **reverse the connections**.
4. When the LED glows, the battery terminal connected to the LED's longer wire is the **positive terminal**.
5. The battery terminal connected to the LED's shorter wire is the **negative terminal** because current passes through an LED only in the correct direction.

7. You are given six cells, but some are working and some are not. Design an activity to identify the working cells.

Answer:

1. Take a small working lamp, connecting wires and the six cells to be tested.
2. Make a simple circuit by connecting one cell to the lamp using wires.
3. If the lamp glows, the cell being tested is **working**.
4. If the lamp does not glow, test the same arrangement with a known working cell first to ensure the lamp and wires are functioning.
5. Repeat the procedure for all six cells and separate the working cells from the non-working ones.

8. Two cells are placed in a torch, but the lamp does not glow. On examining the torch, you find that both cells are working. What should you check and why?

Answer:

1. First, check whether the cells have been placed in the **correct order**.
2. The positive terminal of one cell should be connected to the negative terminal of the next cell.
3. If one cell is reversed, the battery arrangement may not provide the required current through the circuit.
4. The '+' and '–' markings inside the battery compartment can help in placing the cells correctly.
5. After correcting the cell arrangement and completing the circuit, the lamp should glow.

9. A student replaces the metal connecting wire in a circuit first with a plastic strip and then with a metal key. Predict and explain the results.

Answer:

1. When the plastic strip is used, the lamp will **not glow**.
2. Plastic is an insulator and does not allow electric current to pass through easily.
3. When the plastic strip is replaced with a metal key, the lamp should **glow**.
4. This is because metals are good conductors of electricity.
5. The experiment demonstrates that the nature of the material used in a circuit determines whether current can flow through it.

10. A lamp is glowing in a simple circuit. Predict what happens when the switch is opened and then closed again. Explain your reasoning.
Answer:
1. When the switch is opened, a **gap** is created in the electrical circuit.
2. The circuit becomes an **open circuit**, so electric current cannot flow.
3. Therefore, the lamp stops glowing.
4. When the switch is closed again, the gap disappears and a complete path is formed.
5. Current flows through the closed circuit and the lamp glows again.

11. Why would a broken filament prevent an incandescent lamp from glowing even when the cell, wires and switch are working properly?
Answer:
1. Electric current must pass through the filament for an incandescent lamp to glow.
2. When current flows through the filament, it becomes hot and produces light.
3. A broken filament creates a **break in the path of electric current**.
4. Therefore, current cannot pass through the lamp even though the other components are working.
5. Hence, the lamp becomes **fused** and does not glow.

12. Why is it dangerous to touch an electrical switch with wet hands? Explain scientifically.
Answer:
1. The human body is a **conductor of electricity**.
2. Electric current passing through the body can cause severe injury or even death.
3. Wet conditions increase the danger while handling electrical equipment.
4. Therefore, touching switches or plugs with wet hands can expose a person to the risk of electric shock.
5. Electrical switches, plugs and appliances should always be handled carefully with dry hands and proper insulation.

3.13 Five-mark questions with Answers of Applied Type: (5 Questions)

These questions require students to **apply the concepts learned in the chapter to practical situations** involving cells, batteries, lamps, LEDs, switches, conductors, insulators, and circuits.

1. Your torch does not glow when you switch it ON. How would you identify and correct the problem?
Answer:
1. First, I would check whether the cells in the torch are working.
2. I would make sure that the cells are placed correctly, with the positive terminal of one connected towards the negative terminal of the next.
3. I would check whether the lamp is fused due to a broken filament.
4. I would examine the switch and connections to see whether the circuit is properly completed.
5. After correcting the faulty component or connection, I would switch on the torch again to check whether it glows.

2. You are given a metal spoon, plastic scale, rubber eraser, key and wooden stick. How would you find out which are conductors and which are insulators?
Answer:
1. I would make a simple conduction tester using an electric cell, lamp and connecting wires.

2. I would leave two ends of the wires free and place each object between them one at a time.
3. If the lamp glows, the material allows electric current to pass through it.
4. Such a material is classified as an **electrical conductor**.
5. If the lamp does not glow, the material is classified as an **insulator or poor conductor**.

3. You have to make a simple switch for a science project. Explain how you would construct and use it.

Answer:

1. I would take two drawing pins, a safety pin, two wires and a small piece of cardboard.
2. I would fix the safety pin to the cardboard using one drawing pin so that it can rotate freely.
3. I would place the second drawing pin where the free end of the safety pin can touch it.
4. When the safety pin touches both pins, the circuit becomes **closed** and the lamp glows.
5. When it does not touch the second pin, the circuit becomes **open** and the lamp stops glowing.

4. You have an LED and a battery. Explain how you would connect them correctly to make the LED glow.

Answer:

1. I would first identify the two terminals of the LED by observing the lengths of its wires.
2. The longer wire is the **positive terminal**, while the shorter wire is the **negative terminal**.
3. I would connect the longer wire of the LED to the positive terminal of the battery.
4. I would connect the shorter wire of the LED to the negative terminal of the battery.
5. The LED will then glow because electric current can pass through an LED only in the correct direction.

5. The plastic covering of an electrical wire is damaged and the metal wire inside is exposed. Apply your knowledge of conductors and insulators to explain why this is dangerous.

Answer:

1. The metal inside the wire is a **conductor** and allows electric current to pass through it.
2. The plastic covering is an **insulator** that prevents current from reaching our body.
3. If the plastic covering is damaged, a person may accidentally touch the conducting metal.
4. Since the human body is also a conductor, electric current may pass through the body and cause severe injury.
5. Therefore, damaged electrical wires should not be touched or used and should be properly repaired or replaced.

6. You are given six electric cells, but some of them are not working. Describe how you would identify the working cells.

Answer:

1. I would take a small working lamp, connecting wires and the six cells to be tested.
2. I would connect one cell at a time to the lamp to form a complete circuit.
3. If the lamp glows, I would conclude that the cell is working.
4. If the lamp does not glow, I would check the same circuit with a known working cell to ensure that the lamp and wires are functioning.
5. I would repeat the procedure for all six cells and separate the working cells from the non-working ones.

7. While making a circuit, a student forgets to remove the plastic covering from the ends of the connecting wires. What should the student do to make the lamp glow?

Answer:

1. The student should first identify why the electrical connection is incomplete.
2. Plastic is an insulator and does not allow electric current to pass through easily.
3. About **1 cm of plastic covering** should be removed from both ends of each connecting wire.
4. The exposed metal ends should then be properly connected to the cell and lamp terminals.
5. When a complete conducting path is formed, current will flow and the lamp will glow.

8. You need to choose materials for making an electrical wire. Which materials would you select for the inner wire and outer covering? Explain your choice.
Answer:
1. I would select **copper** for the inner part of the electrical wire.
2. Copper is a good conductor and allows electric current to flow easily.
3. It is widely used because it is comparatively less costly and abundantly available.
4. I would use plastic or rubber for the outer covering because these materials are electrical insulators.
5. This combination allows electricity to flow efficiently through the wire while protecting people from electric shocks.

9. Suppose the '+' and '–' markings on a battery are not visible. How would you use an LED to identify the battery terminals?
Answer:
1. I would identify the longer and shorter wires of a working LED.
2. I would connect the LED to the two unknown terminals of the battery.
3. If the LED does not glow, I would reverse the connections.
4. When the LED glows, the battery terminal connected to the LED's longer wire is the **positive terminal**.
5. The other battery terminal, connected to the shorter LED wire, is the **negative terminal**.

10. You have to prepare a battery using two electric cells for a small device. How would you arrange the cells correctly?
Answer:
1. I would first identify the positive and negative terminals of both cells.
2. I would connect the **positive terminal of one cell to the negative terminal of the next cell**.
3. The two cells connected in this way form a battery.
4. I would use the remaining free positive and negative terminals to connect the battery to the device.
5. This arrangement can provide the circuit with more energy and/or energy for a longer time than a single cell.

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

Olympiad-Type Multiple Choice Questions:
Chapter 3: ***Electricity: Circuits and their Components***
The following questions are designed at a **competitive/Olympiad level**, with greater emphasis on conceptual understanding, application, reasoning, circuit analysis, and troubleshooting. They are based on the chapter concepts of cells, batteries, incandescent lamps, LEDs, switches, circuit diagrams, conductors, and insulators.

1. A torch contains two cells. Which arrangement will correctly form a battery?
A. Positive terminal of one cell connected to the positive terminal of the other
B. Negative terminal of one cell connected to the negative terminal of the other

C. Positive terminal of one cell connected to the negative terminal of the next
D. The cells need not touch each other
Answer: C
Explanation: A battery is formed when the positive terminal of one cell is connected to the negative terminal of the next cell.

---

2. A student connects an incandescent lamp correctly to a working cell, but the lamp does not glow. Which is the most likely reason?
A. The positive terminal of the cell is too large
B. The filament of the lamp may be broken
C. Incandescent lamps work only with two cells
D. The cell must always be connected through a switch
Answer: B
Explanation: A broken filament prevents current from flowing through the lamp; such a lamp is said to be fused.

---

3. An incandescent lamp is glowing in a complete circuit. If the connections to the two terminals of the lamp are interchanged, what will happen?
A. The lamp will stop glowing.
B. The lamp will continue to glow.
C. The cell will stop working.
D. The filament will immediately break.
Answer: B
Explanation: For an incandescent lamp, it does not matter which lamp terminal is connected to the positive or negative terminal of the cell, provided the circuit remains complete.

---

4. An LED is connected to a working battery but does not glow. The circuit is otherwise complete. What should be tried first?
A. Reverse the LED connections.
B. Remove one cell.
C. Replace the wires with plastic strips.
D. Open the switch.
Answer: A
Explanation: Current passes through an LED only in one direction. Its longer wire should connect to the positive terminal and shorter wire to the negative terminal.

---

5. Which observation best distinguishes an LED from an incandescent lamp?
A. An LED has no terminals.
B. An LED contains a thick filament.
C. An LED does not contain a filament and allows current through it in only one direction.
D. An LED can never be used in a torch.
Answer: C

---

6. Four materials P, Q, R and S are tested using a conduction tester.

Material	Lamp
P	Glows
Q	Does not glow
R	Glows
S	Does not glow

Which conclusion is correct?
A. P and R are conductors; Q and S are insulators.
B. P and Q are conductors.
C. Q and S are conductors.
D. All four are insulators.
Answer: A
Explanation: Materials through which current flows easily are conductors; materials that do not allow it to pass are insulators.

---

7. Why is copper commonly used for making electrical wires even though silver, copper and gold are among the best conductors?
A. Copper is an insulator.
B. Copper does not conduct electricity.
C. Copper is comparatively less costly and abundantly available.
D. Copper prevents electric shocks.
Answer: C

---

8. A student makes a circuit using a cell, lamp and connecting wires but forgets to remove the plastic covering from the ends of the wires. What is most likely to happen?
A. The lamp will glow brighter.
B. The lamp will not glow because plastic prevents proper electrical contact.
C. The cell will become a battery.
D. The lamp will glow only for a few seconds.
Answer: B
Explanation: Plastic is an electrical insulator, while the exposed metal is required to make conducting connections.

---

9. Which combination is correctly matched?
A. Copper — Insulator
B. Rubber — Conductor
C. Plastic — Insulator
D. Metal key — Insulator
Answer: C

---

10. A switch is placed in the OFF position. Which statement correctly describes the circuit?
A. The circuit is closed and current flows.
B. The circuit is open and current does not flow.
C. The cell stops producing electrical energy permanently.
D. The lamp receives twice the current.
Answer: B
Explanation: In the OFF position, a gap exists in the circuit, preventing current from flowing.

---

11. A student moves a switch from one side of a simple series circuit to another side. What effect will this have on its ability to control the lamp?
A. It will no longer work.
B. The lamp will remain permanently ON.
C. It can still complete or break the circuit.
D. It will reverse the terminals of the cell.
Answer: C

Explanation: A switch can be placed anywhere in a simple circuit because its purpose is to complete or break the conducting path.

---

12. In the conventional direction described in the chapter, electric current in a closed circuit is taken to flow:
A. from negative to positive terminal
B. from positive to negative terminal
C. from the lamp towards both cell terminals
D. only through the switch
Answer: B

---

13. Which statement about an electric cell is INCORRECT?
A. It is a portable source of electrical energy.
B. It has a positive terminal.
C. It has a negative terminal.
D. It acts as a switch that opens and closes the circuit.
Answer: D

---

14. In the circuit symbol of an electric cell, the longer line represents:
A. the negative terminal
B. the positive terminal
C. the filament
D. the insulating layer
Answer: B

---

15. Why are standard circuit symbols useful?
A. They increase the electrical energy of a circuit.
B. They make batteries last longer.
C. They make circuits easier to draw and understand.
D. They make conductors behave like insulators.
Answer: C
Explanation: A representation of an electrical circuit using standard symbols is called a circuit diagram.

---

16. Consider the following statements:
I. An incandescent lamp has a filament.
II. An LED has a filament.
III. Current can pass through an LED in only one direction.
IV. An incandescent lamp can glow with either orientation of its terminals in a complete circuit.
Which combination is correct?
A. I and II only
B. I, III and IV only
C. II and III only
D. I, II, III and IV
Answer: B

---

17. Two cells are correctly connected to form a battery. Compared with using one cell, the main reason for using more than one cell is that they can:

A. turn an insulator into a conductor
B. provide energy for a longer time and/or more energy
C. eliminate the need for a complete circuit
D. make current pass through plastic
Answer: B

---

18. A student tests a metal spoon, rubber eraser, plastic scale and metal key using a conduction tester. The lamp is most likely to glow for:
A. spoon and key only
B. eraser and scale only
C. spoon and scale only
D. all four objects
Answer: A
Explanation: Metals are generally conductors, whereas rubber and plastic are electrical insulators.

---

19. Why does an incandescent lamp glow when connected in a complete circuit?
A. Its glass bulb produces electricity.
B. Its filament gets hot and produces light when current passes through it.
C. Its metal case becomes an insulator.
D. The cell directly produces light inside the lamp.
Answer: B

---

20. A lamp, working cell and wires are connected. Which condition is essential for the lamp to glow?
A. Both lamp terminals must connect to the same terminal of the cell.
B. There must be a complete path for current through the lamp.
C. The connecting wires must be covered entirely by exposed metal.
D. The switch must always be placed next to the positive terminal.
Answer: B

---

21. Which sequence correctly describes what happens when a switch is turned ON?
A. Circuit breaks → current stops → lamp glows
B. Circuit completes → current flows → lamp glows
C. Circuit completes → current stops → lamp goes off
D. Cell becomes an insulator → lamp glows
Answer: B

---

22. A student wants to determine the polarity of a battery whose '+' and '–' marks are erased. Which component would be particularly useful?
A. An incandescent lamp, because its orientation matters
B. An LED, because it allows current through it in only one direction
C. A rubber eraser
D. A plastic scale
Answer: B
Explanation: The LED's polarity can be used to identify the battery terminals because it glows only when connected in the correct direction.

---

23. Three students make the following statements:

Riya: Metals can be used inside electrical wires because they conduct electricity.
Aman: Plastic covering is used because plastic is a conductor.
Neha: Insulating coverings help protect people from electric shocks.
Who is/are correct?
A. Riya only
B. Aman only
C. Riya and Neha only
D. All three
Answer: C

---

24. A circuit contains two incandescent lamps connected one after another in a single path. If the filament of one lamp breaks, what will happen?
A. Only the broken lamp will stop glowing.
B. The other lamp will glow brighter.
C. Both lamps will stop glowing because the conducting path is broken.
D. The battery will reverse its polarity.
Answer: C
Explanation: The chapter's Fig. 3.17 presents two lamps in a single circuit. A broken filament creates a break in that path, preventing current from flowing through the circuit.

---

25. Which of the following represents the best design for an ordinary electrical wire?
A. Plastic core surrounded by copper
B. Copper conductor covered with insulating plastic or rubber
C. Rubber core covered with wood
D. Glass conductor covered with copper
Answer: B

---

26. An LED has one long lead and one short lead. Which connection should make it glow?
A. Long lead → negative; short lead → positive
B. Both leads → positive
C. Long lead → positive; short lead → negative
D. Both leads → negative
Answer: C

---

27. Which statement correctly compares electricity from a battery with electricity from a wall socket, according to the chapter?
A. Both are always AC.
B. Batteries usually provide DC, while wall sockets receive AC from the power supply.
C. Batteries provide AC and wall sockets provide DC.
D. Both are always DC.
Answer: B

---

28. A conduction tester's lamp glows when object X is placed between its two free wire ends. What can be concluded most reasonably?
A. X completes the conducting path and is a conductor.
B. X must be made of plastic.
C. X is definitely an insulator.
D. X produces electrical energy.
Answer: A

---

29. Which of the following situations is the MOST dangerous?
A. Holding the plastic body of a properly insulated device
B. Using a battery-operated torch
C. Touching an electrical switch with wet hands
D. Drawing a circuit diagram on paper
Answer: C
Explanation: The chapter warns that the human body conducts electricity and specifically cautions against touching switches or plugs with wet hands.

---

30. A lamp does not glow in a circuit. Which sequence is the best scientific approach to finding the fault?
A. Immediately conclude that the cell is dead.
B. Replace every component simultaneously.
C. Check whether the circuit is complete and systematically test the cell, lamp, wires and switch.
D. Connect the circuit directly to a household wall socket.
Answer: C
Explanation: A non-glowing lamp may result from several possible faults, so the components and connections should be checked systematically. The chapter also specifically warns students **never to perform experiments using household power supply**.

Answer Key

Q.	Ans.	Q.	Ans.	Q.	Ans.
1	C	11	C	21	B
2	B	12	B	22	B
3	B	13	D	23	C
4	A	14	B	24	C
5	C	15	C	25	B
6	A	16	B	26	C
7	C	17	B	27	B
8	B	18	A	28	A
9	C	19	B	29	C
10	B	20	B	30	C

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

Since this chapter is strongly **activity-, observation-, experimentation-, and enquiry-based**, the following can be adopted as classroom best practices. The chapter itself encourages students to construct circuits, predict outcomes, test switches, identify conductors and insulators, draw circuit diagrams, and troubleshoot faulty circuits.

(1) Learning by Doing – Build a Working Circuit:
Organise students into small groups and provide cells, wires, lamps/LEDs and switches. Ask each group to construct a working circuit and then deliberately create an open circuit to observe the difference. This converts the concepts of *open circuit, closed circuit and current flow* into hands-on learning.

(2) Predict–Experiment–Observe–Explain (PEOE) Method:
Before connecting a circuit, students should **predict** whether the lamp will glow, perform the experiment, record their **observation**, and finally **explain** the result. This

develops scientific reasoning rather than simple memorisation—the textbook itself uses prediction and observation in its circuit activity.

(3) "Circuit Detective" – Fault Finding Challenge:
Give each group a deliberately faulty circuit—for example, a fused lamp, wrongly connected LED, reversed cell, open switch, loose wire or insulated wire end. Students identify the fault and suggest a correction. This promotes **problem-solving, critical thinking and troubleshooting skills**, similar to the chapter's faulty-circuit enquiry.

(4) Conductor–Insulator Discovery Lab:
Students can construct a simple tester and investigate everyday objects such as coins, keys, pencil lead, aluminium foil, rubber, plastic, glass, paper and wood. They first predict and then classify the objects as **conductors or insulators** based on experimental evidence.

(5) Circuit Symbol & Diagram Challenge:
Display real components—cell, battery, lamp, LED, switch and wires—and ask students to convert a physical circuit into a **standard circuit diagram** and vice versa. Groups can exchange diagrams and attempt to construct each other's circuits. This strengthens visual literacy and application of standard electrical symbols.

(6) STEM Mini-Project – Solar-Powered Toy:
As an extension activity, students can construct a simple circuit using a **small solar panel and toy fan**, connecting the chapter with renewable energy and real-life applications. The chapter specifically proposes this as an exploratory project.

(7) Safety-First Electricity Audit:
Students can conduct a supervised "Electrical Safety Audit" of their classroom/home by identifying insulated wires, plugs, switches and unsafe practices. They can prepare a *Safe/Unsafe* chart or poster. This reinforces the chapter's warnings about wet hands, damaged insulation and electric shock.

(8) Peer Teaching through "Explain My Circuit":
Each group constructs or draws a different circuit and one student explains **why the lamp/LED glows or does not glow**. Other groups question the explanation. This develops scientific vocabulary, communication, collaboration and conceptual clarity.

(9) Olympiad Corner – Higher-Order Thinking Question of the Day:
End each lesson with one challenging question such as: *"A lamp does not glow even though the switch is ON. Give five possible reasons."* or *"How can you identify the positive and negative terminals of an unmarked battery using an LED?"* Such questions prepare students for **Olympiad and competitive examinations** while strengthening reasoning. The chapter itself includes similar enquiry-based problems.

(10) Home Electricity Classification Project:
Ask students to identify household objects and classify them into **conductors only, insulators only, and objects containing both conductors and insulators**. Students can present photographs/drawings with reasons for their classification. This is directly aligned with the chapter's exploratory project.

Five particularly strong practices for a lesson plan:
If only **five Best Practices** are required for documentation, I recommend:
1. Learning by Doing – Circuit Construction
2. Predict–Experiment–Observe–Explain (PEOE)
3. Circuit Detective – Fault Finding & Problem Solving
4. Conductor–Insulator Discovery Lab
5. Olympiad Corner – HOTS & Application-Based Questions

Together, these move the chapter from **"learning about electricity" to "investigating, constructing, analysing and applying electricity."**

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

The chapter provides excellent scope for innovative teaching because students learn about **cells, batteries, lamps, LEDs, switches, circuit diagrams, conductors and insulators** through observation and experimentation.

(1) Virtual Circuit Laboratory:
Use an interactive circuit simulation on a smartboard/computer where students can virtually connect cells, switches, bulbs and LEDs. Let them intentionally make incorrect connections and discover why a circuit works or fails before constructing the real circuit.

(2) Gamified "Escape the Circuit" Challenge:
Create a classroom game in which teams solve successive circuit puzzles—identify a broken circuit, select the correct conductor, determine LED polarity, and interpret circuit symbols. Each correct solution provides a clue for the next level. The chapter specifically develops reasoning about complete circuits and current flow.

(3) Design-a-Switch Innovation Challenge:
Instead of merely demonstrating a switch, challenge students to invent a simple switch using low-cost materials such as cardboard, drawing pins, paper clips or safety pins. Students can compare their designs and explain how each completes or breaks the circuit.

(4) "Mystery Material" Conductivity Challenge:
Give groups several unidentified everyday materials and ask them to **predict → test → classify** each as a conductor or insulator using a student-made tester. Students earn points not merely for correct predictions but for scientifically explaining their observations. This innovatively extends the chapter's conductivity-testing activity.

(5) Circuit Doctor – Diagnose and Repair:
Provide students with deliberately faulty circuits containing problems such as an open switch, incorrect LED polarity, poor connection, exhausted cell or broken filament. Students act as **"Circuit Doctors"**, diagnose the fault and propose a solution. This directly develops the enquiry and troubleshooting skills encouraged in the chapter.

(6) Student Circuit Innovation Fair:
Groups can design simple working models using cells, LEDs, switches and safe low-voltage components—for example, a **mini traffic signal, model-house lighting system, quiz buzzer/light, emergency light or illuminated greeting card**. Students should also draw the circuit diagram corresponding to their model, connecting innovation with the chapter's use of standard circuit symbols.

(7) Renewable-Energy Innovation – Solar Toy Challenge:
Students can explore how a small solar panel can replace a cell as the source of electrical energy and operate a toy fan. They can investigate what happens under different lighting conditions and propose other small solar-powered models. The chapter itself introduces a solar-panel-and-toy-fan exploratory project.

(8) QR-Code / Digital Learning Stations:
Set up learning stations around the classroom with QR codes leading to teacher-prepared animations, short quizzes, circuit diagrams or challenge questions. Students rotate through stations covering **cells and batteries, LED polarity, switches, circuits, conductors and insulators**.

(9) "Invent for Society" Design-Thinking Activity:

Present a problem such as: *"There is a power failure at night. Design a simple battery-operated lighting solution."* Students follow **Identify Problem → Imagine → Design → Build → Test → Improve**. This connects well with the chapter's exploration of how daily life is affected when electricity supply is disrupted.

(10) AI-Assisted Circuit Quiz and Error Analysis:
Under teacher supervision, students can use an AI-based learning tool to generate simple circuit situations, predict whether the lamp/LED will glow, and then experimentally verify the answers. More importantly, students should identify and correct any incorrect AI explanation, developing **AI literacy along with scientific reasoning**.

Recommended five for the "Innovations" column:
For a school lesson plan or academic documentation, the strongest five can be recorded as:
Virtual Circuit Laboratory; Gamified "Escape the Circuit" Challenge; Circuit Doctor – Diagnose and Repair; Student Circuit Innovation Fair; and Renewable-Energy Solar Toy Challenge.
These innovations shift the learning approach from **Observe → Remember** to **Explore → Design → Experiment → Diagnose → Innovate**.

3.17: Practicing Questions/Question Bank

A. Fill in the Blanks:

1. An electric cell is a portable source of __________ energy.
   Answer: Electrical

2. An electric cell has __________ terminals.
   Answer: Two

3. The metal cap of an electric cell is its __________ terminal.
   Answer: Positive

4. The flat metal disc of an electric cell is its __________ terminal.
   Answer: Negative

5. A combination of two or more cells is called a __________.
   Answer: Battery

6. The thin wire that glows inside an incandescent lamp is called the __________.
   Answer: Filament

7. LED stands for __________.
   Answer: Light Emitting Diode

8. The longer wire of an LED is connected to its __________ terminal.
   Answer: Positive

9. Electric current can pass through an LED in __________ direction only.
   Answer: One

10. A complete path through which electric current flows is called an electrical __________.
    Answer: Circuit

11. A switch in the ON position makes the circuit __________.
    Answer: Closed

12. A switch in the OFF position makes the circuit __________.
    Answer: Open

13. The direction of electric current is taken from the __________ terminal to the __________ terminal of a cell.
    Answer: Positive; negative

14. The representation of an electrical circuit using symbols is called a __________.
    Answer: Circuit diagram

15. Materials through which electric current can flow easily are called __________.
    Answer: Conductors

16. Plastic, rubber and ceramics are electrical __________.
    Answer: Insulators

17. __________ is mainly used for making electrical wires because of its comparatively lower cost and abundant supply.
    Answer: Copper

18. Electricity supplied by batteries to small devices is generally called __________ current.
    Answer: Direct Current (DC)

The chapter explains that metals are generally conductors, while materials such as plastic, rubber and ceramics are insulators used for electrical safety.

B. One-Mark Descriptive Questions:

1. **What is an electric cell?**
   Answer: An electric cell is a portable source of electrical energy.

2. **Name the two terminals of an electric cell.**
   Answer: Positive terminal and negative terminal.

3. **What is a battery?**
   Answer: A combination of two or more cells connected together is called a battery.

4. **What is the filament of a lamp?**
   Answer: The thin wire inside an incandescent lamp that gets hot and glows is called the filament.

5. **What is an LED?**
   Answer: An LED is a Light Emitting Diode that emits light when current passes through it in the correct direction.

6. **How can you identify the positive terminal of an LED?**
   Answer: The longer wire of an LED is its positive terminal.

7. **What is an electrical circuit?**
   Answer: An electrical circuit is a complete path through which electric current can flow.

8. **What is a fused lamp?**
   Answer: An incandescent lamp with a broken filament is usually called a fused lamp.

9. **What is an electric switch?**
   Answer: An electric switch is a device that completes or breaks an electrical circuit.

10. **What is a closed circuit?**
    Answer: A circuit having a complete path for electric current to flow is called a closed circuit.
11. **What is an open circuit?**
    Answer: A circuit having a gap that prevents the flow of current is called an open circuit.
12. **What is a circuit diagram?**
    Answer: A representation of an electrical circuit using symbols is called a circuit diagram.
13. **What is an electrical conductor?**
    Answer: A material through which electric current can flow easily is called a conductor.
14. **What is an electrical insulator?**
    Answer: A material through which electric current cannot pass is called an insulator.
15. **Give two examples of electrical insulators.**
    Answer: Rubber and plastic are electrical insulators.

The chapter emphasizes that an LED has polarity and permits current in only one direction, unlike the incandescent lamp connection described in the chapter.

C. Two-Mark Descriptive Questions:

1. Differentiate between a cell and a battery.

Answer:

- An electric cell is a portable source of electrical energy.
- A combination of two or more cells connected together is called a battery.

2. How are two cells connected to form a battery?

Answer:

- The positive terminal of one cell is connected to the negative terminal of the next cell.
- Two or more cells connected in this manner form a battery.

3. Why does an incandescent lamp glow?

Answer:

- Electric current passes through the filament of the lamp.
- The filament becomes hot and glows, producing light.

4. Why does a fused incandescent lamp not glow?

Answer:

- In a fused lamp, the filament is usually broken.
- The broken filament stops the flow of current through the lamp.

5. State two differences between an LED and an incandescent lamp.

Answer:

- An LED does not have a filament, whereas an incandescent lamp has a filament.

- Current can pass through an LED in only one direction, whereas the incandescent lamp can work with either terminal connected to the positive terminal of the cell.

6. What happens when a switch is in the ON and OFF positions?

Answer:

- In the ON position, the switch completes the circuit and allows current to flow.
- In the OFF position, it breaks the circuit and prevents current from flowing.

7. Why are electrical wires generally made of metal and covered with plastic?

Answer:

- Metals conduct electricity and therefore allow current to flow.
- Plastic is an insulator and helps protect people from electric shocks.

8. Why is copper commonly used for electrical wires?

Answer:

- Copper is a good conductor of electricity.
- It is comparatively less expensive and abundantly available.

9. Mention two electrical safety precautions.

Answer:

- Never touch electrical switches or plugs with wet hands.
- Never use equipment with damaged insulation or broken plugs.

10. Why are standard symbols used in circuit diagrams?

Answer:

- Symbols make electrical circuits easier to draw and understand.
- Standard symbols help people in different countries and industries understand circuit diagrams uniformly.

D. Three-Mark Descriptive Questions:

1. Explain the structure of an electric cell.

Answer:

1. An electric cell has two terminals.
2. The protruding metal cap is its positive terminal.
3. The flat metal disc is its negative terminal.

2. Explain how an incandescent lamp produces light.

Answer:

1. An incandescent lamp contains a thin wire called a filament.

2. Electric current passes through the filament when the circuit is complete.
3. The filament becomes hot and glows, producing light.

3. Explain the correct way to connect an LED to a battery.

Answer:

1. Identify the longer wire of the LED as its positive terminal.
2. Connect it to the positive terminal of the battery and connect the shorter LED wire to the negative terminal.
3. Current then passes through the LED and it glows.

4. Explain the working of an electric switch.

Answer:

1. A switch controls whether the electrical circuit is complete or broken.
2. In the ON position, the circuit is closed and current flows.
3. In the OFF position, the circuit is open and current cannot flow.

5. Explain how you can test whether a material is a conductor or an insulator.

Answer:

1. Make a tester using a cell, lamp and connecting wires with two free ends.
2. Place the material to be tested between the free ends.
3. If the lamp glows, the material is a conductor; if it does not, the material is an insulator.

6. Explain the importance of conductors and insulators in electrical appliances.

Answer:

1. Conductors such as metals are used in wires, switches, plugs and sockets.
2. Insulators such as rubber, plastic and ceramics are used to cover electrical parts.
3. Insulators help protect users from electric shocks.

7. Why may a lamp fail to glow even when connected to a cell?

Answer:

1. The circuit may be incomplete or a connection may be loose.
2. The cell may not be working properly.
3. The lamp may be fused because its filament is broken.

8. Differentiate between Direct Current (DC) and Alternating Current (AC).

Answer:

1. Electricity from batteries is generally Direct Current (DC).
2. DC commonly powers small devices.

3. Electricity supplied from power plants to wall sockets is Alternating Current (AC) and can run larger appliances.

E. Five-Mark Descriptive Questions:

1. Describe the main components of a simple electrical circuit and explain how it works.

Answer:

1. A simple circuit may contain an electric cell or battery, connecting wires, a lamp and a switch.
2. The cell or battery acts as the source of electrical energy.
3. Connecting wires provide a path for electric current.
4. When the switch is ON, the circuit is complete and current passes through the lamp.
5. When the switch is OFF, the circuit is broken and the lamp does not glow.

2. Explain the structure and working of an incandescent lamp.

Answer:

1. An incandescent lamp contains a thin wire called the filament inside a glass bulb.
2. The filament is connected to two thicker supporting wires.
3. One thick wire connects to the metal case and the other to the metal tip at the base.
4. When current passes through the filament, it becomes hot.
5. The hot filament glows and produces light.

3. Explain LEDs and how they are connected in an electrical circuit.

Answer:

1. LED stands for Light Emitting Diode.
2. Unlike an incandescent lamp, an LED does not have a filament.
3. Its longer wire is the positive terminal and its shorter wire is the negative terminal.
4. Current can pass through an LED in only one direction.
5. Therefore, the positive LED terminal must be connected to the positive battery terminal and the negative LED terminal to the negative battery terminal for it to glow.

4. Explain conductors and insulators with their uses and examples.

Answer:

1. Conductors are materials through which electric current can flow easily.
2. Metals such as copper, silver and gold are good electrical conductors.
3. Insulators are materials through which electric current cannot pass.
4. Plastic, rubber and ceramics are examples of electrical insulators.

5. Conductors are used for carrying current, while insulators cover electrical parts to protect people from electric shocks.

5. Describe an experiment to identify whether different materials are conductors or insulators.

Answer:

1. Connect an electric cell and a lamp using wires, leaving two wire ends free.
2. First touch the free ends together to ensure that the tester works.
3. Place different objects, such as a metal key, plastic scale, rubber eraser, glass bangle or pencil lead, between the free wire ends.
4. Observe whether the lamp glows for each material.
5. Materials that allow the lamp to glow are classified as conductors, while those that do not are classified as insulators.

6. Explain five important safety measures while using electricity.

Answer:

1. Never perform experiments using electricity from wall sockets.
2. Use only cells or batteries for classroom experiments.
3. Never touch switches or plugs with wet hands.
4. Never use electrical appliances in wet areas.
5. Never handle equipment with damaged insulation or broken plugs.

These questions provide a balanced **Grade 7 question bank**, progressing from factual recall through explanation, comparison, experimentation, circuit reasoning, and practical application.

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7th Standard Science Book Chapter 4

Chapter 4: The World of Metals and Non-metals

4.1 Summary of the Chapter:

Summary – Chapter 4: ***The World of Metals and Non-metals***

(1) **Metals and non-metals have different physical properties.** Metals such as iron, copper, and aluminium are generally hard and lustrous, while non-metals such as sulfur and coal are generally dull and comparatively softer. However, exceptions exist: sodium and potassium are soft metals, while mercury is liquid at room temperature.

(2) **Malleability** is the property by which a material can be beaten into thin sheets. Most metals are malleable, while substances such as coal and sulfur are brittle and break when hammered. Gold and silver are among the most malleable metals.

(3) **Ductility** is the ability of a material to be drawn into wires. Metals such as copper and aluminium are ductile and are therefore widely used for electrical wires, ornaments, musical instruments, and other applications.

(4) **Metals are sonorous**, meaning that they produce a ringing sound when struck or dropped. This property explains the characteristic sound produced by metal bells, coins, plates, and ghungroos.

(5) **Metals are generally good conductors of heat.** Heat passes through a metal spoon much more easily than through a wooden spoon. Hence, cooking vessels are usually made of metals, while their handles are made of materials that conduct heat poorly.

(6) **Metals are also good conductors of electricity.** Aluminium, iron, and copper allow electric current to pass through them, whereas materials such as sulfur, wood, rubber, stone, and nylon are poor conductors. This is why rubber gloves and plastic-covered tools help protect electricians from electric shock.

(7) **Iron rusts when exposed to both air and water.** The reddish-brown deposit formed on iron is called **rust**, and the process is known as **rusting**. The chapter's experiment with three bottles demonstrates that both air and water are necessary for rusting.

(8) **Corrosion** is the gradual deterioration of metal surfaces due to air, water, or other substances. Rusting can be reduced or prevented through methods such as **painting, oiling, greasing, and galvanisation** with zinc.

(9) **Metals generally form basic oxides when they react with oxygen.** For example, magnesium burns in air with a dazzling white flame to form magnesium oxide, whose solution turns red litmus blue, showing its basic nature.

(10) **Non-metals behave differently from metals.** Sulfur burns in oxygen to form sulfur dioxide, which forms sulfurous acid when dissolved in water. Non-metals are generally non-lustrous, non-malleable, non-ductile, non-sonorous, and poor conductors of heat and electricity; their oxides are generally acidic.

(11) **Metals and non-metals are categories of elements.** An element is a substance that cannot be broken down into simpler substances. The chapter states that 118 elements are presently known and that they form the basic building blocks of matter.

(12) **Both metals and non-metals are essential in everyday life.** Oxygen is necessary for respiration, carbon is a basic component of living organisms, nitrogen is important in fertilisers, chlorine is used for water purification, and iodine solution is used as an antiseptic. Metals and their alloys are important in utensils, tools, industries, aerospace, and modern technologies.

4.2 Important Formulas:

This Grade 7 chapter is **mainly conceptual and experimental**. It does **not introduce mathematical formulas for solving numerical/quantitative problems**. Instead, students need to understand a few important **reaction relationships and chemical equations** connected with metals and non-metals. The chapter emphasizes properties such as malleability, ductility, sonority, and conductivity rather than numerical calculations.

No.	Concept	Important Formula / Equation
1	General reaction of a metal with oxygen	**Metal + Oxygen → Metal oxide**
2	Magnesium reacting with oxygen	**$2Mg + O_2 \rightarrow 2MgO$**
3	Magnesium oxide with water	**$MgO + H_2O \rightarrow Mg(OH)_2$**
4	Nature of metal oxides	**Metal oxide + Water → Basic solution**
5	General reaction of a non-metal with oxygen	**Non-metal + Oxygen → Non-metal oxide**
6	Sulfur burning in oxygen	**$S + O_2 \rightarrow SO_2$**
7	Sulfur dioxide dissolving in water	**$SO_2 + H_2O \rightarrow H_2SO_3$** (Sulfurous acid)
8	Nature of non-metal oxides	**Non-metal oxide + Water → Acidic solution**
9	Condition necessary for rusting	**Iron + Oxygen + Water → Rust**
10	Simplified representation of rusting	**$Fe + O_2 + H_2O \rightarrow$ Hydrated iron oxide (rust)**

The chapter specifically demonstrates that magnesium burns with a dazzling white flame and forms magnesium oxide; the resulting solution is basic. It also explains that sulfur burns in oxygen to produce sulfur dioxide, which forms sulfurous acid when dissolved in water.

Key relationships to remember:

For Metals:

Metal + Oxygen → Metal Oxide → Generally Basic

For Non-metals:

Non-metal + Oxygen → Non-metal Oxide → Generally Acidic

For Rusting:

Iron + Air (Oxygen) + Water/Moisture → Rust

The experiment in the chapter establishes that **both air and water are necessary for iron to rust**; dry air alone or water without access to air does not produce the brown rust deposit under the experimental conditions.

Important point for the Question Bank

Since **Chapter 4 does not contain mathematical formulas or conventional numerical problems**, it would be better **not to artificially create quantitative formula-based questions** for Grade 7. Instead, numerical/application questions can be framed around information given in the chapter—for example, the fact that **1 gram of gold can be drawn into a 2 km long wire** or that the **Iron Pillar of Delhi is about 8 m high, weighs more than 6000 kg, and is over 1600 years old**.

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

The following questions are based directly on the concepts, terminology, experiments, and examples given in the chapter.

1. Materials like copper, aluminium, and iron are known as __________.
   Answer: Metals

2. The shine shown by metals is known as metallic __________.
   Answer: Lustre
3. The property by which materials can be beaten into thin sheets is called __________.
   Answer: Malleability
4. __________ and silver are the most malleable metals.
   Answer: Gold
5. Coal and sulfur break into pieces when hammered and are therefore called __________.
   Answer: Brittle
6. The property by which a material can be drawn into wires is called __________.
   Answer: Ductility
7. One gram of gold can be drawn into a wire about __________ kilometres long.
   Answer: 2
8. The property of metals that enables them to produce a ringing sound is called __________.
   Answer: Sonority
9. Metals that produce a ringing sound are said to be __________ in nature.
   Answer: Sonorous
10. The transfer of heat from one point to another through a material is called __________.
    Answer: Conduction
11. Metals are generally good conductors of __________ and electricity.
    Answer: Heat
12. Wood is a __________ conductor of heat.
    Answer: Poor
13. Aluminium, iron, and __________ allow electricity to pass through them easily.
    Answer: Copper
14. Rubber gloves protect electricians from electric shock because rubber is a __________ conductor of electricity.
    Answer: Poor
15. The brown deposit formed on iron objects is called __________.
    Answer: Rust
16. The process of formation of rust on iron objects is called __________.
    Answer: Rusting
17. Both __________ and air are essential for rusting of iron.
    Answer: Water
18. The gradual deterioration of metal surfaces caused by air, water, or other substances is called __________.
    Answer: Corrosion
19. Applying a protective layer of zinc on iron is called __________.
    Answer: Galvanisation
20. Magnesium ribbon burns with a dazzling __________ flame.
    Answer: White
21. When magnesium burns in oxygen, a white powder called __________ is formed.
    Answer: Magnesium oxide
22. Metal oxides are generally __________ in nature.
    Answer: Basic
23. Sodium is stored in __________ to prevent its exposure to moisture and air.
    Answer: Kerosene

24. When sulfur burns in oxygen, __________ gas is formed.
    Answer: Sulfur dioxide
25. Sulfur dioxide dissolves in water to form __________ acid.
    Answer: Sulfurous
26. Non-metal oxides are generally __________ in nature.
    Answer: Acidic
27. __________ is stored in water because it catches fire when exposed to atmospheric air.
    Answer: Phosphorus
28. An __________ is a substance that cannot be broken down into simpler substances.
    Answer: Element
29. Presently, __________ elements are known.
    Answer: 118
30. __________ is a non-metal essential for respiration.
    Answer: Oxygen
31. __________ is the basic building block of all life forms.
    Answer: Carbon
32. __________ is used in the manufacture of fertilisers and is an essential nutrient for plant growth.
    Answer: Nitrogen
33. __________ is a non-metal commonly used in water purification.
    Answer: Chlorine
34. A solution of __________ is applied to wounds as an antiseptic.
    Answer: Iodine
35. A mixture of two or more metals, or a metal and a non-metal, is called an __________.
    Answer: Alloy
36. __________ is a special metal used in aerospace applications.
    Answer: Titanium
37. __________ is used in atomic energy applications.
    Answer: Zirconium
38. In India, metals such as iron and __________ are recycled to minimise waste.
    Answer: Aluminium
39. Mercury is a metal that exists in the __________ state at room temperature.
    Answer: Liquid
40. Sodium and potassium are so __________ that they can be cut with a knife.
    Answer: Soft

These questions are deliberately kept at the **LOTS level**, focusing mainly on **recall, recognition, definitions, properties, examples, and basic factual understanding** from Chapter 4.

4.4 Fill-Up the Blank HOTS type questions with Answers: (40 Questions)

The following questions require students to **apply, analyse, predict, infer, and reason** using the concepts and experiments given in the uploaded chapter.

1. A metal is beaten repeatedly with a hammer and changes into a thin sheet without breaking. The property demonstrated is __________.
   Answer: Malleability

2. If a material breaks into pieces instead of flattening when hammered, it can be inferred that the material is __________.
   Answer: Brittle
3. If a material can be converted into a very long, thin wire, it must possess the property of __________.
   Answer: Ductility
4. A jeweller wants a metal that can be made into extremely thin sheets and fine wires. A suitable choice would be __________.
   Answer: Gold
5. If a student drops an unknown object and it produces a clear ringing sound, the property being demonstrated is __________.
   Answer: Sonority
6. A cooking vessel is made of metal, but its handle is made of wood because wood is a __________ conductor of heat.
   Answer: Poor
7. If metal and wooden spoons are placed in the same hot water for equal periods, the upper end of the __________ spoon will become hotter.
   Answer: Metal
8. A manufacturer wants to make a pan that transfers heat efficiently. Between copper and wood, __________ should be selected.
   Answer: Copper
9. If a material placed in an electric tester makes the bulb glow, it can be classified as a __________ conductor of electricity.
   Answer: Good
10. An electrician uses a screwdriver with a plastic-covered handle mainly to reduce the risk of __________.
    Answer: Electric shock
11. An iron nail kept in completely dry air does not rust because __________ is absent.
    Answer: Water/moisture
12. An iron nail kept in contact with both air and water develops a brown deposit called __________.
    Answer: Rust
13. In the rusting experiment, Bottle C develops rust because the nail comes into contact with both __________ **and** __________.
    Answer: Air and water
14. If an iron gate is regularly painted, its rusting is reduced because the paint prevents direct contact with __________ **and** __________.
    Answer: Air and water
15. An iron object coated with zinc is protected from rusting by a process called __________.
    Answer: Galvanisation
16. If an iron tool is kept continuously in moist surroundings without protection, it is likely to undergo __________.
    Answer: Corrosion
17. In the experiment on rusting, silica gel is placed in Bottle A so that the air remains __________.
    Answer: Dry
18. In Bottle B, a layer of oil is poured over boiled and cooled water mainly to prevent __________ from dissolving in the water.
    Answer: Air

19. If only air were sufficient for rusting, the nail placed with silica gel in Bottle A should have developed __________.
Answer: Rust/brown deposits
20. A magnesium ribbon burns to form a white powder. If its solution turns red litmus blue, the solution must be __________ in nature.
Answer: Basic
21. Since magnesium is a metal and magnesium oxide is basic, we can infer that metal oxides are generally __________ in nature.
Answer: Basic
22. Sodium is stored in kerosene because kerosene prevents it from coming into contact with __________ **and** __________.
Answer: Air and moisture/water
23. When sulfur burns in air and the resulting gas is dissolved in water, the solution will be __________ in nature.
Answer: Acidic
24. If sulfur dioxide is dissolved in water, the substance formed is __________.
Answer: Sulfurous acid
25. If a substance is dull, non-malleable, non-ductile and a poor conductor of heat and electricity, it is most likely a __________.
Answer: Non-metal
26. Phosphorus should not be stored openly in air because it may __________.
Answer: Catch fire
27. From the behaviour of magnesium oxide and sulfur dioxide in water, we can infer that metal oxides are generally basic while non-metal oxides are generally __________.
Answer: Acidic
28. A farmer wants to supply an essential nutrient that promotes plant growth. Fertilisers containing __________ would be useful.
Answer: Nitrogen
29. If drinking water needs purification using a non-metal mentioned in the chapter, __________ may be used.
Answer: Chlorine
30. If a person gets a minor wound and uses the non-metal-based antiseptic mentioned in the chapter, the solution contains __________.
Answer: Iodine
31. Steel ropes are suitable for suspension bridges and cranes because they can support __________ loads.
Answer: Heavy
32. If a material is required for electrical wiring, __________ is more suitable than sulfur because it conducts electricity and can be drawn into wires.
Answer: Copper
33. If an object must produce a ringing sound, a __________ material would generally be preferred over wood.
Answer: Metallic/metal
34. If copper develops a green coating and silver develops a black coating after exposure to the atmosphere, these changes are examples of __________.
Answer: Corrosion
35. Recycling iron and aluminium instead of discarding them helps minimise __________ and contributes to sustainability.
Answer: Waste

Additional Challenging HOTS Fill-Ups:

36. A material is shiny and conducts electricity but cannot be assumed to be a metal based on only one observation; therefore, classification should be based on its __________ properties.
Answer: Multiple/different
37. If sulfur were used instead of zinc as a coating on iron, it would not necessarily be suitable merely because sulfur does not react with water; the coating must effectively __________ the iron from its surroundings.
Answer: Protect/isolate
38. If an iron nail is kept away from moisture, the chances of __________ are greatly reduced.
Answer: Rusting
39. A student observes that an unknown oxide turns red litmus blue. Based on the chapter's generalisation, the original element is likely to be a __________.
Answer: Metal
40. Another oxide forms a solution that is acidic. Based on the general pattern discussed in the chapter, the element producing it is likely to be a __________.
Answer: Non-metal

4.5 One-mark questions with Answers of LOTS Type: (40 Questions)

The following questions are **LOTS (Lower Order Thinking Skills)** questions focusing mainly on remembering and understanding the basic concepts presented in the chapter.

1. **What is metallic lustre?**
Answer: The shiny appearance shown by metals is called metallic lustre.
2. **What is malleability?**
Answer: Malleability is the property by which a material can be beaten into thin sheets.
3. **Name two highly malleable metals.**
Answer: Gold and silver are the most malleable metals.
4. **What is meant by brittleness?**
Answer: Brittleness is the tendency of a material to break into pieces when hammered.
5. **Name two brittle substances mentioned in the chapter.**
Answer: Coal and sulfur are brittle substances.
6. **What is ductility?**
Answer: Ductility is the property by which a material can be drawn into wires.
7. **Name two metals commonly used for making electrical wires.**
Answer: Copper and aluminium are commonly used for making electrical wires.
8. **How long a wire can be drawn from one gram of gold?**
Answer: One gram of gold can be drawn into a wire about 2 kilometres long.
9. **What is sonority?**
Answer: Sonority is the property of metals by which they produce a ringing sound.
10. **What type of sound is produced by coal and wood when dropped?**
Answer: Coal and wood produce dull sounds when dropped.
11. **What is conduction of heat?**
Answer: Conduction is the transfer of heat from one point to another through a material.
12. **Are metals good or poor conductors of heat?**
Answer: Metals are generally good conductors of heat.

13. **Why are metal vessels commonly used for cooking?**
    Answer: Metal vessels are used for cooking because metals are good conductors of heat.
14. **Why are wooden materials used for the handles of cooking vessels?**
    Answer: Wood is used for handles because it is a poor conductor of heat.
15. **What is a good conductor of electricity?**
    Answer: A material that allows electricity to flow through it easily is called a good conductor of electricity.
16. **Name three metals that conduct electricity.**
    Answer: Aluminium, iron, and copper conduct electricity.
17. **Why are rubber gloves used by electricians?**
    Answer: Rubber gloves protect electricians from electric shock because rubber is a poor conductor of electricity.
18. **What is rust?**
    Answer: Rust is the brown deposit that develops on iron objects in the presence of moist air.
19. **What is rusting?**
    Answer: The process of formation of rust on iron objects is called rusting.
20. **What conditions are necessary for the rusting of iron?**
    Answer: Both air and water are necessary for the rusting of iron.
21. **What is corrosion?**
    Answer: Corrosion is the gradual deterioration of metal surfaces caused by air, water, or other substances.
22. **Mention any two methods used to prevent rusting of iron.**
    Answer: Painting and oiling are two methods used to prevent rusting of iron.
23. **What is galvanisation?**
    Answer: Galvanisation is the process of applying a protective layer of zinc metal on iron to prevent rusting.
24. **What happens when magnesium ribbon burns in air?**
    Answer: Magnesium ribbon burns with a dazzling white flame and forms a white powder.
25. **What is the white powder formed when magnesium burns in air?**
    Answer: The white powder formed when magnesium burns in air is magnesium oxide.
26. **What is the nature of magnesium oxide solution?**
    Answer: Magnesium oxide solution is basic in nature.
27. **What is the general nature of metal oxides?**
    Answer: Metal oxides are generally basic in nature.
28. **Why is sodium stored in kerosene?**
    Answer: Sodium is stored in kerosene because it reacts vigorously with oxygen and water.
29. **Which gas is formed when sulfur burns in air?**
    Answer: Sulfur dioxide gas is formed when sulfur burns in air.
30. **What is formed when sulfur dioxide dissolves in water?**
    Answer: Sulfurous acid is formed when sulfur dioxide dissolves in water.
31. **What is the general nature of non-metal oxides?**
    Answer: Non-metal oxides are generally acidic in nature.
32. **Why is phosphorus stored in water?**
    Answer: Phosphorus is stored in water because it catches fire when exposed to atmospheric air.

33. **What is an element?**
    Answer: An element is a substance that cannot be broken down into simpler substances.
34. **How many elements are presently known?**
    Answer: Presently, 118 elements are known.
35. **Name any four non-metals mentioned in the chapter.**
    Answer: Oxygen, hydrogen, nitrogen, and carbon are examples of non-metals.
36. **Which non-metal is essential for respiration?**
    Answer: Oxygen is the non-metal essential for respiration.
37. **Why is carbon important for living organisms?**
    Answer: Carbon is important because it is a basic building block of all life forms.
38. **Which non-metal is used in the manufacture of fertilisers?**
    Answer: Nitrogen is used in the manufacture of fertilisers.
39. **Which non-metal is commonly used for water purification?**
    Answer: Chlorine is commonly used for water purification.
40. **Which non-metal is used as an antiseptic on wounds?**
    Answer: Iodine in solution form is used as an antiseptic on wounds.

4.6 One-mark questions with Answers of HOTS Type: (36 Questions)

The following **HOTS (Higher Order Thinking Skills)** questions require students to **apply, analyse, predict, infer, compare, or give reasons** based on concepts from the chapter.

1. **A metal piece becomes flat when hammered instead of breaking; what can you infer about it?**
   Answer: The material is malleable because it can be beaten into a thin sheet.
2. **Why can aluminium be used to make thin foils for wrapping food?**
   Answer: Aluminium is malleable and can therefore be converted into thin sheets.
3. **A substance breaks into small pieces when hammered; what property does it show?**
   Answer: The substance shows brittleness because brittle materials break into pieces on hammering.
4. **Why cannot sulfur be used for making thin sheets like aluminium?**
   Answer: Sulfur is brittle and non-malleable, so it breaks instead of forming sheets.
5. **Why are copper and aluminium suitable for making electrical wires?**
   Answer: Copper and aluminium are ductile and can be drawn into thin wires.
6. **Why cannot coal be used to make wires?**
   Answer: Coal cannot be made into wires because it is a non-metal and is not ductile.
7. **Why are steel-wire ropes suitable for suspension bridges?**
   Answer: Steel-wire ropes are suitable for suspension bridges because they can support heavy loads.
8. **A school bell produces a ringing sound when struck; what property of its material does this demonstrate?**
   Answer: It demonstrates sonority, a characteristic property of metals.
9. **If a metal coin and a piece of wood are dropped on the floor, how can you distinguish them by sound?**
   Answer: The metal coin produces a ringing sound whereas the wood produces a dull sound.
10. **Why is metal preferred over wood for the body of a cooking vessel?**
    Answer: Metal is preferred because it conducts heat efficiently whereas wood is a poor conductor.

11. **Why should the handle of a hot cooking vessel not be made entirely of metal?**
    Answer: A metal handle would conduct heat and become hot, making it unsafe to hold.
12. **Two similar spoons, one metal and one wooden, are placed in hot water; which will become hotter at the upper end and why?**
    Answer: The metal spoon will become hotter because metal is a better conductor of heat than wood.
13. **A material makes the bulb glow when inserted into a tester circuit; what can you infer?**
    Answer: The material is a good conductor of electricity.
14. **Why are screwdriver handles covered with plastic?**
    Answer: Plastic is a poor conductor of electricity and therefore helps protect the user from electric shock.
15. **Why should an electrician prefer rubber gloves rather than metal-coated gloves?**
    Answer: Rubber is a poor conductor of electricity and reduces the risk of electric shock.
16. **An iron nail is kept in completely dry air; will it rust? Give a reason.**
    Answer: No, it will not rust because both air and water are required for rusting.
17. **An iron nail is exposed to both air and water; what change would you predict after several days?**
    Answer: A brown deposit of rust will develop on the nail.
18. **Why does an iron nail kept with silica gel not rust?**
    Answer: Silica gel keeps the air dry by removing moisture, thereby preventing rusting.
19. **Why is a layer of oil placed over boiled water in the rusting experiment?**
    Answer: The oil layer prevents air from dissolving in the water and reaching the iron nail.
20. **Why does painting an iron gate help it last longer?**
    Answer: Painting prevents iron from coming into direct contact with air and water and thereby reduces rusting.
21. **Why is galvanisation useful for iron objects?**
    Answer: Galvanisation protects iron from rusting by covering it with a protective layer of zinc.
22. **A copper object develops a green coating after prolonged exposure to the atmosphere; what process does this indicate?**
    Answer: The formation of the coating indicates corrosion of the copper surface.
23. **Why is rusting considered an economic problem?**
    Answer: Rusting damages iron structures and requires money to repair or replace them.
24. **What can you infer from the Iron Pillar of Delhi having barely any rust even after more than 1600 years?**
    Answer: It indicates the advanced metal technology and rust-resistant craftsmanship developed in ancient India.
25. **Magnesium oxide solution turns red litmus blue; what can you conclude about it?**
    Answer: Magnesium oxide solution is basic in nature.
26. **If an unknown substance is a metal and forms an oxide with oxygen, what nature would you generally predict for its oxide?**
    Answer: Its oxide would generally be basic in nature.

27. **Why should sodium not be stored in an open container?**
    Answer: Sodium reacts vigorously with oxygen and water and therefore must be protected from air and moisture.
28. **Sulfur dioxide dissolved in water produces a solution that affects litmus like an acid; what can you infer?**
    Answer: The solution is acidic because sulfur dioxide forms sulfurous acid when dissolved in water.
29. **Why is phosphorus stored in water while sodium is stored in kerosene?**
    Answer: Phosphorus is stored in water because it catches fire in air, whereas sodium is stored in kerosene to prevent contact with both air and moisture.
30. **If a substance is dull, non-malleable, non-ductile and a poor conductor, how would you classify it?**
    Answer: It would generally be classified as a non-metal.
31. **Why should plastic not automatically be classified as a non-metal even though it is a poor conductor?**
    Answer: Plastic is not classified as a non-metal because it is not an element.
32. **Why would copper be a better choice than wood for a vessel used to boil water?**
    Answer: Copper is a good conductor of heat and therefore transfers heat to the water efficiently.
33. **Why is nitrogen indirectly important for food production?**
    Answer: Nitrogen is used in fertilisers and is an essential nutrient for plant growth.
34. **Why is chlorine useful in maintaining safe water supplies?**
    Answer: Chlorine is useful because it is commonly used for water purification.
35. **Why does recycling iron and aluminium contribute to sustainability?**
    Answer: Recycling these metals minimises waste and allows useful metal resources to be reused.
36. **An ironsmith heats iron before hammering it into a tool; why is heating useful?**
    Answer: Heating makes the iron easier to shape by hammering into the required form, as illustrated by the ironsmith example in the chapter.

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

1. What is malleability? Give one example of its use.
Answer:
1. Malleability is the property by which a material can be beaten into thin sheets.
2. Aluminium is made into thin foil for wrapping food because of its malleability.

2. What is meant by metallic lustre? Name two metals that show it.
Answer:
1. The shiny appearance shown by metals is called metallic lustre.
2. Copper and aluminium are examples of metals that show metallic lustre.

3. Are all metals hard and solid? Give two exceptions.
Answer:
1. No, all metals are not necessarily hard and solid.
2. Sodium and potassium are soft, while mercury is liquid at room temperature.

4. What are brittle materials? Give two examples.
Answer:
1. Materials that break into pieces when hammered are called brittle materials.
2. Coal and sulfur are examples of brittle materials.

5. What is ductility? Mention one use of this property.
Answer:

1. Ductility is the property by which a material can be drawn into wires.
2. This property allows metals such as copper and aluminium to be used in electrical wiring.

6. Mention any two uses of metal wires.
Answer:
1. Metal wires are used in electrical fittings and for making ornaments.
2. They are also used in stringed musical instruments such as the veena, sitar, violin and guitar.

7. What is sonority? Give one example.
Answer:
1. Sonority is the property of metals by which they produce a ringing sound when struck.
2. The ringing sound of a school bell is due to the sonority of metals.

8. What is conduction of heat? How do metals behave as heat conductors?
Answer:
1. Conduction is the transfer of heat from one point to another through a material.
2. Metals are generally good conductors of heat.

9. Why are metal vessels commonly used for cooking? Why are their handles often made of wood?
Answer:
1. Metal vessels are used because metals are good conductors of heat.
2. Their handles are often made of wood because wood is a poor conductor of heat.

10. What are good and poor conductors of electricity?
Answer:
1. Materials that allow electricity to flow through them easily are called good conductors of electricity.
2. Materials that do not allow electricity to pass through them easily are called poor conductors of electricity.

11. Name three good conductors and three poor conductors of electricity from the chapter.
Answer:
1. Aluminium, iron and copper are good conductors of electricity.
2. Sulfur, wood and rubber are examples of poor conductors of electricity.

12. State any two general properties of metals.
Answer:
1. Metals are generally hard, lustrous, malleable and ductile.
2. They are also generally good conductors of heat and electricity.

13. What is rust? What is rusting?
Answer:
1. The brown deposit formed on objects made of iron in the presence of moist air is called rust.
2. The process of formation of rust on iron objects is called rusting.

14. What two conditions are necessary for the rusting of iron?
Answer:
1. Water or moisture must be present for iron to rust.
2. Air must also be present, as both air and water are essential for rust formation.

15. What is corrosion? Mention two examples of corrosion mentioned in the chapter.
Answer:
1. Corrosion is the gradual deterioration of metal surfaces caused by air, water or other substances.

2. Examples include the green coating on copper objects and the black coating on silver objects.

16. Mention any two methods used to prevent rusting of iron.
Answer:
1. Rusting can be prevented by painting, oiling or greasing iron surfaces.
2. It can also be prevented by applying a protective layer of zinc, a process called galvanisation.

17. What happens when magnesium ribbon is burnt in air? What is the nature of the product formed?
Answer:
1. Magnesium burns with a dazzling white flame and forms a white powder called magnesium oxide.
2. Magnesium oxide is basic in nature and its solution turns red litmus blue.

18. Why is sodium stored in kerosene?
Answer:
1. Sodium reacts vigorously with oxygen and water and produces a large amount of heat.
2. It is therefore stored in kerosene to prevent its exposure to moisture and air.

19. What happens when sulfur burns in air and the resulting gas is dissolved in water?
Answer:
1. Sulfur burns in oxygen to form sulfur dioxide gas.
2. When sulfur dioxide dissolves in water, sulfurous acid is formed.

20. State any two general properties of non-metals.
Answer:
1. Non-metals are usually soft and dull, and they are neither malleable nor ductile.
2. They are generally non-sonorous and poor conductors of heat and electricity.

21. Name any four non-metals mentioned in the chapter.
Answer:
1. Oxygen and hydrogen are non-metals.
2. Nitrogen and carbon are also non-metals.

22. Mention two important uses of non-metals in everyday life.
Answer:
1. Nitrogen is used in manufacturing fertilisers, while chlorine is used for water purification.
2. Iodine solution is used as an antiseptic on wounds, while oxygen is essential for survival.

23. What is an element? How many elements are presently known?
Answer:
1. An element is a substance that cannot be broken down into simpler substances.
2. Presently, **118 elements** are known, and they form the basic building blocks of matter.

24. State two differences between metals and non-metals.
Answer:
1. Metals are generally lustrous, malleable and ductile, whereas non-metals generally do not possess these properties.
2. Metals are generally good conductors of heat and electricity, whereas non-metals are generally poor conductors.

25. State the general nature of oxides formed by metals and non-metals.
Answer:
1. Metals generally react with oxygen to form metal oxides that are basic in nature.
2. Non-metals generally react with oxygen to form oxides that are acidic in nature.

1. An ironsmith heats an iron piece before hammering it into the shape of an axe. Why does this help him?
Answer:
1. Heating makes the iron easier to shape when it is hammered.
2. Since iron is malleable, it can be beaten and shaped into the required form.

2. A student wants to make a very thin sheet from copper, sulfur and aluminium. Which materials should be selected and why?
Answer:
1. Copper and aluminium should be selected because they are malleable and become flat when hammered.
2. Sulfur should not be selected because it is brittle and breaks into pieces.

3. Why would coal be unsuitable for making electrical wires even if it could be shaped into a long piece?
Answer:
1. Coal is not ductile like metals and therefore cannot normally be drawn into wires.
2. It is also a poor conductor of electricity, making it unsuitable for electrical wiring.

4. A designer has to choose between copper and wood for making the strings of a musical instrument. Which should be chosen? Why?
Answer:
1. Copper should be chosen because metals are ductile and can be made into thin wires.
2. Metal wires are suitable for stringed musical instruments such as the veena, sitar, violin and guitar.

5. A school wants a bell that produces a clear ringing sound. Would wood be suitable? Justify your answer.
Answer:
1. Wood would not be suitable because it produces a dull sound when struck or dropped.
2. A metal should be used because metals are sonorous and produce a ringing sound.

6. Two identical spoons, one metal and one wooden, are placed in hot water. Predict which spoon will become hotter at its upper end and explain why.
Answer:
1. The upper end of the metal spoon will become hotter because heat travels through it efficiently.
2. The wooden spoon will remain comparatively cooler because wood is a poor conductor of heat.

7. Why is a cooking pan made of metal but its handle may be made of wood?
Answer:
1. Metal is suitable for the pan because it conducts heat efficiently to the food or water.
2. Wood is suitable for the handle because it conducts heat poorly and therefore reduces heat transfer to the hand.

8. An electrician accidentally uses a screwdriver with a completely metallic handle. Why could this be dangerous?
Answer:
1. Metals are good conductors and can allow electric current to pass through them.
2. Therefore, screwdriver handles are covered with poor conductors such as plastic to protect the electrician from electric shock.

9. In an electric tester, a copper wire makes the bulb glow but a rubber eraser does not. What can you conclude?
Answer:
1. Copper allows electricity to pass through it and is therefore a good conductor of electricity.

2. Rubber does not allow electricity to pass through easily and is therefore a poor conductor.

10. An iron nail is kept in dry air and another is exposed to moist air. Which one is more likely to rust? Why?

Answer:

1. The nail exposed to moist air is more likely to rust because both air and water are available.
2. The nail in dry air will not develop rust because water or moisture is absent.

11. In the rusting experiment, why is a layer of oil poured over freshly boiled and cooled water?

Answer:

1. Boiling removes dissolved gases from the water, while the oil layer prevents air from dissolving in it again.
2. This arrangement helps demonstrate that water without available air does not cause the observed brown rust deposit.

12. Why might painting an iron gate increase its useful life?

Answer:

1. Painting protects the iron surface from direct exposure to moist air.
2. Since both air and water are needed for rusting, this protective covering helps prevent rust formation.

13. A bicycle is frequently exposed to rain. Suggest two ways to protect its iron parts from rusting.

Answer:

1. Its iron parts can be protected by applying oil or grease regularly.
2. They can also be painted or provided with a protective zinc coating to reduce rusting.

14. A magnesium ribbon burns and produces a white powder whose solution turns red litmus blue. What can you infer?

Answer:

1. The white powder is magnesium oxide, formed when magnesium reacts with oxygen.
2. Since its solution turns red litmus blue, magnesium oxide is basic in nature.

15. Predict the nature of the oxide formed by sodium and justify your prediction.

Answer:

1. Sodium oxide is expected to be basic in nature because sodium is a metal.
2. The chapter establishes the general pattern that oxides of metals are basic in nature.

16. Sodium is stored in kerosene, whereas phosphorus is stored in water. Explain the reason for this difference.

Answer:

1. Sodium is stored in kerosene because it reacts vigorously with both oxygen and water.
2. Phosphorus is stored in water because it can catch fire when exposed to atmospheric air.

17. A substance burns in air, and its product forms an acidic solution when dissolved in water. Is the original substance more likely to be magnesium or sulfur? Why?

Answer:

1. The substance is more likely to be sulfur because burning sulfur produces sulfur dioxide, which forms sulfurous acid in water.
2. Magnesium oxide would instead give a basic solution that turns red litmus blue.

18. A student says, "Plastic is a non-metal because it does not conduct electricity." Is the statement correct? Justify.

Answer:

1. No, plastic should not be classified as a non-metal merely because it is a poor conductor of electricity.
2. The chapter explains that plastic is not classified as a metal or non-metal because it is not an element.

19. You have iron, copper, sulfur, coal, plastic, wood and cardboard. Which would you choose to make a pan for boiling water? Give reasons.

Answer:

1. Copper would be a suitable choice because it is a metal and metals are good conductors of heat.
2. Materials such as sulfur, coal, plastic, wood and cardboard are unsuitable because they do not have the required combination of properties for such a pan.

20. A student suggests coating iron with sulfur instead of zinc because sulfur does not react with water. Is this a good idea? Justify.

Answer:

1. No, sulfur is brittle and lacks the useful metallic properties needed for such a protective metal coating.
2. Zinc is used for coating iron in galvanisation and helps protect the iron from rusting.

These questions specifically emphasize the **"why," "predict," "infer," "justify," "choose," and "apply"** dimensions of HOTS rather than simple recall.

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

1. What is malleability? Give two examples of its use.

Answer:

1. Malleability is the property by which a material can be beaten into thin sheets.
2. Most metals possess this property, and gold and silver are the most malleable metals.
3. Silver foil used on sweets and aluminium foil used for wrapping food are examples of malleability.

2. What is ductility? Mention two uses of ductile metals.

Answer:

1. Ductility is the property of a material by which it can be drawn into wires.
2. Copper and aluminium wires are commonly used in electrical fittings.
3. Metal wires are also used in ornaments and stringed musical instruments such as the veena, sitar, violin and guitar.

3. Explain sonority with examples.

Answer:

1. Sonority is the property of metals by which they produce a ringing sound when struck.
2. A metal spoon and a metal coin produce a ringing sound when dropped.
3. The ringing sounds of school bells and ghungroos are due to the sonorous nature of metals.

4. Write three general physical properties of metals.

Answer:

1. Metals are generally hard and have a shiny appearance called metallic lustre.
2. They are generally malleable and ductile.
3. They are generally good conductors of heat and electricity.

5. Describe an activity to show that metals are good conductors of heat.

Answer:

1. Take a metal spoon and a wooden spoon of nearly the same size and immerse them simultaneously in hot water.

2. After a few minutes, carefully touch the upper ends and observe that the metal spoon feels hotter than the wooden spoon.
3. This shows that metals conduct heat well, whereas wood is a poor conductor of heat.

6. What are good and poor conductors of electricity? Give examples.
Answer:
1. Materials that allow electricity to flow through them easily are called good conductors of electricity.
2. Aluminium, iron and copper are good conductors and can make the bulb in a tester circuit glow.
3. Sulfur, wood, rubber and nylon are examples of poor conductors of electricity.

7. What is rusting? State the conditions necessary for rusting.
Answer:
1. The brown deposit formed on objects made of iron is called rust.
2. The process of formation of rust on iron objects is called rusting.
3. Both air and water, that is, moist air, are necessary for rusting to occur.

8. Mention three methods used to prevent the rusting of iron.
Answer:
1. Iron objects can be protected from rusting by painting their surfaces.
2. Oiling or greasing can also be used to protect iron.
3. Applying a protective layer of zinc on iron, called **galvanisation**, is another method of preventing rusting.

9. What is corrosion? Give examples of corrosion in different metals.
Answer:
1. Corrosion is the gradual deterioration of metal surfaces caused by air, water or other substances.
2. Iron develops a brown deposit called rust when exposed to moist air.
3. Copper may develop a green coating, while silver may develop a black coating.

10. Describe what happens when magnesium ribbon is burnt in air.
Answer:
1. Magnesium ribbon burns in air with a dazzling white flame.
2. It changes into a white powder called magnesium oxide due to its reaction with oxygen.
3. Magnesium oxide forms a basic solution with water, which changes red litmus paper to blue.

11. What happens when sulfur is burnt in air and the product is dissolved in water?
Answer:
1. When sulfur burns in air, it reacts with oxygen and forms sulfur dioxide gas.
2. When sulfur dioxide is dissolved in water, sulfurous acid is formed.
3. Therefore, the resulting solution is acidic in nature.

12. Write three characteristic properties of non-metals.
Answer:
1. Non-metals are usually soft and dull in appearance.
2. They are generally neither malleable nor ductile and are not sonorous.
3. They are generally poor conductors of heat and electricity.

13. What is an element? Give examples of metals and non-metals that are elements.
Answer:
1. An element is a substance that cannot be broken down into simpler substances.
2. Metals and non-metals are sub-categories of elements, and 118 elements are presently known.
3. Iron and aluminium are examples of metals, while oxygen, hydrogen, nitrogen and carbon are examples of non-metals.

14. Explain any three uses or importance of non-metals in everyday life.
Answer:
1. Oxygen is essential for respiration and survival.
2. Nitrogen is used to manufacture fertilisers and is an essential nutrient for plant growth.
3. Chlorine is used for water purification, while iodine solution is used as an antiseptic on wounds.

15. Differentiate between metals and non-metals based on three properties.
Answer:
1. Metals are generally lustrous, whereas most non-metals are non-lustrous.
2. Metals are generally malleable and ductile, whereas non-metals generally lack these properties.
3. Metals are good conductors of heat and electricity, whereas non-metals are generally poor conductors.

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

1. A cook has to choose between a copper pan and a wooden vessel for boiling water. Which should be chosen and why?
Answer:
1. The cook should choose the **copper pan** because copper is a metal and a good conductor of heat.
2. It transfers heat efficiently from the flame to the water and therefore helps the water boil effectively.
3. Wood is a poor conductor of heat and hence is unsuitable for making a vessel for boiling water.

2. An iron nail is kept in dry air, another in boiled water without air, and a third in contact with both air and water. Predict what will happen and explain.
Answer:
1. The nail in dry air will not rust because water is absent.
2. The nail in boiled water protected from air will also not rust because air is absent.
3. The nail exposed to both air and water will develop rust, showing that **both air and water are necessary for rusting**.

3. Why are cooking vessels made of metal but their handles often made of wood or other poor conductors?
Answer:
1. Metals are good conductors of heat, so they transfer heat efficiently to the food being cooked.
2. Wood and similar materials conduct heat poorly and therefore do not become hot as quickly.
3. Hence, a metal vessel with a poor-conducting handle combines efficient cooking with safer handling.

4. An electrician has a screwdriver with a metal shaft and a plastic-covered handle. Explain the reason for this design.
Answer:
1. The metal part can conduct electricity, whereas plastic is a poor conductor of electricity.
2. The plastic covering prevents electric current from easily reaching the electrician's hand.
3. Therefore, the combination allows the screwdriver to perform its function while reducing the risk of electric shock.

5. A student says, "Every metal is hard and solid at room temperature." Analyse the statement.

Answer:

1. The statement is incorrect because the general properties of metals have exceptions.
2. Sodium and potassium are so soft that they can be cut with a knife.
3. Mercury is another exception because it exists in the liquid state at room temperature.

6. A student burns an unknown substance and finds that its oxide solution changes red litmus paper to blue. What can the student infer?

Answer:

1. Changing red litmus to blue indicates that the oxide solution is **basic**.
2. The chapter states that oxides of metals are generally basic in nature.
3. Therefore, the observation provides evidence that the unknown substance may be a metal.

7. Why would sulfur be unsuitable for making electrical wires even if it were easily available?

Answer:

1. Sulfur is a non-metal and is not ductile, so it cannot be drawn into wires like metals.
2. It is also a poor conductor of electricity and therefore cannot efficiently carry electric current.
3. Hence, metals such as copper or aluminium are more suitable for electrical wiring.

8. A student suggests making a school bell from wood instead of metal. Evaluate this suggestion.

Answer:

1. Wood would not be a suitable material because it produces a dull sound when struck.
2. Metals produce a clear ringing sound because they possess the property of **sonority**.
3. Therefore, metal is more suitable than wood for making a school bell.

9. Why is sodium stored in kerosene rather than being left exposed to air?

Answer:

1. Sodium reacts vigorously with oxygen and water and produces a large amount of heat.
2. Leaving it exposed would bring it into contact with moisture and oxygen in the air.
3. Kerosene prevents sodium from coming into contact with air and moisture and thus allows it to be stored safely.

10. Magnesium oxide and sulfur oxide solutions show different effects on litmus paper. What conclusion can you draw?

Answer:

1. Magnesium, a metal, reacts with oxygen to form magnesium oxide, whose solution is basic and turns red litmus blue.
2. Sulfur, a non-metal, forms sulfur dioxide, which produces an acidic solution when dissolved in water.
3. Thus, the observations support the generalisation that **metal oxides are generally basic, whereas non-metal oxides are generally acidic**.

11. Why can steel-wire ropes be used in suspension bridges and cranes, while sulfur cannot be used for the same purpose?

Answer:

1. Steel wires can support heavy loads and can therefore be used as strong ropes.
2. Their wire form is possible because metals possess ductility.
3. Sulfur is not ductile and is brittle, so it cannot be drawn into strong wires for such applications.

12. An iron gate near a garden is frequently exposed to rain. Suggest how it can be protected and explain the science involved.

Answer:

1. The gate can be protected by painting, oiling, greasing, or galvanising it with zinc.
2. Rusting requires the presence of both air and water, and the protective layer reduces their contact with the iron surface.
3. Therefore, preventing exposure to moist air helps increase the useful life of the iron gate.

13. Why should plastic, wood, rubber and glass not simply be classified as non-metals?
Answer:

1. Metals and non-metals are sub-categories of substances called **elements**.
2. Plastic, glass, wood and rubber are not elements and therefore cannot simply be placed in the non-metal category.
3. Thus, showing some properties similar to non-metals is not enough to classify a material as a non-metal.

14. A shiny material becomes flat when hammered and makes a bulb glow when inserted into a tester circuit. What can you infer about it?
Answer:

1. Becoming flat on hammering indicates **malleability**, a property generally shown by metals.
2. Making the tester bulb glow indicates that the material is a good conductor of electricity.
3. Since it is also shiny, the combined evidence strongly suggests that the material is a metal.

15. Non-metals are generally poor conductors and lack malleability and ductility. Why does this not mean they are unimportant?
Answer:

1. Oxygen is a non-metal essential for respiration, while carbon is a basic component of life forms.
2. Nitrogen is important for plant growth and fertiliser production, and chlorine is used in water purification.
3. Iodine also has an important use as its solution can be applied to wounds as an antiseptic, showing that non-metals have vital everyday uses.

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

1. Explain the important physical properties of metals.
Answer:

1. Metals are generally **lustrous**, which means they have a shiny appearance.
2. Most metals are **hard**, although sodium and potassium are exceptions as they are soft.
3. Metals are generally **malleable**, meaning they can be beaten into thin sheets.
4. Metals are generally **ductile**, meaning they can be drawn into wires.
5. Metals are also generally **sonorous and good conductors of heat and electricity**.

2. Explain malleability and ductility of metals with suitable examples.
Answer:

1. **Malleability** is the property by which a material can be beaten into thin sheets.
2. Copper, aluminium and iron become flat when they are beaten with a hammer.
3. Silver foil used on sweets and aluminium foil used for wrapping food demonstrate the malleability of metals.
4. **Ductility** is the property by which a material can be drawn into wires.
5. Copper and aluminium wires are used in electrical fittings, while gold is so ductile that one gram can be drawn into a wire about two kilometres long.

3. Describe the experiment that demonstrates that metals are good conductors of heat.

Answer:

1. Take a metal spoon and a wooden spoon of nearly the same size and thickness.
2. Immerse both spoons simultaneously in a glass tumbler containing hot water.
3. Leave the spoons undisturbed for a few minutes and then carefully touch their upper ends.
4. The metal spoon feels hotter because heat travels through it more easily, while the wooden spoon transfers heat poorly.
5. The experiment shows that **metals are good conductors of heat, whereas wood is a poor conductor of heat**.

4. Describe the electrical conductivity of metals and its importance.

Answer:

1. Materials that allow electricity to flow through them easily are called **good conductors of electricity**.
2. Aluminium, iron and copper allow electricity to pass through them and can make a bulb glow in a tester circuit.
3. Materials such as sulfur, coal, wood, stone, rubber and nylon do not allow electricity to pass through them easily.
4. Such materials are called **poor conductors of electricity**.
5. Plastic coverings on screwdrivers and rubber gloves help protect electricians from electric shock because these materials are poor conductors.

5. Explain the conditions necessary for rusting of iron.

Answer:

1. Rusting is the process of formation of a brown deposit called **rust** on objects made of iron.
2. An iron nail kept in dry air alone does not develop a brown deposit.
3. An iron nail kept in water without exposure to air also does not develop the brown deposit.
4. An iron nail exposed to both air and water develops rust.
5. Therefore, the presence of **both air and water, that is, moist air, is necessary for rusting of iron**.

6. What is corrosion? Explain corrosion and the methods of preventing rusting of iron.

Answer:

1. **Corrosion** is the gradual deterioration of metal surfaces caused by air, water or other substances.
2. Rusting of iron is an example of corrosion and causes serious damage to iron objects and structures.
3. Copper may develop a green coating, while silver may develop a black coating when exposed to the atmosphere.
4. Rusting of iron can be prevented by methods such as **painting, oiling and greasing**.
5. It can also be prevented by **galvanisation**, in which a protective layer of zinc metal is applied over iron.

7. Describe what happens when magnesium burns in air and explain the nature of the product formed.

Answer:

1. When a cleaned magnesium ribbon is ignited, it burns with a **dazzling white flame**.
2. After burning, magnesium changes into a white powder called **magnesium oxide**.
3. Magnesium oxide is formed by the reaction of magnesium with oxygen present in the air.
4. When water is added to the white powder, the resulting solution turns red litmus paper blue.

5. This shows that magnesium oxide is **basic in nature**, and generally metal oxides are basic.

8. Describe the properties of non-metals.
Answer:
1. Non-metals such as sulfur and phosphorus are usually **soft and dull in appearance**.
2. They are generally **neither malleable nor ductile**.
3. Non-metals are **not sonorous** and therefore do not produce a ringing sound like metals.
4. They are generally **poor conductors of heat and electricity**.
5. Non-metal oxides are generally **acidic in nature**, and non-metals generally do not react with water.

9. Explain the reaction of sulfur with oxygen and the nature of the product formed.
Answer:
1. When sulfur is burnt in air, it reacts with oxygen.
2. The reaction produces **sulfur dioxide gas**.
3. When sulfur dioxide gas is dissolved in water, **sulfurous acid** is formed.
4. The resulting solution is found to be acidic when tested using an acid-base indicator.
5. This experiment demonstrates that **oxides of non-metals are generally acidic in nature**.

10. Explain the importance of non-metals in everyday life with examples.
Answer:
1. **Oxygen** is an essential non-metal required for respiration and survival.
2. **Carbon** is a building block of life forms and is an important component of proteins, fats and carbohydrates.
3. **Nitrogen** is used in manufacturing fertilisers and is an essential nutrient for plant growth.
4. **Chlorine** is commonly used for water purification.
5. A solution of **iodine** is used as an antiseptic on wounds, showing that non-metals have many important uses in everyday life.

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

1. A cook has to choose between copper, wood, sulfur, plastic, and cardboard to make a pan for boiling water. Which material should be selected? Justify your choice.
Answer:
1. **Copper** should be selected for making the pan.
2. Copper is a metal and is a **good conductor of heat**, so it transfers heat efficiently to the water.
3. Wood, plastic and cardboard are poor conductors of heat and therefore are unsuitable for the main body of the pan.
4. Sulfur is a non-metal and is also a poor conductor of heat.
5. Therefore, copper provides the most suitable property among the given materials for efficiently heating and boiling water.

2. Three iron nails are placed separately in dry air, boiled water covered with oil, and ordinary water exposed to air. Predict what will happen and justify your answer.
Answer:
1. The nail kept in **dry air** will not rust because water or moisture is absent.
2. The nail in boiled water covered with oil will not rust because the oil prevents air from entering the water.
3. The nail in ordinary water exposed to air will develop a brown deposit called **rust**.
4. This happens because this nail is exposed to both **water and air**.

5. Thus, the experiment proves that the simultaneous presence of air and water is necessary for the rusting of iron.

3. An electrician uses a metal screwdriver with a plastic-covered handle and also wears rubber gloves. Analyse why this combination of materials is useful for the electrician.

Answer:

1. The metal part of the screwdriver is useful because metals can conduct electricity.
2. However, allowing electric current to reach the electrician's body can cause an electric shock.
3. Plastic is a **poor conductor of electricity**, so the plastic-covered handle reduces the chance of current passing to the hand.
4. Rubber gloves are also poor conductors and provide additional protection.
5. Thus, the combination makes use of the useful conducting property of metal while using poor conductors for electrical safety.

4. A student says, "All metals are hard solids at room temperature." Evaluate this statement using examples from the chapter.

Answer:

1. The student's statement is **incorrect** because there are exceptions to the general properties of metals.
2. Metals such as copper, aluminium and iron are generally hard.
3. However, **sodium and potassium are so soft that they can be cut with a knife**.
4. **Mercury** is another exception because it exists in the liquid state at room temperature.
5. Therefore, properties of a group describe the general behaviour of its members but should not be treated as rules without exceptions.

5. A student proposes replacing the zinc coating on iron with sulfur because sulfur does not react with water. Would you support the proposal? Justify your answer.

Answer:

1. The proposal should **not** be supported merely because sulfur does not react with water.
2. The chapter identifies applying a protective layer of **zinc metal** as a method of preventing rusting, called galvanisation.
3. Sulfur is a non-metal and is brittle, neither malleable nor ductile, and behaves differently from metals.
4. Therefore, its non-reaction with water alone does not make it a suitable replacement for the protective zinc coating.
5. A suitable protective material must possess the necessary physical properties as well as provide protection from conditions that cause corrosion.

6. Magnesium and sulfur are separately burnt in air. Compare the products formed and explain how you could distinguish them using litmus paper.

Answer:

1. Magnesium burns in air with a dazzling white flame and produces **magnesium oxide**.
2. When water is added, the magnesium oxide mixture changes red litmus towards blue, showing its **basic nature**.
3. Sulfur burns in oxygen to produce **sulfur dioxide gas**, which forms sulfurous acid when dissolved in water.
4. The resulting sulfur-containing solution is therefore **acidic in nature**.
5. Thus, the litmus tests help distinguish the generally basic nature of a metal oxide from the acidic nature of a non-metal oxide.

7. Cooking vessels are usually made of metals, but their handles are often made of wood or similar materials. Analyse the scientific reason behind this design.

Answer:

1. The body of a cooking vessel needs to transfer heat efficiently from the heat source to the food.
2. Metals are **good conductors of heat**, making them suitable for the body of cooking vessels.
3. If the handle were also an unprotected metal, heat could readily travel along it.
4. Wood and similar materials transfer heat poorly and therefore are suitable for handles.
5. Hence, the design combines a good conductor for efficient cooking with a poor conductor for safer handling.

8. Suppose a material is shiny, can be beaten into sheets, drawn into wires, produces a ringing sound, and conducts electricity. How would you classify it? Give reasons.
Answer:

1. The material would most reasonably be classified as a **metal**.
2. Its shiny appearance indicates **metallic lustre**.
3. Its ability to form sheets and wires demonstrates **malleability and ductility**, respectively.
4. Its ringing sound demonstrates **sonority**, another characteristic associated with metals.
5. Its ability to conduct electricity provides further evidence because metals are generally good conductors of electricity.

9. Why would iron structures in places exposed to rain and moist air require greater protection against corrosion? Suggest suitable preventive measures.
Answer:

1. Iron exposed to **both air and water** is favourable for the formation of rust.
2. Therefore, structures frequently exposed to rain and moist air are at risk of rusting.
3. Continuous corrosion gradually damages the metal surface and may require costly repair or replacement.
4. Iron can be protected by **painting, oiling or greasing**, which helps prevent direct exposure to the conditions causing rusting.
5. **Galvanisation**, or coating iron with zinc, is another method mentioned in the chapter for preventing rusting.

10. A student argues, "Metals are more important than non-metals because metals are used in tools, machines and industries." Analyse this statement and give your conclusion.
Answer:

1. The statement is incomplete because **both metals and non-metals are essential** in everyday life.
2. Metals and their alloys are important for utensils, tools, modern technologies and many industries.
3. However, oxygen is essential for respiration, while carbon is a basic component of life forms.
4. Nitrogen is important in fertilisers, chlorine is used in water purification, and iodine solution is used as an antiseptic.
5. Therefore, metals and non-metals have different properties and applications, and **both groups are important for life and society**.

4.13 Five-mark questions with Answers of Applied Type: (5 Questions)

1. Your family wants to buy a new cooking pan. The available materials are copper, sulfur, wood, plastic and cardboard. Which material would you recommend? Explain your choice.
Answer:

1. I would recommend **copper** for making the cooking pan.

2. Copper is a metal and is a **good conductor of heat**.
3. It allows heat to pass efficiently from the flame to the food or water.
4. Materials such as wood, plastic and cardboard are poor conductors of heat, while sulfur is a non-metal and is also unsuitable.
5. Therefore, copper is the most suitable among the given materials for making a pan used for heating or boiling.

2. An electrician has to repair a live electrical circuit. Explain how the properties of metals, plastic and rubber can be applied to make his work safer.

Answer:

1. Metals such as copper are good conductors and are therefore useful for carrying electric current.
2. However, direct contact with conducting materials may expose the electrician to electric shock.
3. The handles of tools such as screwdrivers are therefore covered with **plastic**, which is a poor conductor of electricity.
4. The electrician also uses **rubber gloves and shoes** because rubber does not allow electricity to pass through easily.
5. Thus, conductors are used where electricity must flow, while poor conductors are used for protection.

3. The iron gate of a school begins to develop a brown coating during the rainy season. Identify the problem and suggest measures to protect the gate.

Answer:

1. The brown coating appearing on the iron gate is called **rust**, and its formation is called rusting.
2. Rusting occurs when iron is exposed to **both air and water or moisture**.
3. During the rainy season, the presence of moisture and air provides suitable conditions for rusting.
4. The gate can be protected by **painting, oiling or greasing** its surface.
5. A protective coating of zinc, called **galvanisation**, can also be used to protect iron from rusting.

4. A manufacturer wants to make electrical wires, metal sheets for food wrapping, and a school bell. Which properties of metals are useful for each purpose? Explain.

Answer:

1. **Ductility** enables metals to be drawn into thin wires and is therefore useful for making electrical wires.
2. Metals such as copper and aluminium are used in electrical fittings, and metals generally conduct electricity well.
3. **Malleability** allows metals to be beaten or formed into thin sheets, making aluminium suitable for food wrapping.
4. **Sonority** enables metals to produce a ringing sound when struck.
5. Therefore, ductility, malleability, electrical conductivity and sonority make metals useful for different everyday applications.

5. You are given three iron nails. Design an experiment to show that both air and water are necessary for rusting.

Answer:

1. Place one iron nail in a closed bottle containing **silica gel**, which keeps the air dry.
2. Place the second nail in **boiled and cooled water** and cover the water with a layer of oil to prevent contact with air.
3. Place the third nail partly in water in an open bottle so that it is exposed to **both air and water**.

4. Leave all three bottles undisturbed at room temperature for about **8–10 days** and observe the nails.
5. Only the nail exposed to both air and water develops brown rust, showing that both are required for rusting.

6. A child notices that a cooking vessel becomes hot quickly, but its wooden handle remains comparatively cool. Apply your knowledge of conduction to explain this observation.

Answer:

1. The body of the cooking vessel is made of metal because metals are **good conductors of heat**.
2. Heat therefore travels efficiently through the metal vessel.
3. Wood transfers heat poorly and is therefore a **poor conductor of heat**.
4. Hence, a wooden handle does not become hot as quickly as the metal part of the vessel.
5. This practical application of different heat-conducting properties makes cooking vessels efficient as well as safer to handle.

7. A laboratory has sodium and phosphorus that must be stored safely. How should each be stored? Explain the scientific reasons.

Answer:

1. **Sodium should be stored in kerosene** because it reacts vigorously with oxygen and water.
2. Its reaction generates a large amount of heat, so exposure to moisture and air must be prevented.
3. Kerosene prevents sodium from coming into contact with air and moisture.
4. **Phosphorus should be stored in water** because it can catch fire when exposed to atmospheric air.
5. Thus, different substances require different storage methods depending on how they react with air and water.

8. A farmer, a water-treatment worker and a first-aid worker need different non-metals for their work. Identify suitable non-metals and explain their applications.

Answer:

1. **Nitrogen** is important to the farmer because it is used in manufacturing fertilisers.
2. Nitrogen is also an essential nutrient for the healthy growth of plants.
3. **Chlorine** is useful to the water-treatment worker because it is commonly used in water purification.
4. A solution of **iodine** can be used by the first-aid worker as an antiseptic on wounds.
5. These examples demonstrate that non-metals have important practical applications in agriculture, water purification and healthcare.

4.14 Multiple Choice Questions with answers for Olympiad type Competitive Exams: (20 MCQs of LOTS & 20 MCQs of HOTS Type)

1. Four materials P, Q, R and S have the following properties:

Material	Lustrous	Malleable	Conducts Electricity
P	Yes	Yes	Yes
Q	No	No	No
R	Yes	No	No
S	No	Yes	No

Based on the general properties described in the chapter, which material is most likely a metal?

A) P
B) Q
C) R
D) S
Answer: A) P

---

2. A student strikes four objects with a hammer. Copper and aluminium flatten, sulfur breaks into pieces, while wood neither flattens into a sheet nor breaks into pieces. Which conclusion is correct?
A) Sulfur is malleable.
B) Wood is brittle.
C) Copper and aluminium are malleable.
D) All four materials are metals.
Answer: C) Copper and aluminium are malleable.

---

3. A substance X can be drawn into a very long, thin wire. Which property is being demonstrated?
A) Malleability
B) Sonority
C) Ductility
D) Corrosion
Answer: C) Ductility

---

4. Which pair of properties is MOST directly required to make a metal into thin sheets and wires respectively?
A) Ductility and sonority
B) Malleability and ductility
C) Conductivity and malleability
D) Sonority and conductivity
Answer: B) Malleability and ductility

---

5. Which observation proves that the statement "all metals are hard solids at room temperature" is incorrect?
A) Copper is lustrous.
B) Gold is malleable.
C) Sodium is soft and mercury is liquid at room temperature.
D) Aluminium conducts electricity.
Answer: C) Sodium is soft and mercury is liquid at room temperature.

---

6. A blind person uses the difference in sound produced when a stick strikes different objects to distinguish metal from wood. Which property of metals makes this possible?
A) Ductility
B) Sonority
C) Malleability
D) Corrosion
Answer: B) Sonority

---

7. A metal spoon and a wooden spoon of similar size are simultaneously placed in hot water. After a few minutes, the upper end of the metal spoon is hotter. What is the BEST explanation?

A) Wood absorbs all the heat.
B) Metal is a better conductor of heat than wood.
C) Wood is more malleable than metal.
D) Metal produces heat by itself.
Answer: B) Metal is a better conductor of heat than wood.

---

8. Cooking vessels commonly have metal bodies but handles made of wood or other poorly conducting materials because:
A) metals are poor conductors and wood is a good conductor.
B) metals conduct heat efficiently while the handles reduce heat transfer to the hand.
C) wood is more sonorous than metal.
D) metal handles cannot be manufactured.
Answer: B) Metals conduct heat efficiently while the handles reduce heat transfer to the hand.

---

9. A tester circuit is separately completed using aluminium foil, an iron nail, sulfur and dry wood. In how many cases should the bulb glow according to the chapter?
A) 1
B) 2
C) 3
D) 4
Answer: B) 2
Explanation: Aluminium and iron conduct electricity, whereas sulfur and dry wood do not make the bulb glow in the activity.

---

10. An electrician's screwdriver has a plastic-covered handle mainly because plastic:
A) is highly ductile.
B) is a good conductor of electricity.
C) is a poor conductor of electricity.
D) prevents the metal from becoming sonorous.
Answer: C) It is a poor conductor of electricity.

---

11. Three iron nails are kept under the following conditions:
- P: dry air, no water
- Q: water, but air excluded
- R: both air and water

Which nail is expected to develop rust?
A) P only
B) Q only
C) R only
D) P and Q only
Answer: C) R only
Explanation: The experiment in the chapter demonstrates that both air and water are necessary for rusting.

---

12. In the rusting experiment, why is silica gel placed in one bottle?
A) To provide oxygen
B) To keep the air dry
C) To supply water
D) To speed up rusting

Answer: B) To keep the air dry

---

13. In another bottle of the rusting experiment, boiled and cooled water is covered with oil. What is the main purpose of the oil layer?
A) To react with iron
B) To make the water acidic
C) To prevent air from dissolving in the water
D) To make the nail softer
Answer: C) To prevent air from dissolving in the water.

---

14. Consider the following:
I. Brown deposit on iron
II. Green coating on copper
III. Black coating on silver
These are all related to the broader phenomenon called:
A) ductility
B) sonority
C) corrosion
D) malleability
Answer: C) Corrosion

---

15. Which of the following would NOT be an appropriate method mentioned in the chapter for preventing rusting of iron?
A) Painting
B) Greasing
C) Galvanisation
D) Keeping iron continuously exposed to moist air
Answer: D) Keeping iron continuously exposed to moist air

---

16. A protective layer of which metal is applied to iron during galvanisation?
A) Copper
B) Zinc
C) Gold
D) Aluminium
Answer: B) Zinc

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17. A magnesium ribbon is burnt in air. Which sequence correctly describes the observation and product?
A) Dull flame → black powder → acidic product
B) Dazzling white flame → white magnesium oxide → basic product
C) Blue flame → sulfur dioxide → acidic product
D) No flame → no product
Answer: B) Dazzling white flame → white magnesium oxide → basic product

---

18. A solution prepared from the product formed when magnesium burns in oxygen changes red litmus to blue. This indicates that:
A) the solution is acidic.
B) the solution is basic.
C) magnesium is a non-metal.
D) the product is neutral.

Answer: B) The solution is basic.

---

19. Sodium is stored in kerosene mainly because sodium:
A) dissolves in kerosene to form a protective metal.
B) reacts vigorously with oxygen and water.
C) is a poor conductor of heat.
D) reacts only with kerosene.
Answer: B) It reacts vigorously with oxygen and water.

---

20. Sulfur is burnt in oxygen and the gas produced is dissolved in water. Which sequence is correct?
A) Sulfur → magnesium oxide → basic solution
B) Sulfur → sulfur dioxide → acidic solution
C) Sulfur → hydrogen → neutral solution
D) Sulfur → oxygen → basic solution
Answer: B) Sulfur → sulfur dioxide → acidic solution

---

21. Which combination correctly compares the oxides discussed in the chapter?
A) Metal oxides – generally acidic; non-metal oxides – generally basic
B) Metal oxides – generally basic; non-metal oxides – generally acidic
C) Both are always neutral
D) Both are always basic
Answer: B) Metal oxides – generally basic; non-metal oxides – generally acidic.

---

22. A student puts sulfur powder into water and observes no reaction. Which conclusion is most consistent with the chapter?
A) All non-metals react vigorously with water.
B) Sulfur behaves like sodium.
C) Sulfur does not react with water under the conditions of the activity.
D) Sulfur becomes a metal in water.
Answer: C) Sulfur does not react with water under the conditions of the activity.

---

23. Phosphorus and sodium require special storage. Which combination is correct?
A) Phosphorus—kerosene; Sodium—water
B) Phosphorus—water; Sodium—kerosene
C) Both—water
D) Both—open air
Answer: B) Phosphorus—water; Sodium—kerosene
Explanation: Phosphorus can catch fire on exposure to atmospheric air, while sodium reacts vigorously with oxygen and water.

---

24. Which of the following groups contains only non-metals identified in the chapter?
A) Oxygen, nitrogen, carbon
B) Copper, oxygen, sulfur
C) Aluminium, carbon, nitrogen
D) Iron, copper, hydrogen
Answer: A) Oxygen, nitrogen, carbon

---

25. Which statement about plastic, glass, wood, rubber and paper is correct according to the chapter?

A) They are all non-metals.
B) They are all metals.
C) They are not classified as metals or non-metals because they are not elements.
D) They are all naturally occurring elements.
Answer: C) They are not classified as metals or non-metals because they are not elements.

---

26. A student says, "Every material that does not conduct electricity is a non-metal." Why is this reasoning incorrect according to the chapter?
A) All non-metals conduct electricity.
B) Materials such as rubber, plastic and wood are not classified as non-metals merely because they are poor conductors.
C) Every metal is a poor conductor.
D) Only liquids can be non-metals.
Answer: B) Materials such as rubber, plastic and wood are not classified as non-metals merely because they are poor conductors.

---

27. Match the non-metal with its most appropriate application:
1. Nitrogen
2. Chlorine
3. Iodine
4. Oxygen

P. Antiseptic
Q. Respiration
R. Fertiliser manufacture
S. Water purification
Which is correct?
A) 1-R, 2-S, 3-P, 4-Q
B) 1-Q, 2-P, 3-S, 4-R
C) 1-S, 2-R, 3-Q, 4-P
D) 1-P, 2-Q, 3-R, 4-S
Answer: A) 1-R, 2-S, 3-P, 4-Q

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28. Which statement is NOT correct?
A) Gold and silver are highly malleable.
B) Gold is highly ductile.
C) Coal and sulfur are ductile.
D) Metals are generally sonorous.
Answer: C) Coal and sulfur are ductile.

---

29. A material is dull, neither malleable nor ductile, not sonorous, and a poor conductor of heat and electricity. Based on the general characteristics in the chapter, it is most likely:
A) a metal.
B) a non-metal.
C) necessarily plastic.
D) necessarily an alloy.
Answer: B) A non-metal.

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30. Assertion–Reason Question
Assertion (A): Metals are commonly used to make cooking vessels.
Reason (R): Metals are generally good conductors of heat.

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.

Answer Key

Q.	Ans.	Q.	Ans.	Q.	Ans.
1	A	11	C	21	B
2	C	12	B	22	C
3	C	13	C	23	B
4	B	14	C	24	A
5	C	15	D	25	C
6	B	16	B	26	B
7	B	17	B	27	A
8	B	18	B	28	C
9	B	19	B	29	B
10	C	20	B	30	A

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

The chapter is particularly suitable for **activity-based, inquiry-oriented, experiential and application-based learning**, because it introduces properties such as malleability, ductility, sonority, conductivity, rusting and reactions with air and water through experiments and everyday examples.

1. Hands-on "Metal vs Non-metal" Investigation:
Organise students into small groups and provide safe samples such as **copper, aluminium, iron, coal, sulfur and wood**. Students can observe lustre, hardness and the effect of hammering, and record their findings in an observation table. This converts the textbook activity on malleability into **learning by doing** and helps students infer properties rather than merely memorising them.

2. Predict–Observe–Explain (POE) Method:
Before each experiment, ask students to **predict the result**, then **observe the demonstration**, and finally **explain why it occurred**. For example, before immersing metal and wooden spoons in hot water, students predict which spoon will become hotter. They then relate their observations to the concept of **conduction of heat**.

3. Real-Life Material Selection Challenge:
Give students practical situations such as: *Which material should be used for a cooking pan, electrical wire, saucepan handle, jewellery, school bell or electrical screwdriver handle?* Students should select the material and **justify their choice using properties** such as conductivity, malleability, ductility and sonority. This develops application and reasoning skills rather than rote learning. The chapter itself connects poor electrical conductors such as plastic and rubber with protection from electric shock.

4. Long-Term "Rust Detective" Experiment:
Set up three iron nails under different conditions—**dry air, water without air, and both air and water**—and allow students to maintain an observation diary for 8–10 days. Students can photograph or sketch the changes each day and finally determine the conditions necessary for

rusting. This develops observation, patience, scientific recording and evidence-based conclusion skills; the chapter establishes that rust develops when both air and water are present.

5. Demonstration-Based Learning with Safety Protocols:

Use **teacher demonstrations** for potentially hazardous activities, especially burning magnesium and sulfur. Before beginning, students can identify possible hazards and suggest safety precautions. The chapter specifically recommends protective eyewear and safe distance for magnesium and a fume hood or well-ventilated area for burning sulfur. This integrates **laboratory safety education** with conceptual learning.

6. Concept Mapping and Comparative Learning:

Ask students to construct a **Metals vs Non-metals concept map** covering lustre, hardness, malleability, ductility, sonority, heat conductivity, electrical conductivity, reaction with oxygen, nature of oxides and reaction with water. Encourage them to include important exceptions such as **soft sodium/potassium and liquid mercury**. This provides an effective visual tool for revision and prevents overgeneralisation.

7. Local Craftsperson/Ironsmith Connect:

The chapter begins with children visiting an ironsmith and observing how iron is heated and hammered into useful objects such as axes, spades, tongs and farming tools. Arrange a **local ironsmith interaction, workshop visit or classroom video demonstration** so students can connect scientific properties of metals with traditional skills, occupations and everyday technology.

8. Indian Knowledge and Heritage Integration:

Use the **Iron Pillar of Delhi** as a mini case study on ancient Indian metallurgy. Students can investigate why this more-than-1600-year-old iron structure has barely rusted despite exposure to weather. This creates a meaningful connection among **science, history, Indian technological heritage and corrosion**.

9. "Science Around My Home" Assignment:

Ask students to identify 10–15 objects at home—cooking vessels, electrical wires, aluminium foil, jewellery, bells, tools, handles, etc.—and prepare a table containing **object → material → metal/non-metal → relevant property → reason for its use**. This encourages students to discover that properties of materials determine their practical applications.

10. Sustainability and Recycling Discussion:

Conduct a short classroom discussion titled **"Why should metals be recycled?"** Students can examine the environmental and economic importance of recycling iron and aluminium. The chapter explicitly links metal recycling in India with **waste minimisation and sustainability**.

Recommended Best-Practice Combination:

For Grade 7, an especially effective sequence would be **Explore → Predict → Experiment → Observe → Record → Discuss → Apply → Reflect**. This approach closely matches the chapter's emphasis on **curiosity, enquiry, exploration and discovery**, while simultaneously developing scientific thinking, collaboration, communication and real-life problem-solving skills. The chapter itself concludes with exploratory projects involving Indian metal art, mapping metal resources, investigating materials in smartphones and classroom debate, making project-based learning particularly appropriate.

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

The chapter provides excellent opportunities to move beyond conventional teaching because students can investigate **malleability, ductility, sonority, conductivity, corrosion, reactions with oxygen and the everyday applications of metals and non-metals**.

(1) **"Mystery Material" Scientific Detective Challenge:** Give each group an unknown/sample material and allow students to test or observe its lustre, hardness, malleability, sonority and electrical conductivity. Based on evidence, students prepare a **Material Identity Card** and decide whether it behaves like a metal or non-metal. This turns classification into an investigative game. The chapter identifies these physical properties as important distinguishing characteristics.

(2) **DIY Smart Conductivity Tester:** Students can construct a simple low-voltage tester using a cell, LED/bulb and wires and create a **"Conductivity Map of Our Classroom."** They test teacher-approved objects such as aluminium foil, iron, copper, rubber and dry wood and classify them as good or poor electrical conductors. This extends the chapter's tester-circuit activity into a student-designed STEM investigation.

(3) **Digital Time-Lapse "Rust Lab":** Instead of simply observing rusting once, groups can photograph iron nails exposed to different conditions every day for 8–10 days. The photographs can be combined into a **time-lapse/video diary** showing how rust develops. Students then explain why the nail exposed to both air and water rusts, connecting digital documentation with scientific experimentation.

(4) **"Invent an Anti-Rust Solution" Design Challenge:** Ask groups to design the best method for protecting an imaginary school gate, bicycle or iron playground equipment from corrosion. They may propose **painting, oiling, greasing or galvanisation**, prepare a model/poster, and justify their choice in terms of preventing exposure to air and moisture. This converts a scientific concept into an engineering-design problem.

(5) **Metals Inside My Smartphone – Tech Investigation:** Students investigate the metals and non-metals associated with smartphones and prepare a **labelled model, infographic or digital presentation** explaining how different materials contribute to the device. This directly extends one of the chapter's suggested exploratory projects.

(6) **"Design the Perfect Product" STEM Innovation Lab:** Give teams products such as a **cooking pan, electrical wire, musical bell, jewellery item or suspension-bridge cable**. Students must select an appropriate material and defend their design based on conductivity, malleability, ductility, strength or sonority. For example, the chapter connects steel-wire ropes with suspension bridges and cranes.

(7) **Virtual Metallurgy Museum:** Students can collaboratively create a digital exhibition titled **"Metals: From Ancient India to Modern Technology."** One section can feature the Iron Pillar of Delhi, which the chapter describes as more than 1,600 years old and remarkably resistant to rust. Other sections can showcase traditional metal crafts such as **Dhokra, Bidriware, Pembarthi and Kamrupi**, which are proposed for exploration in the chapter.

(8) **AI-Assisted "Ask a Metal" Role-Play:** Students can use a teacher-supervised generative-AI activity in which groups conduct imaginary interviews with **Iron, Copper, Aluminium, Gold, Oxygen, Carbon or Sulfur**. Questions such as "Why are you used in wires?", "Can you be beaten into sheets?" and "What happens when you react with oxygen?" can make revision interactive. Students must then **fact-check every AI-generated response against the textbook**, developing both science knowledge and AI literacy.

(9) **Metal Recycling Circular-Economy Challenge:** Create a simulated recycling centre in the classroom. Students sort discarded/represented materials, identify which are metals, suggest possible reuse and design a **"Zero Metal Waste School" plan**. This connects directly with the chapter's observation that recycling iron and aluminium helps minimise waste and contributes to sustainability.

(10) **Student Science-Reel/Podcast Challenge:** Groups create a **60–90 second science video, animation or audio podcast** explaining one concept—"Why bells ring," "Why

saucepan handles are not metallic," "Why iron rusts," "Why electrical wires contain metals," or "Why sodium is stored in kerosene." The chapter notes that sodium reacts vigorously with oxygen and water and is therefore stored in kerosene to prevent exposure to air and moisture.

These innovations can transform the chapter from a **content-learning lesson into an Explore → Experiment → Design → Create → Communicate experience**, while developing **curiosity, creativity, scientific enquiry, problem-solving, collaboration, digital literacy and innovation skills** among Grade 7 students.

4.17: Practicing Questions/Question Bank

generally show contrasting properties.

A. Fill in the Blanks – 1 Mark Each:

1. The property by which a material can be beaten into thin sheets is called __________.
   Answer: Malleability
2. The property by which a material can be drawn into wires is called __________.
   Answer: Ductility
3. The shine shown by metals is known as __________ **lustre**.
   Answer: Metallic
4. Gold and silver are the most __________ metals.
   Answer: Malleable
5. Metals that produce a ringing sound are called __________.
   Answer: Sonorous
6. Materials that allow electricity to flow through them easily are called good __________ of electricity.
   Answer: Conductors
7. The brown deposit formed on iron is called __________.
   Answer: Rust
8. Both __________ **and** __________ are necessary for rusting of iron.
   Answer: Air and water
9. Applying a protective layer of zinc on iron is called __________.
   Answer: Galvanisation
10. Magnesium burns in air with a dazzling __________ flame.
    Answer: White
11. Magnesium reacts with oxygen to form __________.
    Answer: Magnesium oxide
12. Metal oxides are generally __________ in nature.
    Answer: Basic
13. Burning sulfur in oxygen produces __________ **gas**.
    Answer: Sulfur dioxide

14. Oxides of non-metals are generally __________ in nature.
    Answer: Acidic
15. Sodium is stored in __________ to prevent its exposure to air and moisture.
    Answer: Kerosene
16. Phosphorus is stored in __________ because it catches fire when exposed to atmospheric air.
    Answer: Water
17. __________ is used in the manufacture of fertilisers.
    Answer: Nitrogen
18. __________ is commonly used in water purification.
    Answer: Chlorine
19. A solution of __________ is applied to wounds as an antiseptic.
    Answer: Iodine
20. There are presently __________ known elements.
    Answer: 118

The definitions and examples of malleability and ductility are explicitly developed through the chapter's activities and examples.

B. One-Mark Descriptive Questions:

1. What is malleability?

Answer: Malleability is the property by which materials can be beaten into thin sheets.

2. What is ductility?

Answer: Ductility is the property by which materials can be drawn into wires.

3. What is sonority?

Answer: Sonority is the property of metals that enables them to produce a ringing sound.

4. Give two examples of malleable metals.

Answer: Gold and silver are highly malleable metals.

5. Name one metal that is liquid at room temperature.

Answer: Mercury is a metal that is liquid at room temperature.

6. Name two metals that can be cut with a knife.

Answer: Sodium and potassium can be cut with a knife.

7. Why are metals used for making cooking vessels?

Answer: Metals are used for cooking vessels because they are good conductors of heat.

8. Why are wooden handles provided on many cooking vessels?

Answer: Wood is a poor conductor of heat and therefore helps protect our hands from heat.

9. Why do electricians use rubber gloves?

Answer: Rubber is a poor conductor of electricity and protects electricians from electric shock.

10. What is rust?

Answer: Rust is the brown deposit that forms on iron when it is exposed to moist air.

11. What is rusting?

Answer: The process of formation of rust on iron objects is called rusting.

12. What is corrosion?

Answer: Corrosion is the gradual deterioration of metal surfaces caused by air, water or other substances.

13. What is galvanisation?

Answer: Galvanisation is the process of applying a protective layer of zinc on iron to prevent rusting.

14. Why is sodium stored in kerosene?

Answer: Sodium is stored in kerosene because it reacts vigorously with oxygen and water.

15. Name two non-metals essential for living organisms and plants.

Answer: Oxygen is essential for respiration, while nitrogen is an essential nutrient for plant growth.

The chapter's experiment establishes that rust requires both air and water and discusses painting, oiling, greasing and galvanisation as preventive methods.

C. Two-Mark Descriptive Questions:

1. Differentiate between malleability and ductility.

Answer:

1. Malleability is the ability of a material to be beaten into thin sheets.
2. Ductility is the ability of a material to be drawn into wires.

2. State two differences between metals and non-metals.

Answer:

1. Metals are generally lustrous, while most non-metals are non-lustrous.
2. Metals are generally good conductors of heat and electricity, while non-metals are generally poor conductors.

3. Why are metals suitable for making electrical wires?

Answer:

1. Metals are ductile and therefore can be drawn into thin wires.
2. They are good conductors of electricity.

4. Explain the sonorous nature of metals with examples.

Answer:

1. Metals produce a ringing sound when struck or dropped and hence are called sonorous.
2. School bells and ghungroos make use of this property.

5. Why are metal vessels generally provided with wooden or other poor-conducting handles?

Answer:

1. Metals conduct heat efficiently and hence the vessel becomes hot.
2. Wood and similar materials transfer heat poorly, making the handles safer to hold.

6. What conditions are necessary for rusting?

Answer:

1. Iron must come into contact with water or moisture.
2. Air must also be present for rust to develop.

7. Mention any two methods of preventing rusting.

Answer:

1. Iron can be protected by painting, oiling or greasing.
2. A protective zinc layer can also be applied through galvanisation.

8. What happens when magnesium burns in air?

Answer:

1. Magnesium burns with a dazzling white flame.
2. It forms a white powder called magnesium oxide.

9. What happens when sulfur burns in air?

Answer:

1. Sulfur reacts with oxygen and produces sulfur dioxide gas.
2. When the gas dissolves in water, sulfurous acid is formed.

10. Mention two important uses of non-metals.

Answer:

1. Chlorine is used for water purification.
2. Iodine solution is used as an antiseptic on wounds.

The chapter contrasts magnesium oxide, which is basic, with the acidic product obtained after sulfur burns and its oxide dissolves in water.

D. Three-Mark Descriptive Questions:

1. Explain three important physical properties of metals.

Answer:

1. Metals are generally lustrous and have a shiny appearance.
2. Metals are malleable and can generally be beaten into thin sheets.
3. Metals are ductile and can generally be drawn into wires.

2. Explain how metals and non-metals differ in their conduction properties.

Answer:

1. Metals generally conduct heat efficiently.
2. Metals also allow electricity to pass through them easily.
3. Non-metals are generally poor conductors of both heat and electricity.

3. Explain why a cooking pan is made of metal but its handle may be made of wood.

Answer:

1. The pan needs to transfer heat efficiently to the food or water.
2. Metals are good conductors of heat and are therefore suitable for the pan.
3. Wood transfers heat poorly and therefore makes the handle safer to hold.

4. Describe the conditions required for rusting of iron.

Answer:

1. An iron nail kept only in dry air does not develop rust.
2. An iron nail kept in water without exposure to air also does not develop rust under the conditions of the chapter's experiment.
3. Rust develops when iron comes into contact with both air and water.

5. Describe the reaction of magnesium with oxygen.

Answer:

1. Magnesium ribbon burns in air with a dazzling white flame.
2. It reacts with oxygen and produces white magnesium oxide.
3. The magnesium oxide solution is basic and turns red litmus blue.

6. Describe the reaction of sulfur with oxygen.

Answer:

1. Sulfur burns in oxygen and forms sulfur dioxide gas.
2. Sulfur dioxide dissolves in water to form sulfurous acid.
3. Hence, the resulting solution is acidic in nature.

7. Give three examples showing the importance of non-metals in everyday life.

Answer:

1. Oxygen is essential for our survival.

2. Nitrogen is used in fertilisers and is an essential nutrient for plants.
3. Chlorine is commonly used for water purification.

8. Why is corrosion considered a serious problem?

Answer:

1. Corrosion gradually deteriorates metal surfaces.
2. Rusting can damage iron structures and reduce their useful life.
3. Large amounts of money are spent repairing or replacing structures damaged by rusting.

The chapter gives oxygen, carbon, nitrogen, chlorine and iodine as important non-metals with significant biological and everyday applications.

E. Five-Mark Descriptive Questions:

1. Explain five important properties of metals with suitable examples.

Answer:

1. **Lustre:** Metals such as copper, aluminium and iron generally have a shiny appearance.
2. **Malleability:** Most metals can be beaten into thin sheets; aluminium foil is an example.
3. **Ductility:** Metals can be drawn into wires; copper and aluminium wires are used in electrical fittings.
4. **Sonority:** Metals produce a ringing sound when struck and are therefore used in objects such as bells.
5. **Conductivity:** Metals are generally good conductors of heat and electricity and are therefore useful in cooking vessels and electrical applications.

2. Describe an experiment to demonstrate that both air and water are necessary for rusting.

Answer:

1. Take three clean iron nails and place them separately in bottles A, B and C.
2. Keep the nail in A with silica gel so that it is exposed to dry air without moisture.
3. Completely immerse the nail in B in freshly boiled and cooled water and add an oil layer to prevent contact with air.
4. In C, partially immerse the nail in water and leave the bottle open so that both air and water are available.
5. After 8–10 days, rust appears on the nail in C but not on those in A and B, showing that both air and water are necessary for rusting.

3. Compare metals and non-metals using five properties.

Answer:

1. Metals are generally lustrous, whereas most non-metals are dull/non-lustrous.
2. Metals are generally malleable, whereas non-metals are not malleable.

3. Metals are generally ductile, whereas non-metals are not ductile.
4. Metals are sonorous, whereas non-metals generally do not produce a ringing sound.
5. Metals are generally good conductors of heat and electricity, whereas non-metals are generally poor conductors.

4. Explain the importance of five non-metals in everyday life.

Answer:

1. **Oxygen** is essential for respiration and survival.
2. **Carbon** is a building block of life forms and is present in proteins, fats and carbohydrates.
3. **Nitrogen** is used in fertilisers and supports plant growth.
4. **Chlorine** is commonly used for water purification.
5. **Iodine** solution is applied to wounds as an antiseptic.

5. Explain corrosion and methods of protecting iron from rusting.

Answer:

1. Corrosion is the gradual deterioration of metal surfaces due to air, water or other substances.
2. Rusting is the formation of a brown deposit called rust on iron in the presence of moist air.
3. **Painting** prevents iron from coming into direct contact with air and moisture.
4. **Oiling or greasing** provides a protective barrier against air and moisture.
5. **Galvanisation** protects iron by providing it with a layer of zinc.

6. Compare what happens when magnesium and sulfur react with oxygen.

Answer:

1. Magnesium is a metal, while sulfur is a non-metal.
2. Magnesium burns with a dazzling white flame and forms magnesium oxide.
3. Magnesium oxide gives a basic solution and turns red litmus blue.
4. Sulfur burns in oxygen to form sulfur dioxide, which forms sulfurous acid when dissolved in water.
5. Thus, the chapter demonstrates the general pattern that **metal oxides are basic whereas non-metal oxides are acidic**.

This set can serve as a **balanced Grade 7 question bank**, with direct-recall questions as well as reasoning, experimental and application-oriented questions.

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7th Standard Science Book Chapter 5

Chapter 5: Changes Around Us: Physical and Chemical

5.1 Summary of the Chapter:

Summary – Chapter 5: ***Changes Around Us: Physical and Chemical***

(1) **Changes occur continuously around us:** Everyday examples include melting of ice, boiling water, ripening of fruits, drying clothes, burning wood, and the growth of a bud into a flower. Changes may affect the **size, shape, state, smell, or other properties** of substances.

(2) **Physical changes:** A change in which only physical properties such as **shape, size, or state** change and **no new substance is formed** is called a physical change. Folding paper, crushing chalk, inflating a balloon, melting ice, and evaporation of water are examples.

(3) **Chemical changes:** A change in which **one or more new substances are formed** is called a chemical change. The process through which new substances are formed is called a **chemical reaction**, which can be represented by a chemical equation.

(4) **Formation and identification of carbon dioxide:** When vinegar or lemon juice reacts with baking soda, **carbon dioxide gas** is produced. The gas can be identified because it turns **lime water milky**.

(5) **Rusting is a chemical change:** During rusting, iron forms a new brown-coloured substance called **rust (iron oxide)**. Since a new substance is produced, rusting is classified as a chemical change.

(6) **Combustion is a chemical change:** A chemical reaction in which a substance reacts with **oxygen and produces heat and/or light** is called combustion. Wood, paper, cotton, and kerosene are examples of combustible substances.

(7) **Oxygen is necessary for combustion:** A burning candle covered with a glass tumbler goes out after some time because its continuous supply of air is cut off. This demonstrates that **oxygen supports combustion**.

(8) **Ignition temperature and the fire triangle:** The **minimum temperature at which a substance catches fire** is called its ignition temperature. Combustion requires three things: **a combustible substance (fuel), oxygen, and sufficient heat to reach the ignition temperature**.

(9) **Physical and chemical changes can occur together:** Burning a candle involves both types of change. **Melting, solidification, and evaporation of wax are physical changes**, whereas the **burning of wax vapour is a chemical change** because new substances are formed.

(10) **Changes may be reversible or irreversible:** Some changes can be reversed—for example, melted ice can be frozen again and water vapour can be condensed. Other changes, such as **chopping vegetables and making popcorn**, cannot be reversed to obtain the original object or substance.

(11) **Changes may be desirable or undesirable:** Changes such as **cooking food, ripening fruits, and converting milk into curd** are useful or desirable, whereas **rusting and food decay** may be undesirable. The same type of change can sometimes be useful—for example, decomposition of food waste helps produce compost.

(12) **Weathering and erosion are important natural changes: Weathering** involves physical and chemical changes that break down and alter rocks, eventually helping in **soil formation**. **Erosion** involves the breaking down and movement of rock particles, soil, and sediments by natural forces such as flowing water and wind; many such changes occur over thousands of years and cannot be reversed.

5.2 Important Formulas:

This Grade 7 chapter is mainly conceptual and does **not contain mathematical formulae for numerical/quantitative problem-solving**. The important formula-like relationships required for solving chapter-based problems are the **chemical equations, combustion conditions, and change relationships** given below. The chapter defines chemical changes as those in which new substances form and notes that chemical reactions can be represented through chemical equations.

No.	Concept	Important Formula / Equation
1	**Carbon dioxide + lime water**	**Calcium hydroxide + Carbon dioxide → Calcium carbonate + Water**
2	In chemical symbols	**$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$**
3	Test for carbon dioxide	**CO_2 + Lime water → Milky appearance**
4	Vinegar and baking soda	**Vinegar + Baking soda → Carbon dioxide + Other substances**
5	Burning of magnesium	**Magnesium + Oxygen → Magnesium oxide + Heat + Light**
6	In chemical symbols	**$2Mg + O_2 \rightarrow 2MgO$ + Heat + Light**
7	Rusting of iron	**Iron + Oxygen → Iron oxide (Rust)**
8	Combustion – general form	**Combustible substance + Oxygen → Products + Heat and/or Light**
9	Candle/wax combustion – simplified	**Wax + Oxygen → Carbon dioxide + Water + Heat + Light**
10	Fire triangle	**Fuel + Oxygen + Heat → Combustion**
11	Melting of ice	**Ice → Water**
12	Freezing of water	**Water → Ice**
13	Evaporation	**Liquid water → Water vapour**
14	Condensation	**Water vapour → Liquid water**
15	Reversible change	**Original substance ⇌ Changed form**

The textbook specifically gives the lime-water reaction as **calcium hydroxide + carbon dioxide → calcium carbonate + water** and explains that insoluble calcium carbonate causes the milky appearance.

Important Relationships to Remember:

1. Physical Change

Substance → Change in shape/size/state → Same substance

No new substance is formed.

2. Chemical Change

Reactant(s) → Chemical reaction → New substance(s)

One or more new substances are produced.

3. Combustion

Fuel + Oxygen + Heat → Combustion

The chapter's **Fire Triangle** shows that combustion requires three essential factors: **fuel, oxygen, and sufficient heat to reach the ignition temperature**.

4. Ignition Temperature

Temperature of substance ≥ Ignition temperature → Substance catches fire
The **ignition temperature** is the minimum temperature at which a substance catches fire.
5. Burning Magnesium
Magnesium + Oxygen → Magnesium oxide + Heat + Light
This is a chemical change because a new substance, magnesium oxide, is formed.
Most Important Equations for Examination
Students should especially remember:
$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$
$2Mg + O_2 \rightarrow 2MgO$
Vinegar + Baking soda → CO_2 + Other substances
Fuel + O_2 + Heat → Combustion
For this particular chapter, **numerical calculations are not a major learning requirement**; questions are more likely to test identification and classification of **physical/chemical, reversible/irreversible, desirable/undesirable changes**, along with combustion, ignition temperature, rusting, weathering, and erosion.

5.3 Fill-Up the Blank LOTS type questions with Answers: (35 Questions)

1. A change in which no new substance is formed is called a __________ **change**.
   Answer: Physical change
2. In a physical change, properties such as shape, size, and __________ may change.
   Answer: State
3. A change in which one or more new substances are formed is called a __________ **change**.
   Answer: Chemical change
4. New substances are formed through a process called a chemical __________.
   Answer: Reaction
5. A chemical reaction can be represented in short form as a chemical __________.
   Answer: Equation
6. Carbon dioxide turns lime water __________.
   Answer: Milky
7. Carbon dioxide reacts with lime water to form insoluble __________.
   Answer: Calcium carbonate
8. Mixing vinegar with baking soda produces __________ **gas**.
   Answer: Carbon dioxide
9. The brown-coloured substance formed during the rusting of iron is called __________.
   Answer: Rust
10. Rust is mainly __________ **oxide**.
    Answer: Iron
11. When magnesium ribbon burns, it forms __________ **oxide**.
    Answer: Magnesium
12. Burning of magnesium is a __________ **change**.
    Answer: Chemical
13. A chemical reaction in which a substance reacts with oxygen and produces heat and/or light is called __________.
    Answer: Combustion
14. Substances that undergo combustion are called __________ **substances**.
    Answer: Combustible
15. The component of air that supports combustion is __________.
    Answer: Oxygen

16. The minimum temperature at which a substance catches fire is called its __________ **temperature**.
    Answer: Ignition
17. A combustible substance used for combustion is also called a __________.
    Answer: Fuel
18. Fuel, oxygen, and __________ are the three requirements for combustion.
    Answer: Heat
19. The melting of candle wax is a __________ **change**.
    Answer: Physical
20. The burning of wax vapour is a __________ **change**.
    Answer: Chemical
21. Burning of a candle involves both physical and __________ **changes**.
    Answer: Chemical
22. Melted ice can be __________ to get ice again.
    Answer: Refrozen
23. Water vapour can be __________ back into liquid water.
    Answer: Condensed
24. Making popcorn from corn is a change that __________ be reversed.
    Answer: Cannot
25. Changing milk into curd is an example of a __________ **change in daily life.**
    Answer: Desirable
26. Rusting of iron is generally considered an __________ **change**.
    Answer: Undesirable
27. Decomposition of food waste can be useful for producing __________.
    Answer: Compost
28. The physical and chemical changes occurring in rocks are collectively called __________.
    Answer: Weathering
29. Weathering of rocks eventually leads to the formation of __________.
    Answer: Soil
30. The breaking down and movement of rock particles, soil, and sediments by wind and flowing water is called __________.
    Answer: Erosion
31. Erosion caused by flowing water and wind is a __________ **change**.
    Answer: Physical
32. River rocks and pebbles become smoother due to constant __________ caused by flowing water.
    Answer: Erosion
33. The production of light without heat in living organisms is called __________.
    Answer: Bioluminescence
34. __________ are insects that produce light through a chemical change.
    Answer: Fireflies
35. The three components represented in the fire triangle are fuel, oxygen, and __________.
    Answer: Heat

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

They require students to **apply, analyse, compare, predict, and infer** using concepts from the uploaded chapter.

1. A sheet of paper is folded into a boat and later unfolded. Since no new substance is produced, the change should be classified as a __________ **change**.
   Answer: Physical
2. A piece of chalk is crushed into powder and cannot easily be made into the original piece again. However, it is still a __________ **change** because no new substance has formed.
   Answer: Physical
3. If a substance changes its shape but its composition remains the same, we can infer that the change is __________.
   Answer: Physical
4. A student blows exhaled air through lime water and observes that it becomes milky. This observation indicates the presence of __________ in exhaled air.
   Answer: Carbon dioxide
5. If an unknown gas turns freshly prepared lime water milky, the gas is most likely __________.
   Answer: Carbon dioxide
6. When lime water turns milky after carbon dioxide is passed through it, the new insoluble substance formed is __________.
   Answer: Calcium carbonate
7. Vinegar and baking soda produce bubbles, and the gas produced turns lime water milky. From these observations, we can infer that a __________ **change** has taken place.
   Answer: Chemical
8. If baking soda is mixed with vinegar and bubbles are observed, the gas responsible for the bubbling is __________.
   Answer: Carbon dioxide
9. An iron nail left exposed develops a new brown-coloured substance. Since a new substance has formed, the process must be a __________ **change**.
   Answer: Chemical
10. If magnesium ribbon burns and produces a white powder along with heat and light, the white powder must be __________.
    Answer: Magnesium oxide
11. A burning candle covered completely by a glass tumbler goes out after some time because the supply of __________ becomes insufficient.
    Answer: Oxygen
12. If the supply of oxygen to a burning material is completely cut off, the process of __________ will stop.
    Answer: Combustion
13. If a person's clothes catch fire, wrapping the person in a suitable cloth or blanket helps extinguish the fire by cutting off the supply of __________.
    Answer: Air/Oxygen
14. A piece of paper kept in air does not burn by itself because it has not reached its __________.
    Answer: Ignition temperature
15. When sunlight is focused on paper using a magnifying glass, the paper catches fire after reaching its __________.
    Answer: Ignition temperature
16. If oxygen and fuel are available but the fuel does not receive sufficient heat, __________ will not begin.
    Answer: Combustion

17. Removing any one of fuel, oxygen, or sufficient __________ can prevent combustion.
    Answer: Heat
18. When a candle burns, melting and solidification of wax are physical changes, whereas the burning of wax vapour is a __________ **change**.
    Answer: Chemical
19. Since burning a candle involves melting of wax as well as burning of wax vapour, it involves both __________ **and chemical changes**.
    Answer: Physical
20. If water vapour is cooled and liquid water is obtained again, the original substance has been recovered; therefore, the change is __________.
    Answer: Reversible
21. Ice melts into water and can later be frozen back into ice. Hence, melting of ice is a __________ **change**.
    Answer: Reversible
22. Popcorn cannot be changed back into the original corn; therefore, making popcorn is a change that __________ **be reversed**.
    Answer: Cannot
23. Decomposition of food is undesirable during storage but useful when food waste is converted into __________.
    Answer: Compost
24. Increased burning of fuels in vehicles can increase the amount of __________ in the atmosphere.
    Answer: Carbon dioxide
25. When growing tree roots enter cracks in rocks and break them into smaller pieces, the breaking is a __________ **change**.
    Answer: Physical
26. When iron present in basalt reacts over time and forms a red-coloured iron oxide layer, the process represents a __________ **change**.
    Answer: Chemical
27. Since weathering can involve both breaking of rocks and changes in their composition, it includes both physical and __________ **changes**.
    Answer: Chemical
28. The gradual physical and chemical changes in rocks that eventually contribute to soil formation are collectively known as __________.
    Answer: Weathering
29. River pebbles gradually become smoother because of continuous __________ caused by flowing water.
    Answer: Erosion
30. When wind or flowing water breaks down and transports soil and rock particles from one place to another, the process is called __________.
    Answer: Erosion
31. When the speed of flowing water decreases, the material transported by erosion tends to __________ **at the bottom**.
    Answer: Settle
32. Sediments deposited over long periods may harden and eventually become new __________.
    Answer: Rocks
33. If vinegar and common salt do not produce a gas that turns lime water milky, we can infer that detectable __________ was not produced in that setup.
    Answer: Carbon dioxide

34. In the experiments illustrated on page 71, the mixtures containing baking soda with vinegar or lemon juice can produce __________, which can be tested using lime water.
    Answer: Carbon dioxide
35. If a balloon attached to a yeast-and-sugar mixture inflates and its collected gas turns lime water milky, the observation indicates the production of __________ **gas**.
    Answer: Carbon dioxide

5.5 One-mark questions with Answers of LOTS Type: (40 Questions)

The following questions are **LOTS (Lower Order Thinking Skills)** questions suitable for **Grade 7 Science**. Each answer is given in **one sentence**, as required.

1. **What is a physical change?**
   Answer: A physical change is a change in which only physical properties such as shape, size, or state change and no new substance is formed.
2. **Give one example of a physical change.**
   Answer: Melting of ice is an example of a physical change.
3. **What happens to a substance during a physical change?**
   Answer: The substance remains the same although its shape, size, state, or appearance may change.
4. **What is a chemical change?**
   Answer: A chemical change is a change in which one or more new substances are formed.
5. **What is a chemical reaction?**
   Answer: A chemical reaction is a process through which new substances are formed.
6. **What is a chemical equation?**
   Answer: A chemical equation is a short representation of a chemical reaction.
7. **What happens when carbon dioxide is passed through lime water?**
   Answer: Lime water turns milky when carbon dioxide is passed through it.
8. **Which substance makes lime water appear milky?**
   Answer: Insoluble calcium carbonate makes lime water appear milky.
9. **Which gas is produced when vinegar is mixed with baking soda?**
   Answer: Carbon dioxide gas is produced when vinegar is mixed with baking soda.
10. **How can carbon dioxide gas be tested?**
    Answer: Carbon dioxide can be tested by passing it through lime water, which turns milky.
11. **What is rusting?**
    Answer: Rusting is a chemical change in which a brown-coloured substance called rust is formed on iron.
12. **What new substance is formed during rusting of iron?**
    Answer: Iron oxide is formed during the rusting of iron.
13. **Why is rusting considered a chemical change?**
    Answer: Rusting is a chemical change because a new substance called iron oxide is formed.
14. **What is formed when magnesium ribbon is burnt?**
    Answer: Magnesium oxide is formed when magnesium ribbon is burnt.
15. **What forms of energy are produced when magnesium ribbon burns?**
    Answer: Heat and light are produced when magnesium ribbon burns.
16. **What is combustion?**
    Answer: Combustion is a chemical reaction in which a substance reacts with oxygen and produces heat and/or light.

17. **What are combustible substances?**
Answer: Substances that undergo combustion reactions are called combustible substances.
18. **Name any two combustible substances.**
Answer: Wood and paper are two combustible substances.
19. **Which component of air supports combustion?**
Answer: Oxygen is the component of air that supports combustion.
20. **Why does a burning candle covered with a glass tumbler go out after some time?**
Answer: The candle goes out because it does not receive a continuous supply of oxygen.
21. **What is bioluminescence?**
Answer: Bioluminescence is the production of light without heat in living organisms.
22. **Name an insect that shows bioluminescence.**
Answer: A firefly is an insect that shows bioluminescence.
23. **What is ignition temperature?**
Answer: Ignition temperature is the minimum temperature at which a substance catches fire.
24. **What are the three requirements for combustion?**
Answer: A combustible substance or fuel, oxygen, and sufficient heat are the three requirements for combustion.
25. **What physical changes occur when a candle burns?**
Answer: Melting, solidification, and evaporation of wax are physical changes that occur when a candle burns.
26. **What chemical change occurs when a candle burns?**
Answer: The burning of wax vapour is the chemical change that occurs when a candle burns.
27. **Why does burning a candle involve both physical and chemical changes?**
Answer: Burning a candle involves physical changes in wax and a chemical change when the wax vapour burns.
28. **What is a reversible change?**
Answer: A reversible change is one in which the original object or substance can be obtained again.
29. **Give one example of a reversible change.**
Answer: Melting of ice is reversible because water can be refrozen into ice.
30. **Give one example of a change that cannot be reversed.**
Answer: Making popcorn from corn is a change that cannot be reversed.
31. **What is a desirable change?**
Answer: A desirable change is a change that is useful or beneficial to us.
32. **Give two examples of desirable changes.**
Answer: Changing milk into curd and cooking food are examples of desirable changes.
33. **Give one example of an undesirable change.**
Answer: Rusting of iron is an example of an undesirable change.
34. **How can decomposition of food waste be useful?**
Answer: Decomposition of food waste is useful because it can convert the waste into compost.
35. **What is weathering?**
Answer: Weathering is the collective physical and chemical changes in rocks that eventually lead to the formation of soil.

36. **Name two factors that can physically break rocks during weathering.**
    Answer: Temperature changes and growing tree roots can physically break rocks during weathering.
37. **What are sediments?**
    Answer: Sediments are materials such as sand, soil, and stones formed from the breaking down of rocks.
38. **What is erosion?**
    Answer: Erosion is the breaking down and movement of rock particles, soil, and sediments from one place to another by natural forces such as wind and flowing water.
39. **Why do river rocks and pebbles become smoother?**
    Answer: River rocks and pebbles become smoother because of constant erosion caused by flowing water.
40. **What happens to sediments when the speed of water or wind decreases?**
    Answer: The transported sediments settle at the bottom when the speed of water or wind decreases.

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

The following **HOTS (Higher Order Thinking Skills)** questions require students to **apply, analyse, infer, predict, or justify** concepts from the Grade 7 Science chapter 5. Each answer is limited to **one sentence**.

1. **A student folds a sheet of paper into an aeroplane and later unfolds it; how would you classify this change and why?**
   Answer: It is a physical change because only the shape changes and no new substance is formed.
2. **A piece of chalk is crushed into powder; why is this still considered a physical change?**
   Answer: It is a physical change because the chalk remains the same substance even though its size and shape change.
3. **A balloon bursts after being pricked; does this prove that a chemical change has occurred? Why?**
   Answer: No, because the rubber remains the same substance and no new substance is formed.
4. **An unknown gas turns lime water milky; what can you infer about the gas?**
   Answer: The gas can be inferred to be carbon dioxide because carbon dioxide turns lime water milky.
5. **Why does lime water turn milky when we blow exhaled air through it?**
   Answer: Carbon dioxide in exhaled air reacts with lime water to form insoluble calcium carbonate.
6. **How does the formation of a white substance in lime water indicate a chemical change?**
   Answer: The white substance indicates a chemical change because a new substance, calcium carbonate, has been formed.
7. **A student mixes vinegar with baking soda and observes bubbles; what does this observation indicate?**
   Answer: The bubbles indicate that a new substance, carbon dioxide gas, has been formed.
8. **How would you confirm that the gas produced by vinegar and baking soda is carbon dioxide?**

Answer: The gas can be passed through fresh lime water, which will turn milky if carbon dioxide is present.

9. **An iron nail develops a brown coating after being left exposed; why is this a chemical change?**
   Answer: It is a chemical change because a new substance called iron oxide or rust is formed.
10. **Why is burning magnesium ribbon different from simply cutting magnesium ribbon?**
    Answer: Burning forms a new substance called magnesium oxide, whereas cutting changes only the size or shape of magnesium.
11. **What would happen if a burning candle were covered completely with a glass tumbler, and why?**
    Answer: The candle would go out after some time because the continuous supply of oxygen required for combustion is cut off.
12. **Why does an uncovered candle continue to burn longer than a candle covered with a glass tumbler?**
    Answer: An uncovered candle continuously receives oxygen from the surrounding air.
13. **Why does wrapping a suitable blanket around a person whose clothes are on fire help extinguish the fire?**
    Answer: The blanket cuts off the supply of air and hence oxygen needed for combustion.
14. **Paper is combustible, yet why does it not catch fire merely by being kept in air?**
    Answer: Paper does not catch fire in air unless it receives enough heat to reach its ignition temperature.
15. **Why can concentrated sunlight from a magnifying glass set paper on fire?**
    Answer: Concentrated sunlight raises the paper's temperature until it reaches its ignition temperature.
16. **What will happen to combustion if one component of the fire triangle is removed?**
    Answer: Combustion will stop or fail to begin if fuel, oxygen, or sufficient heat is removed.
17. **Why does a lighted matchstick make paper burn almost immediately?**
    Answer: The matchstick provides enough heat to raise the paper above its ignition temperature.
18. **Why can burning a candle not be classified only as a chemical change?**
    Answer: Burning a candle involves physical changes such as melting and evaporation of wax as well as the chemical burning of wax vapour.
19. **If melted candle wax solidifies again, what type of change has occurred?**
    Answer: A physical change has occurred because the wax remains the same substance and only its state changes.
20. **Why can melting ice be reversed but making popcorn cannot?**
    Answer: Melted ice can be frozen back into ice, whereas popcorn cannot be changed back into its original corn form.
21. **Water evaporates and is later condensed; what does this tell you about the change?**
    Answer: It shows that the change is reversible because liquid water can be obtained again.
22. **Can a change that is undesirable in one situation be useful in another? Give an example.**

Answer: Yes, decomposition is undesirable when stored food decays but desirable when food waste is converted into compost.

23. **Why can increased fuel consumption by vehicles have a long-term environmental impact?**
    Answer: Increased fuel consumption raises the amount of carbon dioxide released into the atmosphere.
24. **Tree roots growing into cracks can break rocks; what type of change is this and why?**
    Answer: It is a physical change because the rock is broken into smaller pieces without necessarily forming a new substance.
25. **A black basalt rock develops a red layer after long exposure to water and air; what does this indicate?**
    Answer: It indicates a chemical change because iron in the rock forms iron oxide.
26. **Why does weathering involve both physical and chemical changes?**
    Answer: Weathering involves physical breaking of rocks as well as chemical changes in their composition.
27. **Why do pebbles in a flowing river gradually become smoother?**
    Answer: Continuous erosion by flowing water gradually wears down the surfaces of the pebbles.
28. **What is likely to happen to sediments when a fast-flowing river enters a calm lake?**
    Answer: The sediments are likely to settle at the bottom because the speed of the water decreases.
29. **Why is erosion by wind and flowing water classified as a physical change?**
    Answer: It is a physical change because rocks and sediments are broken down and moved without necessarily forming new substances.
30. **In the experiments shown in Fig. 5.11 on page 71, which mixtures would be expected to produce carbon dioxide?**
    Answer: Vinegar with baking soda and lemon juice with baking soda would be expected to produce carbon dioxide.
31. **If a gas produced in an experiment inflates a balloon and later turns lime water milky, what can you infer?**
    Answer: We can infer that the gas collected in the balloon contains carbon dioxide.
32. **Why can the formation of soil from rocks take a very long time?**
    Answer: Soil formation depends on slow physical and chemical weathering processes that gradually break down and alter rocks.
33. **A student says, "Every irreversible change is a chemical change"; is this always correct?**
    Answer: No, because chopping vegetables is an irreversible change but is still a physical change.
34. **Can the formation of a new substance be used to distinguish a chemical change from a physical change?**
    Answer: Yes, formation of one or more new substances is the key indication of a chemical change.
35. **If a substance changes only from solid to liquid and can return to its original state, what can you infer about the change?**
    Answer: The change is physical and reversible because no new substance has been formed.

5.7 Two-mark questions with Answers of LOTS Type: (28 Questions)

The following **LOTS (Lower Order Thinking Skills)** questions are based on the Grade 7 Science chapter 5. Each answer contains **two sentences/points**, suitable for a **2-mark question**.

1. What is a physical change? Give one example.

Answer:

1. A physical change is a change in which physical properties such as shape, size, or state change without forming a new substance.
2. Melting of ice is an example of a physical change.

2. State two characteristics of a physical change.

Answer:

1. Only physical properties such as shape, size, or state of the substance may change.
2. No new substance is formed during a physical change.

3. What is a chemical change? What causes the formation of new substances?

Answer:

1. A chemical change is a change in which one or more new substances are formed.
2. New substances are formed through a process called a chemical reaction.

4. What happens when exhaled air is blown through lime water?

Answer:

1. The lime water turns milky or cloudy when exhaled air is blown through it.
2. Carbon dioxide in exhaled air reacts with lime water to form insoluble calcium carbonate.

5. How can you test for the presence of carbon dioxide?

Answer:

1. Pass the gas to be tested through freshly prepared lime water.
2. If the lime water turns milky, it indicates the presence of carbon dioxide.

6. What happens when vinegar is mixed with baking soda?

Answer:

1. Fizzing and bubbling are observed when vinegar is mixed with baking soda.
2. Carbon dioxide gas is formed, showing that a chemical change has occurred.

7. What is rusting? Why is it a chemical change?

Answer:

1. Rusting is the process in which a brown-coloured substance called rust forms on iron.
2. It is a chemical change because a new substance, iron oxide, is formed.

8. What happens when a magnesium ribbon is burnt in air?

Answer:

1. Magnesium reacts with oxygen and forms a new substance called magnesium oxide.
2. Heat and light are also produced during this chemical change.

9. What is combustion? Give two examples of combustible substances.

Answer:

1. Combustion is a chemical reaction in which a substance reacts with oxygen and produces heat and/or light.
2. Wood and paper are examples of combustible substances.

10. Why does a candle covered with a glass tumbler stop burning?

Answer:

1. The covered candle does not receive a continuous supply of air.
2. Therefore, the supply of oxygen needed for combustion becomes insufficient and the flame goes out.

11. What is bioluminescence? Give an example.

Answer:

1. Bioluminescence is the production of light without heat in living organisms.

2. Fireflies produce light through bioluminescence.

12. What is ignition temperature? Why is it important for combustion?

Answer:

1. Ignition temperature is the minimum temperature at which a substance catches fire.
2. A combustible substance must receive enough heat to reach its ignition temperature before it can burn.

13. State the three requirements necessary for combustion.

Answer:

1. A combustible substance or fuel and oxygen are required for combustion.
2. Sufficient heat is also required to bring the fuel to its ignition temperature.

14. What physical changes occur during the burning of a candle?

Answer:

1. The wax melts and is carried up the wick, where it evaporates due to the heat of the flame.
2. Melting, solidification, and evaporation of wax are physical changes.

15. Why does burning a candle involve both physical and chemical changes?

Answer:

1. Melting, solidification, and evaporation of candle wax are physical changes.
2. Burning of wax vapour is a chemical change because new substances are formed.

16. What are reversible and irreversible changes? Give one example of each.

Answer:

1. A reversible change allows the original substance to be obtained again, as when melted ice is refrozen.
2. An irreversible change does not allow the original form to be obtained again, as in making popcorn from corn.

17. Give two examples each of changes that can and cannot be reversed.

Answer:

1. Melting ice and boiling water are changes that can be reversed.
2. Chopping vegetables and making popcorn are changes that cannot be reversed.

18. What are desirable and undesirable changes? Give examples.

Answer:

1. Useful changes such as cooking food and changing milk into curd are desirable changes.
2. Harmful or unwanted changes such as rusting of iron and decay of stored food are undesirable changes.

19. How can decomposition be both desirable and undesirable?

Answer:

1. Decomposition is undesirable when it causes stored food to decay.
2. It becomes desirable when food waste decomposes to form useful compost.

20. What is weathering? How does it help in soil formation?

Answer:

1. Weathering refers to the physical and chemical changes that gradually break down or alter rocks.
2. These changes eventually lead to the formation of soil.

21. Mention two physical processes that cause rocks to break during weathering.

Answer:

1. Temperature changes due to climatic conditions can cause rocks to break into smaller pieces.
2. Growing tree roots and freezing water inside cracks can also break rocks.

22. How can chemical changes occur during weathering?

Answer:

1. Water or chemicals present in water can react with rocks and change their chemical composition.
2. For example, iron in basalt can form red-coloured iron oxide after prolonged exposure to water or moist air.

23. What is erosion? Name two natural forces that cause it.

Answer:

1. Erosion is the breaking down and movement of rock particles, soil, and sediments from one place to another.
2. Wind and flowing water are two important natural forces that cause erosion.

24. What happens to sediments transported by wind or water?

Answer:

1. When the speed of wind or water decreases, the transported sediments settle at the bottom.
2. These sediments can harden over time and become new rocks.

25. Differentiate between physical and chemical changes.

Answer:

1. In a physical change, only physical properties change and no new substance is formed.
2. In a chemical change, one or more new substances are formed through a chemical reaction.

26. How should a fire be extinguished if a person's clothes catch fire?

Answer:

1. The person should be wrapped with a suitable blanket or cloth to cut off the supply of air.
2. A synthetic blanket or cloth should not be used because it may melt and stick to the skin.

27. Write the word equation for the burning of magnesium and state the type of change.

Answer:

1. **Magnesium + Oxygen → Magnesium oxide + Heat + Light.**
2. It is a chemical change because magnesium oxide, a new substance, is formed.

28. Write the reaction between lime water and carbon dioxide and state its observation.

Answer:

1. **Calcium hydroxide + Carbon dioxide → Calcium carbonate + Water.**
2. Insoluble calcium carbonate is formed, which makes the lime water appear milky.

5.8. Two-mark questions with Answers of HOTS Type: (28 Questions)

1. A student crushes a piece of chalk into powder and says that a chemical change has occurred because the original chalk cannot be obtained back. Is the student correct? Justify.

Answer:

1. No, crushing chalk is a physical change because only its size and shape change.
2. The material remains chalk and no new substance is formed.

2. A paper boat is unfolded back into a sheet of paper. What can you infer about this change?

Answer:

1. It is a physical change because the material remains paper and no new substance is formed.
2. It is also reversible because the folded paper can be returned to its original form.

3. Exhaled air is blown separately into water and lime water. Why are the observations different?
Answer:
1. In ordinary water, exhaled air produces bubbles but does not change the appearance of the water.
2. In lime water, carbon dioxide reacts to form insoluble calcium carbonate, making the solution milky.

4. An unknown gas turns freshly prepared lime water milky. What can you infer from this observation?
Answer:
1. The gas can be inferred to contain carbon dioxide because carbon dioxide turns lime water milky.
2. The milkiness is due to the formation of insoluble calcium carbonate.

5. Vinegar is mixed with baking soda and bubbles are produced. How can you show that a chemical change has occurred?
Answer:
1. The gas produced can be passed through lime water, which turns milky and confirms that carbon dioxide has formed.
2. Since a new substance is formed, the reaction is a chemical change.

6. A student burns magnesium ribbon and obtains a white powder. How would you classify the change and why?
Answer:
1. Burning magnesium is a chemical change because magnesium reacts with oxygen to form a new substance, magnesium oxide.
2. The production of heat and light along with the new white substance provides evidence of the reaction.

7. Why does a burning candle go out when covered with a glass tumbler, while an uncovered candle continues to burn?
Answer:
1. The covered candle soon uses up the available oxygen and does not receive a continuous supply of air.
2. The uncovered candle continues to receive oxygen, which is necessary for combustion.

8. Paper is a combustible substance, yet it does not catch fire simply by being kept in air. Why?
Answer:
1. The presence of oxygen and a combustible material alone is not sufficient for combustion.
2. Paper must also receive enough heat to reach its ignition temperature before it catches fire.

9. A magnifying glass is used to focus sunlight on a piece of paper. Why does the paper eventually catch fire?
Answer:
1. Concentrated sunlight continuously heats the paper and raises its temperature.
2. When the paper reaches its ignition temperature, it starts burning.

10. If any one component of the fire triangle is removed, what will happen? Explain.
Answer:
1. Combustion will stop or cannot begin because all three requirements—fuel, oxygen, and sufficient heat—are necessary.
2. For example, cutting off oxygen by covering a flame can extinguish it.

11. Why is burning a candle considered both a physical and a chemical change?

Answer:
1. Melting, solidification, and evaporation of wax are physical changes because no new substance is formed in these processes.
2. Burning of wax vapour is a chemical change because new substances are formed.

12. Melting ice and making popcorn both change the appearance of a substance. Why are they different with respect to reversibility?

Answer:
1. Melting ice is reversible because water can be frozen again to obtain ice.
2. Making popcorn is irreversible because popcorn cannot be changed back into its original corn form.

13. A student claims that every irreversible change must be a chemical change. Is this conclusion correct? Give a reason.

Answer:
1. No, irreversibility alone cannot be used to identify a chemical change because chopped vegetables cannot return to their original size and shape.
2. A chemical change is identified by the formation of one or more new substances.

14. Food decomposition is considered undesirable at home but useful in composting. Explain.

Answer:
1. Decomposition is undesirable when it causes stored food to decay and become unusable.
2. The same process is desirable when food waste decomposes to produce useful compost.

15. Why can increased use of fuel by vehicles cause a long-term environmental problem?

Answer:
1. Increased fuel consumption by cars, trains, and aeroplanes increases the amount of carbon dioxide in the atmosphere.
2. Therefore, changes caused by human activities can have long-term environmental impacts.

16. Tree roots grow into cracks in rocks and gradually break them. How would you classify this change?

Answer:
1. This is a physical part of weathering because the roots cause large rocks to break into smaller pieces.
2. The process changes the size and shape of the rocks without necessarily forming a new substance.

17. A black basalt rock develops a red-coloured layer after being exposed to moist air for a long time. What does this indicate?

Answer:
1. It indicates a chemical change because iron present in basalt forms iron oxide.
2. The formation of the new red-coloured substance shows that the chemical composition of the rock has changed.

18. Why is weathering considered to involve both physical and chemical changes?

Answer:
1. Physical weathering breaks large rocks into smaller pieces through factors such as temperature changes, roots, and freezing water.
2. Chemical weathering changes the composition of rocks when water or chemicals react with them.

19. Why do rocks and pebbles in a flowing river become smoother with time?

Answer:
1. Flowing water continuously causes erosion of the surfaces of rocks and pebbles.

2. This gradual wearing away makes them smoother over time.

20. What happens when a fast-flowing river carrying sediments enters a calm lake? Give a reason.

Answer:

1. The transported sediments begin to settle at the bottom when the speed of the water decreases.
2. Over time, these sediments may harden and form new rocks.

21. A person's clothes catch fire. Why does wrapping the person in a suitable blanket help extinguish the fire?

Answer:

1. Wrapping the person in a suitable blanket cuts off the supply of air to the burning clothes.
2. Without sufficient oxygen, combustion stops and the fire is extinguished.

22. Why should a synthetic blanket not be used to extinguish burning clothes?

Answer:

1. Synthetic material can melt when exposed to high temperatures.
2. The melted material may stick to the person's skin and cause further injury.

23. In Fig. 5.11, which mixtures would make the lime water milky, and why?

Answer:

1. Vinegar with baking soda and lemon juice with baking soda would produce carbon dioxide and therefore make lime water milky.
2. Carbon dioxide reacts with lime water to form insoluble calcium carbonate, which causes the milky appearance.

24. Suppose water freezes inside cracks in a rock repeatedly. Predict its effect on the rock and relate it to weathering.

Answer:

1. Repeated freezing of water in cracks can cause the rock to break into smaller pieces.
2. This contributes to physical weathering and ultimately helps in soil formation.

25. A student says that every change in appearance is a chemical change. How would you correct the student?

Answer:

1. A change in appearance may be only a physical change if no new substance is formed, as in folding paper or crushing chalk.
2. A chemical change occurs only when one or more new substances are formed through a chemical reaction.

26. How can you distinguish between melting wax and burning wax vapour?

Answer:

1. Melting wax is a physical change because only its state changes and no new substance is formed.
2. Burning wax vapour is a chemical change because combustion produces new substances.

27. A piece of paper catches fire quickly when touched with a burning matchstick but takes time when sunlight is focused on it. Why?

Answer:

1. A burning matchstick is already at a temperature higher than the ignition temperature of paper, so the paper catches fire quickly.
2. Focused sunlight takes some time to heat the paper until it reaches its ignition temperature.

28. Why can erosion during a landslide be classified as a physical change?

Answer:

1. During erosion, rock particles, soil, and sediments are broken down and moved from one place to another.
2. This is classified as a physical change because the process mainly alters their size, shape, or location rather than forming new substances.

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

1. What is a physical change? Give two examples.
Answer:
1. A physical change is a change in which only physical properties such as shape, size, or state of a substance change.
2. No new substance is formed during a physical change.
3. Folding paper and crushing a piece of chalk are examples of physical changes.

2. What is a chemical change? Explain with an example.
Answer:
1. A chemical change is a change in which one or more new substances are formed.
2. New substances are formed through a process called a chemical reaction.
3. Carbon dioxide reacting with lime water to form calcium carbonate is an example of a chemical change.

3. Describe what happens when carbon dioxide is passed through lime water.
Answer:
1. Carbon dioxide reacts with lime water, which is calcium hydroxide.
2. A white-coloured insoluble substance called calcium carbonate is formed.
3. The formation of calcium carbonate makes the lime water appear milky or cloudy.

4. Describe the reaction between vinegar and baking soda.
Answer:
1. When baking soda is added to vinegar, a fizzing or bubbling sound is heard and gas bubbles are formed.
2. The gas produced is carbon dioxide, which can be identified because it turns lime water milky.
3. Since a new substance is formed, the reaction is a chemical change.

5. Explain why rusting of iron is considered a chemical change.
Answer:
1. During rusting, a new brown-coloured substance called rust is formed.
2. The new substance formed is iron oxide.
3. Therefore, rusting is classified as a chemical change because it involves the formation of a new substance.

6. What happens when magnesium ribbon is burnt in air?
Answer:
1. When magnesium ribbon is burnt, it reacts with oxygen present in the air.
2. A new white substance called magnesium oxide is formed.
3. Heat and light are also produced during this chemical change.

7. Define combustion and give examples of combustible substances.
Answer:
1. Combustion is a chemical reaction in which a substance reacts with oxygen and produces heat and/or light.
2. Substances that undergo combustion are called combustible substances.
3. Wood, paper, cotton, and kerosene are examples of combustible substances.

8. Explain the role of oxygen in combustion.
Answer:

1. Oxygen is the component of air that supports combustion.
2. A candle covered with a glass tumbler stops burning after some time because it does not receive a continuous supply of air.
3. Thus, oxygen is necessary for a combustible substance to continue burning.

9. What is ignition temperature? Explain with the example of paper.

Answer:

1. Ignition temperature is the minimum temperature at which a substance catches fire.
2. When sunlight is focused on paper using a magnifying glass, the temperature of the paper gradually increases.
3. The paper starts burning when its temperature reaches its ignition temperature.

10. State the three requirements necessary for combustion.

Answer:

1. A combustible substance, also called fuel, must be present.
2. Oxygen must be available to support combustion.
3. Sufficient heat must be supplied so that the fuel reaches its ignition temperature.

11. Explain the physical and chemical changes occurring when a candle burns.

Answer:

1. The wax melts, moves up the wick, and evaporates due to the heat of the flame.
2. Melting, solidification, and evaporation of wax are physical changes.
3. Burning of wax vapour is a chemical change, so a burning candle shows both physical and chemical changes.

12. What are reversible and irreversible changes? Give examples.

Answer:

1. A reversible change is one in which the original substance or object can be obtained again, as when melted ice is refrozen.
2. An irreversible change is one in which the original form cannot be obtained again.
3. Chopping vegetables and making popcorn are examples of changes that cannot be reversed.

13. What are desirable and undesirable changes? Give examples.

Answer:

1. Desirable changes are useful changes, such as changing milk into curd, ripening fruits, and cooking food.
2. Undesirable changes include rusting of iron and decay of stored food.
3. A change may be undesirable in one situation but useful in another, as food decomposition is useful for making compost.

14. What is weathering of rocks? Explain how it occurs.

Answer:

1. Weathering refers collectively to the physical and chemical changes that occur in rocks over time.
2. Temperature changes, growing tree roots, and freezing water in cracks can physically break rocks into smaller pieces.
3. Water and chemicals can also react with rocks and chemically change their composition, and weathering eventually contributes to soil formation.

15. What is erosion? Describe how it occurs.

Answer:

1. Erosion is the process in which rock pebbles, soil, and sediments are broken down and moved from one place to another by natural forces.
2. Wind and flowing water are important natural agents that cause erosion.
3. When the speed of water or wind decreases, transported materials settle and may eventually harden into new rocks.

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

1. A student crushes a piece of chalk into powder and claims that it is a chemical change because the original chalk piece cannot be obtained again. Do you agree? Justify.

Answer:

1. No, crushing chalk is a physical change because only its size and shape are changed.
2. The material remains chalk even after it is crushed into powder.
3. Therefore, the inability to reverse a change does not necessarily mean that it is a chemical change.

2. A student blows exhaled air into ordinary water and lime water. Predict the observations and explain the difference.

Answer:

1. Blowing exhaled air into ordinary water produces bubbles but causes no visible change in the water.
2. Blowing it into lime water makes the lime water milky because carbon dioxide reacts with it to form insoluble calcium carbonate.
3. The formation of calcium carbonate indicates that a chemical change has occurred in the lime water.

3. Vinegar and baking soda are mixed, producing bubbles. How would you identify the gas and prove that a chemical change has occurred?

Answer:

1. The gas produced can be passed through freshly prepared lime water.
2. If the lime water turns milky, the gas is identified as carbon dioxide.
3. Since carbon dioxide is a new substance formed during the reaction, the mixing of vinegar and baking soda is a chemical change.

4. Two identical candles are lit, but one is covered with a glass tumbler. Predict what happens and explain why.

Answer:

1. The uncovered candle continues to burn because it receives a continuous supply of air.
2. The candle covered with the glass tumbler goes out after some time because the available oxygen becomes insufficient.
3. This experiment demonstrates that oxygen is essential for combustion.

5. Paper is combustible, yet a sheet of paper kept on a table does not burn by itself. Explain using the concept of ignition temperature.

Answer:

1. A combustible substance does not burn merely because oxygen is present around it.
2. The paper must receive enough heat to reach its minimum ignition temperature before combustion begins.
3. Thus, fuel, oxygen, and sufficient heat are all necessary for combustion.

6. Sunlight focused through a magnifying glass can set paper on fire even without using a flame. Explain how.

Answer:

1. The magnifying glass concentrates sunlight onto a small area of the paper and heats it.
2. The temperature of the paper gradually rises until it reaches its ignition temperature.
3. Once the ignition temperature is reached, the paper catches fire even though no flame was initially used.

7. A burning candle undergoes both physical and chemical changes. Analyse the process and justify this statement.

Answer:

1. The candle wax melts, moves up the wick, evaporates, and may solidify again, which are physical changes.
2. The wax vapour burns and produces new substances, making combustion a chemical change.
3. Therefore, the burning of a candle demonstrates that physical and chemical changes can occur together in the same process.

8. A person says, "All physical changes are reversible." Is this statement correct? Give reasons.

Answer:

1. The statement is incorrect because reversibility alone cannot be used to classify a change as physical or chemical.
2. For example, chopped vegetables cannot be restored to their original size and shape even though chopping mainly changes physical properties.
3. A physical change is identified mainly by the fact that no new substance is formed.

9. Decomposition of food is undesirable during storage but desirable in a compost pit. Explain this apparent contradiction.

Answer:

1. Decomposition of stored food is undesirable because it causes the food to decay and become unusable.
2. The same decomposition process is useful when food waste is converted into compost.
3. Hence, whether a change is desirable or undesirable can depend on the situation and its purpose.

10. A black basalt rock develops a reddish layer after being exposed to moist air for a long period. Explain what has happened.

Answer:

1. Basalt contains iron, which undergoes a chemical change when the rock remains exposed to water or moist air.
2. Iron oxide is formed, producing a red-coloured layer on the surface of the rock.
3. Since the composition of the rock changes and a new substance is produced, this is chemical weathering.

11. Explain how both physical and chemical processes contribute to the formation of soil from rocks.

Answer:

1. Temperature changes, growing roots, and freezing water can physically break large rocks into smaller pieces.
2. Water and chemicals present in it can react with rocks and cause chemical changes in their composition.
3. Together, these physical and chemical processes constitute weathering, which eventually contributes to soil formation.

12. Why do pebbles in a river generally become smoother with time, and what happens to the eroded material when the water slows down?

Answer:

1. Flowing water continuously causes erosion, gradually wearing down the surfaces of rocks and pebbles and making them smoother.
2. When the speed of flowing water decreases, the transported sediments settle at the bottom.
3. Over a long period, these sediments may harden and form new rocks.

13. A person's clothes accidentally catch fire. Explain scientifically why wrapping the person in a suitable blanket can extinguish the fire.

Answer:

1. Wrapping the person in a suitable blanket cuts off the supply of air to the burning clothes.
2. Without a sufficient supply of oxygen, combustion cannot continue and the fire gets extinguished.
3. A synthetic blanket should not be used because it may melt and stick to the skin.

14. A student says, "Any substance that gives out light during a chemical change must also become very hot." Use the example of fireflies to evaluate this statement.
Answer:
1. The statement is not always correct because some chemical changes can produce light without producing noticeable heat.
2. Fireflies produce light through a chemical change occurring in their bodies.
3. Such production of light without heat in living organisms is called **bioluminescence**.

15. Increased use of cars, trains, and aeroplanes can cause long-term changes in the environment. Explain the connection using concepts from the chapter.
Answer:
1. Cars, trains, and aeroplanes consume fuels, and increased fuel consumption adds more carbon dioxide to the atmosphere.
2. Therefore, changes caused by human activities can accumulate over time and have long-term environmental impacts.
3. This shows that everyday chemical processes involving fuels can influence the environment on a much larger scale.

These questions deliberately move beyond simple recall and require students to **predict observations, analyse evidence, classify changes, justify conclusions, and apply concepts such as combustion, ignition temperature, reversibility, weathering, and erosion to unfamiliar situations**.

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

1. Explain physical changes with suitable examples.
Answer:
1. A physical change is a change in which only the physical properties of a substance or object change.
2. Physical properties include its shape, size, and state.
3. No new substance is formed during a physical change.
4. Folding paper, crushing chalk, and changing the state of water are examples of physical changes.
5. In these changes, the material remains the same even though its appearance may change.

2. What is a chemical change? Explain the reaction between carbon dioxide and lime water.
Answer:
1. A chemical change is a change in which one or more new substances are formed.
2. New substances are formed through a process called a chemical reaction.
3. When carbon dioxide is passed through lime water, the lime water turns milky or cloudy.
4. This happens because carbon dioxide reacts with calcium hydroxide to form insoluble calcium carbonate and water.
5. The formation of calcium carbonate, a new substance, shows that a chemical change has taken place.

3. Describe the experiment involving vinegar, baking soda, and lime water.

Answer:

1. Take a teaspoonful of vinegar or lemon juice in a test tube and add a pinch of baking soda.
2. A fizzing sound is heard and bubbles of gas are produced.
3. Pass the gas formed through freshly prepared lime water.
4. The lime water turns milky, showing that the gas produced is carbon dioxide.
5. Since carbon dioxide is a new substance formed in the reaction, mixing vinegar and baking soda is a chemical change.

4. Explain rusting and combustion as examples of chemical changes.

Answer:

1. Rusting is a chemical change in which a new brown-coloured substance called rust is formed on iron.
2. The new substance formed during rusting is iron oxide.
3. Combustion is a chemical reaction in which a substance reacts with oxygen and produces heat and/or light.
4. When magnesium burns in oxygen, it forms a new white substance called magnesium oxide along with heat and light.
5. Thus, both rusting and combustion are chemical changes because new substances are formed.

5. Explain the role of oxygen in combustion using the candle experiment.

Answer:

1. Two identical candles are placed separately and lighted, and one of them is covered with a glass tumbler.
2. The uncovered candle continues to burn, while the covered candle stops burning after some time.
3. The covered candle goes out because it does not receive a continuous supply of air.
4. Oxygen is the component of air that supports combustion.
5. Therefore, this experiment demonstrates that oxygen is necessary for combustion to continue.

6. What is ignition temperature? Explain the three requirements for combustion.

Answer:

1. The minimum temperature at which a substance catches fire is called its **ignition temperature**.
2. A substance starts burning only when it receives enough heat to reach this temperature.
3. The first requirement for combustion is the presence of a combustible substance or fuel.
4. The second requirement is the presence of oxygen.
5. The third requirement is sufficient heat to raise the fuel to its ignition temperature; these three requirements form the **fire triangle** shown on page 64.

7. Explain how both physical and chemical changes occur during the burning of a candle.

Answer:

1. When a candle burns, its wax melts because of the heat produced by the flame.
2. The melted wax moves up the wick and evaporates.
3. Melting, solidification, and evaporation of wax are physical changes because no new substances are formed in these processes.
4. The wax vapour burns and produces a flame, which is a chemical change.
5. Thus, the burning of a candle is an example of a process in which physical and chemical changes occur together.

8. Explain reversible and irreversible changes with suitable examples.

Answer:

1. A change is reversible when the original object or substance can be obtained again.

2. For example, melted ice can be frozen again to obtain ice.
3. Similarly, water vapour can be condensed back into liquid water.
4. Some changes, such as chopping vegetables and making popcorn, cannot be reversed to obtain the original materials in their original forms.
5. Hence, changes around us can be classified into reversible and irreversible changes.

9. Explain weathering of rocks and its role in soil formation.

Answer:

1. Large rocks can break into smaller pieces because of temperature changes, growing tree roots, and freezing water in their cracks.
2. These processes cause physical changes in rocks and produce smaller rock fragments and sediments.
3. Water and chemicals present in water can also react with rocks and cause chemical changes in their composition.
4. These physical and chemical changes occurring in rocks are collectively called **weathering**.
5. Weathering takes place slowly over time and eventually contributes to the formation of soil.

10. What is erosion? Explain the process and its effects on rocks and sediments.

Answer:

1. Erosion is the process in which rock pebbles, soil, and sediments are broken down and moved from one place to another by natural forces.
2. Wind and flowing water are important agents that cause erosion.
3. Continuous erosion by flowing water makes river rocks and pebbles smoother.
4. When the speed of water or wind decreases, the transported materials settle at the bottom.
5. These sediments may harden over time and form new rocks, with many such changes taking thousands of years.

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

1. A student says, "If a change cannot be reversed, it must be a chemical change." Analyse this statement with suitable examples.

Answer:

1. The statement is not correct because reversibility alone cannot decide whether a change is physical or chemical.
2. In a physical change, physical properties such as size, shape, or state change without forming a new substance.
3. Chopping vegetables is a physical change, but the chopped vegetables cannot be restored to their original size and shape.
4. Making popcorn is also irreversible, while melting ice is reversible because the water can be frozen again.
5. Therefore, the formation of a new substance, rather than reversibility alone, is the main criterion for identifying a chemical change.

2. A student blows exhaled air separately into tap water and lime water. Analyse the observations and explain how they help identify a chemical change.

Answer:

1. When exhaled air is blown into tap water, bubbles are produced but there is no visible change in the water.
2. When the same air is blown into lime water, the lime water becomes milky or cloudy.

3. Carbon dioxide present in exhaled air reacts with lime water to form insoluble calcium carbonate.
4. The formation of calcium carbonate shows that a new substance has been produced.
5. Therefore, the change in lime water is a chemical change, whereas merely producing bubbles in tap water does not demonstrate the formation of a new substance.

3. Vinegar is mixed separately with baking soda and common salt. How could you use lime water to determine which mixture produces carbon dioxide?

Answer:

1. Mix vinegar with baking soda in one container and vinegar with common salt in another.
2. Pass the gas, if produced, from each mixture separately through freshly prepared lime water.
3. Vinegar and baking soda produce gas bubbles because a chemical reaction takes place.
4. The gas turns lime water milky, confirming that it is carbon dioxide.
5. Thus, the lime-water test provides evidence that the vinegar–baking soda mixture produces carbon dioxide and undergoes a chemical change.

4. Two identical burning candles are kept on separate dishes, and one is covered with a glass tumbler. Predict and explain the observations.

Answer:

1. The uncovered candle continues to burn because it receives a continuous supply of air.
2. The candle covered with the glass tumbler burns only for a short time and then goes out.
3. The flame gets extinguished because the covered candle does not receive a continuous supply of oxygen.
4. Oxygen is the component of air that supports combustion.
5. Hence, the experiment demonstrates that a continuous supply of oxygen is necessary for combustion to continue.

5. Paper is combustible, but it does not normally catch fire while lying in the open air. Explain this using the concept of the fire triangle.

Answer:

1. Paper is a combustible substance and oxygen is already present in the surrounding air.
2. However, these two conditions alone are not sufficient for combustion to begin.
3. The paper must receive enough heat to reach its **ignition temperature**, the minimum temperature at which it catches fire.
4. Thus, combustion requires three things—fuel, oxygen, and sufficient heat to reach the ignition temperature.
5. The absence of any one of these three components of the **fire triangle** prevents combustion from starting or continuing.

6. Explain why the burning of a candle cannot be classified as only a physical change or only a chemical change.

Answer:

1. Heat from the candle flame first melts the solid wax into liquid wax.
2. The liquid wax moves up the wick and evaporates due to the heat of the flame.
3. Melting, solidification, and evaporation of wax are physical changes because they involve changes in physical state.
4. The wax vapour then burns to produce a flame, and this burning is a chemical change.
5. Therefore, a burning candle demonstrates that physical and chemical changes can occur together in a single process.

7. A black basalt rock develops a red-coloured layer after long exposure to moist air. Analyse the change and relate it to weathering and soil formation.

Answer:
1. Basalt contains iron, which can undergo a chemical change when exposed for a long time to water or air containing water vapour.
2. This chemical change produces iron oxide, which gives the rock surface a red colour.
3. Rocks may also break physically because of temperature changes, growing roots, and freezing water in cracks.
4. The combined physical and chemical changes occurring in rocks are called **weathering**.
5. Over a long period, weathering breaks and changes rocks and eventually contributes to the formation of soil.

8. River pebbles are often smooth, while sediments collect at the bottom of lakes and oceans. Explain how these two observations are related.
Answer:
1. Flowing water causes erosion by breaking down and transporting rock particles, soil, and sediments.
2. Continuous erosion by flowing water gradually makes river rocks and pebbles smoother.
3. The moving water carries the eroded material from one location to another.
4. When the speed of the water decreases, the transported sediments settle at the bottom of lakes or oceans.
5. Over time, these sediments may harden to form new rocks, and many such changes take thousands of years.

9. "The same type of change may be desirable in one situation and undesirable in another." Justify this statement using decomposition.
Answer:
1. Changes cannot always be classified as desirable or undesirable without considering the situation.
2. Decomposition of stored food is undesirable because it causes the food to decay.
3. However, decomposition of food waste can be useful because it converts the waste into compost.
4. Thus, the same basic process can have different usefulness depending on where and why it occurs.
5. Therefore, the desirability of a change depends on its circumstances and consequences.

10. Increased use of vehicles involves useful changes but may also produce long-term environmental problems. Analyse this statement using concepts from the chapter.
Answer:
1. Cars, trains, and aeroplanes use fuels that undergo combustion to provide energy.
2. Combustion is a chemical change involving reaction with oxygen and production of heat and/or light.
3. Increased consumption of fuels also increases the amount of carbon dioxide released into the atmosphere.
4. The chapter points out that such changes caused by human activities can have long-term environmental impacts.
5. Therefore, useful chemical changes such as fuel combustion should also be considered in terms of their wider environmental consequences.

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

1. Riya leaves an iron bicycle outside during the rainy season. After a few weeks, she notices a brown coating on its handle and chain. Explain what has happened and classify the change.

Answer:
1. The brown coating formed on the bicycle is called **rust**.
2. Rusting occurs when iron undergoes a chemical change on exposure to suitable environmental conditions.
3. During rusting, a new substance called **iron oxide** is formed.
4. Since a new substance is produced, rusting is classified as a **chemical change**.
5. Thus, the brown coating indicates that the iron parts of the bicycle have undergone a chemical change.

2. During a birthday celebration, a student covers a burning candle with a glass tumbler. After some time, the flame goes out. Apply your knowledge of combustion to explain why.
Answer:
1. A candle requires a continuous supply of oxygen to keep burning.
2. When the candle is covered with a glass tumbler, fresh air cannot continuously enter the tumbler.
3. The available oxygen inside the tumbler is gradually used during combustion.
4. When sufficient oxygen is no longer available, the flame gets extinguished.
5. Therefore, this situation demonstrates that **oxygen is essential for combustion**.

3. A person's clothes accidentally catch fire. Using the concept of the fire triangle, explain what should be done and why.
Answer:
1. Combustion requires fuel, oxygen, and sufficient heat to reach the ignition temperature.
2. If a person's clothes catch fire, the person should be wrapped with a suitable blanket or cloth.
3. The covering cuts off the supply of air and therefore reduces the availability of oxygen.
4. Without oxygen, combustion cannot continue and the fire gets extinguished.
5. A **synthetic blanket or cloth should not be used**, because it can melt and stick to the skin.

4. While preparing food, Aarav chops vegetables, boils water, cooks food, and later converts vegetable waste into compost. Classify these changes using the concepts learned in the chapter.
Answer:
1. Chopping vegetables is a **physical change** because only their size and shape change.
2. Boiling water is also a physical change because water changes its state without forming a new substance.
3. Cooking food is a **chemical change** because it involves the formation of new substances.
4. Decomposition of vegetable waste into compost is also a chemical change.
5. Therefore, activities in a kitchen can involve both physical and chemical changes.

5. Meera mixes lemon juice with baking soda and observes bubbles. How can she experimentally identify the gas produced?
Answer:
1. Meera can collect or pass the gas produced from the mixture into freshly prepared **lime water**.
2. If the lime water turns milky, it indicates the presence of carbon dioxide.
3. Lemon juice or vinegar reacting with baking soda produces carbon dioxide gas.
4. Carbon dioxide reacts with lime water and forms insoluble calcium carbonate, making it appear milky.
5. Since a new substance is formed during the original reaction, mixing lemon juice with baking soda is a **chemical change**.

6. A student leaves an ice cube in a bowl and observes that it becomes water. Later, the water is placed in a freezer and becomes ice again. Explain the changes involved.

Answer:

1. When the ice cube is kept outside, it melts and changes from solid ice into liquid water.
2. No new substance is formed because both ice and liquid water are forms of water.
3. Therefore, melting of ice is a **physical change**.
4. When the water is placed in a freezer, it can be changed back into ice.
5. Hence, this is also an example of a **reversible change**.

7. A student focuses sunlight on a piece of paper using a magnifying glass. After some time, the paper begins to smoke and catches fire. Explain this observation.

Answer:

1. The magnifying glass focuses sunlight onto a small area of the paper.
2. The concentrated sunlight heats the paper and gradually increases its temperature.
3. When the paper reaches its **ignition temperature**, it starts burning.
4. This shows that a substance does not necessarily need a flame to start combustion; sufficient heat can initiate it.
5. The experiment demonstrates that fuel, oxygen, and enough heat to reach the ignition temperature are necessary for combustion.

8. During a visit to a river, students notice that many stones and pebbles are smooth and rounded. Apply the concept of erosion to explain their observation.

Answer:

1. Flowing river water continuously acts on rocks, stones, and pebbles.
2. This action causes **erosion**, in which rock materials are gradually broken down and transported.
3. Continuous erosion by flowing water gradually makes river rocks and pebbles smoother.
4. When the speed of water decreases, transported sediments may settle at the bottom.
5. Thus, the smooth appearance of river pebbles is the result of physical changes occurring over a long period.

9. A student observes a burning candle and says, "Only a chemical change is occurring because the candle is burning." Do you agree? Apply your knowledge to explain.

Answer:

1. The student's statement is incomplete because a burning candle undergoes both **physical and chemical changes**.
2. The solid wax first melts due to the heat of the flame.
3. Melting, solidification, and evaporation of wax are physical changes.
4. The wax vapour burns to produce the flame, and this burning is a chemical change.
5. Therefore, the burning candle is a practical example in which physical and chemical changes occur together.

10. During a field trip to a hilly region, students observe broken rocks, sediments, and soil near the base of a mountain. Explain how these materials may have formed.

Answer:

1. Large rocks can break into smaller pieces because of temperature changes, growing tree roots, and freezing water inside cracks.
2. These processes cause physical changes in the rocks.
3. Water and chemicals present in water can also react with rocks and chemically change their composition.
4. These physical and chemical changes in rocks are collectively called **weathering**.
5. Over a long period, weathering breaks down rocks and eventually contributes to the formation of soil.

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

Olympiad-Type Multiple Choice Questions — Grade 7

The following **25 MCQs** are designed at a **competitive/Olympiad level**, emphasizing conceptual understanding, application, reasoning, experimentation, and analysis. They are based on the uploaded chapter, which distinguishes physical changes by the absence of a new substance and chemical changes by the formation of one or more new substances.

1. Which observation provides the strongest evidence that a chemical change has occurred?

A. A solid is broken into smaller pieces
B. A liquid change into a gas
C. A new substance with different properties is formed
D. An object changes its shape

Answer: C. A new substance with different properties is formed

2. Consider the following changes:

P – Melting of ice
Q – Rusting of iron
R – Boiling of water
S – Burning of magnesium
Which pair represents only chemical changes?
A. P and Q
B. Q and S
C. P and R
D. R and S

Answer: B. Q and S

3. A student blows exhaled air into lime water. It turns milky because:

A. oxygen reacts with lime water.
B. nitrogen forms a white precipitate.
C. carbon dioxide forms insoluble calcium carbonate.
D. water vapour freezes in lime water.

Answer: C. Carbon dioxide forms insoluble calcium carbonate.

4. Which sequence correctly represents the reaction responsible for lime water turning milky?

A. Calcium carbonate + oxygen → calcium hydroxide
B. Calcium hydroxide + carbon dioxide → calcium carbonate + water
C. Carbon dioxide + water → calcium hydroxide
D. Calcium hydroxide + oxygen → carbon dioxide + water

Answer: B. Calcium hydroxide + carbon dioxide → calcium carbonate + water

5. Four students make the following statements about physical changes:

P: A physical change must always be reversible.
Q: A physical change does not form a new substance.
R: A physical change may involve a change in state.
S: A physical change always changes the chemical composition.
Which students are correct?
A. P and Q only
B. Q and R only
C. R and S only
D. P, Q and R

Answer: B. Q and R only

6. Which observation would best confirm that the gas produced by mixing vinegar and baking soda is carbon dioxide?
A. It has no colour.
B. It forms bubbles.
C. It turns lime water milky.
D. It escapes from the test tube.
Answer: C. It turns lime water milky.
7. A candle covered with a glass tumbler stops burning after some time mainly because:
A. the wax becomes cold.
B. the wick becomes shorter.
C. the continuous supply of oxygen is cut off.
D. carbon dioxide changes into oxygen.
Answer: C. The continuous supply of oxygen is cut off.
8. Which set correctly represents the three components of the fire triangle?
A. Fuel, nitrogen and water
B. Fuel, oxygen and sufficient heat
C. Oxygen, carbon dioxide and heat
D. Fuel, carbon dioxide and water
Answer: B. Fuel, oxygen and sufficient heat
9. Paper does not normally catch fire simply by being exposed to air because:
A. paper is non-combustible.
B. air contains no oxygen.
C. paper has not reached its ignition temperature.
D. paper undergoes only physical changes.
Answer: C. Paper has not reached its ignition temperature.
10. A magnifying glass can cause paper to catch fire by focusing sunlight because it:
A. produces oxygen.
B. lowers the ignition temperature of paper.
C. heats the paper until it reaches its ignition temperature.
D. converts paper into a non-combustible substance.
Answer: C. It heats the paper until it reaches its ignition temperature.
11. Which of the following correctly describes a burning candle?
A. Only a reversible physical change occurs.
B. Only a chemical change occurs.
C. Both physical and chemical changes occur.
D. Neither physical nor chemical changes occur.
Answer: C. Both physical and chemical changes occur.
12. Which part of the burning of a candle is a chemical change?
A. Melting of wax
B. Solidification of wax
C. Evaporation of wax
D. Burning of wax vapour
Answer: D. Burning of wax vapour
13. Which conclusion about reversibility is scientifically correct according to the chapter?
A. All physical changes are reversible.
B. All chemical changes are irreversible.
C. Reversibility alone cannot be used to identify a physical change.
D. Every irreversible change must form a new substance.
Answer: C. Reversibility alone cannot be used to identify a physical change.

14. Consider the changes:

1. Melting ice
2. Chopping vegetables
3. Boiling water
4. Making popcorn

Which can be reversed according to the examples in the chapter?
A. 1 and 3 only
B. 2 and 4 only
C. 1, 2 and 3 only
D. All four
Answer: A. 1 and 3 only
15. Rusting is classified as a chemical change primarily because:
A. iron becomes smaller.
B. iron changes its shape.
C. a new substance, iron oxide, is formed.
D. rust can be brown in colour.
Answer: C. A new substance, iron oxide, is formed.
16. When magnesium ribbon burns in air, which combination correctly describes the process?
A. Physical change + magnesium oxide
B. Chemical change + magnesium oxide + heat and light
C. Physical change + carbon dioxide
D. Chemical change + calcium carbonate
Answer: B. Chemical change + magnesium oxide + heat and light
17. A person's clothes catch fire. Which action applies the scientific principle of removing one component of the fire triangle?
A. Expose the clothes to more air.
B. Wrap the person with a suitable blanket or cloth.
C. Place the person near a heater.
D. Use a synthetic cloth to cover the flames.
Answer: B. Wrap the person with a suitable blanket or cloth.
This cuts off the supply of air; the chapter specifically warns against using synthetic material because it may melt and stick to the skin.
18. Which statement best explains why decomposition may be considered both desirable and undesirable?
A. It is always a physical change.
B. Food decomposition during storage is undesirable, but decomposition of food waste to form compost is useful.
C. It never forms new substances.
D. It occurs only in rocks.
Answer: B. Food decomposition during storage is undesirable, but decomposition of food waste to form compost is useful.
19. Which of the following can cause the physical breaking of rocks during weathering?

1. Temperature changes
2. Growing tree roots
3. Freezing water in rock cracks
4. Chemical reaction producing iron oxide

A. 1 and 2 only
B. 1, 2 and 3 only

C. 3 and 4 only
D. All four are physical processes
Answer: B. 1, 2 and 3 only
20. A black basalt rock develops a red-coloured surface after prolonged exposure to moist air. The red colour is mainly associated with:
A. calcium carbonate.
B. magnesium oxide.
C. iron oxide.
D. calcium hydroxide.
Answer: C. Iron oxide.
21. River pebbles gradually become smoother mainly because:
A. they undergo combustion.
B. flowing water continuously causes erosion.
C. they melt and solidify repeatedly.
D. carbon dioxide reacts with them immediately.
Answer: B. Flowing water continuously causes erosion.
22. Four mixtures are prepared:
P – Vinegar + baking soda
Q – Lemon juice + vinegar
R – Vinegar + common salt
S – Lemon juice + baking soda
The gas from each mixture is passed into lime water. Based on the chapter activity, in which cases should the lime water turn milky?
A. P only
B. P and S
C. Q and R
D. P, Q and S
Answer: B. P and S
Both combinations involving baking soda with vinegar/lemon juice produce carbon dioxide, which can be detected using lime water.
23. Assertion (A): Weathering can involve both physical and chemical changes. Reason (R): Rocks may break physically and may also undergo chemical changes in their composition.
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.
24. Assertion (A): A covered burning candle eventually goes out.
Reason (R): Combustion requires a continuous supply of oxygen.
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. Both A and R are false.
Answer: A. Both A and R are true, and R correctly explains A.
25. A student classifies the following:
P. Tearing paper — physical change
Q. Rusting iron — chemical change

R. Melting ice — chemical change
S. Burning magnesium — chemical change
Which classification is correct?
A. P and R only
B. Q and S only
C. P, Q and S only
D. P, Q, R and S
Answer: C. P, Q and S only
Melting ice is a physical change because no new substance is formed.
Answer Key
1-C, 2-B, 3-C, 4-B, 5-B, 6-C, 7-C, 8-B, 9-C, 10-C, 11-C, 12-D, 13-C, 14-A, 15-C, 16-B, 17-B, 18-B, 19-B, 20-C, 21-B, 22-B, 23-A, 24-A, 25-C

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

Since the chapter itself is strongly activity-oriented—covering physical and chemical changes, combustion, reversibility, desirable/undesirable changes, weathering, and erosion—the following best practices can make learning more experiential and conceptually strong.

(1) **Activity-Based "Observe–Predict–Explain" Learning:** Before each demonstration, ask students to predict what will happen, observe the experiment, and then explain the result. Activities such as folding paper, inflating balloons, crushing chalk, melting ice, and boiling water can help students distinguish physical changes from chemical changes based on whether a new substance is formed.

(2) **Mini Science Laboratory for Chemical Changes:** Conduct safe, teacher-supervised experiments such as mixing **vinegar/lemon juice with baking soda** and passing the gas produced through lime water. Students can observe fizzing and the lime water turning milky, thereby learning how experimental evidence can identify carbon dioxide and indicate a chemical change.

(3) **"Change Detective" Classification Activity:** Give groups cards containing examples such as *melting ice, rusting iron, burning magnesium, chopping vegetables, curdling milk, folding clothes,* and *burning a candle*. Students classify them as **physical, chemical, reversible, irreversible, desirable, or undesirable**, and justify each choice. This develops reasoning rather than rote memorisation.

(4) **Fire Triangle Demonstration with Safety Integration:** Use the candle-and-glass-tumbler experiment to demonstrate why oxygen is essential for combustion. Connect the observation to the **fire triangle—fuel, oxygen and sufficient heat to reach ignition temperature—and fire safety**, including why cutting off the air supply can extinguish a fire.

(5) **Real-Life Science Observation Diary:** Ask students to maintain a one-week **"Changes Around Me" diary**, recording changes noticed at home, school, kitchen, garden, and surroundings. Examples could include drying clothes, cooking, ripening fruits, rusting objects, melting ice, and decomposition. Each observation should be classified with a short scientific justification.

(6) **Think–Pair–Share on the Burning Candle:** Recreate the chapter's Think–Pair–Share approach. Students first think individually, discuss with a partner, and then explain to the class why a burning candle involves **both physical changes (melting, solidification and evaporation of wax) and a chemical change (burning of wax vapour)**.

(7) **Environment-Linked Learning through Weathering and Erosion:** Take students on a short campus/local observation walk to identify weathered rocks, soil, sediments,

rusted surfaces, or signs of erosion. Connect their observations with the chapter's explanation that weathering can involve both physical and chemical changes and that wind and flowing water cause erosion.

(8) **Kitchen-to-Classroom Science Project:** Encourage students to identify physical and chemical changes occurring during food preparation—cutting vegetables, making dough, cooking, decomposition, etc. A small composting activity can further demonstrate how a change considered undesirable in stored food can become desirable when food waste is converted into compost.

(9) **Concept Mapping as an Exit Activity:** At the end of the chapter, students can prepare a concept map beginning with **"Changes Around Us"** and branching into *Physical/Chemical* → *Reversible/Irreversible* → *Desirable/Undesirable* → *Combustion* → *Weathering/Erosion*. This provides a quick formative assessment of conceptual connections.

(10) **Evidence-Based Assessment:** Instead of asking only "Is this a physical or chemical change?", ask students to provide **evidence** for their answer—for example, *Was a new substance formed? Did only shape/state change? Can the original material be obtained again? Was heat/light produced?* This practice strengthens HOTS, scientific reasoning, and Olympiad-level problem-solving.

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

The chapter provides excellent scope for innovative learning because it combines everyday observations, experiments, environmental processes, and scientific reasoning. It specifically encourages **innovation, exploration, curiosity, discovery, and enquiry**.

(1) **"Science Detective Lab" – Evidence-Based Investigation:** Convert the classroom into a mini investigation centre. Give groups different changes—melting ice, crushing chalk, vinegar + baking soda, rusting, and burning a candle—and ask them to collect evidence to decide whether each is a physical or chemical change. The emphasis should be on *"What evidence proves your answer?"* rather than memorising classifications.

(2) **Digital/AR Fire Triangle Simulation:** Use an interactive digital simulation or teacher-created animation in which students virtually remove **fuel, oxygen, or heat** and predict whether combustion will continue. Students can then relate their virtual observations to the chapter's fire triangle consisting of fuel, oxygen, and sufficient heat to reach ignition temperature.

(3) **"Mystery Gas Challenge" – Inquiry Learning:** Present students with an unknown gas generated from vinegar/lemon juice and baking soda. Let them design a simple method to identify it using lime water. Students discover that carbon dioxide turns lime water milky, transforming a textbook reaction into a problem-solving investigation.

(4) **Time-Lapse Science Project – Slow Changes:** Students can use a mobile/tablet camera under teacher or parental supervision to create a **time-lapse record** of safe slow changes such as fruit ripening, drying, seed germination, or food-waste composting. They then classify and explain the observed changes, making otherwise slow processes visually accessible.

(5) **"Physical or Chemical?" Interactive Game:** Create a digital or classroom game in which students receive points not merely for identifying a change correctly but for giving the **scientific reason**. Bonus rounds can include challenging cases such as a burning candle, where melting, solidification, and evaporation are physical changes while burning of wax vapour is chemical.

(6) **Invisible-Ink STEAM Activity:** Use the chapter's exploratory project involving **lemon juice as invisible ink**. Students can create secret scientific messages and investigate

what happens when the paper is carefully warmed under adult supervision. This integrates **Science + Art + Creativity + Communication** while encouraging discussion about reversibility.

(7) Build a "Change Decision Tree": Students collaboratively design a flowchart or digital decision tree asking questions such as: **"Is a new substance formed?"** → **"Has only shape/state/size changed?"** → **"Can the original material be obtained again?"** → **"Is the change desirable?"** They can then use their decision tree to classify unfamiliar real-life examples.

(8) Eco-Innovation Challenge – From Waste to Resource: Give students the challenge: **"Can an undesirable change become useful?"** Teams can design a miniature composting model using biodegradable kitchen waste. This directly connects with the chapter's observation that decomposition of stored food may be undesirable, whereas decomposition used to convert food waste into compost is useful.

(9) Weathering and Erosion Model: Students can construct a small model using soil, sand, pebbles, plants, and flowing water to investigate erosion. Different groups can modify variables such as vegetation cover or water flow and compare the movement of soil, connecting their model to the chapter's discussion of weathering, soil formation, and erosion.

(10) Yeast–Balloon Investigation: Extend the chapter's yeast experiment into a student research challenge. Groups can observe how yeast added to sugar solution produces gas that inflates a balloon and then test the collected gas using lime water. Students can identify the physical and chemical changes occurring during the investigation.

Suggested Innovation Outcome:

By integrating **experimentation, digital simulation, gamification, STEAM activities, environmental projects, collaborative problem-solving, and student-led enquiry**, the chapter can move from *"learning definitions of physical and chemical changes"* to **"discovering changes through evidence and investigation."** This approach is especially appropriate for Grade 7 students because it develops **curiosity, observation, scientific reasoning, creativity, collaboration, and real-life application skills**.

5.17: Practicing Questions/Question Bank

A. Fill in the Blanks:

1. A change in which no new substance is formed is called a **physical change**.
2. A change in which one or more new substances are formed is called a **chemical change**.
3. The process through which new substances are formed is called a **chemical reaction**.
4. Carbon dioxide turns lime water **milky**.
5. The white substance formed when carbon dioxide reacts with lime water is **calcium carbonate**.
6. Vinegar reacts with baking soda to produce **carbon dioxide** gas.
7. The brown-coloured substance formed during rusting is called **rust**.
8. Rusting of iron is a **chemical** change.
9. When magnesium burns in oxygen, **magnesium oxide** is formed.

10. A chemical reaction in which a substance reacts with oxygen and produces heat and/or light is called **combustion**.
11. The component of air that supports combustion is **oxygen**.
12. The minimum temperature at which a substance catches fire is called its **ignition temperature**.
13. A combustible substance used for combustion is also called a **fuel**.
14. Fuel, oxygen and heat constitute the **fire triangle**.
15. Melting of wax is a **physical** change.
16. Burning of wax vapour is a **chemical** change.
17. Ice melting into water is a **reversible** change.
18. Changing milk into curd is a **desirable** change.
19. Physical and chemical changes in rocks are collectively called **weathering**.
20. The breaking down and movement of soil and sediments by wind and flowing water is called **erosion**.

B. One-Mark Descriptive Questions:

1. **What is a physical change?**
   Answer: A physical change is a change in which physical properties change but no new substance is formed.
2. **What is a chemical change?**
   Answer: A chemical change is a change in which one or more new substances are formed.
3. **Give one example of a physical change.**
   Answer: Melting of ice is a physical change.
4. **Give one example of a chemical change.**
   Answer: Rusting of iron is a chemical change.
5. **What is a chemical reaction?**
   Answer: The process through which new substances are formed is called a chemical reaction.
6. **Which gas turns lime water milky?**
   Answer: Carbon dioxide turns lime water milky.
7. **What is formed when carbon dioxide reacts with lime water?**
   Answer: Insoluble calcium carbonate and a small amount of water are formed.
8. **What is rust?**
   Answer: Rust is the brown-coloured iron oxide formed during rusting.
9. **What is combustion?**
   Answer: Combustion is a chemical reaction in which a substance reacts with oxygen and produces heat and/or light.
10. **Name two combustible substances.**
    Answer: Wood and paper are combustible substances.

11. **What is ignition temperature?**
    Answer: Ignition temperature is the minimum temperature at which a substance catches fire.

12. **Which gas is necessary for combustion?**
    Answer: Oxygen is necessary for combustion.

13. **What is bioluminescence?**
    Answer: The production of light without heat in living organisms is called bioluminescence.

14. **Give one example of a reversible change.**
    Answer: Melting and refreezing of ice is a reversible change.

15. **Give one example of an irreversible change.**
    Answer: Making popcorn from corn is an irreversible change.

16. **What is weathering?**
    Answer: Physical and chemical changes that break down or alter rocks are collectively called weathering.

17. **What is erosion?**
    Answer: Erosion is the breaking down and movement of rock pebbles, soil and sediments by natural forces such as wind and flowing water.

18. **Name one undesirable change.**
    Answer: Rusting of iron is an undesirable change.

19. **What type of change is burning magnesium?**
    Answer: Burning magnesium is a chemical change.

20. **Why is melting ice a physical change?**
    Answer: Melting ice is physical because no new substance is formed.

C. Two-Mark Descriptive Questions:

1. Differentiate between physical and chemical changes.

Answer:

- In a physical change, physical properties such as shape, size or state may change without forming a new substance.
- In a chemical change, one or more new substances are formed.

2. Why is rusting considered a chemical change?

Answer:

- During rusting, a new brown-coloured substance is formed.
- This new substance is iron oxide, so rusting is a chemical change.

3. How can carbon dioxide be identified?

Answer:

- Pass the gas through freshly prepared lime water.
- If the lime water turns milky, the gas is carbon dioxide.

4. What happens when vinegar is mixed with baking soda?

Answer:

- Fizzing occurs and gas bubbles are produced.
- The gas produced is carbon dioxide.

5. Why does a candle covered with a glass tumbler stop burning?

Answer:

- The candle quickly uses up the available oxygen inside the tumbler.
- Without a continuous supply of oxygen, combustion cannot continue.

6. State the three requirements for combustion.

Answer:

- A combustible substance (fuel) and oxygen are required.
- Sufficient heat is required to bring the fuel to its ignition temperature.

7. Why is burning a candle both a physical and chemical change?

Answer:

- Melting, solidification and evaporation of wax are physical changes.
- Burning of wax vapour is a chemical change because new substances are formed.

8. Differentiate between reversible and irreversible changes.

Answer:

- In a reversible change, the original substance or object can be obtained again.
- In an irreversible change, the original form cannot be obtained again.

9. Give two examples each of desirable and undesirable changes.

Answer:

- Changing milk into curd and cooking food are desirable changes.
- Rusting of iron and decay of stored food are undesirable changes.

10. How does flowing water cause erosion?

Answer:

- Flowing water breaks down and carries rock particles, soil and sediments.
- Continuous erosion also makes river rocks and pebbles smoother.

D. Three-Mark Descriptive Questions:

1. Explain the reaction between carbon dioxide and lime water.

Answer:

1. Carbon dioxide reacts with lime water (calcium hydroxide).
2. Insoluble white calcium carbonate and a small amount of water are formed.
3. Formation of calcium carbonate makes lime water appear milky.

2. Explain the burning of magnesium ribbon.

Answer:

1. Magnesium ribbon reacts with oxygen when burnt.
2. A new white substance called magnesium oxide is formed.
3. Heat and light are also produced, showing that it is a chemical change.

3. Explain the fire triangle.

Answer:

1. A combustible substance or fuel must be present.
2. Oxygen must be available to support combustion.
3. Sufficient heat must raise the fuel to its ignition temperature.

4. Explain the physical and chemical changes occurring in a burning candle.

Answer:

1. Candle wax melts and is carried up the wick.
2. Melting, solidification and evaporation of wax are physical changes.
3. Wax vapour burns to form new substances, making combustion a chemical change.

5. Explain reversible changes with examples.

Answer:

1. A reversible change allows the original substance or object to be obtained again.
2. Melted ice can be refrozen to obtain ice.
3. Water vapour can be condensed back into liquid water.

6. Explain how weathering contributes to soil formation.

Answer:

1. Temperature changes, growing roots and freezing water can physically break rocks.
2. Water and chemicals in water can chemically alter rocks.
3. These physical and chemical processes together cause weathering and eventually contribute to soil formation.

7. Explain erosion and sediment formation.

Answer:

1. Wind and flowing water break down and move soil, rock particles and sediments.

2. When wind or water slows down, transported materials settle.
3. These sediments can harden over long periods and become new rocks.

8. Why can the same change be desirable in one situation and undesirable in another?

Answer:

1. The usefulness of a change depends on its situation and purpose.
2. Decay of stored food is undesirable because it spoils food.
3. Decomposition is desirable when food waste is converted into useful compost.

E. Five-Mark Descriptive Questions:

1. Compare physical and chemical changes with suitable examples.

Answer:

1. A physical change affects properties such as shape, size or state.
2. No new substance is formed during a physical change.
3. Melting ice, folding paper and crushing chalk are examples of physical changes.
4. A chemical change results in the formation of one or more new substances.
5. Rusting, combustion and cooking are examples of chemical changes.

2. Explain combustion and the conditions necessary for it.

Answer:

1. Combustion is a chemical reaction in which a substance reacts with oxygen and gives out heat and/or light.
2. A combustible substance or fuel must be present.
3. Oxygen is necessary to support combustion.
4. The fuel must receive enough heat to reach its ignition temperature.
5. Fuel, oxygen and heat together form the **fire triangle**.

3. Describe an experiment to show that carbon dioxide is produced when vinegar reacts with baking soda.

Answer:

1. Take vinegar or lemon juice in a test tube and add a pinch of baking soda.
2. Fizzing and gas bubbles are observed.
3. Pass the gas produced through freshly prepared lime water.
4. The lime water turns milky.
5. This confirms that the gas produced is carbon dioxide and that a chemical change has occurred.

4. Explain weathering and erosion and their role in natural changes.

Answer:

1. Weathering includes physical and chemical changes occurring in rocks.
2. Temperature changes, growing roots and freezing water can physically break rocks.
3. Water and chemicals can also cause chemical changes in rocks.
4. Erosion moves soil, sediments and rock particles from one place to another through forces such as wind and flowing water.
5. Weathering contributes to soil formation, while erosion helps transport and deposit sediments.

5. Explain reversible and irreversible changes with examples.

Answer:

1. Changes can be classified according to whether the original form can be obtained again.
2. In a reversible change, the original object or substance can be restored.
3. Melting ice is reversible because water can be frozen again.
4. In an irreversible change, the original form cannot be obtained again.
5. Chopping vegetables and making popcorn are examples of changes that cannot be reversed.

These questions provide a balanced **Grade 7 question bank**, progressing from factual recall to explanation, comparison, experimentation, reasoning, and real-life application, while covering the major learning outcomes of Chapter 5.

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7th Standard Science Book Chapter 6

Chapter 6: Adolescence: A Stage of Growth and Change

6.1 Summary of the Chapter:

Summary of Chapter 6: ***Adolescence: A Stage of Growth and Change:***

(1) **Adolescence** is the transitional stage between childhood and adulthood. It generally begins around **10 years of age and continues up to 19 years**, although the timing and duration may vary among individuals.

(2) During adolescence, the body undergoes **rapid growth and development**. Common physical changes include an increase in height and weight, greater strength, broader shoulders and chest in boys, and development of breasts in girls.

(3) Other noticeable changes include **changes in voice, appearance of pimples or acne, and growth of hair** in the armpits and pubic region. Boys may also develop a moustache, beard, and sometimes chest or back hair.

(4) Certain features that distinguish males and females but are not directly involved in reproduction are called **secondary sexual characteristics**. Their appearance indicates the onset of **puberty**.

(5) **Puberty** is the stage during which external and internal changes occur in the adolescent body, gradually making it capable of reproduction. These changes occur naturally in both boys and girls.

(6) In girls, puberty is marked by the beginning of the **menstrual cycle**. Menstruation is a natural biological process involving blood discharge, usually recurring every 28–30 days, though healthy cycles may range from 21–35 days. Myths and taboos associated with menstruation have **no scientific basis**.

(7) Adolescence also involves important **emotional and behavioural changes**, such as mood swings, stronger emotions and increased sensitivity. Understanding emotions and engaging in activities such as sports, music, dance, creativity and social work can support positive development.

(8) A **balanced and nutritious diet** is especially important during adolescence. Proteins, carbohydrates, fats, vitamins and minerals such as calcium and iron support growth, bone development, strength, energy and blood formation.

(9) **Personal hygiene** becomes particularly important during adolescence. Proper body hygiene helps prevent infections, while menstrual hygiene includes the safe use and disposal of sanitary pads or reusable cloth pads.

(10) **Regular exercise, games and sports** help adolescents remain physically and mentally fit, improve stamina and boost mood. A balanced social life based on respect, responsibility and thoughtful interaction is equally important.

(11) Adolescents should use **social media responsibly**, protect their privacy, think before posting and seek help from parents or teachers in cases of cyberbullying. They should also avoid sharing personal information or photographs with strangers online.

(12) Adolescents must learn to **say "NO" to addictive and harmful substances** such as tobacco, cigarettes, alcohol and illegal drugs. Many changes occurring during adolescence are mainly controlled by **hormones**, chemicals produced by the body that regulate growth, development, mood and behaviour. Proper guidance, healthy choices and awareness help adolescents manage this important stage successfully.

6.2 Important Formulas:

Important Formulas / Quantitative Relationships – Chapter 6

Adolescence: A Stage of Growth and Change

After reviewing the chapter 6, **there are no specific mathematical or scientific formulas prescribed for solving quantitative numerical problems**. The chapter is mainly conceptual and focuses on physical, biological, emotional, behavioural, nutritional, and social changes during adolescence.

However, the following **numerical facts and simple relationships** are important and may be useful for application-based questions:

No.	Quantitative fact / relationship	Important value
1	**Age range of adolescence**	Approximately **10–19 years**
2	**Approximate duration of adolescence**	$19 - 10 = 9$years
3	**Typical menstrual cycle interval**	About **28–30 days**
4	**Normal variation in menstrual cycle**	Approximately **21–35 days**
5	**Duration of menstruation**	Usually **3–7 days**
6	**Approximate number of menstrual cycles in a year**	$365 \div 28 \approx 13$cycles, or $365 \div 30 \approx 12$cycles*
7	**Usual age range when menstruation stops naturally**	Approximately **45–55 years**

*The yearly-cycle calculation is a **derived arithmetic application**, not a formula explicitly given in the textbook.

Conclusion:
For **Chapter 6, no formula sheet is actually required**. Students should concentrate more on definitions, concepts, biological changes, puberty, menstruation, hormones, nutrition, hygiene, physical activity, emotional changes, responsible social-media behaviour, and avoiding addictive substances. The chapter's exercises are also primarily conceptual and application-oriented rather than numerical.

6.3 Fill-Up the Blank LOTS type questions with Answers: (35 Questions)

The following questions are **LOTS (Lower Order Thinking Skills)** based, focusing mainly on remembering and understanding important facts, terms, and concepts from the chapter 6.

1. The stage of development between childhood and adulthood is called __________.
   Answer: Adolescence
2. Adolescence generally begins around the age of __________ years.
   Answer: 10
3. Adolescence usually continues up to the age of __________ years.
   Answer: 19
4. The increase in __________ becomes more prominent during adolescence.
   Answer: Height
5. In adolescent boys, the growth of the __________ causes changes in the voice.
   Answer: Voice box
6. The visible bump in the throat region of adolescent boys is called the __________.
   Answer: Adam's apple
7. The skin condition in which small reddish pimples appear is called __________.
   Answer: Acne
8. Acne may occur because increased oily secretions clog the skin __________.
   Answer: Pores
9. During adolescence, both boys and girls develop hair in the __________ and pubic region.
   Answer: Armpits

10. Facial hair in boys gradually develops into a moustache and a __________.
    Answer: Beard
11. Characteristics that distinguish males from females but are not directly involved in reproduction are called __________ **sexual characteristics**.
    Answer: Secondary
12. Secondary sexual characteristics mark the onset of __________.
    Answer: Puberty
13. The stage in which the adolescent body develops into an adult capable of reproduction is called __________.
    Answer: Puberty
14. The menstrual cycle generally recurs every __________ **days**.
    Answer: 28–30 days
15. The discharge of blood during the menstrual cycle is called __________.
    Answer: Menstruation
16. Menstruation may normally last for __________ **days**.
    Answer: Three to seven
17. Menstruation usually stops naturally between the ages of __________ **years**.
    Answer: 45–55
18. Adolescence is associated not only with physical changes but also with emotional and __________ changes.
    Answer: Behavioural
19. Sudden changes in emotional state during adolescence are commonly called __________ **swings**.
    Answer: Mood
20. Activities such as music, dance, and __________ can contribute to positive growth and development.
    Answer: Sports
21. For proper growth and physical performance, adolescents need proteins and __________.
    Answer: Carbohydrates
22. __________ is an important mineral that helps in optimal bone growth.
    Answer: Calcium
23. Spinach, kidney beans, raisins, and figs are sources of __________.
    Answer: Iron
24. Vitamin __________ is required for the proper functioning of the human body and must be obtained from food.
    Answer: B12
25. Maintaining good personal __________ during adolescence helps protect the body from infections.
    Answer: Hygiene
26. Used sanitary pads should be properly wrapped and disposed of inside a __________.
    Answer: Dustbin
27. Regular exercise helps build stamina and boosts our __________.
    Answer: Mood
28. Harassing others using phones, computers, or online platforms is known as __________.
    Answer: Cyberbullying
29. Regular consumption of addictive and harmful substances is called substance __________.
    Answer: Abuse

30. Adolescents should learn to say __________ to addictive substances.
    Answer: NO
31. The National De-addiction Helpline number mentioned in the chapter is __________.
    Answer: 14446
32. Certain chemicals produced in our bodies that regulate growth and development are called __________.
    Answer: Hormones
33. Hormones are released at an appropriate time in response to signals from the __________.
    Answer: Brain
34. Some hormones can influence our mood and __________.
    Answer: Behaviour
35. A balanced diet, good personal hygiene, and regular __________ **activities** help adolescents remain healthy.
    Answer: Physical

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

The following questions require students to **apply, analyse, infer, connect causes with effects, or make appropriate decisions** using concepts from the chapter rather than merely recall definitions. The chapter itself encourages such enquiry and application through situation-based exercises.

1. Rohan is 13 years old and notices that his voice has become hoarse. This change is most likely due to the growth of his __________.
   Answer: voice box
2. Two boys of the same age show different amounts of facial hair. This difference should be considered __________ because adolescent changes vary among individuals.
   Answer: normal
3. If increased oily secretions block the pores of an adolescent's skin, the person may develop __________.
   Answer: acne
4. A boy notices a bump developing in his throat along with a change in his voice. The bump is most likely the __________.
   Answer: Adam’s apple
5. If an adolescent shows physical changes such as facial hair and voice change, these indicate that the body is entering __________.
   Answer: puberty
6. The development of breasts in girls and facial hair in boys can be classified as __________ **sexual characteristics** because they distinguish males and females but are not directly involved in reproduction.
   Answer: secondary
7. A healthy girl's menstrual cycle occurs after 33 days instead of 28 days. According to the chapter, this may still be considered __________.
   Answer: normal
8. If a person says that menstruating girls should always be physically isolated, this belief should be regarded as a __________ because it has no scientific basis.
   Answer: myth/taboo
9. Encouraging students to understand menstruation scientifically can help reduce unnecessary fear, shame, and __________.
   Answer: guilt

10. An adolescent experiencing strong emotions can channel them positively by participating in music, dance, sports, creativity, or __________.
Answer: social work
11. If adolescents understand how their emotions influence their actions, they are more likely to make better __________.
Answer: choices
12. An adolescent who needs proper growth, strength, and energy should include adequate proteins and __________ in the diet.
Answer: carbohydrates
13. If an adolescent has insufficient iron in the diet, a __________**-related health problem** may develop.
Answer: blood
14. An adolescent who wants to support optimal bone growth should include foods rich in __________.
Answer: calcium
15. If adolescents neglect hygiene in the armpits and pubic region, they may become more vulnerable to __________.
Answer: infections
16. If used sanitary pads are left scattered around instead of being properly disposed of, both community health and environmental __________ may be affected.
Answer: cleanliness
17. If an adolescent feels physically inactive and wants to improve stamina as well as mood, regular __________ would be a healthy choice.
Answer: exercise/physical activity
18. A student receives a false and insulting message about a classmate on social media. Forwarding it could contribute to __________.
Answer: cyberbullying
19. If a stranger online asks an adolescent to send personal photographs, the safest decision is __________ **them**.
Answer: not to share
20. An adolescent facing cyberbullying should seek help from parents and __________ rather than remaining scared or helpless.
Answer: teachers
21. If friends pressure a student to try cigarettes "just once," the healthiest response is to firmly say __________.
Answer: NO
22. When repeated use of harmful substances creates a strong urge to consume them again and again, this behaviour can develop into substance __________.
Answer: abuse
23. If prolonged cigarette or beedi smoking causes breathing difficulties, the organ likely to be seriously damaged is the __________.
Answer: lungs
24. An adolescent who is struggling with addiction should first seek __________ **and support** from family, friends, parents, or teachers.
Answer: help
25. If a school wants to reduce substance abuse among adolescents, spreading __________ about its harmful effects would be an important preventive measure.
Answer: awareness

26. If physical and emotional changes begin rapidly during adolescence, the chemicals primarily responsible for regulating many of these changes are __________.
    Answer: hormones
27. Hormones are released at appropriate times in response to signals coming from the __________.
    Answer: brain
28. If an adolescent experiences changes in mood and behaviour along with physical development, some of these changes may also be influenced by __________.
    Answer: hormones
29. A student claims that adolescence involves only an increase in height and body hair. This statement is __________ because adolescence also includes biological, emotional, and behavioural changes.
    Answer: incorrect
30. An adolescent who eats a balanced diet, maintains personal hygiene, exercises regularly, avoids harmful substances, and seeks proper guidance is more likely to experience __________ **development**.
    Answer: healthy/positive

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

The following questions focus on **remembering and basic understanding**, with each answer restricted to **one sentence**.

1. **What is adolescence?**
   Answer: Adolescence is the stage of development between childhood and adulthood, generally from about 10 to 19 years of age.
2. **At what age does adolescence generally begin?**
   Answer: Adolescence generally begins around 10 years of age.
3. **Mention any two physical changes that occur during adolescence.**
   Answer: Increase in height and weight are two common physical changes during adolescence.
4. **What is Adam's apple?**
   Answer: Adam's apple is the visible bump in the throat caused by the growth of the voice box.
5. **Why does the voice of adolescent boys sometimes become hoarse?**
   Answer: The voice of adolescent boys may become hoarse because their voice box grows during adolescence.
6. **What is acne?**
   Answer: Acne is a skin condition in which small reddish pimples appear, commonly on the face.
7. **Why may pimples appear during adolescence?**
   Answer: Pimples may appear because increased oily secretions can clog the skin pores.
8. **Where does body hair commonly appear in both boys and girls during adolescence?**
   Answer: Hair commonly appears in the armpits and pubic region in both boys and girls.
9. **What are secondary sexual characteristics?**
   Answer: Secondary sexual characteristics are features that distinguish males from females but are not directly involved in reproduction.

10. **What is puberty?**
    Answer: Puberty is the stage when an adolescent undergoes external and internal changes to develop into an adult capable of reproduction.
11. **What is menstruation?**
    Answer: Menstruation is the phase of the menstrual cycle during which blood is discharged from the body.
12. **How often does the menstrual cycle generally recur?**
    Answer: The menstrual cycle generally recurs every 28–30 days.
13. **How long may menstruation last?**
    Answer: Menstruation may normally last for three to seven days.
14. **At what age does menstruation usually stop naturally?**
    Answer: Menstruation usually stops naturally between 45 and 55 years of age.
15. **Name two emotional changes that may occur during adolescence.**
    Answer: Mood swings and strong emotions are two emotional changes that may occur during adolescence.
16. **How can adolescents channel their emotions positively?**
    Answer: Adolescents can channel their emotions positively by engaging in activities such as music, dance, sports, creativity, and social work.
17. **Why is a nutritious diet important during adolescence?**
    Answer: A nutritious diet is important because adolescence is a period of rapid growth and development.
18. **Which nutrients are important for proper growth and good performance in physical activities?**
    Answer: Proteins and carbohydrates are important for proper growth and good physical performance.
19. **Name two food sources of iron mentioned in the chapter.**
    Answer: Spinach and kidney beans are two food sources of iron.
20. **Why is vitamin B12 important?**
    Answer: Vitamin B12 is required for the proper functioning of the human body.
21. **Why is personal hygiene important during adolescence?**
    Answer: Personal hygiene helps protect adolescents from potential infections.
22. **Name two products that can be used to maintain menstrual hygiene.**
    Answer: Sanitary pads and reusable cloth pads can be used to maintain menstrual hygiene.
23. **How should used sanitary pads be disposed of?**
    Answer: Used sanitary pads should be wrapped properly and disposed of inside a dustbin.
24. **Why are regular physical activities important during adolescence?**
    Answer: Regular physical activities keep the body and mind fit, build stamina, and boost mood.
25. **What is cyberbullying?**
    Answer: Cyberbullying is the use of digital devices or online platforms to harass others.
26. **Mention one precaution adolescents should take while using social media.**
    Answer: Adolescents should avoid sharing personal information or photographs with strangers online.
27. **What is substance abuse?**
    Answer: Substance abuse is the regular use of harmful and addictive substances after developing a strong urge to consume them repeatedly.

28. **Name any two harmful addictive substances mentioned in the chapter.**
    Answer: Tobacco and alcohol are two harmful addictive substances mentioned in the chapter.
29. **Mention one harmful effect of addictive substances.**
    Answer: Addictive substances can cause serious health problems such as breathing difficulties, memory loss, or lung damage.
30. **What should a person do to overcome addiction?**
    Answer: A person should seek help and support from family, friends, parents, teachers, counsellors, or medical professionals.
31. **What is the National De-addiction Helpline number mentioned in the chapter?**
    Answer: The National De-addiction Helpline number is **14446**.
32. **What are hormones?**
    Answer: Hormones are chemicals produced in the body that regulate various aspects of growth and development.
33. **What controls many of the changes occurring during adolescence?**
    Answer: Many changes occurring during adolescence are primarily controlled by hormones.
34. **What signals the release of hormones at the appropriate time?**
    Answer: Hormones are released at appropriate times in response to signals from the brain.
35. **How can hormones affect adolescents apart from physical growth?**
    Answer: Some hormones can also influence the mood and behaviour of adolescents.

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

The following are **HOTS (Higher Order Thinking Skills)** questions designed to test application, analysis, inference, reasoning, and decision-making. Each answer is limited to **one sentence**.

1. **Ravi is 13 years old and his voice has suddenly become hoarse; what could be the reason?**
   Answer: Ravi's voice may have become hoarse because his voice box is growing during adolescence.
2. **Two boys of the same age have different amounts of facial hair; should this be considered abnormal? Why?**
   Answer: No, it is normal because the timing, nature, and extent of adolescent changes vary among individuals.
3. **An adolescent develops many pimples on the face; what is the most likely biological reason?**
   Answer: Increased oily secretions may clog the skin pores and lead to acne and pimples.
4. **A 12-year-old boy notices a bump developing in the front of his throat; what might it indicate?**
   Answer: The bump may be the Adam's apple formed due to the growth of the voice box during adolescence.
5. **A girl begins developing breasts during adolescence; how would you classify this change?**
   Answer: Development of breasts is a secondary sexual characteristic associated with the onset of puberty.

6. **Why can puberty be considered an important stage in human development?**
   Answer: Puberty is important because the body undergoes external and internal changes that gradually make it capable of reproduction.
7. **A healthy adolescent girl has a menstrual cycle of 33 days; should she necessarily be worried?**
   Answer: No, because the chapter states that healthy menstrual cycles may normally range from 21 to 35 days.
8. **Why is isolating a girl only because she is menstruating scientifically unjustified?**
   Answer: Isolation is scientifically unjustified because menstruation is a natural biological process and such taboos have no scientific basis.
9. **An adolescent frequently experiences mood swings; what positive action could help manage these emotions?**
   Answer: Engaging in activities such as music, dance, or sports can help channel emotional changes positively.
10. **Why can understanding one's emotions help an adolescent make better decisions?**
   Answer: Understanding emotions helps adolescents recognise how feelings influence behaviour and respond to situations thoughtfully.
11. **An adolescent regularly eats only fast food and avoids nutritious meals; why might this be an unhealthy choice?**
   Answer: It may be unhealthy because adolescents require a nutritious diet containing proteins, carbohydrates, fats, vitamins, and minerals for proper growth and development.
12. **An adolescent wants to strengthen growing bones; which type of food should be preferred?**
   Answer: Calcium-rich foods such as milk, millets, curd, cheese, and paneer should be preferred for optimal bone growth.
13. **Why should an adolescent with an iron-deficient diet pay special attention to nutrition?**
   Answer: Iron deficiency may contribute to blood-related health problems, so adequate iron-rich food is important.
14. **Why should adolescents pay special attention to hygiene in the armpits and pubic region?**
   Answer: Maintaining hygiene in these areas can help protect adolescents from potential infections.
15. **You notice a used sanitary pad lying beside a dustbin; what should have been done instead?**
   Answer: The used sanitary pad should have been properly wrapped and disposed of inside the dustbin to maintain community health and environmental cleanliness.
16. **Why may biodegradable sanitary pads be considered a better environmental choice?**
   Answer: Biodegradable sanitary pads are a better environmental choice because they are environment-friendly.
17. **An adolescent feels stressed and physically inactive; what healthy activity suggested in the chapter could help?**
   Answer: Regular exercise, games, or sports can help keep the body and mind fit while improving stamina and mood.
18. **A friend wants to post another student's photograph online without permission; why should you discourage it?**

Answer: Posting someone's personal information or content without consent can be irresponsible and may contribute to cyberbullying.

19. **A stranger on social media asks an adolescent for personal photographs; what should the adolescent do?**
Answer: The adolescent should not share personal photographs or private information with the stranger.
20. **A student is being cyberbullied but is afraid to tell anyone; what would be the wisest action?**
Answer: The student should handle the situation wisely and seek help from parents or teachers.
21. **Why should adolescents think carefully before posting something on social media?**
Answer: Thinking before posting helps adolescents use social media responsibly and protect their own and others' privacy.
22. **A friend says, "Trying a cigarette only once cannot cause any problem"; why is this reasoning risky?**
Answer: This reasoning is risky because addictive substances can create a strong urge for repeated use and may lead to substance abuse.
23. **How should an adolescent respond if friends pressure them to try tobacco or alcohol?**
Answer: The adolescent should remain firm and confidently say "NO" to the harmful substance.
24. **Why might prolonged smoking reduce a person's ability to breathe comfortably?**
Answer: Prolonged exposure to cigarette or beedi smoke can damage the lungs and cause breathing difficulties.
25. **If an adolescent has already developed an addiction, what should be the first step towards overcoming it?**
Answer: The first step should be seeking help and support from family, friends, parents, teachers, counsellors, or medical professionals.
26. **Why is awareness about substance abuse particularly important during adolescence?**
Answer: Awareness is important because adolescent curiosity and peer influence may encourage young people to experiment with harmful addictive substances.
27. **An adolescent experiences simultaneous changes in height, mood, and reproductive development; what could link many of these changes?**
Answer: Hormonal activity can link many of these changes because hormones regulate growth and development and can also influence mood and behaviour.
28. **Why can hormones affect an adolescent even though they cannot be seen?**
Answer: Hormones are internal chemicals that regulate important aspects of growth, development, mood, and behaviour.
29. **A student says, "Adolescence is only about becoming taller"; why is this statement incomplete?**
Answer: The statement is incomplete because adolescence involves physical, biological, emotional, and behavioural changes, not merely an increase in height.
30. **How can an adolescent make this stage of life a healthier and more positive experience?**
Answer: An adolescent can stay healthy by eating a balanced diet, maintaining personal hygiene, exercising regularly, making responsible choices, avoiding addictive substances, and seeking proper guidance.

6.7 Two-mark questions with Answers of LOTS Type: (27 Questions)

The following questions are based directly from the chapter 6 and focus mainly on **Remembering and Understanding (LOTS)**. Each answer is given in **two sentences/points**.

1. **What is adolescence? Mention its usual age range.**
   Answer:
   - Adolescence is the stage of development between childhood and adulthood.
   - It generally begins around 10 years of age and continues up to about 19 years.
2. **Mention any two changes in body structure that occur during adolescence in boys.**
   Answer:
   - Boys may grow taller and gain weight and strength.
   - Their shoulders may become broader and their chests may become wider.
3. **Explain the change in voice that occurs in adolescent boys.**
   Answer:
   - The voice box grows during adolescence, which may make the voice of boys sound hoarse.
   - Its growth may appear as a bump in the throat called the Adam's apple.
4. **What is acne? Why does it commonly occur during adolescence?**
   Answer:
   - Acne is a skin condition in which small reddish pimples commonly appear on the face.
   - It occurs because increased oily secretions can clog the skin pores and lead to infections.
5. **Mention two changes related to body hair during adolescence.**
   Answer:
   - Both boys and girls develop hair in the armpits and pubic region.
   - Boys commonly develop facial hair that later grows into a moustache and beard.
6. **What are secondary sexual characteristics? Give one example.**
   Answer:
   - Secondary sexual characteristics are features that distinguish males from females but are not directly involved in reproduction.
   - Examples include facial and chest hair in boys or development of breasts in girls.
7. **What is puberty? What happens to the body during puberty?**
   Answer:
   - Puberty is a stage during which an adolescent's body undergoes external and internal changes.
   - These changes gradually develop the adolescent into an adult capable of reproduction.
8. **What is menstruation? How long may it normally last?**
   Answer:
   - Menstruation is the phase of the menstrual cycle when blood is discharged from the body.
   - It may normally last for three to seven days.
9. **State two facts about the menstrual cycle.**
   Answer:
   - The menstrual cycle generally recurs every 28–30 days, though healthy cycles may range from 21–35 days.

- Menstruation usually stops naturally between the ages of 45 and 55 years.

10. **Why should myths and taboos related to menstruation be discouraged?**
    Answer:
    - Menstruation is a natural biological process, and myths about it have no scientific basis.
    - A scientific outlook helps promote good reproductive health and a healthier lifestyle for women.
11. **Mention two emotional changes that may occur during adolescence.**
    Answer:
    - Adolescents may experience mood swings and strong emotions.
    - They may also show increased sensitivity and develop deeper interests in new areas.
12. **Mention two ways in which adolescents can positively manage their emotions.**
    Answer:
    - They can participate in activities such as music, dance, and sports.
    - They can engage in creative activities, social work, and other constructive interests.
13. **Why is a nutritious diet important during adolescence? Name some essential nutrients.**
    Answer:
    - A nutritious diet is important because adolescence is a period of rapid growth and development.
    - Adolescents need proteins, carbohydrates, fats, vitamins, and minerals in adequate amounts.
14. **Name two important minerals required during adolescence and state their functions.**
    Answer:
    - Calcium helps in optimal bone growth.
    - Iron helps in the formation of blood.
15. **Why is vitamin B12 important, and how do humans obtain it?**
    Answer:
    - Vitamin B12 is required for the proper functioning of the human body.
    - It cannot be made by the human body and therefore has to be obtained from food.
16. **Why is personal hygiene particularly important during adolescence?**
    Answer:
    - Maintaining body hygiene during adolescence helps protect the body from potential infections.
    - Special attention should be given to hygiene in areas such as the armpits and pubic region.
17. **Mention two good menstrual hygiene practices.**
    Answer:
    - Sanitary pads or reusable cloth pads designed for this purpose can be used to maintain menstrual hygiene.
    - Used sanitary pads should be wrapped properly and disposed of inside a dustbin.
18. **How do physical activities benefit adolescents?**
    Answer:
    - Regular exercise and physical activities help keep the body and mind fit and healthy.

- They also build stamina and boost mood.

19. **Mention two guidelines for responsible social media use.**
    Answer:
    - Adolescents should be respectful and kind and think carefully before posting online.
    - They should protect their privacy and avoid sharing personal photographs with strangers or virtual friends.
20. **What is cyberbullying? Give one example.**
    Answer:
    - Cyberbullying is the use of digital devices or online platforms to harass other people.
    - Sending misleading messages, spreading false rumours, or sharing someone's personal information without consent are examples of cyberbullying.
21. **What should an adolescent do when faced with cyberbullying?**
    Answer:
    - The adolescent should handle the situation wisely rather than feeling scared or helpless.
    - Help should be sought from parents and teachers.
22. **What is substance abuse? Name two addictive substances.**
    Answer:
    - Substance abuse is the regular use of harmful substances after developing a strong urge to consume them repeatedly.
    - Tobacco and alcohol are examples of harmful and addictive substances.
23. **Mention any two harmful effects of addictive substances.**
    Answer:
    - Addictive substances can cause breathing difficulties and damage to the lungs.
    - They may also cause memory loss and other serious health problems.
24. **How can a person take the first steps towards overcoming addiction?**
    Answer:
    - The person should seek help and support from family, friends, parents, or teachers.
    - Counselling and medical advice can also help in handling addiction.
25. **What is Nasha Mukt Bharat Abhiyaan? Mention its main purpose.**
    Answer:
    - Nasha Mukt Bharat Abhiyaan is an initiative launched by the Ministry of Social Justice and Empowerment, Government of India.
    - It aims to spread awareness and prevent substance abuse, with special focus on early-age children.
26. **What are hormones? State one function of hormones during adolescence.**
    Answer:
    - Hormones are certain chemicals produced in different parts of our body.
    - They regulate various aspects of growth and development and may also influence mood and behaviour.
27. **Mention two healthy habits that can make adolescence a joyful experience.**
    Answer:
    - Adolescents should eat a balanced and healthy diet and maintain good personal hygiene.
    - They should regularly participate in physical activities and make thoughtful, healthy decisions.

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

The following questions assess **Higher Order Thinking Skills (HOTS)** such as application, analysis, reasoning, comparison, and decision-making. Each answer is given in **two sentences/points**, suitable for a **2-mark question**.

1. **Rahul and Sameer are both 13 years old, but Rahul has developed a moustache while Sameer has not. Should Sameer be worried? Give reasons.**
   Answer:
   - No, Sameer need not be worried because the timing and extent of physical changes during adolescence vary among individuals.
   - Each person experiences adolescence at their own pace, and such variations are completely normal.
2. **A 13-year-old boy notices that his voice has become hoarse and a bump has appeared in his throat. Explain these changes.**
   Answer:
   - The hoarseness occurs because the voice box grows during adolescence.
   - The visible bump caused by this growth is called the Adam's apple.
3. **An adolescent develops frequent pimples on the face. Explain why this happens and identify the condition.**
   Answer:
   - Increased oily secretions during adolescence may clog skin pores and lead to infections and pimples.
   - This skin condition is called acne, while pimples are its manifestation.
4. **A student says, "Adolescence means only growing taller." Do you agree? Justify your answer.**
   Answer:
   - No, adolescence involves physical, biological, emotional, and behavioural changes in addition to an increase in height.
   - During this period, the body also undergoes changes that prepare it for adulthood and reproductive maturity.
5. **Why would it be incorrect to compare the physical development of two adolescents of the same age?**
   Answer:
   - The timing, nature, and extent of changes such as height, voice, and hair growth vary from one individual to another.
   - Therefore, differences in the rate of development among adolescents of the same age can be completely normal.
6. **A girl has a menstrual cycle of 33 days, while her friend has a cycle of 28 days. Does this necessarily indicate a health problem? Explain.**
   Answer:
   - No, healthy menstrual cycles can vary and may range from 21 to 35 days.
   - Therefore, both 28-day and 33-day cycles can fall within the normal range described in the chapter.
7. **A family prevents a menstruating girl from interacting with others because of a traditional belief. How would you respond scientifically?**
   Answer:
   - Menstruation is a natural biological process, and myths such as physical isolation have no scientific basis.
   - A scientific outlook should be encouraged to reduce fear, shame, and stigma and promote reproductive health.

8. **An adolescent experiences frequent mood swings and strong emotions. Suggest two constructive ways to manage them.**
   Answer:
   - The adolescent can engage in activities such as music, dance, or sports to channel emotions positively.
   - Self-exploration, creative activities, and social work can also support positive growth and development.
9. **Why can understanding one's emotions lead to better decision-making during adolescence?**
   Answer:
   - Emotions can strongly influence an adolescent's behaviour and actions.
   - Understanding this influence helps the adolescent make better choices and respond thoughtfully to situations.
10. **An adolescent regularly chooses fast food instead of a balanced meal. Why may this choice affect growth and development?**
    Answer:
    - Adolescence is a period of rapid growth, so the body requires a nutritious and balanced diet.
    - Proteins, carbohydrates, fats, vitamins, and minerals are needed to support proper growth and development.
11. **An adolescent's diet contains very little iron. Why should this dietary habit be corrected?**
    Answer:
    - Iron is important for the formation of blood, and adolescents may suffer from blood-related health problems when iron is deficient.
    - Therefore, iron-containing foods such as spinach, kidney beans, raisins, and figs should form part of a nutritious diet.
12. **Why should adolescents give special importance to personal hygiene in the armpits and pubic region?**
    Answer:
    - Maintaining cleanliness in these regions may protect adolescents from potential infections.
    - Therefore, good personal hygiene becomes particularly important during this stage of growth and change.
13. **You notice used sanitary pads scattered near a dustbin in a school toilet. What should have been done, and why?**
    Answer:
    - Used sanitary pads should be properly wrapped in newspaper and disposed of inside a dustbin.
    - Proper disposal helps maintain community health and environmental cleanliness.
14. **An adolescent spends most of the day sitting and avoids games and exercise. What two benefits could regular physical activity provide?**
    Answer:
    - Regular physical activity can keep both the body and mind fit and healthy.
    - It can also build stamina and improve mood.
15. **A student receives a false and insulting message about a classmate and plans to forward it. Why should the student avoid doing so?**
    Answer:

- Spreading false rumours or misleading messages through digital platforms can amount to cyberbullying.
- The student should instead use online platforms responsibly and behave respectfully towards others.

16. **A stranger whom an adolescent met online asks for personal photographs and information. What should the adolescent do? Give reasons.**
    Answer:
    - The adolescent should not share personal photographs or private information with strangers or virtual friends.
    - Protecting privacy and being cautious online can reduce the risks associated with irresponsible social-media use.
17. **A student is being cyberbullied and is afraid to tell anyone. What would be the appropriate course of action?**
    Answer:
    - The student should handle the situation wisely rather than remaining scared or helpless.
    - Help and guidance should be sought from parents and teachers.
18. **A friend says, "I will try a cigarette just once and then stop." Why is this decision risky?**
    Answer:
    - Harmful substances are addictive and may create a strong urge to consume them repeatedly.
    - Repeated consumption may eventually develop into substance abuse and cause physical and mental harm.
19. **How should an adolescent respond when friends pressure them to consume tobacco or alcohol?**
    Answer:
    - The adolescent should remain firm and confidently say "NO" to such harmful substances.
    - Completely avoiding them is the safer choice because they can cause serious health problems and addiction.
20. **A person has become addicted to a harmful substance but wants to stop using it. What two steps should the person take?**
    Answer:
    - The person should seek support from family, friends, parents, teachers, or other trusted people.
    - Counselling and medical advice can also help in overcoming addiction.
21. **Why can prolonged smoking cause difficulty in breathing? Use the chapter's illustration to support your answer.**
    Answer:
    - Prolonged exposure to cigarette or beedi smoke can damage the lungs and lead to breathing difficulties.
    - The illustration on page 83 compares lungs before and after prolonged smoke exposure and emphasizes avoiding addictive substances.
22. **An adolescent notices changes in physical growth as well as mood and behaviour. What common factor may influence these changes?**
    Answer:
    - Hormones produced in the body regulate many aspects of growth and development during adolescence.

- Some hormones can also influence mood and behaviour, linking physical and emotional changes.

23. **Why can adolescence be described as a transition rather than simply an age period?**
    Answer:
    - Adolescence involves significant physical, biological, emotional, and behavioural changes as a child develops towards adulthood.
    - The body also undergoes observable and internal changes that gradually lead towards reproductive maturity.
24. **A school wants to make adolescence healthier and more joyful for its students. Suggest two important measures.**
    Answer:
    - The school should encourage balanced nutrition, personal hygiene, and regular physical activities.
    - It should also provide proper guidance and awareness to help students manage physical, emotional, and behavioural changes.
25. **Why is peer pressure particularly important to manage carefully during adolescence?**
    Answer:
    - Adolescents may feel attracted to peers and imitate their behaviour, while curiosity can also make them vulnerable to harmful influences.
    - Thoughtful decisions and the confidence to say "NO" can protect them from risky behaviours such as substance abuse.

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

1. What is adolescence? Mention its age range and importance.
Answer:
1. Adolescence is the stage of development between childhood and adulthood.
2. It generally begins around 10 years of age and continues up to about 19 years.
3. It is a period of rapid growth and development during which the body prepares for adulthood.

2. Describe any three physical changes commonly observed during adolescence.
Answer:
1. There is a prominent increase in height, weight, and strength.
2. Boys may develop broader shoulders and wider chests, while girls develop breasts.
3. Hair begins to grow in areas such as the armpits and pubic region.

3. Explain the changes in voice that occur during adolescence.
Answer:
1. The voice box grows during adolescence in both boys and girls.
2. In boys, its growth may cause a hoarse voice and produce a visible bump called the Adam's apple.
3. The voice box does not grow as much in girls, so their voice generally undergoes only slight changes.

4. What is acne? Explain how pimples develop during adolescence.
Answer:
1. Acne is a common skin condition occurring during adolescence in which small reddish pimples appear.
2. Increased oily secretions from the skin can clog the skin pores and lead to infections.
3. Acne is the condition, while pimples are a manifestation of this condition.

5. What are secondary sexual characteristics? Give examples.
Answer:
1. Secondary sexual characteristics are features that help distinguish males from females but are not directly involved in reproduction.
2. Change in voice and growth of facial and chest hair are examples found particularly in boys.
3. Development of breasts is an example of a secondary sexual characteristic in girls.

6. What is puberty? Mention the important changes associated with it.
Answer:
1. Puberty is the stage during which an adolescent's body undergoes external and internal changes.
2. Secondary sexual characteristics appear and indicate that the body is preparing for adulthood.
3. Various body parts involved in reproduction gradually mature, making the individual capable of reproduction.

7. Explain menstruation and the menstrual cycle.
Answer:
1. The menstrual cycle in adolescent girls generally recurs every 28–30 days, although healthy cycles may range from 21–35 days.
2. The phase during which blood is discharged from the body is called menstruation, and it may last for three to seven days.
3. Menstruation generally stops naturally between 45 and 55 years of age.

8. Why should myths and taboos about menstruation be discouraged?
Answer:
1. Menstruation is a natural biological process, and myths surrounding it have no scientific basis.
2. Wrong beliefs can cause unnecessary fear, shame, or guilt among girls.
3. Developing a scientific outlook towards menstruation helps promote reproductive health and a healthier lifestyle for women.

9. Describe three emotional and behavioural changes that may occur during adolescence.
Answer:
1. Adolescents may experience mood swings, strong emotions, and increased sensitivity.
2. They may develop deeper interests in new areas or become involved in social activities.
3. Understanding the influence of emotions on behaviour helps adolescents make better choices and respond thoughtfully.

10. Explain the importance of a nutritious diet during adolescence.
Answer:
1. Adolescence is a period of rapid growth and development, so a nutritious diet is very important.
2. Proteins and carbohydrates support proper growth and help adolescents perform well in physical activities.
3. Adequate amounts of fats, vitamins, and minerals are also necessary for healthy development.

11. State the importance of calcium, iron, and proteins during adolescence.
Answer:
1. Calcium is important for optimal bone growth.
2. Iron is required for the formation of blood.
3. Proteins help in proper growth, gaining strength, and improving energy levels.

12. Explain the importance of vitamin B12 during adolescence.
Answer:

1. Vitamin B12 is required for the proper functioning of the human body.
2. Like most vitamins, vitamin B12 cannot be produced by the human body.
3. Therefore, it must be obtained through the food we eat.

13. Explain the importance of personal and menstrual hygiene during adolescence.

Answer:

1. Maintaining body hygiene, particularly in the armpits and pubic region, may protect adolescents from infections.
2. During menstruation, sanitary pads or reusable cloth pads designed for this purpose can be used to maintain hygiene and comfort.
3. Used sanitary pads should be wrapped properly and disposed of inside a dustbin to maintain community health and environmental cleanliness.

14. Mention any three government initiatives that support menstrual hygiene.

Answer:

1. The **Menstrual Hygiene Scheme (MHS)** provides sanitary pads free or at reduced prices to adolescent girls in rural areas and promotes awareness.
2. The **Rashtriya Kishor Swasthya Karyakram (RKSK)** works to improve adolescents' overall health, including menstrual health and hygiene.
3. The **Suvidha Sanitary Napkin Initiative** provides affordable biodegradable sanitary pads through Jan Aushadhi Kendras.

15. State three benefits of regular exercise and physical activities during adolescence.

Answer:

1. Regular physical activities help keep the body fit and healthy.
2. They also contribute to a healthy mind and build stamina.
3. Participation in games, sports, and exercise can help boost an adolescent's mood.

16. Explain three ways in which adolescents can use social media responsibly.

Answer:

1. Adolescents should be respectful and kind while communicating with others online.
2. They should think carefully before posting and protect their privacy.
3. They should not share personal photographs or information with strangers or virtual friends.

17. What is cyberbullying? How should an adolescent respond to it?

Answer:

1. Cyberbullying involves using digital devices or online platforms to harass others through false rumours, misleading messages, or sharing personal information without consent.
2. A person facing cyberbullying should not feel scared or helpless but should handle the situation wisely.
3. The person should seek help and guidance from parents and teachers.

18. What is substance abuse? Mention its harmful effects.

Answer:

1. Substance abuse refers to the regular use of harmful substances after developing a strong urge to consume them repeatedly.
2. Harmful substances mentioned in the chapter include tobacco, gutka, cigarettes, beedi, alcohol, and illegal drugs.
3. Such substances can cause serious problems such as breathing difficulties, memory loss, and damage to the lungs.

19. Mention three ways to help a person overcome addiction.

Answer:

1. The person should seek help and support from family and friends.
2. They should talk openly to trusted people such as parents or teachers.

3. Counselling and medical advice can also help in handling addiction.

20. What is Nasha Mukt Bharat Abhiyaan? State its objectives.

Answer:

1. Nasha Mukt Bharat Abhiyaan was launched by the Ministry of Social Justice and Empowerment, Government of India.
2. It spreads awareness about avoiding substance abuse through the participation of youth, women, and the community.
3. It gives special attention to preventing substance abuse among early-age children.

21. What are hormones? Explain their role during adolescence.

Answer:

1. Hormones are certain chemicals produced in different parts of our body.
2. They regulate various aspects of growth and development and are responsible for many changes associated with puberty, including menstruation.
3. Some hormones also influence the mood and behaviour of adolescents.

22. Mention three healthy practices that can make adolescence a joyful experience.

Answer:

1. Adolescents should eat a balanced and nutritious diet to support proper growth and development.
2. They should maintain good personal hygiene and regularly participate in physical activities.
3. Proper guidance, awareness, and healthy decisions help adolescents manage physical, emotional, and behavioural changes effectively.

6.10. Three-mark questions with Answers of HOTS Type: (20 Questions)

1. Arjun and Rohan are both 13 years old. Arjun has developed facial hair and his voice has changed, but Rohan has not experienced these changes yet. Should Rohan be worried? Justify.

Answer:

1. Rohan need not be worried because the timing and extent of adolescent changes vary from person to person.
2. Changes in height, voice, and facial hair may appear earlier in some adolescents and later in others.
3. Such variations are normal because every individual experiences adolescence at their own pace.

2. A student says, "Adolescence is only about physical growth such as becoming taller and heavier." Analyse this statement.

Answer:

1. The statement is incorrect because adolescence includes more than physical growth.
2. Adolescents experience significant physical, emotional, behavioural, and biological changes, including changes related to reproductive maturity.
3. Therefore, adolescence should be understood as a transition involving the overall development of an individual from childhood towards adulthood.

3. Meera has a menstrual cycle of 32 days, while her friend has a 28-day cycle. Meera thinks something is wrong with her. How would you explain the situation?

Answer:

1. Meera need not assume that something is wrong because the length of the menstrual cycle can vary among healthy girls.
2. Although the cycle generally recurs every 28–30 days, healthy cycles may range from 21 to 35 days.

3. Therefore, both the 28-day and 32-day cycles fall within the range described in the chapter.

4. A menstruating girl is asked to remain physically isolated because of a traditional belief. Using scientific reasoning, explain why this practice should be discouraged.

Answer:

1. Menstruation is a natural biological process and should not be treated as something shameful or impure.
2. Beliefs supporting the physical isolation of menstruating girls have no scientific basis and can create unnecessary fear, shame, or guilt.
3. A scientific outlook towards menstruation promotes reproductive health and contributes to a healthier lifestyle for women.

5. An adolescent frequently experiences mood swings and strong emotions. Suggest three constructive ways to deal with these emotional changes.

Answer:

1. The adolescent can participate in activities such as music, dance, or sports to channel emotions positively.
2. Self-exploration and creative activities can help develop creativity and innovation.
3. Compassion and involvement in social work can also help adolescents use their strong emotions for positive growth.

6. Ravi regularly eats fast food and avoids nutritious meals even though he participates in sports. Explain why he should change his food habits.

Answer:

1. Adolescence is a period of rapid growth and development, making a nutritious diet particularly important.
2. Proteins and carbohydrates are required for proper growth and to perform well in physical activities.
3. Ravi should also obtain adequate fats, vitamins, and minerals to support his overall growth and development.

7. An adolescent girl often feels weak, and her diet contains very few iron-rich foods. Based on the chapter, what dietary changes would you suggest and why?

Answer:

1. The chapter notes that adolescents, especially girls, may experience blood-related health problems due to deficiencies of iron or vitamin B12.
2. She should include iron-containing foods mentioned in the chapter, such as spinach, kidney beans, raisins, and figs.
3. This is important because iron helps in the formation of blood.

8. You find used sanitary pads scattered outside the dustbin in your school toilet. What three actions or practices would you recommend?

Answer:

1. Used sanitary pads should be properly wrapped in newspaper before disposal.
2. They should then be placed inside a dustbin instead of being left scattered in the toilet.
3. Proper disposal should be encouraged because it supports community health and environmental cleanliness.

9. A school wants to improve menstrual hygiene among adolescent girls. Suggest three measures based on the chapter.

Answer:

1. The school should ensure that suitable menstrual hygiene products such as sanitary pads are easily available.
2. It should create awareness about menstrual hygiene and encourage proper disposal practices while reducing stigma around sanitary pads.

3. It can also make students aware of government initiatives such as MHS, RKSK, and schemes that improve access to menstrual hygiene products.

10. An adolescent spends most of the day studying or using digital devices and does not participate in games or exercise. What changes would you suggest?

Answer:

1. The adolescent should include regular exercise, games, sports, yoga, or other physical activities in the daily routine.
2. Such activities help keep both the body and mind fit and healthy.
3. Regular physical activity also builds stamina and improves mood.

11. Your friend receives an insulting social-media message about a classmate and wants to forward it to others. What advice would you give?

Answer:

1. Your friend should not forward the message because spreading misleading messages or false rumours can become a form of cyberbullying.
2. Social-media users should communicate respectfully and think carefully before posting or sharing information.
3. If the message involves bullying or harassment, guidance from parents or teachers should be sought.

12. A stranger whom Riya met online asks her to send personal photographs and private information. What should Riya do and why?

Answer:

1. Riya should not share personal photographs or private information with the stranger.
2. She should protect her privacy and be cautious while interacting with strangers or virtual friends online.
3. Responsible use of social media is important because careless sharing can expose adolescents to unsafe situations and misuse of personal information.

13. A group of friends pressures an adolescent to try a cigarette "only once." How should the adolescent respond? Explain your reasoning.

Answer:

1. The adolescent should firmly and confidently say "NO" and refuse to try the cigarette even once.
2. Cigarettes and other harmful substances are addictive, and repeated consumption can develop into substance abuse.
3. The chapter therefore advises adolescents to say "NO" to addictive substances the first time and every time.

14. Examine the illustration of lungs before and after prolonged exposure to cigarette/beedi smoke on page 83. What message does it convey?

Answer:

1. The illustration compares lungs before and after prolonged exposure to cigarette or beedi smoke and shows the harmful effect of smoking.
2. The chapter explains that such substances can cause breathing difficulties and damage the lungs.
3. Therefore, completely avoiding addictive substances is a healthier choice than experimenting with them.

15. A teenager has become addicted to a harmful substance but wants to stop. Suggest a three-step course of action.

Answer:

1. The teenager should first seek help and support from family and friends instead of dealing with addiction alone.
2. They should discuss the problem with trusted adults such as parents or teachers.

3. Counselling and appropriate medical advice can provide further support in overcoming addiction.

16. Two adolescents experience both physical changes and sudden changes in mood during puberty. How can hormones explain this connection?

Answer:

1. Many changes associated with puberty are mainly caused by hormones, which are chemicals produced within the body.
2. Hormones regulate different aspects of growth and development and are released at appropriate times in response to signals from the brain.
3. Since some hormones also influence mood and behaviour, they can contribute to both physical and emotional changes during adolescence.

17. Your class wants to create a "Healthy Adolescence Plan." What three major areas should the plan include? Justify your choices.

Answer:

1. The plan should promote a balanced and nutritious diet because adolescence involves rapid growth and development.
2. It should emphasise personal hygiene and regular physical activity to support health, fitness, stamina, and well-being.
3. It should also provide proper guidance and awareness so that adolescents can manage their physical, emotional, and behavioural changes responsibly.

18. A classmate is embarrassed because they are developing more slowly than other students of the same age. How would you help them understand the situation?

Answer:

1. I would explain that adolescents do not experience physical changes at exactly the same age or at the same rate.
2. The timing, nature, and extent of changes such as height, voice, and hair growth naturally vary among individuals.
3. Therefore, comparing one's development directly with classmates is not appropriate because each person experiences adolescence at their own pace.

19. Why is peer pressure during adolescence something that should be handled thoughtfully?

Answer:

1. Adolescence involves new experiences, emotions, curiosity, and a tendency to feel attracted to peers or imitate their behaviour.
2. Peer influence may sometimes pressure adolescents to experiment with harmful substances such as tobacco or alcohol.
3. Adolescents should therefore make thoughtful decisions, seek guidance when needed, and remain confident in saying "NO" to harmful choices.

20. "Making adolescence joyful requires both personal responsibility and social support." Justify this statement.

Answer:

1. Adolescents have a personal responsibility to develop healthy habits such as nutritious eating, good hygiene, regular exercise, responsible social-media use, and avoiding addictive substances.
2. At the same time, parents, teachers, schools, government programmes, and society can provide guidance, awareness, health facilities, and support.
3. Together, informed personal decisions and appropriate support help adolescents manage physical, emotional, and behavioural changes effectively.

6.11 Five-mark questions with Answers of LOTS Type: (12 Questions)

1. What is adolescence? Explain the major changes that occur during this stage.
Answer:
1. Adolescence is the stage of development between childhood and adulthood, generally beginning around 10 years and lasting until about 19 years.
2. During adolescence, there is rapid growth and development, including noticeable increases in height and weight.
3. Adolescents experience physical changes such as changes in body structure, voice, skin, and growth of hair in different body regions.
4. They also undergo emotional and behavioural changes as they develop towards adulthood.
5. Internal changes also occur as the body gradually reaches reproductive maturity.

2. Describe five important physical changes that take place during adolescence.
Answer:
1. Increase in height becomes more prominent during adolescence.
2. Boys may gain weight, develop broader shoulders, and have a wider chest, while girls undergo changes such as development of breasts.
3. The voice box grows, causing noticeable voice changes, particularly a hoarse voice in adolescent boys.
4. Acne and pimples may appear because increased oily secretions can clog the pores of the skin.
5. Hair grows in the armpits and pubic region in both boys and girls, while boys may also develop facial, chest, or back hair.

3. What are secondary sexual characteristics? Explain them with suitable examples.
Answer:
1. Secondary sexual characteristics are characteristic changes that help distinguish males from females.
2. These characteristics are not directly involved in the process of reproduction.
3. Change in voice and growth of facial and chest hair are examples observed particularly in boys.
4. Development of breasts in girls is another example of a secondary sexual characteristic.
5. These characteristics are natural signs that the body is preparing for adulthood and mark the onset of puberty.

4. Explain puberty and the changes that indicate reproductive capability during adolescence.
Answer:
1. Puberty is the stage in which an adolescent's body undergoes external and internal changes to develop into an adult capable of reproduction.
2. Secondary sexual characteristics appear during this period and indicate that the body is preparing for adulthood.
3. Internal changes include the gradual maturation of various body parts involved in reproduction.
4. Both boys and girls experience these changes gradually as a natural part of growing up.
5. In girls, the onset of the menstrual cycle is an important internal change associated with reproductive maturity.

5. Explain menstruation and the menstrual cycle in adolescent girls.
Answer:
1. The onset of the menstrual cycle is an important internal change associated with adolescence in girls.
2. The menstrual cycle generally recurs every 28–30 days, although healthy cycles may range from 21–35 days.

3. The phase during which blood is discharged from the body is called menstruation, and it may last from three to seven days.
4. Some girls may experience pain or discomfort in the lower abdomen during menstruation.
5. Menstruation usually stops naturally between 45 and 55 years of age, marking the end of reproductive capability in a woman's life.

6. Describe the emotional and behavioural changes experienced during adolescence.
Answer:
1. Adolescence involves emotional and behavioural changes in addition to physical and reproductive changes.
2. Adolescents may experience mood swings, strong emotions, and increased sensitivity.
3. They may develop deeper interests in new areas or become involved in social initiatives.
4. Activities such as music, dance, sports, creativity, and social work can contribute to positive growth and development.
5. Understanding the influence of emotions on behaviour can help adolescents make better choices and respond thoughtfully to situations.

7. Explain the nutritional requirements of adolescents and the importance of a balanced diet.
Answer:
1. A nutritious diet is very important during adolescence because it is a period of rapid growth and development.
2. Proteins and carbohydrates are required for proper growth and for performing well in physical activities.
3. Adequate amounts of fats, vitamins, and minerals are also necessary for healthy development.
4. Calcium obtained from foods such as milk, millets, curd, cheese, and paneer helps in optimal bone growth.
5. Iron from foods such as spinach, kidney beans, raisins, and figs helps in the formation of blood.

8. Explain the importance of personal and menstrual hygiene during adolescence.
Answer:
1. Personal hygiene is particularly important during adolescence for maintaining health and preventing potential infections.
2. Body hygiene should be maintained carefully, especially in the armpits and pubic region.
3. Girls should maintain proper hygiene during menstruation for both comfort and health.
4. Sanitary pads or reusable cloth pads designed for menstrual hygiene can be used during menstruation.
5. Used sanitary pads should be wrapped properly and disposed of inside a dustbin to protect community health and environmental cleanliness.

9. Describe the government initiatives mentioned in the chapter for promoting menstrual hygiene.
Answer:
1. The **Menstrual Hygiene Scheme (MHS)** provides sanitary pads free of charge or at reduced prices to adolescent girls in rural areas and promotes awareness about menstrual health.
2. The **Rashtriya Kishor Swasthya Karyakram (RKSK)** aims to improve adolescents' overall health, including menstrual health and hygiene.

3. RKSK also encourages peer education, in which older students help younger students learn about these topics.
4. The **Suvidha Sanitary Napkin Initiative** provides affordable biodegradable sanitary pads through Jan Aushadhi Kendras.
5. State-level programmes, including Karnataka's **Shuchi Scheme**, also aim to distribute free sanitary pads in government schools.

10. Explain how adolescents can maintain a balanced and responsible social life.
Answer:
1. Adolescents should be polite and respectful towards others to help create a favourable and safe social environment.
2. They should interact thoughtfully and responsibly with others both in person and through social media.
3. Online platforms should be used responsibly for obtaining information, making connections, interacting, and sharing information.
4. Adolescents should be cautious while uploading pictures or sharing personal information with strangers.
5. They should seek guidance from elders, parents, and teachers when dealing with inappropriate online behaviour or cyberbullying.

11. What is substance abuse? Explain its harmful effects and ways to avoid it.
Answer:
1. Harmful substances mentioned in the chapter include tobacco, gutka, cigarettes, beedi, alcohol, and illegal drugs.
2. These substances can be addictive because a person may develop a strong urge to consume them repeatedly.
3. Their regular use can lead to substance abuse and cause problems such as breathing difficulties, memory loss, and lung damage.
4. Adolescents should remain firm and confident and say “NO” to such substances the first time and every time.
5. A person struggling with addiction should seek support from family, friends, parents, teachers, counsellors, or medical professionals.

12. What are hormones? Explain their role in adolescence.
Answer:
1. Hormones are certain chemicals produced in different parts of the body.
2. They play an important role in regulating various aspects of growth and development.
3. Many changes during adolescence, including menstruation and other signs of puberty, are mainly due to hormones.
4. Hormones are released at appropriate times in response to signals from the brain.
5. Some hormones also influence the mood and behaviour of adolescents.

6.12 Five-mark questions with Answers of HOTS Type: (5 Questions)

1. Two students of the same age show different physical changes during adolescence. One has grown taller and developed facial hair, while the other has not. Explain why this difference should not be a cause for worry.
Answer:
1. Adolescence generally occurs between 10 and 19 years, but every person experiences this stage at their own pace.
2. The timing, nature, and extent of changes such as increase in height, voice change, and growth of facial hair vary among individuals.

3. Some adolescents may therefore show certain changes earlier than others of the same age.
4. Such variations in physical development are considered completely normal during adolescence.
5. Hence, adolescents should understand individual differences rather than compare their development unnecessarily with that of others.

2. Shalu says, "Adolescence is only a period of physical growth." Evaluate her statement and explain why it is incomplete.

Answer:

1. Shalu's statement is incomplete because adolescence involves much more than an increase in height, weight, and other physical changes.
2. The body also undergoes internal biological changes and gradually develops reproductive capability.
3. Adolescents experience emotional changes such as mood swings, strong emotions, and increased sensitivity.
4. These emotional changes can influence behaviour, interests, social interactions, and decision-making.
5. Therefore, adolescence should be understood as a period involving significant **physical, biological, emotional, and behavioural changes** while progressing towards adulthood.

3. A 13-year-old student frequently experiences mood swings and becomes very sensitive to comments made by others. Using your understanding of adolescence, suggest how the student can manage these changes positively.

Answer:

1. Mood swings, strong emotions, and increased sensitivity can occur during adolescence and may influence behaviour.
2. The student should first understand that emotions can affect actions and decisions.
3. Participating in activities such as music, dance, or sports can help channel emotions constructively.
4. Self-exploration and creative activities can help develop creativity and innovation, while social work can encourage compassion.
5. By understanding emotions and responding thoughtfully, the student can make better choices and use this stage for positive growth.

4. An adolescent regularly eats fast food, avoids nutritious foods, and does very little physical activity. Analyse the possible problems with this lifestyle and suggest suitable improvements.

Answer:

1. Adolescence is a period of rapid growth and development, so a nutritious diet is especially important during this stage.
2. The adolescent should consume adequate proteins and carbohydrates for proper growth, strength, energy, and physical performance.
3. Fats, vitamins, minerals, calcium, and iron are also important for healthy development, including bone growth and blood formation.
4. Regular exercise, games, sports, or similar physical activities should be included because they keep the body and mind fit, build stamina, and boost mood.
5. Therefore, replacing poor dietary habits with balanced nutrition and regular physical activity would contribute to healthier adolescent development.

5. Some people believe that menstruating girls should be physically isolated. Examine this belief scientifically and suggest how society should respond.

Answer:

1. Menstruation is a natural biological process associated with reproductive development in girls.
2. The chapter clearly states that myths supporting the physical isolation of menstruating girls have no scientific basis.
3. Such beliefs can create unnecessary fear, shame, or guilt among adolescent girls.
4. Society should instead encourage a scientific outlook and promote awareness about menstrual and reproductive health.
5. Proper hygiene facilities, access to menstrual products, and freedom from stigma can help girls manage menstruation comfortably and healthily.

6. You notice used sanitary pads scattered near the dustbin in your school toilet. As a responsible student, what measures would you recommend to improve menstrual hygiene and environmental cleanliness?

Answer:

1. Used sanitary pads should be properly wrapped in newspaper before being discarded.
2. They should always be placed inside a dustbin rather than being left scattered around it.
3. Students should be educated about menstrual hygiene because proper practices contribute to comfort, health, community hygiene, and cleanliness.
4. Schools should ensure the availability of necessary menstrual hygiene facilities and work towards reducing stigma surrounding sanitary pads.
5. Where suitable, environment-friendly options such as biodegradable sanitary pads can also help reduce environmental impact.

7. A student receives an embarrassing photograph of a classmate on social media and is encouraged by friends to forward it. What should the student do? Give reasons.

Answer:

1. The student should not forward the photograph because social media must be used thoughtfully and responsibly.
2. Sharing someone's personal information or content without consent can contribute to cyberbullying and harm that person.
3. The student should follow the principles of being respectful and kind, thinking before posting, and protecting privacy.
4. If bullying or harassment is occurring, the student should seek guidance and help from parents or teachers.
5. Responsible online behaviour creates a safer environment and protects both individual privacy and collective well-being.

8. Your friends pressure you to try a cigarette only once, saying that one-time use cannot cause addiction. How would you respond using the information given in the chapter?

Answer:

1. I would firmly refuse because cigarettes are among the harmful and addictive substances that adolescents are advised to avoid.
2. The chapter explains that once people begin consuming addictive substances, they may develop a strong urge to use them repeatedly.
3. Repeated consumption may eventually develop into substance abuse.
4. Such substances can cause serious health problems, including breathing difficulties, memory loss, and damage to the lungs.
5. Therefore, the safest decision is to remain confident and say **"NO" the first time and every time**, rather than experimenting because of peer pressure.

9. Suppose your school wants to prepare a "Healthy Adolescence Programme." Suggest five major components that should be included and justify them.

Answer:

1. **Balanced nutrition** should be included because adolescents require adequate nutrients for rapid growth and development.
2. **Personal and menstrual hygiene** should be promoted to maintain health, comfort, and protection from potential infections.
3. **Regular physical activity** should be encouraged because it keeps the body and mind fit, improves stamina, and boosts mood.
4. **Responsible social-media behaviour** should be taught to encourage respectful communication, privacy protection, and prevention of cyberbullying.
5. **Prevention of substance abuse** should be included so that students learn to resist peer pressure and confidently avoid tobacco, alcohol, and other addictive substances.

10. "Good habits, thoughtful decisions, and proper guidance can make adolescence a joyful experience." Justify this statement with five examples.

Answer:

1. Eating a balanced and nutritious diet provides the nutrients required for healthy growth and development.
2. Maintaining personal hygiene and menstrual hygiene helps adolescents remain comfortable and protects them from potential infections.
3. Regular exercise and sports improve physical fitness, stamina, mental well-being, and mood.
4. Respectful social interactions, responsible social-media use, and refusal of addictive substances help adolescents make safer choices.
5. Staying informed and seeking guidance from parents, teachers, family, or other trusted people when necessary helps adolescents build a strong foundation for adulthood.

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

1. Rohan and Kiran are both 13 years old. Rohan has become taller, his voice has changed, and he has developed a moustache, whereas Kiran has not experienced all these changes yet. Kiran is worried. How would you explain the situation to him?

Answer:

1. Both Rohan and Kiran are in the stage of adolescence, which generally occurs between 10 and 19 years of age.
2. Physical changes during adolescence do not begin at exactly the same age in every individual.
3. Changes in height, voice, and facial hair may appear earlier in some adolescents and later in others.
4. The timing, nature, and extent of these changes vary among individuals and such variations are completely normal.
5. Therefore, Kiran should understand that each person experiences adolescence at their own pace and should not compare his development with Rohan's.

2. Meera, a 13-year-old girl, frequently eats packaged snacks and avoids milk, vegetables, pulses, and fruits. She also feels tired during physical activities. Using your knowledge of adolescent nutrition, suggest five changes she should make.

Answer:

1. Meera should eat a nutritious and balanced diet because adolescence is a period of rapid growth and development.
2. She should consume protein- and carbohydrate-rich foods to support growth, strength, energy, and physical performance.
3. Milk, millets, curd, cheese, and paneer can provide nutrients such as calcium needed for proper bone growth.

4. Foods such as spinach, kidney beans, raisins, and figs should be included because they provide iron required for blood formation.
5. Her diet should also contain adequate fats, vitamins, and minerals instead of depending mainly on packaged snacks.

3. During a school trip, Anjali gets her period unexpectedly and feels embarrassed because some classmates make fun of her. As her friend, how would you help her and correct the behaviour of the other students?

Answer:

1. I would reassure Anjali that menstruation is a natural process associated with adolescence and reproductive health.
2. I would help her obtain a sanitary pad or another suitable menstrual hygiene product.
3. I would explain to the classmates that shame, stigma, myths, and taboos associated with menstruation have no scientific basis.
4. I would encourage them to respect her privacy and develop a scientific and supportive attitude towards menstruation.
5. I would also ensure that the used sanitary pad is wrapped and disposed of properly in a dustbin to maintain hygiene and environmental cleanliness.

4. Your friend receives hurtful messages on social media, and someone threatens to share their personal photographs without permission. What advice would you give your friend?

Answer:

1. I would explain that sending harassing messages or sharing someone's personal information without consent can constitute cyberbullying.
2. My friend should handle the situation wisely rather than feeling scared or helpless.
3. They should immediately seek help and guidance from parents, teachers, or other trusted adults.
4. They should protect their privacy and avoid sharing personal photographs or information with strangers or virtual friends.
5. In future, they should follow responsible social-media practices such as being respectful, thinking before posting, and protecting personal information.

5. A senior student offers Arun a cigarette and tells him, "Try it just once; nothing will happen." How should Arun respond? Explain the reasons for your advice.

Answer:

1. Arun should firmly and confidently say **"NO"** to the cigarette even if his senior pressures him.
2. Cigarettes and similar substances are harmful to both physical and mental health and can be addictive.
3. A person who starts with "just one time" may develop an urge to use the substance repeatedly and eventually develop substance abuse.
4. Prolonged exposure to cigarette or beedi smoke can cause health problems such as breathing difficulties and lung damage.
5. Therefore, Arun should resist peer pressure, completely avoid such substances, and make healthy choices for his future.

6. Priya has recently become very sensitive and experiences frequent mood swings. Sometimes she feels excited, while at other times she feels low. Suggest five ways in which she can positively manage these changes.

Answer:

1. Priya should understand that adolescence may involve mood swings, strong emotions, and increased sensitivity.
2. She can engage in constructive activities such as music, dance, or sports to channel her emotions positively.

3. She can explore creative activities that encourage self-exploration, creativity, and innovation.
4. Participation in social work can help her develop compassion and direct her strong emotions towards helping others.
5. Most importantly, understanding how emotions influence behaviour can help her make better choices and respond thoughtfully to different situations.

7. Your school wants to introduce a "Healthy Adolescence Week." As a student coordinator, suggest five activities that could be organised based on the chapter.

Answer:

1. A **balanced-diet awareness activity** can teach students about proteins, carbohydrates, fats, vitamins, minerals, calcium, and iron needed during adolescence.
2. A **personal and menstrual hygiene session** can create awareness about hygiene practices and proper disposal of sanitary pads.
3. A **sports, exercise, or yoga session** can demonstrate the importance of physical activities for fitness, stamina, and a positive mood.
4. A **responsible social-media campaign** can teach students about privacy, respectful online behaviour, and prevention of cyberbullying.
5. A **"Say NO to Harmful Substances" campaign** can educate students about the addictive and harmful effects of tobacco, alcohol, and drugs.

8. A student addicted to a harmful substance wants to stop using it but feels unable to do so alone. What five steps or suggestions would you give the student?

Answer:

1. The student should first recognise that addictive substances can create a strong urge for repeated consumption and seriously affect health.
2. The student should seek support from family members and friends rather than trying to manage the problem alone.
3. Trusted adults such as parents and teachers should be approached for guidance and assistance.
4. Counselling and appropriate medical advice can also help in handling addiction.
5. The student can also make use of support initiatives mentioned in the chapter, such as the Government's **National De-addiction Helpline—14446**.

9. Your school notices that many adolescents spend most of their free time online and rarely participate in outdoor activities. Suggest a five-point plan to encourage a healthier lifestyle.

Answer:

1. Students should be encouraged to participate regularly in games, sports, exercise, and other physical activities.
2. Such activities help keep both the body and mind fit and healthy.
3. Regular physical activity can build stamina and improve mood during adolescence.
4. Students should also be taught to use online platforms responsibly rather than allowing careless social-media use to dominate their free time.
5. A balanced routine involving physical activity, healthy social interaction, thoughtful online behaviour, and nutritious food can contribute to overall well-being.

10. Suppose you are asked to prepare a five-point "Healthy Lifestyle Guide for Adolescents" for your classroom notice board. What would you include?

Answer:

1. **Eat a balanced and nutritious diet** containing proteins, carbohydrates, fats, vitamins, and minerals required for growth.
2. **Maintain good personal hygiene**, including proper menstrual hygiene where applicable, to support health and comfort.

3. **Exercise regularly and participate in games or sports** to improve fitness, stamina, and mood.
4. **Maintain a balanced social life and use social media responsibly**, protecting privacy and treating others respectfully.
5. **Stay completely away from tobacco, alcohol, drugs, and other addictive substances**, and seek guidance from trusted adults whenever necessary.

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

Olympiad-Type Multiple Choice Questions with Answers

The following questions are designed at a **competitive/Olympiad level**, with emphasis on conceptual understanding, application, reasoning, assertion–reason, and situation-based analysis. They are based on the uploaded Grade 7 Science chapter. Adolescence generally covers ages 10–19 and includes physical, biological, emotional, and behavioural changes.

1. Which sequence correctly represents the stages of human life mentioned in the chapter?
A. Infancy → Adolescence → Childhood → Adulthood → Old age
B. Infancy → Childhood → Adolescence → Adulthood → Old age
C. Childhood → Infancy → Adolescence → Old age → Adulthood
D. Infancy → Childhood → Adulthood → Adolescence → Old age
Answer: B. Infancy → Childhood → Adolescence → Adulthood → Old age

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2. Which statement most accurately describes adolescence?
A. A period concerned only with increase in height
B. A stage beginning only after 18 years
C. A period of rapid growth and development between childhood and adulthood
D. A stage during which reproduction stops
Answer: C. A period of rapid growth and development between childhood and adulthood

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3. Rahul and Amit are both 13 years old. Rahul has developed facial hair, while Amit has not. Which conclusion is scientifically most appropriate?
A. Amit must have a health problem.
B. Rahul has completed adolescence.
C. The timing of adolescent changes varies among individuals.
D. Facial hair must appear in all boys at exactly 13 years.
Answer: C. The timing of adolescent changes varies among individuals.

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4. Which of the following is NOT a secondary sexual characteristic mentioned in the chapter?
A. Development of breasts in girls
B. Growth of facial hair in boys
C. Change in voice
D. Menstruation
Answer: D. Menstruation
Explanation: Secondary sexual characteristics distinguish males and females but are not directly involved in reproduction; menstruation indicates reproductive capability.

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5. The hoarseness of voice commonly noticed in adolescent boys is mainly associated with:
A. growth of the lungs
B. growth of the voice box

C. increased oily secretion
D. widening of skin pores
Answer: B. Growth of the voice box

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6. Consider the following statements:
1. The voice box grows in both adolescent boys and girls.
2. It generally grows larger in boys than in girls.
3. The Adam's apple is noticeable in every adolescent.

Which option is correct?
A. 1 only
B. 1 and 2 only
C. 2 and 3 only
D. 1, 2 and 3
Answer: B. 1 and 2 only

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7. During adolescence, increased oily secretions from the skin may block pores. What is the most likely consequence?
A. Increase in height
B. Development of acne
C. Change in voice
D. Growth of facial hair
Answer: B. Development of acne

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8. Which combination contains changes that can occur in both boys and girls during adolescence?
A. Facial hair and development of breasts
B. Hair in armpits and pubic region
C. Moustache and beard
D. Development of breasts and chest hair
Answer: B. Hair in armpits and pubic region

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9. Puberty is best defined as:
A. the entire period from birth to adulthood
B. a stage when only emotional changes occur
C. the stage when external and internal changes make an adolescent capable of reproduction
D. the period when physical growth completely stops
Answer: C. The stage when external and internal changes make an adolescent capable of reproduction.

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10. A healthy girl's menstrual cycle occurs every 32 days. Which conclusion agrees with the chapter?
A. It must always be exactly 28 days.
B. A 32-day cycle can fall within the normal 21–35 day range.
C. Menstrual cycles longer than 30 days indicate the end of reproductive capability.
D. Menstruation must last for 32 days.
Answer: B. A 32-day cycle can fall within the normal 21–35 day range.

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11. Which pair is correctly matched?
A. Menstrual cycle — always exactly 28 days
B. Menstruation — blood discharge phase of the menstrual cycle

C. Menstruation — secondary sexual characteristic in boys
D. Puberty — end of reproductive capability
Answer: B. Menstruation — blood discharge phase of the menstrual cycle

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12. Which statement about menstruation is scientifically correct according to the chapter?
A. Menstruating girls should always be physically isolated.
B. Menstruation is an illness occurring during adolescence.
C. Menstruation is a natural process, and myths surrounding it have no scientific basis.
D. Menstruation indicates poor reproductive health.
Answer: C. Menstruation is a natural process, and myths surrounding it have no scientific basis.

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13. An adolescent frequently experiences mood swings and increased sensitivity. Which response is most constructive?
A. Ignore all emotions completely.
B. Stop interacting with others.
C. Engage in music, dance, sports, creative activities, or social work.
D. Assume these emotions indicate physical illness.
Answer: C. Engage in music, dance, sports, creative activities, or social work.

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14. Which nutrient–function pair is correctly matched according to the chapter?
A. Iron — formation of blood
B. Calcium — cyberbullying prevention
C. Protein — menstrual cycle regulation
D. Carbohydrates — development of the Adam's apple
Answer: A. Iron — formation of blood

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15. An adolescent's diet contains spinach, kidney beans, raisins, and figs. The diet is particularly useful for obtaining:
A. iodine
B. iron
C. only fats
D. only carbohydrates
Answer: B. Iron

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16. Why does the chapter emphasise a nutritious diet during adolescence?
A. Growth stops during adolescence.
B. Adolescence is marked by growth and several bodily changes.
C. Adolescents do not require carbohydrates.
D. Only adolescents require vitamins.
Answer: B. Adolescence is marked by growth and several bodily changes.

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17. Dorothy Hodgkin is mentioned in the chapter particularly in connection with her study of the structure of:
A. calcium
B. iron
C. vitamin B12
D. carbohydrates
Answer: C. Vitamin B12

18. Which statement about vitamin B12 is supported by the chapter?
A. The human body produces all the vitamin B12 it needs.
B. It is unnecessary for proper body functioning.
C. It has to be obtained from food because the body cannot make it.
D. It is responsible for causing acne.
Answer: C. It has to be obtained from food because the body cannot make it.

19. Which practice would BEST promote menstrual hygiene as well as environmental cleanliness?
A. Leaving used sanitary pads near a dustbin
B. Throwing them in open spaces
C. Wrapping used sanitary pads and disposing of them inside a dustbin
D. Avoiding sanitary products completely
Answer: C. Wrapping used sanitary pads and disposing of them inside a dustbin.

20. Which government initiative mentioned in the chapter provides biodegradable sanitary pads at affordable prices through Jan Aushadhi Kendras?
A. RKSK
B. Menstrual Hygiene Scheme
C. Suvidha Sanitary Napkin Initiative
D. Nasha Mukt Bharat Abhiyaan
Answer: C. Suvidha Sanitary Napkin Initiative

21. Regular physical activity during adolescence is expected to:
A. prevent all emotional changes
B. keep the body and mind fit, build stamina, and boost mood
C. stop puberty
D. prevent the action of hormones
Answer: B. Keep the body and mind fit, build stamina, and boost mood.

22. Which of the following would qualify as cyberbullying according to the chapter?
A. Politely discussing homework online
B. Sharing educational information
C. Spreading false rumours about someone through an online platform
D. Asking a teacher for guidance online
Answer: C. Spreading false rumours about someone through an online platform.

23. A stranger on a social-media platform asks Riya to send a personal photograph. What is the BEST response?
A. Send it because the person seems friendly.
B. Send it but delete it afterwards.
C. Protect her privacy and avoid sharing personal photographs with strangers.
D. Post the photograph publicly instead.
Answer: C. Protect her privacy and avoid sharing personal photographs with strangers.

24. Which sequence most logically describes the development of substance abuse as explained in the chapter?
A. Experimentation → repeated urge → regular use → substance abuse
B. Substance abuse → experimentation → healthy lifestyle

C. Regular exercise → addiction → substance abuse
D. Experimentation → immediate recovery → addiction
Answer: A. Experimentation → repeated urge → regular use → substance abuse

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25. A friend says, "Trying a cigarette only once cannot lead to any problem." Which chapter-based response is most appropriate?
A. Correct, because addiction occurs only in adults.
B. Correct, if the cigarette is used only once a month.
C. Incorrect, because addiction may begin with experimentation and lead to repeated use.
D. Correct, because cigarettes affect only the lungs and cannot be addictive.
Answer: C. Incorrect, because addiction may begin with experimentation and lead to repeated use.

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26. Which of the following is NOT mentioned as a possible health problem associated with harmful addictive substances?
A. Breathing difficulties
B. Memory loss
C. Lung damage
D. Increased bone growth
Answer: D. Increased bone growth

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27. If an adolescent is already struggling with addiction, which is the most appropriate first step according to the chapter?
A. Hide the problem from everyone.
B. Seek help and support from family, friends, parents, teachers, or other trusted people.
C. Replace one addictive substance with another.
D. Stop attending school.
Answer: B. Seek help and support from family, friends, parents, teachers, or other trusted people.

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28. The National De-addiction Helpline number mentioned in the chapter is:
A. 1098
B. 112
C. 14446
D. 104
Answer: C. 14446

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29. Many changes during adolescence, including menstruation and other signs of puberty, occur mainly due to:
A. enzymes present in food
B. hormones produced in the body
C. physical exercise alone
D. environmental temperature
Answer: B. Hormones produced in the body

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30. Which statement about hormones is incorrect according to the chapter?
A. They are chemicals produced in the body.
B. They help regulate growth and development.
C. Some hormones can influence mood and behaviour.
D. They are produced only during adolescence and disappear afterwards.

Answer: D. They are produced only during adolescence and disappear afterwards.

Assertion–Reason Questions

For Questions **31–35**, choose:

A. Both Assertion and Reason are true, and Reason correctly explains Assertion.
B. Both Assertion and Reason are true, but Reason does not correctly explain Assertion.
C. Assertion is true, but Reason is false.
D. Assertion is false, but Reason is true.

31. Assertion: Acne is commonly observed during adolescence.
Reason: Increased oily secretions can clog skin pores and lead to infections.
Answer: A

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32. Assertion: Every adolescent boy develops facial hair at exactly the same age.
Reason: The timing and extent of adolescent changes vary among individuals.
Answer: D

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33. Assertion: Physical activities are beneficial during adolescence.
Reason: They help maintain physical and mental fitness, build stamina, and boost mood.
Answer: A

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34. Assertion: Addictive substances should be avoided completely.
Reason: They may damage physical and mental health and can lead to repeated use and substance abuse.
Answer: A

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35. Assertion: Adolescence involves only physical changes.
Reason: Adolescents also undergo biological, emotional, and behavioural changes.
Answer: D

Answer Key at a Glance

1-B, 2-C, 3-C, 4-D, 5-B, 6-B, 7-B, 8-B, 9-C, 10-B, 11-B, 12-C, 13-C, 14-A, 15-B, 16-B, 17-C, 18-C, 19-C, 20-C, 21-B, 22-C, 23-C, 24-A, 25-C, 26-D, 27-B, 28-C, 29-B, 30-D, 31-A, 32-D, 33-A, 34-A, 35-D.

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

Since this chapter deals with physical, emotional, behavioural, nutritional, hygiene, social-media, and lifestyle aspects of adolescence, teaching should be **scientific, sensitive, activity-based, inclusive, and non-judgmental**. The chapter itself emphasises that adolescents develop at different rates and that such variations are normal.

(1) **Anonymous Question Box – "Ask Without Fear":**
Keep a question box in the classroom where students can anonymously submit doubts about puberty, physical changes, menstruation, emotions, acne, hygiene, etc. The teacher can answer selected questions scientifically without identifying or embarrassing any student. This is especially appropriate because the chapter covers changes that students may find sensitive to discuss openly.

(2) **Activity-Based "Changes During Adolescence" Classification:**
Give students cards containing changes such as increase in height, change in voice, pimples, development of breasts, facial hair, mood swings, and hair growth in the armpits. Students can classify them as **physical, emotional, behavioural, common to both sexes, or sex-specific**. This extends the chapter's own observation-and-discussion activity.

(3) **Healthy Adolescent Meal-Plate Activity:**
Ask groups to design a balanced meal using locally available foods and identify the proteins, carbohydrates, fats, calcium, iron, vitamins, and other nutrients provided. Students can explain how their chosen foods support growth, bone development, blood formation, strength, and energy.

(4) **Myth versus Scientific Fact Discussion:**
Prepare cards containing common statements about adolescence and menstruation and ask students to classify them as **"Scientific Fact" or "Myth."** Follow this with evidence-based discussion to remove fear, embarrassment, and stigma. This directly supports the chapter's message that myths and taboos surrounding menstruation lack scientific basis.

(5) **Role-Play for Life-Skill Development:**
Conduct short role-plays involving peer pressure to smoke, cyberbullying, mood swings, responsible social-media behaviour, or seeking help from parents and teachers. Students should demonstrate appropriate responses such as saying "NO," protecting privacy, treating others respectfully, and seeking help. The activity converts textbook knowledge into practical decision-making skills.

(6) **"Healthy Habits Tracker" for Self-Learning:**
Students can maintain a one-week personal checklist covering nutritious food, adequate physical activity, personal hygiene, responsible digital behaviour, and constructive recreational activities. The objective should be self-reflection rather than comparison or grading. The chapter specifically links balanced diet, hygiene, and physical activity with adolescent health.

(7) **Cyber-Safety and Responsible Social-Media Campaign:**
Divide students into groups to prepare posters or pamphlets on "Think Before Posting," "Protect Your Privacy," "Be Respectful Online," and "Stop Cyberbullying." Students can display their work on a classroom awareness wall. This directly builds upon Activity 6.4 in the chapter.

(8) **Peer Learning and Expert Interaction:**
Arrange an age-appropriate interactive session with a qualified health professional, counsellor, or school health educator on adolescent nutrition, personal hygiene, emotional changes, menstrual hygiene, and healthy lifestyle choices. Students can prepare questions beforehand. This reinforces the chapter's emphasis on proper guidance, awareness, and seeking support when required.

(9) **"Say NO" Decision-Making Scenarios:**
Give groups realistic situations involving pressure from friends to try tobacco, gutka, cigarettes, alcohol, or other harmful substances. Students should decide what they would do, justify their choice, and identify whom they could approach for support. The chapter stresses firm refusal, healthy choices, and seeking support in cases of addiction.

(10) **Integrate Yoga, Sports and Emotional Well-being:**
Include short demonstrations of yoga, stretching, games, or other physical activities and ask students to reflect on how they feel before and after participation. This connects physical fitness with mental and emotional well-being; the chapter states that regular physical activity helps fitness, stamina, and mood.

Recommended Best-Practice Principle: Throughout this chapter, teachers should **avoid asking students to publicly disclose their own bodily changes, menstrual experiences, emotional difficulties, or family circumstances**. Examples, fictional cases, anonymous questions, group activities, and voluntary participation can create a safer and more respectful learning environment.

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

The chapter covers physical and emotional changes, puberty, nutrition, hygiene, physical activity, social-media behaviour, substance abuse, and hormones, making it well suited for **experiential and technology-supported learning**.

(1) Interactive "Adolescence Journey Map":
Students can work in teams to create a visual or digital journey map from childhood → adolescence → adulthood. They can place cards showing changes in height, voice, body structure, hair growth, emotions, and reproductive maturity at appropriate points. The activity helps students understand adolescence as a multidimensional transition rather than merely physical growth.

(2) QR-Code Learning Stations:
Create different classroom learning stations titled **Physical Changes, Emotional Changes, Nutrition, Personal Hygiene, Physical Fitness, Cyber Safety, and Healthy Choices**. QR codes can lead to teacher-prepared diagrams, short explanations, quizzes, or animations, followed by a worksheet at each station. This turns the chapter into a self-paced rotational learning experience.

(3) "Myth Busters" Scientific Investigation:
Give groups selected statements about puberty and menstruation and ask them to prepare a **Myth–Fact–Scientific Explanation** display. Students can present their findings as posters, mini-talks, or digital slides. This directly reinforces the chapter's emphasis on replacing menstruation-related myths and stigma with a scientific outlook.

(4) Design a "Smart Adolescent Meal" Challenge:
Students can act as young nutrition planners and design a healthy meal using locally available foods. They should label food sources of proteins, carbohydrates, fats, calcium, iron, and other nutrients and explain their functions. This extends the textbook's food–nutrient–function activity into a design-thinking challenge.

(5) Digital Cyberbullying Decision Game:
Present branching scenarios such as: *"A stranger asks for your photograph," "A friend forwards an embarrassing picture,"* or *"Someone spreads a false rumour online."* At each stage, students choose an action and discuss its likely consequences. The activity develops digital citizenship based on the chapter's principles of **being respectful, thinking before posting, and protecting privacy**.

(6) "Emotion Traffic Light" Learning Tool:
Create a three-level classroom tool: **Red – recognise the emotion; Yellow – think before acting; Green – choose a constructive response**. Students apply it to fictional situations involving mood swings, sensitivity, peer interactions, or strong emotions. This connects directly with the chapter's idea that understanding emotions can help adolescents make better choices.

(7) Peer-Pressure Simulation – "Choose Your Response":
Students can perform short simulations in which a fictional peer pressures another student to try tobacco, alcohol, or another harmful substance. Different groups develop assertive ways of refusing and identify trusted people from whom help can be sought. This transforms the chapter's **"Say NO the first time and every time"** message into a practical life skill.

(8) Student-Created Awareness Reels/Animations:
In supervised groups, students can prepare 30–60 second offline videos, stop-motion animations, or digital presentations on themes such as **Healthy Adolescence, Menstrual Hygiene, Balanced Diet, Cyber Safety, Physical Fitness,** or **Say No to**

Addictive Substances. The emphasis should be on scientific accuracy and positive awareness rather than students disclosing personal experiences.

(9) **Gamified "Healthy Adolescence Mission":**
Convert chapter revision into missions where teams earn points or badges for solving case studies, matching nutrients with functions, identifying healthy social-media practices, explaining adolescent changes, and responding to peer-pressure situations. A final **"Healthy Adolescence Champion"** challenge can integrate knowledge from the whole chapter.

(10) **Student-Led Community Project:**
Students can choose one theme—**healthy food, physical activity, cyber safety, menstrual hygiene, or substance-abuse awareness**—and create an awareness product for the school community. The textbook itself encourages exploratory projects, including interviewing organisations working for youth well-being, role-playing social issues, and organising a Yoga Day camp.

Particularly suitable innovative combination:
A strong approach for Grade 7 would be a **"Healthy Adolescence Learning Lab"** combining **QR learning stations + Myth Busters + Smart Meal Challenge + Emotion Traffic Light + Cyber-Safety Game + Say-NO Role Play**. It converts a potentially sensitive chapter into a **student-centred, experiential, collaborative, technology-enabled and life-skill-oriented learning experience** while preserving privacy and dignity.

6.17: Practicing Questions/Question Bank

The following question bank covers the chapter's major concepts: **adolescence, puberty, physical and emotional changes, reproductive maturity, menstruation, nutrition, personal hygiene, physical activity, balanced social life, cyberbullying, substance abuse, and hormones**.

A. Fill in the Blanks:

1. The period of development between childhood and adulthood is called __________.
Answer: Adolescence

2. Adolescence generally occurs between the ages of __________ **and** __________ **years**.
Answer: 10 and 19

3. The increase in __________ becomes more prominent during adolescence.
Answer: Height

4. The bump that may become visible in the throat of adolescent boys is called the __________.
Answer: Adam's apple

5. The skin condition in which small reddish pimples appear is called __________.
Answer: Acne

6. Features that distinguish males from females but are not directly involved in reproduction are called __________ **sexual characteristics**.
Answer: Secondary

7. The stage in which the adolescent body develops towards an adult capable of reproduction is called __________.
Answer: Puberty

8. The menstrual cycle generally recurs every __________ **days**.
   Answer: 28–30

9. The phase of the menstrual cycle during which blood discharge occurs is called __________.
   Answer: Menstruation

10. Menstruation generally stops naturally between __________ **years** of age.
    Answer: 45–55

11. __________ is important for optimal bone growth.
    Answer: Calcium

12. __________ helps in the formation of blood.
    Answer: Iron

13. Vitamin __________ cannot be made by the human body and must be obtained from food.
    Answer: B12

14. Used sanitary pads should be wrapped properly and disposed of inside a __________.
    Answer: Dustbin

15. Spreading false rumours about someone using digital platforms can be a form of __________.
    Answer: Cyberbullying

16. Regular use of addictive harmful substances is called __________.
    Answer: Substance abuse

17. The National De-addiction Helpline number mentioned in the chapter is __________.
    Answer: 14446

18. Chemicals produced in our body that regulate various aspects of growth and development are called __________.
    Answer: Hormones

19. Regular physical activity helps build __________ and boost mood.
    Answer: Stamina

20. Adolescents should say __________ to addictive substances the first time and every time.
    Answer: NO

B. One-Mark Descriptive Questions:

1. **What is adolescence?**
   Answer: Adolescence is the period of development between childhood and adulthood, generally occurring between 10 and 19 years.

2. **What is puberty?**
   Answer: Puberty is the stage when an adolescent undergoes external and internal changes to develop into an adult capable of reproduction.

3. **What are secondary sexual characteristics?**
   Answer: They are features that distinguish males from females but are not directly involved in reproduction.

4. **Why does the voice of adolescent boys become hoarse?**
   Answer: The voice becomes hoarse because of the growth of the voice box.

5. **What is the Adam's apple?**
   Answer: It is the bump in the throat region caused by growth of the voice box.

6. **What is acne?**
   Answer: Acne is a skin condition in which small reddish pimples appear, commonly during adolescence.

7. **What is menstruation?**
   Answer: Menstruation is the phase of the menstrual cycle during which blood is discharged from the body.

8. **Mention one emotional change during adolescence.**
   Answer: Mood swings are a common emotional change during adolescence.

9. **Why is calcium important for adolescents?**
   Answer: Calcium is important for optimal bone growth.

10. **Why is iron important?**
    Answer: Iron helps in the formation of blood.

11. **Why is personal hygiene important during adolescence?**
    Answer: Good personal hygiene may protect adolescents from potential infections.

12. **Give one benefit of regular exercise during adolescence.**
    Answer: Regular exercise helps keep the body and mind fit and healthy.

13. **What is cyberbullying?**
    Answer: Cyberbullying is the use of digital devices or online platforms to harass others.

14. **What is substance abuse?**
    Answer: Regular use of harmful addictive substances after developing a strong urge to consume them is called substance abuse.

15. **What are hormones?**
    Answer: Hormones are chemicals produced in the body that regulate various aspects of growth and development.

C. Two-Mark Descriptive Questions:

1. Mention two physical changes commonly seen during adolescence.

Answer:

1. Height increases prominently during adolescence.
2. Changes occur in body structure, weight, strength, voice, and hair growth.

2. Why do pimples commonly appear during adolescence?

Answer:

1. Oily secretions from the skin increase during adolescence.
2. These secretions can clog skin pores and lead to pimples and infections.

3. Give two examples of secondary sexual characteristics.

Answer:

1. Facial and chest hair and changes in voice are seen particularly in boys.
2. Development of breasts occurs in girls.

4. Mention two facts about the menstrual cycle.

Answer:

1. It generally recurs every 28–30 days, though healthy cycles may range from 21–35 days.
2. Menstruation may last for three to seven days.

5. Why should myths about menstruation be discouraged?

Answer:

1. Menstruation is a natural biological process, and such myths have no scientific basis.
2. Myths may create unnecessary fear, shame, or guilt among girls.

6. Mention two ways adolescents can manage emotional changes positively.

Answer:

1. They can participate in activities such as music, dance, or sports.
2. They can engage in creative activities and social work.

7. State two reasons why a nutritious diet is important during adolescence.

Answer:

1. Adolescence is a period of rapid growth and development.
2. Nutrients provide energy and support proper growth, strength, bone development, and blood formation.

8. Mention two good menstrual hygiene practices.

Answer:

1. Suitable sanitary pads or reusable cloth pads designed for menstruation should be used.
2. Used pads should be wrapped properly and disposed of inside a dustbin.

9. Give two benefits of regular physical activity.

Answer:

1. Physical activities keep the body and mind fit and healthy.
2. They build stamina and boost mood.

10. State two rules for responsible social-media use.

Answer:

1. Think carefully before posting and protect your privacy.
2. Do not share personal photographs with strangers or virtual friends.

11. Mention two harmful effects of addictive substances.

Answer:

1. They can cause breathing difficulties and damage to the lungs.
2. Some harmful substances can also cause memory loss.

12. How can a person struggling with addiction seek help?

Answer:

1. The person should seek support from family, friends, parents, or teachers.
2. Counselling and medical advice can also help in handling addiction.

D. Three-Mark Descriptive Questions:

1. Describe three major physical changes during adolescence.

Answer:

1. Height increases prominently, along with changes in weight and strength.
2. The voice changes, particularly in boys because of the growth of the voice box.
3. Hair grows in the armpits and pubic region, while boys may also develop facial hair.

2. Explain the emotional and behavioural changes occurring during adolescence.

Answer:

1. Adolescents may experience mood swings, strong emotions, and increased sensitivity.
2. These emotions can influence behaviour, interests, and social interactions.
3. Understanding emotions helps adolescents make better choices and respond thoughtfully.

3. Explain three important nutritional requirements during adolescence.

Answer:

1. Proteins and carbohydrates support growth, energy, and physical performance.
2. Calcium supports optimal bone growth.
3. Iron is required for the formation of blood.

4. Why is menstrual hygiene important? Mention good practices.

Answer:

1. Proper menstrual hygiene is important for health and comfort.
2. Sanitary pads or suitable reusable cloth pads can be used during menstruation.
3. Used pads should be wrapped properly and disposed of inside a dustbin.

5. Explain three ways to use social media responsibly.

Answer:

1. Be respectful and kind while communicating online.

2. Think carefully before posting and protect personal privacy.
3. Never share personal photographs or information with strangers or virtual friends.

6. Explain why adolescents should avoid harmful addictive substances.

Answer:

1. Tobacco, cigarettes, alcohol, and illegal drugs can harm physical and mental health.
2. They are addictive and may create a strong urge for repeated use.
3. They may cause serious problems such as breathing difficulties, memory loss, and lung damage.

7. Explain the role of hormones during adolescence.

Answer:

1. Hormones are chemicals produced in different parts of the body.
2. They regulate various aspects of growth and development and cause many changes associated with puberty.
3. Some hormones also influence mood and behaviour.

8. A 13-year-old boy has not developed a moustache while his friend of the same age has. Should he be worried? Explain.

Answer:

1. He should not be worried because adolescent changes do not occur at exactly the same time in everyone.
2. The timing, nature, and extent of changes such as facial hair vary among individuals.
3. Each person experiences adolescence at their own pace, and these variations are normal.

E. Five-Mark Descriptive Questions:

1. Explain the major physical changes that take place during adolescence.

Answer:

1. Increase in height becomes more prominent during adolescence.
2. Changes occur in body structure, weight, and strength.
3. Growth of the voice box causes changes in voice, particularly in boys.
4. Acne and pimples may appear because increased oily secretions can clog skin pores.
5. Hair grows in the armpits and pubic region, while boys may additionally develop facial, chest, or back hair.

2. Explain five practices that can make adolescence a healthy and joyful experience.

Answer:

1. Eat a balanced and nutritious diet to meet the body's increased nutritional needs.

2. Maintain good personal and menstrual hygiene.
3. Participate regularly in exercise, games, sports, or other physical activities.
4. Maintain respectful social relationships and use social media responsibly.
5. Avoid tobacco, alcohol, drugs, and other addictive substances completely.

3. Explain menstruation and discuss healthy attitudes and practices related to it.

Answer:

1. The menstrual cycle generally recurs every 28–30 days, though healthy cycles may range from 21–35 days.
2. Menstruation is the phase when blood discharge occurs and may last for three to seven days.
3. Menstruation is a natural process, and myths and taboos surrounding it have no scientific basis.
4. Proper menstrual hygiene using suitable menstrual products is important for health and comfort.
5. Used sanitary pads should be wrapped properly and disposed of inside a dustbin to protect community health and environmental cleanliness.

4. Explain the dangers of substance abuse and ways to prevent or overcome addiction.

Answer:

1. Harmful substances include tobacco, gutka, cigarettes, beedi, alcohol, and illegal drugs.
2. These substances can be addictive and create a strong urge for repeated consumption.
3. Their use can cause breathing difficulties, memory loss, lung damage, and other health problems.
4. Adolescents should remain firm and confidently say "NO" to harmful substances the first time and every time.
5. A person struggling with addiction should seek support from trusted people and obtain counselling or medical advice when required.

5. Prepare a five-point healthy lifestyle guide for adolescents.

Answer:

1. Consume a nutritious and balanced diet rich in essential nutrients.
2. Maintain good body and menstrual hygiene.
3. Exercise regularly to maintain physical and mental fitness.
4. Be respectful in social interactions, protect online privacy, and use digital platforms responsibly.
5. Stay away from addictive substances and seek guidance and support whenever necessary.

6. Your school wants to conduct an "Adolescent Health Awareness Programme." Suggest five important topics that should be included.

Answer:

1. **Understanding puberty:** Explain normal physical and biological changes and individual variation.
2. **Nutrition:** Create awareness about proteins, carbohydrates, calcium, iron, vitamins, and balanced diets.
3. **Personal and menstrual hygiene:** Teach hygienic practices and scientifically address menstruation-related myths.
4. **Emotional and digital well-being:** Discuss mood changes, respectful relationships, cyberbullying, and responsible social-media use.
5. **Substance-abuse prevention:** Teach students to resist peer pressure, say “NO” to addictive substances, and seek help when necessary.

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7th Standard Science Book Chapter 7

Chapter 7: Heat Transfer in Nature

7.1 Summary of the Chapter:

Chapter 7: Heat Transfer in Nature — Summary

(1) **Heat Transfer:** Heat always flows from a hotter region to a colder region. The three main modes of heat transfer are **conduction, convection, and radiation**.

(2) **Conduction:** Conduction is the transfer of heat from the hotter part of an object to its colder part without the particles changing their positions. It is the main method of heat transfer in **solids**.

(3) **Conductors and Insulators:** Materials such as metals allow heat to pass through easily and are called **good conductors of heat**. Materials such as wood, glass, clay, and porcelain are **poor conductors or insulators**. Air is also a poor conductor, which is why woollen clothes and layers of blankets keep us warm.

(4) **Convection:** In liquids and gases, heat is mainly transferred through **convection**, in which heated particles actually move. Hot air or water expands, becomes lighter and rises, while cooler and heavier particles move downward, producing convection currents.

(5) **Land and Sea Breezes:** Land heats and cools faster than water. During the day, cooler air moves from the sea towards the warmer land, producing a **sea breeze**. At night, cooler air moves from the land towards the relatively warmer sea, producing a **land breeze**.

(6) **Radiation:** Heat can also travel through **radiation**, which does not require any material medium. Heat from the Sun reaches the Earth by radiation. Light-coloured surfaces reflect more heat, whereas dark surfaces absorb more heat.

(7) **Modes of Heat Transfer in Daily Life:** Conduction, convection, and radiation can occur together. For example, while heating water in a pan, the utensil receives heat through conduction, water gets heated through convection, and warmth around the flame and hot utensil is felt through radiation.

(8) **Water Cycle:** The Sun's heat causes water from oceans, rivers, and lakes to **evaporate**, while plants release water through **transpiration**. Water vapour cools and condenses to form clouds, followed by **precipitation** as rain, snow, or hail. This continuous circulation constitutes the **water cycle**.

(9) **Infiltration and Groundwater:** Surface water that seeps through soil and rocks is called **infiltration**. Water seeps fastest through gravel, slower through sand, and slowest through clay. The water stored in pore spaces below the Earth's surface forms **groundwater**, while underground layers that store groundwater are called **aquifers**.

(10) **Groundwater Conservation:** Excessive extraction, reduced vegetation, and increased concrete surfaces can deplete groundwater. **Rainwater harvesting and recharge pits** help replenish groundwater. The chapter also describes **ice stupas in Ladakh** as an innovative method of storing winter water for use during spring and summer.

7.2 Important Formulas:

Important Formulas/Calculations – Chapter 7: *Heat Transfer in Nature:*

This chapter is **mainly conceptual and activity-based** and does not introduce standard heat equations such as $Q = mc\Delta T$. The quantitative work specifically supported by the chapter mainly involves **temperature change, comparison of heating/cooling, time intervals, volume, and seepage of water**. For example, the chapter asks students to measure soil and water temperatures every 5 minutes and compare their temperature rise over 20 minutes.

No.	Formula / Calculation	Use
1	**Temperature Rise = Final Temperature − Initial Temperature** $\Delta T = T_f - T_i$	To calculate the increase in temperature when a substance is heated.
2	**Temperature Fall = Initial Temperature − Final Temperature** $\Delta T = T_i - T_f$	To calculate how much a substance cools.
3	**Difference in Temperature = Higher Temperature − Lower Temperature**	To compare temperatures of soil and water or two different objects.
4	**Rate of Temperature Rise = Temperature Rise ÷ Time Taken** $= \frac{\Delta T}{t}$	To compare how quickly soil and water get heated.
5	**Rate of Cooling = Temperature Fall ÷ Time Taken** $= \frac{\Delta T}{t}$	To compare how quickly different materials cool.
6	**Time Interval = Final Time − Initial Time** $t = t_f - t_i$	Useful when temperature observations are made at fixed intervals.
7	**Amount of Water Seeped = Initial Water Added − Water Remaining/Retained**	Useful for comparing water seepage through clay, sand and gravel. The chapter's activity uses **200 mL** of water and observes seepage for **10 minutes**.
8	**Rate of Seepage = Amount of Water Seeped ÷ Time Taken**	Can be used to quantitatively compare infiltration through different materials. The chapter establishes that water seeps fastest through gravel, slower through sand and slowest through clay.
9	**Percentage of Water Seeped =** $\frac{\text{Water Seeped}}{\text{Water Added}} \times 100$	An extension useful for application-based numerical questions on infiltration.
10	**Average Temperature =** $\frac{\text{Sum of Temperature Readings}}{\text{Number of Readings}}$	Useful for analysing a series of experimental temperature observations.

Important Units to Remember
Temperature: degree Celsius (°C)
Time: seconds (s) or minutes (min)
Volume of water: millilitre (mL) or litre (L)
Length: centimetre (cm) or metre (m)
Most Important for Grade 7
For examination-oriented quantitative problems from this chapter, students should particularly practise:
Temperature rise/fall → $\Delta T = T_f - T_i$
Temperature difference → Higher temperature − Lower temperature
Rate of heating/cooling → $\Delta T \div t$
Rate of seepage → Water seeped ÷ Time
The chapter itself emphasizes observation and comparison rather than advanced mathematical treatment: **soil heats and cools faster than water**, while heat transfer is explained through **conduction, convection and radiation**.

7.3 Fill-Up the Blank LOTS type questions with Answers: (35 Questions)

1. The process of heat transfer from the hotter part of an object to the colder part is called __________.
   Answer: Conduction
2. Materials that allow heat to pass through them easily are called good __________ of heat.
   Answer: Conductors
3. In solids, heat is mainly transferred through __________.
   Answer: Conduction
4. Glass and wood are __________ conductors of heat.
   Answer: Poor
5. Woollen fabric traps __________ in its pores and helps us stay warm.
   Answer: Air
6. Air is a __________ conductor of heat.
   Answer: Poor
7. Heat transfer by the actual movement of particles is called __________.
   Answer: Convection
8. In liquids and gases, heat is mainly transferred by __________.
   Answer: Convection
9. When air is heated, it expands, becomes lighter and moves __________.
   Answer: Upwards
10. During the day, land gets heated __________ than water.
    Answer: Faster
11. The movement of cooler air from the sea towards the land is called __________.
    Answer: Sea breeze
12. At night, land cools down __________ than the water in the sea.
    Answer: Faster
13. The movement of cooler air from land towards the sea is called __________.
    Answer: Land breeze
14. Heat transfer that does not require a material medium is called __________.
    Answer: Radiation
15. Heat from the Sun reaches the Earth through __________.
    Answer: Radiation
16. Light-coloured clothes __________ most of the heat falling on them.
    Answer: Reflect
17. Dark-coloured surfaces __________ more heat.
    Answer: Absorb
18. The three processes of heat transfer are conduction, convection and __________.
    Answer: Radiation
19. Water exists in __________ states in nature.
    Answer: Three
20. The conversion of water into water vapour is called __________.
    Answer: Evaporation
21. Water also evaporates from trees and plants through the process of __________.
    Answer: Transpiration
22. Water vapour cools and condenses to form __________.
    Answer: Clouds
23. Rain, snow and hail falling from clouds are forms of __________.
    Answer: Precipitation

24. The continuous movement of water between the Earth's surface and atmosphere is called the __________.
    Answer: Water cycle
25. The process of surface water seeping through soil and rocks is called __________.
    Answer: Infiltration
26. Water seeps fastest through __________.
    Answer: Gravel
27. Water seeps slowest through __________.
    Answer: Clay
28. Water stored in pore spaces and openings in rocks beneath the Earth's surface is called __________.
    Answer: Groundwater
29. Underground layers of sediments and rocks that store water in their pore spaces are called __________.
    Answer: Aquifers
30. __________ **harvesting** and recharge pits are used to replenish groundwater.
    Answer: Rainwater
31. In Ladakh, cone-shaped structures made of ice for conserving water are called __________.
    Answer: Ice stupas
32. Ice stupas melt slowly during __________, providing water for farming and other needs.
    Answer: Spring
33. The Sun is the main source of heat and __________ for the Earth.
    Answer: Light
34. Clay and __________ are poor conductors of heat and are therefore suitable for cups used for hot beverages.
    Answer: Porcelain
35. A traditional room heater used in the upper Himalayan region is known as a __________.
    Answer: Bukhari

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

1. If one end of an iron rod is heated, the other end gradually becomes hot due to __________.
   Answer: Conduction
2. If the metal strip in the pin experiment is replaced with wood, the pins are unlikely to fall because wood is a __________ conductor of heat.
   Answer: Poor
3. A metal cooking vessel heats food efficiently because metal allows heat to pass through it __________.
   Answer: Easily
4. A saucepan should have a metal body but a handle made of a __________ **conductor** of heat to prevent burns.
   Answer: Poor
5. Two thin blankets can keep a person warmer than one thick blanket because the __________ trapped between them acts as an insulator.
   Answer: Air

6. If a house in a very hot region is built using hollow bricks, the trapped air will reduce the transfer of __________ into the house.
   Answer: Heat
7. When a partially inflated balloon is kept in sunlight, it becomes larger because the heated air inside __________.
   Answer: Expands
8. A smoke detector should preferably be installed near the ceiling because heated air and smoke tend to move __________.
   Answer: Upwards
9. When water is heated from below, the hotter water rises while the cooler water moves downward, producing __________ **currents**.
   Answer: Convection
10. If convection in a liquid did not involve movement of particles, the entire liquid would not get heated through __________.
    Answer: Convection
11. On a sunny afternoon near a beach, cooler air moves from the sea towards the land because the __________ heats faster than water.
    Answer: Land
12. If land and seawater heated at exactly the same rate during the day, a strong __________ **breeze** would be unlikely to develop.
    Answer: Sea
13. At night, air above the sea rises because the sea remains __________ than the land.
    Answer: Warmer
14. If you stand near a fire without touching it, the warmth reaching you mainly demonstrates __________.
    Answer: Radiation
15. Astronauts can receive heat from the Sun even through space because __________ does not require a material medium.
    Answer: Radiation
16. A person wearing a white shirt on a hot sunny day may feel more comfortable because white surfaces __________ most of the heat falling on them.
    Answer: Reflect
17. Dark-coloured clothes are more suitable during cold weather because dark surfaces __________ more heat.
    Answer: Absorb
18. While heating water in a metal pan, heat passes through the pan mainly by conduction, while the water gets heated mainly by __________.
    Answer: Convection
19. The warmth felt by a person standing near a hot cooking pan without touching it is mainly due to __________.
    Answer: Radiation
20. Wet clothes are likely to dry faster on a sunny day because heat from the Sun increases the rate of __________.
    Answer: Evaporation
21. If water vapour rising in the atmosphere cools sufficiently, it will __________ to form clouds.
    Answer: Condense
22. If transpiration from plants decreases considerably, the amount of water vapour entering the atmosphere from plants will __________.
    Answer: Decrease

23. Rainwater falling on a gravel-covered surface will generally infiltrate __________ than on a clay-covered surface.
    Answer: Faster
24. Gravel allows greater infiltration because the spaces between its particles are relatively __________.
    Answer: Wider
25. If the spaces between soil particles are wide, open, and interconnected, water infiltration will occur more __________.
    Answer: Readily
26. Increasing concrete surfaces in cities can cause groundwater levels to decline because concrete reduces __________ of rainwater.
    Answer: Infiltration
27. Excessive extraction of groundwater without sufficient recharge can lead to groundwater __________.
    Answer: Depletion
28. Constructing recharge pits can increase the amount of rainwater reaching underground __________.
    Answer: Aquifers
29. If vegetation and open soil are replaced extensively by concrete, groundwater recharge is likely to __________.
    Answer: Decrease
30. Ice stupas are useful in Ladakh because they melt __________ during spring and provide water when it is needed.
    Answer: Slowly
31. If an ice stupa melted completely at the beginning of spring, its usefulness for providing water throughout summer would __________.
    Answer: Decrease
32. Coastal regions generally experience less extreme temperatures because large water bodies heat and cool more __________ than land.
    Answer: Slowly
33. When a hot utensil is removed from the flame, it gradually cools because it __________ heat to its surroundings.
    Answer: Radiates
34. In a bukhari, the metal stove transfers heat to a cooking utensil through __________, while the warmth felt around it also involves radiation.
    Answer: Conduction
35. If groundwater extraction continues to increase while infiltration decreases, a sustainable groundwater supply will become more __________ to maintain.
    Answer: Difficult

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

1. **What is conduction?**
   Answer: Conduction is the transfer of heat from the hotter part of an object to its colder part without movement of the particles from their positions.
2. **What are good conductors of heat?**
   Answer: Materials that allow heat to pass through them easily are called good conductors of heat.
3. **Give one example of a good conductor of heat.**
   Answer: Steel is an example of a good conductor of heat.

4. **What are poor conductors of heat?**
   Answer: Materials that do not allow heat to pass through them easily are called poor conductors or insulators.
5. **Name two poor conductors of heat.**
   Answer: Wood and glass are poor conductors of heat.
6. **Why are metals generally used for making cooking utensils?**
   Answer: Metals are used for cooking utensils because they are good conductors of heat.
7. **Why do woollen clothes keep us warm in winter?**
   Answer: Woollen clothes trap air, which is a poor conductor of heat and reduces heat loss from our body.
8. **Why are hollow bricks useful in constructing houses?**
   Answer: Hollow bricks trap air, which acts as a poor conductor of heat and reduces heat transfer.
9. **What is convection?**
   Answer: Convection is the transfer of heat through the actual movement of particles of liquids or gases.
10. **What happens to air when it is heated?**
    Answer: Heated air expands, becomes lighter, and rises upwards.
11. **Why does smoke from a burning incense stick rise upwards?**
    Answer: Smoke rises because it is warmer than the surrounding air.
12. **How is heat mainly transferred through liquids?**
    Answer: Heat is mainly transferred through liquids by convection.
13. **Which gets heated faster—soil or water?**
    Answer: Soil gets heated faster than water.
14. **Which cools faster—land or water?**
    Answer: Land cools faster than water.
15. **What is sea breeze?**
    Answer: Sea breeze is the movement of cooler air from the sea towards the land during the day.
16. **What is land breeze?**
    Answer: Land breeze is the movement of cooler air from the land towards the sea at night.
17. **What is radiation?**
    Answer: Radiation is the transfer of heat from one place to another without requiring a material medium.
18. **How does heat from the Sun reach the Earth?**
    Answer: Heat from the Sun reaches the Earth through radiation.
19. **Why are light-coloured clothes preferred in summer?**
    Answer: Light-coloured clothes are preferred in summer because they reflect most of the heat falling on them.
20. **Why are dark-coloured clothes comfortable in winter?**
    Answer: Dark-coloured clothes are comfortable in winter because they absorb more heat.
21. **Name the three modes of heat transfer.**
    Answer: The three modes of heat transfer are conduction, convection, and radiation.
22. **Which modes of heat transfer require a material medium?**
    Answer: Conduction and convection require a material medium for heat transfer.
23. **What is evaporation?**
    Answer: Evaporation is the process by which liquid water changes into water vapour.

24. **What is transpiration?**
Answer: Transpiration is the process through which water evaporates from trees and plants.
25. **What is precipitation?**
Answer: Precipitation is the process by which water falls from clouds as rain, snow, or hail.
26. **What is the water cycle?**
Answer: The water cycle is the continuous movement of water between the Earth's surface and the atmosphere.
27. **What is infiltration?**
Answer: Infiltration is the process by which surface water seeps through soil and rocks.
28. **What is groundwater?**
Answer: Groundwater is water stored in pore spaces of sediments and openings in rocks beneath the Earth's surface.
29. **What is an aquifer?**
Answer: An aquifer is an underground layer of sediments and rocks that stores water in its pore spaces.
30. **Through which material does water seep fastest—clay, sand, or gravel?**
Answer: Water seeps fastest through gravel because it has wider spaces between its particles.
31. **Name one method used to replenish groundwater.**
Answer: Rainwater harvesting is one method used to replenish groundwater.
32. **Why is groundwater getting depleted in many areas?**
Answer: Groundwater is getting depleted due to excessive extraction and reduced infiltration.
33. **What is an ice stupa?**
Answer: An ice stupa is a cone-shaped ice structure made in Ladakh to conserve water for later use.
34. **How does an ice stupa help people in Ladakh?**
Answer: An ice stupa melts slowly during spring and supplies water for farming and other needs.
35. **Who was Varahamihira?**
Answer: Varahamihira was a sixth-century astronomer and mathematician who described methods for predicting seasonal rainfall.

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

1. **Why does a metal spoon kept in hot tea become hot after some time?**
Answer: Heat travels through the metal spoon from its hotter end to its colder end by conduction.
2. **Why would a wooden spoon remain comparatively cooler than a metal spoon when placed in hot soup?**
Answer: Wood is a poor conductor of heat and therefore transfers heat much more slowly than metal.
3. **If the pins attached with wax to a heated metal strip are at different distances from the flame, which pin will fall first?**
Answer: The pin nearest the flame will fall first because heat reaches it first and melts its wax.

4. **Why would two thin blankets keep you warmer than one thick blanket?**
   Answer: Two blankets trap a layer of air between them, and this air acts as a poor conductor of heat.
5. **Why are hollow bricks useful for constructing houses in regions with extreme temperatures?**
   Answer: Hollow bricks trap air that reduces heat transfer because air is a poor conductor of heat.
6. **A person wears several layers of clothes on a cold day; how does this help?**
   Answer: Air trapped between the layers reduces the loss of body heat to the surroundings.
7. **Why does a partially inflated balloon become larger when left in the Sun?**
   Answer: The air inside the balloon gets heated, expands, and occupies more space.
8. **Why does smoke from a fire move upwards instead of downwards?**
   Answer: The hot gases in the smoke are warmer and lighter than the surrounding air and therefore rise.
9. **Where should a smoke detector preferably be installed in a room and why?**
   Answer: A smoke detector should preferably be installed on the ceiling because warm smoke rises upwards.
10. **Why does heated water at the bottom of a vessel rise upwards?**
    Answer: Heated water expands, becomes lighter, and rises while cooler and heavier water moves down.
11. **What would happen to convection if the movement of particles in a liquid were prevented?**
    Answer: Convection would not occur because it depends on the actual movement of particles.
12. **Why does the coloured streak in heated water rise in the middle and move down along the sides?**
    Answer: Hot water rises from the heated region while cooler, heavier water descends along the sides.
13. **Why is the land near a beach usually hotter than seawater during the daytime?**
    Answer: Land heats up faster than water when both receive heat from the Sun.
14. **Why does sea breeze generally occur during the daytime?**
    Answer: During the day, warm air over the faster-heating land rises and cooler air from the sea moves towards the land.
15. **Why does the direction of breeze near a seashore reverse at night?**
    Answer: Land cools faster than seawater at night, causing cooler air from the land to move towards the sea.
16. **Why are windows of houses in coastal areas often made facing the sea?**
    Answer: Sea-facing windows allow the cooler sea breeze to enter the house during the day.
17. **If there were no material medium between the Sun and Earth, could the Sun still heat the Earth?**
    Answer: Yes, because radiation can transfer heat without requiring a material medium.
18. **Why can you feel the warmth of a fire without touching it?**
    Answer: Heat from the fire reaches the body directly through radiation.
19. **Why does a hot utensil cool even after it is removed from the flame?**
    Answer: The hot utensil radiates heat to its cooler surroundings and gradually cools.

20. **Why would a white shirt be more comfortable than a black shirt on a hot sunny day?**
    Answer: A white shirt reflects more heat, whereas a black shirt absorbs more heat.
21. **When water is heated in a metal pan, why are both conduction and convection involved?**
    Answer: Heat passes through the metal pan by conduction and spreads through the water by convection.
22. **Why do wet clothes dry faster on a sunny day?**
    Answer: Heat from the Sun increases the evaporation of water from the wet clothes.
23. **What would happen to cloud formation if water vapour did not cool as it rose?**
    Answer: Cloud formation would be greatly reduced because condensation requires water vapour to cool.
24. **How does the Sun help maintain the water cycle?**
    Answer: The Sun supplies heat that causes evaporation of water from oceans, rivers, lakes, and other surfaces.
25. **Why does water seep through gravel faster than through clay?**
    Answer: Gravel has wider and better-connected spaces between its particles, allowing water to pass through more easily.
26. **Which area would allow better groundwater recharge—an open grassy field or a concrete-covered ground?**
    Answer: An open grassy field would allow better groundwater recharge because more rainwater can infiltrate into the soil.
27. **Why can excessive construction of concrete surfaces reduce groundwater levels?**
    Answer: Concrete surfaces reduce the infiltration of rainwater into the ground and therefore limit groundwater recharge.
28. **Why are recharge pits useful in cities?**
    Answer: Recharge pits allow rainwater to infiltrate into the ground and replenish groundwater.
29. **If an underground layer has many wide, connected pore spaces, how will it affect groundwater storage?**
    Answer: It can store and allow movement of more groundwater because water readily enters interconnected pore spaces.
30. **Why may a well stop supplying water when groundwater is excessively extracted?**
    Answer: Excessive extraction can lower groundwater levels below the depth from which the well draws water.
31. **How does the water cycle help prevent permanent loss of water from rivers and lakes?**
    Answer: The water cycle continuously redistributes and replenishes water through evaporation, condensation, precipitation, and return flow.
32. **Why are ice stupas useful in Ladakh even though they eventually melt?**
    Answer: Ice stupas store winter water as ice and release it slowly during spring and summer when water is needed.
33. **What would happen if an ice stupa melted very quickly in early spring?**
    Answer: Much of the stored water would become available too early and less water would remain for later summer needs.
34. **Why are coastal areas generally less affected by extreme temperature changes than inland areas?**
    Answer: Large water bodies heat and cool more slowly than land and therefore moderate the temperature of nearby areas.

35. **Why can the principles of heat transfer be useful while designing both houses and clothes?**
Answer: Understanding heat transfer helps us select materials and designs that either reduce unwanted heat flow or promote useful heat transfer.

7.7 Two-mark questions with Answers of LOTS Type: (28 Questions)

1. What is conduction? How does heat move during conduction?
Answer:
- Conduction is the transfer of heat from the hotter part of an object to its colder part.
- During conduction, particles pass heat to neighbouring particles without moving from their positions.

2. What are good conductors and poor conductors of heat?
Answer:
- Materials that allow heat to pass through them easily are called good conductors of heat.
- Materials that do not allow heat to pass through them easily are called poor conductors or insulators.

3. Why are metals generally used for making cooking utensils?
Answer:
- Metals are good conductors of heat and allow heat to pass through them easily.
- Therefore, metal utensils transfer heat efficiently to the food during cooking.

4. Why do woollen clothes keep us warm during winter?
Answer:
- Woollen fabric traps air in its pores, and air is a poor conductor of heat.
- The trapped air reduces the flow of heat from our body to the surroundings.

5. What is convection? In which states of matter does it mainly occur?
Answer:
- Convection is the transfer of heat through the actual movement of particles.
- It mainly occurs in liquids and gases.

6. Explain what happens to air when it is heated.
Answer:
- When air is heated, it expands, occupies more space, and becomes lighter.
- The lighter, warmer air rises above the cooler surrounding air.

7. How does convection take place in water?
Answer:
- Water at the bottom gets heated, expands, becomes lighter, and rises upwards.
- Cooler and heavier water moves down to replace it, producing a continuous convection cycle.

8. What is a sea breeze? When does it occur?
Answer:
- Sea breeze is the movement of cooler air from the sea towards the land.
- It occurs during the day because land heats up faster than seawater.

9. What is a land breeze? When does it occur?
Answer:
- Land breeze is the movement of cooler air from the land towards the sea.
- It occurs at night because land cools faster than seawater.

10. What is radiation? Does it require a medium?
Answer:

- Radiation is the process by which heat travels directly from one place or object to another.
- Radiation does not require any material medium for the transfer of heat.

11. Why are light-coloured clothes preferred in summer and dark-coloured clothes in winter?

Answer:

- Light-coloured clothes reflect most of the heat falling on them and therefore keep us comfortable in summer.
- Dark-coloured clothes absorb more heat and therefore are more suitable during winter.

12. Name the three modes of heat transfer and state one feature of each.

Answer:

- The three modes are conduction, convection, and radiation.
- Conduction transfers heat through neighbouring particles, convection through particle movement, and radiation without requiring a material medium.

13. What are the three states in which water occurs in nature? Give examples.

Answer:

- Water occurs as liquid in oceans, rivers, and lakes and as solid in snow, ice sheets, and glaciers.
- It also occurs as a gas in the form of water vapour in the atmosphere.

14. What are evaporation and condensation in the water cycle?

Answer:

- Evaporation is the conversion of water into water vapour due to heating.
- Condensation occurs when rising water vapour cools and changes into tiny water droplets that form clouds.

15. What is precipitation? Name its common forms.

Answer:

- Precipitation is the process by which water returns from clouds to the Earth's surface.
- Rain, snow, and hail are forms of precipitation.

16. Define the water cycle and mention its importance.

Answer:

- The water cycle is the continuous movement of water upward as water vapour and downward through precipitation before returning to water bodies.
- It helps redistribute and replenish water in rivers, lakes, oceans, and other sources.

17. What is transpiration? How does it contribute to the water cycle?

Answer:

- Transpiration is the process through which water evaporates from trees and plants.
- The released water vapour enters the atmosphere and becomes part of the water cycle.

18. What is infiltration? What factors help water infiltrate more readily?

Answer:

- Infiltration is the process by which surface water seeps through soil and rocks.
- Water infiltrates more readily when spaces between soil and rock particles are wider, open, and interconnected.

19. What is groundwater? What is an aquifer?

Answer:

- Groundwater is water stored in the pore spaces of sediments and openings in rocks beneath the Earth's surface.
- An aquifer is an underground layer of sediments and rocks that stores water in its pore spaces.

20. Compare the seepage of water through gravel, sand, and clay.

Answer:

- Water seeps fastest through gravel, slower through sand, and slowest through clay.
- Gravel allows faster seepage because the spaces between its particles are wider.

21. State two reasons for the depletion of groundwater.
Answer:
- Excessive extraction of groundwater due to increasing water requirements causes groundwater depletion.
- Decreased vegetation and increased concrete surfaces reduce infiltration and groundwater recharge.

22. How can groundwater be replenished?
Answer:
- Rainwater harvesting helps collect rainwater and allows it to enter the ground.
- Recharge pits increase infiltration and help replenish groundwater sources.

23. What is an ice stupa and where is it used?
Answer:
- An ice stupa is a tall, cone-shaped structure of ice created by freezing water during winter in Ladakh.
- It melts slowly during spring and provides water for farming and other needs during the warmer months.

24. How are conduction, convection, and radiation involved when water is heated in a pan?
Answer:
- Heat is transferred to the utensil by conduction, while the water inside gets heated by convection.
- The warmth felt around the flame and hot utensil is due to radiation.

25. Differentiate between conduction and convection.
Answer:
- In conduction, heat is transferred from particle to particle without the particles moving from their positions.
- In convection, heat is transferred through the actual movement of particles from one place to another.

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

1. A metal spoon and a wooden spoon are kept in a cup of hot tea. After a few minutes, which spoon will feel hotter at its upper end? Why?
Answer:
- The metal spoon will feel hotter because metal is a good conductor and transfers heat quickly from the hot tea to its upper end.
- The wooden spoon will remain comparatively cooler because wood is a poor conductor of heat.

2. Two thin blankets can sometimes keep a person warmer than one thick blanket. Explain why.
Answer:
- Air gets trapped between the two thin blankets, and air is a poor conductor of heat.
- This trapped air reduces the loss of body heat to the surroundings and keeps the person warmer.

3. If the metal strip in the pin-and-wax experiment is replaced by a wooden strip, predict what will happen to the pins. Give a reason.
Answer:

- The pins will not fall in sequence as they do on the metal strip because heat does not travel easily through wood.
- Wood is a poor conductor of heat, whereas metal allows heat to pass through it easily.

4. Why are cooking vessels made of metal but their handles often made of wood or another insulating material?
Answer:

- The metal body conducts heat efficiently to the food and helps it cook.
- The insulating handle transfers heat poorly and therefore makes the vessel safer to hold.

5. A partially inflated balloon is kept in sunlight for some time. Predict what will happen and explain why.
Answer:

- The balloon will become larger because the air inside gets heated by the Sun.
- Heated air expands and occupies more space, causing the balloon to increase in size.

6. Why should a smoke detector preferably be installed near the ceiling rather than near the floor?
Answer:

- Smoke contains hot gases that are warmer and lighter than the surrounding air, so they rise upwards.
- Therefore, a detector near the ceiling is more likely to detect smoke quickly.

7. Water is heated at the bottom of a vessel. Explain why the entire water eventually becomes hot.
Answer:

- Water at the bottom gets heated, expands, becomes lighter, and rises while the cooler, heavier water moves downward.
- This continuous movement produces convection currents that gradually heat the entire volume of water.

8. Why do people living near the coast often experience cooler air from the sea during the daytime?
Answer:

- During the day, land heats faster than seawater, causing the warmer air above the land to rise.
- Cooler air from the sea moves towards the land to replace it, producing a sea breeze.

9. If you stand on a beach at night, in which direction would you expect the breeze to blow? Explain.
Answer:

- The breeze will generally move from the land towards the sea because land cools faster than seawater at night.
- The warmer air above the sea rises and cooler air from the land moves towards the sea, forming a land breeze.

10. An astronaut can receive heat from the Sun even though space has almost no material medium. Which mode of heat transfer explains this? Why?
Answer:

- The heat is received through radiation, the same process by which solar heat reaches the Earth.
- Radiation does not require a material medium for transferring heat.

11. A student wears a black shirt on a sunny summer afternoon while another wears a white shirt. Who is likely to feel more comfortable? Why?
Answer:

- The student wearing the white shirt is likely to feel more comfortable because light colours reflect most of the heat falling on them.
- The black shirt absorbs more heat and can therefore make the wearer feel warmer.

12. When water is heated in a metal pan, all three modes of heat transfer may occur. Identify them.
Answer:
- Heat is transferred through the metal utensil by conduction, while water gets heated through convection.
- The warmth felt around the flame and hot utensil is transferred through radiation.

13. Why do wet clothes dry faster on a sunny day than on a cooler day?
Answer:
- Heat from the Sun increases the evaporation of water present in the wet clothes.
- Therefore, water changes into water vapour more rapidly and the clothes dry faster.

14. Suppose water vapour rises into the atmosphere but does not cool sufficiently. How would this affect cloud formation?
Answer:
- Cloud formation would decrease because cooling is necessary for water vapour to condense.
- With less condensation, the formation of clouds and subsequent precipitation would also be affected.

15. Equal amounts of water are poured over gravel, sand, and clay. Through which material will water seep fastest and why?
Answer:
- Water will seep fastest through gravel because the spaces between gravel particles are wider.
- Wider, open, and interconnected spaces allow water to infiltrate more easily.

16. A city replaces large areas of open soil with concrete roads and buildings. How could this affect groundwater?
Answer:
- Concrete surfaces reduce the amount of rainwater that can infiltrate into the ground.
- Consequently, groundwater recharge decreases and groundwater sources may gradually become depleted.

17. Why would constructing recharge pits be useful in a city where groundwater levels are falling?
Answer:
- Recharge pits allow more rainwater to infiltrate through the soil and reach underground water-storage layers.
- They therefore help replenish groundwater and support a more sustainable groundwater supply.

18. A farmer has fields containing mainly clay soil and another has gravel-rich soil. Which field would allow faster seepage of rainwater? Explain.
Answer:
- The gravel-rich field would allow rainwater to seep into the ground faster because gravel has larger spaces between its particles.
- Clay has smaller spaces between particles and therefore allows much slower seepage.

19. Why are hollow bricks useful for constructing the outer walls of houses in regions with extreme temperatures?
Answer:
- Hollow bricks trap air inside them, and air is a poor conductor of heat.

- The trapped air reduces heat transfer, helping houses remain cooler in summer and warmer in winter.

20. How does the presence of a large water body help reduce extreme temperature changes in nearby coastal regions?
Answer:
- Land heats and cools faster than water, while large water bodies change temperature more slowly.
- This difference produces sea and land breezes and helps moderate temperature conditions near the coast.

21. Why can excessive use of bore wells create water problems even in an area receiving rainfall?
Answer:
- Excessive groundwater extraction can remove water from aquifers faster than infiltration can replenish it.
- If recharge is also reduced by concrete surfaces or loss of vegetation, groundwater levels can continue to fall.

22. If vegetation in an area is greatly reduced, how could it affect both the water cycle and groundwater recharge?
Answer:
- Reduced vegetation can decrease the contribution of plants to atmospheric water through transpiration.
- It can also contribute to reduced infiltration, thereby limiting the replenishment of groundwater.

23. Why are ice stupas considered an innovative solution to water scarcity in Ladakh?
Answer:
- Water is stored as ice during the extremely cold winter and forms a tall cone-shaped structure.
- The ice melts slowly during spring and provides water for farming and other needs when natural streams may have little water.

24. A hot metal utensil is removed from the stove and kept on a table. Why does it eventually cool even if nobody touches it?
Answer:
- The hot utensil continuously radiates heat to its cooler surroundings.
- As it loses heat through radiation, its temperature gradually decreases.

25. A paper spiral is suspended above a burning candle, as suggested in the chapter's exploratory activity. Predict what will happen and explain the reason.
Answer:
- The paper spiral is expected to move or rotate because the air above the candle becomes hot and rises.
- The rising air produces convection currents that act on the suspended spiral and cause its movement.

7.9. Three-mark questions with Answers of LOTS Type: (10 Questions)

1. What is conduction? Explain how heat is transferred through conduction.
Answer:
1. Conduction is the process of heat transfer from the hotter part of an object to its colder part.
2. A heated particle passes heat to its neighbouring particle, and the process continues from particle to particle.

3. During conduction, the particles themselves do not move from their positions.

2. Differentiate between good conductors and poor conductors of heat with examples.

Answer:

1. Materials that allow heat to pass through them easily are called **good conductors of heat**; metals are common examples.
2. Materials that do not allow heat to pass through them easily are called **poor conductors or insulators**.
3. Wood, glass, clay, and porcelain are examples of poor conductors of heat.

3. Explain how woollen clothes keep us warm during winter.

Answer:

1. Woollen fabric traps air in the small spaces or pores present in it.
2. Air is a poor conductor of heat and therefore reduces the flow of heat from our body to the surroundings.
3. As a result, our body loses less heat and we feel warm in woollen clothes.

4. What is convection? Explain how it takes place in water.

Answer:

1. Convection is the transfer of heat through the actual movement of particles in liquids and gases.
2. When water is heated, the warmer water expands, becomes lighter, and rises upwards.
3. Cooler and heavier water moves downward to replace it, producing continuous convection currents.

5. Explain why smoke from a burning incense stick rises upwards.

Answer:

1. Smoke consists of hot gases and tiny solid particles released during burning.
2. The gases in the smoke are warmer than the surrounding air and therefore rise upwards.
3. This upward movement of warm air is associated with convection in gases.

6. What is a sea breeze? Explain how it is formed.

Answer:

1. During the daytime, land gets heated faster than seawater, making the air above the land warm and causing it to rise.
2. Cooler air from the sea moves towards the land to take the place of the rising warm air.
3. This movement of cooler air from the sea towards the land is called a **sea breeze**.

7. What is a land breeze? Explain how it is formed.

Answer:

1. At night, land cools faster than seawater, so the air above the sea remains comparatively warmer.
2. The warm air above the sea rises, and cooler air from the land moves towards the sea.
3. This movement of cooler air from the land towards the sea is called a **land breeze**.

8. What is radiation? Give two examples.

Answer:

1. Radiation is a process of heat transfer that does not require any material medium.
2. Heat from the Sun reaches the Earth through radiation.
3. We also feel warmth from a fireplace through radiation, and hot objects radiate heat to their surroundings.

9. Explain the role of conduction, convection, and radiation when water is heated in a pan.

Answer:

1. Heat from the flame is transferred through the metal utensil by **conduction**.
2. Water inside the utensil gets heated through **convection**.
3. The warmth felt around the flame and hot utensil is transferred through **radiation**.

10. Explain why light-coloured clothes are preferred in summer and dark-coloured clothes in winter.

Answer:

1. Light-coloured clothes reflect most of the heat falling on them and therefore keep us more comfortable during summer.
2. Dark surfaces absorb more heat than light-coloured surfaces.
3. Therefore, dark-coloured clothes are more comfortable during winter because they absorb more heat.

11. What is the water cycle? Mention its major processes.

Answer:

1. The continuous movement of water from the Earth's surface to the atmosphere and back to the Earth is called the **water cycle**.
2. Water reaches the atmosphere mainly through evaporation and transpiration and forms clouds through condensation.
3. Water returns to the Earth's surface through precipitation in the form of rain, snow, or hail.

12. Explain evaporation, condensation, and precipitation in the water cycle.

Answer:

1. **Evaporation** occurs when the Sun heats water in oceans, rivers, and lakes and changes it into water vapour.
2. **Condensation** occurs when rising water vapour cools and forms clouds.
3. **Precipitation** occurs when water returns from clouds to the Earth as rain, snow, or hail.

13. What is infiltration? Explain how the size of spaces between particles affects it.

Answer:

1. The process by which surface water seeps through soil and rocks is called **infiltration**.
2. Water infiltrates more readily when the spaces between soil and rock particles are wider, open, and interconnected.
3. Therefore, water seeps fastest through gravel, slower through sand, and slowest through clay.

14. What are groundwater and aquifers? How do we obtain water from aquifers?

Answer:

1. Water that seeps into the ground and gets stored in pore spaces of sediments and openings in rocks is called **groundwater**.
2. Underground layers of sediments and rocks that store this water in pore spaces are called **aquifers**.
3. Groundwater is obtained by digging wells or drilling bore wells into aquifers.

15. State three causes or measures associated with groundwater depletion and conservation.

Answer:

1. Excessive extraction of groundwater due to increasing water requirements causes groundwater depletion.
2. Decreased vegetation and increased concrete surfaces reduce water infiltration into the ground.
3. Rainwater harvesting and recharge pits can help replenish groundwater and maintain a sustainable supply.

16. Explain how an ice stupa is formed in Ladakh.

Answer:

1. During winter, water from mountain streams is channelled through underground pipes and sprayed into the extremely cold air.

2. The sprayed water freezes and gradually builds up layer by layer into a tall, cone-shaped structure called an **ice stupa**.
3. The ice stupa melts slowly during spring and provides water for farming and other needs during summer.

17. Explain how the water cycle helps maintain water on Earth.

Answer:

1. The water cycle continuously moves water upward as water vapour and downward through precipitation.
2. It helps redistribute and replenish water in rivers, lakes, oceans, soil, and groundwater sources.
3. It also helps conserve the total amount of water present on the Earth.

18. State three important differences among conduction, convection, and radiation.

Answer:

1. In **conduction**, heat passes from particle to particle without the particles moving from their positions.
2. In **convection**, heat is transferred through the actual movement of particles in liquids and gases.
3. Conduction and convection require a material medium, whereas **radiation does not require a medium**.

7.10. Three-mark questions with Answers of HOTS Type: (20 Questions)

1. A metal spoon and a wooden spoon are kept in a bowl of hot soup. After a few minutes, the metal spoon feels hotter. Why?

Answer:

1. Metal is a good conductor of heat, whereas wood is a poor conductor or insulator.
2. Heat from the hot soup travels rapidly through the metal spoon by conduction.
3. Therefore, the metal spoon becomes hot much faster than the wooden spoon.

2. Two thin blankets may keep a person warmer than one thick blanket. Justify this statement.

Answer:

1. Two blankets trap a layer of air between them.
2. Air is a poor conductor of heat and reduces the transfer of body heat to the surroundings.
3. Therefore, the trapped air provides additional insulation and helps the person remain warm.

3. A house in a very hot region is constructed using hollow bricks. Predict how this will affect the temperature inside the house.

Answer:

1. Hollow bricks contain trapped air within their empty spaces.
2. Since air is a poor conductor of heat, it reduces the transfer of outside heat into the house.
3. Therefore, hollow-brick walls can help keep the house cooler during hot weather.

4. Why should a smoke detector preferably be installed near the ceiling rather than near the floor?

Answer:

1. Smoke contains hot gases that are warmer than the surrounding air.
2. Warm gases expand, become lighter, and rise upwards due to convection.
3. Therefore, smoke reaches the ceiling first, making it a suitable location for a smoke detector.

5. Suppose land and seawater heated and cooled at exactly the same rate. How would this affect sea and land breezes?

Answer:

1. Sea and land breezes arise because land and water heat and cool at different rates.
2. If both changed temperature at the same rate, the temperature difference needed to produce the movement of warm and cool air would be greatly reduced.
3. Therefore, the usual sea breeze during the day and land breeze during the night would not develop in the same way.

6. Why are windows of houses in coastal regions often placed facing the sea?

Answer:

1. During the day, land becomes hotter faster than the sea and the warm air above the land rises.
2. Cooler air then moves from the sea towards the land, producing a sea breeze.
3. Windows facing the sea allow this cooler air to enter the house and provide relief from the heat.

7. A student says, "Heat from the Sun reaches the Earth through convection." Is the student correct? Justify your answer.

Answer:

1. The statement is incorrect because convection requires the actual movement of particles in a material medium.
2. Heat from the Sun reaches the Earth through **radiation**, which does not require a material medium.
3. Therefore, radiation can transfer the Sun's heat through the space between the Sun and the Earth.

8. A person wears a black shirt on a hot sunny afternoon while another wears a white shirt. Who is likely to feel more comfortable? Why?

Answer:

1. The person wearing the white shirt is likely to feel more comfortable.
2. Light-coloured surfaces reflect most of the heat falling on them, whereas dark surfaces absorb more heat.
3. Therefore, the black shirt absorbs more heat and may make its wearer feel warmer.

9. When water is heated in a metal pan, three modes of heat transfer can occur. Identify how each one is involved.

Answer:

1. Heat is transferred through the metal utensil by **conduction**.
2. Water inside the utensil gets heated through the movement of water particles by **convection**.
3. The warmth felt around the flame and hot utensil is transferred through **radiation**.

10. Wet clothes dry faster on a sunny day than on a less sunny day. Explain the connection between this observation and the water cycle.

Answer:

1. Heat from the Sun increases the rate of evaporation of water from wet clothes.
2. Similarly, solar heat causes water from oceans, rivers, and lakes to evaporate and enter the atmosphere as water vapour.
3. Thus, solar heating drives evaporation, an important process in the water cycle.

11. Equal amounts of water are poured through clay, sand, and gravel. Predict where water will seep fastest and explain why.

Answer:

1. Water will seep fastest through gravel, slower through sand, and slowest through clay.
2. Gravel has wider spaces between its particles than sand and clay.

3. Wider, open, and interconnected spaces allow water to infiltrate more easily.

12. A city replaces large areas of soil and vegetation with concrete roads and buildings. How might this affect groundwater?

Answer:

1. Concrete surfaces reduce the amount of rainwater that can infiltrate into the ground.
2. Reduced infiltration means that less water reaches and replenishes underground groundwater sources.
3. Therefore, increasing concrete surfaces can contribute to groundwater depletion.

13. A village is facing a falling groundwater level. Suggest a suitable solution based on the chapter and justify it.

Answer:

1. The village can construct **rainwater-harvesting systems and recharge pits**.
2. These measures allow more rainwater to infiltrate into the soil and replenish groundwater.
3. Such groundwater recharge can contribute to a more sustainable groundwater supply.

14. Why would excessive removal of vegetation indirectly contribute to groundwater depletion?

Answer:

1. Vegetated and open ground allows rainwater to seep through soil and rocks.
2. Decreased vegetation cover, especially when accompanied by increased concrete surfaces, limits infiltration.
3. As a result, less water reaches underground aquifers and groundwater replenishment decreases.

15. Why are ice stupas useful for farmers in Ladakh even though they are created during winter?

Answer:

1. During winter, mountain-stream water is sprayed into very cold air and freezes to form an ice stupa.
2. The stored ice melts slowly during spring when water from natural streams may be scarce.
3. Therefore, ice stupas provide water for farming and other needs during the warmer months.

16. A hot metal utensil is removed from a stove and left on a table. After some time, it becomes cooler. Explain why.

Answer:

1. A hot object exchanges heat with its cooler surroundings.
2. The hot utensil radiates heat to its surroundings even after it has been removed from the flame.
3. As it continues to lose heat, its temperature gradually decreases.

17. In the metal-strip experiment, why do the pins near the flame fall before those farther away?

Answer:

1. Heat travels by conduction from the hotter end of the metal strip towards the colder end.
2. The wax holding the pin nearest to the flame receives heat and melts before the wax farther away.
3. Hence, the pins fall successively according to their distance from the heated end.

18. If the metal strip in the pin experiment were replaced by a wooden strip, predict what would happen and give reasons.

Answer:

1. The pins would not fall in the same manner because wood does not allow heat to pass through it easily.
2. Wood is a poor conductor of heat, unlike the metal strip used in the original experiment.
3. Therefore, sufficient heat would not readily travel along the wooden strip to melt the wax holding the pins.

19. A partially inflated balloon is kept in sunlight and becomes larger. What can you infer from this observation?

Answer:

1. Sunlight heats the air present inside the balloon.
2. On heating, the air expands and occupies more space.
3. Therefore, the balloon becomes larger, demonstrating the expansion of air on heating.

20. Explain why protecting the water cycle and promoting infiltration are important for a sustainable groundwater supply.

Answer:

1. Rainfall produced through the water cycle supplies water that can seep into soil and rocks.
2. Through infiltration, some of this water reaches underground layers and replenishes groundwater and aquifers.
3. Therefore, maintaining infiltration and groundwater recharge is essential for sustaining groundwater resources.

7.11 Five-mark questions with Answers of LOTS Type: (12 Questions)

1. What is conduction? Explain the process of conduction of heat.

Answer:

1. Conduction is the process of heat transfer from the hotter part of an object to its colder part.
2. In conduction, a particle that gets heated passes heat to its neighbouring particle.
3. The neighbouring particle then transfers heat to the next particle.
4. The particles themselves do not move from their positions during this process.
5. In solids, heat transfer takes place mainly through conduction.

2. Differentiate between good conductors and poor conductors of heat.

Answer:

1. Materials that allow heat to pass through them easily are called **good conductors of heat**.
2. Metals such as steel, aluminium, and iron are good conductors of heat.
3. Materials that do not allow heat to pass through them easily are called **poor conductors or insulators**.
4. Wood, glass, clay, and porcelain are examples of poor conductors of heat.
5. Metals are therefore used for cooking utensils, while clay and porcelain are suitable for cups used for hot drinks.

3. Explain how woollen clothes help us to keep warm during winter.

Answer:

1. Woollen fabric contains many pores that trap air.
2. Air is a poor conductor of heat.
3. The trapped air reduces the flow of heat from our body to the surroundings.
4. Air trapped between different layers of clothing also acts as an insulator.
5. Therefore, woollen clothes reduce heat loss from our body and help us remain warm during winter.

4. What is convection? Explain how convection takes place in water.

Answer:

1. Convection is the process of heat transfer through the actual movement of particles.
2. When water at the bottom of a vessel is heated, it expands and becomes lighter.
3. The warmer and lighter water rises upwards.
4. The cooler and heavier water from the sides moves downwards to take its place.
5. This continuous movement forms convection currents and gradually heats the entire volume of water.

5. Explain the formation of sea breeze during the daytime.

Answer:

1. During the day, land gets heated faster than seawater.
2. The air above the warmer land gets heated and rises upwards.
3. Cooler air from above the sea moves towards the land to replace the rising warm air.
4. This movement of cooler air from the sea towards the land is called **sea breeze**.
5. Sea breeze provides relief from heat to people living in coastal areas.

6. Explain the formation of land breeze during the night.

Answer:

1. At night, land cools faster than seawater.
2. Therefore, the air above the sea remains warmer than the air above the land.
3. The warmer air above the sea rises upwards.
4. Cooler air from the land moves towards the sea to replace the rising warm air.
5. This movement of cooler air from the land towards the sea is called **land breeze**.

7. What is radiation? Explain heat transfer through radiation with examples.

Answer:

1. Radiation is a process in which heat is transferred without requiring a material medium.
2. Heat from a fire can reach a person sitting near it through radiation.
3. Heat from the Sun reaches the Earth through radiation.
4. All objects exchange heat with their surroundings through radiation.
5. A hot utensil kept away from a flame gradually cools by radiating heat to its surroundings.

8. Explain the three methods of heat transfer using the example of water being heated in a pan.

Answer:

1. The three methods of heat transfer are **conduction, convection, and radiation**.
2. When water is heated in a pan, heat is transferred from the flame to the utensil by conduction.
3. The water inside the utensil gets heated through convection.
4. The warmth that we feel around the flame and hot utensil is due to radiation.
5. Thus, conduction, convection, and radiation can occur together while water is being heated.

9. Describe the water cycle.

Answer:

1. Heat from the Sun causes water in oceans, rivers, and lakes to evaporate into water vapour.
2. Water also enters the atmosphere from plants through transpiration.
3. As water vapour rises, it cools and condenses to form clouds.
4. Water returns to the Earth as rain, snow, or hail through precipitation.
5. This continuous movement of water between the Earth's surface and atmosphere is called the **water cycle**.

10. Explain infiltration, groundwater, and aquifers.

Answer:

1. The process by which surface water seeps through soil and rocks is called **infiltration**.
2. Water infiltrates more easily when the spaces between soil and rock particles are wide, open, and interconnected.
3. Water that seeps underground and gets stored in the pore spaces of sediments and openings in rocks is called **groundwater**.
4. Underground layers of sediments and rocks that store water in their pore spaces are called **aquifers**.
5. Groundwater stored in aquifers can be obtained by digging wells or drilling bore wells.

These questions cover the chapter's main concepts—**conduction, conductors and insulators, convection, land and sea breeze, radiation, water cycle, infiltration, groundwater, and aquifers**—which are also highlighted in the chapter summary.

7.12 Five-mark questions with Answers of HOTS Type: (5 Questions)

1. A metal spoon and a wooden spoon are kept in a bowl of hot soup. After a few minutes, the metal spoon feels much hotter than the wooden spoon. Explain why.

Answer:

1. Heat flows from the hot soup into both the metal and wooden spoons.
2. Metal is a good conductor and allows heat to travel through it easily.
3. Therefore, heat is quickly transferred by conduction from the immersed end to the handle of the metal spoon.
4. Wood is a poor conductor of heat, so very little heat reaches the handle of the wooden spoon.
5. Hence, the metal spoon feels much hotter than the wooden spoon even though both are kept in the same soup.

2. A family living in a very cold region has a choice between one thick blanket and two thin blankets. Which should they choose? Justify your answer.

Answer:

1. They should preferably use **two thin blankets** instead of one thick blanket.
2. A layer of air gets trapped between the two blankets.
3. Air is a poor conductor of heat and therefore acts as an insulator.
4. The trapped air reduces the transfer of body heat to the colder surroundings.
5. Thus, two thin blankets with an air layer between them can keep the family warmer.

3. Why are hollow bricks useful for constructing houses in places experiencing very hot summers and cold winters? Analyse using the concept of heat transfer.

Answer:

1. Hollow bricks contain empty spaces in which air gets trapped.
2. Air is a poor conductor of heat and acts as an insulating material.
3. During summer, trapped air reduces the transfer of outside heat into the house.
4. During winter, it reduces the loss of heat from inside the house to the colder surroundings.
5. Therefore, hollow-brick walls help keep houses relatively cool in summer and warm in winter.

4. A smoke detector has to be installed in a room. Should it be installed near the floor or on the ceiling? Explain scientifically.

Answer:

1. A smoke detector should preferably be installed on the **ceiling**.
2. Smoke contains hot gases and tiny solid particles produced during burning.
3. The hot gases are warmer than the surrounding air and therefore rise upwards.

4. This upward movement occurs because heated air expands, becomes lighter, and rises due to convection.
5. Hence, smoke reaches the ceiling first, making it a suitable location for detecting smoke quickly.

5. Why are houses near the seashore often designed with windows facing the sea? Explain using the concept of convection.

Answer:

1. During the daytime, land gets heated faster than seawater.
2. The air above the land becomes warmer and rises upwards.
3. Cooler air from the sea moves towards the land to replace the rising warm air.
4. This movement of cooler air from sea to land is known as **sea breeze**.
5. Therefore, windows facing the sea allow cool sea breeze to enter the house and provide relief from heat.

6. Suppose you visit a beach during both afternoon and night. Predict how the direction of the breeze will change and explain why.

Answer:

1. During the afternoon, land heats faster than seawater, causing warm air above the land to rise.
2. Cooler air therefore moves from the sea towards the land, producing a **sea breeze**.
3. At night, land cools faster than seawater, so the air above the sea remains relatively warmer.
4. The warm air above the sea rises, and cooler air moves from the land towards the sea.
5. Therefore, the wind direction reverses from **sea-to-land during the day to land-to-sea during the night**.

7. A student says, "Since there is almost no material medium between the Sun and Earth, heat from the Sun cannot reach us." Evaluate this statement.

Answer:

1. The student's statement is incorrect because heat can be transferred through **radiation**.
2. Unlike conduction and convection, radiation does not require a material medium.
3. Therefore, heat can travel through the space between the Sun and the Earth.
4. The Sun's heat reaches the Earth mainly through radiation.
5. Thus, radiation explains how we receive solar heat even though there is no continuous material medium between the Sun and Earth.

8. A person wears a black shirt on a hot sunny afternoon, while another person wears a white shirt. Who is likely to feel more comfortable? Explain.

Answer:

1. The person wearing the **white shirt** is likely to feel more comfortable.
2. Light-coloured surfaces reflect most of the heat radiation falling on them.
3. Therefore, the white shirt absorbs comparatively less heat from the Sun.
4. Dark surfaces absorb more heat, so the black shirt is likely to become warmer.
5. Hence, light-coloured clothes are more suitable for hot summer conditions, while dark-coloured clothes are more useful during winter.

9. A city is rapidly replacing open soil and vegetation with concrete roads and buildings. Predict its possible effect on groundwater and suggest a solution.

Answer:

1. Increasing concrete surfaces reduces the amount of rainwater that can seep into the ground.
2. Reduced vegetation and concrete-covered surfaces therefore decrease **infiltration**.
3. If groundwater continues to be extracted while recharge decreases, groundwater levels may decline.

4. Rainwater harvesting and recharge pits can help direct more rainwater into the ground.
5. Therefore, maintaining vegetation and promoting groundwater-recharge measures can help ensure a more sustainable groundwater supply.

10. Ladakh faces water scarcity during spring. Explain how an ice stupa provides a scientific solution to this problem.

Answer:

1. During winter, water from mountain streams is channelled through underground pipes and sprayed into the extremely cold air.
2. The sprayed water freezes and gradually forms a tall, cone-shaped structure called an **ice stupa**.
3. This structure effectively stores water in the form of ice during winter.
4. During spring, the ice stupa melts slowly and releases water when natural streams may have insufficient water.
5. Thus, ice stupas apply natural freezing and melting processes to provide water for farming and other needs into the summer.

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

1. Your family is buying a new cooking pan. What type of materials would you suggest for the body and handle of the pan? Explain your choice.

Answer:

1. I would suggest a **metal such as aluminium or steel** for the body of the cooking pan.
2. Metals are good conductors of heat and transfer heat quickly from the flame to the food.
3. The handle should be made of a **poor conductor of heat**, such as wood or another insulating material.
4. A poor conductor reduces the transfer of heat from the hot pan to the handle.
5. Thus, using a good conductor for the pan and a poor conductor for the handle makes cooking efficient and handling safer.

2. A family living in a cold mountainous region wants to design a house that remains warm during winter. Apply your knowledge of heat transfer and suggest suitable features.

Answer:

1. The house can be constructed with walls containing layers of poor conductors such as wood and mud.
2. Hollow bricks can also be used because the air trapped inside them acts as an insulator.
3. Air is a poor conductor and reduces the transfer of heat from inside the house to the cold surroundings.
4. People inside can use layered woollen clothing and blankets that trap air and reduce heat loss.
5. These applications of insulation can help the house remain warmer during cold weather.

3. You are asked to design a house near a seashore where the daytime temperature is high. How would you use the concept of sea breeze to make the house more comfortable?

Answer:

1. During the day, land becomes hot faster than seawater.
2. The air above the land gets heated, expands, becomes lighter, and rises.
3. Cooler air from the sea moves towards the land to replace the rising warm air, producing a **sea breeze**.
4. I would therefore provide windows and openings on the side of the house facing the sea.
5. This arrangement would allow the cooler sea breeze to enter the house and provide natural cooling.

4. During summer, your friend wears a black shirt while playing outdoors at noon. What advice would you give your friend based on the concept of radiation?
Answer:
1. I would advise my friend to wear **white or light-coloured clothes** during hot summer days.
2. Dark-coloured surfaces absorb more heat and therefore a black shirt can make the person feel warmer.
3. Light-coloured clothes reflect most of the heat falling on them.
4. Therefore, they absorb comparatively less heat from the surroundings.
5. Wearing light-coloured clothes is consequently more comfortable during summer.

5. Your school wants to install smoke detectors for fire safety. Where should the detectors be installed, and how does your knowledge of convection help you decide?
Answer:
1. Smoke detectors should preferably be installed **on or near the ceiling** of rooms.
2. During a fire, the air and gases around the flame become heated.
3. Heated air expands, becomes lighter, and rises upwards.
4. Smoke, which contains hot gases and tiny solid particles, therefore moves upwards with the warm air.
5. Hence, placing smoke detectors near the ceiling helps them detect rising smoke quickly and sound an alarm.

6. Your locality is facing a fall in groundwater level because many open areas have been converted into concrete surfaces. Suggest measures based on the concepts learnt in the chapter.
Answer:
1. Concrete surfaces reduce the amount of rainwater that can infiltrate into the soil.
2. More open and vegetated areas should therefore be maintained so that rainwater can seep into the ground.
3. **Rainwater harvesting systems** can be installed to collect and direct rainwater for groundwater recharge.
4. **Recharge pits** can also be constructed to increase the amount of water entering underground aquifers.
5. These measures can help replenish groundwater and contribute to a sustainable groundwater supply.

7. You are heating water in a metal pan. Identify how conduction, convection, and radiation are involved in this everyday activity.
Answer:
1. When the pan is heated, heat is transferred through the metal utensil by **conduction**.
2. The water near the heated part of the pan becomes warm, expands, becomes lighter, and rises.
3. Cooler and heavier water moves downward, producing **convection currents** that heat the water.
4. We can also feel warmth around the flame and hot pan because of **radiation**.
5. Thus, conduction, convection, and radiation can all operate together while heating water in a pan.

8. Your school wants to demonstrate how different types of soil affect groundwater recharge. Design a simple experiment using clay, sand, and gravel and explain the expected results.
Answer:
1. Take three similar inverted containers and fill them separately with **clay, sand, and gravel**.

2. Pour an equal quantity of water into each and collect the water passing through them for the same amount of time.
3. Water is expected to seep **fastest through gravel, slower through sand, and slowest through clay**.
4. Gravel allows faster seepage because it has wider spaces between its particles than sand and clay.
5. The experiment demonstrates that infiltration occurs more readily when spaces between soil or rock particles are wider, open, and interconnected.

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

Olympiad-Type Multiple Choice Questions with Answers:
The following **30 MCQs** are designed for **Grade 7 Olympiad/competitive examinations**, with emphasis on conceptual understanding, application, reasoning, prediction, and analysis. They are based on the uploaded chapter covering conduction, convection, radiation, land and sea breezes, the water cycle, infiltration, groundwater, and aquifers.

1. Four pins are fixed with wax at equal distances on a metal strip. One end is heated. Which pin will fall first?
A. The pin farthest from the flame
B. The pin nearest the flame
C. All pins simultaneously
D. The middle pin
Answer: B. The pin nearest the flame

2. If the metal strip in the above experiment is replaced by wood, the pins are unlikely to fall because:
A. Wood absorbs all the heat
B. Wood produces convection currents
C. Wood is a poor conductor of heat
D. Wood reflects all heat
Answer: C. Wood is a poor conductor of heat

3. Which combination is most suitable for making a saucepan?
A. Metal body and insulating handle
B. Wooden body and metal handle
C. Glass body and metal handle
D. Insulating body and metal handle
Answer: A. Metal body and insulating handle

4. Two thin blankets may keep a person warmer than one thick blanket mainly because:
A. Two blankets produce heat
B. Air trapped between them is a poor conductor
C. Air trapped between them is a good conductor
D. The blankets prevent radiation completely
Answer: B. Air trapped between them is a poor conductor

5. Houses made with hollow bricks can remain comparatively comfortable in both summer and winter because:
A. The bricks continuously produce heat
B. Air trapped in the bricks is a poor conductor
C. Air inside the bricks causes rapid convection
D. Hollow bricks absorb all radiation
Answer: B. Air trapped in the bricks is a poor conductor

6. A partially inflated balloon is placed in sunlight. After some time, it becomes larger. The best explanation is:
A. Air inside the balloon contracts
B. Air enters through the balloon wall
C. Heated air inside expands
D. Sunlight increases the mass of air
Answer: C. Heated air inside expands
7. A smoke detector should preferably be fitted:
A. Near the floor
B. At the centre of the wall
C. On the ceiling
D. Behind a door
Answer: C. On the ceiling
8. Smoke from a burning incense stick rises mainly because:
A. Hot gases are warmer than the surrounding air and rise
B. Smoke is attracted towards the ceiling
C. Gravity pushes smoke upwards
D. Smoke is always lighter than every gas
Answer: A. Hot gases are warmer than the surrounding air and rise
9. In a beaker of water heated from below, the heated water:
A. Becomes heavier and sinks
B. Becomes lighter and rises
C. Remains permanently at the bottom
D. Changes immediately into steam
Answer: B. Becomes lighter and rises
10. Which statement correctly describes convection?
A. Heat transfer occurs without any particle movement.
B. Heat transfer occurs only in solids.
C. Heat transfer takes place through the actual movement of particles.
D. Heat transfer occurs without a material medium.
Answer: C. Heat transfer takes place through the actual movement of particles.
11. Consider the following statements:
I. Soil heats faster than water.
II. Soil cools faster than water.
III. Water heats and cools faster than soil.
Which is correct?
A. I only
B. I and II only
C. II and III only
D. I, II and III
Answer: B. I and II only
12. During daytime near a seashore, the correct sequence is:
A. Sea heats faster → air above sea rises → land breeze
B. Land heats faster → air above land rises → sea breeze
C. Land cools faster → air above sea rises → sea breeze
D. Sea cools faster → air above land rises → land breeze
Answer: B. Land heats faster → air above land rises → sea breeze
13. At night, land breeze occurs because:
A. Land remains warmer than the sea
B. Sea cools faster than land

C. Land cools faster than seawater
D. Both land and water remain at the same temperature
Answer: C. Land cools faster than seawater
14. Why are windows in coastal houses often placed facing the sea?
A. To increase conduction
B. To receive cooler sea breeze during the day
C. To absorb maximum solar radiation
D. To prevent convection
Answer: B. To receive cooler sea breeze during the day
15. Which mode of heat transfer allows energy from the Sun to reach the Earth?
A. Conduction
B. Convection
C. Radiation
D. Infiltration
Answer: C. Radiation
16. Which statement about radiation is correct?
A. It occurs only in solids.
B. It requires air as a medium.
C. It requires water as a medium.
D. It does not require a material medium.
Answer: D. It does not require a material medium.
17. A student has a white shirt and a black shirt. Which choice is scientifically more suitable for a hot summer afternoon?
A. Black, because it reflects more heat
B. White, because it reflects most of the heat falling on it
C. Black, because it conducts less heat
D. Both are identical in heat absorption
Answer: B. White, because it reflects most of the heat falling on it
18. When water is heated in a metal pan, which sequence correctly identifies the heat-transfer processes?
A. Pan—convection; water—radiation; surroundings—conduction
B. Pan—conduction; water—convection; warmth around pan—radiation
C. Pan—radiation; water—conduction; surroundings—convection
D. Pan—convection; water—conduction; surroundings—radiation
Answer: B. Pan—conduction; water—convection; warmth around pan—radiation
19. Which of the following requires NO material medium?
A. Conduction only
B. Convection only
C. Radiation only
D. Conduction and convection
Answer: C. Radiation only
20. Wet clothes generally dry faster on a sunny day because:
A. Solar heat increases evaporation
B. Solar heat increases condensation
C. Water undergoes infiltration
D. Clothes absorb groundwater
Answer: A. Solar heat increases evaporation
21. Arrange the following processes of the water cycle in a logical sequence:
1. Condensation
2. Evaporation

3. Precipitation

A. 1 → 2 → 3
B. 2 → 1 → 3
C. 3 → 2 → 1
D. 2 → 3 → 1
Answer: B. 2 → 1 → 3
22. Which process adds water vapour to the atmosphere specifically from plants?
A. Condensation
B. Precipitation
C. Transpiration
D. Infiltration
Answer: C. Transpiration
23. Water vapour rises, cools, and changes into tiny droplets. This process is:
A. Evaporation
B. Condensation
C. Infiltration
D. Convection
Answer: B. Condensation
24. Equal quantities of water are poured separately through clay, sand, and gravel. Which order represents decreasing rate of seepage?
A. Clay > Sand > Gravel
B. Gravel > Sand > Clay
C. Sand > Clay > Gravel
D. Gravel > Clay > Sand
Answer: B. Gravel > Sand > Clay
25. Why does water seep more rapidly through gravel than clay?
A. Gravel absorbs more heat.
B. Gravel has wider spaces between its particles.
C. Clay has no particles.
D. Gravel causes evaporation.
Answer: B. Gravel has wider spaces between its particles.
26. The process by which surface water seeps through soil and rocks is called:
A. Transpiration
B. Condensation
C. Infiltration
D. Radiation
Answer: C. Infiltration
27. Which statement best describes an aquifer?
A. A surface lake storing rainwater
B. A cloud containing condensed water
C. An underground layer of sediments and rocks that stores water in pore spaces
D. A pipe used to carry groundwater
Answer: C. An underground layer of sediments and rocks that stores water in pore spaces
28. Which combination would most likely cause groundwater depletion in a rapidly growing city?
A. More vegetation + rainwater harvesting
B. More concrete surfaces + excessive groundwater extraction
C. Recharge pits + open soil
D. Increased infiltration + reduced extraction

Answer: B. More concrete surfaces + excessive groundwater extraction

29. Which measure would be most helpful for replenishing groundwater?

A. Covering open land with concrete
B. Increasing bore-well extraction
C. Constructing recharge pits
D. Removing vegetation

Answer: C. Constructing recharge pits

30. Ice stupas are useful in Ladakh mainly because they:

A. Prevent all evaporation from streams
B. convert groundwater permanently into ice
C. store winter water as ice and release it gradually during warmer months
D. increase the temperature of mountain streams

Answer: C. Store winter water as ice and release it gradually during warmer months

Answer Key

Q.	Ans.	Q.	Ans.	Q.	Ans.
1	B	11	B	21	B
2	C	12	B	22	C
3	A	13	C	23	B
4	B	14	B	24	B
5	B	15	C	25	B
6	C	16	D	26	C
7	C	17	B	27	C
8	A	18	B	28	B
9	B	19	C	29	C
10	C	20	A	30	C

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

"Best Practices" Opportunities for Teaching–Learning:

The chapter is particularly suitable for **activity-based, inquiry-oriented, experiential, and real-life learning**, as it includes experiments on conduction, convection, heating of land and water, seepage of water, and exploratory projects.

(1) **Activity-Based Learning through Simple Experiments:** Conduct the chapter experiments in small groups rather than teaching the concepts only through explanation. For example, students can observe conduction using pins attached with wax to a metal strip and infer how heat travels from the hotter end to the colder end.

(2) **Predict–Observe–Explain (POE) Method:** Before each experiment, ask students to **predict** what will happen, then **observe** the actual result and finally **explain** it scientifically. This can be effectively used for the metal-strip experiment, convection in water, and comparison of water seepage through clay, sand, and gravel.

(3) **Connect Science with Everyday Life:** Relate conduction, convection, and radiation to familiar examples such as metal cooking utensils, woollen clothes, blankets, hollow bricks, smoke rising, and light- versus dark-coloured clothes. Such connections help students understand why the principles of heat transfer are important in clothing and house design.

(4) **Demonstrate Convection Visually:** Use the chapter's potassium-permanganate activity to allow students to observe the coloured streak rising from the heated region

and descending along the sides. Students can then draw and label the resulting convection current in their notebooks.

(5) **Use Local Weather to Teach Land and Sea Breezes:** Connect the concept to students' geographical surroundings, especially in coastal regions. Students can compare daytime and nighttime wind directions and relate them to the fact that land heats and cools faster than water.

(6) **Concept Mapping for Modes of Heat Transfer:** Ask students to prepare a three-branch concept map for **Conduction → Convection → Radiation**, showing definition, medium required, examples, and applications. They should also identify situations, such as heating water in a pan, where all three processes operate together.

(7) **Water-Cycle Model and Role Play:** Students can construct a simple water-cycle model or enact the roles of the **Sun, evaporation, transpiration, condensation, clouds, precipitation, infiltration, and water bodies**. This makes the continuous movement and replenishment of water easier to visualise.

(8) **Hands-On Investigation of Infiltration:** Provide equal quantities of clay, sand, and gravel and ask groups to predict and measure the rate of water seepage. Students should record observations in a table and conclude why water seeps fastest through gravel and slowest through clay.

(9) **Environmental Responsibility through Project-Based Learning:** Organise a visit to a **rainwater-harvesting system or recharge pit** and ask students to prepare an illustrated report explaining how it works. This connects groundwater, infiltration, water conservation, and sustainability with real community practices, as suggested in the chapter's exploratory projects.

(10) **Use Indian Context and Indigenous Innovation:** Discuss the **ice stupa of Ladakh** as a case study of applying scientific knowledge to solve water scarcity. Students can explain how winter water is stored as ice and gradually released during spring and summer for farming and other needs.

(11) **Collaborative Learning and Peer Teaching:** Divide students into groups such as *Conduction Team, Convection Team, Radiation Team, Water Cycle Team,* and *Groundwater Team*. Each group can prepare a diagram, demonstration, examples, and a short presentation to teach its concept to the rest of the class.

(12) **Exit Ticket for Formative Assessment:** At the end of the lesson, ask every student to answer three short questions: **“What did I learn today?”, “Where do I observe it in daily life?”, and “What question do I still have?”** This helps the teacher identify misconceptions and plan reinforcement activities.

Recommended Best-Practice Approach: For this chapter, an effective sequence would be **Experience → Predict → Experiment → Observe → Explain → Apply → Reflect**. This aligns especially well with the textbook's emphasis on enquiry, exploration, curiosity, discovery, and innovation.

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

“Innovations” Opportunities while Teaching Chapter 7 – *Heat Transfer in Nature*

The chapter provides excellent scope for innovative teaching because it connects **conduction, convection, radiation, land and sea breezes, the water cycle, infiltration, groundwater, aquifers, and water conservation** with everyday experiences.

(1) **“Heat Detective” Classroom Challenge:**

Convert the classroom into a science investigation zone. Students identify examples of conduction, convection, and radiation around them—such as metal utensils, sunlight, warm air, insulated bottles, and ventilation—and justify the type of heat transfer involved. This strengthens observation and application skills.

(2) **Digital/Animated Heat-Transfer Simulation:**
Use animations or interactive simulations to visualise the movement of particles during conduction and convection and the transfer of heat through radiation. Students can then create their own simple digital diagrams or animated presentations comparing the three processes. The chapter specifically distinguishes particle behaviour and the need for a medium in these processes.

(3) **Design-a-Climate-Smart House Challenge:**
Ask groups to design a miniature house suitable for a **very hot or very cold region** using cardboard, hollow materials, cotton, wood, mud, etc. Students must explain their choice of insulating materials using the concept that trapped air and poor conductors reduce heat transfer.

(4) **Create a Mini Sea-Breeze/Land-Breeze Model:**
Students can construct a model representing land and sea and use arrows, small paper streamers, or safe demonstrations to show the direction of air movement during day and night. They can then explain why coastal areas experience reversing wind directions.

(5) **STEM-Based "Keep It Hot/Keep It Cold" Design Competition:**
Give students identical cups and allow them to create insulating covers using safe everyday materials such as paper, cloth, cotton, cardboard, or wool. Students predict which design will retain temperature longest, test their models, record temperature changes, and identify the scientific reason behind the winning design.

(6) **DIY Water-Cycle Terrarium:**
Students can build a miniature closed water-cycle model using a transparent container, water, soil, and plants. They observe evaporation and condensation and relate their observations to the textbook's sequence of evaporation, transpiration, condensation, precipitation, and return of water to water bodies.

(7) **"Build an Aquifer" STEM Model:**
Use transparent bottles or containers containing layers of gravel, sand, and clay to create a working groundwater model. Students can investigate how particle size affects infiltration and explain why water seeps fastest through gravel and slowest through clay.

(8) **Smart Rainwater-Harvesting Design Project:**
Challenge students to design a **rainwater-harvesting system for their school or home**. They can draw the rooftop, pipes, filter, storage tank, recharge pit, and groundwater layer and explain how their design can improve groundwater recharge. The chapter highlights rainwater harvesting and recharge pits as measures for replenishing groundwater.

(9) **Ice Stupa Innovation Challenge:**
After studying the Ladakh ice stupa, ask students to propose their own innovative method for conserving water in a water-scarce community. They may present the solution as a drawing, model, poster, or short pitch. The chapter describes ice stupas as an innovative means of storing winter water for use during warmer months.

(10) **Science Reel/Video Creation by Students:**
Small groups can create 1–2 minute educational videos titled **"Conduction Around Me," "Why Does Smoke Rise?", "Journey of a Water Drop," "Why Do Sea Breezes Occur?"** or **"Where Does Groundwater Come From?"** This turns students from passive learners into science communicators.

(11) **Paper-Spiral Convection Toy:**
Students can make the spiral-paper model suggested in the chapter and investigate why the suspended spiral rotates above a heat source. They can modify the spiral's size or

shape and compare its movement, transforming the textbook activity into a small design investigation.

(12) **Interdisciplinary "Heat–Water–Life" Exhibition:**
Organise a mini exhibition integrating **Science** + **Geography** + **Art** + **Technology** + **Society**. Groups can exhibit working models of heat transfer, coastal breezes, water cycles, aquifers, climate-smart houses, rainwater harvesting, and ice stupas. This directly extends the chapter's interdisciplinary orientation involving society, art, economy, geography, technology, and history.

These innovations can make the chapter follow a **"Learn → Experiment → Design → Create → Apply"** approach, developing scientific curiosity, creativity, problem-solving, collaboration, and environmental awareness among 7th Standard students.

7.17: Practicing Questions/Question Bank

A. Fill in the Blanks:

1. The transfer of heat from the hotter part of an object to the colder part is called __________.
   Answer: Conduction

2. Materials that allow heat to pass through them easily are called __________ of heat.
   Answer: Good conductors

3. Wood and glass are __________ conductors of heat.
   Answer: Poor

4. Woollen clothes keep us warm because they trap __________ in their pores.
   Answer: Air

5. Heat transfer in liquids and gases mainly takes place through __________.
   Answer: Convection

6. The movement of cooler air from the sea towards the land is called __________.
   Answer: Sea breeze

7. The movement of cooler air from land towards the sea is called __________.
   Answer: Land breeze

8. Heat from the Sun reaches the Earth through __________.
   Answer: Radiation

9. The process by which water vapour cools and forms clouds is called __________.
   Answer: Condensation

10. The process of surface water seeping through soil and rocks is called __________.
    Answer: Infiltration

11. Water stored beneath the Earth's surface is called __________.
    Answer: Groundwater

12. Underground layers of sediments and rocks that store water in pore spaces are called __________.
    Answer: Aquifers

13. Water seeps fastest through __________ compared with sand and clay.
    Answer: Gravel

14. Rain, snow, and hail are forms of __________.
    Answer: Precipitation

15. In Ladakh, water is conserved during winter by constructing __________.
    Answer: Ice stupas

The chapter explains that infiltration is easier where spaces between particles are wider and interconnected, and groundwater is stored in aquifers.

B. One-Mark Descriptive Questions:

1. **What is conduction?**
   Answer: Conduction is the transfer of heat from the hotter part of an object to its colder part.

2. **What is a good conductor of heat?**
   Answer: A material that allows heat to pass through it easily is called a good conductor of heat.

3. **Give two examples of poor conductors of heat.**
   Answer: Wood and glass are poor conductors of heat.

4. **Why do woollen clothes keep us warm?**
   Answer: Woollen clothes trap air, which is a poor conductor of heat and reduces body heat loss.

5. **What is convection?**
   Answer: Convection is heat transfer through the actual movement of particles in liquids and gases.

6. **Why does hot air rise?**
   Answer: Hot air expands, becomes lighter, and rises.

7. **What is sea breeze?**
   Answer: The movement of cooler air from the sea towards the land during daytime is called sea breeze.

8. **What is land breeze?**
   Answer: The movement of cooler air from the land towards the sea at night is called land breeze.

9. **What is radiation?**
   Answer: Radiation is the transfer of heat without requiring a material medium.

10. **What is infiltration?**
    Answer: Infiltration is the process by which surface water seeps through soil and rocks.

11. **What is groundwater?**
    Answer: Groundwater is water stored in pore spaces of sediments and openings in rocks beneath the Earth's surface.

12. **What is an aquifer?**
    Answer: An aquifer is an underground layer of sediments and rocks that stores water in pore spaces.

C. Two-Mark Descriptive Questions:

1. Why are metals used for making cooking utensils?

Answer:

- Metals are good conductors of heat.
- They transfer heat efficiently from the flame to the food.

2. Why do two thin blankets keep us warm?

Answer:

- Air gets trapped between the two blankets.
- Air is a poor conductor and reduces the loss of body heat.

3. Why does smoke from an incense stick rise?

Answer:

- Smoke contains hot gases that are warmer than the surrounding air.
- The warmer gases rise upwards.

4. Differentiate between sea breeze and land breeze.

Answer:

- Sea breeze moves from the sea towards land during daytime.
- Land breeze moves from land towards the sea during nighttime.

5. Why are light-coloured clothes preferred during summer?

Answer:

- Light-coloured clothes reflect most of the heat falling on them.
- Hence, they absorb less heat and make us feel more comfortable.

6. What happens to water vapour when it rises in the atmosphere?

Answer:

- Water vapour cools as it rises.
- It condenses and forms clouds.

7. Why does water seep faster through gravel than through clay?

Answer:

- Gravel has wider spaces between its particles.
- Therefore, water can pass through gravel more easily.

8. Mention two measures for replenishing groundwater.

Answer:

- Rainwater harvesting can increase groundwater recharge.

- Recharge pits help rainwater infiltrate into the ground.

D. Three-Mark Descriptive Questions:

1. Explain conduction of heat.

Answer:

1. Conduction transfers heat from the hotter part of an object to its colder part.
2. A heated particle transfers heat to its neighbouring particle.
3. The particles themselves do not move from their positions.

2. Explain convection in water.

Answer:

1. Water at the bottom gets heated, expands, becomes lighter, and rises.
2. Cooler and heavier water moves downwards to take its place.
3. This continuous movement produces convection currents that heat the entire water.

3. Explain the formation of sea breeze.

Answer:

1. During daytime, land heats faster than seawater.
2. Warm air above the land rises upwards.
3. Cooler air from the sea moves towards land, producing a sea breeze.

4. Explain the formation of land breeze.

Answer:

1. At night, land cools faster than seawater.
2. The warmer air above the sea rises.
3. Cooler air from the land moves towards the sea, producing a land breeze.

5. Explain the role of evaporation, condensation, and precipitation in the water cycle.

Answer:

1. Water from water bodies evaporates due to heat from the Sun.
2. Water vapour rises, cools, and condenses to form clouds.
3. Water returns to Earth as rain, snow, or hail through precipitation.

6. Explain infiltration and groundwater formation.

Answer:

1. Rainwater seeps through soil and rocks by infiltration.
2. Some of this water gets stored in pore spaces and openings beneath the surface.

3. This stored underground water is called groundwater.

7. Why is groundwater getting depleted?

Answer:

1. Increasing population has resulted in excessive groundwater extraction.
2. Decreased vegetation reduces favourable conditions for infiltration.
3. Increased concrete surfaces in urban areas limit the infiltration of rainwater.

E. Five-Mark Descriptive Questions:

1. Explain conduction, convection, and radiation with suitable examples.

Answer:

1. Conduction transfers heat from the hotter to the colder part of an object.
2. It occurs mainly in solids, such as heat travelling through a metal utensil.
3. Convection transfers heat through the actual movement of particles in liquids and gases.
4. Heating water and the formation of land and sea breezes are examples of convection.
5. Radiation requires no material medium; heat from the Sun reaches Earth through radiation.

2. Describe the water cycle.

Answer:

1. Heat from the Sun causes water from oceans, rivers, and lakes to evaporate.
2. Plants also release water vapour through transpiration.
3. Water vapour rises, cools, and condenses to form clouds.
4. Water returns to Earth through precipitation as rain, snow, or hail.
5. The continuous circulation of water between Earth's surface and atmosphere constitutes the water cycle.

3. Explain how groundwater is formed and stored.

Answer:

1. Rainwater falling on the ground begins to seep through soil and rocks.
2. This process is called infiltration.
3. Infiltrated water gets stored in pore spaces of sediments and openings in rocks.
4. This stored water is known as groundwater.
5. Underground layers storing groundwater are called aquifers, from which water can be obtained through wells and bore wells.

4. Explain the causes of groundwater depletion and measures to conserve groundwater.

Answer:

1. Increasing water requirements have resulted in excessive groundwater extraction.
2. Decreased vegetation cover can contribute to reduced groundwater recharge.
3. Concrete surfaces in urban areas reduce infiltration of rainwater.
4. Rainwater harvesting can be used to replenish groundwater.
5. Recharge pits can improve infiltration and help maintain a sustainable groundwater supply.

5. Explain the working and importance of ice stupas in Ladakh.

Answer:

1. During winter, water from mountain streams is channelled through underground pipes.
2. The water is sprayed into the extremely cold air, where it freezes.
3. Ice gradually builds up into a tall cone-shaped structure called an **ice stupa**.
4. During spring, the ice stupa melts slowly and releases stored water.
5. This water is useful for farming and other needs during periods of water scarcity.

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7th Standard Science Book Chapter 8

Chapter 8: Measurement of Time and Motion

8.1 Summary of the Chapter:

Summary :

(1) **Measurement of Time:** Humans have measured time since ancient times by observing periodic natural events such as the rising and setting of the Sun, phases of the Moon, and changing seasons. Early time-measuring devices included **sundials, water clocks, hourglasses, and candle clocks**.

(2) **Ancient Timekeeping Devices:** A **sundial** measures time using the changing position of a shadow, a **water clock** uses the flow of water, an **hourglass** uses the flow of sand, and a **candle clock** uses markings on a burning candle to indicate the passage of time.

(3) **Development of Clocks:** With advances in civilisation, increasingly accurate mechanical devices were developed using weights, gears, and springs. The invention of the **pendulum clock by Christiaan Huygens in 1656**, inspired by Galileo's investigations, was an important breakthrough in timekeeping.

(4) **Simple Pendulum:** A simple pendulum consists of a small metallic ball called a **bob**, suspended from a rigid support by a long thread. When displaced slightly and released, it performs periodic oscillatory motion about its mean position.

(5) **Oscillation and Time Period:** One complete to-and-fro movement of a pendulum is called an **oscillation**. The time taken to complete one oscillation is called its **time period**; for a given location, the time period depends on the pendulum's length but not on the mass of its bob.

(6) **Modern Measurement of Time:** All clocks use some continuously repeating process to mark equal intervals of time. Modern quartz clocks use vibrations of quartz crystals, while highly accurate atomic clocks use processes associated with specific atoms.

(7) **Units of Time:** The **SI unit of time is the second (s)**. Larger commonly used units are the **minute (min)** and **hour (h)**, where **60 s = 1 min** and **60 min = 1 h**.

(8) **Fast and Slow Motion:** When two objects move for the same interval of time, the object that covers a greater distance is considered faster. The idea of **speed** enables us to compare how fast or slow different objects move.

(9) **Speed and its Unit:** Speed is defined as the **distance covered by an object per unit time** and is calculated as **Speed = Total Distance Covered ÷ Total Time Taken.** Its SI unit is **metre per second (m/s)**, while **kilometre per hour (km/h)** is also commonly used.

(10) **Relationship between Speed, Distance and Time:** The three quantities are related as **Distance = Speed × Time** and **Time = Distance ÷ Speed**. The chapter applies these relationships to practical situations involving bicycles, buses, and trains.

(11) **Uniform and Non-uniform Linear Motion:** An object moving along a straight line at constant speed is in **uniform linear motion** and covers equal distances in equal intervals of time. If its speed keeps changing, it is in **non-uniform linear motion** and it covers unequal distances in equal intervals of time.

(12) **Average Speed and Everyday Applications:** In real life, objects seldom maintain constant speed for long periods, so **average speed** is commonly used; it is calculated by dividing the total distance travelled by the total time taken. Vehicles use a **speedometer** to display speed and an **odometer** to measure distance travelled.

Key Concepts at a Glance:

Time Measurement → Pendulum → Time Period → SI Unit of Time → Speed → Distance–Time Relationship → Average Speed → Uniform Motion → Non-uniform Motion

These are also the principal concepts highlighted in the chapter's **“In a Nutshell”** section.

8.2 Important Formulas:

Important Formulas for Solving Quantitative Problems:

The following formulas are directly relevant to the numerical problems and activities in the uploaded Grade 7 Science chapter.

1. Speed

$$\boxed{\text{Speed} = \frac{\text{Total Distance Covered}}{\text{Total Time Taken}}}$$

Symbolically:

$$\boxed{v = \frac{d}{t}}$$

where:

- v= speed
- d= distance covered
- t= time taken

The chapter defines speed as the distance covered by an object in unit time.

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2. Distance Covered

When speed and time are known:

$$\boxed{\text{Distance} = \text{Speed} \times \text{Time}}$$

or

$$\boxed{d = v \times t}$$

Example: If a bus travels at 50 km/h for 2 h:

$$d = 50 \times 2 = 100 \text{ km}$$

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3. Time Taken

When distance and speed are known:

$$\boxed{\text{Time} = \frac{\text{Distance}}{\text{Speed}}}$$

or

$$\boxed{t = \frac{d}{v}}$$

Example: A train travelling at 90 km/h covers 360 km in:

$$t = \frac{360}{90} = 4 \text{ h}$$

---

4. Average Speed

When the speed varies during a journey:

$$\boxed{\text{Average Speed} = \frac{\text{Total Distance Covered}}{\text{Total Time Taken}}}$$

The chapter notes that the speed calculated from total distance and total time is actually the **average speed** when an object does not maintain the same speed throughout its journey.

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5. Time Period of a Simple Pendulum

$$\boxed{\text{Time Period} = \frac{\text{Total Time Taken for Oscillations}}{\text{Number of Oscillations}}}$$

For the chapter's experiment involving 10 oscillations:

$$\boxed{T = \frac{\text{Time taken for 10 oscillations}}{10}}$$

where T represents the time period of the pendulum.

Important Unit Conversions

6. Seconds and Minutes

$$\boxed{60 \text{ s} = 1 \text{ min}}$$

Therefore,

$$\boxed{1 \text{ min} = 60 \text{ s}}$$

7. Minutes and Hours

$$\boxed{60 \text{ min} = 1 \text{ h}}$$

Therefore,

$$\boxed{1 \text{ h} = 3600 \text{ s}}$$

The chapter identifies the **second (s)** as the SI unit of time.

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8. Kilometres and Metres

For numerical problems involving speed:

$$\boxed{1 \text{ km} = 1000 \text{ m}}$$

Thus,

$$\boxed{\text{Distance in metres} = \text{Distance in km} \times 1000}$$

The chapter demonstrates this conversion while calculating the speed of a bicycle in m/s.

Speed Unit Conversions

From the relationships used in the chapter:

9. km/h to m/s

$$\boxed{\text{Speed in m/s} = \text{Speed in km/h} \times \frac{5}{18}}$$

10. m/s to km/h

$$\boxed{\text{Speed in km/h} = \text{Speed in m/s} \times \frac{18}{5}}$$

These follow from:

$$1 \text{ km} = 1000 \text{ m and } 1 \text{ h} = 3600 \text{ s}$$

Quick Formula Table

Quantity to Find	**Formula**
Speed	$v = \frac{d}{t}$
Distance	$d = v \times t$
Time	$t = \frac{d}{v}$
Average Speed	$\frac{\text{Total Distance}}{\text{Total Time}}$

Quantity to Find	Formula
Pendulum Time Period	$T = \frac{\text{Total Time}}{\text{Number of Oscillations}}$
km/h → m/s	Multiply by $\frac{5}{18}$
m/s → km/h	Multiply by $\frac{18}{5}$
Minutes → Seconds	Multiply by 60
Hours → Minutes	Multiply by 60
Hours → Seconds	Multiply by 3600
Kilometres → Metres	Multiply by 1000

Most Important Formula Triangle
For Grade 7 numerical problems, students can remember:

$$\boxed{\begin{array}{c} D \\ S\ T \end{array}}$$

From this:

- **Distance = Speed × Time**
- **Speed = Distance ÷ Time**
- **Time = Distance ÷ Speed**

These three relationships form the main basis for the chapter's quantitative problems, including calculations involving runners, bicycles, cars, buses, and trains.

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

1. Humans initially used repeating events in __________ for timekeeping.
   Answer: nature
2. The rising and setting of the __________ was used to define a day.
   Answer: Sun
3. In a sundial, time is determined by the changing position of the __________ of an object.
   Answer: shadow
4. A water clock measures time using the flow of __________.
   Answer: water
5. An hourglass measures time using the flow of __________ from one bulb to another.
   Answer: sand
6. Candles with markings indicating the passage of time were called __________ clocks.
   Answer: candle
7. The sinking bowl-type water clock used in ancient India was known as the __________.
   Answer: Ghatika-yantra
8. The Samrat Yantra, the world's largest stone sundial, is located at Jantar Mantar in __________.
   Answer: Jaipur

Ancient time-measuring devices discussed in the chapter include sundials, water clocks, hourglasses, and candle clocks.

9. The pendulum clock was invented by __________.
   Answer: Christiaan Huygens
10. The pendulum clock was invented in the year __________.
   Answer: 1656

11. Huygens was inspired by the investigations of pendulums carried out by __________.
    Answer: Galileo Galilei
12. The small metallic ball of a simple pendulum is called its __________.
    Answer: bob
13. A pendulum at rest is in its __________ position.
    Answer: mean
14. The motion of a pendulum is __________ in nature because it repeats its path after a fixed interval of time.
    Answer: periodic
15. One complete to-and-fro movement of a pendulum is called an __________.
    Answer: oscillation
16. The time taken by a pendulum to complete one oscillation is called its __________.
    Answer: time period
17. The time period of a simple pendulum depends on its __________.
    Answer: length
18. The time period of a simple pendulum does not depend on the __________ of its bob.
    Answer: mass
19. Modern quartz clocks use vibrations of a __________ crystal.
    Answer: quartz
20. The most precise modern clocks mentioned in the chapter are __________ clocks.
    Answer: atomic
21. The SI unit of time is the __________.
    Answer: second
22. The symbol for second is __________.
    Answer: s
23. One minute is equal to __________ seconds.
    Answer: 60
24. One hour is equal to __________ minutes.
    Answer: 60
25. The distance covered by an object in unit time is called its __________.
    Answer: speed
26. Speed is calculated by dividing the total distance covered by the total __________ taken.
    Answer: time
27. The SI unit of speed is __________.
    Answer: metre per second (m/s)
28. When distance is expressed in kilometres and time in hours, speed is expressed in __________.
    Answer: kilometre per hour (km/h)
29. An instrument in a vehicle that measures and displays its speed is called a __________.
    Answer: speedometer
30. An instrument fitted in a vehicle to measure the distance travelled is called an __________.
    Answer: odometer

Additional LOTS Questions for Practice

31. An object moving along a straight line with constant speed is said to be in __________ linear motion.
    Answer: uniform

32. In uniform linear motion, an object covers __________ distances in equal intervals of time.
Answer: equal
33. When the speed of an object moving along a straight line keeps changing, its motion is called __________ linear motion.
Answer: non-uniform
34. In non-uniform linear motion, an object covers __________ distances in equal intervals of time.
Answer: unequal
35. The speed calculated by dividing the total distance travelled by the total time taken is actually the __________ speed.
Answer: average
36. Total distance covered = Speed × Total __________ taken.
Answer: time
37. Total time taken = Total distance covered ÷ __________.
Answer: speed
38. The smallest interval of time measurable using the wall clock shown in the chapter is one __________.
Answer: second
39. Someone who covers more distance within the same time is considered __________.
Answer: faster
40. Uniform linear motion is considered an __________ because objects seldom maintain constant speed for long intervals in everyday life.
Answer: idealisation

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

1. Two runners cover the same distance, but Riya takes less time than Meera. Therefore, Riya has a __________ speed.
Answer: higher
2. Two cyclists ride for the same amount of time. If Cyclist A covers 5 km and Cyclist B covers 7 km, Cyclist __________ is faster.
Answer: B
3. A runner covers 100 m in 20 s. His speed is __________ m/s.
Answer: 5
4. A car travels 120 km in 2 h. Its average speed is __________ km/h.
Answer: 60
5. A train moving at 80 km/h for 3 h will cover a distance of __________ km.
Answer: 240
6. A bus travels 150 km at a speed of 50 km/h. The time taken is __________ hours.
Answer: 3

These applications follow the chapter's relationship: **Speed = Distance ÷ Time**, **Distance = Speed × Time**, and **Time = Distance ÷ Speed**.

7. A cyclist covers 600 m in 2 minutes. After converting the time into seconds, the cyclist's speed is __________ m/s.
Answer: 5
8. A car covers 150 m in 10 s. Its speed is __________ m/s.
Answer: 15
9. A train covers 180 km in 3 h. Its speed is __________ km/h.
Answer: 60

10. A train travels at 25 m/s for 100 s. The distance travelled by it is __________ m.
    Answer: 2500
11. Two runners cover 400 m in 50 s and 40 s respectively. The __________ runner has the greater speed.
    Answer: second
12. If the distance travelled by an object doubles while the time taken remains the same, its speed becomes __________.
    Answer: double
13. If an object covers the same distance in twice the time, its speed becomes __________ of the original speed.
    Answer: half

The chapter explains that the object covering more distance in the same time is faster and defines speed as distance covered per unit time.

14. Two pendulums of the same length but having bobs of different masses will have __________ time periods at the same location.
    Answer: the same
15. If the length of a simple pendulum is changed, its time period will also __________.
    Answer: change
16. If only the mass of the pendulum bob is changed while its length remains fixed, its time period will __________.
    Answer: remain unchanged
17. A pendulum takes 20 s to complete 10 oscillations. Its time period is __________ s.
    Answer: 2
18. A pendulum takes 30 s for 15 oscillations. The time taken for one oscillation is __________ s.
    Answer: 2

These inferences are based on the experimental observation that the time period depends on pendulum length but not on the bob's mass.

19. A car covers 20 km every 20 minutes along a straight road. Its motion can be classified as __________ linear motion.
    Answer: uniform
20. A bus covers 10 km in the first 10 minutes, 15 km in the next 10 minutes, and 8 km in the following 10 minutes. Its motion is __________ linear motion.
    Answer: non-uniform
21. If a train covers equal distances in equal intervals of time along a straight track, it is undergoing __________ linear motion.
    Answer: uniform
22. A car moving through crowded city traffic repeatedly speeds up and slows down. Its motion is most likely __________.
    Answer: non-uniform
23. In the chapter's Table 8.3, Train X covers 20 km during every 10-minute interval; hence Train X shows __________ linear motion.
    Answer: uniform
24. In the same table, Train Y covers different distances during successive equal time intervals; hence its motion is __________.
    Answer: non-uniform
25. If an object moving along a straight line covers unequal distances in equal intervals of time, its speed must be __________.
    Answer: changing

The chapter uses the train data on **page 117** to demonstrate that equal distances in equal time intervals indicate uniform motion, whereas unequal distances indicate non-uniform motion.

Additional Challenging HOTS Questions

26. A car travels 60 km in the first hour, 70 km in the second hour, and 50 km in the third hour. Its total distance is 180 km, so its average speed is __________ km/h.
    Answer: 60
27. Since the car in Question 26 covers different distances during equal one-hour intervals, its motion is __________.
    Answer: non-uniform
28. A vehicle travels 200 km in 4 h but changes its speed several times during the journey. Its calculated speed of 50 km/h represents its __________ speed.
    Answer: average
29. A speedometer shows how fast a vehicle is moving, whereas an __________ records the distance travelled by it.
    Answer: odometer
30. Modern atomic clocks are preferred when extremely precise time measurement is required because their measurements are much more __________ than those of early pendulum clocks.
    Answer: accurate

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

1. **What is a sundial?**
   Answer: A sundial is a device that determines time using the changing position of a shadow cast by sunlight.
2. **How does a water clock measure time?**
   Answer: A water clock measures time using the controlled flow of water into or out of a vessel.
3. **How does an hourglass measure time?**
   Answer: An hourglass measures time by the flow of sand from one bulb to another.
4. **What is a candle clock?**
   Answer: A candle clock is a marked candle that indicates the passage of time as it burns.
5. **Name any two ancient devices used to measure time.**
   Answer: Sundials and water clocks are two ancient devices used to measure time.
6. **What is the Ghatika-yantra?**
   Answer: The Ghatika-yantra is a sinking bowl-type water clock used for measuring time in ancient India.
7. **Who invented the pendulum clock?**
   Answer: Christiaan Huygens invented the pendulum clock in 1656.
8. **Whose investigations of pendulums inspired Christiaan Huygens?**
   Answer: Christiaan Huygens was inspired by the investigations of Galileo Galilei.
9. **What is a simple pendulum?**
   Answer: A simple pendulum consists of a small metallic ball called a bob suspended from a rigid support by a long thread.
10. **What is the bob of a pendulum?**
    Answer: The small metallic ball suspended by the thread of a pendulum is called its bob.
11. **What is the mean position of a pendulum?**
    Answer: The position of the pendulum when it is at rest is called its mean position.

12. **What is one oscillation of a pendulum?**
    Answer: One oscillation is one complete to-and-fro movement of the pendulum bob.
13. **What is the time period of a pendulum?**
    Answer: The time taken by a pendulum to complete one oscillation is called its time period.
14. **What type of motion does an oscillating pendulum show?**
    Answer: An oscillating pendulum shows periodic motion because its path repeats after a fixed interval of time.
15. **On what factor does the time period of a simple pendulum depend?**
    Answer: The time period of a simple pendulum depends on its length.
16. **Does the mass of the bob affect the time period of a simple pendulum?**
    Answer: No, the mass of the bob does not affect the time period of a simple pendulum.
17. **What is the SI unit of time?**
    Answer: The SI unit of time is the second (s).
18. **How many seconds are there in one minute?**
    Answer: There are 60 seconds in one minute.
19. **How many minutes are there in one hour?**
    Answer: There are 60 minutes in one hour.
20. **What is speed?**
    Answer: Speed is the distance covered by an object in unit time.
21. **How is the speed of an object calculated?**
    Answer: Speed is calculated by dividing the total distance covered by the total time taken.
22. **What is the SI unit of speed?**
    Answer: The SI unit of speed is metre per second (m/s).
23. **What is another commonly used unit of speed?**
    Answer: Kilometre per hour (km/h) is another commonly used unit of speed.
24. **What is average speed?**
    Answer: Average speed is the total distance covered divided by the total time taken to cover it.
25. **What is linear motion?**
    Answer: The motion of an object along a straight line is called linear motion.
26. **What is uniform linear motion?**
    Answer: The motion of an object along a straight line at a constant speed is called uniform linear motion.
27. **What is non-uniform linear motion?**
    Answer: The motion of an object along a straight line with changing speed is called non-uniform linear motion.
28. **What distances are covered in equal intervals of time during uniform linear motion?**
    Answer: An object in uniform linear motion covers equal distances in equal intervals of time.
29. **What distances are covered in equal intervals of time during non-uniform linear motion?**
    Answer: An object in non-uniform linear motion covers unequal distances in equal intervals of time.
30. **What is a speedometer?**
    Answer: A speedometer is an instrument that measures and displays the speed of a vehicle.

31. **What is an odometer?**
 Answer: An odometer is an instrument that measures the distance travelled by a vehicle.
32. **What basic principle is used in clocks to measure time?**
 Answer: Clocks measure time using processes that repeat periodically at equal intervals.
33. **What type of vibrations are used in quartz clocks?**
 Answer: Quartz clocks use rapid vibrations of a quartz crystal.
34. **What do atomic clocks use for measuring time?**
 Answer: Atomic clocks use vibrations associated with specific atoms for measuring time.
35. **What is the smallest interval of time measurable by the wall clock shown in the chapter?**
 Answer: The smallest interval measurable by the wall clock shown is one second.

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

1. **Why can a sundial not be used effectively at night?**
 Answer: A sundial cannot be used at night because it requires sunlight to produce the shadow used for measuring time.
2. **Why might a water clock with water flowing out become less accurate as time passes?**
 Answer: As the water level decreases, the rate of flow also decreases, making the clock less accurate.
3. **Why is the motion of a simple pendulum considered periodic?**
 Answer: The motion is periodic because the pendulum repeats its path after a fixed interval of time.
4. **A pendulum takes 20 seconds for 10 oscillations; what is its time period?**
 Answer: Its time period is 20 ÷ 10 = **2 seconds**.
5. **If two pendulums of the same length have bobs of different masses, how will their time periods compare?**
 Answer: Their time periods will be the same because the time period does not depend on the mass of the bob.
6. **What would happen to the time period if the length of a simple pendulum is changed?**
 Answer: The time period would change because it depends on the length of the pendulum.
7. **Why is it better to measure the time for 10 oscillations rather than only one oscillation?**
 Answer: Measuring several oscillations reduces the effect of small timing errors and gives a more reliable time period.
8. **Why are atomic clocks more suitable than pendulum clocks for extremely precise measurements?**
 Answer: Atomic clocks are more suitable because they are far more precise and lose only about one second in millions of years.
9. **Two runners cover the same distance, but one takes less time; who has the higher speed?**
 Answer: The runner who takes less time has the higher speed.

10. **Two cyclists ride for the same amount of time but cover different distances; who is faster?**
Answer: The cyclist who covers the greater distance in the same time is faster.
11. **A student walks 100 m in 20 s; what is the student's speed?**
Answer: The student's speed is **100 ÷ 20 = 5 m/s**.
12. **A car travels at 60 km/h for 2 hours; how far does it travel?**
Answer: The car travels **60 × 2 = 120 km**.
13. **A bus travels 150 km at 50 km/h; how long does the journey take?**
Answer: The bus takes **150 ÷ 50 = 3 hours**.
14. **If the speed of an object doubles while the travelling time remains the same, what happens to the distance covered?**
Answer: The distance covered doubles because distance equals speed multiplied by time.
15. **If an object covers the same distance in half the original time, what happens to its speed?**
Answer: Its speed becomes twice the original speed.
16. **A car covers 20 km every 30 minutes on a straight road; what type of motion does it show?**
Answer: It shows uniform linear motion because it covers equal distances in equal intervals of time.
17. **A bus covers 10 km, 15 km, and 20 km in three successive equal time intervals; what type of motion does it show?**
Answer: It shows non-uniform linear motion because it covers unequal distances in equal intervals of time.
18. **Why is the motion of a car in city traffic generally non-uniform?**
Answer: Its motion is generally non-uniform because its speed keeps changing due to traffic, signals, and stops.
19. **Why is uniform linear motion less common in everyday life?**
Answer: Uniform linear motion is less common because objects seldom maintain a constant speed for long periods or distances.
20. **A train covers 120 km in 2 hours; what is its average speed?**
Answer: Its average speed is **120 ÷ 2 = 60 km/h**.
21. **A car travels at different speeds during a journey; why can its overall speed still be calculated?**
Answer: Its average speed can be calculated by dividing the total distance travelled by the total time taken.
22. **A speedometer shows 50 km/h; what information does this provide to the driver?**
Answer: It tells the driver that the vehicle's speed at that time is 50 km/h.
23. **Why would an odometer be useful when calculating the average speed of a journey?**
Answer: An odometer provides the distance travelled, which can be divided by the total journey time to calculate average speed.
24. **Why are very precise time-measuring devices important in sprint races?**
Answer: They help distinguish winners when runners finish within tiny fractions of a second.
25. **If two trains cover 120 km in the same total time but one changes its speed repeatedly, can both have the same average speed?**
Answer: Yes, both can have the same average speed if their total distances and total times are equal.

26. **A train covers 20 km in every 10-minute interval; what can you infer about its motion?**
    Answer: The train is in uniform linear motion because it covers equal distances in equal time intervals.
27. **Train X covers 20 km in every 10 minutes, while Train Y covers different distances in successive 10-minute intervals; which train has uniform motion?**
    Answer: Train X has uniform motion because it covers equal distances in equal intervals of time.
28. **If a child of greater weight sits on the same playground swing, should the swing's time period change significantly?**
    Answer: It should remain almost the same because the time period of a pendulum does not depend on the mass of its bob.
29. **Why should repeated readings be taken while measuring a pendulum's time period?**
    Answer: Repeated readings help identify small experimental errors and improve the reliability of the result.
30. **Why do scientists continue developing more accurate clocks even though modern clocks are already precise?**
    Answer: Greater accuracy is needed for applications such as space exploration, medicine, sports, and advanced scientific experiments.

8.7 Two-mark questions with Answers of LOTS Type: (28 Questions)

1. What natural events were used by humans in ancient times to keep track of time?
Answer:
1. Humans observed repeating natural events such as the rising and setting of the Sun, phases of the Moon, and changing seasons.
2. The cycles of these events were used for timekeeping and developing calendars.

2. What is a sundial? How does it measure time?
Answer:
1. A sundial is an ancient device used for measuring time during the day.
2. It determines time from the changing position of the shadow of an object cast by sunlight.

3. Explain the working of a water clock.
Answer:
1. A water clock measures time by allowing water to flow into or out of a vessel.
2. The changing water level or the time taken for a floating bowl to fill and sink indicates the passage of time.

4. How do an hourglass and a candle clock measure time?
Answer:
1. An hourglass measures time by the flow of sand from one bulb to another.
2. A candle clock uses markings on a burning candle to indicate the passage of time.

5. What is a simple pendulum? Name its main parts.
Answer:
1. A simple pendulum consists of a small metallic ball called a bob suspended by a long thread from a rigid support.
2. Its main parts are the **bob, long thread, and rigid support**.

6. What are the mean and extreme positions of a pendulum?
Answer:
1. The position of the pendulum when it is at rest is called its **mean position**.

2. The farthest positions reached by the bob on either side of the mean position are called its **extreme positions**.

7. What is one oscillation of a simple pendulum?
Answer:
1. One oscillation occurs when the bob moves from its mean position to one extreme, then to the other extreme, and returns to the mean position.
2. It can also be counted when the bob moves from one extreme position to the other and returns to the starting extreme position.

8. What is the time period of a simple pendulum? How can it be measured?
Answer:
1. The time taken by a pendulum to complete one oscillation is called its **time period**.
2. It can be calculated by dividing the total time taken for a number of oscillations by the number of oscillations.

9. State two facts about the time period of a simple pendulum.
Answer:
1. The time period of a simple pendulum depends on its length but not on the mass of its bob.
2. Pendulums of the same length have the same time period at a given location.

10. What principle is used in clocks to measure time?
Answer:
1. Clocks are based on a process that repeats continuously at equal intervals of time.
2. Modern clocks use rapid periodic vibrations of quartz crystals or specific atoms for measuring time.

11. What is the SI unit of time? Mention two larger units of time.
Answer:
1. The SI unit of time is the **second**, represented by the symbol **s**.
2. Larger units are the **minute (min)** and **hour (h)**, where 60 s = 1 min and 60 min = 1 h.

12. What is speed? How is it calculated?
Answer:
1. Speed is the distance covered by an object in a unit time.
2. It is calculated using the formula **Speed = Total distance covered ÷ Total time taken**.

13. State the SI unit of speed and one other commonly used unit.
Answer:
1. The SI unit of speed is **metre per second (m/s)**.
2. Another commonly used unit of speed is **kilometre per hour (km/h)**.

14. Write the relationships among speed, distance, and time.
Answer:
1. **Distance = Speed × Time.**
2. **Time = Distance ÷ Speed**, while speed is calculated as distance divided by time.

15. What is average speed? Why is it useful?
Answer:
1. Average speed is calculated by dividing the total distance covered by the total time taken.
2. It is useful when an object moves at different speeds during different parts of its journey.

16. What is linear motion? Give one example.
Answer:
1. The motion of an object along a straight line is called **linear motion**.

2. A train moving along a straight railway track between two stations is an example of linear motion.

17. What is uniform linear motion?

Answer:

1. An object moving along a straight line with constant speed is said to be in **uniform linear motion**.
2. Such an object covers equal distances in equal intervals of time.

18. What is non-uniform linear motion?

Answer:

1. An object moving along a straight line with continuously changing speed is said to be in **non-uniform linear motion**.
2. In such motion, the object covers unequal distances in equal intervals of time.

19. What are a speedometer and an odometer?

Answer:

1. A **speedometer** is an instrument fitted in a vehicle to measure and display its speed, usually in km/h.
2. An **odometer** is an instrument that measures the total distance travelled by the vehicle in kilometres.

20. Why is accurate measurement of very small intervals of time important? Give examples.

Answer:

1. Very small time intervals are important for accurately recording events in fields such as sports, medicine, computing, and scientific research.
2. For example, sports timing devices measure fractions of a second to identify winners, while ECG machines measure millisecond variations in heartbeats.

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

1. Two pendulums have the same length but bobs of different masses. Will their time periods be different? Give a reason.

Answer:

1. No, both pendulums will have the same time period at the same location.
2. This is because the time period depends on the length of the pendulum and not on the mass of its bob.

2. A student increases the length of a pendulum but keeps the same bob. What change would you expect in its time period?

Answer:

1. The time period will change when the length of the pendulum is changed.
2. Therefore, pendulums of different lengths should not be expected to have the same time period.

3. Why is measuring the time for 10 oscillations more useful than measuring just one oscillation in a pendulum experiment?

Answer:

1. Measuring several oscillations makes it easier to obtain a reliable value for the time period.
2. The time taken for 10 oscillations can be divided by 10 to calculate the time period of one oscillation.

4. A student pushes the bob while releasing a pendulum. Why might this affect the experiment?

Answer:

1. The pendulum should be moved slightly to one side and released gently without pushing it.
2. Pushing it does not follow the prescribed experimental procedure and can make the observations less reliable.

5. Why would a sundial not be suitable for measuring time at night?
Answer:

1. A sundial determines time using the changing position of a shadow produced by sunlight.
2. Since sunlight is unavailable at night, the required shadow cannot be used for time measurement.

6. Why was the sinking-bowl water clock an improvement over some earlier water clocks?
Answer:

1. In water-flowing-out clocks, the flow rate decreased as the water level dropped, reducing accuracy.
2. This limitation contributed to the development of the sinking-bowl water clock or Ghatika-yantra.

7. Two runners cover the same distance, but Runner A takes less time than Runner B. Who has the greater speed? Why?
Answer:

1. Runner A has the greater speed because the same distance is covered in less time.
2. Since speed equals distance divided by time, a smaller time for the same distance gives a higher speed.

8. Runner P covers 100 m in 20 s and Runner Q covers 100 m in 25 s. Compare their speeds.
Answer:

1. P's speed = 100 ÷ 20 = **5 m/s**, while Q's speed = 100 ÷ 25 = **4 m/s**.
2. Therefore, Runner P is faster than Runner Q by **1 m/s**.

9. Two cyclists travel for the same amount of time, but one covers a greater distance. Which cyclist is faster? Explain.
Answer:

1. The cyclist who covers the greater distance in the same time is faster.
2. An object that covers more distance in a given interval of time has a higher speed.

10. A car travels 120 km in 2 hours. If it maintains the same speed, how far will it travel in 5 hours?
Answer:

1. Speed = 120 ÷ 2 = **60 km/h**.
2. Distance in 5 h = 60 × 5 = **300 km**.

11. A train travels at 80 km/h. How much time will it take to travel 240 km?
Answer:

1. Time = Distance ÷ Speed = 240 ÷ 80.
2. Therefore, the train will take **3 hours** to cover 240 km.

12. A car covers 40 km in the first hour and 60 km in the second hour. Is its motion uniform? Why?
Answer:

1. No, the car is in non-uniform motion because it covers unequal distances in equal one-hour intervals.
2. In uniform linear motion, an object must cover equal distances in equal intervals of time.

13. A train covers 20 km every 10 minutes for one hour. What can you conclude about its motion?
Answer:
1. The train covers equal distances in equal intervals of time and therefore has constant speed.
2. Hence, if it is moving along a straight line, it is in **uniform linear motion**.

14. Why is the motion of a car in city traffic usually non-uniform?
Answer:
1. A car in city traffic repeatedly speeds up, slows down, or stops because of traffic and other conditions.
2. Since its speed keeps changing while moving, its motion is generally non-uniform.

15. A vehicle's speedometer shows 60 km/h while its odometer reading changes from 12,500 km to 12,530 km. What information do the two instruments provide?
Answer:
1. The speedometer indicates the vehicle's speed, while the odometer shows the distance travelled.
2. Here, the displayed speed is **60 km/h**, and the change in odometer reading shows that the vehicle has travelled **30 km**.

16. Train X covers 20 km every 10 minutes, while Train Y covers 20 km, 15 km, 15 km, 25 km, 20 km, and 25 km in successive 10-minute intervals. Compare their motions.
Answer:
1. Train X is in uniform linear motion because it covers equal distances in equal intervals of time.
2. Train Y is in non-uniform linear motion because the distances covered during equal intervals keep changing.

17. A car travels 60 km in the first hour, 70 km in the second hour, and 50 km in the third hour. Calculate its average speed and identify its type of motion.
Answer:
1. Average speed = (60 + 70 + 50) ÷ 3 = **60 km/h**.
2. Its motion is non-uniform because it covers unequal distances during equal one-hour intervals.

18. Why can two objects have the same average speed even though their motions during the journey are different?
Answer:
1. Average speed depends on the **total distance covered and total time taken**, not on the speed during every part of the journey.
2. Therefore, two objects with different changes in speed can still have the same average speed if their total-distance-to-total-time ratios are equal.

19. Why are highly accurate clocks especially important in a close sprint race?
Answer:
1. Two runners may appear to cross the finish line almost together, making ordinary observation insufficient to identify the winner accurately.
2. Modern sports timing devices can measure hundredths or thousandths of a second, allowing very small differences in finishing times to be detected.

20. A student says, "If two vehicles cover the same total distance, they must have the same speed." Is the statement correct? Justify.
Answer:
1. No, the statement is incorrect because speed depends on both the distance covered and the time taken.
2. For the same distance, the vehicle taking less time will have the greater speed.

8.9. Three-mark questions with Answers of LOTS Type: (10 Questions)

1. Name and explain any three ancient devices used for measuring time.
Answer:
1. A **sundial** measures time using the changing position of the shadow cast by sunlight.
2. A **water clock** measures time using the flow of water into or out of a vessel.
3. An **hourglass** measures time by the flow of sand from one bulb to another.

2. Explain how a simple water clock can be constructed using a plastic bottle.
Answer:
1. Cut a transparent plastic bottle into two parts and make a small hole in its cap.
2. Place the upper part upside down over the lower part and fill it with water.
3. Allow the water to drip down and mark the water level at every one-minute interval using a watch.

3. What is a simple pendulum? Name its main parts.
Answer:
1. A simple pendulum consists of a small metallic ball called a **bob**, suspended by a long thread.
2. The upper end of the thread is attached to a **rigid support**.
3. Its important parts are therefore the **bob, thread, and rigid support**.

4. Explain one complete oscillation of a simple pendulum.
Answer:
1. The bob starts from its mean position O and moves towards one extreme position A.
2. It then changes direction, passes through O, and reaches the other extreme position B.
3. When it changes direction again and returns to O, it completes **one oscillation**.

5. What is the time period of a pendulum? State two important facts about it.
Answer:
1. The time taken by a pendulum to complete one oscillation is called its **time period**.
2. The time period of a simple pendulum depends on its length but not on the mass of its bob.
3. Pendulums of the same length have the same time period at a given location.

6. Describe how the time period of a simple pendulum can be measured experimentally.
Answer:
1. Move the bob slightly to one side, release it gently, and measure the time taken for 10 oscillations.
2. Repeat the measurement three or four times to obtain reliable readings.
3. Divide the time taken for 10 oscillations by 10 to calculate the time period of the pendulum.

7. State the SI unit of time and explain the relationship among second, minute, and hour.
Answer:
1. The SI unit of time is the **second**, represented by the symbol **s**.
2. **60 seconds = 1 minute (min).**
3. **60 minutes = 1 hour (h).**

8. Explain the basic principle used in modern clocks.
Answer:
1. All clocks are based on some process that repeats continuously at equal intervals.
2. Quartz clocks use tiny and rapid vibrations of a quartz crystal.
3. Atomic clocks use vibrations associated with specific atoms and are extremely precise.

9. Define speed and mention its commonly used units.
Answer:
1. Speed is the **distance covered by an object in a unit time**.
2. The SI unit of speed is **metre per second (m/s)**.
3. Speed can also be expressed in **kilometre per hour (km/h)**.

10. State the relationship between speed, distance, and time.
Answer:
1. **Speed = Total distance covered ÷ Total time taken.**
2. **Distance = Speed × Time.**
3. **Time = Distance ÷ Speed.**

11. What is average speed? Why is it commonly used?
Answer:
1. Average speed is calculated by dividing the **total distance covered by the total time taken**.
2. An object may sometimes move faster and sometimes slower during its journey.
3. Therefore, average speed is useful for describing motion when speed does not remain constant throughout the journey.

12. What is linear motion? Explain it using the example of a train.
Answer:
1. When an object moves along a straight line, its motion is called **linear motion**.
2. A train moving on a straight railway track between two stations is an example of linear motion.
3. During its journey, the train may move slowly, faster, at constant speed, and then slow down before stopping.

13. What is uniform linear motion? State its main characteristics.
Answer:
1. An object moving along a straight line with constant speed is said to be in **uniform linear motion**.
2. Its speed remains unchanged during the motion.
3. Such an object covers **equal distances in equal intervals of time**.

14. What is non-uniform linear motion? State its characteristics.
Answer:
1. An object moving along a straight line with continuously changing speed is said to be in **non-uniform linear motion**.
2. Its speed does not remain constant during its journey.
3. It covers **unequal distances in equal intervals of time**.

15. What are a speedometer and an odometer? Explain their functions.
Answer:
1. A **speedometer** is an instrument fitted in a vehicle to measure and display its speed.
2. Vehicle speed is generally displayed by the speedometer in **km/h**.
3. An **odometer** measures the total distance travelled by the vehicle in kilometres.

8.10. Three-mark questions with Answers of HOTS Type: (20 Questions)

1. Two pendulums have the same length but bobs of different masses. Predict their time periods and justify your answer.
Answer:
1. Both pendulums will have approximately the **same time period** at the same location.
2. The time period of a simple pendulum depends on its **length and not on the mass of its bob**.

3. Therefore, changing only the mass of the bob will not change the time period.

2. A student changes the length of a pendulum but keeps the same bob. What change would you expect in its time period? How could the student verify it?

Answer:

1. The time period will change because the time period of a simple pendulum depends on its length.
2. The student can measure the time taken for 10 oscillations for pendulums of different lengths.
3. Dividing each measured time by 10 and comparing the results will show how length affects the time period.

3. A runner covers 400 m in 50 s, while another runner covers 400 m in 40 s. Who is faster and why?

Answer:

1. Speed of the first runner = 400 ÷ 50 = **8 m/s**.
2. Speed of the second runner = 400 ÷ 40 = **10 m/s**.
3. Therefore, the second runner is faster because the same distance is covered in less time.

4. A car travels 120 km in 2 hours and another car travels 180 km in 3 hours. Which car is faster? Explain your reasoning.

Answer:

1. Speed of the first car = 120 ÷ 2 = **60 km/h**.
2. Speed of the second car = 180 ÷ 3 = **60 km/h**.
3. Therefore, both cars have the same average speed even though they cover different distances.

5. A car covers 60 km in the first hour, 70 km in the second hour, and 50 km in the third hour. Analyse its motion and calculate its average speed.

Answer:

1. The car covers unequal distances in equal intervals of one hour, so its motion is **non-uniform**.
2. Total distance = 60 + 70 + 50 = **180 km**, and total time = **3 h**.
3. Average speed = 180 ÷ 3 = **60 km/h**.

6. Train X covers 20 km every 10 minutes, while Train Y covers different distances during successive 10-minute intervals. What can you infer about their motion?

Answer:

1. Train X covers equal distances in equal intervals of time and hence has **uniform linear motion**.
2. Train Y covers unequal distances in equal intervals and hence has **non-uniform linear motion**.
3. Thus, the distance covered during equal time intervals can be used to identify the nature of motion.

7. Why would a sundial be unsuitable for measuring the time of a night-time sports event? Suggest a better alternative.

Answer:

1. A sundial determines time from the changing position of a shadow produced by **sunlight**.
2. At night, sunlight is unavailable, so the required shadow cannot be produced.
3. A modern clock or stopwatch would therefore be more suitable for timing the event.

8. A bus moves at 50 km/h for 2 hours. If another bus has to cover the same distance in 1 hour, calculate the required speed of the second bus.

Answer:

1. Distance travelled by the first bus = 50 × 2 = **100 km**.
2. Required speed of the second bus = 100 ÷ 1 = **100 km/h**.
3. Thus, to cover the same distance in half the time, the second bus must travel at twice the speed.

9. A student measures the time for one pendulum oscillation several times and gets slightly different readings. What could the student do to obtain a more reliable time period?
Answer:
1. Instead of timing one oscillation, the student should measure the time taken for **10 oscillations**.
2. The experiment should be repeated three or four times to reduce the effect of measurement errors.
3. The time for 10 oscillations should be divided by 10 to determine a more reliable time period.

10. A train travels at 90 km/h. Calculate the distance it will cover in 30 minutes and explain your method.
Answer:
1. Convert 30 minutes into hours: 30 min = **0.5 h**.
2. Distance = Speed × Time = 90 × 0.5 = **45 km**.
3. Therefore, the train will cover **45 km in 30 minutes**.

11. A vehicle travels 150 km in 3 hours, but its speedometer does not show the same speed throughout the journey. How can its speed still be stated as 50 km/h?
Answer:
1. Average speed = Total distance ÷ Total time = 150 ÷ 3 = **50 km/h**.
2. The vehicle may have moved faster or slower during different parts of the journey.
3. Hence, 50 km/h represents its **average speed**, not necessarily its speed at every moment.

12. A car moves on a straight highway at a constant speed and later enters busy city traffic. Compare the nature of its motion in the two situations.
Answer:
1. On the straight highway, if its speed remains constant, the car undergoes **uniform linear motion**.
2. In city traffic, the car repeatedly speeds up, slows down, and stops, resulting in **non-uniform linear motion**.
3. Therefore, changes in speed determine whether linear motion is uniform or non-uniform.

13. Why are highly precise clocks particularly important in a 100-metre sprint where two runners appear to finish together?
Answer:
1. Two runners may cross the finish line with only a tiny fraction of a second separating them.
2. Modern sports timekeeping devices can measure hundredths or even thousandths of a second.
3. Such precision makes it possible to determine the winner accurately even when the finish appears simultaneous.

14. A train moves from station A to D. It speeds up from A to B, moves at constant speed from B to C, and slows down from C to D. Classify its motion in each section.
Answer:
1. From **A to B**, its speed changes, so the train has non-uniform linear motion.
2. From **B to C**, it travels at constant speed, so it has uniform linear motion.

3. From **C to D**, it slows down, so its motion is again non-uniform.

15. Two students want to determine whether the mass of a pendulum bob affects its time period. Design a simple investigation for them.
Answer:
1. They should make pendulums of the **same length** but use bobs of different masses.
2. They should measure the time taken for 10 oscillations of each pendulum and calculate their time periods.
3. The nearly equal time periods will show that the time period depends on the pendulum's length and not on the bob's mass.

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

Five-Mark Descriptive Questions with Answers – LOTS Type
1. Explain how time was measured in ancient times using different devices.
Answer:
1. People initially used regularly repeating natural events such as the rising and setting of the Sun, phases of the Moon, and changing seasons to keep track of time.
2. A **sundial** measured time using the changing position of the shadow produced by sunlight.
3. A **water clock** measured time using the controlled flow of water into or out of a vessel.
4. An **hourglass** measured time by the flow of sand from one bulb to another.
5. A **candle clock** used markings on a burning candle to indicate the passage of time.

2. Describe a simple pendulum and explain its oscillatory motion.
Answer:
1. A simple pendulum consists of a small metallic ball called a **bob**, suspended from a rigid support by a long thread.
2. When at rest, the bob remains at its **mean position**.
3. When the bob is moved slightly to one side and released, it begins to move to and fro.
4. One complete movement from the mean position to one extreme, then to the other extreme, and back to the mean position constitutes **one oscillation**.
5. The time taken by the pendulum to complete one oscillation is called its **time period**.

3. Describe the experiment used to determine the time period of a simple pendulum.
Answer:
1. Suspend a bob from a rigid support using a thread of about **100 cm length**.
2. Move the bob slightly to one side and release it gently without pushing it.
3. Using a watch or stopwatch, measure the time taken by the pendulum to complete **10 oscillations**.
4. Repeat the experiment three or four times and record the observations.
5. Divide the time taken for 10 oscillations by 10 to obtain the **time period of the pendulum**.

4. State five important facts about the time period of a simple pendulum.
Answer:
1. The time taken to complete one oscillation is called the **time period** of the pendulum.
2. The time period of a simple pendulum depends on its **length**.
3. The time period does **not depend on the mass of the bob**.
4. Pendulums of the same length have the same time period at a given location.
5. The constant time period of a pendulum of a given length can be used for the **measurement of time**.

5. Define speed and explain its relationship with distance and time.
Answer:

1. **Speed** is the distance covered by an object in a unit time.
2. Speed is calculated using the formula: **Speed = Total distance covered ÷ Total time taken**.
3. The SI unit of speed is **metre per second (m/s)**.
4. Distance can be calculated using: **Distance = Speed × Time**.
5. Time can be calculated using: **Time = Distance ÷ Speed**.

6. Explain the SI unit of time and the correct way of writing units of time.
Answer:

1. The SI unit of time is the **second**, represented by the symbol **s**.
2. Larger units of time include the **minute (min)** and **hour (h)**.
3. **60 seconds = 1 minute**, and **60 minutes = 1 hour**.
4. Symbols such as s, min, and h are written in lowercase and remain singular.
5. A space should always be left between the numerical value and the unit, such as **10 s** or **5 min**.

7. Differentiate between uniform and non-uniform linear motion.
Answer:

1. An object moving along a straight line with constant speed is said to have **uniform linear motion**.
2. In uniform linear motion, an object covers **equal distances in equal intervals of time**.
3. When the speed of an object moving along a straight line keeps changing, it has **non-uniform linear motion**.
4. In non-uniform linear motion, the object covers **unequal distances in equal intervals of time**.
5. For example, a train moving at constant speed on a straight track shows uniform motion, while a train speeding up or slowing down shows non-uniform motion.

8. Explain the development of clocks from early mechanical clocks to modern clocks.
Answer:

1. As civilisation advanced, accurate measurement of time became increasingly important.
2. Mechanical timekeeping devices using **weights, gears, and springs** developed from the fourteenth century onwards.
3. The invention of the **pendulum clock** in the seventeenth century was a major development in timekeeping.
4. Modern quartz clocks use rapid periodic vibrations of **quartz crystals**, while atomic clocks use processes involving specific atoms.
5. Atomic clocks are extremely precise and can lose only about **one second in millions of years**.

9. Explain the functions of a speedometer and an odometer and their importance in vehicles.
Answer:

1. A **speedometer** is an instrument fitted in vehicles to measure and display their speed.
2. The speed of vehicles is generally displayed in **kilometres per hour (km/h)**.
3. An **odometer** is another instrument fitted in vehicles.
4. It measures the **distance travelled by the vehicle in kilometres**.
5. Thus, the speedometer provides information about speed, whereas the odometer records the distance travelled.

10. Explain why accurate measurement of very small intervals of time is important in modern life.
Answer:

1. Modern instruments can measure very small fractions of a second with great accuracy.

2. In sports, precise timekeeping helps determine winners when competitors finish almost simultaneously.
3. In medicine, instruments such as **ECG machines** measure millisecond variations in heartbeats.
4. Smartphones and computers process signals in **microseconds**, enabling very fast operation.
5. Precise time measurement is also important in areas such as digital recording, space exploration, medicine, and advanced scientific experiments.

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

Five-Mark Descriptive Questions with Answers – HOTS Type

1. Two students make pendulums of the same length but use bobs of different masses. Predict whether their time periods will be different. Justify your answer.

Answer:

1. The two pendulums will have almost the **same time period** at the same location.
2. The time period of a simple pendulum depends on its **length**, not on the mass of its bob.
3. Since both pendulums have the same length, changing the mass of the bob will not significantly change their time periods.
4. This can be tested by keeping the length fixed, using bobs of different masses, and measuring the time for the same number of oscillations.
5. Therefore, the experiment demonstrates that **bob mass does not determine the time period of a simple pendulum**.

2. A student observes that a car travels 40 km in the first hour, 60 km in the second hour, and 50 km in the third hour. Analyse its motion and calculate its average speed.

Answer:

1. The car covers different distances—40 km, 60 km, and 50 km—in equal intervals of one hour.
2. Therefore, its speed changes during the journey, indicating **non-uniform motion**.
3. Total distance travelled = 40 + 60 + 50 = **150 km**.
4. Total time taken = **3 h**, so average speed = 150 ÷ 3 = **50 km/h**.
5. Thus, although its average speed is 50 km/h, the car was **not moving uniformly** throughout the journey.

3. Why would a sundial not be suitable for measuring the finishing times of runners in a 100-metre race? Explain.

Answer:

1. A sundial determines time from the changing position of a **shadow produced by sunlight**.
2. It therefore depends on the availability and position of the Sun and cannot function effectively at night or without sufficient sunlight.
3. A 100-metre race requires measurement of very **small intervals of time** to compare runners accurately.
4. Modern sports timekeeping can distinguish intervals as small as one-hundredth or even one-thousandth of a second.
5. Therefore, precise modern timekeeping devices are far more suitable than sundials for deciding the winner of a close race.

4. A train travels on a straight track, first increasing its speed, then maintaining constant speed, and finally slowing down before stopping. Analyse the different types of motion during the journey.

Answer:

1. The train is undergoing **linear motion** because it is moving along a straight track.
2. While its speed is increasing after leaving the station, it is in **non-uniform linear motion**.
3. During the part where it maintains constant speed, it is in **uniform linear motion**.
4. When it slows down before reaching the next station, it again undergoes **non-uniform linear motion**.
5. Thus, a single journey can contain both uniform and non-uniform linear motion depending on whether the train's speed remains constant or changes.

5. Two runners complete a 400 m race. Runner A takes 50 s and Runner B takes 40 s. Compare their speeds and determine who is faster and by how much.

Answer:

1. Speed is calculated using **Speed = Distance ÷ Time**.
2. Speed of Runner A = 400 ÷ 50 = **8 m/s**.
3. Speed of Runner B = 400 ÷ 40 = **10 m/s**.
4. Difference in their speeds = 10 − 8 = **2 m/s**.
5. Therefore, **Runner B is faster than Runner A by 2 m/s** because B covers the same distance in less time.

6. Train X covers 20 km every 10 minutes, while Train Y covers different distances in successive 10-minute intervals. What can you conclude about their motion? Explain.

Answer:

1. Train X covers **equal distances in equal intervals of time**, indicating that its speed remains constant.
2. Therefore, Train X is undergoing **uniform linear motion**.
3. Train Y covers different distances during successive equal intervals of 10 minutes.
4. Hence, Train Y's speed keeps changing and it is undergoing **non-uniform linear motion**.
5. This comparison shows that the pattern of distances covered in equal time intervals can be used to identify whether motion is uniform or non-uniform.

7. A student says, "If two vehicles travel the same distance, both must have the same speed." Evaluate this statement.

Answer:

1. The statement is **incorrect** because speed depends on both distance travelled and time taken.
2. Speed is calculated as **distance divided by time**.
3. Two vehicles may travel the same distance but take different amounts of time to complete it.
4. The vehicle taking less time will have the **higher speed**.
5. Therefore, distance alone cannot be used to compare speeds; **both distance and time must be considered**.

8. Why are atomic clocks more useful than early pendulum clocks when extremely accurate time measurement is required?

Answer:

1. Both pendulum clocks and atomic clocks work using **periodically repeating processes**.
2. Early pendulum clocks could gain or lose about **10 seconds each day**.
3. Atomic clocks use processes involving specific atoms and provide much greater precision.
4. According to the chapter, modern atomic clocks can lose only about **one second in millions of years**.

5. Therefore, atomic clocks are more suitable wherever extremely precise measurement of time is required.

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

Five-Mark Descriptive Questions with Answers – Applied Type
The following questions apply the concepts of **time measurement, simple pendulum, speed, distance, time, average speed, and uniform/non-uniform motion** to practical situations from the chapter.

1. Riya travels 6 km from her home to school by bicycle in 20 minutes. Calculate her speed in m/s. If she wants to reach school in 15 minutes, what speed should she maintain?

Answer:

1. Distance = 6 km = **6000 m**.
2. Time taken = 20 min = **1200 s**.
3. Present speed = Distance ÷ Time = 6000 ÷ 1200 = **5 m/s**.
4. For 15 minutes, time = 15 × 60 = 900 s; required speed = 6000 ÷ 900 = **6.67 m/s**.
5. Therefore, Riya must increase her speed from **5 m/s to approximately 6.67 m/s** to reach school in 15 minutes.

2. During a school sports event, Arun completes a 400 m race in 50 seconds, while Varun completes it in 40 seconds. Calculate their speeds and identify the faster runner.

Answer:

1. Speed of Arun = 400 ÷ 50 = **8 m/s**.
2. Speed of Varun = 400 ÷ 40 = **10 m/s**.
3. Varun's speed is greater than Arun's speed.
4. Difference in speed = 10 − 8 = **2 m/s**.
5. Therefore, **Varun is faster than Arun by 2 m/s** and completes the same distance in less time.

3. A family travels to a city 240 km away by car. If the car maintains an average speed of 60 km/h, calculate the time required. What happens to the journey time if the average speed decreases to 40 km/h?

Answer:

1. Time = Distance ÷ Speed.
2. At 60 km/h, time = 240 ÷ 60 = **4 hours**.
3. At 40 km/h, time = 240 ÷ 40 = **6 hours**.
4. The decrease in average speed increases the journey time by **2 hours**.
5. Thus, for a fixed distance, a vehicle travelling at a lower average speed requires **more time to reach its destination**.

4. A student makes a simple pendulum and finds that it takes 20 seconds to complete 10 oscillations. Calculate its time period. What should the student do to investigate whether the mass of the bob affects its time period?

Answer:

1. Time period = Time taken for oscillations ÷ Number of oscillations.
2. Time period = 20 ÷ 10 = **2 seconds**.
3. The student should keep the **length of the pendulum fixed** and use bobs of different masses.
4. The time for 10 oscillations should be measured for each bob and their time periods compared.
5. The student should find that changing the bob's mass does **not affect the time period significantly**, because the time period depends on the pendulum's length and not on the bob's mass.

5. A car covers 60 km in the first hour, 80 km in the second hour, and 40 km in the third hour. Determine whether its motion is uniform or non-uniform and calculate its average speed.
Answer:
1. The car covers **different distances in equal intervals of one hour**.
2. Hence, its speed changes and its motion is **non-uniform**.
3. Total distance = 60 + 80 + 40 = **180 km**.
4. Total time = 3 h; average speed = 180 ÷ 3 = **60 km/h**.
5. Therefore, the car has **non-uniform motion with an average speed of 60 km/h**.

6. A train travels at 90 km/h for 3 hours. Find the distance travelled. If another train covers the same distance in 2 hours, calculate its speed and identify the faster train.
Answer:
1. Distance travelled by the first train = Speed × Time = 90 × 3 = **270 km**.
2. The second train also travels **270 km**.
3. Speed of second train = 270 ÷ 2 = **135 km/h**.
4. Since 135 km/h > 90 km/h, the second train has the higher speed.
5. Therefore, the **second train is faster by 45 km/h**.

7. While travelling in a car, Meera notices two instruments on the dashboard. One shows 65 km/h and the other shows 24,850 km. Explain what each instrument measures and how the readings are useful.
Answer:
1. The instrument showing **65 km/h is the speedometer**.
2. It measures and displays the **speed of the vehicle**.
3. The instrument showing **24,850 km is the odometer**.
4. The odometer measures the **distance travelled by the vehicle in kilometres**.
5. Thus, the speedometer helps the driver know how fast the vehicle is moving, while the odometer keeps track of the distance travelled.

8. Students make a water clock using a plastic bottle. Explain how they can calibrate and use it to measure a five-minute interval.
Answer:
1. They should make a small hole in the bottle cap and place the upper half of the bottle upside down over the lower half.
2. They should fill the upper part with water and allow it to drip into the lower part.
3. Using a watch, they should **mark the water level after every one minute**.
4. During use, they can observe the water reaching successive markings to count the minutes.
5. When the water reaches the **fifth one-minute marking, five minutes have passed**.

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

Chapter 8: Measurement of Time and Motion
Olympiad-Type Multiple Choice Questions – Grade 7
The following questions are based on the concepts, numerical applications, experiments, and reasoning presented in the uploaded chapter. The chapter defines speed as distance covered per unit time and develops the relationships among speed, distance, and time.
1. A pendulum completes 20 oscillations in 40 seconds. What is its time period?
A) 0.5 s
B) 2 s
C) 20 s
D) 40 s

Answer: B) 2 s
2. Two pendulums P and Q have the same length but their bobs have different masses. At the same location, which statement is correct?
A) P must have a greater time period
B) Q must have a greater time period
C) Both have the same time period
D) Their time periods cannot be compared
Answer: C) Both have the same time period
3. Which of the following changes is expected to affect the time period of a simple pendulum according to the chapter?
A) Changing the mass of the bob
B) Changing the length of the pendulum
C) Changing the colour of the bob
D) Changing the material of the bob only
Answer: B) Changing the length of the pendulum
4. A cyclist covers 600 m in 2 minutes. What is the cyclist's speed?
A) 3 m/s
B) 5 m/s
C) 10 m/s
D) 12 m/s
Answer: B) 5 m/s
5. A car moves at 72 km/h. How far will it travel in 30 minutes?
A) 18 km
B) 24 km
C) 36 km
D) 72 km
Answer: C) 36 km
6. A train covers 240 km in 4 hours. Its average speed is:
A) 40 km/h
B) 50 km/h
C) 60 km/h
D) 80 km/h
Answer: C) 60 km/h
7. A runner covers 100 m in 10 s and another runner covers 150 m in 15 s. Which is correct?
A) First runner is faster
B) Second runner is faster
C) Both have the same speed
D) There is insufficient information
Answer: C) Both have the same speed
8. Which pair is correctly matched?
A) Speedometer — distance travelled
B) Odometer — speed of vehicle
C) Speedometer — speed of vehicle
D) Sundial — flow of water
Answer: C) Speedometer — speed of vehicle
The chapter distinguishes a speedometer, which displays vehicle speed, from an odometer, which measures distance travelled.
9. A car covers equal distances in equal intervals of time along a straight road. Its motion is:
A) Circular motion
B) Non-uniform linear motion

C) Uniform linear motion
D) Oscillatory motion
Answer: C) Uniform linear motion
10. A car travels 20 km in the first 30 minutes and 30 km in the next 30 minutes along a straight road. Its motion during these intervals is:
A) Uniform
B) Non-uniform
C) Periodic
D) Oscillatory
Answer: B) Non-uniform
11. A bus travelling at 50 km/h takes 3 hours to reach its destination. What distance does it cover?
A) 100 km
B) 150 km
C) 200 km
D) 250 km
Answer: B) 150 km
12. A train travels 360 km at an average speed of 90 km/h. The time taken is:
A) 2 h
B) 3 h
C) 4 h
D) 5 h
Answer: C) 4 h
13. Which of the following represents the correct relationship?
A) Speed = Time ÷ Distance
B) Distance = Speed ÷ Time
C) Time = Speed × Distance
D) Distance = Speed × Time
Answer: D) Distance = Speed × Time
14. A boy walks at 2 m/s for 5 minutes. What distance does he cover?
A) 150 m
B) 300 m
C) 600 m
D) 1,000 m
Answer: C) 600 m
15. Which ancient time-measuring device depends directly on the changing position of a shadow?
A) Water clock
B) Hourglass
C) Sundial
D) Candle clock
Answer: C) Sundial
16. In an hourglass, time is measured using the:
A) Oscillation of a bob
B) Flow of sand
C) Flow of water
D) Movement of a shadow
Answer: B) Flow of sand
17. The Ghatika-yantra described in the chapter is a type of:
A) Sundial

B) Pendulum clock
C) Sinking bowl water clock
D) Atomic clock
Answer: C) Sinking bowl water clock
18. If one ghati corresponds to 24 minutes, how many ghatis make a 24-hour day?
A) 24
B) 30
C) 60
D) 100
Answer: C) 60
19. Which of the following is the SI unit of time?
A) Minute
B) Hour
C) Second
D) Millisecond
Answer: C) Second
20. Which is the correct way to write a time interval according to the conventions given in the chapter?
A) 20 sec
B) 20s
C) 20 s
D) 20 secs.
Answer: C) 20 s
21. A car travels 150 m in 10 s. Its speed in km/h is:
A) 15 km/h
B) 36 km/h
C) 54 km/h
D) 72 km/h
Answer: C) 54 km/h
22. A horse gallops at 18 m/s while a train moves at 72 km/h. Which is faster?
A) Horse
B) Train
C) Both have the same speed
D) Cannot be compared
Answer: B) Train
Reason: 72 km/h = 20 m/s, which is greater than 18 m/s.
23. Train X covers 20 km every 10 minutes, while Train Y covers 20 km, 15 km, 15 km, 25 km, 20 km and 25 km in successive 10-minute intervals. Which statement is correct?
A) Both have uniform motion
B) Both have non-uniform motion
C) X has uniform motion and Y has non-uniform motion
D) X has non-uniform motion and Y has uniform motion
Answer: C) X has uniform motion and Y has non-uniform motion
24. A car travels 60 km in the first hour, 70 km in the second hour and 50 km in the third hour. What is its average speed?
A) 50 km/h
B) 55 km/h
C) 60 km/h
D) 70 km/h
Answer: C) 60 km/h

25. A vehicle covers 2 km in 200 s. What is its average speed for the entire journey?
A) 5 m/s
B) 10 m/s
C) 20 m/s
D) 40 m/s
Answer: B) 10 m/s
26. A runner A covers 400 m in 50 s, while runner B covers the same distance in 40 s. By how much is B faster than A?
A) 1 m/s
B) 2 m/s
C) 4 m/s
D) 8 m/s
Answer: B) 2 m/s
27. Which statement about modern clocks is correct?
A) Quartz clocks use flowing water
B) Atomic clocks use vibrations associated with specific atoms
C) Atomic clocks use pendulum oscillations
D) Quartz clocks use moving shadows
Answer: B) Atomic clocks use vibrations associated with specific atoms
28. A wall clock can measure a smallest interval of 1 second. How many such intervals occur in 5 minutes?
A) 60
B) 120
C) 300
D) 600
Answer: C) 300
29. A train travels at 25 m/s. How much distance will it cover in 2 minutes?
A) 500 m
B) 1,500 m
C) 3,000 m
D) 5,000 m
Answer: C) 3,000 m
30. Consider the statements:
I. Uniform linear motion involves constant speed along a straight line.
II. Non-uniform linear motion involves changing speed along a straight line.
III. An object in uniform linear motion covers equal distances in equal time intervals.
Which are 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

Answer Key:
1-B, 2-C, 3-B, 4-B, 5-C, 6-C, 7-C, 8-C, 9-C, 10-B, 11-B, 12-C, 13-D, 14-C, 15-C, 16-B, 17-C, 18-C, 19-C, 20-C, 21-C, 22-B, 23-C, 24-C, 25-B, 26-B, 27-B, 28-C, 29-C, 30-D.

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

“Best Practices” Opportunities while Teaching Chapter 8 – *Measurement of Time and Motion:*

The chapter provides excellent opportunities for **activity-based, experiential, inquiry-oriented and quantitative learning**, particularly through water clocks, pendulums, speed calculations, and observations of uniform and non-uniform motion.

(1) **Learning by Doing – Construct a Water Clock:**
Organise students into small groups to construct a simple water clock using a discarded transparent plastic bottle. Students can mark water levels at one-minute intervals and compare the accuracy of their clocks, combining scientific learning with reuse of materials. This directly extends Activity 8.1 in the chapter.

(2) **Hands-on Pendulum Experiment:**
Allow students to construct simple pendulums and measure the time taken for 10 oscillations. They should repeat the measurement, calculate the time period, and investigate how changing the **length of the pendulum** or **mass of the bob** affects it. This promotes observation, experimentation, data recording and evidence-based conclusions.

(3) **Outdoor “Speed Laboratory”:**
Convert the school playground into a science laboratory. Students can run or walk over a measured distance while classmates use stopwatches to record time; they can then calculate and compare their speeds using **Speed = Distance ÷ Time**.

(4) **Real-Life Data-Based Problem Solving:**
Use authentic examples such as school-bus journeys, cycling, athletics and railway travel to teach speed, distance and time. Students can examine railway timetable data and calculate the speeds of passenger, express and superfast trains, as suggested in the chapter.

(5) **Observe Uniform and Non-uniform Motion:**
Ask students to observe moving vehicles, runners or toy cars and classify their motion as uniform or non-uniform. Reinforce that uniform linear motion covers equal distances in equal intervals of time, whereas non-uniform motion does not.

(6) **Integrate History of Science with Concepts:**
Create a classroom timeline showing the development of time-measuring devices—from **sundials, water clocks, hourglasses and candle clocks to pendulum, quartz and atomic clocks**. Special attention can be given to India's **Ghatika-yantra** and the contributions associated with Aryabhata and Varahamihira.

(7) **Think–Predict–Experiment–Explain Strategy:**
Before performing an experiment, ask students to predict outcomes—for example, “Will a heavier pendulum bob have a different time period?” Students then conduct the experiment, record observations and explain whether their prediction was correct. This develops scientific reasoning rather than simple memorisation.

(8) **Collaborative Numerical Problem-Solving:**
Divide students into teams and provide different real-life numerical problems involving **speed, distance and time**. Each group should solve, explain the calculation, check units and present its method to the class. The chapter explicitly develops all three mathematical relationships.

(9) **Connect Science with Everyday Instruments:**
Show students a stopwatch, wall clock, wristwatch, vehicle dashboard or suitable images/videos and ask them to identify what each instrument measures. In particular, clarify that a **speedometer measures speed**, while an **odometer measures distance travelled**.

(10) **Mini-Project and Reflective Learning:**

End the chapter with a small investigation such as measuring the time period of playground swings, comparing speeds in different races, constructing a floating-bowl water clock, or investigating sources of experimental error. The chapter itself proposes such exploratory projects, making project-based assessment especially appropriate.

These practices can make *Measurement of Time and Motion* a **hands-on, inquiry-driven and application-oriented chapter**, while simultaneously developing students' observation, measurement, calculation, collaboration and scientific reasoning skills.

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

"Innovations" Opportunities while Teaching-Learning Chapter 8 – *Measurement of Time and Motion:*

The following innovative approaches can make the chapter more **interactive, technology-enabled, inquiry-based and experiential** for Grade 7 students. The chapter itself encourages innovation, exploration, curiosity, discovery and enquiry through practical projects.

(1) **Smartphone-Based Motion Laboratory:** Students can use stopwatch/timer functions on smartphones or tablets to record the time taken for walking, running or toy-car movement over a fixed distance. They can calculate and compare speeds, directly applying the relationship **Speed = Distance ÷ Time**.

(2) **"Design Your Own Timekeeper" STEM Challenge:** Groups can creatively design a time-measuring device using low-cost/recycled materials. They may construct a water clock, sundial or modified hourglass and then test its accuracy against a digital clock. This extends the chapter's discussion of traditional time-measuring devices and water-clock construction.

(3) **Virtual Pendulum Investigation:** Use a digital simulation or interactive classroom model in which students vary pendulum length and bob mass, predict the result and compare it with an actual pendulum experiment. Students should discover that the time period depends on the pendulum's length but not on the bob's mass at a given location.

(4) **Human Speedometer Challenge:** Mark a fixed distance on the playground and let students walk, jog and run across it while classmates record their times. Teams calculate speeds and prepare a "Human Speedometer" ranking, making speed calculations enjoyable and physically engaging.

(5) **Train-Speed Digital Investigation:** Students can use railway timetable information to find the distance and travel time between two stations and calculate the average speed of different trains. Groups can compare passenger, express and superfast trains and present their findings digitally. This develops ICT skills alongside numerical competency.

(6) **Motion Detective – Uniform or Non-uniform?:** Show short videos of trains, bicycles, runners, buses and cars. Students act as "motion detectives" and identify whether each represents uniform or non-uniform linear motion, giving evidence for their conclusions.

(7) **Playground Swing Science Lab:** Convert playground swings into experimental pendulums. Students can measure the time for 10 oscillations with children of different weights and then repeat the activity with swings of different lengths. The chapter specifically proposes this as an exploratory investigation.

(8) **Ancient-to-Atomic Clock Digital Timeline:** Students can collaboratively create a digital timeline or poster tracing the development of timekeeping from sundials, water clocks and the Indian **Ghatika-yantra** to pendulum, quartz and atomic clocks. This integrates **Science + History + Technology + Indian Knowledge Systems**.

(9) **Olympic Speed Data Project:** Students can collect timings of winners of the **100 m, 200 m and 400 m Olympic races**, calculate their speeds and compare performances.

The textbook itself recommends comparing men's and women's Olympic race timings, making this an excellent opportunity for integrating science, mathematics, sports and data analysis.

(10) Student-Generated Science Quiz/Game: After completing the chapter, students can create their own digital or card-based quiz containing puzzles on **time period, SI units, speed–distance–time, uniform motion and non-uniform motion**. Groups can exchange quizzes and compete, shifting students from passive learners to creators of learning resources. These are the chapter's principal conceptual outcomes.

These innovations transform *Measurement of Time and Motion* from a formula-centred lesson into a **STEM-oriented learning experience involving experimentation, digital literacy, data interpretation, collaboration, creativity and real-world problem-solving**.

8.17: Practicing Questions/Question Bank

Grade 7 Science – Chapter 8: *Measurement of Time and Motion:*

The following questions are based on the major concepts in the chapter: **measurement of time, traditional timekeeping devices, simple pendulum, time period, SI units of time, speed, speed–distance–time relationship, and uniform and non-uniform linear motion**.

A. Fill in the Blanks:

1. The SI unit of time is the __________.
   Answer: second
2. The symbol for second is __________.
   Answer: s
3. A device that determines time using the changing position of a shadow is called a __________.
   Answer: sundial
4. An hourglass measures time using the flow of __________.
   Answer: sand
5. The small metallic ball of a simple pendulum is called its __________.
   Answer: bob
6. The time taken by a pendulum to complete one oscillation is called its __________.
   Answer: time period
7. The time period of a simple pendulum depends on its __________.
   Answer: length
8. The distance covered by an object in unit time is called its __________.
   Answer: speed
9. The SI unit of speed is __________.
   Answer: m/s
10. Speed expressed in kilometre per hour is written as __________.
    Answer: km/h
11. The instrument in a vehicle that displays its speed is called a __________.
    Answer: speedometer

12. The instrument that measures the distance travelled by a vehicle is called an __________.
Answer: odometer

13. An object covering equal distances in equal intervals of time is said to have __________ linear motion.
Answer: uniform

14. When the speed of an object moving along a straight line keeps changing, its motion is called __________ linear motion.
Answer: non-uniform

15. The ancient Indian sinking-bowl water clock was known as the __________.
Answer: Ghatika-yantra

The chapter establishes the SI unit of time and its conversions as **60 s = 1 min and 60 min = 1 h**.

B. One-Mark Questions:

1. **What is a sundial?**
Answer: A sundial is a device that determines time using the changing position of the shadow cast by sunlight.

2. **What is a simple pendulum?**
Answer: A simple pendulum consists of a small metallic ball called a bob suspended from a rigid support by a long thread.

3. **What is one oscillation of a pendulum?**
Answer: One complete to-and-fro movement of the pendulum bob constitutes one oscillation.

4. **Define the time period of a pendulum.**
Answer: The time taken by a pendulum to complete one oscillation is called its time period.

5. **Does the mass of the bob affect the time period of a simple pendulum?**
Answer: No, the time period does not depend on the mass of the bob.

6. **What is the SI unit of time?**
Answer: The SI unit of time is second (s).

7. **Define speed.**
Answer: Speed is the distance covered by an object in unit time.

8. **Write the formula for speed.**
Answer: Speed = Total distance covered ÷ Total time taken.

9. **What is the SI unit of speed?**
Answer: The SI unit of speed is metre per second (m/s).

10. **What does a speedometer measure?**
Answer: A speedometer measures and displays the speed of a vehicle.

11. **What does an odometer measure?**
Answer: An odometer measures the distance travelled by a vehicle.

12. **What is linear motion?**
Answer: The motion of an object along a straight line is called linear motion.

13. **What is uniform linear motion?**
Answer: Motion along a straight line at constant speed is called uniform linear motion.

14. **What is non-uniform linear motion?**
    Answer: Motion along a straight line in which speed keeps changing is called non-uniform linear motion.

15. **Who invented the pendulum clock?**
    Answer: Christiaan Huygens invented the pendulum clock in 1656.

C. Two-Mark Questions:

1. **Name any four devices used in earlier times to measure time.**
   Answer:
   - Sundial and water clock.
   - Hourglass and candle clock.

2. **How does a sundial measure time?**
   Answer:
   - Sunlight casts the shadow of an object on the sundial.
   - The changing position of the shadow is used to determine time.

3. **How does an hourglass measure time?**
   Answer:
   - Sand flows from one bulb of the hourglass to another.
   - A fixed quantity of flowing sand represents a particular interval of time.

4. **State two characteristics of a simple pendulum.**
   Answer:
   - Its motion is oscillatory and periodic.
   - Its time period for a given length remains almost constant at a place.

5. **How can the time period of a pendulum be determined experimentally?**
   Answer:
   - Measure the total time taken for 10 oscillations.
   - Divide this time by 10 to obtain the time period.

6. **Differentiate between a speedometer and an odometer.**
   Answer:
   - A speedometer measures the speed of a vehicle.
   - An odometer measures the distance travelled by the vehicle.

7. **Differentiate between uniform and non-uniform linear motion.**
   Answer:
   - In uniform linear motion, an object covers equal distances in equal intervals of time.
   - In non-uniform linear motion, it covers unequal distances in equal intervals of time.

8. **A bicycle covers 200 m in 40 s. Find its speed.**
   Answer:

- Speed = 200 ÷ 40
- Speed = **5 m/s**

9. **A bus travels at 50 km/h for 3 hours. Find the distance travelled.**
   Answer:
   - Distance = Speed × Time
   - Distance = 50 × 3 = **150 km**

10. **Why are atomic clocks more accurate than early pendulum clocks?**
    Answer:
    - Atomic clocks use very precise periodically repeating processes associated with atoms.
    - They are so accurate that they may lose only about one second in millions of years.

D. Three-Mark Questions:

1. **Explain the construction and working of a simple pendulum.**
   Answer:
   - A simple pendulum consists of a bob suspended from a rigid support by a long thread.
   - When the bob is displaced slightly and released, it moves to and fro about its mean position.
   - The time required to complete one oscillation is called its time period.

2. **Explain the relationship between speed, distance and time.**
   Answer:
   - Speed = Distance ÷ Time.
   - Distance = Speed × Time.
   - Time = Distance ÷ Speed.

3. **A train travels 240 km in 4 hours. Calculate its speed and the distance it will cover in 6 hours at the same speed.**
   Answer:
   - Speed = 240 ÷ 4 = **60 km/h**.
   - Distance = Speed × Time.
   - Distance in 6 h = 60 × 6 = **360 km**.

4. **Explain three differences between uniform and non-uniform linear motion.**
   Answer:
   - Uniform motion has constant speed, whereas non-uniform motion has changing speed.
   - Uniform motion covers equal distances in equal intervals; non-uniform motion covers unequal distances.
   - A vehicle moving steadily on a straight road may show uniform motion, while a vehicle moving through traffic generally shows non-uniform motion.

5. **Describe how a simple water clock can be constructed.**
   Answer:
   - Cut a transparent plastic bottle into two parts and make a small hole in its cap.
   - Invert the upper portion over the lower portion, fill it with water and allow the water to drip.
   - Mark the water level after every minute using a watch to calibrate the water clock.

6. **A runner covers 400 m in 50 s. Find the speed in m/s and explain what the result means.**
   Answer:
   - Speed = 400 ÷ 50.
   - Speed = **8 m/s**.
   - This means that the runner covers an average distance of 8 metres per second.

E. Five-Mark Descriptive Questions:

1. **Explain the different methods used for measuring time from ancient times to the modern period.**
   Answer points:
   - Natural cycles such as sunrise, sunset, phases of the Moon and seasons were initially used for timekeeping.
   - Sundials determined time using changing shadows.
   - Water clocks measured time using the flow of water.
   - Hourglasses used flowing sand, while candle clocks used marked candles.
   - Modern clocks use periodically repeating processes, including quartz vibrations and atomic processes.

2. **Describe an experiment to determine the time period of a simple pendulum.**
   Answer points:
   - Suspend a bob from a rigid support using a thread of suitable length.
   - Move the bob slightly to one side and release it without pushing.
   - Measure the time required for 10 oscillations using a stopwatch.
   - Divide the measured time by 10 to obtain the time period.
   - Repeat the experiment several times and compare the results; the time period should be nearly the same.

3. **Explain speed and the relationship between speed, distance and time with a suitable numerical example.**
   Answer points:
   - Speed is the distance covered by an object in unit time.
   - Speed = Distance ÷ Time.
   - Distance = Speed × Time.

- Time = Distance ÷ Speed.
- For example, a bus travelling at 60 km/h for 3 h covers **60 × 3 = 180 km**.

4. **Explain uniform and non-uniform linear motion with suitable examples.**
Answer points:
    - Motion along a straight line is called linear motion.
    - An object moving along a straight line at constant speed has uniform linear motion.
    - It covers equal distances in equal intervals of time.
    - If its speed keeps changing, the motion is non-uniform linear motion.
    - A steadily moving train on a straight track may show uniform motion, whereas a car moving through city traffic generally shows non-uniform motion.
5. **A car covers 60 km in the first hour, 70 km in the second hour and 50 km in the third hour. Determine whether its motion is uniform and calculate its average speed.**
Answer:
    - Distance in first hour = 60 km.
    - Distance in second hour = 70 km and third hour = 50 km.
    - Since unequal distances are covered in equal intervals of time, the motion is **non-uniform**.
    - Total distance = 60 + 70 + 50 = **180 km**; total time = **3 h**.
    - Average speed = 180 ÷ 3 = **60 km/h**.

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7th Standard Science Book Chapter 9

Chapter 9: Life Processes in Animals

9.1 Summary of the Chapter:

Chapter 9: Life Processes in Animals — Summary

(1) **Life processes** are essential activities required for the survival of living beings. They include nutrition, respiration, circulation, excretion, and reproduction. This chapter mainly explains **nutrition and respiration in animals**.

(2) **Nutrition and digestion:** Animals obtain energy from food. Complex food components such as carbohydrates, proteins, and fats must be broken down into simpler forms through **digestion** before the body can use them.

(3) **Human digestive system:** The alimentary canal consists of the **mouth, oesophagus, stomach, small intestine, large intestine, rectum, and anus**. The liver and pancreas also assist in digestion.

(4) **Digestion begins in the mouth:** Teeth crush and chew food, while saliva moistens it and helps break down **starch into simpler sugars**. The tongue mixes food with saliva and helps in swallowing.

(5) **Digestion in the stomach:** Food reaches the stomach through the oesophagus. The stomach churns food and mixes it with digestive juice, acid, and mucus. Digestive juice helps break down proteins, acid kills many harmful bacteria, and mucus protects the stomach lining.

(6) **Small intestine and absorption:** Digestion is completed with the help of secretions from the small intestine, **liver, and pancreas**. Digested nutrients are absorbed into the blood through numerous finger-like projections in the small intestine, which increase the surface area for absorption.

(7) **Large intestine and egestion:** The large intestine absorbs water and some salts from undigested food. The remaining semi-solid waste, called **stool**, is stored in the rectum and finally expelled through the anus by a process called **egestion**.

(8) **Digestion differs among animals:** Cows and buffaloes are **ruminants** that bring partially digested food back to the mouth and chew it again. Birds do not have teeth; instead, their **gizzard** helps grind food, often with the help of swallowed grit.

(9) **Human respiration:** Breathing involves **inhalation and exhalation**. Air enters through the nostrils, passes through the nasal passages and windpipe, and reaches the lungs. Tiny hair and mucus in the nasal passages help trap dust and dirt.

(10) **Mechanism of breathing:** During inhalation, the ribs move up and outward and the **diaphragm moves downward**, allowing air to enter the lungs. During exhalation, the ribs move down and inward and the diaphragm moves upward, forcing air out.

(11) **Gas exchange and respiration:** Gas exchange occurs in the **alveoli** of the lungs. Oxygen passes into the blood, while carbon dioxide moves from the blood into the alveoli. During respiration, oxygen helps break down glucose to release energy: **Glucose + Oxygen → Carbon dioxide + Water + Energy**. Breathing is a physical process, whereas respiration is a chemical process.

(12) **Respiration in different animals:** Different animals have breathing structures suited to their habitats. Many land animals breathe through **lungs**, fish use **gills**, adult frogs use lungs on land and skin in water, and earthworms exchange gases through their **moist skin**. The circulatory system, consisting of the heart, blood, and blood vessels, transports oxygen and nutrients throughout the body.

9.2 Important Formulas:

Important Formulas / Quantitative Relationships — Chapter 9: *Life Processes in Animals*
This chapter is mainly conceptual and contains **very few direct mathematical formulas**. However, the following equations and quantitative relationships are important for numerical, data-based, and application questions.

1. Equation for Respiration

Glucose + Oxygen → Carbon dioxide + Water + Energy

This is the most important equation in the chapter. Oxygen helps break down glucose to release energy required for various activities.

2. Breathing Rate

Breathing Rate = Number of breaths ÷ Time taken

When time is measured in minutes:

Breathing Rate = Number of breaths / Number of minutes

Unit: **breaths per minute**

This relationship can be used for questions comparing breathing rates before and after physical activity; the chapter itself asks students to compare breaths per minute after running.

3. Number of Breaths

Number of breaths = Breathing rate × Time

Example: If a person breathes 18 times per minute for 5 minutes:

Number of breaths = 18 × 5 = 90 breaths

4. Percentage of Oxygen Used

Oxygen used (%) = Oxygen in inhaled air (%) − Oxygen in exhaled air (%)

The chapter gives approximately:

- Oxygen in inhaled air = **21%**
- Oxygen in exhaled air = **16–17%**

Therefore, approximately **4–5 percentage points** of the inhaled-air volume corresponds to oxygen removed from the air during its passage through the lungs.

5. Increase in Carbon Dioxide Percentage

Increase in CO_2 = CO_2 in exhaled air (%) − CO_2 in inhaled air (%)

Given in the chapter:

- CO_2 in inhaled air ≈ **0.04%**
- CO_2 in exhaled air ≈ **4–5%**

This can be used to construct simple comparison and subtraction problems.

6. Percentage of a Gas in a Given Volume of Air

For quantitative problems:

Volume of a gas = (Percentage of gas ÷ 100) × Total volume of air

Example: If 1,000 mL of inhaled air contains approximately 21% oxygen:

Oxygen = 21/100 × 1,000 = 210 mL

This formula is a useful mathematical application of the percentages shown in Fig. 9.13, though the formula itself is not explicitly stated in the textbook.

7. Difference in Length of Intestines

Difference in length = Length of small intestine − Length of large intestine

The chapter states:

- Small intestine ≈ **6 m**
- Large intestine ≈ **1.5 m**

Therefore:

Difference = 6 − 1.5 = 4.5 m

8. Ratio of Lengths of Small and Large Intestines

Ratio = Length of small intestine ÷ Length of large intestine

Using the textbook values:
6 ÷ 1.5 = 4
Hence, the small intestine is approximately **4 times as long as the large intestine**.
9. Time Conversion for Rumination/Chewing
The chapter states that a cow spends about **8 hours a day chewing food**.
Useful conversion:
Time in minutes = Time in hours × 60
Therefore:
8 × 60 = 480 minutes
10. Percentage of a Day Spent Chewing
For an application-based problem:
Percentage of day = (Time spent ÷ 24 hours) × 100
For a cow chewing about 8 hours:
(8 ÷ 24) × 100 ≈ 33.3%
Thus, approximately one-third of a 24-hour day is represented by 8 hours.

Important Numerical Values to Remember

Quantity	**Value given in Chapter**
Length of small intestine	≈ **6 m**
Length of large intestine	≈ **1.5 m**
Cow's chewing time	≈ **8 hours/day**
Oxygen in inhaled air	≈ **21%**
Oxygen in exhaled air	≈ **16–17%**
Carbon dioxide in inhaled air	≈ **0.04%**
Carbon dioxide in exhaled air	≈ **4–5%**
Chewing time in saliva activity	**30–60 seconds**
Finger-like projection scale shown in Fig. 9.5	**0.5 mm**

The **most important equation to remember from the textbook itself** is:
Glucose + Oxygen → Carbon dioxide + Water + Energy

For Grade 7, quantitative questions from this chapter are most likely to involve **breathing rate, percentages of gases, time calculations, and comparison of intestinal lengths**, rather than complex numerical formulas.

9.3 Fill-Up the Blank LOTS type questions with Answers: (50 Questions)

1. Processes essential for the survival of living beings are collectively called ___________.
   Answer: Life processes
2. Animals obtain ___________ from food to carry out various life processes.
   Answer: Energy
3. The breaking down of complex food components into simpler forms is called ___________.
   Answer: Digestion
4. The long tube through which food passes from the mouth to the anus is called the ___________.
   Answer: Alimentary canal

5. The initial breakdown of food into fine pieces by crushing and chewing is called __________ **digestion**.
   Answer: Mechanical
6. Saliva helps break down __________ into sugar.
   Answer: Starch
7. Iodine solution gives a __________ colour when it reacts with starch.
   Answer: Blue-black
8. The __________ helps in mixing chewed food with saliva and pushing it into the food pipe.
   Answer: Tongue
9. The food pipe is also known as the __________.
   Answer: Oesophagus
10. The walls of the food pipe contract and relax in a __________ motion to push food towards the stomach.
    Answer: Wave-like
11. The secretion from the stomach contains digestive juice, acid and __________.
    Answer: Mucus
12. The digestive juice of the stomach helps break down __________ into simpler components.
    Answer: Proteins
13. The __________ in the stomach kills many harmful bacteria.
    Answer: Acid
14. The stomach lining is protected from acid by __________.
    Answer: Mucus
15. The longest part of the alimentary canal is the __________.
    Answer: Small intestine
16. The small intestine is almost __________ **metres** long.
    Answer: 6
17. The liver secretes a digestive substance called __________.
    Answer: Bile
18. Bile helps break down __________ into tiny droplets.
    Answer: Fats
19. The __________ secretes pancreatic juice.
    Answer: Pancreas
20. The process by which digested nutrients pass from the small intestine into the blood is called __________.
    Answer: Absorption of nutrients
21. The inner lining of the small intestine contains thousands of __________ **projections** that increase the surface area for absorption.
    Answer: Finger-like
22. The large intestine absorbs water and some __________ from undigested food.
    Answer: Salts
23. The semi-solid waste formed in the large intestine is called __________.
    Answer: Stool
24. Stool is stored in the __________ before being expelled from the body.
    Answer: Rectum
25. The process of expelling stool through the anus is called __________.
    Answer: Egestion

26. The process in which partially digested food is brought back to the mouth and chewed again is called __________.
    Answer: Rumination
27. Grass-eating animals such as cows and buffaloes that practise rumination are called __________.
    Answer: Ruminants
28. Birds have a muscular chamber called the __________ that helps grind food.
    Answer: Gizzard
29. The process of inhaling and exhaling air is called __________.
    Answer: Breathing
30. The pair of openings through which air enters the human respiratory system are called __________.
    Answer: Nostrils
31. Tiny hair and __________ in the nasal passages help trap dust and dirt.
    Answer: Mucus
32. Air reaches the lungs from the nasal passages through the __________.
    Answer: Windpipe
33. The small balloon-like sacs present in the lungs are called __________.
    Answer: Alveoli
34. The lungs are protected by the __________.
    Answer: Rib cage
35. During inhalation, the diaphragm moves __________.
    Answer: Downwards
36. During exhalation, the diaphragm moves __________.
    Answer: Upwards
37. Lime water turns milky when it reacts with __________.
    Answer: Carbon dioxide
38. Exhaled air contains more __________ than inhaled air.
    Answer: Carbon dioxide
39. Oxygen from the alveoli passes into the __________.
    Answer: Blood
40. Oxygen helps break down __________ to release energy during respiration.
    Answer: Glucose
41. Breathing is a __________ process.
    Answer: Physical
42. Respiration is a __________ process that occurs inside the body.
    Answer: Chemical
43. The circulatory system consists of the heart, blood and __________.
    Answer: Blood vessels
44. The __________ pumps blood through blood vessels to different parts of the body.
    Answer: Heart
45. Most aquatic animals such as fish breathe through __________.
    Answer: Gills
46. Tadpoles breathe through __________.
    Answer: Gills
47. Adult frogs use __________ for breathing on land.
    Answer: Lungs
48. Adult frogs use their __________ for gas exchange when they stay in water.
    Answer: Skin

49. Earthworms exchange oxygen and carbon dioxide through their __________ skin.
Answer: Moist
50. The exchange of oxygen and carbon dioxide in human lungs occurs in the __________.
Answer: Alveoli

9.4 Fill-Up the Blank HOTS type questions with Answers: (40 Questions)

These questions focus on **application, analysis, prediction, comparison and scientific reasoning** based on digestion, respiration and adaptations in animals.

1. If a student chews a piece of chapati for a long time, it begins to taste sweet because saliva converts __________ **into sugar**.
Answer: starch
2. When iodine solution is added to chewed rice and it does not turn blue-black, we can infer that most of the __________ **has been broken down by saliva**.
Answer: starch
3. If a person swallows food without chewing it properly, the process of __________ **digestion** in the mouth will be reduced.
Answer: mechanical
4. Even when a person is lying down, food can move from the mouth towards the stomach because of the __________ **movement** of the walls of the oesophagus.
Answer: wave-like
5. If the stomach stopped producing mucus, its inner lining could be damaged by the __________ present in stomach secretions.
Answer: acid
6. If harmful bacteria enter the stomach with food, many of them may be killed by the __________ present in the stomach.
Answer: acid
7. If bile were not secreted, digestion of __________ would become more difficult because they would not be broken into tiny droplets.
Answer: fats
8. Food entering the small intestine from the stomach contains acid; __________ helps neutralise this acid and also assists in fat digestion.
Answer: bile
9. If the finger-like projections in the small intestine were damaged, the efficiency of nutrient __________ would decrease.
Answer: absorption
10. Thousands of finger-like projections make nutrient absorption efficient because they increase the __________ **area** of the small intestine.
Answer: surface
11. A person who eats adequate fibre-rich food is likely to pass stool more easily because fibre helps the __________ **intestine** function properly.
Answer: large
12. If insufficient water is absorbed from undigested food, the formation of normal semi-solid __________ may be affected.
Answer: stool
13. A cow can chew food even when it is not grazing because partially digested food is brought back to the __________ for further chewing.
Answer: mouth

14. Unlike humans, birds can grind food without teeth because they possess a muscular chamber called the __________.
    Answer: gizzard
15. If a bird swallows small stones along with food, these stones can assist the __________ in grinding food.
    Answer: gizzard
16. A person should preferably breathe through the nose rather than the mouth because tiny hairs and __________ in the nasal passages help trap dust and dirt.
    Answer: mucus
17. In the breathing model, pulling the rubber sheet downward causes the balloons to inflate; therefore, the rubber sheet represents the __________.
    Answer: diaphragm
18. During inhalation, the diaphragm moves downward and increases the space in the __________, allowing air to enter the lungs.
    Answer: chest
19. If the diaphragm moves upward and the ribs move down and inward, the person is undergoing __________.
    Answer: exhalation
20. If lime water turns milky more quickly when exhaled air is passed through it, this indicates that exhaled air contains more __________.
    Answer: carbon dioxide
21. The walls of alveoli are thin so that the exchange of oxygen and __________ between air and blood can occur efficiently.
    Answer: carbon dioxide
22. If the alveoli were severely damaged, the exchange of __________ between the lungs and blood would be affected.
    Answer: gases
23. After vigorous running, muscles require more energy; therefore, the body needs more __________ to help break down glucose.
    Answer: oxygen
24. If glucose is available but sufficient oxygen does not reach the body tissues, the normal process of __________ described in the chapter would be affected.
    Answer: respiration
25. A student says that breathing and respiration are identical. The statement is incorrect because breathing is a physical process whereas respiration is a __________ **process**.
    Answer: chemical
26. Inhaled air contains nearly 21% oxygen, while exhaled air contains nearly __________ **oxygen**, showing that not all inhaled oxygen is used.
    Answer: 16–17%
27. If the heart fails to pump blood effectively, the transport of oxygen and __________ to different parts of the body will be affected.
    Answer: nutrients
28. The heart, blood and blood vessels together form the __________ **system**, which links digestion and respiration with different parts of the body.
    Answer: circulatory
29. A fish taken out of water cannot use its normal breathing mechanism effectively because its specialised respiratory organs called __________ are adapted for gas exchange in water.
    Answer: gills

30. A tadpole breathes through gills, but an adult frog on land breathes through __________, showing a change in breathing mechanism during development.
Answer: lungs
31. An adult frog remaining underwater can exchange gases through its __________, an adaptation that helps it survive in both land and water habitats.
Answer: skin
32. If an earthworm's skin becomes dry, its gas exchange may be affected because it normally breathes through its __________ **skin**.
Answer: moist
33. If the small intestine were smooth and lacked finger-like projections, a smaller __________ **area** would be available for nutrient absorption.
Answer: surface
34. A student finds that unchewed rice turns blue-black with iodine while well-chewed rice does not. This difference provides evidence for the digestive action of __________.
Answer: saliva
35. If the pancreatic juice were absent, digestion of carbohydrates, proteins and __________ in the small intestine would be affected.
Answer: fats
36. A person who inhales dust-laden air may sneeze because the respiratory system attempts to remove irritating __________ entering through the nose.
Answer: dust particles
37. During strenuous exercise, an increase in breathing rate helps supply additional oxygen required to release more __________ from glucose.
Answer: energy
38. A fish and an earthworm both require oxygen, but the fish uses gills while the earthworm uses its moist skin; this illustrates adaptation to different __________.
Answer: habitats
39. Although the small intestine is longer than the large intestine, the latter is called "large" because it is __________.
Answer: wider
40. Digestion, respiration and circulation must work together because nutrients and oxygen have to reach different parts of the body to release __________ and sustain life.
Answer: energy

9.5 One-mark questions with Answers of LOTS Type: (40 Questions)

1. **What are life processes?**
Answer: Life processes are essential processes such as nutrition, respiration, circulation, excretion, and reproduction that help living beings survive.
2. **What is digestion?**
Answer: Digestion is the process of breaking down complex food components into simpler forms that can be used by the body.
3. **What is the alimentary canal?**
Answer: The alimentary canal is a long tube through which food passes from the mouth to the anus.
4. **What is mechanical digestion?**
Answer: Mechanical digestion is the initial breakdown of food into smaller pieces by crushing and chewing.

5. **What is the role of saliva in digestion?**
   Answer: Saliva helps break down starch present in food into simple sugars.
6. **What is the function of the tongue during digestion?**
   Answer: The tongue mixes chewed food with saliva and pushes the softened food into the oesophagus.
7. **What is the oesophagus?**
   Answer: The oesophagus is a long, flexible tube that carries food from the mouth to the stomach.
8. **How does food move through the oesophagus?**
   Answer: Food moves through the oesophagus by wave-like contraction and relaxation of its walls.
9. **What is the role of acid in the stomach?**
   Answer: The acid in the stomach helps break down proteins and kills many harmful bacteria.
10. **What is the function of mucus in the stomach?**
    Answer: Mucus protects the stomach lining from damage caused by acid.
11. **Which is the longest part of the alimentary canal?**
    Answer: The small intestine is the longest part of the alimentary canal.
12. **What is bile?**
    Answer: Bile is a mildly basic secretion produced by the liver that neutralises acid and helps in the digestion of fats.
13. **What is the function of pancreatic juice?**
    Answer: Pancreatic juice helps neutralise acids and breaks down carbohydrates, proteins, and fats.
14. **What is absorption of nutrients?**
    Answer: Absorption of nutrients is the process by which digested nutrients pass from the small intestine into the blood.
15. **Why does the small intestine have finger-like projections?**
    Answer: The finger-like projections increase the surface area for efficient absorption of nutrients.
16. **What is the main function of the large intestine?**
    Answer: The large intestine absorbs water and some salts from undigested food.
17. **What is stool?**
    Answer: Stool is the semi-solid waste formed from undigested food in the large intestine.
18. **What is egestion?**
    Answer: Egestion is the process of expelling undigested waste from the body through the anus.
19. **What is rumination?**
    Answer: Rumination is the process in which partially digested food is brought back to the mouth and chewed again.
20. **What are ruminants?**
    Answer: Ruminants are grass-eating animals such as cows and buffaloes that bring partially digested food back to the mouth for further chewing.
21. **What is the function of the gizzard in birds?**
    Answer: The gizzard breaks down food by contraction and relaxation of its muscular walls, often with the help of grit.
22. **What is respiration?**
    Answer: Respiration is the process by which nutrients such as glucose are broken down using oxygen to release usable energy.

23. **What is breathing?**
    Answer: Breathing is the process of inhaling and exhaling air.
24. **What is inhalation?**
    Answer: Inhalation is the process of taking air into the lungs.
25. **What is exhalation?**
    Answer: Exhalation is the process of expelling air from the lungs.
26. **What is the function of tiny hairs and mucus in the nasal passages?**
    Answer: Tiny hairs and mucus trap dust and dirt present in the inhaled air.
27. **What is the diaphragm?**
    Answer: The diaphragm is a dome-shaped muscle located below the lungs that helps in breathing.
28. **What happens to the diaphragm during inhalation?**
    Answer: During inhalation, the diaphragm moves downward and increases the space inside the chest.
29. **What happens to the diaphragm during exhalation?**
    Answer: During exhalation, the diaphragm moves upward and reduces the space inside the chest.
30. **What are alveoli?**
    Answer: Alveoli are small balloon-like sacs in the lungs where the exchange of oxygen and carbon dioxide takes place.
31. **What happens to oxygen in the alveoli?**
    Answer: Oxygen passes from the alveoli into the blood and is transported to different parts of the body.
32. **What happens to carbon dioxide in the alveoli?**
    Answer: Carbon dioxide passes from the blood into the alveoli and is expelled during exhalation.
33. **Write the word equation for respiration.**
    Answer: Glucose + Oxygen → Carbon dioxide + Water + Energy.
34. **How is breathing different from respiration?**
    Answer: Breathing is a physical process, whereas respiration is a chemical process occurring inside the body.
35. **What is the circulatory system?**
    Answer: The circulatory system is the body system consisting of the heart, blood, and blood vessels that transports substances throughout the body.
36. **What is the function of the heart?**
    Answer: The heart pumps blood through blood vessels to different parts of the body.
37. **Which respiratory organs are used by fish?**
    Answer: Fish breathe through specialised respiratory structures called gills.
38. **How do tadpoles breathe?**
    Answer: Tadpoles breathe through gills.
39. **How do adult frogs breathe on land?**
    Answer: Adult frogs breathe through their lungs when they are on land.
40. **How do earthworms exchange gases?**
    Answer: Earthworms exchange oxygen and carbon dioxide through their moist skin.

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

1. **Why does chapati taste sweeter when it is chewed for a longer time?**
   Answer: Chapati tastes sweeter because saliva breaks down its starch into simple sugars.

2. **What would happen if food were swallowed without being chewed properly?**
   Answer: Digestion would become less efficient because food would not be mechanically broken into smaller pieces and mixed sufficiently with saliva.
3. **Why does chewed rice show little or no blue-black colour when iodine is added?**
   Answer: Saliva breaks down much of the starch in chewed rice into sugars, leaving little or no starch to react with iodine.
4. **Why is saliva important for swallowing food besides helping in digestion?**
   Answer: Saliva moistens and softens food, making it easier to swallow.
5. **What would happen if the walls of the oesophagus could not contract and relax?**
   Answer: Food would not be pushed efficiently from the mouth towards the stomach.
6. **Why does the stomach need mucus even though mucus does not digest food?**
   Answer: Mucus protects the stomach lining from being damaged by the acid present in the stomach.
7. **Why must the acidic food coming from the stomach be neutralised in the small intestine?**
   Answer: It must be neutralised so that digestion can continue effectively in the small intestine.
8. **Why does bile break fats into tiny droplets?**
   Answer: Breaking fats into tiny droplets makes them easier for digestive juices to digest.
9. **Why are thousands of finger-like projections present in the small intestine?**
   Answer: They increase the surface area of the small intestine and thereby make nutrient absorption more efficient.
10. **What may happen to nutrient absorption if the inner lining of the small intestine is damaged?**
    Answer: Nutrient absorption may decrease because digested nutrients cannot pass efficiently into the blood.
11. **Why can fibre-rich food help a person who has difficulty passing stool?**
    Answer: Fibre-rich food helps the large intestine function properly and makes stool easier to pass.
12. **Why is the large intestine called "large" even though it is shorter than the small intestine?**
    Answer: It is called the large intestine because it is wider than the small intestine.
13. **Why does a cow continue chewing even when it is not grazing?**
    Answer: A cow brings partially digested food back to its mouth and chews it again during rumination.
14. **How can birds digest solid food effectively even though they do not have teeth?**
    Answer: Their muscular gizzard breaks down food through contraction and relaxation, often with the help of swallowed grit.
15. **Why is breathing through the nose better than breathing through the mouth?**
    Answer: Tiny hairs and mucus in the nasal passages trap dust and dirt from inhaled air.
16. **What would happen to inhalation if the diaphragm failed to move downward?**
    Answer: The chest cavity would not expand properly, so less air would enter the lungs.
17. **In the breathing model, why do the balloons inflate when the rubber sheet is pulled downward?**
    Answer: Pulling the rubber sheet downward increases the space inside the bottle and causes air to enter and inflate the balloons.

18. **Why does lime water turn milkier when exhaled air is passed through it than when inhaled air is passed through it?**
    Answer: Exhaled air contains more carbon dioxide, which reacts with lime water and makes it milky.
19. **Why are the walls of alveoli thin and surrounded by blood vessels?**
    Answer: Their thin walls and surrounding blood vessels allow efficient exchange of oxygen and carbon dioxide.
20. **Why does exhaled air still contain some oxygen?**
    Answer: Exhaled air contains some oxygen because the body does not use all the oxygen present in inhaled air.
21. **Why is respiration necessary even when a person is resting?**
    Answer: Respiration is necessary because the body continuously requires energy to carry out essential life processes.
22. **Why does a person breathe faster after running?**
    Answer: Faster breathing supplies more oxygen needed to release energy for increased body activity.
23. **Why cannot breathing and respiration be considered the same process?**
    Answer: Breathing is the physical movement of air into and out of the lungs, whereas respiration is the chemical process that releases energy from food.
24. **Why is the circulatory system necessary after nutrients are absorbed from the small intestine?**
    Answer: The circulatory system carries absorbed nutrients through the blood to different parts of the body.
25. **What may happen to body cells if the heart stops pumping blood effectively?**
    Answer: Body cells may receive insufficient oxygen and nutrients because blood cannot transport them properly.
26. **Why are fish able to obtain oxygen even though they live underwater?**
    Answer: Fish use gills to exchange gases between their blood and the gases dissolved in water.
27. **Why does an adult frog use different breathing organs on land and in water?**
    Answer: An adult frog uses lungs on land and skin in water as an adaptation to living in both environments.
28. **Why must an earthworm keep its skin moist?**
    Answer: An earthworm needs moist skin for the efficient exchange of oxygen and carbon dioxide.
29. **Why can smoking affect not only smokers but also people around them?**
    Answer: Smoking releases toxic chemicals into the surrounding air that can be inhaled by non-smokers through passive smoking.
30. **What can you infer from the fact that fish, frogs, earthworms, and humans use different structures for breathing?**
    Answer: Different animals have developed breathing mechanisms suited to their habitats and ways of life.

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

1. What are life processes? Give any four examples.
Answer:

1. Life processes are processes essential for the survival of living beings.
2. Nutrition, respiration, excretion, circulation, and reproduction are examples of life processes.

2. What is digestion? Where does it begin in humans?
Answer:
1. Digestion is the process of breaking down complex food components into simpler forms.
2. In humans, digestion begins in the mouth, where food is chewed and mixed with saliva.

3. What is mechanical digestion? How does it occur in the mouth?
Answer:
1. Mechanical digestion is the initial physical breakdown of food into smaller pieces.
2. It occurs in the mouth when the teeth crush and chew the food.

4. State two functions of saliva in digestion.
Answer:
1. Saliva contains digestive juice that helps break down starch into sugar.
2. It also moistens and softens food, making it easier to swallow.

5. What is the oesophagus? How does food move through it?
Answer:
1. The oesophagus or food pipe is a long, flexible tube that carries food from the mouth to the stomach.
2. Its walls contract and relax in a wave-like motion to push food towards the stomach.

6. Mention any two functions of acid in the stomach.
Answer:
1. The acid in the stomach helps in breaking down proteins.
2. It also kills many harmful bacteria present in food.

7. What are the functions of digestive juice and mucus in the stomach?
Answer:
1. Digestive juice helps break down proteins in food into simpler components.
2. Mucus protects the inner lining of the stomach from damage by acid.

8. Name the three sources of digestive secretions received by the small intestine.
Answer:
1. The small intestine receives secretions from its own inner lining.
2. It also receives digestive secretions from the liver and pancreas.

9. State two functions of bile in digestion.
Answer:
1. Bile neutralises the acids present in food coming from the stomach.
2. It breaks fats into tiny droplets, making their digestion easier.

10. What are the functions of pancreatic juice?
Answer:
1. Pancreatic juice helps neutralise the acids present in food.
2. It also helps break down carbohydrates, proteins, and fats into simpler forms.

11. What is absorption of nutrients? How is the small intestine adapted for it?
Answer:
1. Absorption is the process by which digested nutrients pass from the small intestine into the blood.
2. The small intestine has thousands of finger-like projections that increase the surface area for efficient absorption.

12. State two functions of the large intestine.
Answer:
1. The large intestine absorbs water and some salts from undigested food.
2. It converts the remaining waste into semi-solid stool, which is stored in the rectum before egestion.

13. What is rumination? Which animals are called ruminants?
Answer:
1. Rumination is the process in which partially digested food is brought back to the mouth and chewed again.
2. Grass-eating animals such as cows and buffaloes that perform this process are called ruminants.

14. How do birds break down food without teeth?
Answer:
1. Birds possess a muscular chamber called the gizzard that helps break down food.
2. The walls of the gizzard contract and relax, often using swallowed grit or small stones to crush the food.

15. What is breathing? Name its two phases.
Answer:
1. Breathing is the process of inhaling and exhaling air.
2. Its two phases are inhalation, in which air enters the lungs, and exhalation, in which air leaves the lungs.

16. What is the function of the nasal passages during breathing?
Answer:
1. Air entering through the nostrils passes through the nasal passages before reaching the lungs.
2. Tiny hairs and mucus in these passages trap dust and dirt present in inhaled air.

17. Describe the role of the diaphragm during inhalation and exhalation.
Answer:
1. During inhalation, the diaphragm moves downward, increasing the space in the chest and allowing air to enter the lungs.
2. During exhalation, it moves upward, reducing the space in the chest and pushing air out.

18. What are alveoli? What is their function?
Answer:
1. Alveoli are small balloon-like sacs present at the ends of the finer branches inside the lungs.
2. They are the sites where oxygen passes into the blood and carbon dioxide passes from the blood into the air.

19. What is respiration? Write its word equation.
Answer:
1. Respiration is the process in which oxygen helps break down glucose to release energy.
2. **Glucose + Oxygen → Carbon dioxide + Water + Energy.**

20. Give two differences between breathing and respiration.
Answer:
1. Breathing is a physical process involving inhalation and exhalation, whereas respiration is a chemical process occurring inside the body.
2. Breathing brings in oxygen and removes carbon dioxide, while respiration uses oxygen to break down food and release energy.

21. What is the circulatory system? Name its main components.
Answer:
1. The circulatory system transports nutrients, oxygen, and other substances throughout the body and carries away wastes.
2. It consists mainly of the heart, blood, and blood vessels.

22. How do fish breathe in water?

Answer:

1. Fish breathe through specialised respiratory structures called gills.
2. Through the gills, oxygen and carbon dioxide are exchanged between the blood and gases dissolved in water.

23. How does a frog breathe at different stages of its life?

Answer:

1. Tadpoles breathe through gills, whereas adult frogs use lungs while living on land.
2. Adult frogs also use their skin for gas exchange when they are in water.

24. How do earthworms breathe?

Answer:

1. Earthworms use their moist skin for breathing.
2. Oxygen and carbon dioxide are exchanged through their moist skin.

25. State two harmful effects of smoking mentioned in the chapter.

Answer:

1. Smoking damages the lungs and increases the risk of lung cancer and other respiratory illnesses.
2. It also releases toxic chemicals into the air, exposing non-smokers to harmful passive smoking.

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

1. Riya chews a piece of chapati for a long time and notices that it starts tasting sweet. Why?

Answer:

1. Saliva contains digestive juice that breaks down the starch present in chapati into simpler sugars.
2. As chewing continues, more starch is acted upon by saliva, making the chapati taste sweet.

2. Boiled rice turns blue-black with iodine, but thoroughly chewed boiled rice may not. Explain why.

Answer:

1. Iodine turns blue-black in the presence of starch, so unchewed boiled rice shows this colour.
2. In chewed rice, saliva has converted much of the starch into simple sugars, resulting in little or no blue-black colour.

3. What might happen to digestion if a person produces very little saliva? Give reasons.

Answer:

1. Digestion of starch in the mouth would be reduced because saliva helps break starch into sugars.
2. Swallowing may also become difficult because saliva moistens and softens the food.

4. The stomach contains acid, yet it normally does not damage itself. Why?

Answer:

1. The stomach produces mucus that forms a protective layer over its inner lining.
2. This mucus prevents the stomach acid from damaging the stomach wall.

5. Why is bile necessary when food passes from the stomach into the small intestine?

Answer:

1. Bile is mildly basic and neutralises the acid present in food coming from the stomach.
2. It also breaks fats into tiny droplets, making their digestion easier.

6. A person's small intestine has damaged finger-like projections. How could this affect the person's health?
Answer:
1. The surface area available for absorption would decrease, so fewer digested nutrients would enter the blood.
2. Consequently, the body may not receive sufficient nutrients for energy, growth, repair, and normal functioning.

7. Why can a diet lacking fibre make passing stool difficult?
Answer:
1. Fibre-rich food helps the large intestine function properly and makes stool easier to pass.
2. Therefore, insufficient fibre may make the elimination of waste more difficult.

8. A cow continues chewing even when it is not grazing. How would you explain this observation?
Answer:
1. A cow initially swallows partially chewed grass, which undergoes partial digestion in its stomach.
2. The partially digested food is later returned to the mouth and chewed again in a process called rumination.

9. Birds do not have teeth. How are they still able to break down solid food?
Answer:
1. Birds possess a muscular chamber called the gizzard whose walls contract and relax to break down food.
2. Swallowed grit or small stones often assists the gizzard in crushing the food mechanically.

10. Why is breathing through the nose considered better than breathing through the mouth?
Answer:
1. The nasal passages contain tiny hairs and mucus that trap dust and dirt from inhaled air.
2. Breathing through the nose therefore helps prevent many unwanted particles from entering the respiratory system.

11. In the breathing model shown in the chapter, why do the balloons inflate when the rubber sheet is pulled downward?
Answer:
1. Pulling the rubber sheet downward increases the space inside the bottle, causing the balloons to inflate.
2. This represents inhalation, during which the diaphragm moves downward and air enters the lungs.

12. Suppose the diaphragm does not move properly. How would this affect breathing?
Answer:
1. The space inside the chest would not increase and decrease normally during inhalation and exhalation.
2. As a result, the movement of air into and out of the lungs would be affected.

13. Two test tubes contain lime water. Exhaled air is blown into one while ordinary air is passed into the other. Why does one turn milky faster?
Answer:
1. Lime water turns milky when it reacts with carbon dioxide.
2. Exhaled air contains more carbon dioxide than inhaled air, so the tube receiving exhaled air turns milky more readily.

14. Why are alveoli present in large numbers and surrounded by blood vessels?
Answer:
1. The alveoli provide surfaces through which oxygen can enter the blood and carbon dioxide can leave it.
2. Their close association with blood vessels enables efficient exchange and transport of these gases.

15. A student says, "We inhale oxygen and exhale carbon dioxide." Why is this statement not completely correct?
Answer:
1. We inhale **air rich in oxygen**, not pure oxygen, and some carbon dioxide is also present in inhaled air.
2. Exhaled air still contains about 16–17% oxygen but has a higher carbon dioxide content of about 4–5%.

16. Why does a person breathe faster after running than while sitting quietly?
Answer:
1. Running requires more energy, so the body needs more oxygen for respiration to release that energy.
2. Faster breathing helps supply oxygen and remove the increased carbon dioxide produced during respiration.

17. A student says that breathing and respiration are the same because both involve oxygen. How would you correct the student?
Answer:
1. Breathing is a physical process involving inhalation and exhalation of air.
2. Respiration is a chemical process in which oxygen helps break down glucose to release energy.

18. Why is the circulatory system necessary even though oxygen enters directly into the lungs?
Answer:
1. Oxygen entering the lungs must be transported by blood to cells in different parts of the body.
2. The circulatory system also transports nutrients and carries waste products away from different body parts.

19. Why would a fish have difficulty surviving for a long time outside water even though air contains oxygen?
Answer:
1. Fish use gills to exchange gases between their blood and the gases dissolved in water.
2. Their breathing mechanism is adapted to an aquatic habitat, so simply having oxygen in the surrounding air does not provide their normal conditions for gas exchange.

20. How does a frog's breathing mechanism help it survive both on land and in water?
Answer:
1. Adult frogs use lungs for breathing when they are on land.
2. They use their skin for gas exchange while in water, enabling them to live in both environments.

21. Earthworms need moist skin. Explain why dry conditions could create difficulty for them.
Answer:
1. Earthworms exchange oxygen and carbon dioxide through their moist skin.
2. Therefore, conditions that prevent the skin from remaining moist can interfere with their normal gas exchange.

22. Why can smoking harm people who themselves do not smoke?
Answer:
1. Smoking releases toxic chemicals into the surrounding air, which can then be inhaled by non-smokers.
2. This passive smoking can be particularly dangerous for children, pregnant women, and elderly people.

23. If the large intestine stopped absorbing water efficiently, what change would you expect in the waste produced?
Answer:
1. More water would remain in the undigested material because the large intestine normally absorbs water and some salts.
2. Therefore, the waste would be less semi-solid than normal.

24. Why are digestion, respiration, and circulation interdependent life processes?
Answer:
1. Digestion supplies simple nutrients such as glucose, while breathing supplies oxygen needed to release energy from glucose during respiration.
2. The circulatory system transports absorbed nutrients and oxygen to different parts of the body.

25. Different animals have different structures for digestion and breathing. What conclusion can you draw from this?
Answer:
1. Animals have structures suited to their food habits and habitats—for example, birds use a gizzard for breaking down food, while fish use gills for gas exchange.
2. These differences show that animals have different mechanisms adapted to their particular ways of life and environments.

9.9. Three-mark questions with Answers of LOTS Type: (20 Questions)

1. What is digestion? Explain how digestion begins in the mouth.
Answer:
1. Digestion is the process of breaking down complex food components into simpler forms that the body can use.
2. Teeth crush and chew the food into smaller pieces, which is called mechanical digestion.
3. Saliva mixes with food and begins the digestion of starch by breaking it down into sugars.

2. Explain the role of the oesophagus in the digestive system.
Answer:
1. The oesophagus or food pipe is a long, flexible tube connecting the mouth to the stomach.
2. Its walls contract and relax in a wave-like motion to push food downwards.
3. This movement carries the swallowed food from the mouth to the stomach.

3. Describe the process of digestion in the stomach.
Answer:
1. The walls of the stomach contract and relax to churn and mix the food with stomach secretions.
2. Digestive juice and acid help break down proteins, while the acid also kills many harmful bacteria.
3. Mucus protects the stomach lining from acid, and the food becomes a partially digested semi-liquid mass.

4. State three functions of bile in the digestion of food.
Answer:
1. Bile is secreted by the liver and is mildly basic in nature.
2. It neutralises the acids present in the food coming from the stomach.
3. It breaks fats into tiny droplets, making their digestion easier.

5. Explain the role of pancreatic juice in digestion.
Answer:
1. The pancreas secretes pancreatic juice into the small intestine.
2. Pancreatic juice is basic and helps neutralise acids present in the food.
3. It also helps break down carbohydrates, proteins, and fats.

6. How does absorption of nutrients take place in the small intestine?
Answer:
1. Digested nutrients pass from the small intestine into the blood vessels present in its walls.
2. Thousands of finger-like projections in its inner lining increase the surface area for efficient absorption.
3. The blood then carries the absorbed nutrients to different parts of the body.

7. Explain the functions of the large intestine, rectum, and anus.
Answer:
1. The large intestine absorbs water and some salts from undigested food and makes the waste semi-solid.
2. The semi-solid waste, called stool, is stored in the rectum until the body is ready to remove it.
3. The stool is finally expelled through the anus in a process called egestion.

8. What is rumination? Explain the process in grass-eating animals.
Answer:
1. Grass-eating animals such as cows and buffaloes partially chew grass and swallow it into their stomachs.
2. The partially digested food is later brought back to the mouth and chewed thoroughly.
3. This process is called **rumination**, and animals that perform it are called **ruminants**.

9. How do birds break down food even though they do not have teeth?
Answer:
1. Birds have a special chamber called the **gizzard** for breaking down food.
2. The walls of the gizzard contract and relax to crush the food.
3. Small stones or grit swallowed by birds also help the gizzard break down the food.

10. Describe the pathway of air through the human respiratory system.
Answer:
1. Air enters the respiratory system through the nostrils and passes through the nasal passages.
2. It then travels through the windpipe, which divides into two branches entering the lungs.
3. Inside the lungs, these branches divide into finer branches ending in balloon-like sacs called alveoli.

11. Explain the process of inhalation in humans.
Answer:
1. During inhalation, the ribs move upwards and outwards, causing the chest to expand.
2. The diaphragm moves downwards, increasing the space inside the chest cavity.
3. As the space increases, air enters the lungs.

12. Explain the process of exhalation in humans.
Answer:
1. During exhalation, the ribs move downwards and inwards.

2. The diaphragm moves upwards, reducing the space inside the chest cavity.
3. This reduction in space pushes air out of the lungs.

13. How does the exchange of gases take place in the alveoli?

Answer:

1. Alveoli are small air sacs with thin walls surrounded by fine blood vessels.
2. Oxygen from the alveoli passes into the blood and is transported to different parts of the body.
3. Carbon dioxide carried by the blood passes into the alveoli and is released through exhalation.

14. What is respiration? Write its word equation and importance.

Answer:

1. Respiration is the process in which oxygen helps break down glucose to release energy.
2. Its word equation is: **Glucose + Oxygen → Carbon dioxide + Water + Energy**.
3. The energy released through respiration enables us to perform activities such as walking, running, playing, and thinking.

15. Differentiate between breathing and respiration.

Answer:

1. Breathing is the physical process of inhaling air into the lungs and exhaling air from the lungs.
2. Respiration is a chemical process in which oxygen is used to break down food and release energy.
3. Breathing supplies oxygen and removes carbon dioxide, whereas respiration produces usable energy for the body.

16. Describe the circulatory system and its functions.

Answer:

1. The circulatory system consists of the heart, blood, and blood vessels.
2. The heart pumps blood through the blood vessels to transport oxygen, nutrients, and other substances throughout the body.
3. The blood also carries waste products away from different parts of the body.

17. How do fish breathe?

Answer:

1. Most aquatic animals such as fish breathe using specialised structures called **gills**.
2. The gills are richly supplied with blood vessels.
3. Oxygen and carbon dioxide are exchanged between the blood and the gases dissolved in water across the gills.

18. Explain how frogs breathe at different stages and in different habitats.

Answer:

1. Tadpoles breathe through gills while living in water.
2. Adult frogs use lungs for breathing when they are on land.
3. Adult frogs use their skin for gas exchange when they stay in water.

19. What are the functions of nostrils and nasal passages during breathing?

Answer:

1. Nostrils are the external openings through which air is inhaled and exhaled.
2. The inhaled air passes from the nostrils into the nasal passages.
3. Tiny hairs and mucus in the nasal passages trap dust and dirt present in the inhaled air.

20. State three important features of the human digestive system.

Answer:

1. The alimentary canal consists of the mouth, oesophagus, stomach, small intestine, large intestine, and anus.

2. The liver and pancreas are associated parts that provide digestive secretions needed for digestion.
3. Digested food is mainly absorbed through the walls of the small intestine and transported by blood to different parts of the body.

9.10. Three-mark questions with Answers of HOTS Type: (20 Questions)

1. Riya chews a piece of chapati for a long time and notices that it gradually tastes sweet. Explain why.

Answer:

1. Chapati contains starch, which is a complex carbohydrate.
2. Saliva in the mouth acts on starch and breaks it down into simpler sugars.
3. Therefore, prolonged chewing allows more starch to be converted into sugar, making the chapati taste sweet.

2. A student adds iodine solution separately to boiled rice and thoroughly chewed boiled rice. Predict the observations and explain them.

Answer:

1. The boiled rice turns blue-black because it contains starch, which reacts with iodine.
2. The thoroughly chewed rice may not turn blue-black, or may show only a faint colour, because saliva has acted on its starch.
3. This demonstrates that saliva breaks down starch into simpler sugars during digestion.

3. Suppose the mucus lining of a person's stomach is damaged. What problem might occur? Explain.

Answer:

1. The stomach contains acid that helps in digestion and kills many harmful bacteria.
2. Mucus normally protects the stomach lining from the action of this acid.
3. If the mucus layer is damaged, the acid may harm the stomach lining and cause discomfort or injury.

4. Why would damage to the finger-like projections in the small intestine affect a person's health?

Answer:

1. The finger-like projections increase the surface area available for absorption of digested nutrients.
2. If these projections are damaged, nutrients may not be absorbed efficiently into the blood.
3. Consequently, the body may receive fewer nutrients for energy, growth, repair, and proper functioning.

5. A person regularly eats very little fibre-rich food. Predict how this may affect egestion.

Answer:

1. Fibre-rich foods help the large intestine function properly and make stool easier to pass.
2. A diet poor in fibre may make the removal of stool more difficult.
3. Therefore, eating fruits, vegetables, and whole grains can support proper egestion and digestive health.

6. A bird has no teeth, yet it can break down hard food. How is this possible?

Answer:

1. Birds have a special chamber called the **gizzard**, which helps break down food.
2. The walls of the gizzard contract and relax to crush the food mechanically.
3. Small stones or grit swallowed by birds further help the gizzard grind the food.

7. A cow continues chewing even when it is not grazing. Give a scientific explanation for this behaviour.

Answer:

1. A cow initially chews grass only partially before swallowing it.
2. The partially digested food is later brought back from the stomach to the mouth for further chewing.
3. This process, called **rumination**, helps the cow thoroughly break down its food before further digestion.

8. Why is breathing through the nose better than breathing through the mouth?

Answer:

1. Air entering through the nose passes through the nasal passages containing tiny hairs and mucus.
2. These hairs and mucus trap dust and dirt present in inhaled air.
3. Therefore, breathing through the nose helps prevent many unwanted particles from entering deeper into the respiratory system.

9. In the breathing model, what would happen if the rubber sheet at the bottom of the bottle were pulled down? Explain.

Answer:

1. The rubber sheet represents the diaphragm, while the balloons represent the lungs.
2. Pulling the rubber sheet down increases the space inside the bottle and causes the balloons to inflate.
3. This represents inhalation, during which the diaphragm moves downward and air enters the lungs.

10. Two test tubes contain equal amounts of lime water. Ordinary air is passed through one, while exhaled air is blown into the other. Which one will turn milky faster and why?

Answer:

1. The lime water receiving exhaled air will turn milky more readily.
2. Lime water turns milky when it reacts with carbon dioxide.
3. Since exhaled air contains more carbon dioxide than inhaled air, the observation shows that our body releases carbon dioxide during respiration.

11. A student says, "We inhale oxygen and exhale carbon dioxide." Why is this statement scientifically incomplete?

Answer:

1. We actually inhale **air rich in oxygen**, rather than pure oxygen.
2. Exhaled air still contains about 16–17% oxygen, showing that the body does not use all the inhaled oxygen.
3. Exhaled air contains a higher proportion of carbon dioxide, about 4–5%, compared with about 0.04% in inhaled air.

12. A student says that breathing and respiration are the same process. How would you correct the student?

Answer:

1. Breathing is the physical process of inhaling and exhaling air.
2. Respiration is a chemical process in which oxygen helps break down glucose to release energy.
3. Thus, breathing enables gas exchange, whereas respiration releases the energy needed for activities such as walking, running, playing, and thinking.

13. Why are alveoli well suited for the exchange of gases in the lungs?

Answer:

1. Alveoli are small air sacs with thin walls and are surrounded by fine blood vessels.
2. Oxygen passes from the alveoli into the blood, while carbon dioxide moves from the blood into the alveoli.
3. Their structure therefore allows efficient exchange and transport of respiratory gases.

14. After running a race, a student's breathing rate becomes faster. Explain why increased breathing would be useful.

Answer:

1. During physical activity, the body requires more energy to support increased muscular activity.
2. Respiration uses oxygen to break down glucose and release usable energy.
3. Faster breathing helps bring in more oxygen and remove the increased carbon dioxide associated with the body's greater energy requirement.

15. If the diaphragm could not move properly, how would breathing be affected?

Answer:

1. During inhalation, the diaphragm normally moves downward and increases the space inside the chest.
2. During exhalation, it moves upward, reducing the chest space and helping push air out.
3. Therefore, restricted diaphragm movement would interfere with the normal entry and exit of air from the lungs.

16. Why can a fish not use the same breathing mechanism as a human being?

Answer:

1. Humans use lungs to exchange gases with air, whereas fish live in water.
2. Fish have gills richly supplied with blood vessels that exchange gases with those dissolved in water.
3. Thus, the breathing structures of fish are adapted to their aquatic habitat.

17. Frogs can survive both on land and in water. How does their respiratory system help them do so?

Answer:

1. Tadpoles breathe through gills during their aquatic stage.
2. Adult frogs use lungs for breathing when they are on land.
3. When adult frogs are in water, their skin participates in gas exchange, enabling them to live in both habitats.

18. Why would a person have difficulty obtaining energy even after eating enough food if sufficient oxygen did not reach the body cells?

Answer:

1. Digestion breaks food down into simple substances such as glucose.
2. During respiration, oxygen helps break down glucose to release usable energy.
3. Therefore, insufficient oxygen would interfere with efficient energy release even when adequate food is available.

19. Why are the digestive, respiratory, and circulatory systems interdependent?

Answer:

1. The digestive system breaks down food and provides nutrients that are absorbed into the blood.
2. The respiratory system supplies oxygen, while the circulatory system transports oxygen and nutrients throughout the body.
3. Together, these systems enable respiration, energy release, growth, repair, and removal of waste products.

20. A person smokes near children regularly. Explain why this behaviour can affect both the smoker and the children.

Answer:

1. Smoking damages the lungs and increases the risk of respiratory diseases in the smoker.
2. Smoking also releases toxic chemicals into the surrounding air, which can be inhaled by non-smokers.

3. This **passive smoking** can be especially dangerous for children and therefore affects people other than the smoker.

9.11 Five-mark questions with Answers of LOTS Type: (12 Questions)

1. Explain the process of digestion in the human alimentary canal.
Answer:
1. Digestion begins in the **mouth**, where teeth mechanically break food into smaller pieces and saliva starts breaking down starch into sugars.
2. The swallowed food passes through the **oesophagus** to the stomach by wave-like contraction and relaxation of its walls.
3. In the **stomach**, food is churned and mixed with digestive juice and acid, which help in the digestion of proteins.
4. In the **small intestine**, bile, pancreatic juice, and intestinal digestive juice complete the digestion of carbohydrates, proteins, and fats.
5. Digested nutrients are absorbed into the blood through the walls of the small intestine, while undigested material passes into the large intestine and is eventually egested.

2. Describe the structure and functions of the small intestine.
Answer:
1. The small intestine is the **longest part of the alimentary canal** and is almost six metres long.
2. It receives digestive secretions from its own inner lining as well as from the **liver and pancreas**.
3. Bile from the liver neutralises acids and breaks fats into tiny droplets, while pancreatic juice helps digest carbohydrates, proteins, and fats.
4. Its inner lining is thin and contains thousands of **finger-like projections**, which increase the surface area for absorption.
5. Digested nutrients pass through these projections into the blood and are transported to different parts of the body.

3. Explain the role of the mouth, saliva, tongue, and oesophagus in digestion.
Answer:
1. Digestion begins in the mouth, where the **teeth crush and chew food** into smaller pieces.
2. Saliva contains digestive juice that helps break down **starch into sugar**.
3. Saliva also moistens the food and makes it soft and easier to swallow.
4. The tongue mixes the chewed food with saliva and pushes it into the **oesophagus or food pipe**.
5. The walls of the oesophagus contract and relax in a wave-like motion to push food towards the stomach.

4. Describe the role of the stomach in digestion.
Answer:
1. Food reaching the stomach is churned by the contraction and relaxation of the stomach walls.
2. The churned food mixes with secretions containing **digestive juice, acid, and mucus**.
3. The digestive juice breaks down proteins present in food into simpler components.
4. The acid assists in protein digestion and also kills many harmful bacteria, while mucus protects the stomach lining from the acid.
5. The food becomes partially digested and forms a **semi-liquid mass** before passing into the small intestine.

5. Explain the functions of the large intestine, rectum, and anus.
Answer:
1. Undigested food from the small intestine passes into the **large intestine**.
2. The large intestine absorbs water and some salts from the undigested food.
3. This absorption converts the waste into a semi-solid substance called **stool**.
4. The stool is temporarily stored in the lower part of the large intestine called the **rectum**.
5. Finally, stool is expelled through the **anus**, and this process is known as **egestion**.

6. Explain rumination in grass-eating animals.
Answer:
1. Grass-eating animals such as cows and buffaloes partially chew grass before swallowing it.
2. Partial digestion of this food takes place in their stomach.
3. The partially digested food is then brought back from the stomach to the mouth.
4. The animal gradually chews this food thoroughly, and this process is called **rumination**.
5. Animals that perform rumination are called **ruminants**, and the thoroughly chewed food again passes down the alimentary canal for further digestion.

7. Describe the human respiratory system and the pathway followed by inhaled air.
Answer:
1. Air enters the respiratory system through a pair of openings called **nostrils**.
2. It passes through the **nasal passages**, where tiny hairs and mucus help trap dust and dirt.
3. From the nasal passages, air travels through the **windpipe** towards the lungs.
4. The windpipe forms two branches that enter the two lungs and divide into smaller and finer branches.
5. These branches end in tiny balloon-like sacs called **alveoli**, where the exchange of oxygen and carbon dioxide takes place.

8. Explain the mechanism of inhalation and exhalation in humans.
Answer:
1. During **inhalation**, the ribs move upward and outward and the chest expands.
2. At the same time, the diaphragm moves downward, increasing the space inside the chest.
3. The increase in chest space allows air to enter the lungs.
4. During **exhalation**, the ribs move downward and inward and the diaphragm moves upward.
5. This reduces the space inside the chest and pushes air out of the lungs.

9. Explain how the exchange of gases takes place in the alveoli.
Answer:
1. Fresh air entering the lungs during breathing fills the tiny air sacs called **alveoli**.
2. The alveoli have thin walls and are surrounded by fine tubes containing blood.
3. Oxygen from the air present in the alveoli passes into the blood.
4. At the same time, carbon dioxide carried by the blood passes into the alveoli.
5. Oxygen is transported by the blood to different parts of the body, while carbon dioxide is removed from the body through exhalation.

10. Explain respiration and distinguish it from breathing.
Answer:
1. **Breathing** is the process of inhaling air into the lungs and exhaling air from the lungs.
2. **Respiration** is the process in which oxygen helps break down glucose to release usable energy.
3. During respiration, glucose and oxygen produce **carbon dioxide, water, and energy**.

4. Breathing is a **physical process**, whereas respiration is a **chemical process** occurring inside the body.
5. Breathing supplies oxygen required for respiration, while respiration releases energy needed for activities such as walking, running, playing, and thinking.

11. Describe the circulatory system and its functions.

Answer:

1. The circulatory system is the body's system for transporting nutrients, oxygen, and other substances.
2. It consists mainly of the **heart, blood, and blood vessels**.
3. The heart pumps blood through the blood vessels to different parts of the body.
4. Blood carries absorbed nutrients and oxygen to body tissues where they are required.
5. The circulatory system also helps carry waste products away from different parts of the body.

12. Describe the different breathing mechanisms found in animals.

Answer:

1. Animals such as birds, elephants, lions, cows, goats, lizards, and snakes breathe through **lungs**.
2. Most aquatic animals such as fish breathe through specialised structures called **gills**.
3. Tadpoles breathe through gills, while adult frogs use lungs when they are on land.
4. Adult frogs can also exchange gases through their **skin** when they stay in water.
5. Earthworms exchange oxygen and carbon dioxide through their **moist skin**, showing that different animals have breathing mechanisms suited to their habitats.

9.12 Five-mark questions with Answers of HOTS Type: (12 Questions)

1. Riya chews a piece of chapati for a long time and notices that it gradually tastes sweet. Explain scientifically why this happens.

Answer:

1. Chapati contains **starch**, which is a complex carbohydrate.
2. While chewing, the chapati mixes thoroughly with **saliva** present in the mouth.
3. Saliva contains digestive juice that begins breaking down starch into **simpler sugars**.
4. Longer chewing allows saliva more time to act on the starch, resulting in the formation of more sugar.
5. Therefore, the chapati gradually develops a **sweet taste**, showing that digestion begins in the mouth.

2. Suppose the finger-like projections in a person's small intestine are damaged. Predict how this could affect the person's health.

Answer:

1. The finger-like projections of the small intestine increase the **surface area available for absorption**.
2. If they are damaged, the effective surface area for nutrient absorption will decrease.
3. Consequently, fewer digested nutrients may pass from the small intestine into the blood.
4. The body may receive insufficient nutrients for **energy, growth, repair, and proper functioning**.
5. Therefore, even if the person eats sufficient food, damaged intestinal lining can interfere with proper nutrition.

3. A person frequently eats very little fibre-rich food. Predict how this habit may affect the functioning of the large intestine.

Answer:

1. The large intestine absorbs water and salts from undigested food and converts the remaining waste into stool.
2. Fibre-rich foods such as fruits, vegetables, and whole grains help the large intestine function properly.
3. Fibre helps make stool easier to pass through the digestive system.
4. Therefore, eating very little fibre may make the elimination of stool more difficult.
5. The person should include suitable **fibre-rich foods** in the diet to support a healthy digestive system.

4. A student says, "Breathing and respiration are exactly the same." How would you prove that the statement is incorrect?

Answer:

1. **Breathing** is the physical process of inhaling air and exhaling air.
2. **Respiration** is a chemical process in which oxygen helps break down glucose to release energy.
3. During respiration, glucose and oxygen produce **carbon dioxide, water, and energy**.
4. Breathing provides oxygen to the body and removes carbon dioxide, whereas respiration releases usable energy from food.
5. Hence, breathing and respiration are **different but closely related processes**, both of which are essential for survival.

5. Two students run the same distance, but one is breathing faster than the other afterwards. Suggest possible reasons using your understanding of respiration.

Answer:

1. Running increases the body's demand for **energy**.
2. Respiration requires oxygen to break down glucose and release this energy.
3. The student breathing faster may require more oxygen because of greater physical effort or a higher energy requirement.
4. Differences in physical fitness or the intensity at which the two students ran could also produce different breathing rates.
5. Thus, breathing rate can vary because individuals may have **different oxygen and energy requirements** during physical activity.

6. In an experiment, iodine is added to boiled rice and chewed boiled rice. Predict the observations and explain the difference.

Answer:

1. Iodine reacts with starch and produces a **blue-black colour**.
2. Therefore, boiled rice that has not been chewed will turn blue-black because it contains starch.
3. Chewed rice has been mixed with saliva for some time.
4. Saliva breaks down starch into simpler sugars, so the chewed rice may show no blue-black colour or only a very light colour.
5. The experiment therefore demonstrates that **saliva plays an important role in the digestion of starch**.

7. Why would digestion be affected if the liver stopped producing bile?

Answer:

1. Food entering the small intestine from the stomach contains acid.
2. The liver produces **bile**, which is mildly basic and helps neutralise this acid.
3. Bile also breaks fats into tiny droplets, making their digestion easier.
4. Without sufficient bile, neutralisation of the acidic food and efficient processing of fats would be affected.
5. Therefore, the absence of bile would interfere particularly with the proper conditions for digestion in the **small intestine and the digestion of fats**.

8. A person has difficulty moving the diaphragm properly. How could this affect breathing?

Answer:

1. The diaphragm is a dome-shaped muscle located below the lungs and plays an important role in breathing.
2. During inhalation, it moves downward and increases the space inside the chest.
3. This increase in space allows air to enter the lungs.
4. During exhalation, the diaphragm moves upward, reducing the space and helping push air out.
5. Therefore, improper movement of the diaphragm could make **both inhalation and exhalation difficult**.

9. Why is breathing through the nose considered better than breathing through the mouth?

Answer:

1. Air entering through the nose passes through the **nasal passages** before reaching the lungs.
2. Tiny hairs are present inside the nostrils.
3. These hairs, along with mucus, help **trap dust and dirt** present in inhaled air.
4. Breathing through the mouth bypasses this filtering function of the nasal passages.
5. Therefore, breathing through the nose provides better protection to the respiratory system from dust and dirt.

10. Fish and earthworms do not have the same breathing organs as humans. Explain how their breathing mechanisms are suited to their habitats.

Answer:

1. Humans breathe through lungs because they obtain oxygen mainly from air.
2. Fish live in water and possess **gills**, which exchange gases between the blood and gases dissolved in water.
3. Gills are richly supplied with blood vessels, helping in the exchange of oxygen and carbon dioxide.
4. Earthworms exchange oxygen and carbon dioxide through their **moist skin**.
5. These differences demonstrate that animals possess different breathing mechanisms **adapted to their particular habitats**.

11. A student's exhaled air is passed through lime water, which turns milky. What conclusion can be drawn from this observation?

Answer:

1. Lime water turns milky when it reacts with **carbon dioxide**.
2. In the chapter's experiment, lime water receiving exhaled air becomes milky or cloudy.
3. Lime water through which ordinary inhaled air is passed does not show the same noticeable change.
4. This indicates that **exhaled air contains more carbon dioxide than inhaled air**.
5. The observation therefore provides experimental evidence that carbon dioxide is released from the body during the breathing process.

12. Explain why a cow and a bird require different digestive adaptations even though both need to digest food.

Answer:

1. Animals consume different kinds of food and therefore show variations in their digestive systems.
2. Cows partially chew grass, swallow it, and later bring the partially digested food back to the mouth for further chewing, a process called **rumination**.
3. Birds do not have teeth and therefore cannot chew food in the same way.

4. Birds possess a muscular **gizzard**, whose contractions help break down food, often with the help of swallowed grit.
5. Thus, the digestive systems of cows and birds illustrate how animals are **adapted to different ways of obtaining and digesting food**.

9.13 Five-mark questions with Answers of Applied Type: (12 Questions)

1. Aarav eats his lunch very quickly without chewing the food properly. Explain how this habit can affect the initial stages of digestion.
Answer:
1. Chewing breaks food into smaller pieces and is an important part of **mechanical digestion**.
2. Proper chewing allows food to mix thoroughly with **saliva**.
3. Saliva contains digestive juice that begins the breakdown of starch into simpler sugars.
4. Saliva also moistens and softens food, making it easier to swallow and pass through the oesophagus.
5. Therefore, Aarav should chew his food properly so that the **initial stages of digestion occur effectively**.

2. Meera's doctor advises her to include more fruits, vegetables, and whole grains in her diet. Explain how this advice can help her digestive system.
Answer:
1. Fruits, vegetables, and whole grains are important sources of **dietary fibre**.
2. After digestion and absorption, undigested food enters the large intestine.
3. The large intestine absorbs water and some salts from this material and forms semi-solid stool.
4. Fibre-rich food helps the large intestine function properly by making the stool easier to pass.
5. Therefore, including fibre-rich foods in the diet supports **healthy digestion and easier egestion**.

3. During a football match, Rohan notices that he starts breathing much faster after running continuously. Apply your knowledge of respiration to explain why.
Answer:
1. Running increases the activity of the muscles and therefore increases the body's **energy requirement**.
2. The body obtains usable energy when oxygen helps break down glucose during respiration.
3. Faster breathing brings more oxygen-rich air into the lungs.
4. It also helps the body remove the increased carbon dioxide associated with respiration.
5. Thus, Rohan breathes faster during strenuous exercise to support the body's **greater demand for energy and gas exchange**.

4. A child has the habit of breathing through the mouth instead of the nose. Using your knowledge of the respiratory system, explain why breathing through the nose is preferable.
Answer:
1. Air normally enters the respiratory system through the **nostrils**.
2. The inhaled air then passes through the nasal passages.
3. Tiny hairs and mucus present there help trap **dust and dirt** from inhaled air.
4. Mouth breathing bypasses this filtering action of the nasal passages.
5. Therefore, breathing through the nose provides useful protection to the respiratory system by **filtering inhaled air**.

5. During a science experiment, a student blows exhaled air into lime water and notices that it becomes milky. Explain the observation and what it proves.
Answer:
1. Lime water turns milky when it reacts with **carbon dioxide**.
2. Exhaled air contains a greater proportion of carbon dioxide than inhaled air.
3. When the student blows into the lime water, carbon dioxide from the exhaled air reacts with it.
4. Therefore, the lime water becomes milky or cloudy.
5. This experiment demonstrates that **exhaled air contains more carbon dioxide than the air we inhale**.

6. A person suffers damage to the inner lining of the small intestine. Explain how this may affect the person's nutrition and health.
Answer:
1. The inner lining of the small intestine has thousands of **finger-like projections**.
2. These projections increase the surface area available for efficient absorption of digested nutrients.
3. Nutrients normally pass through this lining into blood vessels and are transported throughout the body.
4. If the lining is damaged, nutrient absorption may become less effective.
5. Consequently, the body may receive fewer nutrients needed for **energy, growth, repair, and proper functioning**.

7. A student sees a cow chewing continuously even though it is not eating grass at that moment. Explain this observation.
Answer:
1. Cows are grass-eating animals called **ruminants**.
2. They initially chew grass only partially and swallow it into the stomach.
3. Partial digestion of the swallowed food takes place in the stomach.
4. The partially digested food is later brought back to the mouth and chewed thoroughly.
5. Therefore, the cow may appear to be eating when it is actually carrying out **rumination**.

8. A bird is seen swallowing tiny stones along with its food. A child thinks the bird has done so accidentally. Explain why the tiny stones can actually be useful.
Answer:
1. Birds do not have teeth to chew their food.
2. Instead, they possess a muscular chamber called the **gizzard**.
3. The walls of the gizzard contract and relax to break down food mechanically.
4. Small stones or **grit** swallowed by birds assist the gizzard in breaking down food.
5. Thus, swallowing tiny stones can be a useful digestive adaptation rather than an accident.

9. A person has difficulty moving the diaphragm normally because of an injury. Explain how this can affect breathing.
Answer:
1. The diaphragm is a dome-shaped muscle situated below the lungs.
2. During inhalation, it moves downward, increasing the space inside the chest.
3. The increased chest space helps air enter the lungs.
4. During exhalation, the diaphragm moves upward, reducing chest space and helping force air out.
5. Therefore, impaired diaphragm movement can interfere with the person's normal **inhalation and exhalation**.

10. A fish is accidentally taken out of water and kept on land. Apply your knowledge of animal respiration to explain why it cannot breathe normally like a human.

Answer:
1. Humans obtain oxygen from air mainly through **lungs**, whereas most fish use **gills**.
2. Fish gills are richly supplied with blood vessels.
3. They are adapted for exchanging gases between the blood and gases **dissolved in water**.
4. A fish therefore depends on its aquatic environment for its normal mechanism of gas exchange.
5. This example demonstrates that animals possess **different breathing mechanisms adapted to their habitats**.

11. A doctor advises a person with celiac disease to avoid wheat and instead consume foods such as ragi, jowar, and bajra. Explain the reason for this advice.

Answer:
1. Celiac disease involves the body's reaction to **gluten**, a protein found in wheat, barley, and rye.
2. This reaction can damage the inner lining of the small intestine.
3. Damage to this lining affects the intestine's ability to absorb nutrients properly.
4. Millets such as **jowar, bajra, and ragi are naturally gluten-free**.
5. Therefore, replacing gluten-containing foods with these alternatives helps in managing celiac disease.

12. A family member smokes regularly inside the house. Explain why this habit can affect not only the smoker but also other family members.

Answer:
1. Smoking damages the lungs and increases the risk of serious respiratory diseases.
2. It may cause persistent coughing and frequent infections in the smoker.
3. Smoking also releases **toxic chemicals into the surrounding air**.
4. Non-smokers who inhale this polluted air experience **passive smoking**.
5. Therefore, avoiding smoking protects both the smoker and others, particularly vulnerable people such as **children, pregnant women, and the elderly**.

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

1. A student chews a piece of chapati continuously for about one minute. After some time, the chapati begins to taste sweet. Which explanation is most appropriate?
A. Proteins in chapati are converted into sugar.
B. Saliva breaks down starch into simpler sugars.
C. Fat in chapati dissolves in saliva.
D. Saliva produces glucose independently.
Answer: B. Saliva breaks down starch into simpler sugars.

---

2. Two samples of boiled rice are tested with iodine. Sample P is unchewed and turns blue-black, while sample Q has been chewed thoroughly and shows little or no blue-black colour. What can be concluded?
A. Chewing removes all carbohydrates.
B. Saliva converts starch into simpler sugars.
C. Iodine reacts only with unchewed food.
D. Chewing converts starch into protein.
Answer: B. Saliva converts starch into simpler sugars.

---

3. Suppose the wave-like contraction and relaxation of the oesophagus stopped completely. Which process would be affected most directly?

A. Absorption of nutrients into blood
B. Movement of food towards the stomach
C. Breakdown of fats by bile
D. Exchange of gases in alveoli
Answer: B. Movement of food towards the stomach.

---

4. The stomach secretes acid, yet its own wall is normally protected from damage. Which secretion is mainly responsible for this protection?
A. Bile
B. Saliva
C. Mucus
D. Pancreatic juice
Answer: C. Mucus.

---

5. Which combination correctly describes the functions of acid in the stomach?
A. Absorbs nutrients and water
B. Helps break down proteins and kills many harmful bacteria
C. Breaks fats into droplets and absorbs glucose
D. Converts starch directly into fat
Answer: B. Helps break down proteins and kills many harmful bacteria.

---

6. A substance entering the small intestine from the stomach is acidic. Which secretion helps neutralise this acidity and also breaks fats into tiny droplets?
A. Saliva
B. Mucus
C. Bile
D. Blood
Answer: C. Bile.

---

7. Which digestive secretion can help break down **carbohydrates, proteins, and fats**?
A. Bile
B. Pancreatic juice
C. Saliva only
D. Stomach acid only
Answer: B. Pancreatic juice.

---

8. If the finger-like projections lining the small intestine were greatly reduced, which function would be affected most?
A. Mechanical digestion in the mouth
B. Absorption of digested nutrients
C. Storage of stool
D. Production of saliva
Answer: B. Absorption of digested nutrients. The projections increase the surface area available for efficient absorption.

---

9. A patient has damage to the inner lining of the small intestine due to celiac disease. Which consequence is most likely?
A. Increased absorption of nutrients
B. Reduced nutrient absorption

C. Increased oxygen absorption
D. Complete stoppage of breathing
Answer: B. Reduced nutrient absorption.

---

10. Which sequence correctly represents the major pathway followed by food?
A. Mouth → stomach → oesophagus → small intestine → anus
B. Mouth → oesophagus → stomach → small intestine → large intestine → anus
C. Mouth → liver → stomach → pancreas → anus
D. Mouth → oesophagus → large intestine → stomach → anus
Answer: B. Mouth → oesophagus → stomach → small intestine → large intestine → anus.

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11. Why is the large intestine called "large" even though it is shorter than the small intestine?
A. It contains more digestive juice.
B. It absorbs more nutrients.
C. It is wider than the small intestine.
D. It is approximately six metres long.
Answer: C. It is wider than the small intestine.

---

12. Which process occurs mainly in the large intestine?
A. Absorption of most digested nutrients
B. Absorption of water and some salts from undigested food
C. Breakdown of starch by saliva
D. Breakdown of proteins by stomach juice
Answer: B. Absorption of water and some salts from undigested food.

---

13. A person consumes very little fibre for a long period. Which digestive process is most likely to become difficult?
A. Entry of oxygen into blood
B. Passage of stool
C. Breakdown of starch in the mouth
D. Movement of air into the lungs
Answer: B. Passage of stool. Fibre-rich foods help make stool easier to pass.

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14. A cow appears to be chewing food even though it is not grazing. The best explanation is that:
A. it is producing saliva without food.
B. partially digested food has returned to its mouth for further chewing.
C. its gizzard is pushing stones into its mouth.
D. it is unable to swallow grass.
Answer: B. Partially digested food has returned to its mouth for further chewing. This process is called **rumination**.

---

15. Birds sometimes swallow small stones or grit. What is their main digestive advantage?
A. They chemically digest proteins.
B. They absorb excess water.
C. They assist the gizzard in mechanically breaking down food.
D. They neutralise stomach acid.
Answer: C. They assist the gizzard in mechanically breaking down food.

---

16. Which statement best distinguishes breathing from respiration?

A. Both are purely physical processes.
B. Breathing releases energy, whereas respiration moves air.
C. Breathing is physical, whereas respiration is a chemical process involving the release of energy from food.
D. Respiration occurs only in the lungs.
Answer: C. Breathing is physical, whereas respiration is a chemical process involving the release of energy from food.

---

17. Which word equation correctly represents respiration as given in the chapter?
A. Glucose + carbon dioxide → oxygen + water + energy
B. Glucose + oxygen → carbon dioxide + water + energy
C. Oxygen + water → glucose + carbon dioxide
D. Glucose + water → oxygen + energy
Answer: B. Glucose + oxygen → carbon dioxide + water + energy.

---

18. Tiny hairs and mucus in the nasal passages primarily:
A. produce oxygen.
B. absorb carbon dioxide.
C. trap dust and dirt from inhaled air.
D. increase the breathing rate.
Answer: C. Trap dust and dirt from inhaled air.

---

19. In the bottle model of breathing shown in the chapter, the two balloons and rubber sheet respectively represent:
A. alveoli and rib cage.
B. lungs and diaphragm.
C. lungs and windpipe.
D. diaphragm and lungs.
Answer: B. Lungs and diaphragm.

---

20. During inhalation, which combination of events occurs?
A. Ribs move down and inward; diaphragm moves upward.
B. Ribs move up and outward; diaphragm moves downward.
C. Ribs remain stationary; diaphragm moves upward.
D. Ribs move inward; diaphragm moves downward.
Answer: B. Ribs move up and outward; diaphragm moves downward.

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21. During exhalation:
A. chest space increases and air enters the lungs.
B. diaphragm moves downward and lungs expand.
C. ribs move down and inward, while the diaphragm moves upward.
D. diaphragm remains stationary.
Answer: C. Ribs move down and inward, while the diaphragm moves upward.

---

22. Equal amounts of lime water are placed in two test tubes. Ordinary atmospheric air is passed through tube A, while exhaled air is blown through tube B. Tube B becomes milky more readily. This demonstrates that:
A. inhaled air contains no carbon dioxide.
B. exhaled air contains more carbon dioxide than inhaled air.

C. exhaled air contains no oxygen.
D. inhaled air contains more carbon dioxide.
Answer: B. Exhaled air contains more carbon dioxide than inhaled air.

---

23. According to the diagram comparing inhaled and exhaled air, which pair is approximately correct?
A. Inhaled oxygen: 21%; exhaled oxygen: 16–17%
B. Inhaled oxygen: 16%; exhaled oxygen: 21%
C. Inhaled carbon dioxide: 5%; exhaled carbon dioxide: 0.04%
D. Inhaled and exhaled air contain equal oxygen.
Answer: A. Inhaled oxygen: 21%; exhaled oxygen: 16–17%. The same figure shows approximately 0.04% carbon dioxide in inhaled air and 4–5% in exhaled air.

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24. Which feature of alveoli is particularly useful for gas exchange?
A. They have thick muscular walls.
B. They contain digestive juices.
C. They have thin walls surrounded by fine tubes containing blood.
D. They store carbon dioxide permanently.
Answer: C. They have thin walls surrounded by fine tubes containing blood.

---

25. During gas exchange in the lungs, which movement is correct?
A. Oxygen: blood → alveoli; carbon dioxide: alveoli → blood
B. Oxygen: alveoli → blood; carbon dioxide: blood → alveoli
C. Both oxygen and carbon dioxide: blood → alveoli
D. Both oxygen and carbon dioxide: alveoli → blood
Answer: B. Oxygen: alveoli → blood; carbon dioxide: blood → alveoli.

---

26. Which structure-function pair is **incorrectly matched**?
A. Alveoli — gas exchange
B. Rib cage — protection of lungs
C. Nasal hair and mucus — trapping dust and dirt
D. Diaphragm — digestion of carbohydrates
Answer: D. Diaphragm — digestion of carbohydrates. The diaphragm assists inhalation and exhalation.

---

27. A student runs 500 metres and immediately begins breathing faster. What is the most appropriate explanation?
A. The digestive system requires more bile.
B. Increased muscular activity creates a greater demand for energy, requiring increased oxygen supply.
C. Running stops cellular respiration.
D. Carbon dioxide is converted directly into oxygen.
Answer: B. Increased muscular activity creates a greater demand for energy, requiring increased oxygen supply. Respiration uses oxygen to break down glucose and release energy.

---

28. Which animal-stage-respiratory structure combination is correct?
A. Fish — lungs
B. Tadpole — gills
C. Adult frog in water — gills only
D. Earthworm — lungs

Answer: B. Tadpole — gills.

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29. An adult frog is underwater for some time. Which structure helps it exchange gases under these conditions?
A. Gizzard
B. Moist skin
C. Rumen
D. Alveoli only
Answer: B. Moist skin. Adult frogs use lungs on land and skin for gas exchange while in water.

---

30. Which animal exchanges oxygen and carbon dioxide through its moist skin?
A. Cow
B. Fish
C. Earthworm
D. Bird
Answer: C. Earthworm.

Challenge Questions
31. Consider the following statements:
I. Bile is mildly basic.
II. Pancreatic juice is basic.
III. Both help neutralise acids present in food entering the small intestine.
IV. Both are secreted by the pancreas.
Which option 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. Bile is secreted by the liver, whereas pancreatic juice is secreted by the pancreas.

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32. Arrange the following events in the correct order:
P. Oxygen passes from alveoli into blood.
Q. Air enters through the nostrils.
R. Air reaches the lungs through the windpipe.
S. Oxygen is transported to different parts of the body.
A. Q → R → P → S
B. R → Q → S → P
C. P → Q → R → S
D. Q → P → R → S
Answer: A. Q → R → P → S.

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33. A student says, “All oxygen present in inhaled air is consumed by the body.” Which observation from the chapter disproves this statement?
A. Exhaled air contains approximately 16–17% oxygen.
B. Exhaled air contains 0% oxygen.
C. Inhaled air contains 4–5% carbon dioxide.
D. Alveoli contain no oxygen.
Answer: A. Exhaled air contains approximately 16–17% oxygen.

34. If mucus secretion in the stomach suddenly stopped while acid secretion continued normally, what would most likely happen?
A. The stomach lining could be damaged by acid.
B. Fat digestion would completely stop.
C. Nutrient absorption would increase greatly.
D. The oesophagus would begin producing bile.
Answer: A. The stomach lining could be damaged by acid. Mucus normally protects the stomach lining from acid.

---

35. Which statement best demonstrates the relationship among the digestive, respiratory, and circulatory systems?
A. Digestion provides nutrients, respiration helps release usable energy from food using oxygen, and circulation transports nutrients and oxygen through the body.
B. Digestion produces oxygen, respiration transports blood, and circulation digests proteins.
C. All three systems perform exactly the same function.
D. The three systems function independently and do not interact.
Answer: A. Digested nutrients enter the blood; oxygen participates in respiration to release energy from glucose; and the circulatory system transports nutrients, oxygen, and other substances throughout the body.

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

(1) **Learning by Doing – Simple Digestion Experiments:**
Conduct the **saliva–starch experiment** using boiled rice/chapati and iodine solution. Students can compare chewed and unchewed food and record observations to understand how saliva breaks down starch into simpler sugars. This promotes observation, experimentation, and scientific reasoning.

(2) **Model-Based Learning – Human Digestive System:**
Ask students to prepare a **3-D model of the digestive system** using clay, cardboard, recycled materials, or dough. Students should label the mouth, oesophagus, stomach, liver, pancreas, small intestine, large intestine, rectum, and anus and explain the function of each part. The chapter itself suggests a coloured-clay 3-D model as an exploratory project.

(3) **Working Model of the Breathing Mechanism:**
Demonstrate inhalation and exhalation using the **bottle–balloon lung model** described in the chapter. Students can observe how pulling the rubber sheet downward inflates the balloons and relate the balloons to the lungs and the rubber sheet to the diaphragm.

(4) **Comparative Learning – Digestion and Respiration in Different Animals:**
Use a comparison chart for **humans, cows, birds, fish, frogs, and earthworms**. Students can identify adaptations such as rumination in cows, the gizzard in birds, gills in fish, lungs/skin in frogs, and moist skin in earthworms. This develops classification and comparative reasoning skills.

(5) **Health and Lifestyle Integration:**
Connect the chapter with students' everyday lives through discussions on **oral hygiene, fibre-rich food, fermented food, digestive health, breathing exercises, air quality, and the harmful effects of smoking**. Students can maintain a short “Healthy Life Processes Diary” recording healthy food, water intake, physical activity, and breathing practices.

(6) **Inquiry-Based Learning through “Predict–Observe–Explain”:**

Before each experiment, ask students to **predict** what will happen, **observe** the actual result, and then **explain** it scientifically. For example, students can predict which lime-water sample will become milky when comparing inhaled and exhaled air, then relate the result to carbon dioxide.

(7) Physical Activity and Breathing-Rate Investigation:
Let students measure their breathing rate at rest and again after safe physical activity such as walking or light jogging. They can tabulate the results and discuss why breathing becomes faster when the body's energy requirement increases. This connects respiration with real-life physiological changes. The chapter itself encourages reasoning about differences in breathing rate after running.

(8) Diagram-Based Concept Mapping:
Use the chapter's diagrams of the **digestive system, respiratory system, breathing mechanism, alveoli, and animal respiratory structures**. Students can create concept maps such as:
Food → Digestion → Absorption → Blood → Cells → Respiration → Energy. This helps students understand that digestive, respiratory, and circulatory processes are interconnected rather than isolated topics.

(9) Collaborative Group Learning and Peer Teaching:
Divide the class into groups such as **"Digestive Detectives," "Respiration Researchers," "Animal Adaptation Experts," and "Health Scientists."** Each group studies one aspect of the chapter, prepares a chart/model, and teaches it to classmates. This encourages teamwork, communication, leadership, and deeper conceptual understanding.

(10) Project-Based Learning on Environment and Respiratory Health:
Assign students a mini-project on **Air Quality Index (AQI)** and its possible effects on people such as farmers, factory workers, and street vendors. Students can collect local observations, prepare posters, and suggest ways to protect respiratory health. This directly extends an exploratory project suggested in the chapter.

These practices shift the chapter from **"learning about life processes" to "observing, experimenting with, comparing, and applying life processes,"** making Science more experiential and competency-oriented for Grade 7 students.

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

(1) Digital Journey Through the Human Body:
Use an interactive animation or teacher-prepared digital presentation in which students "travel" with a piece of food from the **mouth → oesophagus → stomach → small intestine → large intestine → anus**. At each stage, students identify the organ and explain what happens to the food there. This converts the alimentary canal into a visual storytelling experience.

(2) DIY Smart Lung Model Challenge:
After constructing the bottle-and-balloon breathing model described in the chapter, challenge student groups to **improve or redesign the model** using low-cost/recycled materials. They should demonstrate how movement of the diaphragm changes chest space during inhalation and exhalation and explain the limitations of their model.

(3) "Digestive Detective" Experimental Lab:
Turn the saliva-and-starch activity into an investigation. Different groups can vary the **chewing time** and compare iodine-test results, then construct an observation table and infer how saliva acts on starch. The chapter itself encourages students to repeat the experiment with increased chewing time.

(4) **Breathing-Rate Data Science Activity:**
Students can record their number of breaths per minute **before and after safe physical activity**, enter the results in a spreadsheet, and create a simple bar graph. They can then analyse why breathing rates differ among students. This extends the chapter's question comparing breathing rates after running.

(5) **AR/QR-Based Organ Exploration:**
Create QR-code learning stations for the **stomach, small intestine, lungs, alveoli, diaphragm, heart, and gills**. Scanning each QR code can open a teacher-created diagram, short animation, question, or challenge. Students rotate through stations and complete a "Life Processes Passport."

(6) **Animal Adaptation Design Challenge:**
Give groups habitat cards such as **water, land, moist soil, or land-and-water** and ask them to design an imaginary animal with an appropriate breathing mechanism. Students must justify their design using examples from fish, frogs, earthworms, and lung-breathing animals discussed in the chapter.

(7) **Human Alveoli Simulation:**
Students can create a model showing alveoli surrounded by blood vessels and use differently labelled beads/cards to represent **oxygen and carbon dioxide**. They physically move "oxygen" from alveoli to blood and "carbon dioxide" from blood to alveoli, making gas exchange easier to visualise.

(8) **AQI and Respiratory Health Mini-Research Project:**
Students can investigate **air quality and AQI** and prepare posters or presentations explaining how air quality may affect farmers, factory workers, or street vendors. This directly develops the exploratory project proposed in the chapter into an environmental-health investigation.

(9) **Gamified "Escape from the Human Body" Quiz:**
Design an escape-room-style classroom game where students solve clues about **saliva, stomach acid, bile, absorption, alveoli, diaphragm, respiration, and circulation**. Each correct answer unlocks the next organ or stage. The final challenge can require students to connect digestion, respiration, and circulation into one complete life-process pathway.

(10) **Life Processes Innovation Exhibition:**
Organise a small classroom exhibition titled **"Inside Animals: How Life Works."** Student teams can display 3-D digestive-system models, working lung models, animal respiratory adaptations, healthy-digestion posters, AQI projects, and breathing investigations. The chapter itself recommends model-making and several exploratory projects suitable for such an exhibition.

Particularly suitable innovations for Grade 7:
For practical classroom implementation, the **five most promising** are: **Digital Journey Through the Human Body, Digestive Detective Lab, DIY Smart Lung Model, Breathing-Rate Data Analysis, and Animal Adaptation Design Challenge**. Together, they integrate **experiential learning, technology, creativity, data interpretation, collaboration, and scientific enquiry** while remaining closely aligned with the uploaded chapter.

9.17: Practicing Questions/Question Bank

A. Fill in the Blanks:

1. The breaking down of complex food components into simpler forms is called __________.
   Answer: Digestion

2. The initial breakdown of food by crushing and chewing is called __________ **digestion**.
   Answer: Mechanical
3. Saliva helps break down starch into __________.
   Answer: Sugar
4. The food pipe is also known as the __________.
   Answer: Oesophagus
5. The stomach secretion contains digestive juice, acid, and __________.
   Answer: Mucus
6. The __________ secretes bile.
   Answer: Liver
7. The longest part of the alimentary canal is the __________.
   Answer: Small intestine
8. The process by which digested nutrients pass into the blood is called __________.
   Answer: Absorption
9. Semi-solid waste formed in the large intestine is called __________.
   Answer: Stool
10. The removal of stool through the anus is called __________.
    Answer: Egestion
11. The process of bringing partially digested food back to the mouth and chewing it again is called __________.
    Answer: Rumination
12. Birds possess a muscular chamber called the __________ that helps break down food.
    Answer: Gizzard
13. The process of inhaling and exhaling air is called __________.
    Answer: Breathing
14. The small balloon-like sacs in the lungs are called __________.
    Answer: Alveoli
15. During inhalation, the diaphragm moves __________.
    Answer: Downwards
16. Exhaled air contains more __________ than inhaled air.
    Answer: Carbon dioxide
17. Respiration uses oxygen to break down __________ to release energy.
    Answer: Glucose
18. The circulatory system consists of the heart, blood, and __________.
    Answer: Blood vessels
19. Most fish breathe through __________.
    Answer: Gills
20. Earthworms exchange gases through their __________ **skin**.
    Answer: Moist

These concepts and terms are directly covered in the chapter's sections on digestion and respiration.

B. One-Mark Descriptive Questions:

1. **What are life processes?**
   Answer: Processes essential for the survival of living beings, such as nutrition, respiration, excretion, circulation, and reproduction, are collectively called life processes.

2. **What is mechanical digestion?**
   Answer: The initial breakdown of food into smaller pieces by crushing and chewing is called mechanical digestion.

3. **What is the function of saliva?**
   Answer: Saliva moistens food and helps break down starch into sugar.

4. **What is digestion?**
   Answer: Digestion is the process of breaking complex food components into simpler forms.

5. **What is the function of mucus in the stomach?**
   Answer: Mucus protects the stomach lining from damage caused by acid.

6. **What is the role of bile?**
   Answer: Bile neutralises acids and breaks fats into tiny droplets, making their digestion easier.

7. **What is absorption of nutrients?**
   Answer: The passage of digested nutrients from the small intestine into the blood is called absorption.

8. **Why does the small intestine have finger-like projections?**
   Answer: They increase the surface area for efficient nutrient absorption.

9. **What is rumination?**
   Answer: Rumination is the process in which partially digested food is brought back to the mouth and chewed again.

10. **What is the function of the gizzard in birds?**
    Answer: The gizzard mechanically breaks down food through contraction and relaxation, often with the help of grit.

11. **Define breathing.**
    Answer: Breathing is the process of inhaling and exhaling air.

12. **What are alveoli?**
    Answer: Alveoli are small balloon-like sacs in the lungs where gas exchange occurs.

13. **What is respiration?**
    Answer: Respiration is the process in which oxygen helps break down glucose to release energy.

14. **What is the function of the diaphragm?**
    Answer: The diaphragm helps in inhalation and exhalation by changing the space inside the chest.

15. **How do earthworms breathe?**
    Answer: Earthworms exchange oxygen and carbon dioxide through their moist skin.

C. Two-Mark Descriptive Questions:

1. State two functions of saliva.

Answer:

1. Saliva helps break down starch into sugar.
2. It moistens and softens food, making it easier to swallow.

2. What are the functions of acid and mucus in the stomach?

Answer:

1. Acid helps break down proteins and kills many harmful bacteria.
2. Mucus protects the stomach lining from the acid.

3. State two functions of bile.

Answer:

1. Bile neutralises acids present in food entering from the stomach.
2. It breaks fats into tiny droplets, making their digestion easier.

4. How is the small intestine adapted for absorption?

Answer:

1. Its inner lining is thin and contains thousands of finger-like projections.
2. These projections increase the surface area for efficient absorption of nutrients.

5. State two functions of the large intestine.

Answer:

1. It absorbs water and some salts from undigested food.
2. It helps form semi-solid stool for egestion.

6. Differentiate between inhalation and exhalation.

Answer:

1. During inhalation, the ribs move up and outward and the diaphragm moves downward.
2. During exhalation, the ribs move down and inward and the diaphragm moves upward.

7. Give two differences between breathing and respiration.

Answer:

1. Breathing is a physical process, while respiration is a chemical process.
2. Breathing involves inhalation and exhalation, while respiration uses oxygen to break down glucose and release energy.

8. How do frogs breathe during different stages and habitats?

Answer:

1. Tadpoles breathe through gills.
2. Adult frogs use lungs on land and skin for gas exchange in water.

9. What is the role of the circulatory system?

Answer:

1. It transports nutrients, oxygen, and other substances throughout the body.
2. It also carries waste products away from different parts of the body.

10. Why is breathing through the nose preferable to breathing through the mouth?

Answer:

1. Tiny hairs and mucus in the nasal passages trap dust and dirt.
2. Thus, the nose helps filter inhaled air before it reaches the lungs.

D. Three-Mark Descriptive Questions:

1. Explain digestion in the mouth.

Answer:

1. Teeth crush and chew food into smaller pieces.
2. Saliva mixes with food and begins breaking down starch into sugar.
3. The tongue mixes food with saliva and helps push it into the oesophagus.

2. Explain digestion in the stomach.

Answer:

1. The stomach walls contract and relax to churn food.
2. Digestive juice and acid help break down proteins into simpler components.
3. Mucus protects the stomach lining from the action of acid.

3. Explain the role of the small intestine in digestion and absorption.

Answer:

1. Bile, pancreatic juice, and intestinal digestive juice help complete digestion.
2. Digested nutrients pass through the walls of the small intestine into the blood.
3. Finger-like projections increase the surface area for efficient absorption.

4. Explain rumination in cows.

Answer:

1. Cows partially chew grass and swallow it.
2. Partially digested food is later brought back to the mouth.

3. It is chewed thoroughly and swallowed again for further digestion.

5. Describe the mechanism of inhalation.

Answer:

1. During inhalation, the ribs move upward and outward.
2. The diaphragm moves downward, increasing the space inside the chest.
3. As a result, air enters the lungs.

6. Explain gas exchange in the alveoli.

Answer:

1. Alveoli have thin walls and are surrounded by fine blood vessels.
2. Oxygen passes from the alveoli into the blood.
3. Carbon dioxide moves from the blood into the alveoli to be exhaled.

7. Explain how the lime-water experiment shows the presence of carbon dioxide in exhaled air.

Answer:

1. Exhaled air is passed through lime water.
2. The lime water turns milky because it reacts with carbon dioxide.
3. This shows that exhaled air contains more carbon dioxide than inhaled air.

8. Compare breathing in fish, frogs, and earthworms.

Answer:

1. Fish exchange gases through gills.
2. Adult frogs use lungs on land and skin in water.
3. Earthworms exchange gases through their moist skin.

E. Five-Mark Descriptive Questions:

1. Explain the journey of food through the human digestive system.

Answer:

1. Food enters the mouth, where teeth chew it and saliva begins starch digestion.
2. The oesophagus carries the softened food towards the stomach through wave-like movements.
3. In the stomach, food is churned and mixed with digestive juice, acid, and mucus.
4. In the small intestine, digestion is completed and nutrients are absorbed into the blood.
5. The large intestine absorbs water and salts, and the remaining stool is expelled through the anus.

2. Explain the mechanism of breathing in human beings.

Answer:

1. During inhalation, the ribs move upward and outward.
2. The diaphragm moves downward, increasing the space inside the chest.
3. Air therefore enters and fills the lungs.
4. During exhalation, the ribs move downward and inward while the diaphragm moves upward.
5. This decreases chest space and pushes air out of the lungs.

3. Describe the human respiratory system and the pathway of air.

Answer:

1. Air enters through the nostrils and passes through the nasal passages.
2. Tiny hairs and mucus help trap dust and dirt.
3. Air then travels through the windpipe, which divides into two branches entering the lungs.
4. These branches divide into finer branches ending in alveoli.
5. In the alveoli, oxygen enters the blood and carbon dioxide passes from the blood into the alveoli.

4. Explain how different animals are adapted for digestion and breathing.

Answer:

1. Ruminants such as cows bring partially digested food back to the mouth for further chewing.
2. Birds have a gizzard that mechanically breaks down food, often with the help of grit.
3. Fish possess gills for exchanging gases dissolved in water.
4. Adult frogs use lungs on land and skin for gas exchange in water.
5. Earthworms exchange oxygen and carbon dioxide through their moist skin.

5. Explain the relationship among digestion, respiration, and circulation.

Answer:

1. Digestion converts complex food components into simpler nutrients.
2. Digested nutrients are absorbed into the blood through the small intestine.
3. Breathing supplies oxygen to the body through the respiratory system.
4. Respiration uses oxygen to break down glucose and release usable energy.
5. The circulatory system transports nutrients and oxygen throughout the body and carries away waste products.

6. Explain the importance of maintaining healthy digestive and respiratory systems.

Answer:

1. Fibre-rich foods such as fruits, vegetables, and whole grains support proper functioning of the large intestine.

2. Proper oral hygiene helps prevent tooth decay and bad smell in the mouth.
3. Mindful eating, proper meal timings, and avoiding overeating support digestive health.
4. Breathing practices can support respiratory well-being, relaxation, and concentration.
5. Smoking should be avoided because it damages the lungs and exposes other people to harmful passive smoke.

Question-bank balance: For a Grade 7 assessment, these can be mixed with **diagram-based questions** on the human digestive system, respiratory system, inhalation/exhalation mechanism, alveoli, ruminant digestive system, bird gizzard, and fish gills. The chapter's own end exercises also emphasize experimental reasoning using the **iodine–starch test and lime-water test**, making these especially suitable for competency-based assessment.

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7th Standard Science Book Chapter 10

Chapter 10: Life Processes in Plants

10.1 Summary of the Chapter:

Summary of Chapter 10: Life Processes in Plants:

(1) **Growth in Plants:** Plants show growth by increasing in height, developing new leaves and branches, and thickening their stems. Experiments in the chapter demonstrate that **both sunlight and water are essential for healthy plant growth**.

(2) **Leaves as Food Factories:** Unlike animals, plants do not obtain ready-made food. Their leaves act as **"food factories"**, producing food. Leaves are generally broad, flat, and green because they contain **chlorophyll**, which helps capture sunlight.

(3) **Starch as Stored Food:** Plants store food in the form of **starch**, a carbohydrate. The presence of starch in leaves can be tested using **iodine solution**; a blue-black colour indicates the presence of starch.

(4) **Role of Sunlight and Chlorophyll:** Experiments with green and non-green portions of leaves show that **chlorophyll and sunlight are essential for the preparation of starch**. Therefore, green parts of leaves are mainly responsible for food preparation.

(5) **Role of Carbon Dioxide:** Plants obtain **carbon dioxide from the air**, and experiments using caustic soda demonstrate that carbon dioxide is essential for preparing starch.

(6) **Photosynthesis:** The process by which green plants prepare food using **carbon dioxide and water in the presence of sunlight and chlorophyll** is called **photosynthesis**. Leaves are the primary sites of photosynthesis, although other green parts containing chlorophyll can also perform it.

(7) **Products of Photosynthesis:** During photosynthesis, plants produce **glucose and oxygen**. Glucose provides immediate energy and can later be converted into starch for storage. The word equation is:
Carbon dioxide + Water → Glucose + Oxygen *(in the presence of sunlight and chlorophyll)*.

(8) **Release of Oxygen:** Experiments with water plants demonstrate that **oxygen is released during photosynthesis**. This process takes place effectively in the presence of sunlight.

(9) **Stomata and Gas Exchange:** Leaves contain tiny pores called **stomata**. These pores facilitate the exchange of gases, particularly **carbon dioxide and oxygen**, during photosynthesis and respiration.

(10) **Transport of Water and Minerals:** Roots absorb **water and minerals from the soil**. These substances are transported upward to the stem, leaves, and other plant parts through thin tube-like structures called **xylem**.

(11) **Transport of Food:** Food prepared mainly in the leaves through photosynthesis is transported to different parts of the plant through another set of tube-like structures called **phloem**. Some of this food may be stored in parts such as **roots and seeds**.

(12) **Respiration in Plants:** Plants also respire. During respiration, **glucose is broken down using oxygen to release carbon dioxide, water, and energy**. This energy supports plant growth and development. All plant parts—green as well as non-green—carry out respiration. Thus, photosynthesis, transport, and respiration work together to sustain plant life.

10.2 Important Formulas:

Important Formulae / Equations – Chapter 10: Life Processes in Plants

This chapter is mainly **conceptual and experimental**, so it does **not contain mathematical formulae for numerical problems**. However, the following **word equations and simple calculation relationships** are important for examinations.

1. Word Equation for Photosynthesis

Carbon dioxide + Water → Glucose + Oxygen

(in the presence of sunlight and chlorophyll)

Plants use carbon dioxide and water to prepare glucose during photosynthesis. Sunlight supplies energy, while chlorophyll helps capture it.

2. Symbolic/Balanced Equation for Photosynthesis

For understanding and higher-level questions, the process may be represented as:

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

(Sunlight and chlorophyll)

Note: The uploaded Grade 7 chapter provides the **word equation**, not this balanced chemical equation. Therefore, the word equation should be given priority for chapter-based examinations.

3. Word Equation for Respiration

Glucose + Oxygen → Carbon dioxide + Water + Energy

During respiration, glucose is broken down in the presence of oxygen to release energy required for plant growth and development.

4. Symbolic/Balanced Equation for Respiration

For higher-level understanding:

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ **+ Energy**

Again, the uploaded chapter specifically teaches the **word equation** rather than the balanced chemical equation.

5. Increase in Plant Height

The chapter's experiment records plant height on Day 1 and after two weeks. Therefore, simple quantitative questions could use:

Increase in height = Final height − Initial height

For example, if a plant grows from 12 cm to 19 cm:

Increase = 19 − 12 = 7 cm

This calculation is not explicitly given as a formula in the textbook but can be derived from the plant-growth observation table.

6. Increase in Number of Leaves

Increase in number of leaves = Final number of leaves − Initial number of leaves

The chapter asks students to count and compare the number of leaves before and after the experimental period.

7. Average Growth per Day

For **applied/HOTS quantitative questions**, a useful derived formula is:

Average growth per day = Increase in plant height ÷ Number of days

For example, if a plant grows by 7 cm in 14 days:

Average growth = 7 ÷ 14 = 0.5 cm/day

The chapter itself does **not explicitly state this formula**, but its two-week growth experiment makes such calculations possible.

8. Percentage Increase in Plant Height

For Olympiad/application-type questions:

Percentage increase in height = [(Final height − Initial height) ÷ Initial height] × 100

This is also an **extension formula**, not directly provided in the chapter.

Quick Revision:

Concept	Important Equation/Relationship
Photosynthesis	Carbon dioxide + Water → Glucose + Oxygen
Respiration	Glucose + Oxygen → Carbon dioxide + Water + Energy
Increase in height	Final height − Initial height
Increase in leaves	Final leaves − Initial leaves
Average growth	Increase in height ÷ Time
% growth	(Increase ÷ Initial value) × 100

For Grade 7 examinations, the two most important equations to remember are the word equations for *photosynthesis* and *respiration*. The chapter otherwise contains no dedicated mathematical formulae for quantitative problem-solving.

10.3 Fill-Up the Blank LOTS type questions with Answers: (35 Questions)

1. Plants require both ________ and water for their growth.
   Answer: Sunlight
2. Plants store food in the form of ________.
   Answer: Starch
3. Starch is a type of ________.
   Answer: Carbohydrate
4. The green pigment present in leaves is called ________.
   Answer: Chlorophyll
5. Chlorophyll helps plants capture ________ efficiently.
   Answer: Sunlight
6. Leaves are also called the ________ of plants.
   Answer: Food factories
7. The presence of starch in a leaf can be tested using ________ solution.
   Answer: Iodine
8. A leaf containing starch turns ________ when iodine solution is added.
   Answer: Blue-black
9. ________ soda is used to absorb carbon dioxide from the air in the experiment.
   Answer: Caustic
10. The gas from the air that is essential for the preparation of food in plants is ________.
    Answer: Carbon dioxide
11. The process by which plants prepare their food is called ________.
    Answer: Photosynthesis
12. The primary site of photosynthesis in a plant is the ________.
    Answer: Leaf
13. During photosynthesis, food is produced in the form of ________.
    Answer: Glucose
14. Glucose is later converted into ________ for storage.
    Answer: Starch
15. ________ is released during the process of photosynthesis.
    Answer: Oxygen
16. Tiny pores present on the surface of leaves are called ________.
    Answer: Stomata
17. Stomata help in the exchange of ________.
    Answer: Gases
18. Water and minerals present in the soil are taken up by the ________ of a plant.
    Answer: Roots

19. Water and minerals are transported through thin tube-like structures called ________.
    Answer: Xylem
20. Food prepared in the leaves is transported through structures called ________.
    Answer: Phloem
21. Food transported through phloem may be stored in plant parts such as seeds and ________.
    Answer: Roots
22. During respiration, ________ is broken down in the presence of oxygen.
    Answer: Glucose
23. Respiration releases carbon dioxide, water and ________.
    Answer: Energy
24. The energy produced during respiration is used by plants for their growth and ________.
    Answer: Development
25. All parts of a plant, whether green or non-green, carry out ________.
    Answer: Respiration
26. Lime water turns ________ in the presence of more carbon dioxide.
    Answer: Milky
27. In the respiration experiment, ________ bean seeds are soaked in water overnight.
    Answer: Moong
28. The Indian scientist ________ studied the process of photosynthesis.
    Answer: Rustom Hormusji Dastur
29. ________ received a Ph.D. for her remarkable contribution in the area of respiration in plants.
    Answer: Kamala Sohonie
30. The ancient Indian text that records observations about plant growth, soil and agricultural practices is called ________.
    Answer: Vrikshayurveda

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

1. A plant receiving sufficient water but kept continuously in darkness will show poor growth because it cannot carry out ________ effectively.
   Answer: Photosynthesis
2. If two identical plants receive equal sunlight but only one is watered regularly, the plant without water is likely to ________.
   Answer: Die
3. If the green portion of a variegated leaf turns blue-black after the iodine test, we can infer that ________ has been produced there.
   Answer: Starch
4. If a green leaf is kept in darkness for 36 hours and then tested with iodine, it will not turn blue-black because ________ has not been produced.
   Answer: Starch
5. If the non-green portion of a variegated leaf does not turn blue-black after the iodine test, insufficient ________ may be responsible.
   Answer: Chlorophyll
6. If a destarched plant is exposed to sunlight but deprived of carbon dioxide, its leaves will not produce ________.
   Answer: Starch

7. In the experiment using caustic soda, the portion of the leaf inside the bottle does not turn blue-black because caustic soda absorbs ________.
   Answer: Carbon dioxide
8. If a plant has water, chlorophyll and carbon dioxide but receives no sunlight, the process of ________ will not occur effectively.
   Answer: Photosynthesis
9. If a plant has sunlight, water and carbon dioxide but lacks chlorophyll, it will not be able to prepare sufficient ________.
   Answer: Food (glucose/starch)
10. A green stem can perform photosynthesis if its cells contain ________.
    Answer: Chlorophyll
11. If air bubbles are produced by a water plant exposed to sunlight, the gas accumulating in the test tube is rich in ________.
    Answer: Oxygen
12. If the same water plant is moved from sunlight to complete darkness, the production of oxygen bubbles due to photosynthesis will ________.
    Answer: Stop/decrease greatly
13. A glowing or lit matchstick burns more intensely when inserted into the collected gas because the gas is rich in ________.
    Answer: Oxygen
14. If stomata were unable to function properly, the exchange of carbon dioxide and ________ through the leaf would be affected.
    Answer: Oxygen
15. If the xylem of a plant stem is damaged, the transport of water and ________ from the roots to other parts will be affected.
    Answer: Minerals
16. When a white flower is placed in red-coloured water and later its petals become reddish, this demonstrates that coloured water has moved through the ________.
    Answer: Xylem
17. If the phloem of a plant is severely damaged, food prepared in the ________ will not be transported efficiently to the other parts.
    Answer: Leaves
18. A potato stores starch even though photosynthesis mainly takes place in its leaves because food is transported from the leaves through the ________.
    Answer: Phloem
19. If germinating seeds release carbon dioxide during an experiment, the lime water connected to the flask will turn ________.
    Answer: Milky
20. Germinating seeds kept in a flask release carbon dioxide because they are carrying out ________.
    Answer: Respiration
21. If a plant could photosynthesise but could not respire, it would be unable to efficiently obtain ________ from the glucose it produces.
    Answer: Energy
22. In respiration, if glucose is represented by X and oxygen by Y in the equation **X + Y → Carbon dioxide + Water + Energy**, Y represents ________.
    Answer: Oxygen
23. If all photosynthetic organisms disappeared from Earth, the amount of ________ released through photosynthesis would eventually decrease drastically.
    Answer: Oxygen

24. A plant kept in sunlight with adequate water but without access to carbon dioxide will fail to form starch because ________ is an essential raw material for photosynthesis.
    Answer: Carbon dioxide
25. A plant kept in darkness with sufficient carbon dioxide and water will still fail to form starch because it lacks ________.
    Answer: Sunlight
26. If xylem functions normally but phloem is blocked, water can reach the leaves, but the transport of ________ from the leaves will be affected.
    Answer: Food
27. Broad and flat leaves are advantageous to plants because they can capture more ________ for photosynthesis.
    Answer: Sunlight
28. In a sealed bottle garden, carbon dioxide produced during respiration can be used by the plant for ________.
    Answer: Photosynthesis
29. In the same sealed bottle garden, oxygen produced during photosynthesis can subsequently be used for ________.
    Answer: Respiration
30. The continued survival of a plant in a properly maintained sealed bottle demonstrates the interdependence between ________ and respiration.
    Answer: Photosynthesis

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

One-Mark Descriptive Questions with Answers – LOTS Type

1. **What two factors are essential for the growth of plants according to Activity 10.1?**
   Answer: Plants require both sunlight and water for proper growth.
2. **In what form do plants store food?**
   Answer: Plants store food in the form of starch, which is a carbohydrate.
3. **What is chlorophyll?**
   Answer: Chlorophyll is the green pigment in plants that helps capture sunlight efficiently.
4. **Why are leaves called the 'food factories' of plants?**
   Answer: Leaves are called the food factories of plants because they are the primary site where food is prepared.
5. **Which test is used to detect starch in a leaf?**
   Answer: The iodine test is used to detect the presence of starch in a leaf.
6. **What colour indicates the presence of starch in the iodine test?**
   Answer: A blue-black colour indicates the presence of starch.
7. **Why is a leaf decolourised before performing the iodine test?**
   Answer: A leaf is decolourised so that the colour change indicating the presence of starch can be easily observed.
8. **What is the role of chlorophyll in photosynthesis?**
   Answer: Chlorophyll helps plants prepare food by capturing sunlight.
9. **Which gas from the air is essential for the preparation of food in plants?**
   Answer: Carbon dioxide is essential for the preparation of food in plants.
10. **What is the function of caustic soda in the experiment on photosynthesis?**
    Answer: Caustic soda absorbs carbon dioxide from the air.

11. **What is photosynthesis?**
    Answer: Photosynthesis is the process by which plants prepare food using carbon dioxide and water in the presence of sunlight and chlorophyll.
12. **What are the essential requirements for photosynthesis?**
    Answer: Sunlight, water, carbon dioxide and chlorophyll are essential for photosynthesis.
13. **Which gas is released during photosynthesis?**
    Answer: Oxygen is released during photosynthesis.
14. **What is the main food produced during photosynthesis?**
    Answer: Glucose, a simple carbohydrate, is produced during photosynthesis.
15. **What happens to some of the glucose produced during photosynthesis?**
    Answer: Some glucose is converted into starch and stored in the plant.
16. **What are stomata?**
    Answer: Stomata are tiny pores present on the surface of leaves.
17. **What is the function of stomata?**
    Answer: Stomata help in the exchange of gases such as oxygen and carbon dioxide.
18. **From where do plants obtain water and minerals?**
    Answer: Plants obtain water and minerals from the soil through their roots.
19. **What is xylem?**
    Answer: Xylem is a thin tube-like structure that transports water and dissolved minerals through the plant.
20. **What is the main function of xylem?**
    Answer: Xylem transports water and minerals from the roots to the leaves and other parts of the plant.
21. **What is phloem?**
    Answer: Phloem is the tube-like tissue that transports food prepared in the leaves to other parts of the plant.
22. **Where may the food transported through phloem be stored?**
    Answer: The transported food may be stored in plant parts such as seeds and roots.
23. **Do plants respire?**
    Answer: Yes, all parts of a plant, whether green or non-green, carry out respiration.
24. **What happens to glucose during respiration?**
    Answer: During respiration, glucose is broken down in the presence of oxygen to release energy.
25. **Which gas is used by plants during respiration?**
    Answer: Plants use oxygen during respiration.
26. **Which gas is released by plants during respiration?**
    Answer: Plants release carbon dioxide during respiration.
27. **What are the products of respiration in plants?**
    Answer: Respiration produces carbon dioxide, water and energy.
28. **Why does lime water turn milky in the experiment with germinating seeds?**
    Answer: Lime water turns milky because the germinating seeds release carbon dioxide during respiration.
29. **For what purpose do plants use the energy released during respiration?**
    Answer: Plants use the energy released during respiration for their growth and development.
30. **State the word equation for photosynthesis.**
    Answer: Carbon dioxide + Water → Glucose + Oxygen, in the presence of sunlight and chlorophyll.

31. **State the word equation for respiration in plants.**
    Answer: Glucose + Oxygen → Carbon dioxide + Water + Energy.
32. **Name the Indian scientist who studied the effects of water, temperature and colour of light on photosynthesis.**
    Answer: Rustom Hormusji Dastur studied these factors in relation to photosynthesis.
33. **Who was Kamala Sohonie?**
    Answer: Kamala Sohonie was an Indian scientist who made important contributions to the study of respiration in plants.
34. **Can green parts of a plant other than leaves perform photosynthesis?**
    Answer: Yes, other green parts containing chlorophyll can also perform photosynthesis.
35. **What is the primary site of photosynthesis in a plant?**
    Answer: The leaf is the primary site of photosynthesis.

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

The following questions are designed to test **application, analysis, prediction, reasoning, and inference**, while keeping each answer to **one sentence**.

1. **A plant receives plenty of sunlight but is not watered for several days; what is likely to happen and why?**
   Answer: The plant will show poor growth or may die because water is essential for its growth.
2. **Two identical plants are watered equally, but one is kept in sunlight and the other in darkness; which will grow better?**
   Answer: The plant kept in sunlight will grow better because sunlight is essential for photosynthesis and proper growth.
3. **A green leaf kept in darkness for 36 hours does not turn blue-black with iodine; what can you infer?**
   Answer: The leaf did not produce detectable starch because it did not receive sunlight.
4. **Why do only the green patches of a variegated leaf kept in sunlight turn blue-black during the iodine test?**
   Answer: The green patches contain sufficient chlorophyll to produce starch through photosynthesis.
5. **A plant has water, carbon dioxide and sunlight but lacks chlorophyll; can it prepare starch normally?**
   Answer: No, it cannot prepare starch normally because chlorophyll is essential for photosynthesis.
6. **Why would covering a green plant completely from sunlight reduce its food production?**
   Answer: Covering the plant prevents it from receiving sunlight required for photosynthesis.
7. **If caustic soda is placed around part of a leaf in an experimental bottle, why does that part fail the starch test?**
   Answer: Caustic soda absorbs carbon dioxide, so that part of the leaf cannot produce starch through photosynthesis.
8. **Why is a plant destarched before conducting an experiment to test the requirements of photosynthesis?**
   Answer: Destarching removes previously stored starch so that any newly formed starch can be linked to photosynthesis during the experiment.

9. **A water plant produces bubbles when placed in sunlight; what can you infer about the gas in the bubbles?**
   Answer: The bubbles contain oxygen released by the plant during photosynthesis.
10. **Why does a glowing or lit matchstick burn more intensely in the gas collected from a photosynthesising water plant?**
    Answer: It burns more intensely because the collected gas is rich in oxygen, which supports burning.
11. **If a plant's stomata cannot function properly, which process related to photosynthesis will be directly affected?**
    Answer: The exchange of carbon dioxide and oxygen will be affected because stomata facilitate gaseous exchange.
12. **Why are broad and flat leaves advantageous to a plant?**
    Answer: Broad and flat leaves can capture sunlight efficiently and thereby support photosynthesis.
13. **If the xylem of a plant stem is damaged, which substances will have difficulty reaching the leaves?**
    Answer: Water and dissolved minerals will have difficulty reaching the leaves because they are transported through xylem.
14. **A white flower turns reddish after its cut stem is placed in red-coloured water; what does this demonstrate?**
    Answer: It demonstrates that water moves upward through the xylem to different parts of the plant.
15. **If the phloem is unable to function, what will happen to the food prepared in the leaves?**
    Answer: The food prepared in the leaves will not be transported effectively to other parts of the plant.
16. **How does starch reach a potato tuber even though photosynthesis mainly occurs in leaves?**
    Answer: Food prepared in the leaves is transported through the phloem to the potato tuber, where it can be stored as starch.
17. **Why do roots depend indirectly on leaves for their food?**
    Answer: Roots depend on leaves because food produced in the leaves is transported to the roots through the phloem.
18. **Germinating seeds kept in a flask make lime water turn milky; what does this observation prove?**
    Answer: It proves that germinating seeds release carbon dioxide during respiration.
19. **Why are germinating seeds kept in darkness in the respiration experiment?**
    Answer: Keeping them in darkness prevents photosynthesis from interfering with the observation of carbon dioxide released during respiration.
20. **Can the non-green parts of a plant respire? Give a reason.**
    Answer: Yes, non-green parts can respire because all parts of a plant carry out respiration.
21. **What would happen to plant growth if respiration stopped completely?**
    Answer: Plant growth and development would stop because respiration provides the energy needed for these activities.
22. **Why can photosynthesis not continue normally if a plant receives sunlight but no carbon dioxide?**
    Answer: Photosynthesis cannot continue normally because carbon dioxide is an essential raw material for preparing glucose.

23. **A plant has carbon dioxide and water but is kept in complete darkness; will it produce starch?**
    Answer: No, it will not produce starch because sunlight is necessary for photosynthesis.
24. **If all photosynthetic organisms disappeared from Earth, what major change would occur in atmospheric oxygen?**
    Answer: Atmospheric oxygen would progressively decrease because photosynthetic organisms release oxygen during photosynthesis.
25. **Why are photosynthesis and respiration considered complementary processes in plants?**
    Answer: Photosynthesis produces glucose and oxygen that support respiration, while respiration releases carbon dioxide that can be used in photosynthesis.
26. **How can a plant survive for some time in a sealed bottle garden?**
    Answer: It can survive because carbon dioxide released during respiration is used in photosynthesis and oxygen released during photosynthesis is used in respiration.
27. **A plant is supplied with sufficient water and carbon dioxide but very little light; what is likely to happen to its food production?**
    Answer: Its food production will decrease because insufficient light limits photosynthesis.
28. **Why might regulating light, water and carbon dioxide in a greenhouse improve plant growth?**
    Answer: Regulating these factors can provide favourable conditions for photosynthesis and plant growth.
29. **If food could not be transported from leaves to roots, how might the roots be affected?**
    Answer: The roots would receive insufficient food for their energy needs, growth and development.
30. **Why is photosynthesis important not only to plants but also to animals?**
    Answer: Photosynthesis is important to animals because it produces food that supports food chains and releases oxygen required for respiration.

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

Two-Mark Descriptive Questions with Answers – LOTS Type
Each answer contains two sentences/points.

1. **What changes are generally observed when a plant grows?**
   Answer:
   1. New leaves and branches emerge, and the height of the plant increases.
   2. The stem also becomes thicker as the plant grows.
2. **What are the two important requirements for the proper growth of plants demonstrated in Activity 10.1?**
   Answer:
   1. Plants require an adequate supply of water for proper growth.
   2. They also require sunlight for healthy growth.
3. **Why are leaves called the ‘food factories’ of plants?**
   Answer:
   1. Leaves are the primary sites where plants prepare food.
   2. Chlorophyll in leaves helps in preparing starch in the presence of sunlight.
4. **What is chlorophyll? State its importance.**
   Answer:

1. Chlorophyll is the green pigment present mainly in the leaves of plants.
2. It helps capture sunlight efficiently for the preparation of food.

5. **What is the iodine test for starch?**
   Answer:
   1. A few drops of diluted iodine solution are added to a decolourised leaf.
   2. The appearance of a blue-black colour indicates the presence of starch.
6. **Why is a leaf decolourised before testing it for starch?**
   Answer:
   1. Decolourisation removes the leaf's colour.
   2. This makes the colour change caused by iodine easier to observe.
7. **What does the experiment with green and non-green patches of a leaf demonstrate?**
   Answer:
   1. Green patches exposed to sunlight turn blue-black during the iodine test, indicating starch.
   2. This shows that chlorophyll is essential for the preparation of starch in the presence of sunlight.
8. **What is the role of carbon dioxide in photosynthesis?**
   Answer:
   1. Carbon dioxide from the air is essential for plants to prepare food.
   2. Plants use carbon dioxide along with water to produce glucose during photosynthesis.
9. **What is the role of caustic soda in the experiment demonstrating the need for carbon dioxide?**
   Answer:
   1. Caustic soda or sodium hydroxide absorbs carbon dioxide from the air inside the bottle.
   2. The absence of starch in that part of the leaf demonstrates that carbon dioxide is necessary for food preparation.
10. **Define photosynthesis and name its essential requirements.**
    Answer:
    1. Photosynthesis is the process by which plants prepare food in the presence of sunlight and chlorophyll.
    2. Sunlight, water, chlorophyll and carbon dioxide are essential for this process.
11. **What are the products of photosynthesis?**
    Answer:
    1. Glucose is produced as food during photosynthesis and may later be converted into starch for storage.
    2. Oxygen is also produced and released during photosynthesis.
12. **Write the word equation for photosynthesis.**
    Answer:
    1. **Carbon dioxide + Water → Glucose + Oxygen.**
    2. The process takes place in the presence of **sunlight and chlorophyll**.
13. **What are stomata? What is their function?**
    Answer:
    1. Stomata are tiny pores present on the surface of leaves.
    2. They help in the exchange of gases such as carbon dioxide and oxygen.
14. **What is xylem? State its function.**
    Answer:

1. Xylem consists of thin tube-like structures present in the stem, branches and leaves.
2. It transports water and dissolved minerals from the roots to the leaves and other parts of the plant.

15. **What is phloem? State its function.**
Answer:
    1. Phloem consists of thin tube-like structures responsible for food transport in plants.
    2. It carries food prepared in the leaves to different parts of the plant.
16. **Differentiate between xylem and phloem based on their functions.**
Answer:
    1. Xylem transports water and minerals from the roots to different parts of the plant.
    2. Phloem transports food prepared in the leaves to different parts of the plant.
17. **What does the red-ink experiment demonstrate about transport in plants?**
Answer:
    1. Red colour appears in the stem, leaves and flowers when a twig is placed in red-coloured water.
    2. This demonstrates that water moves upward through the xylem.
18. **What is respiration in plants?**
Answer:
    1. During respiration, glucose is broken down in the presence of oxygen.
    2. This process releases carbon dioxide, water and energy.
19. **Write the word equation for respiration in plants.**
Answer:
    1. **Glucose + Oxygen → Carbon dioxide + Water + Energy.**
    2. The energy released is used by plants for their growth and development.
20. **How does the germinating-seed experiment demonstrate respiration in plants?**
Answer:
    1. Germinating seeds release additional carbon dioxide during respiration.
    2. This carbon dioxide turns the lime water connected to the flask milky.
21. **Do only green parts of a plant respire? Explain.**
Answer:
    1. No, both green and non-green parts of plants carry out respiration.
    2. The energy produced during respiration is used for plant growth and development.
22. **How are glucose and starch related in plants?**
Answer:
    1. Photosynthesis initially produces glucose, which is a simple carbohydrate and an instant source of energy.
    2. Glucose can later be converted into starch for storage.
23. **State two functions of stomata related to plant life processes.**
Answer:
    1. Stomata allow carbon dioxide to enter for photosynthesis.
    2. They help in the exchange of oxygen and carbon dioxide during photosynthesis and respiration.
24. **What happens to the food prepared in the leaves?**
Answer:
    1. Food prepared in the leaves is transported to all parts of the plant through phloem.

   2. Some of this transported food may be stored in parts such as seeds and roots.

25. **How are photosynthesis and respiration different in terms of gases?**
    Answer:
    1. During photosynthesis, plants use carbon dioxide and release oxygen.
    2. During respiration, plants use oxygen and release carbon dioxide.

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

The following questions emphasize **reasoning, analysis, prediction, application, and interpretation** based on the experiments and concepts in the chapter. The chapter explains photosynthesis, transport through xylem and phloem, stomata, and respiration in plants.

1. A plant is supplied with enough water but is kept continuously in darkness. Predict what will happen to it and explain why.

Answer:
1. The plant will show poor growth and may eventually become weak because it does not receive sunlight.
2. Without sunlight, it cannot carry out photosynthesis effectively to prepare food.

2. Two identical plants are kept in sunlight, but only one is watered regularly. Which plant will grow better? Why?

Answer:
1. The regularly watered plant will grow better because plants require both sunlight and water for growth.
2. The plant without water may wilt or die even though sufficient sunlight is available.

3. Why does a green patch of a variegated leaf turn blue-black with iodine while a non-green patch may not?

Answer:
1. The green patch contains sufficient chlorophyll and produces starch in the presence of sunlight.
2. The non-green patch may lack sufficient chlorophyll to produce enough detectable starch.

4. A student performs an iodine test on a green leaf kept in darkness for 36 hours. Predict the result and justify it.

Answer:
1. The leaf will not show the expected blue-black colour indicating starch.
2. Although chlorophyll is present, the absence of sunlight prevents the production of starch through photosynthesis.

5. Why is it necessary to decolourise a leaf before testing it with iodine?

Answer:
1. Decolourisation removes the leaf colour that could interfere with observing the iodine-test result.
2. It makes the blue-black colour indicating starch easier to observe.

6. Suppose a plant receives sunlight, water and carbon dioxide but its leaves have no chlorophyll. Can it prepare starch? Give reasons.

Answer:
1. The plant cannot prepare starch through normal photosynthesis because chlorophyll is essential for the process.
2. Chlorophyll helps capture sunlight needed for the preparation of food.

7. In the carbon dioxide experiment, why does the part of the leaf outside the bottle turn blue-black while the part inside does not?

Answer:

1. The outside portion receives carbon dioxide from the air and therefore produces starch.
2. Caustic soda inside the bottle absorbs carbon dioxide, so the enclosed portion cannot produce starch.

8. If caustic soda were accidentally omitted from the bottle in the carbon dioxide experiment, how would the result change?

Answer:

1. Carbon dioxide would remain available to the part of the leaf inside the bottle.
2. Hence, that portion could also produce starch and turn blue-black, making the experiment unable to demonstrate the role of carbon dioxide.

9. A student observes bubbles coming from a water plant kept in sunlight but not from an identical plant kept in darkness. What can the student infer?

Answer:

1. The bubbles indicate the release of oxygen during photosynthesis in the plant receiving sunlight.
2. Their absence in darkness indicates that photosynthesis requires sunlight.

10. Why can a broad and flat leaf be considered better suited for photosynthesis?

Answer:

1. A broad and flat leaf provides a large surface that can receive sunlight efficiently.
2. Since chlorophyll captures sunlight for photosynthesis, such a leaf structure can support efficient food preparation.

11. If the stomata of a leaf were completely blocked, how would photosynthesis be affected?

Answer:

1. Carbon dioxide would not be exchanged efficiently through the leaf surface, so photosynthesis would be affected.
2. This is because stomata are tiny pores responsible for the exchange of gases in leaves.

12. A white flower is placed in water containing red ink. After a day, red colour appears in its stem and petals. What does this demonstrate?

Answer:

1. The red colour shows that water moves upward through the plant from the stem to other parts.
2. This movement takes place through thin tube-like structures called **xylem**.

13. What would happen to a plant if its xylem stopped functioning properly?

Answer:

1. Water and dissolved minerals would not be transported efficiently from the roots to the leaves and other parts.
2. As a result, important processes such as photosynthesis and growth would be affected.

14. What would happen if the phloem of a plant were unable to function?

Answer:

1. Food prepared in the leaves would not be transported effectively to other parts of the plant.
2. Growing and storage regions such as roots and seeds would therefore receive insufficient food.

15. A potato grows underground and cannot directly perform much photosynthesis. How does starch reach the potato?

Answer:

1. Food is synthesised mainly in the leaves through photosynthesis and is transported to other plant parts.
2. It reaches the potato through the phloem and is stored there as starch.

16. Why does lime water connected to a flask containing germinating seeds turn milky?

Answer:
1. Germinating seeds respire and release additional carbon dioxide into the flask.
2. The presence of this carbon dioxide causes the lime water to turn milky.

17. A student says, "Only green parts of a plant respire." Do you agree? Justify your answer.
Answer:
1. No, the statement is incorrect because all parts of a plant, whether green or non-green, carry out respiration.
2. Respiration releases energy from glucose, which plants use for growth and development.

18. Why can photosynthesis not replace respiration in plants even though photosynthesis produces glucose?
Answer:
1. Photosynthesis produces glucose, whereas respiration breaks down glucose to release usable energy.
2. Plants require this released energy for their growth and development.

19. How are photosynthesis and respiration interconnected in a sealed bottle garden?
Answer:
1. Carbon dioxide produced during respiration can be used by the plant for photosynthesis.
2. Oxygen produced during photosynthesis can, in turn, be used during respiration.

20. What might happen to living organisms if all photosynthetic organisms suddenly disappeared from Earth?
Answer:
1. The production of food and oxygen through photosynthesis would be severely disrupted.
2. Organisms dependent directly or indirectly on plants for food and oxygen would consequently be unable to survive normally.

21. A farmer grows plants in a greenhouse. Why would controlling light, water and carbon dioxide improve plant growth?
Answer:
1. Sunlight, water and carbon dioxide are essential requirements for photosynthesis.
2. Regulating their availability can provide favourable conditions for efficient food production and plant growth.

22. Why are leaves called the "food factories" of plants even though roots absorb water and minerals?
Answer:
1. Leaves contain chlorophyll and are the primary sites where photosynthesis produces glucose.
2. Roots supply water and minerals, but the actual synthesis of food mainly occurs in the leaves.

23. A plant has healthy roots and receives enough water, but its leaves are severely damaged. How will this affect the plant?
Answer:
1. Food production will decrease because leaves are the primary sites of photosynthesis.
2. Reduced photosynthesis will limit the glucose available for the plant's growth and energy needs.

24. Why are xylem and phloem both necessary for the survival of a plant?
Answer:
1. Xylem transports water and minerals from the roots to the leaves and other plant parts.
2. Phloem transports food prepared in the leaves to different parts of the plant.

25. A plant kept in sunlight has water and chlorophyll but is deprived of carbon dioxide. Will it release oxygen through photosynthesis? Explain.
Answer:
1. It will not carry out normal photosynthesis effectively because carbon dioxide is an essential raw material for the process.
2. Therefore, oxygen generation through photosynthesis will also be greatly affected, despite the availability of sunlight, water and chlorophyll.

10.9. Three-mark questions with Answers of LOTS Type: (10 Questions)

1. What changes are observed when a plant grows?
Answer:
1. New leaves and branches emerge as a plant grows.
2. The height of the plant increases.
3. Its stem becomes thicker as it develops.

2. Explain the importance of sunlight and water for plant growth.
Answer:
1. Plants require both sunlight and water for proper growth.
2. A plant receiving adequate water and sunlight grows better than one deprived of either factor.
3. Lack of water may cause a plant to die, while lack of sunlight results in poor growth.

3. Why are leaves called the 'food factories' of plants?
Answer:
1. Leaves are the primary sites where plants prepare their food.
2. They contain chlorophyll, which helps capture sunlight for food preparation.
3. Food produced as glucose during photosynthesis can later be converted into starch for storage.

4. Describe the iodine test for starch in a leaf.
Answer:
1. The leaf is first softened in boiling water and then decolourised using alcohol.
2. A few drops of diluted iodine solution are added to the decolourised leaf.
3. If the leaf turns blue-black, it indicates the presence of starch.

5. What is the role of chlorophyll in photosynthesis?
Answer:
1. Chlorophyll is the green pigment present mainly in the leaves of plants.
2. It helps the plant capture sunlight efficiently.
3. Chlorophyll is essential for preparing starch in the presence of sunlight.

6. What are the essential requirements for photosynthesis?
Answer:
1. Plants require carbon dioxide and water as raw materials for photosynthesis.
2. Sunlight provides the energy, while chlorophyll helps capture sunlight.
3. In the presence of these factors, plants produce glucose and release oxygen.

7. Write the word equation for photosynthesis and explain its products.
Answer:
1. The word equation is: **Carbon dioxide + Water → Glucose + Oxygen**, in the presence of sunlight and chlorophyll.
2. Glucose is a simple carbohydrate that provides an immediate source of energy.
3. Glucose can later be converted into starch for storage, while oxygen is released.

8. What are stomata? State their role in plants.
Answer:

1. Stomata are tiny pores present on the surface of leaves.
2. They help in the exchange of gases between the plant and its surroundings.
3. Through this gas exchange, carbon dioxide and oxygen are exchanged during photosynthesis and respiration.

9. Explain how water and minerals are transported in plants.

Answer:

1. Roots take up water and minerals present in the soil.
2. Water and dissolved minerals move upwards through thin tube-like structures called **xylem**.
3. Xylem transports them to the leaves and other parts of the plant.

10. Explain how food is transported in plants.

Answer:

1. Leaves are the primary sites where food is prepared by photosynthesis.
2. The prepared food is transported to different parts of the plant through **phloem**.
3. Some of this transported food may be stored in parts such as seeds and roots.

11. What is respiration in plants? Write its word equation.

Answer:

1. Respiration is the process in which glucose is broken down in the presence of oxygen to release energy.
2. Its word equation is: **Glucose + Oxygen → Carbon dioxide + Water + Energy**.
3. The energy released is used by plants for their growth and development.

12. Differentiate between the functions of xylem and phloem.

Answer:

1. **Xylem** transports water and minerals from the roots to the leaves and other parts of the plant.
2. **Phloem** transports food prepared in the leaves to different parts of the plant.
3. Thus, xylem is mainly associated with water and mineral transport, while phloem is associated with food transport.

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

The following questions focus on **application, analysis, reasoning, prediction, and inference**, with **three points/sentences in each answer**.

1. A student keeps one plant in sunlight with sufficient water and another plant in complete darkness with sufficient water. Predict the differences after two weeks and explain why.

Answer:

1. The plant receiving sunlight and water will show better growth, with more healthy green leaves.
2. The plant kept in darkness will show poor growth because sunlight is necessary for photosynthesis.
3. This demonstrates that water alone is insufficient and that both sunlight and water are required for proper plant growth.

2. A variegated leaf has both green and non-green patches. After exposure to sunlight, why do mainly the green patches turn blue-black during the iodine test?

Answer:

1. The green patches contain sufficient chlorophyll to prepare starch in the presence of sunlight.
2. The non-green patches may not contain enough chlorophyll to produce detectable quantities of starch.

3. Therefore, the experiment demonstrates the importance of chlorophyll in food preparation.

3. A healthy green plant is kept in darkness for 36 hours and then tested for starch. Predict the result and justify it.

Answer:

1. The leaf is not expected to turn blue-black because little or no detectable starch has been produced during the period in darkness.
2. Although the leaf contains chlorophyll, it cannot carry out photosynthesis without sunlight.
3. Thus, chlorophyll alone is insufficient; sunlight is also essential for starch production.

4. In an experiment, half of a leaf is placed inside a bottle containing caustic soda while the other half remains outside. Why does only the outside portion turn blue-black in the iodine test?

Answer:

1. Caustic soda absorbs the carbon dioxide available to the part of the leaf inside the bottle.
2. Without carbon dioxide, that portion cannot prepare detectable starch even though other conditions are available.
3. The outside portion receives carbon dioxide from the air and produces starch, proving that carbon dioxide is essential for photosynthesis.

5. A water plant kept in sunlight releases bubbles, but a similar set-up kept in darkness does not. What can you infer?

Answer:

1. The bubbles produced by the plant in sunlight contain oxygen released during photosynthesis.
2. The plant kept in darkness does not show the same photosynthetic oxygen release because sunlight is necessary for photosynthesis.
3. Hence, the observation provides evidence that photosynthesis occurs in the presence of sunlight and releases oxygen.

6. Suppose the stomata of a plant's leaves are blocked. How could this affect photosynthesis?

Answer:

1. Stomata normally help in the exchange of gases between leaves and the surrounding air.
2. Blocking them would interfere with the exchange of carbon dioxide required for photosynthesis.
3. Consequently, the plant's ability to prepare food efficiently would be affected.

7. A white flower is placed in red-coloured water, and after a day red colour appears in its stem, leaves, and petals. Explain the observation.

Answer:

1. The coloured water moves upward through thin tube-like structures called xylem.
2. Since the colour reaches the stem, leaves, and flowers, it traces the pathway through which water is transported.
3. The experiment therefore provides evidence that xylem carries water and dissolved minerals to different parts of the plant.

8. If the phloem of a plant cannot function properly, predict how the plant will be affected.

Answer:

1. Food prepared in the leaves will not be transported efficiently to other parts of the plant.
2. Parts requiring this food for growth or storage, including roots and seeds, would therefore receive less food.

3. Thus, disruption of phloem transport would adversely affect the plant's growth and food storage.

9. A potato contains starch even though the potato itself is underground. Explain how the starch reaches the potato.

Answer:

1. Food is synthesised mainly in the leaves through photosynthesis.
2. The food prepared in the leaves is transported to other plant parts through the phloem.
3. Some of this transported food is stored in plant parts, explaining the presence of stored starch in the potato.

10. Why are broad and flat leaves more suitable for photosynthesis than very narrow leaves?

Answer:

1. The chapter notes that leaves are generally broad and flat and contain chlorophyll that captures sunlight efficiently.
2. A broad, flat form provides a large exposed surface that can receive sunlight.
3. Therefore, such a structure supports the leaf's role as the primary site of photosynthesis.

11. Germinating seeds are kept in a closed flask, and the gas from the flask is passed through lime water. Why does the lime water turn milky?

Answer:

1. Germinating seeds respire and produce additional carbon dioxide.
2. The carbon dioxide released from the seeds passes into the lime water, causing it to turn milky.
3. This observation provides evidence that plants release carbon dioxide during respiration.

12. A student says, "Only green parts of a plant respire because only green parts are living." Evaluate this statement.

Answer:

1. The statement is incorrect because the chapter states that all parts of a plant, both green and non-green, carry out respiration.
2. During respiration, glucose is broken down using oxygen, releasing carbon dioxide, water, and energy.
3. The released energy is required for the plant's growth and development.

13. What would happen to living organisms if all photosynthetic organisms disappeared from Earth?

Answer:

1. The production of food through photosynthesis would cease, severely affecting organisms that depend directly or indirectly on plants for nutrition.
2. Photosynthetic oxygen production would also stop, disturbing the availability of oxygen needed for respiration.
3. Therefore, the disappearance of photosynthetic organisms would seriously disrupt the balance necessary for living organisms to survive.

14. A plant has sufficient water, carbon dioxide, and chlorophyll but is kept in complete darkness. Will it produce starch and oxygen? Justify.

Answer:

1. The plant will not produce detectable starch through photosynthesis because sunlight is absent.
2. It will also not release oxygen through photosynthesis under these conditions.
3. This shows that all the essential conditions—water, carbon dioxide, chlorophyll, and sunlight—must be available for photosynthesis.

15. Explain how photosynthesis and respiration complement each other in a sealed bottle garden.
Answer:
1. During respiration, the plant produces carbon dioxide, which can be utilised during photosynthesis.
2. During photosynthesis, oxygen is produced, which can in turn be utilised in respiration.
3. This exchange helps explain how a properly established plant can continue growing in a sealed bottle garden.

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

1. What is photosynthesis? Explain the process of photosynthesis in plants.
Answer:
1. Photosynthesis is the process by which plants prepare their food in the presence of sunlight and chlorophyll.
2. Plants take in carbon dioxide from the air and obtain water through their roots.
3. Chlorophyll present in the green parts of plants helps capture sunlight required for the process.
4. During photosynthesis, glucose is produced as food and may later be converted into starch for storage.
5. Oxygen is released during photosynthesis, and the word equation is: **Carbon dioxide + Water → Glucose + Oxygen**, in the presence of sunlight and chlorophyll.

2. Explain the role of chlorophyll and sunlight in the preparation of food in plants.
Answer:
1. Chlorophyll is the green pigment present mainly in the leaves of plants.
2. It helps the plant capture sunlight efficiently for food preparation.
3. In a variegated leaf exposed to sunlight, the green patches turn blue-black during the iodine test, indicating the presence of starch.
4. A plant kept in darkness does not show a blue-black colour even in its green patches because starch is not produced without sunlight.
5. Therefore, both chlorophyll and sunlight are essential for the preparation of starch during photosynthesis.

3. Describe the iodine test used to detect starch in a leaf.
Answer:
1. First, the leaf is kept in boiling water for about five minutes to soften it.
2. The leaf is then placed in alcohol and heated indirectly using a water bath until it becomes colourless.
3. The decolourised leaf is removed and placed on a plate.
4. A few drops of diluted iodine solution are added to the leaf using a dropper.
5. If the leaf turns **blue-black**, it indicates the presence of starch in the leaf.

4. Explain the role of carbon dioxide in photosynthesis with the help of an experiment.
Answer:
1. A green plant is first kept in darkness for two to three days to remove its stored starch.
2. Half of a destarched leaf is inserted into a bottle containing caustic soda, while the other half remains outside.
3. Caustic soda absorbs the carbon dioxide present inside the bottle, and the experimental set-up is placed in sunlight.
4. After the iodine test, the outside portion turns blue-black, whereas the portion inside the bottle does not.

5. This experiment demonstrates that **carbon dioxide is essential for plants to prepare starch during photosynthesis**.

5. Explain how water and minerals are transported in plants.

Answer:

1. Plants absorb water and minerals present in the soil through their roots.
2. Water and dissolved minerals have to be transported from the roots to the leaves and other parts of the plant.
3. This transport takes place through thin tube-like structures called **xylem**.
4. Xylem is present in the stem, branches, and leaves of plants.
5. Thus, xylem forms the pathway through which water and dissolved minerals move upward to different parts of the plant.

6. Describe an experiment to demonstrate the transportation of water through xylem.

Answer:

1. Take two tumblers, label them A and B, and fill one-third of each with water; add a few drops of red ink to tumbler B.
2. Take two similar tender plant twigs, cut their stems obliquely at the base while keeping them in water, and place one twig in each tumbler.
3. Leave the set-up and observe the plants on the next day.
4. The stem, leaves, and flowers of the twig placed in red-coloured water show red colour, and the colour can also be seen in the cut stem.
5. This demonstrates that water moves upward through the thin tube-like **xylem** present in the plant.

7. Explain the transport of food in plants and the role of phloem.

Answer:

1. Leaves are the primary site where food is prepared through photosynthesis.
2. The food prepared in the leaves must be transported to the other parts of the plant.
3. This transportation takes place through thin tube-like structures called **phloem**.
4. Phloem carries the prepared food from the leaves to different parts of the plant.
5. Some of the transported food may also be stored in plant parts such as seeds and roots.

8. What are stomata? Explain their role in plants.

Answer:

1. Stomata are tiny pores found on the surface of leaves.
2. They can be observed by examining a thin leaf peel under a microscope.
3. Stomata help in the exchange of gases between the leaf and its surroundings.
4. Carbon dioxide required for photosynthesis and oxygen released during the process are exchanged through these pores.
5. Stomata therefore play an important role in gaseous exchange during both photosynthesis and respiration.

9. Explain respiration in plants.

Answer:

1. Respiration is the process through which plants break down glucose to release energy.
2. During respiration, glucose is broken down in the presence of oxygen.
3. Carbon dioxide, water, and energy are produced during this process.
4. The word equation is: **Glucose + Oxygen → Carbon dioxide + Water + Energy**.
5. The energy released is used for growth and development, and all green as well as non-green parts of a plant carry out respiration.

10. Describe the experiment that demonstrates respiration in germinating seeds.

Answer:

1. Soaked moong seeds are placed over moist cotton in a conical flask, which is fitted with tubes and left undisturbed for 24 hours in darkness.

2. The flask is then connected through a tube to a test tube containing lime water.
3. The lime water connected to the flask turns milky.
4. The milkiness is caused by the additional carbon dioxide released by the germinating seeds during respiration.
5. Hence, the experiment demonstrates that germinating seeds respire and release **carbon dioxide**.

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

1. A plant is supplied with sufficient water but is kept continuously in darkness. Predict what will happen to the plant and justify your answer.
Answer:
1. The plant will not be able to carry out normal photosynthesis because sunlight is essential for the process.
2. Even though sufficient water is available, the plant cannot prepare glucose effectively in the absence of sunlight.
3. An iodine test on its leaves will not show the expected blue-black colour because new starch has not been produced.
4. The plant may initially survive by using its previously stored food, but its growth will eventually be affected.
5. Therefore, both **water and sunlight** are necessary for proper food production and growth in plants.

2. Suppose all photosynthetic organisms on Earth suddenly disappeared. Analyse the possible effects on other living organisms.
Answer:
1. The production of new food by photosynthesis would stop, severely affecting the food supply for living organisms.
2. Herbivores would lose their major source of food, followed by carnivores that depend on herbivores.
3. The release of oxygen through photosynthesis would also stop.
4. Organisms requiring oxygen for respiration would face increasing difficulty as the balance of atmospheric gases changed.
5. Thus, the disappearance of photosynthetic organisms would disturb **food chains, oxygen availability, and the balance of life on Earth**.

3. A potato growing underground contains a large amount of starch even though it does not receive sunlight. Explain how this is possible.
Answer:
1. Photosynthesis mainly takes place in the green leaves of the potato plant, which receive sunlight.
2. The leaves use water and carbon dioxide in the presence of sunlight and chlorophyll to prepare glucose.
3. The prepared food is transported from the leaves to other parts of the plant through the **phloem**.
4. Some of this transported food reaches the underground potato and is stored there.
5. Hence, a potato can contain starch even though the potato itself does not receive sunlight or directly perform significant photosynthesis.

4. A student claims, "A plant receiving plenty of sunlight can prepare food even if carbon dioxide is absent." Evaluate this statement using experimental evidence.
Answer:

1. The statement is incorrect because carbon dioxide is one of the essential requirements for photosynthesis.
2. In the chapter's experiment, caustic soda is used to absorb carbon dioxide from the air surrounding part of a leaf.
3. After exposure to sunlight, the portion having access to carbon dioxide turns blue-black with iodine, showing the presence of starch.
4. The portion deprived of carbon dioxide does not turn blue-black even though sunlight and chlorophyll are available.
5. Therefore, sunlight alone is insufficient; **carbon dioxide is essential for the preparation of food during photosynthesis**.

5. A farmer notices that the leaves of some crop plants are healthy, but their roots and fruits are not receiving sufficient food. Which transport tissue might be affected? Explain your reasoning.

Answer:

1. The affected tissue is most likely the **phloem** because it transports food prepared in leaves to other parts of the plant.
2. Healthy green leaves can continue preparing food through photosynthesis.
3. However, if phloem transport is affected, the prepared food cannot be efficiently carried to roots, fruits, seeds, and other parts.
4. As a result, these parts may receive inadequate nourishment even though photosynthesis continues in the leaves.
5. Therefore, proper functioning of phloem is essential for distributing prepared food throughout the plant.

6. If the xylem of a plant is severely damaged, predict how photosynthesis and growth of the plant will be affected.

Answer:

1. Xylem transports water and dissolved minerals from the roots to the leaves and other plant parts.
2. If xylem is damaged, the supply of water and minerals to the leaves will be reduced.
3. Since water is essential for photosynthesis, food production in the leaves will be affected.
4. Reduced food production and mineral supply will eventually result in poor growth and development of the plant.
5. Therefore, severe damage to xylem can indirectly reduce photosynthesis and may ultimately threaten the plant's survival.

7. A student covers most of the stomata of a leaf with a substance that prevents gaseous exchange. Predict how this would affect photosynthesis.

Answer:

1. Stomata are tiny pores on the leaf surface that help in the exchange of gases.
2. Covering most stomata would reduce the entry of carbon dioxide into the leaf.
3. Carbon dioxide is an essential raw material for photosynthesis.
4. Therefore, reduced carbon dioxide availability would decrease the plant's ability to produce glucose and store starch.
5. Thus, blocking stomata would interfere with gaseous exchange and consequently reduce photosynthesis.

8. Photosynthesis and respiration appear to be opposite processes. Explain how they are interconnected and important for a plant.

Answer:

1. During photosynthesis, plants use carbon dioxide and water to produce glucose and oxygen in the presence of sunlight and chlorophyll.

2. During respiration, plants use oxygen to break down glucose and release carbon dioxide, water, and energy.
3. The glucose produced during photosynthesis therefore becomes a material used during respiration.
4. Oxygen released during photosynthesis is used in respiration, while carbon dioxide released during respiration can be used for photosynthesis.
5. Hence, these two processes are interconnected and enable plants to **prepare food and obtain energy for growth and development**.

9. Why are broad and flat leaves generally more suitable for photosynthesis? Analyse using the information in the chapter.

Answer:

1. Leaves are generally broad and flat and serve as the primary sites of photosynthesis.
2. Their broad structure provides a large surface that can be exposed to sunlight.
3. Leaves contain chlorophyll, which helps capture sunlight efficiently.
4. Their surface also contains stomata that allow the exchange of carbon dioxide and oxygen.
5. Therefore, the broad, flat structure together with chlorophyll and stomata makes leaves well suited for efficient photosynthesis.

10. A sealed bottle garden continues to grow for some time without regular exchange of outside air. Explain how photosynthesis and respiration can support this system.

Answer:

1. The plant inside the bottle carries out respiration and releases carbon dioxide.
2. This carbon dioxide can be used by the plant during photosynthesis when sufficient light is available.
3. Photosynthesis produces glucose and releases oxygen.
4. The oxygen produced during photosynthesis can then be used by the plant during respiration.
5. Thus, the recycling of **carbon dioxide and oxygen between photosynthesis and respiration** helps the plant maintain gaseous exchange within the sealed bottle garden.

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

1. Riya keeps two similar plants on her balcony. She waters both regularly, but one receives sunlight while the other remains behind a thick curtain. After two weeks, she notices a difference in their growth. Explain the reason.

Answer:

1. The plant receiving sunlight will generally grow better because sunlight is necessary for photosynthesis.
2. Although both plants receive water, the plant behind the curtain does not receive sufficient light for effective food preparation.
3. Chlorophyll in green leaves captures sunlight and helps the plant prepare food.
4. In adequate sunlight, glucose is produced through photosynthesis and may later be converted into starch for storage.
5. Therefore, providing both **adequate water and sunlight** is important for healthy plant growth.

2. A gardener wants to find out whether a leaf has prepared and stored food. Suggest a simple test and explain the procedure and expected result.

Answer:

1. The gardener can perform an **iodine test** to detect starch in the leaf.

2. The leaf should first be softened in boiling water and then treated with alcohol until it becomes colourless.
3. After decolourisation, the leaf should be placed on a plate and a few drops of diluted iodine solution added.
4. If the leaf turns **blue-black**, it indicates the presence of starch.
5. Thus, the iodine test provides evidence that food has been prepared and stored as starch in the leaf.

3. A farmer notices that a crop is receiving sufficient sunlight and water, but its leaves are pale and food production is poor. Using your knowledge of photosynthesis, explain one possible reason.

Answer:

1. The pale leaves may have insufficient **chlorophyll**, the green pigment important for photosynthesis.
2. Chlorophyll helps leaves capture sunlight efficiently for preparing food.
3. The chapter's experiment shows that starch is produced detectably in green patches containing sufficient chlorophyll when exposed to sunlight.
4. Therefore, adequate sunlight and water alone are not enough if sufficient chlorophyll is unavailable.
5. Healthy food production in plants requires **sunlight, water, carbon dioxide and chlorophyll**.

4. During a school experiment, a student places a white-flowered plant twig in water containing red ink. The next day, red colour appears in its stem, leaves and flowers. Explain this observation.

Answer:

1. The red ink dissolves in the water and moves upward through the plant stem.
2. The movement takes place through thin tube-like structures called **xylem**.
3. Xylem is present in the stem, branches and leaves of plants.
4. In the same way, water containing dissolved minerals normally moves from the roots to different plant parts through xylem.
5. Therefore, the appearance of red colour in the stem, leaves and flowers demonstrates the **transport of water through xylem**.

5. A potato plant prepares food mainly in its leaves, but starch is stored in the underground potato. Explain how the food reaches the potato.

Answer:

1. Green leaves are the primary sites of photosynthesis and prepare food for the plant.
2. During photosynthesis, glucose is produced, some of which can later be converted into starch for storage.
3. The food prepared in the leaves must therefore be transported to other parts of the plant.
4. This transportation occurs through thin tube-like structures called **phloem**.
5. Hence, food prepared in the leaves reaches underground storage parts such as the potato, where it can be stored as starch.

6. Meera places a water plant under a funnel with an inverted test tube and keeps the setup in sunlight. After some time, bubbles collect in the test tube. Explain what is happening.

Answer:

1. The water plant receives sunlight and carries out photosynthesis.
2. During photosynthesis, the plant uses carbon dioxide and water to prepare food.
3. **Oxygen** is released as a product of this process.
4. The released oxygen appears as bubbles and gradually collects in the inverted test tube.

5. Therefore, the experiment demonstrates that plants **release oxygen during photosynthesis in the presence of sunlight**.

7. A student observes tiny pores on the lower surface of a leaf under a microscope. Explain how these structures help the plant in its life processes.

Answer:

1. The tiny pores observed on the leaf surface are called **stomata**.
2. Stomata help in the exchange of gases between the leaf and its surroundings.
3. Carbon dioxide required for photosynthesis is exchanged through these pores.
4. Oxygen produced during photosynthesis is also exchanged through the stomata.
5. Thus, stomata play an important role in gaseous exchange associated with **photosynthesis and respiration**.

8. A student keeps germinating moong seeds in a flask and connects it to a test tube containing lime water. After some time, the lime water turns milky. Apply your knowledge of respiration to explain the result.

Answer:

1. Germinating moong seeds are living and carry out respiration.
2. During respiration, glucose is broken down in the presence of oxygen.
3. This process releases **carbon dioxide, water and energy**.
4. The additional carbon dioxide released by the germinating seeds causes the lime water to turn milky.
5. Hence, the observation provides evidence that **plants respire and release carbon dioxide during respiration**.

9. A greenhouse farmer wants to improve plant growth. Based on the chapter, suggest five factors or practices the farmer should consider.

Answer:

1. The farmer should provide plants with an adequate supply of **water**, which is needed for growth and photosynthesis.
2. Plants should receive suitable **light** because sunlight provides energy for photosynthesis.
3. Adequate **carbon dioxide** should be available because it is an essential raw material for photosynthesis.
4. Healthy green leaves containing chlorophyll should be maintained because chlorophyll is essential for food preparation.
5. The farmer should also ensure suitable conditions for efficient plant processes such as photosynthesis and transport, since greenhouse cultivation can regulate light, water and carbon dioxide.

10. A transparent bottle containing a healthy plant is sealed after the plant has grown properly. The plant continues to survive for some time. Apply the concepts of photosynthesis and respiration to explain this observation.

Answer:

1. The plant inside the bottle continues to carry out both photosynthesis and respiration.
2. During respiration, the plant releases carbon dioxide.
3. The carbon dioxide produced can be utilised during photosynthesis when light is available.
4. Oxygen generated during photosynthesis can, in turn, be utilised by the plant during respiration.
5. Thus, the exchange and reuse of **carbon dioxide and oxygen** between photosynthesis and respiration help support the plant inside the sealed bottle garden.

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

Chapter 10: Life Processes in Plants
25 Multiple Choice Questions for Olympiad-Type Competitive Examinations
The following questions are based on the chapter concepts and experiments involving plant growth, photosynthesis, chlorophyll, stomata, transport through xylem and phloem, and respiration.

1. Three identical plants are kept under the following conditions:
P – sunlight + adequate water
Q – sunlight + no water
R – darkness + adequate water
Which plant is expected to show the best growth?
A) P only
B) Q only
C) R only
D) Q and R equally
Answer: A) P only

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2. A destarched plant is kept in sunlight for several hours. Which combination is essential for starch to be produced in its green leaves?
A) Oxygen, minerals and darkness
B) Carbon dioxide, water, sunlight and chlorophyll
C) Carbon dioxide, oxygen and minerals only
D) Water, oxygen and darkness
Answer: B) Carbon dioxide, water, sunlight and chlorophyll

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3. A variegated leaf containing green and non-green patches is exposed to sunlight and then tested with iodine. Which region is most likely to turn blue-black?
A) Only the non-green region
B) Mainly the green region
C) Entire leaf equally
D) Neither region
Answer: B) Mainly the green region

---

4. Why is a leaf decolourised before performing the iodine test?
A) To destroy starch
B) To remove water
C) To make the iodine colour change clearly visible
D) To produce glucose
Answer: C) To make the iodine colour change clearly visible

---

5. A student observes that a decolourised leaf turns blue-black after adding iodine solution. The most appropriate conclusion is that the leaf contains:
A) glucose
B) chlorophyll
C) starch
D) protein
Answer: C) starch

---

6. In an experiment, half of a destarched leaf is placed inside a bottle containing sodium hydroxide while the other half remains outside. After exposure to sunlight, only the outside portion turns blue-black with iodine. Why?

A) Sodium hydroxide supplied oxygen
B) Sodium hydroxide absorbed carbon dioxide
C) The inside portion lacked water
D) The outside portion lacked chlorophyll
Answer: B) Sodium hydroxide absorbed carbon dioxide

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7. Which observation provides the strongest evidence that sunlight is required for photosynthesis?
A) Roots absorb water from soil.
B) Green leaves contain chlorophyll.
C) A green leaf exposed to sunlight produces starch, while a similar leaf kept in darkness does not.
D) Xylem transports water.
Answer: C) A green leaf exposed to sunlight produces starch, while a similar leaf kept in darkness does not.

---

8. Which of the following correctly represents photosynthesis?
A) Glucose + Oxygen → Carbon dioxide + Water + Energy
B) Carbon dioxide + Water → Glucose + Oxygen, in the presence of sunlight and chlorophyll
C) Oxygen + Water → Glucose + Carbon dioxide
D) Glucose + Carbon dioxide → Water + Oxygen
Answer: B) Carbon dioxide + Water → Glucose + Oxygen, in the presence of sunlight and chlorophyll

---

9. During photosynthesis, glucose produced by plants:
A) is always immediately released into the air
B) can provide energy and later be converted into starch for storage
C) is converted directly into carbon dioxide
D) is transported only to the roots
Answer: B) can provide energy and later be converted into starch for storage

---

10. An aquatic plant kept in sunlight produces bubbles that collect in an inverted test tube. Which gas is most likely present in the bubbles?
A) Carbon dioxide
B) Nitrogen
C) Oxygen
D) Hydrogen
Answer: C) Oxygen

---

11. If the aquatic plant in Question 10 is shifted from sunlight to complete darkness, the immediate effect on the production of photosynthetic oxygen would most likely be:
A) a substantial decrease
B) a large increase
C) no change
D) conversion of oxygen into chlorophyll
Answer: A) a substantial decrease

---

12. Which structures on the surface of leaves mainly facilitate the exchange of carbon dioxide and oxygen?

A) Xylem
B) Phloem
C) Stomata
D) Root hairs
Answer: C) Stomata

---

13. A white flower is placed in water containing red ink. The next day, red colour appears in its petals. Which tissue is primarily responsible for carrying the coloured water upward?
A) Phloem
B) Xylem
C) Stomata
D) Chlorophyll
Answer: B) Xylem

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14. If the functional xylem of a plant were severely damaged, which process would be affected most directly?
A) Transport of food from leaves
B) Transport of water and dissolved minerals
C) Production of carbon dioxide during respiration
D) Exchange of gases through stomata
Answer: B) Transport of water and dissolved minerals

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15. A potato contains stored starch even though it grows underground and receives no sunlight. Which explanation is most appropriate?
A) The potato absorbs starch directly from soil.
B) The potato performs photosynthesis underground.
C) Food prepared in leaves is transported to the potato through phloem and stored there.
D) Xylem produces starch inside the potato.
Answer: C) Food prepared in leaves is transported to the potato through phloem and stored there.

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16. Which pair is correctly matched?
A) Xylem – transport of food; Phloem – transport of water
B) Xylem – transport of water and minerals; Phloem – transport of food
C) Stomata – transport of food; Xylem – gas exchange
D) Phloem – photosynthesis; Stomata – water absorption
Answer: B) Xylem – transport of water and minerals; Phloem – transport of food

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17. Germinating seeds are kept in a closed flask connected to lime water. After some time, the lime water becomes milky. This demonstrates that germinating seeds:
A) release oxygen only
B) release carbon dioxide during respiration
C) absorb all the carbon dioxide
D) produce starch in darkness
Answer: B) release carbon dioxide during respiration

---

18. Which equation correctly represents respiration as described in the chapter?
A) Carbon dioxide + Water → Glucose + Oxygen
B) Glucose + Oxygen → Carbon dioxide + Water + Energy

C) Glucose + Carbon dioxide → Oxygen + Energy
D) Water + Oxygen → Glucose + Energy
Answer: B) Glucose + Oxygen → Carbon dioxide + Water + Energy

---

19. Which statement about respiration in plants is correct?
A) Only green leaves respire.
B) Only roots respire.
C) Only non-green parts respire.
D) Both green and non-green parts respire.
Answer: D) Both green and non-green parts respire.

---

20. Consider the following statements:
I. Photosynthesis requires carbon dioxide.
II. Photosynthesis releases oxygen.
III. Respiration uses oxygen.
IV. Respiration releases carbon dioxide.
Which combination is correct?
A) I and II only
B) III and IV only
C) I, II and III only
D) I, II, III and IV
Answer: D) I, II, III and IV

---

21. Four similar green plants receive adequate water:

- P: sunlight + carbon dioxide
- Q: sunlight + no carbon dioxide
- R: darkness + carbon dioxide
- S: darkness + no carbon dioxide

In which plant would starch formation through photosynthesis be expected?
A) P only
B) P and Q
C) P and R
D) All four
Answer: A) P only

---

22. In the conditions described in Question 21, which plant would generate oxygen as a product of photosynthesis?
A) P only
B) Q only
C) R only
D) R and S
Answer: A) P only

---

23. Which sequence correctly describes the movement of substances involved in plant nutrition?
A) Soil → phloem → leaves for water; leaves → xylem → storage organs for food
B) Soil → roots → xylem → leaves for water/minerals; leaves → phloem → other parts for food
C) Soil → stomata → roots; roots → phloem → leaves
D) Leaves → xylem → roots for food; roots → stomata → leaves for water

Answer: B) Soil → roots → xylem → leaves for water/minerals; leaves → phloem → other parts for food

---

24. A broad and flat leaf is advantageous for photosynthesis mainly because this structure helps the leaf:
A) remain completely free from respiration
B) capture sunlight efficiently
C) transport food only to roots
D) prevent gas exchange
Answer: B) capture sunlight efficiently

---

25. A healthy plant is grown in a sealed transparent bottle and continues to survive under suitable conditions. Which explanation best accounts for the recycling of gases inside the bottle?
A) Oxygen from respiration is used in photosynthesis.
B) Carbon dioxide from photosynthesis is used in respiration.
C) Carbon dioxide from respiration can be used in photosynthesis, while oxygen from photosynthesis can be used in respiration.
D) Neither photosynthesis nor respiration occurs in a sealed bottle.
Answer: C) Carbon dioxide from respiration can be used in photosynthesis, while oxygen from photosynthesis can be used in respiration.

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

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

"Best Practices" Opportunities while Teaching Chapter 10: ***Life Processes in Plants:***
The chapter is highly suitable for **activity-based, inquiry-oriented and experiential teaching** because it covers photosynthesis, gas exchange, transport of water and food, and respiration through several experiments. The chapter itself emphasizes that plants require sunlight and water for growth and encourages students to observe changes scientifically.

1. Learning by Experimentation – "Plant Growth Challenge":
Divide students into groups and ask them to grow similar saplings under different conditions—**sunlight with water, sunlight without water, and darkness with water**. Students maintain a two-week observation diary recording height, number of leaves and leaf colour. They then compare results and infer the importance of sunlight and water. This directly follows Activity 10.1 in the chapter.

2. Demonstration-Based Learning – "Detect the Hidden Starch":
Demonstrate the **iodine test for starch** using a decolourised leaf. Before the experiment, ask students to predict what will happen when iodine is added. After observing the blue-black colour, students should explain the result in their own words. This develops observation, prediction, inference and scientific reasoning skills.

3. Inquiry-Based Learning – "What Does a Plant Need to Make Food?":
Instead of directly giving students the requirements of photosynthesis, allow them to derive them from the chapter's experiments. Groups can investigate the roles of **sunlight, water, chlorophyll and carbon dioxide** and prepare an evidence table showing what happens when one factor is absent. They should finally formulate the concept of photosynthesis themselves.

4. Microscope-Based Observation of Stomata:

Provide students with prepared leaf-peel slides or demonstrate the preparation of a leaf peel and allow them to observe **stomata under a microscope**. Students can draw and label what they observe and connect the tiny pores with gaseous exchange in plants. The chapter specifically identifies stomata as pores on leaf surfaces that help in gas exchange.

5. Visual Demonstration of Xylem Transport:

Use a **white flower or tender plant twig placed in coloured water** to make water transport visible. Students observe the colour appearing in the stem, leaves and flowers and examine a cut section of the stem. They can then relate the coloured pathway to **xylem**, which transports water and dissolved minerals through the plant.

6. Concept Mapping – "Plant Life Processes Network":

After completing the chapter, students prepare a concept map connecting:

Roots → Water & Minerals → Xylem → Leaves → Photosynthesis → Glucose/Starch → Phloem → Plant Parts → Respiration → Energy

This helps students understand that photosynthesis, transport and respiration are **interconnected processes**, rather than isolated concepts. The chapter distinguishes xylem as the transporter of water and minerals and phloem as the transporter of prepared food.

7. Compare-and-Contrast Strategy – Photosynthesis vs. Respiration:

Ask students to construct a comparison chart for **photosynthesis and respiration** based on raw materials, products, site/process and importance. Students should also write the word equations and explain how the products of one process are connected with the requirements of the other. This strengthens conceptual understanding and reduces common misconceptions.

8. Evidence-Based Respiration Experiment:

Demonstrate respiration using **germinating moong seeds and lime water**. Before revealing the result, students predict whether the lime water will change. They then explain why it turns milky and relate the observation to carbon dioxide released during respiration.

9. Real-Life Application through a "Bottle Garden":

Students can develop a simple **bottle garden** as a mini-project and observe it over several weeks. They should explain how carbon dioxide produced during respiration can be used for photosynthesis and how oxygen produced during photosynthesis can support respiration. This is also suggested as an exploratory project in the chapter.

10. Field-Based Learning – School Garden/Greenhouse Study:

Take students to the **school garden, nursery, farm or greenhouse** and ask them to identify how growers manage sunlight, water and other conditions for healthy plant growth. Students can interview a gardener or farmer and relate practical agricultural practices to photosynthesis, respiration and transport. The chapter itself recommends visiting a greenhouse to study regulation of light, water and carbon dioxide.

Best-practice outcome: These approaches shift the chapter from simple textbook learning to **"Observe → Predict → Experiment → Record → Analyse → Infer → Apply."** They develop scientific temperament, curiosity, collaboration, experimental skills and higher-order thinking while keeping the learning closely connected to everyday plants and agriculture.

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

"Innovations" Opportunities while Teaching-Learning Chapter 10: *Life Processes in Plants:*

The chapter *Life Processes in Plants* provides excellent opportunities for innovative teaching because students can investigate **photosynthesis, stomata, transport through xylem and phloem, and respiration** through experiments and exploratory projects.

1. "Smart Plant Lab" – Digital Growth Diary:

Students can grow similar plants under different conditions of **light and water** and create a digital growth diary. They can photograph the plants every day, measure height, count leaves and prepare simple graphs showing changes over two weeks. At the end, groups can present their evidence and explain which conditions produced the best growth. This innovatively extends the chapter's experiment comparing plants under different sunlight and water conditions.

2. "I Am a Leaf" – Role-Play Photosynthesis:

Students can become different components of photosynthesis: **Sunlight, Water, Carbon Dioxide, Chlorophyll, Glucose and Oxygen**. They physically arrange themselves to demonstrate how the inputs are used to produce glucose and oxygen. The activity converts the word equation into an interactive classroom simulation and helps students remember the process.

3. Build a 3D Working Model of Plant Transport:

Students can construct a model of a plant using **transparent tubes, straws or recycled materials**. One set of tubes represents **xylem**, carrying coloured water upward, while another represents **phloem**, showing the movement of food from leaves to other plant parts. This makes an otherwise invisible transport system visually understandable.

4. "Stomata Detective" – Smartphone Microscopy:

After observing a leaf peel under a microscope, students can photograph the microscopic image using a smartphone attached to the eyepiece, where permitted. They can identify and mark the **stomata**, prepare a digital poster and explain their role in gaseous exchange. This extends the chapter's microscope activity into a digital documentation exercise.

5. Bottle Garden – Mini Ecosystem Innovation Challenge:

Groups can create a **transparent bottle garden** and observe it over several weeks. Students maintain records and explain how oxygen generated during photosynthesis can be used in respiration and how carbon dioxide from respiration can support photosynthesis. They can compete to design the most sustainable mini-ecosystem. The chapter specifically proposes the bottle garden as an exploratory project.

6. "Plant Hospital" – Problem-Based Learning:

Create imaginary cases such as a **yellowing plant, wilted plant, plant kept in darkness, damaged roots, blocked xylem, or leaves with insufficient light**. Student teams act as "Plant Doctors," diagnose the probable problem using concepts from the chapter and recommend corrective measures. This develops application, analysis and problem-solving skills rather than simple memorisation.

7. Design-Your-Own Experiment Challenge:

Give students a scientific question without giving them the procedure, for example: **"Is water transported faster in plants under warm or cold conditions?"** Teams design their own experiment, identify variables, predict results, conduct observations and defend their conclusions. The chapter itself asks students to design such an investigation.

8. "Photosynthesis Escape Room":

Create classroom stations containing puzzles on **chlorophyll, sunlight, carbon dioxide, water, glucose, oxygen, stomata, xylem and phloem**. Correctly solving one question provides the clue needed to move to the next station. The final puzzle can require students to correctly construct the photosynthesis equation.

9. Plant-Life Augmented/Virtual Learning:

Use simple **AR/3D digital models or animations** to allow students to virtually enter a leaf and observe carbon dioxide entering through stomata, water travelling through xylem, food moving through phloem and oxygen leaving the leaf. Students can subsequently draw a "journey through a plant" flow diagram based on what they observed.

10. "Greenhouse Engineer" STEM Challenge:

Groups can design a miniature greenhouse on paper or using waste materials. They must decide how they would control **sunlight, water and carbon dioxide** to promote plant growth and justify every design choice scientifically. This connects directly with the chapter's suggestion that students investigate how greenhouse growers regulate light, water and carbon dioxide.

11. Photosynthesis vs. Respiration Game:

Create cards labelled **Glucose, Oxygen, Carbon Dioxide, Water, Energy, Sunlight and Chlorophyll**. Teams race to arrange the appropriate cards into photosynthesis and respiration equations and then explain the relationship between the two processes. This converts equation learning into collaborative game-based learning.

12. "Plant Scientist for a Day" Mini Research Project:

Each student or group can select a nearby plant and investigate its **leaf shape, colour, exposure to sunlight, growth conditions and possible adaptations for obtaining light and water**. Students prepare a one-page "scientific research report" containing a question, hypothesis, observations, photographs, conclusion and a new question for further investigation.

Innovation focus: These activities transform the chapter from **"read and remember" into "observe, experiment, design, create, analyse and discover."** They integrate **experiential learning, STEM, digital technology, gamification, collaborative learning, problem-based learning and scientific inquiry**, making *Life Processes in Plants* engaging and meaningful for 7th Standard students.

10.17: Practicing Questions/Question Bank

Chapter 10: ***Life Processes in Plants*** **— Grade 7 Science**

The following questions are based on the major concepts covered in the uploaded chapter: **plant growth, photosynthesis, chlorophyll, stomata, transport through xylem and phloem, and respiration in plants**.

A. Fill in the Blanks:

1. The green pigment present in leaves is called ________.
   Answer: Chlorophyll
2. The process by which green plants prepare their food is called ________.
   Answer: Photosynthesis
3. Plants prepare glucose using water and ________ in the presence of sunlight and chlorophyll.
   Answer: Carbon dioxide
4. During photosynthesis, plants release ________ into the atmosphere.
   Answer: Oxygen
5. Plants store food in the form of ________.
   Answer: Starch
6. A leaf containing starch turns ________ when tested with iodine solution.
   Answer: Blue-black
7. Tiny pores found on the surface of leaves are called ________.
   Answer: Stomata
8. Stomata help in the ________ of gases.
   Answer: Exchange

9. Water and minerals are transported through the ________ tissue.
   Answer: Xylem

10. Food prepared in the leaves is transported through the ________ tissue.
    Answer: Phloem

11. The primary site of photosynthesis in plants is the ________.
    Answer: Leaf

12. Glucose is a simple ________.
    Answer: Carbohydrate

13. During respiration, glucose is broken down in the presence of ________.
    Answer: Oxygen

14. Respiration releases carbon dioxide, water and ________.
    Answer: Energy

15. Lime water turns ________ in the presence of increased carbon dioxide.
    Answer: Milky

16. Plants require both sunlight and ________ for proper growth.
    Answer: Water

17. The food produced during photosynthesis is initially in the form of ________.
    Answer: Glucose

18. Caustic soda absorbs ________ from the air.
    Answer: Carbon dioxide

19. All parts of a plant, whether green or non-green, carry out ________.
    Answer: Respiration

20. Minerals dissolved in water move upward through the ________.
    Answer: Xylem

The chapter identifies sunlight, water, chlorophyll and carbon dioxide as essential for food synthesis and defines this process as photosynthesis.

B. One-Mark Questions:

1. **What is photosynthesis?**
   Answer: Photosynthesis is the process by which plants prepare food using carbon dioxide and water in the presence of sunlight and chlorophyll.

2. **Why are leaves called the food factories of plants?**
   Answer: Leaves are called food factories because they are the primary sites where food is prepared by photosynthesis.

3. **What is chlorophyll?**
   Answer: Chlorophyll is the green pigment that helps plants capture sunlight.

4. **Name the gas required for photosynthesis.**
   Answer: Carbon dioxide.

5. **Which gas is released during photosynthesis?**
   Answer: Oxygen.
6. **What is the immediate food produced during photosynthesis?**
   Answer: Glucose.
7. **How is glucose stored in plants?**
   Answer: Glucose can be converted into starch for storage.
8. **What are stomata?**
   Answer: Stomata are tiny pores on leaf surfaces that help in gaseous exchange.
9. **What is the function of xylem?**
   Answer: Xylem transports water and minerals to different parts of a plant.
10. **What is the function of phloem?**
    Answer: Phloem transports food prepared in leaves to other parts of the plant.
11. **Which chemical is used to test a leaf for starch?**
    Answer: Iodine solution.
12. **What colour indicates the presence of starch?**
    Answer: Blue-black.
13. **Why is a leaf decolourised before the iodine test?**
    Answer: Decolourisation makes the iodine-induced colour change easier to observe.
14. **What does caustic soda absorb?**
    Answer: Carbon dioxide.
15. **What happens to glucose during respiration?**
    Answer: Glucose is broken down to release energy.

C. Two-Mark Descriptive Questions:

1. Why are sunlight and water important for plant growth?

Answer:

1. Sunlight provides the energy needed for photosynthesis.
2. Water is required for photosynthesis and other processes essential for plant growth.

2. State any two functions of chlorophyll.

Answer:

1. Chlorophyll gives most leaves their green colour.
2. It helps capture sunlight efficiently for photosynthesis.

3. What are stomata? State their function.

Answer:

1. Stomata are tiny pores present on the surface of leaves.
2. They facilitate the exchange of gases such as carbon dioxide and oxygen.

4. Differentiate between xylem and phloem.

Answer:

1. Xylem transports water and minerals from the roots to other plant parts.
2. Phloem transports food from leaves to other parts of the plant.

5. Why is chlorophyll essential for photosynthesis?

Answer:

1. Chlorophyll captures sunlight needed for food preparation.
2. Experiments with green and non-green leaf patches show that starch is mainly produced where sufficient chlorophyll is present.

6. What happens during respiration in plants?

Answer:

1. Glucose is broken down in the presence of oxygen.
2. Carbon dioxide, water and energy are released.

7. Write the word equation for photosynthesis.

Answer:
Carbon dioxide + Water → Glucose + Oxygen
The process takes place in the presence of **sunlight and chlorophyll**.

8. Write the word equation for respiration.

Answer:
Glucose + Oxygen → Carbon dioxide + Water + Energy.

9. How can you test a leaf for starch?

Answer:

1. Decolourise the leaf and add diluted iodine solution.
2. A blue-black colour indicates the presence of starch.

10. Why is carbon dioxide necessary for plants?

Answer:

1. Carbon dioxide is a raw material for photosynthesis.
2. Without carbon dioxide, plants cannot prepare starch through photosynthesis.

D. Three-Mark Descriptive Questions:

1. Explain the role of sunlight in photosynthesis.

Answer:

1. Sunlight supplies energy for photosynthesis.
2. Chlorophyll present in green parts captures sunlight.

3. A plant kept in darkness does not produce detectable starch even when its leaves contain green patches.

2. Explain the transport of water and minerals in plants.

Answer:

1. Roots take up water containing dissolved minerals from the soil.
2. Xylem forms thin tube-like structures in stems, branches and leaves.
3. Water and dissolved minerals move through the xylem to other parts of the plant.

3. Explain the transport of food in plants.

Answer:

1. Leaves are the primary sites of photosynthesis.
2. Food prepared in leaves is transported through phloem.
3. The transported food reaches different plant parts and may also be stored in structures such as seeds and roots.

4. Explain the importance of stomata.

Answer:

1. Stomata are tiny pores found on leaf surfaces.
2. They help carbon dioxide enter the leaf for photosynthesis.
3. They also facilitate gaseous exchange associated with photosynthesis and respiration.

5. How does the iodine test demonstrate the presence of starch?

Answer:

1. The leaf is first softened and decolourised.
2. Diluted iodine solution is added to it.
3. A blue-black colour indicates the presence of starch.

6. What are the requirements and products of photosynthesis?

Answer:

1. Photosynthesis requires carbon dioxide and water.
2. Sunlight and chlorophyll are necessary for the process.
3. It produces glucose and oxygen.

7. Explain respiration in plants.

Answer:

1. Plants use oxygen to break down glucose during respiration.
2. Carbon dioxide, water and energy are released.
3. The released energy is used for the plant's growth and development.

8. Why are leaves well suited for photosynthesis?

Answer:

1. Leaves are generally broad and flat.
2. They contain chlorophyll that efficiently captures sunlight.
3. Their stomata facilitate gaseous exchange necessary for photosynthesis.

E. Five-Mark Descriptive Questions:

1. Explain the process of photosynthesis.

Answer:

1. Plants take up water from the soil through their roots.
2. Carbon dioxide from the air becomes available to leaves through gaseous exchange.
3. Chlorophyll helps capture sunlight efficiently.
4. Using these requirements, plants produce glucose and release oxygen.
5. Glucose provides an immediate source of energy and can later be converted into starch for storage.

2. Describe an experiment showing that sunlight is necessary for starch formation.

Answer:

1. Take similar plants/leaves and compare one kept in sunlight with one kept in darkness.
2. Use leaves having green and non-green patches and perform the starch test.
3. Decolourise the leaves and add iodine solution.
4. Green patches from the plant exposed to sunlight turn blue-black, indicating starch.
5. The leaf from the plant kept in darkness does not show the blue-black colour, demonstrating the importance of sunlight in starch production.

3. Explain how carbon dioxide is shown to be essential for photosynthesis.

Answer:

1. A green plant is first kept in darkness for two to three days to destarch it.
2. Half of a leaf is placed inside a bottle containing caustic soda, while the other half remains outside.
3. Caustic soda absorbs carbon dioxide inside the bottle.
4. After exposure to sunlight, the outside part turns blue-black in the iodine test while the inside part does not.
5. Therefore, carbon dioxide is essential for plants to prepare starch.

4. Explain transportation in plants with reference to xylem and phloem.

Answer:

1. Roots take up water and minerals from the soil.
2. Xylem transports water and dissolved minerals upward through the plant.
3. Water reaching the leaves is used for various functions, including photosynthesis.
4. Food produced in leaves is transported through phloem.
5. This food reaches different plant parts and may be stored in parts such as roots and seeds.

5. Explain respiration in plants and describe an experiment that demonstrates it.

Answer:

1. Germinating moong seeds can be kept over moist cotton in a conical flask.
2. After being left for about 24 hours in darkness, the gas from the flask is passed into lime water.
3. The lime water turns milky because the germinating seeds release additional carbon dioxide during respiration.
4. During respiration, glucose reacts with oxygen to produce carbon dioxide, water and energy.
5. The released energy is used for plant growth and development, and all plant parts—green and non-green—carry out respiration.

These questions provide a **balanced question-bank set** ranging from factual recall to explanation, experimentation and conceptual understanding, while covering the principal learning outcomes of Chapter 10, *Life Processes in Plants*.

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7th Standard Science Book Chapter 11

Chapter 11: Light: Shadows and Reflections

11.1 Summary of the Chapter:

Summary of Chapter 11: Light: Shadows and Reflections
Grade 7 Science — 12 Key Points

(1) **Sources of Light:** The Sun is the main natural source of light on Earth. Stars, lightning, natural fire, and certain animals such as fireflies also emit their own light. Objects that emit their own light are called **luminous objects**, while objects that do not are called **non-luminous objects**. The Moon is non-luminous and shines by reflecting sunlight.

(2) **Artificial Sources of Light:** Humans initially used fire for artificial lighting and later developed lamps using oil, wax, gas, and electricity. Modern **LED lamps** consume less power, are brighter, and last longer than traditional lamps.

(3) **Light Travels in a Straight Line:** Experiments using aligned matchboxes and a straight pipe demonstrate that **light generally travels along a straight path**. A candle flame can be seen through a straight pipe but not through a bent pipe.

(4) **Transparent, Translucent and Opaque Materials:** Materials are classified according to the amount of light that passes through them. **Transparent materials** allow almost all light to pass through, **translucent materials** allow light to pass partially, and **opaque materials** do not allow light to pass through.

(5) **Formation of Shadows:** A **shadow** is a dark region formed when an object blocks the path of light. To observe a shadow, we generally need a **source of light, an object, and a screen or surface** on which the shadow falls.

(6) **Nature of Shadows:** Opaque objects produce darker shadows, translucent objects produce lighter shadows, and even some transparent objects may produce faint shadows. The **shape, size, and sharpness** of a shadow depend on the relative positions of the light source, object, and screen. Changing the colour of an opaque object does not change the colour of its shadow.

(7) **Reflection of Light:** When light falls on a shiny surface or mirror, its direction changes. This change in the direction of light by a mirror is called **reflection of light**.

(8) **Image Formation by a Plane Mirror:** A plane mirror forms an image that is **erect and of the same size as the object**. The image appears behind the mirror and **cannot be obtained on a screen**.

(9) **Lateral Inversion:** In a plane mirror, the left side appears to be the right side and the right appears to be the left. This apparent left-right reversal is called **lateral inversion**. This explains why the word "AMBULANCE" is written in reverse on the front of an ambulance.

(10) **Pinhole Camera:** A **pinhole camera** allows light rays from an object to pass through a tiny hole and form an image on a screen. The image produced by a pinhole camera is **inverted or upside down**.

(11) **Periscope:** A simple periscope can be constructed using **two plane mirrors** arranged in a suitable manner. Reflection from the mirrors enables us to see objects that cannot be viewed directly. Periscopes are used in **submarines, tanks, and bunkers**.

(12) **Kaleidoscope:** A kaleidoscope uses **three plane mirrors** arranged in a triangular manner. Multiple reflections create beautiful and continuously changing patterns. Kaleidoscopes can provide designers and artists with ideas for creating new patterns.

Key Concepts to Remember:

Luminous objects → Straight-line travel of light → Transparent/Translucent/Opaque materials → Shadows → Reflection → Plane-mirror images → Lateral inversion → Pinhole camera → Periscope → Kaleidoscope.

11.2 Important Formulas:

The chapter is **mainly conceptual and activity-based**. It does **not introduce any formal mathematical formulas** for solving numerical problems. The chapter focuses on straight-line propagation of light, shadows, reflection, plane-mirror images, pinhole cameras, periscopes, and kaleidoscopes.

However, the following **simple quantitative relationships** are useful for application-based or numerical questions:

1. Distance of Image from a Plane Mirror

For a plane mirror:

$$\boxed{\text{Image distance} = \text{Object distance}}$$

If an object is placed $d$cm in front of a plane mirror, its image appears $d$cm behind the mirror. The chapter asks students to observe this relationship by standing at different distances from a mirror.

Example:

If a child stands **3 m** in front of a plane mirror:

$$\text{Image distance} = 3\text{ m behind the mirror}$$

2. Distance Between Object and Its Image

Since the object and image are equally far from the mirror:

$$\boxed{\text{Object–image distance} = 2 \times \text{Object distance from mirror}}$$

Example: If an object is 2 m from a mirror:

$$2 \times 2 = 4\text{ m}$$

Therefore, the distance between the object and its image is **4 m**.

3. Size of Image in a Plane Mirror

The chapter explicitly states that the image formed by a plane mirror has the **same size as the object**.

Therefore:

$$\boxed{\text{Image size} = \text{Object size}}$$

or, as a useful ratio,

$$\boxed{\frac{\text{Image size}}{\text{Object size}} = 1}$$

Example: If an object is 15 cm tall, its plane-mirror image is **15 cm tall**.

4. Movement of Image with Movement of Object

From the equal-distance property of a plane mirror:

$$\boxed{\text{Distance moved by image} = \text{Distance moved by object}}$$

Thus, if a person moves **50 cm towards the mirror**, the image also moves **50 cm towards the mirror** on the other side.

Consequently, the separation between the person and image decreases by:

$$\boxed{2 \times 50 = 100\text{ cm}}$$

This is a useful derived relationship for HOTS-type numerical questions.

5. Shadow Size — Qualitative Relationship

The chapter does **not provide a mathematical formula** for calculating shadow size. However, it emphasizes that the size, shape, and sharpness of a shadow depend upon the relative positions of the **light source, object, and screen**.

For the situations discussed in the chapter:

- Object closer to the **light source** → generally **larger shadow**.
- Object closer to the **screen** → generally **smaller shadow**.

The textbook specifically uses the ball-and-torch setup to test this relationship.

6. Time Taken by Sunlight to Reach Earth

The chapter provides the factual value:

$$\boxed{t \approx 8 \text{ minutes } 20 \text{ seconds}}$$

Converting it into seconds:

$$t = (8 \times 60) + 20 = \boxed{500 \text{ seconds}}$$

The chapter states that sunlight takes about **8 minutes 20 seconds** to reach Earth.

Formula Quick-Revision Table

Concept	**Formula / Relationship**
Plane-mirror image distance	**Image distance = Object distance**
Object–image separation	**2 × Object distance from mirror**
Plane-mirror image size	**Image size = Object size**
Size ratio	**Image size / Object size = 1**
Movement of image	**Image movement = Object movement**
Change in object–image separation	**2 × movement of object**
Sunlight travel time	**8 min 20 s = 500 s**
Shadow size	Depends on positions of source, object and screen

Note: For the **Grade 7 syllabus covered in this chapter**, formulas such as the laws of reflection in angular form, mirror formula, magnification formula, and speed-of-light calculations are **not introduced and therefore should not normally be included in the chapter-based question bank**.

11.3 Fill-Up the Blank LOTS type questions with Answers: (35 Questions)

1. The _________ is the main source of natural light on Earth.
   Answer: Sun
2. Objects that emit their own light are called _________ objects.
   Answer: luminous
3. Objects that do not emit their own light are called _________ objects.
   Answer: non-luminous
4. The Moon shines by reflecting the light of the _________.
   Answer: Sun
5. Fire was the earliest form of _________ lighting used by humans.
   Answer: artificial
6. LED stands for _________.
   Answer: Light Emitting Diode
7. Light generally travels in a _________ line.
   Answer: straight
8. Light passes almost completely through _________ materials.
   Answer: transparent
9. Light passes only partially through _________ materials.
   Answer: translucent
10. Light does not pass through _________ materials.
    Answer: opaque

11. The dark patch formed where light does not reach is called a ________.
    Answer: shadow
12. ________ objects usually form darker shadows.
    Answer: Opaque
13. Translucent objects generally form ________ shadows.
    Answer: lighter
14. To observe a shadow, we need a source of light, an opaque object, and a ________.
    Answer: screen
15. The shape, size, and sharpness of a shadow depend on the ________ of the object relative to the light source and screen.
    Answer: position
16. Changing the colour of an opaque object does not change the ________ of its shadow.
    Answer: colour
17. The change in the direction of light by a mirror is called ________ of light.
    Answer: reflection
18. A mirror that is flat and not curved is called a ________ mirror.
    Answer: plane
19. The image formed by a plane mirror is of the ________ size as the object.
    Answer: same
20. An upright image is called an ________ image.
    Answer: erect
21. The image formed by a plane mirror cannot be obtained on a ________.
    Answer: screen
22. The perceived left-right reversal in a plane mirror is called ________.
    Answer: lateral inversion
23. The word "AMBULANCE" is written in reverse on the front of an ambulance because of ________ inversion.
    Answer: lateral
24. A ________ camera uses a tiny hole to form an image on a screen.
    Answer: pinhole
25. The image formed by a pinhole camera is ________.
    Answer: inverted
26. A simple periscope uses ________ plane mirrors.
    Answer: two
27. The two plane mirrors of a simple periscope are placed in a ________-shaped box.
    Answer: Z
28. Periscopes are commonly used in ________ to see objects that are not directly visible.
    Answer: submarines
29. A kaleidoscope uses ________ rectangular plane-mirror strips.
    Answer: three
30. The mirrors in a kaleidoscope are joined together in a ________ manner.
    Answer: triangular
31. A kaleidoscope produces many interesting patterns because of multiple ________.
    Answer: reflections
32. Designers and artists often use ________ to get ideas for new patterns.
    Answer: kaleidoscopes
33. Fireflies use light to ________.
    Answer: communicate

34. The number of fireflies is decreasing due to light pollution, reduced forest cover, and excessive ________.
Answer: tourism
35. Light emitted by the Sun takes approximately ________ minutes and 20 seconds to reach Earth.
Answer: 8

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

1. If one of three aligned matchboxes with holes is moved sideways, the light spot on the screen will ________.
Answer: disappear
2. A candle flame can be seen through a straight pipe but not through a bent pipe because light travels in a ________ line.
Answer: straight
3. If a clear glass sheet is placed between a torch and a screen, most of the light will ________ through it.
Answer: pass
4. If tracing paper is placed between a torch and a screen, light will pass through it ________.
Answer: partially
5. If thick cardboard is placed between a torch and a screen, it will ________ the light.
Answer: block
6. If an opaque ball is removed from between a torch and a screen, its shadow will ________.
Answer: disappear
7. If the torch is switched off while an opaque object and screen remain in position, a shadow will ________.
Answer: not form
8. If a red opaque ball is replaced by a blue opaque ball of the same size and shape, the colour of its shadow will ________.
Answer: remain unchanged
9. Compared with an opaque object, a translucent object generally produces a ________ shadow.
Answer: lighter
10. If an opaque object is moved closer to a torch while the screen remains fixed, its shadow generally becomes ________.
Answer: larger
11. If the same opaque object is moved closer to the screen, its shadow generally becomes ________.
Answer: smaller
12. If an object is tilted while the torch and screen remain fixed, the ________ of its shadow may change.
Answer: shape
13. The shape, size and sharpness of a shadow can be altered by changing the ________ of the object relative to the source and screen.
Answer: position
14. When sunlight falls on a plane mirror and a bright spot appears on another wall, the phenomenon involved is ________.
Answer: reflection

15. Tilting a mirror changes the position of the reflected light spot because the mirror changes the ________ of light.
Answer: direction
16. If a student moves closer to a plane mirror, the image also appears ________ to the mirror.
Answer: closer
17. If a student raises the left hand while facing a plane mirror, the image appears to raise the ________ hand.
Answer: right
18. The reversed writing on the front of an ambulance becomes readable in a rear-view mirror because of ________.
Answer: lateral inversion
19. If a pen is moved to different positions in front of a plane mirror, the size of its image remains ________ to that of the pen.
Answer: equal
20. If a screen is placed behind a plane mirror to capture its image, the image ________ be obtained on the screen.
Answer: cannot
21. If the letter **T** is held in front of a plane mirror, its appearance may remain identical because it has ________ symmetry.
Answer: vertical
22. An image of a candle flame produced by a pinhole camera appears ________ compared with the actual flame.
Answer: inverted
23. The formation of an inverted image in a pinhole camera demonstrates that light travels in ________ lines.
Answer: straight
24. To see a distant tree clearly through a sliding pinhole camera, the smaller box may be moved ________ or backward until an image appears.
Answer: forward
25. Unlike a plane-mirror image, a pinhole-camera image can be obtained on a ________.
Answer: screen
26. A person inside a submarine can observe objects above the water using a ________.
Answer: periscope
27. A periscope allows us to see an object that is not directly visible by using ________ from two mirrors.
Answer: reflection
28. If the mirrors are removed from a simple periscope, it will no longer properly ________ light to the observer's eyes.
Answer: reflect
29. When a kaleidoscope is rotated, a new pattern is formed because of multiple ________ inside it.
Answer: reflections
30. Three mirrors arranged in a kaleidoscope produce many images due to reflections of ________.
Answer: reflections
31. If two torches illuminate the same opaque ball from different positions, ________ shadows may be formed on the screen.
Answer: two

32. A bird flying very high may not produce a clearly visible shadow on the ground, but its shadow becomes more noticeable when it flies ________ to the ground.
    Answer: closer
33. If two plane mirrors are placed at an angle to each other, ________ images of an object may be observed.
    Answer: multiple
34. The beautiful patterns inside a kaleidoscope demonstrate repeated ________ of light.
    Answer: reflection
35. If the Sun suddenly stopped emitting light, people on Earth would continue to receive its previously emitted light for about ________.
    Answer: 8 minutes 20 seconds

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

1. **What is a luminous object?**
   Answer: An object that emits its own light is called a luminous object.
2. **What is a non-luminous object?**
   Answer: An object that does not emit its own light is called a non-luminous object.
3. **Name the main natural source of light on Earth.**
   Answer: The Sun is the main natural source of light on Earth.
4. **Why is the Moon considered a non-luminous object?**
   Answer: The Moon is non-luminous because it does not emit its own light but reflects sunlight.
5. **Name any two natural sources of light other than the Sun.**
   Answer: Stars and lightning are two natural sources of light.
6. **What are LED lamps?**
   Answer: LED lamps are modern light sources that consume less power, are brighter, and last longer than traditional lamps.
7. **How does light usually travel?**
   Answer: Light usually travels in a straight line.
8. **Why can a candle flame be seen through a straight pipe but not through a bent pipe?**
   Answer: A candle flame can be seen only through a straight pipe because light travels in a straight line.
9. **What is a transparent material?**
   Answer: A transparent material allows light to pass almost completely through it.
10. **What is a translucent material?**
    Answer: A translucent material allows light to pass only partially through it.
11. **What is an opaque material?**
    Answer: An opaque material does not allow light to pass through it.
12. **What is a shadow?**
    Answer: A shadow is a dark region formed where light is blocked by an object.
13. **What three things are required to observe a shadow?**
    Answer: A source of light, an opaque object, and a screen are required to observe a shadow.
14. **What kind of shadow is formed by an opaque object?**
    Answer: An opaque object forms a darker shadow.
15. **What kind of shadow is formed by a translucent object?**
    Answer: A translucent object forms a lighter shadow.

16. **Does changing the colour of an opaque object change the colour of its shadow?**
    Answer: No, changing the colour of an opaque object does not change the colour of its shadow.
17. **What is reflection of light?**
    Answer: The change in the direction of light by a mirror is called reflection of light.
18. **What is a plane mirror?**
    Answer: A plane mirror is a mirror that has a flat, non-curved reflecting surface.
19. **What happens when light falls on a plane mirror?**
    Answer: Light changes its direction when it falls on a plane mirror.
20. **What is an image?**
    Answer: The appearance of an object produced by a mirror through reflection is called its image.
21. **What is an erect image?**
    Answer: An upright image is called an erect image.
22. **How does the size of an image formed by a plane mirror compare with the object?**
    Answer: The image formed by a plane mirror is the same size as the object.
23. **Can an image formed by a plane mirror be obtained on a screen?**
    Answer: No, an image formed by a plane mirror cannot be obtained on a screen.
24. **What is lateral inversion?**
    Answer: Lateral inversion is the perceived left-right reversal in an image formed by a plane mirror.
25. **Why is "AMBULANCE" written in a laterally inverted manner on an ambulance?**
    Answer: It is written that way so that drivers can read it correctly in their rear-view mirrors.
26. **What is a pinhole camera?**
    Answer: A pinhole camera is a device in which light passes through a tiny hole and forms an image on a screen.
27. **What type of image is formed by a pinhole camera?**
    Answer: A pinhole camera forms an inverted or upside-down image on a screen.
28. **What is a periscope?**
    Answer: A periscope is a device that uses reflection from two mirrors to view objects that are not directly visible.
29. **Where are periscopes commonly used?**
    Answer: Periscopes are commonly used in submarines, tanks, and by soldiers in bunkers.
30. **How many plane mirrors are used in a simple periscope?**
    Answer: Two plane mirrors are used in a simple periscope.
31. **What is a kaleidoscope?**
    Answer: A kaleidoscope is a device that uses multiple reflections from mirrors to produce beautiful patterns.
32. **How many mirror strips are used in the kaleidoscope described in the chapter?**
    Answer: Three rectangular plane mirror strips are used in the kaleidoscope.
33. **Why does a kaleidoscope produce many interesting patterns?**
    Answer: A kaleidoscope produces many patterns because its three mirrors create multiple images through repeated reflections.
34. **Who often uses kaleidoscopes to get ideas for new patterns?**
    Answer: Designers and artists often use kaleidoscopes to get ideas for new patterns.

35. **How long does light from the Sun take to reach Earth?**
Answer: Light from the Sun takes about 8 minutes and 20 seconds to reach Earth.

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

1. **Why can you see a candle flame through a straight pipe but not through a bent pipe?**
Answer: The flame is visible only through the straight pipe because light travels in a straight line.
2. **If one of three aligned matchboxes is moved slightly sideways, why does the light spot disappear from the screen?**
Answer: The light spot disappears because the holes are no longer in one straight line for light to pass through.
3. **A student calls the Moon a luminous object because it appears bright at night; why is the student incorrect?**
Answer: The student is incorrect because the Moon does not produce its own light but reflects sunlight.
4. **Why does a cardboard sheet placed in front of a torch produce a dark shadow?**
Answer: Cardboard is opaque and blocks the light falling on it, producing a dark shadow.
5. **Why does tracing paper produce a lighter shadow than cardboard?**
Answer: Tracing paper allows some light to pass through it, whereas cardboard blocks light more completely.
6. **If a transparent glass sheet replaces an opaque object in a shadow experiment, what change would you expect?**
Answer: The shadow would become very faint or may be difficult to observe because most light passes through the glass.
7. **What would happen to a shadow if the light source were switched off?**
Answer: The shadow would disappear because light is necessary for shadow formation.
8. **What would happen to the shadow if the opaque object were removed from between the torch and screen?**
Answer: The shadow would disappear because there would be no object to block the light.
9. **If a red opaque ball is replaced by a blue opaque ball of the same size and position, will the colour of the shadow change?**
Answer: No, changing the colour of an opaque object does not change the colour of its shadow.
10. **Why can a wall or the ground act as a screen for a shadow?**
Answer: A wall or the ground can receive the region where light is blocked and therefore make the shadow visible.
11. **Why does moving an object relative to a torch and screen change its shadow?**
Answer: The size, shape, and sharpness of a shadow depend on the object's position relative to the light source and screen.
12. **A ball is moved closer to a torch while the screen remains fixed; what happens to its shadow?**
Answer: The shadow becomes larger when the ball is moved closer to the torch.
13. **Why might the shape of a shadow change when an object is tilted?**
Answer: Tilting changes the part or outline of the object that blocks the light, thereby changing the shadow's shape.

14. **Why can a shiny steel plate produce both a shadow and a bright spot?**
    Answer: The plate blocks some light to form a shadow while its shiny surface reflects some light to produce a bright spot.
15. **If a plane mirror is tilted slightly, why does the reflected light spot move on the wall?**
    Answer: Tilting the mirror changes the direction in which the light is reflected.
16. **How could you direct sunlight onto a wall that is not receiving sunlight directly?**
    Answer: A plane mirror can be suitably tilted to reflect and redirect sunlight onto the wall.
17. **A pen is moved closer to a plane mirror; what happens to its image?**
    Answer: The image also appears closer to the mirror while remaining the same size as the pen.
18. **Why can the image formed by a plane mirror not be collected on a screen?**
    Answer: The image formed by a plane mirror only appears to be behind the mirror and cannot be obtained on a screen.
19. **If you raise your left hand in front of a plane mirror, which hand appears raised in the image and why?**
    Answer: The image appears to raise its right hand because a plane mirror produces lateral inversion.
20. **Why is the word "AMBULANCE" written in reverse on the front of an ambulance?**
    Answer: It appears correctly in the rear-view mirror of the vehicle ahead because of lateral inversion.
21. **Which letters among A, B, O and T are more likely to appear unchanged in a plane mirror when considered for left-right symmetry?**
    Answer: O and T can appear unchanged because they have vertical symmetry, as highlighted in the chapter's mirror-image exercise.
22. **Why is the image of a candle flame upside down in a pinhole camera?**
    Answer: Light travels in straight lines through the tiny pinhole, causing rays from different parts of the flame to form an inverted image.
23. **How can you distinguish a pinhole-camera image from a plane-mirror image?**
    Answer: A pinhole camera forms an inverted image on a screen, whereas a plane mirror forms an erect but laterally inverted image that cannot be obtained on a screen.
24. **Why is a dark cloth useful while observing an outdoor image through a pinhole camera?**
    Answer: The dark cloth reduces surrounding light and makes the image on the tracing-paper screen easier to observe.
25. **Why can a periscope help a soldier see over an obstacle without looking directly over it?**
    Answer: The two mirrors in a periscope reflect light so that objects not directly visible can be seen.
26. **Why are two plane mirrors required in the simple periscope described in the chapter?**
    Answer: Successive reflection from the two mirrors redirects light through the periscope to the observer's eye.
27. **Why does turning a kaleidoscope produce a new pattern?**
    Answer: Turning it changes the arrangement being reflected by its three mirrors, producing different multiple-image patterns.
28. **Why does a kaleidoscope produce many images even though it contains only three mirrors?**

Answer: Its mirrors repeatedly reflect images formed by the other mirrors, creating multiple reflections.

29. **Why may the shadow of a bird flying very high be difficult to see on the ground?**
    Answer: When the bird is very far from the ground, its shadow becomes too faint or indistinct to be easily observed.
30. **If the Sun suddenly stopped emitting light, why would we not know immediately?**
    Answer: We would notice it only after about 8 minutes and 20 seconds because sunlight takes that much time to reach Earth.

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

1. What are luminous and non-luminous objects? Give one example of each.
Answer:
1. Objects that emit their own light are called **luminous objects**, such as the Sun.
2. Objects that do not emit their own light are called **non-luminous objects**, such as the Moon.

2. Name any two natural sources of light.
Answer:
1. The **Sun and stars** are natural sources of light.
2. **Lightning and natural fire** are also natural sources of light.

3. Why is the Moon considered a non-luminous object?
Answer:
1. The Moon does not emit its own light.
2. It appears bright because it reflects the light of the Sun.

4. State two advantages of LED lamps.
Answer:
1. LED lamps consume much less power and are brighter than traditional lamps.
2. They last longer and help reduce electricity consumption.

5. How can we demonstrate that light travels in a straight line using matchboxes?
Answer:
1. Light passes through three matchbox holes and reaches the screen when all the holes are aligned in a straight line.
2. When one matchbox is moved out of alignment, the light spot disappears, showing that light travels in a straight line.

6. What happens when we try to see a candle flame through straight and bent pipes?
Answer:
1. The candle flame can be seen through a straight pipe.
2. It cannot be seen through a bent pipe because light travels in a straight line.

7. Differentiate between transparent and translucent materials.
Answer:
1. **Transparent materials** allow light to pass through them almost completely.
2. **Translucent materials** allow light to pass through them only partially.

8. What are opaque materials? How do they affect light?
Answer:
1. Opaque materials are materials through which light does not pass.
2. When placed in the path of light, they block the light and can form a dark shadow.

9. What is a shadow? How is it formed?
Answer:
1. A shadow is a dark patch or region where light does not reach.

2. It is formed when an object blocks light from reaching a surface or screen.

10. What are the three things required to observe a shadow?

Answer:

1. A **source of light** and an **opaque object** are required for shadow formation.
2. A **screen or surface** is required to observe the shadow.

11. How do opaque and translucent objects differ in the shadows they form?

Answer:

1. Opaque objects generally form **darker shadows** because they block light.
2. Translucent objects form **lighter shadows** because some light passes through them.

12. What factors determine the shape, size, and sharpness of a shadow?

Answer:

1. They depend on the position of the object relative to the light source.
2. They also depend on the position of the object relative to the screen.

13. Does changing the colour of an opaque object change the colour of its shadow? Explain.

Answer:

1. No, changing the colour of an opaque object does not change the colour of its shadow.
2. A shadow is produced because the object blocks light from reaching the screen.

14. What is reflection of light?

Answer:

1. A shiny surface or mirror can change the direction of light falling on it.
2. This change in the direction of light by a mirror is called **reflection of light**.

15. What happens when a beam of light falls on a plane mirror?

Answer:

1. The plane mirror changes the direction of the light beam falling on it.
2. This phenomenon is called reflection of light.

16. State any two characteristics of an image formed by a plane mirror.

Answer:

1. The image formed by a plane mirror is **erect and of the same size as the object**.
2. It cannot be obtained on a screen and shows **lateral inversion**.

17. What is lateral inversion? Give an example.

Answer:

1. Lateral inversion is the perceived left-right reversal in an image formed by a plane mirror.
2. For example, your left hand appears as the right hand in the mirror image.

18. Why is "AMBULANCE" written in reverse on the front of an ambulance?

Answer:

1. A plane mirror produces lateral inversion of an image.
2. Therefore, the reversed word appears as "AMBULANCE" in the rear-view mirror of the vehicle ahead.

19. What is a pinhole camera? What kind of image does it form?

Answer:

1. A pinhole camera is a device in which light from an object passes through a tiny hole and forms an image on a screen.
2. The image produced by a pinhole camera is **inverted or upside down**.

20. Mention two differences between the images formed by a plane mirror and a pinhole camera.

Answer:

1. A plane mirror forms an erect, laterally inverted image, whereas a pinhole camera forms an upside-down image.

2. A plane-mirror image cannot be obtained on a screen, whereas a pinhole-camera image is formed on a screen.

21. What is a periscope? Mention one use of it.

Answer:

1. A simple periscope uses two plane mirrors placed in a Z-shaped arrangement to enable us to see objects that are not directly visible.
2. Periscopes are used in submarines, tanks, and by soldiers to see outside bunkers.

22. What is a kaleidoscope and how does it produce patterns?

Answer:

1. A kaleidoscope uses three plane mirrors arranged in a triangular manner along with coloured objects.
2. Multiple reflections from the mirrors produce beautiful and changing patterns.

23. Why do the patterns in a kaleidoscope change when it is turned?

Answer:

1. Turning the kaleidoscope changes the arrangement of the objects seen through the mirrors.
2. Multiple reflections of the changed arrangement produce a different pattern each time.

24. What is shadow puppetry? How are shadow puppets used?

Answer:

1. Shadow puppetry is an art form in which flat cut-out figures are placed between a light source and a screen.
2. Puppeteers move the figures and light to create life-like shadow movements on the screen.

25. How long does sunlight take to reach Earth? What does this imply?

Answer:

1. Light emitted by the Sun takes about **8 minutes and 20 seconds** to reach Earth.
2. Therefore, if the Sun suddenly stopped emitting light, we would not know about it for another 8 minutes and 20 seconds.

11.8. Two-mark questions with Answers of HOTS Type: (22 Questions)

1. Three matchboxes with aligned holes allow torchlight to reach a screen. What happens if the middle matchbox is shifted slightly? Why?

Answer:

1. The bright spot on the screen will disappear because the three holes are no longer in a straight line.
2. This demonstrates that light travels in a straight line.

2. A student can see a candle flame through a straight pipe but not through a bent pipe. What conclusion can be drawn?

Answer:

1. The flame is visible through the straight pipe because light can travel directly from the flame to the eye.
2. It is not visible through the bent pipe because light normally travels in a straight line and does not follow the bend.

3. A student places glass, tracing paper, and cardboard one by one in front of a torch. Predict how much light will pass through each.

Answer:

1. Light will pass almost completely through transparent glass and only partially through translucent tracing paper.
2. Cardboard is opaque, so light will not pass through it.

4. Two objects of the same shape are made of cardboard and tracing paper. How will their shadows differ?
Answer:
1. The opaque cardboard will produce a darker shadow because it blocks light more completely.
2. The translucent tracing paper will produce a lighter shadow because some light passes through it.

5. What will happen to the shadow if the opaque object is removed from between a torch and a screen? Explain.
Answer:
1. The shadow will disappear because there is no object to block the light.
2. Light from the torch will then reach the screen directly, producing a bright region instead.

6. A red ball is replaced by a blue ball of exactly the same size at the same position. Will the colour of the shadow change? Why?
Answer:
1. The colour of the shadow will not change merely because the colour of the opaque object has changed.
2. A shadow is produced by the blocking of light, and the chapter states that changing the colour of an opaque object does not change the shadow's colour.

7. A ball is moved closer to a torch while the screen remains fixed. What change would you expect in its shadow?
Answer:
1. The shadow would become larger when the ball is moved closer to the torch.
2. This shows that the size of a shadow depends on the relative positions of the light source, object, and screen.

8. Why can the shadow of a bird be more noticeable when it flies close to the ground than when it flies very high?
Answer:
1. When the bird is closer to the ground, its shadow can appear more distinct on the ground.
2. This is because the sharpness and appearance of a shadow depend on the object's position relative to the light source and the screen.

9. A student wants to illuminate a wall that is not receiving direct sunlight. How can a plane mirror help?
Answer:
1. The student can place and tilt a plane mirror so that sunlight falling on it is redirected towards the wall.
2. This works because a mirror changes the direction of incident light through **reflection**.

10. A student tilts a mirror while sunlight is reflected onto a wall. Why does the bright spot on the wall change its position?
Answer:
1. Tilting the mirror changes the direction in which the reflected light travels.
2. Therefore, the reflected beam reaches a different position on the wall.

11. A child moves closer to a plane mirror. What happens to the apparent position of the image?
Answer:
1. As the child moves closer to the mirror, the image also appears closer to the mirror.
2. Similarly, when the child moves farther away, the image appears farther behind the mirror.

12. Why is the word "AMBULANCE" written in reverse on the front of an ambulance?
Answer:
1. A plane mirror produces lateral inversion, making left appear right and right appear left.
2. Hence, the reversed writing appears correctly as "AMBULANCE" in the rear-view mirror of the vehicle ahead.

13. A student tries to collect the image formed by a plane mirror on a white screen. Will the experiment succeed? Explain.
Answer:
1. No, the image formed by a plane mirror cannot be obtained on a screen.
2. Moving the screen either behind or in front of the mirror will therefore not produce the mirror image on it.

14. A candle is placed in front of a pinhole camera. Why does its flame appear upside down on the screen?
Answer:
1. Light from different parts of the candle flame travels in straight lines through the tiny pinhole.
2. This arrangement produces an inverted or upside-down image on the screen.

15. A student observes an image in a plane mirror and another in a pinhole camera. How can the student distinguish between them?
Answer:
1. The plane-mirror image is erect but laterally inverted and cannot be obtained on a screen.
2. The pinhole-camera image is upside down and is formed on a screen.

16. Why is tracing paper suitable as a screen in the sliding pinhole camera described in the chapter?
Answer:
1. Tracing paper is translucent and is used to form the screen on which the pinhole-camera image appears.
2. It therefore allows the image formed by light passing through the pinhole to be observed from the viewing side.

17. A soldier wants to observe an object outside a bunker without directly exposing himself. Which device from the chapter would be useful and why?
Answer:
1. A **periscope** would be useful because it allows objects that are not directly visible to be seen.
2. It uses reflection from two plane mirrors and is specifically mentioned as useful for soldiers looking outside bunkers.

18. Why does a kaleidoscope show a new pattern when it is turned?
Answer:
1. Turning the kaleidoscope changes the arrangement of the coloured objects relative to its mirrors.
2. Multiple images produced by repeated reflections create a different pattern with each turn.

19. A student uses two torches instead of one to illuminate an opaque ball. What can happen to the number of shadows?
Answer:
1. Two shadows can appear on the screen because the ball can block light arriving from the two different torch positions.
2. Thus, changing the number and positions of light sources can change the shadows observed.

20. If the Sun suddenly stopped emitting light, would we know immediately? Give a reason.
Answer:
1. No, we would not know immediately because sunlight takes about **8 minutes and 20 seconds** to reach Earth.
2. Therefore, the light already travelling towards Earth would continue reaching us for approximately that duration.

21. A shiny steel plate produces a shadow but also creates a bright spot on another wall. How can both effects occur?
Answer:
1. The plate is opaque and can block light in one direction, thereby producing a shadow.
2. Its shiny surface can simultaneously redirect some incident light by reflection, producing a bright spot elsewhere.

22. Why are shadow puppets placed between the light source and the screen rather than behind the screen?
Answer:
1. The puppets must block the light before it reaches the screen in order to form visible shadows.
2. Moving the puppets and light then allows the puppeteer to create different life-like shadow movements.

11.9. Three-mark questions with Answers of LOTS Type: (18 Questions)

1. What are luminous and non-luminous objects? Give examples.
Answer:
1. Objects that emit their own light are called **luminous objects**.
2. The Sun, stars, lightning, natural fire, and certain animals are examples of luminous objects.
3. Objects that do not emit their own light are called **non-luminous objects**; the Moon is an example because it reflects sunlight.

2. Describe an activity to show that light travels in a straight line.
Answer:
1. Make holes at the same position in three matchboxes and arrange them so that all the holes are in a straight line.
2. Place a torch on one side and a screen on the other; a bright spot is obtained when the holes are aligned.
3. When one matchbox is moved out of alignment, the spot disappears, showing that **light travels in a straight line**.

3. Classify materials based on the amount of light that passes through them.
Answer:
1. **Transparent materials** allow light to pass through them almost completely.
2. **Translucent materials** allow light to pass through them only partially.
3. **Opaque materials** do not allow light to pass through them.

4. What is a shadow? What are the three requirements for its formation?
Answer:
1. A **shadow** is a dark patch formed where light does not reach because an object blocks its path.
2. A source of light and an opaque object are required for the formation of a shadow.
3. A screen or surface is also required on which the shadow can be observed.

5. Explain the shadows formed by opaque, translucent, and transparent objects.

Answer:
1. Opaque objects block light and therefore form **darker shadows**.
2. Translucent objects allow some light to pass through them and form **lighter shadows**.
3. Some transparent objects can also produce **faint shadows**.

6. What factors affect the appearance of a shadow?
Answer:
1. The **shape, size, and sharpness** of a shadow can vary.
2. These characteristics depend on the position of the object relative to the light source and the screen.
3. Changing the colour of an opaque object does not change the colour of its shadow.

7. What is reflection of light? Explain it using a plane mirror.
Answer:
1. A shiny surface or plane mirror can change the direction of light falling on it.
2. This change in the direction of light by a mirror is called **reflection of light**.
3. When a beam of light falls on a plane mirror, its path changes after striking the mirror.

8. State any three characteristics of an image formed by a plane mirror.
Answer:
1. The image formed by a plane mirror is of the **same size** as the object.
2. The image is **erect**, meaning that it appears upright.
3. The image cannot be obtained on a screen.

9. What is lateral inversion? Explain with an example.
Answer:
1. In a plane mirror, the left side of an object appears as the right side and the right appears as the left.
2. This perceived left-right reversal is called **lateral inversion**.
3. Therefore, "AMBULANCE" is written in reverse on the front of an ambulance so that it can be read correctly in the rear-view mirror of the vehicle ahead.

10. What is a pinhole camera? Describe the image formed by it.
Answer:
1. A **pinhole camera** is a device in which light rays from an object pass through a tiny hole called a pinhole.
2. The light passing through the pinhole forms an image on a screen.
3. The image formed by a pinhole camera is **inverted or upside down**.

11. Describe the construction of a simple sliding pinhole camera.
Answer:
1. Take two cardboard boxes that can slide into each other and make a small pinhole in the middle of the opposite face of the larger box.
2. Cut a square opening of about **5–6 cm** in the smaller box and cover it with thin translucent paper such as tracing paper to make a screen.
3. Slide the smaller box into the larger box with the tracing-paper side inside and point the pinhole towards a brightly lit object to obtain its image.

12. What is a periscope? Mention its construction and uses.
Answer:
1. A simple **periscope** can be made by placing two plane mirrors in a Z-shaped box.
2. Reflection from the two mirrors allows us to see objects that are not directly visible.
3. Periscopes are used in submarines, tanks, and by soldiers to see outside bunkers.

13. Describe the basic construction of a kaleidoscope.
Answer:
1. Three rectangular plane-mirror strips of equal width are joined together in a triangular arrangement and placed inside a tube.

2. A transparent plastic sheet is fixed at one end, on which pieces of coloured bangles or beads are placed.
3. The end is covered with tracing paper, and beautiful patterns can be seen by looking through the open side.

14. Why does a kaleidoscope produce many beautiful patterns?

Answer:

1. A kaleidoscope contains three mirrors arranged in a triangular manner.
2. Multiple images are produced because of **reflections of reflections** inside these mirrors.
3. As the kaleidoscope is turned, different patterns are produced, which can provide ideas to designers and artists.

15. Differentiate between the images formed by a plane mirror and a pinhole camera.

Answer:

1. A plane mirror forms an **erect** image, whereas a pinhole camera forms an **inverted or upside-down** image.
2. The plane-mirror image shows **lateral inversion**, while the pinhole-camera image is upside down.
3. A plane-mirror image cannot be obtained on a screen, whereas a pinhole camera forms its image on a screen.

16. Write three points about shadow puppetry mentioned in the chapter.

Answer:

1. Shadow puppetry uses flat cut-out figures placed between a light source and a screen.
2. Puppeteers move the puppets and light to create life-like movements and characters.
3. Indian traditions include **Togalu Gombeyaata** in Karnataka, **Ravana Chhaya** in Odisha, and **Tholpavakoothu** in Kerala, among others.

17. Write three advantages or features of LED lamps mentioned in the chapter.

Answer:

1. LED lamps consume **much less electrical power** than traditional lamps.
2. They are **brighter and last longer**, thereby helping to reduce electricity bills.
3. They are better for the environment, but at the end of their life they should be properly disposed of or recycled rather than thrown into garbage.

18. Describe the candle-and-pipe activity used to demonstrate the straight-line propagation of light.

Answer:

1. A lighted candle is first viewed through a straight hollow flexible pipe.
2. When the same pipe is bent, the candle flame can no longer be seen through it.
3. This observation demonstrates that **light travels in a straight line**.

11.10. Three-mark questions with Answers of HOTS Type: (20 Questions)

1. Three cardboard sheets with small holes are arranged between a torch and a screen. A bright spot is visible initially, but disappears when the middle sheet is shifted. Why?

Answer:

1. Initially, all three holes are aligned, so light from the torch travels through them to the screen.
2. Shifting the middle sheet blocks the straight path of the light.
3. This demonstrates that **light travels in a straight line**.

2. A student can see a candle flame through a straight pipe but not when the pipe is bent. Analyse the reason.

Answer:

1. In a straight pipe, there is an unobstructed straight path between the candle flame and the student's eye.
2. When the pipe is bent, the light cannot follow the curved path of the pipe.
3. Therefore, the observation provides evidence that light normally travels along a straight path.

3. Three objects made of clear glass, tracing paper, and cardboard are placed separately in front of a torch. Predict what will happen to the light.

Answer:

1. Clear glass is transparent, so light will pass through it almost completely.
2. Tracing paper is translucent, so only part of the light will pass through it.
3. Cardboard is opaque, so it will block the light and produce a dark shadow.

4. Why does a translucent object produce a lighter shadow than an opaque object?

Answer:

1. An opaque object blocks light and therefore produces a darker shadow.
2. A translucent object allows some light to pass through it, so less light is blocked.
3. Hence, the shadow produced by a translucent object is lighter than that produced by an opaque object.

5. A ball is placed between a fixed torch and a wall. Predict what happens to its shadow when the ball is first moved towards the torch and then towards the wall.

Answer:

1. When the ball is moved closer to the torch, its shadow on the wall becomes larger.
2. When the ball is moved closer to the wall, its shadow becomes smaller and more closely resembles the size of the ball.
3. Thus, the size of a shadow depends on the relative positions of the light source, object, and screen.

6. A red ball is replaced by a blue ball of exactly the same shape and size without changing the light source or screen. Will the shadow change? Justify.

Answer:

1. If both balls are opaque and placed at the same position, their shadows will have the same shape and size.
2. Changing the colour of an opaque object does not change the colour of its shadow.
3. Therefore, replacing the red ball with an identical blue ball will not significantly change the shadow.

7. A shiny steel plate placed in sunlight produces a bright spot on a nearby wall when tilted appropriately. Explain why.

Answer:

1. Sunlight falling on the shiny steel surface is redirected towards the wall.
2. This change in the direction of light by a shiny surface is due to **reflection**.
3. Tilting the plate changes the direction of the reflected light and therefore changes the position of the bright spot.

8. A student moves two metres farther away from a plane mirror. What change would you expect in the image?

Answer:

1. As the student moves farther from the mirror, the image also appears farther from the mirror.
2. The image remains erect and of the same size as the student.
3. Thus, changing the student's distance changes the apparent position of the image but not its basic characteristics.

9. Why is the word "AMBULANCE" written in reverse on the front of an ambulance?

Answer:

1. A plane mirror produces **lateral inversion**, in which left appears right and right appears left.
2. The reversed word therefore appears correctly as “AMBULANCE” in the rear-view mirror of the vehicle ahead.
3. This helps drivers identify the emergency vehicle quickly and give way to it.

10. A student tries to capture the image formed by a plane mirror on a white screen but fails. Explain the observation.

Answer:

1. A plane mirror forms an image that appears to be behind the mirror.
2. The chapter's experiment shows that this image cannot be obtained on a screen.
3. Therefore, moving a white screen in front of or behind the mirror will not capture the mirror image.

11. A candle is placed in front of a pinhole camera. Why does its flame appear upside down on the screen?

Answer:

1. Light from different parts of the candle flame travels in straight lines through the small pinhole.
2. The rays pass through the pinhole and form an image on the screen.
3. Because of their straight-line paths through the tiny opening, the image formed on the screen appears **inverted**.

12. Compare what happens when a student looks at a tree through a pinhole camera and at the same tree in a plane mirror.

Answer:

1. A pinhole camera produces an **inverted image** of the tree on its screen.
2. A plane mirror produces an **erect, laterally inverted image** that cannot be obtained on a screen.
3. Thus, the two devices produce images with different orientations and properties.

13. A soldier wants to observe an area outside a bunker without exposing himself directly. Which device based on this chapter would be useful and why?

Answer:

1. A **periscope** would be useful because it allows objects that are not directly visible to be observed.
2. It uses two plane mirrors arranged in a Z-shaped structure to redirect light by reflection.
3. The chapter specifically identifies bunkers, submarines, and tanks as situations in which periscopes are useful.

14. Why does a kaleidoscope show a different pattern when it is rotated?

Answer:

1. A kaleidoscope contains three reflecting surfaces arranged in a triangular manner.
2. Multiple images are produced because light undergoes repeated reflections or “reflections of reflections.”
3. When the kaleidoscope is turned, the arrangement of the objects changes and hence a new pattern is produced.

15. Why may the shadow of a bird flying very high in the sky not be clearly visible, while its shadow becomes visible when it flies closer to the ground?

Answer:

1. The appearance and sharpness of a shadow depend on the position of the object relative to the light source and the screen.
2. When the bird is very high, its shadow on the ground becomes too faint or poorly defined to be easily noticed.

3. When the bird comes closer to the ground, the shadow becomes better defined and therefore easier to see.

16. Suppose two torches are placed on the same side of a ball facing a screen. Predict what may happen and explain.

Answer:

1. Each torch acts as an independent light source illuminating the ball.
2. Since the ball blocks light coming from each source along different paths, separate shadow regions can be produced.
3. Hence, the chapter's exercise predicts that **two shadows** may appear on the screen when two torches are used.

17. Why can shadow puppeteers create different-looking characters and movements using flat puppets?

Answer:

1. The shape, size, and sharpness of a shadow depend on the relative positions of the light source, object, and screen.
2. Puppeteers can therefore move the puppet and light source to change how the shadow appears.
3. By controlling these positions, they can produce life-like movements and visually interesting characters on the screen.

18. If a student removes the screen while performing a shadow experiment, will the shadow still be observed? Explain.

Answer:

1. A shadow is observed when an object blocks light from falling on a suitable surface or screen.
2. If the screen is removed and there is no other surface behind the object, there will be no surface on which the shadow can be observed.
3. Therefore, a **light source, an object, and a screen/surface** are needed to observe the shadow clearly.

19. A student switches off the torch during a shadow experiment. What will happen and why?

Answer:

1. The shadow will disappear because there is no longer a source of light.
2. A shadow forms only when an object blocks light travelling towards a screen.
3. Without light, the required condition for shadow formation is absent.

20. The Moon appears bright at night, yet it is classified as a non-luminous object. Explain this apparent contradiction.

Answer:

1. A luminous object must produce or emit its **own light**.
2. The Moon does not emit its own light; it reflects the light of the Sun falling on it.
3. Therefore, although the Moon appears bright, it is correctly classified as a **non-luminous object**.

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

1. What are luminous and non-luminous objects? Explain with examples.

Answer:

1. Objects that emit their own light are called **luminous objects**.
2. The Sun is the main natural source of light on the Earth.
3. Stars, lightning, natural fire, and certain animals are other examples of natural luminous objects.

4. Objects that do not emit their own light are called **non-luminous objects**.
5. The Moon is non-luminous because it does not produce its own light but reflects the light of the Sun.

2. Explain with an activity that light travels in a straight line.

Answer:

1. Take three matchboxes and make a small hole at the same position in the inner tray of each.
2. Arrange the three matchboxes in a straight line so that all the holes are at the same height and perfectly aligned.
3. Place a torch on one side and a cardboard screen on the other side to obtain a bright spot on the screen.
4. Move one of the matchboxes slightly so that the three holes are no longer in the same straight line.
5. The bright spot disappears, showing that **light travels in a straight line**.

3. Differentiate between transparent, translucent, and opaque materials based on the passage of light.

Answer:

1. Materials can be classified as transparent, translucent, or opaque according to how much light passes through them.
2. **Transparent materials** allow light to pass through them almost completely.
3. **Translucent materials** allow light to pass through them only partially.
4. **Opaque materials** do not allow light to pass through them.
5. Glass, tracing paper, and cardboard can respectively illustrate these three categories in a classroom activity.

4. Explain the formation and important characteristics of shadows.

Answer:

1. A shadow is formed when an object blocks light from falling on a screen or surface.
2. A source of light, an object, and a screen or surface are required to observe a shadow.
3. Opaque objects generally produce darker shadows, while translucent objects produce lighter shadows.
4. The shape, size, and sharpness of a shadow depend on the position of the object relative to the light source and screen.
5. Changing the colour of an opaque object does not change the colour of its shadow.

5. What is reflection of light? Explain how it can be demonstrated using a plane mirror.

Answer:

1. The change in the direction of light by a mirror is called **reflection of light**.
2. Take a plane mirror or shiny flat steel plate and allow sunlight to fall on it.
3. Turn the mirror suitably so that the sunlight is redirected towards a nearby wall.
4. A bright spot of reflected light can be observed on the wall, and its position changes when the mirror is tilted.
5. This activity demonstrates that a mirror changes the direction of the light falling on it.

6. Describe five important characteristics of an image formed by a plane mirror.

Answer:

1. The image formed by a plane mirror appears behind the mirror.
2. The image is of the **same size** as the object.
3. The image is **erect**, meaning that it appears upright.
4. The image formed by a plane mirror **cannot be obtained on a screen**.
5. It shows **lateral inversion**, in which the left side appears right and the right side appears left.

7. What is lateral inversion? Explain it with suitable examples.

Answer:

1. Lateral inversion is the perceived left-right reversal seen in an image formed by a plane mirror.
2. When you raise your left arm, your mirror image appears to raise its right arm.
3. Similarly, when you touch your right ear, the image appears to touch its left ear.
4. Thus, the left side appears right and the right side appears left in a plane mirror.
5. This is why the word “AMBULANCE” is written in reverse on the front of an ambulance so that it can be read correctly in rear-view mirrors.

8. What is a pinhole camera? Describe how it forms an image.

Answer:

1. A **pinhole camera** is a device in which light rays from an object pass through a tiny hole and form an image on a screen.
2. A small hole is made in a piece of cardboard and a screen is placed behind it.
3. When a lighted candle is placed in front of the pinhole, light from the flame passes through the hole.
4. The light passing through the pinhole forms an image of the candle flame on the screen.
5. The image formed by a pinhole camera is **inverted or upside down**.

9. Describe the construction and uses of a simple periscope.

Answer:

1. A simple periscope can be made by placing **two plane mirrors** in a Z-shaped box.
2. Light from an object undergoes reflection from the two mirrors.
3. These reflections enable us to see objects that are not directly visible.
4. Periscopes are used in **submarines, tanks, and bunkers** to observe objects outside.
5. A simple periscope can also be used to look ahead when a person's direct view is blocked by taller people.

10. Describe the construction and working of a kaleidoscope.

Answer:

1. A kaleidoscope can be made using three rectangular plane-mirror strips of equal width joined in a triangular arrangement.
2. The mirrors are fixed inside a circular tube, with coloured pieces such as broken bangles or beads placed at one end.
3. A transparent plastic sheet and tracing paper are used to hold and cover the coloured pieces.
4. Looking through the open end produces beautiful patterns because of multiple reflections from the three mirrors.
5. Every time the kaleidoscope is turned, a different pattern can be seen, and such patterns can provide ideas to designers and artists.

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

1. A student can see a candle flame through a straight pipe but cannot see it after the pipe is bent. Analyse the observation and explain what it proves about light.

Answer:

1. Light from the candle flame enters the opening of the straight pipe and travels towards the student's eye.
2. Since the pipe is straight, there is an unobstructed straight path for the light to travel.
3. When the pipe is bent, the light cannot follow the curved path of the pipe to reach the student's eye.
4. Therefore, the candle flame is no longer visible through the bent pipe.
5. This experiment provides evidence that **light travels in a straight line**.

2. Three objects made of glass, tracing paper, and cardboard are placed separately between a torch and a screen. Predict and explain the observations.

Answer:

1. Glass, being transparent, allows light to pass through almost completely, so the screen remains well illuminated.
2. Tracing paper is translucent and therefore allows only part of the light to pass through it.
3. Hence, the illumination behind tracing paper will be less than that behind transparent glass.
4. Cardboard is opaque and blocks the light, producing a dark shadow on the screen.
5. Thus, the observations demonstrate how materials can be classified as **transparent, translucent, or opaque** according to their transmission of light.

3. A ball is placed between a fixed torch and a wall. Predict what happens to its shadow when the ball is moved first towards the torch and then towards the wall. Give reasons.

Answer:

1. The size of a shadow depends on the relative positions of the light source, object, and screen.
2. When the ball is moved closer to the torch, it blocks a larger portion of the spreading light.
3. Therefore, a **larger shadow** is produced on the wall.
4. When the ball is moved closer to the wall, its shadow becomes **smaller**.
5. This demonstrates that the size of a shadow can change even though the actual size of the object remains unchanged.

4. A child changes a red opaque object to a blue opaque object of exactly the same shape and keeps it at the same position between a torch and a screen. Predict the effect on its shadow and justify your answer.

Answer:

1. Both the red and blue objects are opaque and therefore block the light falling on them.
2. A shadow represents the region on the screen where light has been blocked.
3. Changing the colour of an opaque object does not change the colour of its shadow.
4. If its shape, size, and position remain unchanged, the shadow will also remain essentially unchanged.
5. Therefore, **the object's colour does not determine the colour of its shadow**; the blocking of light is responsible for shadow formation.

5. Why is the word “AMBULANCE” written in reverse on the front of an ambulance? Analyse the scientific principle involved.

Answer:

1. A plane mirror produces a perceived left-right reversal known as **lateral inversion**.
2. Therefore, normally written words appear laterally inverted when viewed through a rear-view mirror.
3. The word “AMBULANCE” is consequently written in reverse on the front of an ambulance.
4. When a driver ahead views this reversed writing through the rear-view mirror, it appears correctly oriented.
5. The driver can therefore recognise the ambulance quickly, showing a practical application of **lateral inversion in plane mirrors**.

6. Compare the images formed by a plane mirror and a pinhole camera. Why should they not be considered the same type of image?

Answer:

1. A plane mirror forms an image that is **erect and of the same size as the object**.

2. Its image shows **lateral inversion**, where the perceived left and right sides are reversed.
3. The image formed by a plane mirror cannot be obtained on a screen.
4. A pinhole camera, in contrast, forms an **inverted or upside-down image on a screen**.
5. Therefore, the two images differ significantly in their orientation and whether they can be obtained on a screen.

7. A soldier inside a bunker cannot directly see what is happening outside. Explain how a periscope can solve the problem.
Answer:
1. A periscope contains two plane mirrors arranged inside a suitably shaped tube or box.
2. Light coming from an object outside reaches the first mirror and changes direction due to reflection.
3. The reflected light then reaches the second mirror and is redirected towards the observer's eye.
4. Thus, the observer can see an object even when it is not directly in the observer's line of sight.
5. This is why periscopes are useful in **submarines, tanks, and bunkers**, where direct viewing may not be possible.

8. A student observes that every time a kaleidoscope is rotated, a different pattern appears. Analyse why this happens.
Answer:
1. A kaleidoscope contains three reflecting surfaces arranged in a triangular manner.
2. Coloured objects or pieces placed at one end are seen through reflections in these surfaces.
3. The mirrors produce multiple images because reflections themselves undergo further reflections.
4. When the kaleidoscope is rotated, the positions of the coloured pieces change, producing a new arrangement of multiple images.
5. Hence, each rotation creates a **different attractive pattern**, which is why kaleidoscopes can inspire artists and designers.

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

1. You are standing behind a tall wall and want to see what is happening on the other side without climbing it. How can you use the concept of reflection to solve this problem?
Answer:
1. A simple **periscope** can be constructed using two plane mirrors placed inside a Z-shaped box or tube.
2. The upper mirror receives light coming from the object on the other side of the wall.
3. It reflects this light towards the second mirror inside the periscope.
4. The second mirror redirects the light towards the observer's eyes, making the hidden object visible.
5. Thus, multiple reflections in a periscope allow us to see objects that are not in our direct line of sight.

2. A shopkeeper wants customers to see products inside a display case clearly but also wants to protect the products from dust. Which type of material should be used for the case? Explain.
Answer:
1. The shopkeeper should use a **transparent material**, such as clear glass, for the display case.
2. Transparent materials allow light to pass through them almost completely.

3. Light reflected from the products can therefore pass through the glass and reach the customers' eyes.
4. An opaque material would block the view, while a translucent material would not allow the products to be seen clearly.
5. Hence, transparent glass is suitable because it provides visibility while physically protecting the products.

3. During a school play, students want to make a small puppet appear to have a very large shadow on the screen. How should they arrange the light source, puppet, and screen?

Answer:

1. The students should place the puppet between the light source and the screen.
2. Since the puppet is opaque, it will block light and produce a shadow on the screen.
3. To obtain a larger shadow, the puppet should be moved **closer to the light source**.
4. Moving the puppet closer to the screen would make its shadow comparatively smaller.
5. Thus, by changing the relative positions of the light source, puppet, and screen, students can control the size of the shadow during the play.

4. An ambulance needs vehicles ahead to recognise it quickly through their rear-view mirrors. Explain how the properties of a plane mirror are applied for this purpose.

Answer:

1. A plane mirror produces **lateral inversion**, in which left and right appear reversed.
2. Therefore, the word "AMBULANCE" is written in a laterally reversed form on the front of the ambulance.
3. When a driver sees this reversed writing through the rear-view mirror, it appears correctly oriented.
4. The driver can therefore read "AMBULANCE" quickly and recognise the emergency vehicle.
5. This practical application of lateral inversion helps drivers respond promptly and give way to an ambulance.

5. You are asked to make a simple device that can produce an image of a distant tree without using a lens or mirror. Describe how you would do it.

Answer:

1. I would construct a **pinhole camera** using two cardboard boxes that can slide into each other.
2. A tiny pinhole would be made in the centre of one end of the larger box.
3. The opposite end of the smaller box would be covered with tracing paper to act as a screen.
4. The pinhole would be pointed towards the distant tree, and the boxes would be adjusted until a clear image appeared on the tracing paper.
5. The image would appear **upside down or inverted**, demonstrating that light from the object travels through the small hole to form an image on the screen.

6. A student wants to redirect sunlight onto a shaded wall during an experiment. How can a plane mirror be used for this purpose?

Answer:

1. The student can place a plane mirror where sunlight falls directly on its shiny surface.
2. The mirror changes the direction of the light falling on it through **reflection**.
3. The mirror should be tilted gradually until the reflected light reaches the shaded wall.
4. Changing the orientation of the mirror changes the position of the bright spot on the wall.
5. Thus, reflection from a plane mirror can be practically used to redirect light towards a required location.

7. A fashion designer wants a device that can generate many different decorative patterns using a few coloured pieces. What device would you recommend, and how does it work?
Answer:
1. I would recommend making a **kaleidoscope** using three plane mirror strips arranged in a triangular form.
2. Small coloured pieces such as broken bangles or beads can be placed at one end.
3. The three reflecting surfaces produce multiple images through repeated reflections.
4. When the kaleidoscope is rotated, the positions of the coloured pieces change and a new pattern is produced.
5. Therefore, a kaleidoscope can provide designers and artists with ideas for creating a variety of decorative patterns.

8. Your classroom has windows through which bright sunlight enters, but you want light to enter while reducing direct visibility from outside. Which type of material would you choose for the windows? Explain.
Answer:
1. A **translucent material**, such as suitable frosted or tracing-type material, can be used for such a purpose.
2. Translucent materials allow light to pass through them only partially.
3. Therefore, some light can enter the classroom without providing the clear visibility associated with transparent materials.
4. An opaque material would block light, while transparent glass would permit much clearer viewing through it.
5. Hence, the application of a translucent material provides a suitable balance between admitting light and reducing clear visibility.

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

1. Which of the following groups contains only luminous objects?
A. Sun, Moon, mirror
B. Sun, Pole Star, firefly
C. Moon, Venus, Sun
D. Mirror, firefly, Moon
Answer: B. Sun, Pole Star, firefly

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2. A student can see a candle flame through a straight pipe but not through a bent pipe. Which property of light does this demonstrate?
A. Light is absorbed by pipes
B. Light travels in straight lines
C. Light travels only through transparent objects
D. Light always changes direction
Answer: B. Light travels in straight lines

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3. Three cardboard sheets, each having a small hole, are placed between a torch and a screen. A bright spot will appear on the screen only when:
A. the holes are of different sizes
B. the holes are exactly in a straight line
C. the middle sheet is opaque
D. the torch is placed above the holes
Answer: B. the holes are exactly in a straight line

---

4. Consider three materials P, Q and R. Light passes almost completely through P, partially through Q and not at all through R. P, Q and R are respectively:
A. opaque, translucent, transparent
B. translucent, transparent, opaque
C. transparent, translucent, opaque
D. transparent, opaque, translucent
Answer: C. transparent, translucent, opaque

---

5. Which arrangement is essential for observing a clear shadow of an opaque object?
A. Screen → light source → object
B. Light source → opaque object → screen
C. Opaque object → screen → light source
D. Light source → transparent object → mirror
Answer: B. Light source → opaque object → screen

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6. A red opaque ball is replaced by a blue opaque ball of exactly the same size and at the same position. What is most likely to happen to its shadow?
A. The shadow becomes blue
B. The shadow becomes red
C. The shadow's colour does not change because the object's colour does not determine the shadow's colour
D. No shadow is formed
Answer: C. The shadow's colour does not change because the object's colour does not determine the shadow's colour

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7. A ball is placed between a fixed torch and a wall. To obtain a larger shadow, the ball should generally be moved:
A. closer to the torch
B. closer to the wall
C. behind the wall
D. away from both the torch and wall
Answer: A. closer to the torch

---

8. Which statement about shadows is correct?
A. Only opaque objects can form any kind of shadow
B. Translucent objects always form darker shadows than opaque objects
C. Opaque objects form darker shadows, while translucent objects form lighter shadows
D. Transparent objects can never form even faint shadows
Answer: C. Opaque objects form darker shadows, while translucent objects form lighter shadows

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9. A plane mirror is tilted slightly while sunlight falls on it. The bright spot produced on a wall changes its position. This happens because:
A. the mirror produces its own light
B. the direction of reflected light changes
C. sunlight stops travelling in straight lines
D. the wall becomes luminous
Answer: B. the direction of reflected light changes

---

10. The change in the direction of light after it falls on a mirror is called:

A. shadow formation
B. transparency
C. reflection
D. lateral inversion
Answer: C. reflection

---

11. Which combination correctly describes the image formed by a plane mirror?
A. Inverted, smaller and obtainable on a screen
B. Erect, same size and laterally inverted
C. Erect, larger and obtainable on a screen
D. Inverted, same size and not laterally inverted
Answer: B. Erect, same size and laterally inverted

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12. Rahul stands 2 m in front of a plane mirror. He then moves closer to the mirror. What happens to his image?
A. It appears farther from the mirror
B. It appears closer to the mirror
C. Its size becomes smaller
D. It becomes inverted
Answer: B. It appears closer to the mirror

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13. A student raises the left hand while looking into a plane mirror. The image appears to raise its:
A. left hand
B. right hand
C. both hands
D. neither hand
Answer: B. right hand

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14. Why is the word "AMBULANCE" written in a laterally reversed form on the front of an ambulance?
A. To make the letters appear larger
B. To make it readable correctly in the rear-view mirror of vehicles ahead
C. To reduce reflection
D. To produce an inverted image
Answer: B. To make it readable correctly in the rear-view mirror of vehicles ahead

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15. Which pair shows the correct difference between a plane mirror and a pinhole camera?
A. Both produce upside-down images
B. Plane mirror: laterally inverted; pinhole camera: upside-down image
C. Plane mirror: upside-down; pinhole camera: erect
D. Both always produce laterally inverted images
Answer: B. Plane mirror: laterally inverted; pinhole camera: upside-down image

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16. In a pinhole camera, an image is formed because:
A. light bends sharply around the pinhole
B. light from the object passes through the tiny hole and reaches the screen
C. the screen reflects all the light back through the hole
D. the pinhole acts as a plane mirror

Answer: B. light from the object passes through the tiny hole and reaches the screen

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17. The image of a candle flame formed by a pinhole camera is:
A. erect
B. laterally inverted only
C. upside down
D. always larger than the flame
Answer: C. upside down

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18. A submarine crew wants to observe objects above the water while remaining below the surface. Which device is most appropriate?
A. Pinhole camera
B. Kaleidoscope
C. Periscope
D. Transparent screen
Answer: C. Periscope

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19. A simple periscope works mainly because of:
A. absorption of light by two mirrors
B. reflection of light from two mirrors
C. formation of shadows by mirrors
D. production of light by mirrors
Answer: B. reflection of light from two mirrors

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20. Why does a kaleidoscope produce many beautiful patterns?
A. It contains a luminous object
B. Three mirrors produce multiple images through repeated reflections
C. Its mirrors absorb different colours
D. It uses an opaque screen to produce shadows
Answer: B. Three mirrors produce multiple images through repeated reflections

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21. Which of the following sequences correctly ranks the shadows from generally darkest to faintest?
A. Transparent → translucent → opaque
B. Opaque → translucent → some transparent objects
C. Translucent → opaque → transparent
D. All produce equally dark shadows
Answer: B. Opaque → translucent → some transparent objects

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22. A student removes the screen from a torch–object–screen arrangement. Which statement is most appropriate?
A. Light stops travelling
B. The object becomes luminous
C. There is no screen on which to observe the shadow
D. The object becomes transparent
Answer: C. There is no screen on which to observe the shadow

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23. Which of the following would NOT change merely because an opaque object is changed from green to yellow while its position and shape remain the same?

A. Colour of the shadow
B. Colour of the object
C. Appearance of the object
D. Light reflected from the object's surface
Answer: A. Colour of the shadow

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24. Four students make the following statements:
P: The Moon is luminous because it appears bright.
Q: The Sun is luminous because it emits its own light.
R: A mirror is non-luminous although it can appear bright.
S: The Moon shines by reflecting sunlight.
Which students are correct?
A. P and Q only
B. Q and R only
C. Q, R and S only
D. P, Q, R and S
Answer: C. Q, R and S only

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25. Consider the statements:
Statement I: A plane-mirror image cannot be obtained on a screen.
Statement II: A pinhole-camera image can be formed on a screen.
Which option is correct?
A. Only Statement I is correct
B. Only Statement II is correct
C. Both statements are correct
D. Both statements are incorrect
Answer: C. Both statements are correct

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26. If two torches are placed on the same side of an opaque ball so that each illuminates it from a different position, what may be observed on the screen?
A. No shadow
B. Two shadows
C. Only an inverted image
D. A laterally inverted image
Answer: B. Two shadows

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27. Which observation provides the strongest evidence that light travels in straight lines?
A. A mirror produces an image
B. A candle can be seen through a straight pipe but not through a bent pipe
C. A firefly emits light
D. A kaleidoscope forms patterns
Answer: B. A candle can be seen through a straight pipe but not through a bent pipe

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28. Why might the shadow of a bird flying very high in the sky not be easily visible on the ground, while it becomes visible when the bird flies close to the ground?
A. The bird becomes transparent at high altitude
B. The Sun stops illuminating the bird at high altitude
C. The distance between the bird and the ground affects the sharpness and visibility of its shadow
D. Light does not travel in straight lines at high altitude

Answer: C. The distance between the bird and the ground affects the sharpness and visibility of its shadow
The chapter emphasizes that the shape, size and sharpness of a shadow depend on the object's position relative to the light source and screen.

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29. Which device would be most useful to an artist looking for ideas for new repeating decorative patterns?
A. Periscope
B. Pinhole camera
C. Kaleidoscope
D. Plane glass sheet
Answer: C. Kaleidoscope

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30. Which statement gives the most complete comparison of a shadow and a plane-mirror image?
A. Both can always be obtained on a screen.
B. A shadow results when light is blocked, whereas a plane-mirror image results from reflection.
C. Both are always laterally inverted.
D. Both require transparent objects.
Answer: B. A shadow results when light is blocked, whereas a plane-mirror image results from reflection.

Answer Key:
1-B, 2-B, 3-B, 4-C, 5-B, 6-C, 7-A, 8-C, 9-B, 10-C, 11-B, 12-B, 13-B, 14-B, 15-B, 16-B, 17-C, 18-C, 19-B, 20-B, 21-B, 22-C, 23-A, 24-C, 25-C, 26-B, 27-B, 28-C, 29-C, 30-B

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

"Best Practices" Opportunities for Teaching Chapter 11: ***Light: Shadows and Reflections:*** The chapter is particularly suitable for activity-based and inquiry-oriented teaching because it includes investigations of straight-line travel of light, material classification, shadow formation, reflection, mirror images, pinhole cameras, periscopes, and kaleidoscopes.

(1) **Predict–Observe–Explain (POE) Approach:** Before each experiment, ask students to predict the outcome, conduct the activity, record observations, and explain any difference between prediction and result. This is especially effective when classifying transparent, translucent, and opaque materials, as the chapter itself encourages prediction followed by observation.

(2) **Hands-on Verification of Rectilinear Propagation:** Allow students to work in small groups using aligned matchboxes/cardboards with holes, a torch, and a screen. Students can change the alignment and discover experimentally that light travels in a straight line rather than merely memorising the statement.

(3) **Shadow Investigation Station:** Create a learning station with a torch, screen, and objects of different shapes and materials. Students should investigate how moving an object closer to the source or screen, tilting it, or changing its material affects the size, shape, darkness, and sharpness of its shadow.

(4) **Mirror Exploration and Real-Life Connections:** Let students investigate plane mirrors using pens, letters, names, and simple drawings. Connect lateral inversion to the reversed writing of "AMBULANCE" and ask students to identify other everyday applications of mirrors.

(5) **Learning by Making – Pinhole Camera:** Organise a simple STEM activity in which students construct a pinhole camera using cardboard boxes and tracing paper. They can observe distant objects and discover that a pinhole camera produces an inverted image on a screen.

(6) **Design-and-Build Periscope:** Students can construct a simple periscope using two plane mirrors and a cardboard box and then explain its working using reflection. Relate the activity to practical applications in submarines, tanks, and bunkers.

(7) **Kaleidoscope as a STEAM Activity:** Integrate science with art by asking students to construct a kaleidoscope and create or sketch the patterns they observe. Discuss how repeated reflections from three mirrors produce changing patterns and how artists and designers can use these as sources of inspiration.

(8) **Connect Science with Indian Cultural Heritage:** Use shadow puppetry as an interdisciplinary learning activity. Students can prepare simple shadow puppets and explore traditions such as *Togalu Gombeyaata* of Karnataka while simultaneously demonstrating the scientific principles of light and shadow.

(9) **Outdoor Shadow Observation:** Ask students to measure their shadows at different times—such as 9 a.m., noon, and 4 p.m.—and compare their lengths. Students can record the observations in a table and discuss why the length and direction of shadows change during the day, extending the chapter's suggested activity.

(10) **Environmental Awareness through Light:** Use the chapter's opening example of declining firefly populations to initiate a discussion or mini-project on **light pollution**. Students can investigate unnecessary lighting around their homes or school and suggest ways of reducing it while conserving electricity; the chapter links declining fireflies with light pollution, reduced forest cover, and excessive tourism.

These practices can make the chapter **experiential, inquiry-based, collaborative, interdisciplinary, environmentally conscious, and application-oriented**, rather than limiting learning to definitions and textbook exercises.

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

"Innovations" Opportunities while Teaching-Learning Chapter 11: *Light: Shadows and Reflections:*

The chapter offers excellent scope for innovative learning because it combines experimentation, observation, construction, art, environmental awareness, and real-life applications of light. The core concepts include straight-line propagation of light, shadows, reflection, plane-mirror images, pinhole cameras, periscopes, and kaleidoscopes.

(1) **"Light Lab in a Box" – Student Discovery Kit:** Create small kits containing a torch, mirrors, cardboard, tracing paper, transparent sheets, and different objects. Student teams rotate through challenge stations to discover how light travels, passes through materials, forms shadows, and gets reflected. This converts the classroom into a miniature optics laboratory.

(2) **Shadow Engineering Challenge:** Give students a torch, an opaque object, and a screen and challenge them to produce the **largest, smallest, sharpest, and differently shaped shadows** without changing the object. They must discover the required positions of the light source, object, and screen through experimentation. The chapter establishes that shadow characteristics depend on these relative positions.

(3) **DIY Optical-Instrument Innovation Fair:** Divide students into teams to design improved versions of a **pinhole camera, periscope, or kaleidoscope** using waste or low-cost materials. Each group can demonstrate its model and explain the scientific

principle behind it. The chapter specifically introduces construction and applications of these devices.

(4) **Mirror-Code and Secret-Message Game:** Students create secret messages that can be read correctly only through a plane mirror. They can investigate which letters remain unchanged and which appear reversed, turning **lateral inversion** into a puzzle-based learning experience. This can be connected to the reversed "AMBULANCE" example discussed in the chapter.

(5) **Digital Shadow Diary:** Students photograph or sketch their shadows at different times of the day and create a simple digital presentation or time-sequence record. They compare shadow length and direction at morning, noon, and afternoon and explain their observations. This extends the chapter's suggested 9 a.m., 12 p.m., and 4 p.m. shadow investigation.

(6) **Science + Art Shadow-Puppet Theatre:** Students design shadow puppets and produce a short story demonstrating how shadows change with the position of the light source. The activity can integrate science, art, language, storytelling, and Indian cultural heritage, including Karnataka's *Togalu Gombeyaata*.

(7) **Multiple-Mirror Pattern Investigation:** Provide two plane mirrors and allow students to vary the angle between them. They predict and record how the number and arrangement of images change. This directly extends the chapter's exploratory project involving two or more mirrors positioned at angles or parallel to one another.

(8) **"Save the Fireflies" Innovation Project:** Students investigate light pollution in their locality and design a **dark-sky-friendly school or neighbourhood lighting plan**. They could propose switching off unnecessary lights, directing outdoor lights downward, or creating awareness posters. This builds on the chapter's discussion of declining fireflies due partly to light pollution.

(9) **Light Escape-Room Challenge:** Create classroom puzzles in which teams must use straight-line propagation, reflection, shadows, lateral inversion, and transparent/translucent/opaque materials to obtain clues. Each correctly solved optics problem unlocks the next challenge, introducing **gamification** into science learning.

(10) **Young Optical Inventor Challenge:** Give students a real-life problem such as **"How can you see over a wall without climbing it?"**, **"How can you send light around an obstacle using mirrors?"**, or **"How can you create changing decorative patterns using mirrors?"** Students design prototypes and justify them scientifically. This encourages **creativity, critical thinking, problem-solving, collaboration, and STEM-design skills** while applying the chapter's concepts of reflection and optical devices.

11.17: Practicing Questions/Question Bank

A. Fill in the Blanks:

1. Objects that emit their own light are called __________ objects.
   Answer: Luminous

2. The __________ is the main natural source of light on Earth.
   Answer: Sun

3. The Moon is a __________ object.
   Answer: Non-luminous

4. Light travels in a __________ line.
   Answer: Straight

5. Light passes almost completely through __________ materials.
   Answer: Transparent

6. Light passes partially through __________ materials.
   Answer: Translucent

7. Light does not pass through __________ materials.
   Answer: Opaque

8. The dark patch formed when an object blocks light is called a __________.
   Answer: Shadow

9. A source of light, an opaque object and a __________ are needed to observe a shadow.
   Answer: Screen

10. The change in the direction of light by a mirror is called __________.
    Answer: Reflection

11. An upright image is called an __________ image.
    Answer: Erect

12. The left-right reversal observed in a plane mirror is called __________.
    Answer: Lateral inversion

13. A pinhole camera forms an __________ image.
    Answer: Inverted

14. A simple periscope uses __________ plane mirrors.
    Answer: Two

15. A kaleidoscope described in the chapter uses __________ mirror strips.
    Answer: Three

These concepts are explicitly summarised in the chapter, including the different transmission of light through materials and properties of shadows.

B. One-Mark Questions:

1. **What is a luminous object?**
   Answer: An object that emits its own light is called a luminous object.

2. **Give two natural sources of light.**
   Answer: The Sun and stars are natural sources of light.

3. **Why is the Moon called a non-luminous object?**
   Answer: The Moon does not emit its own light but reflects sunlight.

4. **How does light normally travel?**
   Answer: Light travels in a straight line.

5. **What is a transparent material?**
   Answer: A material through which light passes almost completely is called transparent.

6. **What is an opaque material?**
   Answer: A material that does not allow light to pass through it is called opaque.

7. **What is a shadow?**
   Answer: A shadow is the dark region formed where light is blocked by an object.
8. **Name the three requirements for observing a shadow.**
   Answer: A light source, an opaque object and a screen are required.
9. **What is reflection of light?**
   Answer: The change in the direction of light by a mirror is called reflection.
10. **What is lateral inversion?**
    Answer: The perceived left-right reversal in a plane-mirror image is called lateral inversion.
11. **Can an image formed by a plane mirror be obtained on a screen?**
    Answer: No, a plane-mirror image cannot be obtained on a screen.
12. **What type of image does a pinhole camera produce?**
    Answer: A pinhole camera produces an inverted image on a screen.
13. **What is a periscope used for?**
    Answer: A periscope enables us to see objects that are not directly visible.
14. **Name two places where periscopes are used.**
    Answer: Periscopes are used in submarines and tanks.
15. **Why does a kaleidoscope produce many patterns?**
    Answer: Multiple reflections from its mirrors produce many different patterns.

C. Two-Mark Descriptive Questions:

1. Differentiate between luminous and non-luminous objects.

Answer:

- Luminous objects emit their own light, such as the Sun and stars.
- Non-luminous objects do not emit their own light; the Moon is an example.

2. How can you demonstrate that light travels in a straight line?

Answer:

- Arrange three matchboxes having holes at the same height in a straight line and shine a torch through them.
- Light reaches the screen when the holes are aligned, but not when one matchbox is displaced.

3. Differentiate between transparent and translucent materials.

Answer:

- Transparent materials allow light to pass almost completely through them.
- Translucent materials allow light to pass only partially through them.

4. What happens when an opaque object is placed in the path of light?

Answer:

- The opaque object blocks the light travelling towards the screen.

- A dark region called a shadow is formed.

5. What factors affect the shape, size and sharpness of a shadow?

Answer:

- They depend on the position of the object relative to the light source.
- They also depend on the position of the object relative to the screen.

6. State two characteristics of an image formed by a plane mirror.

Answer:

- The image is erect and of the same size as the object.
- It is laterally inverted and cannot be obtained on a screen.

7. Explain lateral inversion with an example.

Answer:

- In a plane mirror, the left side appears right and the right side appears left.
- This is why "AMBULANCE" is written in a reversed manner so that drivers can read it correctly in their rear-view mirrors.

8. What is the difference between images formed by a pinhole camera and a plane mirror?

Answer:

- A pinhole camera produces an inverted image on a screen.
- A plane mirror produces an erect, laterally inverted image that cannot be obtained on a screen.

9. How does a periscope help us see hidden objects?

Answer:

- A periscope uses two plane mirrors.
- Reflection from the mirrors allows us to see objects that are not directly visible.

10. Why do opaque and translucent objects form different kinds of shadows?

Answer:

- Opaque objects block light and therefore form darker shadows.
- Translucent objects allow some light through and therefore form lighter shadows.

D. Three-Mark Descriptive Questions:

1. Explain the conditions necessary for the formation of a shadow.

Answer:

1. There must be a source of light.
2. An object must block the path of the light.

3. A screen or surface is required to observe the shadow.

2. Explain the behaviour of light through transparent, translucent and opaque materials.

Answer:

1. Light passes almost completely through transparent materials.
2. Light passes partially through translucent materials.
3. Light does not pass through opaque materials.

3. State three characteristics of the image formed by a plane mirror.

Answer:

1. The image is of the same size as the object.
2. The image is erect.
3. It is laterally inverted and cannot be obtained on a screen.

4. Explain the working of a pinhole camera.

Answer:

1. Light from an object enters through a tiny pinhole.
2. Since light travels in straight lines, the rays pass through the hole and reach the screen.
3. An inverted image of the object is formed on the screen.

5. Explain the working and uses of a periscope.

Answer:

1. A simple periscope contains two plane mirrors arranged in a Z-shaped box.
2. Reflection from the two mirrors enables the observer to see objects that are not directly visible.
3. Periscopes are used in submarines, tanks and bunkers.

6. Explain how the position of an object affects its shadow.

Answer:

1. The size of a shadow changes when the position of the object changes.
2. Moving the object towards the light source or towards the screen changes the shadow differently.
3. Tilting the object can also change the shape of its shadow.

7. Explain how a kaleidoscope produces beautiful patterns.

Answer:

1. Three plane mirror strips are joined in a triangular arrangement.
2. Coloured objects such as pieces of bangles or beads are placed at one end.

3. Multiple reflections from the mirrors produce different beautiful patterns whenever the kaleidoscope is turned.

E. Five-Mark Descriptive Questions:

1. Describe an experiment to show that light travels in a straight line.

Answer:

1. Take three matchboxes and make holes at identical positions in their trays.
2. Arrange the matchboxes in a straight line with all three holes aligned.
3. Place a torch at one end and a screen at the other.
4. A bright spot is obtained on the screen when all the holes are aligned.
5. When one matchbox is moved out of alignment, the spot disappears, showing that light travels in a straight line.

2. Describe the formation and characteristics of shadows.

Answer:

1. A shadow is formed when an object blocks light from reaching a screen.
2. A source of light, an object and a screen are needed to observe a shadow.
3. Opaque objects generally form darker shadows, while translucent objects form lighter shadows.
4. The shape, size and sharpness of a shadow depend on the relative positions of the light source, object and screen.
5. Changing the colour of an opaque object does not change the colour of its shadow.

3. Describe five important properties of an image formed by a plane mirror.

Answer:

1. The image appears behind the mirror.
2. It is the same size as the object.
3. The image is erect.
4. It cannot be obtained on a screen.
5. It shows lateral inversion—the left and right sides appear reversed.

4. Describe the construction and working of a pinhole camera.

Answer:

1. Take two cardboard boxes so that one can slide inside the other.
2. Make a small pinhole in the middle of the larger box.
3. Make an opening in the smaller box and cover it with translucent tracing paper to act as a screen.

4. Point the pinhole towards a brightly illuminated distant object and adjust the boxes.
5. Light passing through the pinhole forms an inverted image on the tracing-paper screen.

5. Explain the construction, working and uses of a kaleidoscope.

Answer:

1. Three rectangular plane-mirror strips of equal width are joined in a triangular arrangement.
2. They are placed inside a tube, with coloured pieces such as beads or broken bangles at one end.
3. Light undergoes multiple reflections between the three mirrors.
4. Different beautiful patterns appear as the kaleidoscope is rotated.
5. Designers and artists can use kaleidoscopes to obtain ideas for new patterns.

6. Explain reflection of light and demonstrate it using a plane mirror.

Answer:

1. Light normally travels in straight lines.
2. When light falls on a shiny surface or plane mirror, its direction changes.
3. This change in direction is called **reflection of light**.
4. A thin beam from a torch can be directed towards a plane mirror and its changed path observed.
5. Tilting the mirror changes the direction of the reflected beam, demonstrating that a mirror can redirect light.

These questions provide a balanced **Grade 7 question bank**, progressing from recall and understanding to explanation, experimentation and application, while covering the principal learning outcomes of Chapter 11, *Light: Shadows and Reflections*.

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7th Standard Science Book Chapter 12

Chapter 12: Earth, Moon, and the Sun

12.1 Summary of the Chapter:

Chapter 12: Earth, Moon, and the Sun — Summary

(1) **Rotation of the Earth:** The Earth spins or rotates on its own imaginary axis, which passes through the North Pole and South Pole. It completes one rotation in about **24 hours**.

(2) **Direction of Rotation:** Viewed from above the North Pole, the Earth rotates **anticlockwise**, that is, from **West to East**. Because of this rotation, the Sun appears to move across the sky from East to West.

(3) **Day and Night:** The Earth's rotation causes the **day-night cycle**. The half of the Earth facing the Sun experiences daytime, while the other half experiences night.

(4) **Apparent Movement of Celestial Objects:** The Sun, Moon, and stars appear to rise in the **East** and set in the **West** because the Earth rotates from West to East. The Pole Star appears nearly stationary because the Earth's rotational axis points very close to it.

(5) **Revolution of the Earth:** Besides rotating on its axis, the Earth **revolves around the Sun**. Its path, called an **orbit**, is nearly circular, and one revolution takes about **365 days and 6 hours**.

(6) **Changing Night Sky:** As the Earth revolves around the Sun, we look towards different regions of space during different parts of the year. Therefore, the **stars and constellations visible in the night sky gradually change** over the year.

(7) **Cause of Seasons:** The Earth's axis is **tilted** with respect to its orbit. The combination of this tilt and the Earth's **spherical shape** causes different parts of the Earth to receive sunlight of different intensity and duration, producing the seasons.

(8) **Seasons in the Hemispheres:** In June, the Northern Hemisphere is tilted towards the Sun and experiences **summer**, while the Southern Hemisphere experiences winter. In December, the situation is reversed.

(9) **Solstices and Equinoxes:** In the Northern Hemisphere, the longest day occurs around **21 June (summer solstice)** and the shortest around **22 December (winter solstice)**. Around **21 March and 23 September**, day and night are approximately 12 hours each; these are the **equinoxes**.

(10) **Solar Eclipse:** A **solar eclipse** occurs when the Moon comes between the Sun and the Earth and blocks sunlight from reaching part of the Earth. Depending on how much of the Sun is covered, it may be a **total or partial solar eclipse**.

(11) **Safe Viewing of Solar Eclipses:** A solar eclipse should **never be viewed directly with the naked eye**, sunglasses, binoculars, or telescopes because intense sunlight can damage the eyes. Specialised solar-viewing protection or safe projection methods should be used.

(12) **Lunar Eclipse:** A **lunar eclipse** occurs when the Earth comes between the Sun and the Moon and blocks sunlight from reaching the Moon. It may be **total or partial**, and unlike a solar eclipse, a lunar eclipse can be safely viewed with the naked eye.

12.2 Important Formulas:

Important Formulas / Quantitative Relationships — Chapter 12: *Earth, Moon, and the Sun*

This chapter is **mainly conceptual and does not introduce many explicit mathematical formulas**. However, the following relationships and conversions are useful for solving quantitative and application-based problems related to the chapter.

1. **Time taken for one rotation of the Earth**

$$1 \text{ rotation} \approx 24 \text{ hours}$$

The Earth completes one rotation about its axis in approximately 24 hours.

2. **Angular rotation of the Earth per hour**

Since one complete rotation is 360°:

$$\text{Angular rotation per hour} = \frac{360^\circ}{24} = 15^\circ/\text{hour}$$

Therefore:

$$1 \text{ hour} = 15^\circ$$

This is a useful derived relationship based on the chapter's 24-hour rotation period.

3. **Time corresponding to 1° of Earth's rotation**

$$\text{Time for } 1^\circ = \frac{24 \times 60}{360} = 4 \text{ minutes}$$

Hence:

$$1^\circ = 4 \text{ minutes}$$

4. **Time difference based on angular/longitudinal difference**

$$\boxed{\text{Time difference} = \frac{\text{Angular difference}}{15^\circ} \text{ hours}}$$

or

$$\boxed{\text{Time difference} = \text{Angular difference} \times 4 \text{ minutes}}$$

This can help explain why sunrise occurs earlier in eastern locations than in western locations, consistent with the Earth's west-to-east rotation.

5. **Time taken for one revolution of the Earth**

$$1 \text{ revolution} \approx 365 \text{ days} + 6 \text{ hours}$$

The chapter states that the Earth takes about **365 days and 6 hours** to complete one revolution around the Sun.

6. **Approximate duration of one year in hours**

$$(365 \times 24) + 6 = 8766 \text{ hours}$$

Therefore:

$$\boxed{1 \text{ year} \approx 8766 \text{ hours}}$$

7. **Fraction of Earth's revolution completed**

For $d$days:

$$\boxed{\text{Fraction of revolution} = \frac{d}{365.25}}$$

Approximate angular movement around the Sun can therefore be calculated as:

$$\boxed{\theta = \frac{d}{365.25} \times 360^\circ}$$

8. **Approximate angular revolution of Earth per day**

$$\frac{360^\circ}{365.25} \approx 0.986^\circ$$

Thus, the Earth moves approximately:

$$\boxed{1^\circ \text{ per day}}$$

around the Sun.

9. **Day and night relationship**

Since one complete rotation takes 24 hours:

$$\boxed{\text{Duration of day} + \text{Duration of night} = 24 \text{ hours}}$$

The chapter explains that sunlight duration varies with season and location; at the Equator, there are approximately **12 hours of daylight and 12 hours of darkness**.

10. **Equinox relationship**

Around the equinoxes:

$$\boxed{\text{Daylight} \approx \text{Night} \approx 12 \text{ hours}}$$

The chapter identifies approximately **21 March and 23 September** as equinox dates in the Northern Hemisphere.

11. **Scale conversion for Earth–Sun distance activity**

The chapter's exploratory project gives the scale:

$$\boxed{1 \text{ cm} = 10 \text{ million km}}$$

Hence:

$$\boxed{\text{Actual distance} = \text{Drawing distance in cm} \times 10 \text{ million km}}$$

For example:

$$14.7 \text{ cm} \times 10 = 147 \text{ million km}$$
$$15.2 \text{ cm} \times 10 = 152 \text{ million km}$$

These represent the approximate closest and farthest distances used in the chapter's activity.

12. **Difference between closest and farthest distances**

Using the values in the activity:

$$152 - 147 = 5 \text{ million km}$$

Thus:

$$\boxed{\text{Difference} = 5 \text{ million km}}$$

The activity uses this small relative difference to reinforce that changing Earth–Sun distance is **not the reason for seasons**.

Important Numerical Values to Remember

Concept	**Value**
One Earth rotation	≈ 24 hours
One complete rotation	360°
Earth's rotation per hour	15°
Time corresponding to 1° rotation	4 minutes
One Earth revolution	≈ 365 days 6 hours
Earth's revolution per day	≈ 1°
Day + Night	24 hours
Daylight at Equator	≈ 12 hours
Darkness at Equator	≈ 12 hours
Scale used in chapter activity	1 cm = 10 million km
Closest distance represented	147 million km
Farthest distance represented	152 million km

Note: For **Grade 7**, the most important numerical facts explicitly emphasized by the chapter are the **24-hour rotation**, **365 days and 6 hours revolution**, variations in daylight duration, and the **distance-scale activity**. The angular-rate formulas above are useful derived relationships for additional quantitative/HOTS problems rather than formulas explicitly stated in the textbook.

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

The following questions are based directly on the important facts, definitions, and concepts presented in the chapter. The chapter covers Earth's rotation and revolution, seasons, and solar and lunar eclipses.

1. The Earth rotates on its own __________.
   Answer: axis
2. The Earth completes one rotation in about __________ **hours**.
   Answer: 24 hours
3. The Earth rotates from __________ **to** __________.
   Answer: West; East
4. The Earth's axis of rotation passes through the geographic __________ **Pole** and __________ **Pole**.
   Answer: North; South
5. The side of the Earth facing the Sun experiences __________.
   Answer: daytime
6. The side of the Earth away from sunlight experiences __________.
   Answer: night
7. The Earth's rotation causes the __________ **and** __________ **cycle**.
   Answer: day; night
8. Due to the rotation of the Earth, the Sun appears to rise in the __________.
   Answer: East
9. The Sun appears to set in the __________.
   Answer: West
10. The Earth's axis of rotation points very close to the __________ **Star** in the Northern Hemisphere.
    Answer: Pole
11. The Pole Star appears nearly __________ in the sky.
    Answer: stationary
12. The apparent motion of stars recorded as arcs of circles in long-exposure photographs is known as __________.
    Answer: star trails
13. The motion of an object around another object is called __________.
    Answer: revolution
14. The path taken by an object while revolving around another object is called its __________.
    Answer: orbit
15. The Earth completes one revolution around the Sun in about __________ **days and** __________ **hours**.
    Answer: 365 days; 6 hours
16. The orbit of the Earth around the Sun is nearly __________ when viewed from the top.
    Answer: circular
17. The Earth's axis of rotation is not upright but is __________.
    Answer: tilted
18. Seasons occur because of the tilt of the Earth's axis and the __________ **shape** of the Earth.
    Answer: spherical
19. In June, the Northern Hemisphere is tilted __________ **the Sun**.
    Answer: towards

20. The Northern Hemisphere experiences __________ in June.
    Answer: summer
21. The Northern Hemisphere experiences __________ in December.
    Answer: winter
22. In the Southern Hemisphere, it is __________ in June and summer in December.
    Answer: winter
23. The longest day in the Northern Hemisphere occurs around __________.
    Answer: 21 June
24. The longest day in the Northern Hemisphere is known as the __________ **solstice**.
    Answer: summer
25. The shortest day in the Northern Hemisphere occurs around __________.
    Answer: 22 December
26. Around 21 March and 23 September, daytime lasts for approximately __________ **hours**.
    Answer: 12 hours
27. The days when daytime lasts about 12 hours are called __________.
    Answer: equinoxes
28. On the Equator, there are always about __________ **hours** of sunlight and 12 hours of darkness.
    Answer: 12 hours
29. A __________ **eclipse** occurs when the Moon comes between the Sun and the Earth and obstructs sunlight.
    Answer: solar
30. During a total solar eclipse, the __________ blocks the Sun from our view.
    Answer: Moon
31. When the Moon completely blocks the Sun from our view, it is called a __________ **solar eclipse**.
    Answer: total
32. When the Moon blocks only a part of the Sun, it is called a __________ **solar eclipse**.
    Answer: partial
33. Directly viewing a solar eclipse with the naked eyes can cause __________.
    Answer: blindness
34. A __________ **eclipse** occurs when the Earth blocks sunlight from reaching the Moon.
    Answer: lunar
35. During a lunar eclipse, the __________ **comes between the Sun and the Moon**.
    Answer: Earth
36. When the Moon is completely within the Earth's shadow, it is called a __________ **lunar eclipse**.
    Answer: total
37. During a total lunar eclipse, the Moon appears __________ **in colour**.
    Answer: dark red
38. Unlike a solar eclipse, a lunar eclipse can be safely viewed with the __________ **eye**.
    Answer: naked
39. An eclipse is known as __________ in Sanskrit and many Indian languages.
    Answer: grahan
40. The ancient Indian astronomical text widely referred to for calculations predicting eclipses is the __________.
    Answer: Surya Siddhanta

12.4 Fill-Up the Blank HOTS type questions with Answers: (40 Questions)

1. If the Earth stopped rotating on its axis, the regular __________ **cycle** would no longer occur in the present manner.
   Answer: day-night
2. A student observes that the Sun appears to travel from east to west. This apparent motion is actually caused by the Earth rotating from __________ **to** __________.
   Answer: West; East
3. When a location on Earth rotates from the dark side into the illuminated side, the observer experiences __________.
   Answer: sunrise
4. If it is daytime in India while it is night-time in another part of the world, this difference occurs because different parts of the Earth face the __________ at different times.
   Answer: Sun
5. If the Earth rotated from East to West instead of West to East, the Sun would appear to rise in the __________.
   Answer: West
6. The Pole Star appears nearly stationary while other stars appear to move around it because the Earth's axis points very close to the __________.
   Answer: Pole Star
7. If a long-exposure photograph of the night sky shows circular star trails, these trails provide evidence for the __________ **of the Earth**.
   Answer: rotation
8. If the Earth completed one rotation in 48 hours instead of about 24 hours, the duration of one day-night cycle would be approximately __________ **hours**.
   Answer: 48
9. Different groups of stars become visible at the same time of night during different months mainly because of the Earth's __________ **around the Sun**.
   Answer: revolution
10. If the Earth did not revolve around the Sun, the annual change in the view of the __________ **sky** would not occur in the same way.
    Answer: night
11. In June, the Northern Hemisphere receives more intense sunlight because the same amount of sunlight is spread over a __________ **area**.
    Answer: smaller
12. If the Northern Hemisphere is tilted towards the Sun, it generally experiences __________, while the Southern Hemisphere experiences winter.
    Answer: summer
13. If the Southern Hemisphere is experiencing summer in December, the Northern Hemisphere will generally be experiencing __________.
    Answer: winter
14. A student says that summer occurs because the Earth is much closer to the Sun during summer. According to the chapter, this explanation is __________.
    Answer: incorrect
15. The fact that the Earth is closest to the Sun in January shows that seasonal changes are not primarily caused by changes in the Earth-Sun __________.
    Answer: distance
16. If the Earth's axis were not tilted with respect to its orbit, the seasonal differences would become much less __________.
    Answer: pronounced

17. A person at the North Pole in June may receive sunlight continuously for __________ **hours** during one rotation of the Earth.
    Answer: 24
18. If a place in the Northern Hemisphere has its longest daytime around 21 June, that day is known as the __________ **solstice**.
    Answer: summer
19. Around an equinox, a place experiences approximately equal durations of __________ **and** __________.
    Answer: day; night
20. Seasons are less prominent near the Equator because there is little difference in the __________ **of sunrays** received there during different months.
    Answer: intensity
21. Although the Moon is much smaller than the Sun, it can completely cover the Sun during a total solar eclipse because their __________ **sizes**, as viewed from Earth, are similar.
    Answer: apparent
22. The Moon has an apparent size similar to the Sun because it is much __________ **to the Earth** than the Sun.
    Answer: closer
23. Venus cannot completely cover the Sun as seen from Earth because its apparent size is much __________ **than that of the Sun**.
    Answer: smaller
24. If an observer is located where the Moon completely blocks the Sun, the observer experiences a __________ **solar eclipse**.
    Answer: total
25. If only a portion of the Sun is blocked by the Moon, an observer witnesses a __________ **solar eclipse**.
    Answer: partial
26. A total solar eclipse lasts only a few minutes at a particular location because the Moon's shadow __________ **across the Earth's surface**.
    Answer: moves
27. If a student wants to observe a solar eclipse safely, looking directly at the Sun through ordinary sunglasses should be __________.
    Answer: avoided
28. When the Earth comes between the Sun and Moon and blocks sunlight from reaching the Moon, a __________ **eclipse** occurs.
    Answer: lunar
29. If only part of the Moon enters the Earth's shadow, observers witness a __________ **lunar eclipse**.
    Answer: partial
30. When the Moon is completely within the Earth's shadow, its bright disc appears __________ **in colour**.
    Answer: dark red
31. A lunar eclipse can generally be viewed from a much larger region of the Earth than a total solar eclipse because a solar eclipse is restricted to the relatively small area covered by the Moon's __________.
    Answer: shadow
32. If the Earth's axial tilt increased substantially, the difference between summer and winter would likely become more __________.
    Answer: extreme

33. If a cricket team from India travels to Australia in December, it should mainly prepare for __________, because Australia lies in the Southern Hemisphere.
Answer: summer
34. If the Earth revolved around the Sun but had no axial tilt, the present pattern of __________ would be greatly reduced.
Answer: seasons
35. If two locations lie on opposite illuminated and dark portions of the rotating Earth, one may experience day while the other experiences __________.
Answer: night
36. A student observes the same constellation at a fixed time each month and notices that its position gradually changes. This observation provides evidence for the Earth's __________ around the Sun.
Answer: revolution
37. If the Northern Hemisphere receives sunlight for more than 12 hours per day, it is generally tilted __________ **the Sun**.
Answer: towards
38. When the Northern Hemisphere experiences shorter daytime in December, the Southern Hemisphere experiences comparatively __________ **daytime**.
Answer: longer
39. If the Moon moves away from directly in front of the Sun after a total solar eclipse, observers first begin to see a __________ **solar eclipse**.
Answer: partial
40. The fact that ancient astronomers could calculate and predict eclipses demonstrates that eclipses are __________ **astronomical events rather than mysterious occurrences**.
Answer: predictable

12.5 One-mark questions with Answers of LOTS Type: (40 Questions)

1. **What is rotation?**
Answer: Rotation is the motion of an object in which all its parts move in circles around an imaginary line called its axis.
2. **What is the axis of rotation?**
Answer: The axis of rotation is an imaginary line around which an object rotates.
3. **Through which two geographical points does the Earth's axis of rotation pass?**
Answer: The Earth's axis of rotation passes through the geographic North Pole and South Pole.
4. **How much time does the Earth take to complete one rotation?**
Answer: The Earth takes about 24 hours to complete one rotation.
5. **In which direction does the Earth rotate?**
Answer: The Earth rotates from West to East.
6. **What causes the cycle of day and night?**
Answer: The rotation of the Earth from West to East causes the cycle of day and night.
7. **Which side of the Earth experiences daytime?**
Answer: The side of the Earth facing the Sun experiences daytime.
8. **When does sunrise occur at a particular location?**
Answer: Sunrise occurs when a location on Earth rotates into the region illuminated by the Sun.

9. **Why does the Sun appear to move from East to West?**
   Answer: The Sun appears to move from East to West because the Earth rotates from West to East.
10. **Why does the Pole Star appear nearly stationary in the sky?**
    Answer: The Pole Star appears nearly stationary because the Earth's axis of rotation points very close to it.
11. **What are star trails?**
    Answer: Star trails are arcs of circles produced by the apparent motion of stars in long-exposure photographs.
12. **What is a Foucault pendulum?**
    Answer: A Foucault pendulum is a long pendulum used to demonstrate the rotation of the Earth.
13. **Who was Aryabhata?**
    Answer: Aryabhata was a famous ancient Indian mathematician and astronomer who wrote the *Aryabhatiya*.
14. **What is revolution?**
    Answer: Revolution is the motion of an object around another object.
15. **What is an orbit?**
    Answer: An orbit is the path taken by an object while revolving around another object.
16. **How much time does the Earth take to complete one revolution around the Sun?**
    Answer: The Earth takes about 365 days and 6 hours to complete one revolution around the Sun.
17. **Why does our view of the night sky change throughout the year?**
    Answer: Our view of the night sky changes throughout the year because the Earth revolves around the Sun.
18. **What causes seasons on the Earth?**
    Answer: Seasons occur because of the tilt of the Earth's axis of rotation and the Earth's spherical shape.
19. **Which season occurs in the Northern Hemisphere in June?**
    Answer: The Northern Hemisphere experiences summer in June.
20. **Which season occurs in the Northern Hemisphere in December?**
    Answer: The Northern Hemisphere experiences winter in December.
21. **How are the seasons in the Southern Hemisphere related to those in the Northern Hemisphere?**
    Answer: The seasons in the Southern Hemisphere are reversed compared with those in the Northern Hemisphere.
22. **When does the summer solstice occur in the Northern Hemisphere?**
    Answer: The summer solstice in the Northern Hemisphere occurs around 21 June.
23. **When does the winter solstice occur in the Northern Hemisphere?**
    Answer: The winter solstice in the Northern Hemisphere occurs around 22 December.
24. **What is an equinox?**
    Answer: An equinox is a time when daytime lasts approximately 12 hours.
25. **When do the spring and autumn equinoxes occur in the Northern Hemisphere?**
    Answer: The spring and autumn equinoxes occur around 21 March and 23 September, respectively.
26. **What is a solar eclipse?**
    Answer: A solar eclipse occurs when the Moon comes between the Sun and the Earth and obstructs sunlight from reaching us.

27. **What is meant by the apparent size of an object?**
    Answer: Apparent size is the size of an object as it appears to our eyes depending on its actual size and distance.
28. **Why can the Moon cover the Sun during a solar eclipse?**
    Answer: The Moon can cover the Sun because their apparent sizes as viewed from the Earth are similar.
29. **What is a total solar eclipse?**
    Answer: A total solar eclipse occurs when the Moon completely blocks the Sun from an observer's view.
30. **What is a partial solar eclipse?**
    Answer: A partial solar eclipse occurs when the Moon blocks only a part of the Sun.
31. **Why should we not look directly at a solar eclipse?**
    Answer: We should not look directly at a solar eclipse because the Sun's intense light can damage our eyes and even cause blindness.
32. **What is a lunar eclipse?**
    Answer: A lunar eclipse occurs when the Earth blocks sunlight from reaching the Moon.
33. **What is a total lunar eclipse?**
    Answer: A total lunar eclipse occurs when the Moon is completely within the Earth's shadow.
34. **What colour does the Moon appear during a total lunar eclipse?**
    Answer: The Moon appears dark red during a total lunar eclipse.
35. **What is a partial lunar eclipse?**
    Answer: A partial lunar eclipse occurs when only part of the Moon is within the Earth's shadow.
36. **Can a lunar eclipse be viewed safely with the naked eye?**
    Answer: Yes, a lunar eclipse can be viewed safely with the naked eye.
37. **What is the Sanskrit term for an eclipse?**
    Answer: An eclipse is known as *grahan* in Sanskrit.
38. **Which ancient Indian text contains calculations for predicting eclipses?**
    Answer: The *Surya Siddhanta* is a well-known ancient Indian text containing calculations for predicting eclipses.
39. **Where is the Kodaikanal Solar Observatory located?**
    Answer: The Kodaikanal Solar Observatory is located in the Palani range of hills in southern India.
40. **Who is known as the father of modern Indian astronomy?**
    Answer: M. K. Vainu Bappu is known as the father of modern Indian astronomy.

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

1. **Why does the Sun appear to move from East to West even though the Earth rotates from West to East?**
   Answer: The Sun appears to move from East to West because an observer on the rotating Earth sees celestial objects apparently moving in the opposite direction.
2. **If the Earth stopped rotating, would the regular 24-hour day-night cycle continue? Why?**
   Answer: No, the regular day-night cycle would not continue because it is caused by the Earth's rotation on its axis.

3. **Why does sunrise occur earlier in eastern India than in western India?**
   Answer: Sunrise occurs earlier in eastern India because the Earth rotates from West to East, bringing eastern regions into sunlight first.
4. **Why is it daytime in India while it may be nighttime in the USA?**
   Answer: It can be daytime in India and nighttime in the USA because different parts of the rotating Earth face the Sun at different times.
5. **Why does the Pole Star appear almost stationary while other stars appear to move around it?**
   Answer: The Pole Star appears almost stationary because the Earth's axis of rotation points very close to it.
6. **What would happen to the apparent daily movement of the Sun if the Earth rotated from East to West?**
   Answer: If the Earth rotated from East to West, the Sun would appear to rise in the West and set in the East.
7. **Why do different constellations become visible at the same time of night in different months?**
   Answer: Different constellations become visible because the Earth's revolution around the Sun changes the direction in which we view the night sky.
8. **Why do we not experience a new season every day even though the Earth rotates every 24 hours?**
   Answer: Seasons do not change daily because they result from the Earth's axial tilt and revolution around the Sun rather than its daily rotation.
9. **Why is June generally warmer in the Northern Hemisphere than December?**
   Answer: June is generally warmer because the Northern Hemisphere receives more intense sunlight for a longer duration.
10. **Why does the Southern Hemisphere experience winter when the Northern Hemisphere experiences summer?**
    Answer: The hemispheres experience opposite seasons because when one is tilted towards the Sun, the other is tilted away from it.
11. **Why are days longer during summer than during winter in the Northern Hemisphere?**
    Answer: Summer days are longer because the Northern Hemisphere is tilted towards the Sun and receives sunlight for a greater part of each rotation.
12. **Why is the North Pole continuously illuminated during part of the year?**
    Answer: The North Pole remains continuously illuminated when the Northern Hemisphere is tilted towards the Sun during that part of Earth's revolution.
13. **Why are seasonal differences less prominent near the Equator?**
    Answer: Seasonal differences are less prominent near the Equator because it receives about 12 hours of sunlight daily with little variation in sunlight intensity throughout the year.
14. **If the Earth's axis were not tilted, how would seasons be affected?**
    Answer: If the Earth's axis were not tilted, the present pattern of seasonal changes caused by variations in sunlight intensity and day length would not occur.
15. **Why is the Earth's changing distance from the Sun not the main cause of seasons?**
    Answer: Earth's changing distance from the Sun is not the main cause because the difference in distance is very small and Earth is actually closest to the Sun in January.
16. **Why can a small thumb hide a much larger distant object from our view?**
    Answer: A nearby thumb can hide a much larger distant object because apparent size depends on both the actual size of an object and its distance from the observer.

17. **How can the Moon completely cover the much larger Sun during a total solar eclipse?**
Answer: The Moon can cover the Sun because its much smaller physical size is compensated by its much smaller distance from the Earth, giving both similar apparent sizes.
18. **Why cannot Venus completely cover the Sun as seen from the Earth even though Venus is larger than the Moon?**
Answer: Venus cannot completely cover the Sun because its greater distance from Earth makes its apparent size much smaller than that of the Sun.
19. **Why is a total solar eclipse visible only from a small region of the Earth?**
Answer: A total solar eclipse is visible only from a small region because the Moon's shadow falls on only a small area of the Earth's surface.
20. **Why does a total solar eclipse last only for a few minutes at a particular location?**
Answer: A total solar eclipse lasts only a few minutes because the Moon's shadow moves across the Earth due to Earth's rotation and the Moon's orbital motion.
21. **Why is it unsafe to look directly at the Sun even during a solar eclipse?**
Answer: It is unsafe because the Sun remains intense enough during an eclipse to damage the eyes and may even cause blindness.
22. **Why are ordinary sunglasses not suitable for viewing a solar eclipse?**
Answer: Ordinary sunglasses do not provide the specialised eye protection required to view the intense light of the Sun safely.
23. **Why can a lunar eclipse be safely observed with the naked eye but a solar eclipse cannot?**
Answer: A lunar eclipse can be safely viewed because we observe the Moon rather than looking directly at the intense light of the Sun.
24. **How can you distinguish a total lunar eclipse from a partial lunar eclipse?**
Answer: In a total lunar eclipse the entire Moon lies within Earth's shadow, whereas in a partial lunar eclipse only part of the Moon lies within the shadow.
25. **Why does the Moon appear dark red during a total lunar eclipse?**
Answer: According to the chapter, the Moon appears dark red when it is completely within the Earth's shadow during a total lunar eclipse.
26. **If only part of the Sun is blocked by the Moon, what would an observer see?**
Answer: The observer would see a partial solar eclipse because only some regions of the Sun are blocked by the Moon.
27. **If the Earth comes between the Sun and the Moon, which eclipse can occur?**
Answer: A lunar eclipse can occur because the Earth blocks sunlight from reaching the Moon.
28. **If the Moon comes between the Sun and the Earth and blocks sunlight, which eclipse occurs?**
Answer: A solar eclipse occurs because the Moon obstructs sunlight from reaching part of the Earth.
29. **Why did people in ancient times often fear eclipses more than people do today?**
Answer: People often feared eclipses because their scientific causes were not understood and various superstitions became associated with them.
30. **How does scientific knowledge help us respond rationally to eclipses?**
Answer: Scientific knowledge explains eclipses as predictable astronomical events, allowing us to observe them safely without unnecessary fear.
31. **A student says that summer occurs because the Earth is closer to the Sun; why is this reasoning incorrect?**

Answer: This reasoning is incorrect because seasons mainly result from Earth's axial tilt and spherical shape, not its small variation in distance from the Sun.

32. **Why would increasing the tilt of the Earth's axis be expected to produce more extreme seasonal differences?**
    Answer: A greater axial tilt would increase differences in the intensity and duration of sunlight received by the hemispheres during the year.
33. **If you observe a constellation at a fixed time every month, why will its position gradually change?**
    Answer: Its position will gradually change because Earth moves to different positions in its orbit around the Sun.
34. **Why do long-exposure photographs of stars produce curved star trails?**
    Answer: Curved star trails are produced because Earth's rotation makes stars appear to move across the sky while the camera shutter remains open.
35. **Why can observations of the night sky provide evidence for the Earth's rotation?**
    Answer: The apparent movement of stars around the nearly stationary Pole Star provides observable evidence of the Earth's rotation.

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

1. What is rotation? How long does the Earth take to complete one rotation?
Answer:
1. Rotation is the motion of an object around its own axis.
2. The Earth takes about **24 hours** to complete one rotation.

2. What is the Earth's axis of rotation?
Answer:
1. The Earth's axis of rotation is an imaginary line about which the Earth rotates.
2. It passes through the geographic **North Pole and South Pole**.

3. In which direction does the Earth rotate? How does the Sun appear to move?
Answer:
1. The Earth rotates from **West to East** or anticlockwise when viewed from above the North Pole.
2. Therefore, the Sun appears to move across the sky from **East to West**.

4. How does the rotation of the Earth cause day and night?
Answer:
1. The half of the Earth facing the Sun receives sunlight and experiences **daytime**.
2. The other half remains dark and experiences **night-time** as the Earth rotates.

5. What causes sunrise and sunset?
Answer:
1. Sunrise occurs when a place on Earth rotates into the region receiving sunlight.
2. Sunset occurs when that place rotates away from sunlight into darkness.

6. Why does the Sun appear to rise in the East and set in the West?
Answer:
1. The Earth rotates on its axis from **West to East**.
2. Due to this rotation, the Sun appears to rise in the East, move across the sky, and set in the West.

7. Why does the Pole Star appear nearly stationary in the sky?
Answer:
1. The Earth's axis of rotation points very close to the Pole Star in the Northern Hemisphere.

2. Hence, the Pole Star appears nearly stationary while other stars appear to move around it.

8. What are star trails? How are they photographed?

Answer:

1. Star trails are arcs of circles formed by the apparent motion of stars in the night sky.
2. They are recorded by taking long-exposure photographs with the camera shutter kept open for a long time.

9. What is revolution? How long does the Earth take to revolve around the Sun?

Answer:

1. Revolution is the motion of one object around another object.
2. The Earth takes about **365 days and 6 hours** to complete one revolution around the Sun.

10. What is an orbit? What is the shape of the Earth's orbit?

Answer:

1. The path followed by an object while revolving around another object is called its **orbit**.
2. When viewed from the top, the Earth's orbit around the Sun is **nearly circular**.

11. Why do the stars visible in the night sky change during the year?

Answer:

1. The Earth continuously revolves around the Sun throughout the year.
2. As a result, we look in different directions in space and see different stars in the night sky.

12. What are the two main factors responsible for seasons on Earth?

Answer:

1. The **tilt of the Earth's axis of rotation** is one factor responsible for seasons.
2. The **spherical shape of the Earth** is the other factor that gives rise to seasons.

13. Why does the Northern Hemisphere experience summer in June?

Answer:

1. In June, the Northern Hemisphere is tilted towards the Sun and receives more intense sunlight.
2. It also receives sunlight for more than 12 hours, resulting in the summer season.

14. How are the seasons in the Southern Hemisphere different from those in the Northern Hemisphere?

Answer:

1. The seasons in the Southern Hemisphere are reversed compared with those in the Northern Hemisphere.
2. The Southern Hemisphere experiences **winter in June and summer in December**.

15. What are summer solstice and winter solstice in the Northern Hemisphere?

Answer:

1. The **summer solstice**, around 21 June, is the longest day in the Northern Hemisphere.
2. The **winter solstice**, around 22 December, is the shortest day and longest night there.

16. What are the spring and autumn equinoxes?

Answer:

1. Around **21 March**, daytime lasts for 12 hours and the day is called the spring equinox in the Northern Hemisphere.
2. Around **23 September**, daytime again lasts for 12 hours and the day is called the autumn equinox.

17. What is a solar eclipse? How does it occur?

Answer:

1. A solar eclipse occurs when the **Moon comes between the Sun and the Earth**.

2. The Moon obstructs sunlight from reaching some parts of the Earth.

18. What is the difference between a total and a partial solar eclipse?
Answer:
1. A **total solar eclipse** occurs where the Moon completely blocks the Sun from view.
2. A **partial solar eclipse** occurs where the Moon blocks only some regions of the Sun.

19. What is meant by the apparent size of an object?
Answer:
1. Apparent size is the size of an object as it appears to our eyes.
2. It depends on both the object's **actual physical size and its distance from the observer**.

20. Why can the Moon cover the Sun during a total solar eclipse?
Answer:
1. Although the Moon is much smaller than the Sun, it is also much closer to the Earth.
2. Therefore, the Moon and Sun have similar apparent sizes when viewed from the Earth.

21. Mention two precautions to be followed while observing a solar eclipse.
Answer:
1. A solar eclipse should **never be viewed directly with the naked eye**, as intense sunlight can damage the eyes.
2. It should also not be viewed through ordinary sunglasses, binoculars, or telescopes without specialised protection.

22. What is a lunar eclipse? How does it occur?
Answer:
1. A lunar eclipse occurs when the **Earth blocks sunlight from reaching the Moon**.
2. During such an eclipse, the Earth's shadow falls on the Moon.

23. What is the difference between a total and a partial lunar eclipse?
Answer:
1. A **total lunar eclipse** occurs when the Moon is completely within the Earth's shadow.
2. A **partial lunar eclipse** occurs when only part of the Moon lies within the Earth's shadow.

24. What happens to the appearance of the Moon during a total lunar eclipse?
Answer:
1. When the Moon is completely within the Earth's shadow, its bright disc starts to appear **dark red**.
2. It remains this way until the Moon moves out of the Earth's shadow.

25. State two differences between a solar eclipse and a lunar eclipse.
Answer:
1. In a solar eclipse, the Moon blocks sunlight from reaching the Earth, whereas in a lunar eclipse, the Earth blocks sunlight from reaching the Moon.
2. A solar eclipse should not be viewed directly, whereas an eclipsed full Moon can be safely viewed with the naked eye.

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

1. Why does the Sun appear to move from East to West although the Earth rotates from West to East?
Answer:
1. When we observe objects from a rotating body, they appear to move in the direction opposite to our rotation.

2. Therefore, Earth's West-to-East rotation makes the Sun appear to move from East to West.

2. If the Earth stopped rotating, how would the normal day-night cycle be affected?

Answer:

1. The regular 24-hour day-night cycle would no longer occur because it is caused by Earth's rotation.
2. Places would not move into and out of sunlight every 24 hours as they do at present.

3. Why does sunrise occur earlier in the eastern parts of India than in the western parts?

Answer:

1. The Earth rotates from West to East about its North-South axis.
2. Therefore, eastern parts of India move into sunlight before the western parts.

4. Why can it be daytime in India while it is nighttime in the USA?

Answer:

1. At any given time, only the half of the Earth facing the Sun receives sunlight.
2. Due to Earth's rotation, India may face the Sun while the USA is on the darker side of the Earth.

5. Why does the Pole Star appear nearly stationary while other stars appear to move around it?

Answer:

1. The Earth's axis of rotation points very close to the Pole Star in the Northern Hemisphere.
2. Hence, the Pole Star appears nearly stationary while other stars appear to move around it.

6. A student observes the Big Dipper at two-hour intervals during the same night. What change should the student expect, and why?

Answer:

1. The Big Dipper will appear to change its position and move around the Pole Star.
2. This apparent movement is caused by the rotation of the Earth on its axis.

7. Why do different groups of stars appear in the night sky during different months?

Answer:

1. As the Earth revolves around the Sun, our viewing direction towards space gradually changes.
2. Therefore, different stars and constellations become visible at the same time of night in different months.

8. Why does the Northern Hemisphere experience summer in June?

Answer:

1. In June, the Northern Hemisphere is tilted towards the Sun and receives more intense sunlight.
2. It also receives sunlight for more than 12 hours, resulting in longer and warmer days.

9. Why does Australia experience summer when India experiences winter in December?

Answer:

1. The seasons and length of daytime in the Southern Hemisphere are reversed compared with the Northern Hemisphere.
2. Therefore, Australia experiences summer in December while India, in the Northern Hemisphere, experiences winter.

10. Why is the changing distance between the Earth and Sun not the main cause of seasons?

Answer:

1. The difference between the Earth's nearest and farthest distances from the Sun is too small to explain the seasons.

2. In fact, the Earth is closest to the Sun in January, showing that seasons are mainly related to axial tilt and Earth's spherical shape.

11. Why are seasons less prominent in regions close to the Equator?

Answer:

1. The Equator receives about 12 hours of sunlight and 12 hours of darkness throughout the year.
2. The intensity of sunlight also changes very little there during different months, so seasonal differences are less prominent.

12. What would happen to seasons if the Earth's axis were not tilted?

Answer:

1. The present seasonal variation caused by changing sunlight intensity and day length would be greatly reduced.
2. This is because the chapter identifies Earth's axial tilt, together with its spherical shape, as the cause of seasons.

13. If the tilt of the Earth's axis increased, what effect would you expect on seasons?

Answer:

1. A greater tilt would produce greater differences in the intensity and duration of sunlight received during different parts of the year.
2. Therefore, seasonal differences would be expected to become more extreme.

14. Why can the Moon completely cover the Sun even though the Moon is much smaller?

Answer:

1. Apparent size depends on both the actual size of an object and its distance from the observer.
2. Since the Moon is much closer to Earth than the Sun, their apparent sizes are similar and the Moon can cover the Sun.

15. Why cannot Venus completely block the Sun even though Venus is larger than the Moon?

Answer:

1. Venus is much farther from the Earth than the Moon and therefore has a much smaller apparent size.
2. Hence, when Venus passes between the Earth and Sun, it appears only as a tiny black dot against the Sun.

16. Why is a total solar eclipse visible only for a few minutes at a particular place?

Answer:

1. Earth's rotation and the Moon's motion in its orbit cause the Moon's shadow to move across Earth's surface.
2. Consequently, a particular location remains within the region of total eclipse for only a few minutes.

17. Why can a total solar eclipse be seen only from a small area of the Earth?

Answer:

1. During a solar eclipse, the Moon's shadow falls on only a small area of the Earth's surface.
2. Only observers within this area see the Moon completely blocking the Sun.

18. Why can a lunar eclipse be observed from a larger part of the Earth than a total solar eclipse?

Answer:

1. During a lunar eclipse, people on the nighttime side of Earth who can see the Moon can observe Earth's shadow falling on it.
2. In contrast, a total solar eclipse is restricted to the small region of Earth covered by the Moon's shadow.

19. Why is it unsafe to observe a solar eclipse directly with the naked eye or ordinary sunglasses?
Answer:
1. Even during an eclipse, sunlight remains intense enough to damage the eyes and may cause blindness.
2. Ordinary sunglasses do not provide the specialised protection required for safe solar viewing.

20. Why can a lunar eclipse be viewed safely with the naked eye while a solar eclipse cannot?
Answer:
1. During a lunar eclipse, we observe the Moon affected by Earth's shadow rather than looking directly at the Sun.
2. Therefore, the eclipsed full Moon can be safely watched with the naked eye.

21. A student sees only part of the Sun covered by the Moon. What can the student conclude?
Answer:
1. The student is observing a **partial solar eclipse** because only some regions of the Sun are blocked by the Moon.
2. The student must still avoid looking directly at the Sun and should use specialised safe-viewing methods.

22. How can a globe and a torch be used to explain the occurrence of day and night?
Answer:
1. The torch represents the Sun and illuminates only the half of the globe facing it, representing daytime.
2. Rotating the globe from West to East shows how a place moves alternately into light and darkness, producing day and night.

23. Why does the Northern Hemisphere have longer days in June and shorter days in December?
Answer:
1. In June, its tilt towards the Sun allows places to receive sunlight for more than 12 hours during one rotation.
2. In December, the opposite orientation causes these places to remain in darkness for a longer period.

24. Why is scientific understanding of eclipses useful in overcoming superstitions?
Answer:
1. Science explains eclipses as natural and predictable events caused by the relative positions of the Sun, Earth, and Moon.
2. Therefore, there is no need to fear eclipses, although proper safety precautions are necessary while observing a solar eclipse.

25. If the Indian cricket team travels to Australia in December, should the players carry mainly summer or winter clothes? Give a reason.
Answer:
1. They should carry mainly **summer clothes** because Australia lies in the Southern Hemisphere, where December falls in summer.
2. Seasons in the Southern Hemisphere are reversed compared with those in the Northern Hemisphere.

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

1. What is rotation of the Earth? Explain its direction and duration.

Answer:

1. Rotation is the spinning of the Earth on its own axis.
2. The Earth rotates from **West to East**, or anticlockwise when viewed from above the North Pole.
3. It completes one rotation in about **24 hours**.

2. Explain how the rotation of the Earth causes day and night.

Answer:

1. At any time, the half of the Earth facing the Sun receives sunlight and experiences daytime.
2. The other half remains away from sunlight and experiences night.
3. As the Earth rotates from West to East, places continuously move into and out of sunlight, producing the day-night cycle.

3. Explain the apparent daily movement of the Sun in the sky.

Answer:

1. The Sun appears to rise in the East in the morning.
2. It appears to move across the sky from East to West and sets in the West.
3. This apparent movement is caused by the Earth rotating from West to East.

4. What is the Earth's axis of rotation? Describe it.

Answer:

1. The Earth's axis is an imaginary line around which the Earth rotates.
2. It passes through the geographic North Pole and South Pole.
3. The Earth's axis is tilted rather than upright with respect to its orbit around the Sun.

5. Describe the apparent movement of stars due to the Earth's rotation.

Answer:

1. Stars appear to move across the night sky because the Earth rotates from West to East.
2. The Pole Star appears nearly stationary because the Earth's axis points very close to it in the Northern Hemisphere.
3. Other stars, such as those of the Big Dipper, appear to move around the Pole Star.

6. What is revolution of the Earth? Describe its orbit and duration.

Answer:

1. Revolution is the motion of an object around another object, and the Earth revolves around the Sun.
2. The path followed by the Earth around the Sun is called its **orbit**, which is nearly circular when viewed from the top.
3. The Earth takes about **365 days and 6 hours** to complete one revolution.

7. How does the revolution of the Earth change our view of the night sky?

Answer:

1. The Earth continuously revolves around the Sun while also rotating on its axis.
2. As it revolves, we look towards different directions in space during different parts of the year.
3. Therefore, the stars seen in the night sky after sunset gradually change throughout the year.

8. Explain why seasons occur on the Earth.

Answer:

1. The Earth's axis of rotation is tilted with respect to its orbit around the Sun.
2. The Earth maintains this tilt while revolving around the Sun.
3. The tilt of the Earth's axis, together with the spherical shape of the Earth, gives rise to seasons.

9. Describe the conditions in the Northern Hemisphere during June.

Answer:

1. In June, the Northern Hemisphere is tilted towards the Sun.
2. It receives more intense sunlight because a given amount of sunlight is spread over a smaller area.
3. It also receives sunlight for more than 12 hours, resulting in the summer season.

10. Describe the difference between seasons in the Northern and Southern Hemispheres.
Answer:
1. The seasons in the Southern Hemisphere are reversed compared with those in the Northern Hemisphere.
2. When the Northern Hemisphere experiences summer in June, the Southern Hemisphere experiences winter.
3. When the Northern Hemisphere experiences winter in December, the Southern Hemisphere experiences summer.

11. What are summer solstice, winter solstice, and equinox in the Northern Hemisphere?
Answer:
1. The **summer solstice**, around 21 June, is the longest day in the Northern Hemisphere.
2. The **winter solstice**, around 22 December, is the shortest day and longest night.
3. Around 21 March and 23 September, daytime lasts for about 12 hours, and these days are called the spring and autumn **equinoxes**, respectively.

12. What is a solar eclipse? Explain how it occurs.
Answer:
1. A solar eclipse occurs when the Moon comes between the Sun and the Earth.
2. The Moon obstructs sunlight from reaching a part of the Earth.
3. Depending on how much of the Sun is blocked, observers may see a total or partial solar eclipse.

13. Differentiate between a total solar eclipse and a partial solar eclipse.
Answer:
1. In a **total solar eclipse**, the Moon completely blocks the Sun as viewed from a particular region of the Earth.
2. In a **partial solar eclipse**, the Moon blocks only some regions of the Sun.
3. A total solar eclipse makes it dark for a few minutes, whereas during a partial eclipse some sunlight continues to reach the observer.

14. What precautions should be taken while observing a solar eclipse?
Answer:
1. A solar eclipse should never be viewed directly with the naked eye because intense sunlight can damage the eyes.
2. Ordinary sunglasses, binoculars, and telescopes should not be used for direct viewing.
3. It is safer to attend organised eclipse-viewing programmes where specialised eye protection and proper scientific guidance are provided.

15. What is a lunar eclipse? Describe total and partial lunar eclipses.
Answer:
1. A lunar eclipse occurs when the Earth comes between the Sun and Moon and blocks sunlight from reaching the Moon.
2. When the Moon is completely within the Earth's shadow, it is called a **total lunar eclipse**, and the Moon appears dark red.
3. When only part of the Moon lies in the Earth's shadow, it is called a **partial lunar eclipse**.

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

1. A student says, "The Sun moves from East to West around the Earth every day." How would you correct this statement?
Answer:
1. The Sun only **appears** to move from East to West because we observe it from the rotating Earth.
2. The Earth actually rotates on its axis from **West to East**.
3. This rotation produces the apparent east-to-west movement of the Sun across the sky.

2. Suppose the Earth suddenly stopped rotating. What would happen to the normal day-night cycle?
Answer:
1. The normal 24-hour day-night cycle would no longer occur because it is caused by the Earth's rotation.
2. A location would not regularly move from the illuminated side of the Earth to the dark side every 24 hours.
3. Thus, the familiar pattern of sunrise, daytime, sunset, and night would be disrupted.

3. Why does sunrise occur earlier in eastern India than in western India?
Answer:
1. The Earth rotates from West to East on its axis.
2. Therefore, the eastern parts of India move into sunlight before the western parts.
3. Hence, sunrise is observed earlier in eastern India than in western India.

4. A student observes the Big Dipper at different times during the same night and finds that it appears to move around the Pole Star. Explain the observation.
Answer:
1. The apparent movement of the Big Dipper is caused by the rotation of the Earth.
2. The Pole Star appears nearly stationary because the Earth's rotational axis points very close to it in the Northern Hemisphere.
3. Therefore, other stars and constellations appear to move around the Pole Star during the night.

5. Why do we see different groups of stars at the same time of night during different months?
Answer:
1. The Earth continuously revolves around the Sun while rotating on its axis.
2. As the Earth changes its position in its orbit, the night side faces different directions in space.
3. Therefore, the stars visible at a fixed time of night gradually change during the year.

6. A student claims that summer occurs because the Earth is closer to the Sun. Why is this explanation incorrect?
Answer:
1. The difference in the Earth's distance from the Sun during the year is too small to be the cause of seasons.
2. In fact, the Earth is closest to the Sun in January, when the Northern Hemisphere experiences winter.
3. Seasons mainly result from the **tilt of the Earth's axis and the spherical shape of the Earth**.

7. Why is June summer in the Northern Hemisphere but winter in the Southern Hemisphere?
Answer:
1. In June, the Northern Hemisphere is tilted towards the Sun while the Southern Hemisphere is tilted away from it.

2. The Northern Hemisphere receives more intense sunlight for a longer duration, while the Southern Hemisphere receives less intense sunlight.
3. Therefore, the Northern Hemisphere experiences summer while the Southern Hemisphere experiences winter.

8. Why are seasonal changes less prominent in places located close to the Equator?
Answer:
1. Places on the Equator receive approximately **12 hours of daylight and 12 hours of darkness** throughout the year.
2. There is also little variation in the intensity of sunlight falling on the Equator in different months.
3. Therefore, seasonal changes are less prominent in regions close to the Equator.

9. If the Earth's axis were not tilted, what effect would this have on seasons?
Answer:
1. The Earth's axial tilt is an important reason for the seasonal variation in sunlight received by different hemispheres.
2. Without the tilt, the major seasonal changes caused by differences in sunlight intensity and day length would not occur in the same way.
3. Therefore, the familiar cycle of seasons would be greatly reduced or absent.

10. The Moon is much smaller than the Sun. How can it completely cover the Sun during a total solar eclipse?
Answer:
1. The apparent size of an object depends on both its actual size and its distance from the observer.
2. Although the Moon is much smaller than the Sun, it is also much closer to the Earth.
3. Therefore, the Moon and Sun can have similar apparent sizes in our sky, allowing the Moon to cover the Sun completely.

11. Why can Mercury or Venus not completely block the Sun from our view even though they are larger than the Moon?
Answer:
1. Mercury and Venus are much farther from the Earth than the Moon.
2. Because of their greater distance, their apparent sizes in the sky are much smaller than that of the Sun.
3. Hence, they cannot completely cover the Sun as the Moon can during a total solar eclipse.

12. Why can a total solar eclipse be seen only from a small region of the Earth?
Answer:
1. During a total solar eclipse, the Moon's shadow falls on only a small area of the Earth's surface.
2. Only observers located within this shadowed region see the Sun completely covered by the Moon.
3. As the Earth rotates and the Moon moves in its orbit, the shadow moves across the Earth's surface, so totality at one place lasts only a few minutes.

13. A student wants to watch a solar eclipse using ordinary sunglasses. Why should the student not do so?
Answer:
1. Even during an eclipse, sunlight can remain intense enough to damage the eyes and may cause blindness.
2. Ordinary sunglasses do not provide the specialised protection required for safely observing the Sun.

3. The student should instead use specialised solar-viewing protection or participate in an organised eclipse-viewing programme.

14. Why can a lunar eclipse be safely observed with the naked eye while a solar eclipse cannot?

Answer:

1. During a lunar eclipse, we observe the Moon as it passes into the Earth's shadow.
2. During a solar eclipse, looking towards the Sun can expose the eyes to intense sunlight capable of causing serious damage.
3. Therefore, an eclipsed Moon can be viewed safely with the naked eye, whereas direct viewing of a solar eclipse must be avoided.

15. An Indian cricket team travels to Australia in December. Should the players mainly pack summer or winter clothes? Justify your answer.

Answer:

1. India lies in the Northern Hemisphere, whereas Australia lies in the Southern Hemisphere.
2. Seasons in the Southern Hemisphere are reversed compared with those in the Northern Hemisphere.
3. Since December is summer in the Southern Hemisphere, the players should mainly pack **summer clothes**.

12.11 Five-mark questions with Answers of LOTS Type: (8 Questions)

1. Explain the rotation of the Earth and its effects.

Answer:

1. The Earth spins or rotates on its own imaginary axis in space.
2. Its axis of rotation passes through the geographic North Pole and South Pole.
3. The Earth completes one rotation in about **24 hours**.
4. When viewed from above the North Pole, the Earth rotates anticlockwise, that is, from **West to East**.
5. This rotation causes **day and night** and the apparent movement of the Sun, Moon, and stars across the sky.

2. Explain how day and night occur on the Earth.

Answer:

1. The Earth rotates on its axis from West to East.
2. At any given time, the half of the Earth facing the Sun receives sunlight and experiences **day**.
3. The other half remains away from sunlight and experiences **night**.
4. Sunrise occurs when a place on the rotating Earth moves into the illuminated region, while sunset occurs when it moves into darkness.
5. Thus, the continuous rotation of the Earth produces the regular **day-night cycle**.

3. Describe the apparent movement of the Sun, Moon, and stars due to the Earth's rotation.

Answer:

1. The Earth rotates from West to East, making celestial objects appear to move in the opposite direction.
2. The Sun appears to rise in the eastward direction and move across the sky from East to West.
3. It appears to set in the westward direction, after which stars become visible.
4. The Moon also appears to rise in the eastward direction and set in the westward direction.

5. The stars similarly appear to move across the sky because of the Earth's rotation.

4. Explain the revolution of the Earth and how it changes our view of the night sky.

Answer:

1. **Revolution** is the motion of one object around another object.
2. The Earth revolves around the Sun along a path called its **orbit**.
3. The Earth's orbit around the Sun is nearly circular when viewed from the top.
4. The Earth takes about **365 days and 6 hours** to complete one revolution around the Sun.
5. As the Earth revolves continuously, the stars visible in the night sky gradually change throughout the year because we look in different directions in space.

5. Explain how seasons occur on the Earth.

Answer:

1. The Earth's axis of rotation is **tilted** with respect to its orbit around the Sun.
2. The Earth maintains this tilt while it revolves around the Sun.
3. In June, the Northern Hemisphere is tilted towards the Sun and receives more intense sunlight for a longer duration.
4. In December, the situation is reversed, and the Northern Hemisphere receives sunlight for a shorter duration.
5. Thus, the **tilt of the Earth's axis and the spherical shape of the Earth** give rise to seasons.

6. Describe the summer solstice, winter solstice, and equinoxes in the Northern Hemisphere.

Answer:

1. The longest day in the Northern Hemisphere occurs around **21 June** and is called the **summer solstice**.
2. After the summer solstice, the duration of daytime gradually becomes shorter while the night becomes longer.
3. The shortest day and longest night occur around **22 December**, called the **winter solstice**.
4. Around **21 March**, daytime lasts for 12 hours, and this is called the **spring equinox**.
5. Around **23 September**, daytime again lasts for 12 hours, and this is called the **autumn equinox**.

7. Explain the occurrence of a solar eclipse and distinguish between total and partial solar eclipses.

Answer:

1. A **solar eclipse** occurs when the Moon comes between the Sun and the Earth and obstructs sunlight from reaching us.
2. The Moon can cover the Sun because their apparent sizes in the sky are similar when viewed from the Earth.
3. During a **total solar eclipse**, the Moon's shadow falls on a small area of the Earth where the Sun is completely hidden.
4. A **partial solar eclipse** occurs in areas where the Moon blocks only some regions of the Sun.
5. During a total solar eclipse, it becomes dark for a few minutes because sunlight is blocked from reaching that part of the Earth.

8. Explain a lunar eclipse and its types.

Answer:

1. A **lunar eclipse** occurs when the Earth blocks sunlight from reaching the Moon.
2. During the eclipse, the Earth's shadow falls on the Moon.

3. When the Moon is completely within the Earth's shadow, it is called a **total lunar eclipse**.
4. During a total lunar eclipse, the bright disc of the Moon appears dark red until it moves out of the Earth's shadow.
5. When only a part of the Moon lies within the Earth's shadow, it is called a **partial lunar eclipse**, and unlike a solar eclipse, an eclipsed Moon can be safely viewed with the naked eye.

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

1. Suppose the Earth suddenly stopped rotating on its axis. Predict how this would affect the day-night cycle and the apparent movement of celestial objects.
Answer:
1. The normal day-night cycle would no longer occur every 24 hours because this cycle is caused by the Earth's rotation.
2. A place on Earth would not regularly move from the illuminated side to the dark side as it does now.
3. The Sun would no longer appear to rise in the east and set in the west every day due to Earth's rotation.
4. The daily apparent movement of the Moon and stars across the sky would also be drastically changed.
5. Thus, Earth's rotation is essential for the regular 24-hour day-night cycle and the familiar daily apparent motion of celestial objects.

2. If the Earth's axis were not tilted with respect to its orbit, what changes would you expect in the seasons?
Answer:
1. Seasons occur because of the **tilt of the Earth's axis** together with the spherical shape of the Earth.
2. If the axis were not tilted, the seasonal variation in the duration and intensity of sunlight would be greatly reduced.
3. The Northern Hemisphere would not tilt towards the Sun in June and away from it in December as it presently does.
4. Therefore, the present pattern of summer and winter caused by these differences in sunlight would not occur in the same way.
5. Hence, the Earth's axial tilt plays a crucial role in producing the seasonal changes experienced during the year.

3. India experiences summer in June while the Southern Hemisphere experiences winter. Analyse why.
Answer:
1. In June, the Northern Hemisphere is tilted towards the Sun while the Southern Hemisphere is tilted away from it.
2. Sunrays falling on the Northern Hemisphere are spread over a smaller area and are therefore more intense.
3. The Northern Hemisphere also receives sunlight for more than 12 hours, resulting in greater heating.
4. In contrast, the Southern Hemisphere receives less intense sunlight and has shorter daytime.
5. Therefore, June corresponds broadly to summer in the Northern Hemisphere and winter in the Southern Hemisphere.

4. A student says, "Summer occurs because the Earth is closer to the Sun during that season." Evaluate this statement.

Answer:

1. The student's statement is **incorrect** because changes in the Earth-Sun distance are not the main cause of seasons.
2. The difference in the Earth's distance from the Sun during the year is too small to explain the seasons.
3. In fact, the Earth is closest to the Sun in **January**, when the Northern Hemisphere experiences winter.
4. Seasons mainly result from the Earth's tilted axis and its spherical shape, which affect the intensity and duration of sunlight received.
5. Therefore, seasonal temperature changes should be explained mainly through Earth's axial tilt rather than its distance from the Sun.

5. The Moon is much smaller than the Sun. Analyse how it can still completely cover the Sun during a total solar eclipse.

Answer:

1. An object's **apparent size** depends on both its actual physical size and its distance from the observer.
2. Although the Moon is much smaller than the Sun, it is also much closer to the Earth.
3. Therefore, the Moon and Sun have similar apparent sizes when viewed from the Earth.
4. When the Moon comes appropriately between the Earth and Sun, it can appear to cover the entire disc of the Sun.
5. Hence, a small region of the Earth falling within the Moon's shadow can experience a **total solar eclipse**.

6. Why can a total solar eclipse be observed only from a small region of the Earth, whereas a lunar eclipse can be observed from a much larger region?

Answer:

1. During a total solar eclipse, the Moon comes between the Sun and Earth and casts its shadow on the Earth.
2. The Moon's shadow falls on only a **small area** of the Earth's surface.
3. Therefore, only observers located within that small shadowed area can see the Sun completely covered.
4. During a lunar eclipse, however, the Earth's shadow falls on the Moon, so the eclipsed Moon can be seen from a much larger part of the Earth's night side.
5. Thus, the different shadow arrangements shown in the chapter's solar- and lunar-eclipse diagrams explain their different regions of visibility.

7. A person in India observes that it is daytime while a relative in the USA is experiencing night. Use the Earth's rotation to explain this observation.

Answer:

1. At any given time, sunlight illuminates only about half of the Earth's surface.
2. The side facing the Sun experiences **day**, while the opposite side experiences **night**.
3. Because India and the USA are located in different parts of the rotating Earth, they can lie on differently illuminated portions at the same time.
4. As the Earth rotates from West to East, different places continuously move into and out of sunlight.
5. Therefore, it can be daytime in India while it is night in parts of the USA because of the Earth's rotation and spherical shape.

8. A student wants to observe a solar eclipse using ordinary sunglasses because the Sun appears less bright during the eclipse. Assess whether this is safe and suggest a better method.

Answer:

1. Using ordinary sunglasses to observe a solar eclipse is **unsafe**.
2. Even during an eclipse, sunlight is intense enough to damage the eyes and may cause blindness.
3. The Sun should also not be viewed directly through binoculars or telescopes.
4. A safer choice is to attend an organised eclipse-viewing programme where specialised eye protection is provided, or use a properly supervised projection method described in the chapter.
5. Therefore, scientific safety precautions must always be followed even when the Sun appears partially or almost completely covered.

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

1. Rohan notices that the Sun appears in the east every morning and disappears in the west every evening. Apply your knowledge of Earth's rotation to explain this observation.

Answer:

1. The Earth rotates on its own axis from **West to East** and completes one rotation in about 24 hours.
2. Because we are standing on the rotating Earth, the Sun only **appears** to move across the sky in the opposite direction.
3. As Rohan's location rotates into the illuminated side of the Earth, he observes **sunrise in the east**.
4. As his location later rotates away from sunlight, he observes **sunset in the west**.
5. Thus, the apparent daily movement of the Sun is actually an effect of the Earth's rotation rather than the Sun travelling around the Earth each day.

2. A student in India calls a relative in the USA during daytime and finds that it is night there. Explain this situation using the concepts learned in the chapter.

Answer:

1. At any particular time, only about half of the Earth receives sunlight.
2. The half facing the Sun experiences **day**, while the other half experiences **night**.
3. India and the USA are situated at different locations on the Earth's surface.
4. Because the Earth rotates continuously from West to East, different locations enter and leave the illuminated region at different times.
5. Therefore, when India is experiencing daytime, parts of the USA can be experiencing night.

3. The Indian cricket team travels to Australia in December. Based on your understanding of seasons, what kind of clothes should the players pack? Explain.

Answer:

1. Australia lies in the **Southern Hemisphere**, while India lies in the Northern Hemisphere.
2. The seasons in the Southern Hemisphere are reversed compared with those in the Northern Hemisphere.
3. In December, the Northern Hemisphere experiences winter because it receives less intense sunlight for a shorter duration.
4. During the same period, the Southern Hemisphere experiences **summer**.
5. Therefore, the players should mainly pack **summer or light clothing** for their December visit to Australia, while also considering local weather conditions.

4. Your school plans to organise a solar-eclipse observation programme. Suggest five precautions or arrangements that should be made for safe observation.

Answer:

1. Students should be clearly instructed **not to look directly at the Sun**, because its intense light can damage their eyes.
2. Ordinary sunglasses should not be used for observing a solar eclipse.
3. Students should also never look at the Sun through binoculars or telescopes without appropriate specialised protection.
4. The school can arrange specialised eye protection or use a supervised method in which the Sun's image is projected onto a screen.
5. The entire activity should be conducted under proper teacher or astronomy-expert supervision so that students can observe the eclipse safely.

5. Meera observes the Big Dipper at different times on the same night and finds that it appears to change its position around the Pole Star. Apply your knowledge to explain her observations.

Answer:

1. The Earth continuously rotates on its axis from West to East.
2. Because of this rotation, stars appear to move across the night sky.
3. The Earth's axis of rotation points very close to the **Pole Star** in the Northern Hemisphere.
4. Therefore, the Pole Star appears nearly stationary while stars such as those of the Big Dipper appear to move around it.
5. Meera can confirm this apparent movement by sketching the Big Dipper's position at intervals of about two hours during the same night.

6. A farmer observes that different groups of stars become visible during different months of the year. How can this observation be explained and applied?

Answer:

1. The Earth not only rotates on its axis but also **revolves around the Sun**.
2. It takes about **365 days and 6 hours** to complete one revolution around the Sun.
3. As the Earth moves along its orbit, we look towards different regions of the sky at night during different parts of the year.
4. Therefore, the stars visible after sunset gradually change over the course of a year.
5. Such observations can have practical value; for example, the chapter notes that the **Bhil and Pawara communities** used the appearance of certain star patterns as markers for the arrival of monsoon rain.

7. During a total solar eclipse, a child asks, "How can the small Moon cover the huge Sun?" Explain this using a simple everyday example.

Answer:

1. The apparent size of an object depends on both its **actual size and its distance from the observer**.
2. A thumb held close to the eye can appear large enough to cover the head of a person standing several metres away.
3. Similarly, the Moon is physically much smaller than the Sun but is also much closer to the Earth.
4. Consequently, the Moon and Sun can have similar apparent sizes when viewed from Earth.
5. Therefore, when the Moon comes between the Sun and Earth in the proper alignment, it can appear to cover the entire Sun and produce a total solar eclipse.

8. A student says that summer occurs because the Earth moves much closer to the Sun. How would you use the chapter to correct this misconception?

Answer:

1. The student should first understand that the difference in the Earth's distance from the Sun during the year is too small to explain the seasons.

2. In fact, the chapter states that the Earth is **closest to the Sun in January**, when the Northern Hemisphere is experiencing winter.
3. Seasons occur mainly because the Earth's **axis is tilted** and the Earth has a spherical shape.
4. In June, for example, the Northern Hemisphere receives more intense sunlight and sunlight for a longer duration, producing summer conditions there.
5. Therefore, seasonal changes are explained mainly by Earth's axial tilt and the resulting differences in the intensity and duration of sunlight, not simply by Earth-Sun distance.

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

1. If the Earth suddenly started rotating from East to West instead of West to East, which change would most likely be observed?
A) The Sun would appear to rise in the West and set in the East
B) The Sun would stop appearing to move
C) There would be no day and night
D) The length of a year would become shorter
Answer: A) The Sun would appear to rise in the West and set in the East

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2. An observer sees the Big Dipper changing its position around the Pole Star during a night. What is primarily responsible for this apparent movement?
A) Revolution of the Moon
B) Rotation of the Earth
C) Revolution of the Earth
D) Movement of the Pole Star around Earth
Answer: B) Rotation of the Earth

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3. Which combination correctly describes the Earth's motion?

Rotation	Revolution
A) About its axis	Around the Sun
B) Around the Sun	About its axis
C) Around the Moon	Around the Sun
D) Around the Sun	Around the Moon

Answer: A) About its axis; Around the Sun

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4. A student shines a torch on a globe in a dark room. At any instant, approximately half of the globe is illuminated. This activity best demonstrates:
A) seasons
B) lunar eclipse
C) day and night
D) revolution of the Moon
Answer: C) Day and night

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5. Sunrise occurs earlier in the eastern part of India mainly because:
A) eastern India is closer to the Sun
B) the Earth rotates from West to East
C) the Sun revolves around the Earth
D) the Earth rotates from East to West
Answer: B) The Earth rotates from West to East

6. Suppose the Earth continued to revolve around the Sun but did not rotate on its axis. Which phenomenon described in the chapter would no longer occur in its present approximately 24-hour pattern?
A) Seasons
B) The ordinary day-night cycle
C) Solar eclipses
D) Lunar eclipses
Answer: B) The ordinary day-night cycle

7. Different groups of stars are seen after sunset during different months mainly because:
A) stars disappear during some months
B) the Earth revolves around the Sun
C) the Moon blocks different stars
D) the Earth changes its direction of rotation
Answer: B) The Earth revolves around the Sun

8. Which statement about Earth's orbit is correct according to the chapter?
A) It is perfectly rectangular
B) It is highly elongated
C) It is nearly circular when viewed from the top
D) It changes from circular to triangular during the year
Answer: C) It is nearly circular when viewed from the top

9. The Earth takes approximately how long to complete one revolution around the Sun?
A) 24 hours
B) 30 days
C) 365 days and 6 hours
D) 12 hours
Answer: C) 365 days and 6 hours

10. In June, the Northern Hemisphere experiences summer mainly because it:
A) becomes much closer to the Sun
B) receives more intense sunlight for a longer duration
C) rotates faster than in December
D) receives sunlight only at night
Answer: B) Receives more intense sunlight for a longer duration

11. If it is summer in the Northern Hemisphere, which season would generally occur in the Southern Hemisphere?
A) Summer
B) Winter
C) The same season everywhere
D) No season
Answer: B) Winter

12. Which observation provides the strongest evidence that the Earth-Sun distance is not the main cause of seasons?
A) Earth rotates once in about 24 hours
B) Earth is closest to the Sun in January

C) The Moon revolves around Earth
D) Stars are visible at night
Answer: B) Earth is closest to the Sun in January

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13. In the Northern Hemisphere, the longest day of the year occurs around:
A) 21 March
B) 21 June
C) 23 September
D) 22 December
Answer: B) 21 June

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14. A student records approximately 12 hours of daytime on 21 March in the Northern Hemisphere. This day is associated with the:
A) winter solstice
B) summer solstice
C) spring equinox
D) lunar eclipse
Answer: C) Spring equinox

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15. Which sequence correctly represents the arrangement during a solar eclipse?
A) Sun → Earth → Moon
B) Earth → Sun → Moon
C) Sun → Moon → Earth
D) Moon → Sun → Earth
Answer: C) Sun → Moon → Earth

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16. Which sequence correctly represents the arrangement during a lunar eclipse?
A) Sun → Moon → Earth
B) Sun → Earth → Moon
C) Earth → Moon → Sun
D) Moon → Sun → Earth
Answer: B) Sun → Earth → Moon

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17. The Moon is much smaller than the Sun. Why can it nevertheless completely cover the Sun during a total solar eclipse?
A) The Moon becomes larger during an eclipse
B) The Sun becomes smaller during an eclipse
C) The Moon is much closer to Earth, giving it an apparent size similar to the Sun
D) The Earth magnifies the Moon
Answer: C) The Moon is much closer to Earth, giving it an apparent size similar to the Sun

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18. Venus is physically much larger than the Moon, yet it cannot completely cover the Sun as viewed from Earth. The best explanation is:
A) Venus does not receive sunlight
B) Venus is much farther from Earth, so its apparent size is much smaller
C) Venus does not move
D) Venus produces its own light
Answer: B) Venus is much farther from Earth, so its apparent size is much smaller

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19. An observer sees only a portion of the Sun covered by the Moon. The observer is witnessing:
A) a total lunar eclipse
B) a partial lunar eclipse
C) a total solar eclipse
D) a partial solar eclipse
Answer: D) A partial solar eclipse

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20. Why is a total solar eclipse visible from only a relatively small area of Earth?
A) The Sun shines only on a small part of Earth
B) The Moon's shadow falls on only a small area of Earth's surface
C) The Earth stops rotating during an eclipse
D) Clouds always cover the remaining parts of Earth
Answer: B) The Moon's shadow falls on only a small area of Earth's surface

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21. During a total lunar eclipse, the Moon:
A) completely disappears permanently
B) appears bright blue
C) can appear dark red while completely within Earth's shadow
D) produces its own red light
Answer: C) Can appear dark red while completely within Earth's shadow

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22. Which of the following is safe according to the chapter?
A) Looking directly at a solar eclipse
B) Watching a solar eclipse through ordinary sunglasses
C) Looking at a solar eclipse through binoculars
D) Watching an eclipsed full Moon with the naked eye
Answer: D) Watching an eclipsed full Moon with the naked eye

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23. Consider the following statements:
I. Earth rotates from West to East.
II. The Sun therefore appears to move from East to West.
III. Day and night are caused by Earth's revolution around the Sun.
Which option is correct?
A) I only
B) I and II only
C) II and III only
D) I, II and III
Answer: B) I and II only

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24. At the North Pole in June, according to the chapter's diagram, sunlight may be received for:
A) 6 hours
B) 12 hours
C) 18 hours
D) 24 hours
Answer: D) 24 hours

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25. If Earth's axis were not tilted with respect to its orbit, which consequence would be most directly expected based on the chapter?

A) Day and night would disappear
B) The seasonal variations caused by Earth's axial tilt would largely disappear
C) Earth would stop revolving
D) Solar eclipses would occur every day
Answer: B) The seasonal variations caused by Earth's axial tilt would largely disappear

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26. Which pair is incorrectly matched?
A) Rotation — Day and night
B) Revolution — Changing view of the night sky over a year
C) Axial tilt and spherical shape — Seasons
D) Revolution — Daily sunrise and sunset
Answer: D) Revolution — Daily sunrise and sunset

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27. Why does the Pole Star appear nearly stationary while other stars appear to move around it?
A) The Pole Star does not belong to our galaxy
B) Earth's rotational axis points very close to the Pole Star
C) The Pole Star revolves around Earth every 24 hours
D) The Pole Star is much closer to Earth than all other stars
Answer: B) Earth's rotational axis points very close to the Pole Star

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28. A cricket team travels from India to Australia in December. Based only on the broad seasonal pattern discussed in the chapter, which clothing would be more appropriate?
A) Mainly heavy winter clothing because December is winter everywhere
B) Mainly summer clothing because Australia is in the Southern Hemisphere
C) Only raincoats because December is monsoon everywhere
D) Clothing cannot be predicted because hemispheres have identical seasons
Answer: B) Mainly summer clothing because Australia is in the Southern Hemisphere

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29. Which statement best distinguishes rotation from revolution?
A) Rotation is motion around another object; revolution is motion about one's own axis
B) Rotation is motion about an axis; revolution is motion around another object
C) Both mean exactly the same type of motion
D) Rotation occurs only in stars and revolution only in planets
Answer: B) Rotation is motion about an axis; revolution is motion around another object

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30. Aryabhata compared the apparent movement of stars to stationary objects seen by a person travelling in a moving boat. Which scientific idea does this analogy illustrate?
A) Actual westward revolution of stars around Earth
B) Apparent motion caused by the observer's own motion
C) Stars moving because of Earth's revolution
D) Formation of seasons due to stars
Answer: B) Apparent motion caused by the observer's own motion

Answer Key
1-A, 2-B, 3-A, 4-C, 5-B, 6-B, 7-B, 8-C, 9-C, 10-B, 11-B, 12-B, 13-B, 14-C, 15-C, 16-B, 17-C, 18-B, 19-D, 20-B, 21-C, 22-D, 23-B, 24-D, 25-B, 26-D, 27-B, 28-B, 29-B, 30-B

12.15 Best Practices Opportunity List from the Chapter: (12 Ideas)

Best Practices for Teaching Chapter 12 – *Earth, Moon, and the Sun:*

The chapter lends itself especially well to **observation, model-based demonstrations, inquiry, and experiential learning**. It covers Earth's rotation and revolution, day and night, changing views of the night sky, seasons, and solar and lunar eclipses.

1. Activity-Based Globe–Light Demonstration:

Use a **globe and torch/electric lamp** to demonstrate Earth's rotation, day and night, and the direction of sunrise and sunset. Allow students themselves to rotate the globe from west to east and identify the illuminated and dark portions. This directly reinforces the textbook activity showing that the side facing the Sun experiences day while the other experiences night.

2. Learning through Real-Life Observation:

Encourage students to maintain a short **"Sky Observation Diary."** They can record the position and length of shadows in the morning, noon, and evening; sunrise and sunset directions; and visible stars or constellations. This connects classroom concepts with everyday observations, similar to the chapter's opening example of changing coconut-tree shadows.

3. Night-Sky Observation Project:

Organise a guided activity in which students observe the **Big Dipper (Saptarishi) and Pole Star (Dhruva Tara)** at different times during the same night. Students can sketch their positions and infer how Earth's rotation produces the apparent movement of stars while the Pole Star appears nearly stationary.

4. "Students as Celestial Bodies" Role Play:

Select three students to represent the **Sun, Earth, and Moon**. Have the "Earth" rotate while revolving around the "Sun," and let the "Moon" revolve around the "Earth." The same role play can demonstrate the arrangements for solar and lunar eclipses. This converts relatively abstract spatial relationships into a memorable physical experience.

5. Seasons with a Tilted-Globe Model:

Use a lamp as the Sun and move a **tilted globe around it**, keeping the direction of the tilt consistent. Ask students to compare illumination of the Northern and Southern Hemispheres at different positions. This helps them discover why the hemispheres experience opposite seasons and why summer has longer daylight.

6. Misconception-Correction Strategy:

Begin with statements such as **"Summer occurs because Earth is closer to the Sun"** and ask students whether they agree. Let them discuss and then use the globe model and chapter evidence to correct the misconception. The chapter specifically points out that Earth-Sun distance is not the reason for seasons and notes that Earth is actually closest to the Sun in January.

7. Eclipse Simulation and Comparison

Use three different-sized balls and a light source to model **total/partial solar eclipses and lunar eclipses**. Ask students to physically arrange the models as **Sun–Moon–Earth** for a solar eclipse and **Sun–Earth–Moon** for a lunar eclipse. Students can then prepare a comparison chart showing position, shadow formation, visibility, and type of eclipse.

8. Apparent-Size Demonstration

Recreate the chapter's **thumb-and-friend activity**: a nearby thumb can apparently cover a distant person's head. Use this to explain why the much smaller Moon can apparently cover the enormous Sun during a total solar eclipse—the apparent size depends on both physical size and distance.

9. Integrate Indian Scientific Heritage:

Introduce **Aryabhata's explanation of apparent celestial motion** and discuss his analogy of a person in a moving boat seeing stationary objects appear to move backward. Students can connect ancient Indian astronomical thinking with the modern explanation of Earth's rotation.

10. Promote Scientific Temper through Eclipse Education:

Use eclipses to distinguish **scientific explanations from myths and superstitions**. Students can prepare posters titled *"Eclipses: Science, Not Fear"* explaining how eclipses occur and the scientifically appropriate precautions for solar viewing. The chapter emphasizes that eclipses are predictable astronomical events and that direct viewing of the Sun must be avoided.

11. Digital Astronomy Integration:

Use astronomy simulation software to allow students to explore **upcoming eclipses, night-sky patterns, and celestial movements** from their own location. The chapter itself recommends using the computer version of Stellarium to obtain information about upcoming solar and lunar eclipses.

12. Inquiry-Based "What If?" Questions:

Conclude the chapter with higher-order questions such as: **"What if Earth stopped rotating?", "What if Earth's axis were not tilted?", "What if Earth's axial tilt increased?", and "Why can a lunar eclipse be seen over a larger region than a total solar eclipse?"** Such questions encourage prediction, reasoning, application, and scientific argument rather than memorisation. The chapter itself proposes investigating how an increased axial tilt might affect the severity of seasons.

Recommended Best-Practice Model: A particularly effective sequence for this chapter would be **Observe → Predict → Demonstrate → Discuss → Explain → Apply → Reflect**. This approach keeps students actively involved and develops **observation, spatial reasoning, scientific temper, inquiry skills, collaboration, and conceptual understanding** rather than relying mainly on textbook narration.

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

"Innovations" Opportunities while Teaching-Learning Chapter 12 – *Earth, Moon, and the Sun:*

The following innovative activities are suitable for **7th Standard students** and are closely aligned with the chapter concepts of Earth's rotation and revolution, seasons, changing night sky, and solar and lunar eclipses.

1. Digital Planetarium / Virtual Sky Lab:

Use a digital astronomy simulation or **Stellarium** to create a virtual night-sky laboratory. Students can change the date and time to observe sunrise and sunset, star movements, constellations, and upcoming eclipses. The chapter itself recommends Stellarium for obtaining information about solar and lunar eclipses visible from a particular location.

Innovation: Students become virtual astronomers rather than passive learners.

2. "Human Solar System" Simulation:

Transform the classroom or playground into a **living Solar System model**. Students take the roles of the Sun, Earth and Moon and physically demonstrate:

- Earth's rotation,
- Earth's revolution,
- Moon's revolution,
- day and night,
- seasons,
- solar eclipse, and
- lunar eclipse.

Students can record the simulation as a short educational video. This makes the spatial relationships involved in eclipses easier to visualise.

3. DIY Earth–Sun–Moon Working Model:

Organise students into small groups and challenge them to construct a **low-cost moving model** using balls, cardboard, sticks, lamps, discarded materials, or simple motors. The model should demonstrate at least three phenomena such as rotation, revolution, seasons and eclipses.
Innovation: Introduce a **Design–Build–Test–Explain** approach, integrating science with creativity and engineering.
4. Time-Lapse Shadow Investigation:
Students can mark the position of a stick's shadow at regular intervals during the school day and photograph each observation. The photographs can then be combined into a simple **time-lapse sequence** showing how the shadow changes.
This directly extends the chapter's opening observation about coconut-tree shadows changing during the day.
Innovation: Combines real-world observation, photography, measurement and scientific explanation.
5. Star-Trail and Constellation Investigation:
Create a **"Junior Astronomer Project."** Students observe the Big Dipper/Saptarishi and Pole Star at different times, make sketches or use suitable sky-observation technology, and compare observations. The textbook explains that the Pole Star appears nearly stationary while other stars appear to move around it because of Earth's rotation.
6. AR/VR-Based Space Exploration:
Where facilities are available, use **Augmented Reality (AR) or Virtual Reality (VR)** to allow students to virtually travel around the Earth, Moon and Sun. They can view Earth's tilted axis, revolution around the Sun and eclipse geometry from different perspectives.
Innovation: Difficult three-dimensional astronomical concepts become immersive learning experiences.
7. "What If?" Scientific Innovation Challenge:
Divide students into teams and give each team a hypothetical situation:

- What if Earth stopped rotating?
- What if Earth rotated from East to West?
- What if Earth's axis had no tilt?
- What if Earth's axial tilt increased?
- What if the Moon were much farther from Earth?

Students predict the consequences and present their reasoning through a poster, model or presentation. The chapter itself encourages investigation of what would happen to seasons without Earth's tilt and what might happen if the tilt increased.
8. Eclipse Myth-vs-Science Digital Campaign:
Ask groups to identify common beliefs about eclipses and prepare a **"Myth or Science?"** presentation, poster, short video or digital infographic. They should explain eclipses scientifically and include safe solar-viewing practices. The chapter discusses historical fears and superstitions surrounding eclipses and emphasizes scientific understanding and safe observation.
Innovation: Combines scientific temper, media literacy, communication and social awareness.
9. Ancient Indian Astronomy Meets Modern Science:
Create an **"Aryabhata Astronomy Corner."** Students can compare Aryabhata's explanation of apparent celestial motion with a modern globe-based demonstration of Earth's rotation. The chapter describes Aryabhata's explanation that apparent westward stellar motion results from Earth's rotation and records his remarkably close estimate of Earth's rotation period.
Innovation: Integrates **Indian Knowledge Systems (IKS), history, mathematics and modern astronomy**.
10. Astronomy Newsroom / School Magazine Project:

Turn the classroom into an **"Astronomy Newsroom."** Groups prepare short news reports on topics such as *Why Seasons Occur*, *How Solar Eclipses Happen*, *Why the Moon Turns Reddish During a Lunar Eclipse*, or *What If Earth's Tilt Increased?* The chapter itself suggests researching planetary tilt and writing an article for a newspaper or school magazine.

11. Gamified "Mission Earth–Moon–Sun":

Convert revision into a **mission-based learning game**. Teams progress through stations such as "Rotation Station," "Season Zone," "Constellation Challenge," "Solar Eclipse Mission," and "Lunar Eclipse Mission." Each successfully solved puzzle, diagram or HOTS question unlocks the next mission.

Innovation: Uses **gamification, teamwork, problem-solving and peer learning** to assess understanding without relying only on written tests.

12. Student Astronomy Innovation Exhibition:

Conclude the chapter with a mini **"Young Astronomers Innovation Expo."** Students exhibit working models, shadow investigations, constellation charts, eclipse models, digital presentations and "What If?" projects. The textbook itself encourages enquiry, innovation, exploration, curiosity and discovery in its learning activities.

These innovations shift the chapter from **"learning about astronomy" to "learning like an astronomer"** through observation, experimentation, modelling, digital technology, interdisciplinary learning, creativity and scientific enquiry.

12.17: Practicing Questions/Question Bank:

A. Fill in the Blanks:

1. The Earth completes one rotation in about ______ hours.
   Answer: 24
2. The Earth rotates from ______ to ______.
   Answer: West; East
3. The imaginary line around which the Earth rotates is called its ______.
   Answer: axis of rotation
4. The Earth's axis passes through the geographic ______ and ______ Poles.
   Answer: North; South
5. The Earth's rotation causes the cycle of ______ and ______.
   Answer: day; night
6. The Sun appears to rise in the ______ and set in the ______.
   Answer: East; West
7. The Pole Star appears nearly ______ in the night sky.
   Answer: stationary
8. The motion of an object around another object is called ______.
   Answer: revolution
9. The path followed by an object while revolving around another object is called its ______.
   Answer: orbit
10. The Earth completes one revolution around the Sun in about ______ days and ______ hours.
    Answer: 365; 6

11. The Earth's axis of rotation is ______ with respect to its orbit.
    Answer: tilted

12. In June, the Northern Hemisphere is tilted ______ the Sun.
    Answer: towards

13. In December, the Northern Hemisphere experiences ______.
    Answer: winter

14. The longest day in the Northern Hemisphere occurs around ______ June.
    Answer: 21

15. The shortest day in the Northern Hemisphere occurs around ______ December.
    Answer: 22

16. Around an equinox, daytime lasts approximately ______ hours.
    Answer: 12

17. When the Moon comes between the Sun and Earth and blocks sunlight, a ______ occurs.
    Answer: solar eclipse

18. When Earth blocks sunlight from reaching the Moon, a ______ occurs.
    Answer: lunar eclipse

19. When the Moon completely covers the Sun from our view, it is called a ______ solar eclipse.
    Answer: total

20. During a total lunar eclipse, the Moon appears ______ in colour.
    Answer: dark red

The chapter establishes that Earth rotates in about 24 hours and revolves around the Sun in about 365 days and 6 hours.

B. One-Mark Descriptive Questions:

Answer in one sentence.

1. **What is rotation?**
   Answer: Rotation is the motion of an object in which its parts move in circles around an imaginary line called its axis.

2. **How long does Earth take to complete one rotation?**
   Answer: Earth takes about 24 hours to complete one rotation.

3. **In which direction does Earth rotate?**
   Answer: Earth rotates from West to East.

4. **What causes day and night?**
   Answer: Earth's rotation on its axis causes day and night.

5. **Why does the Sun appear to move from East to West?**
   Answer: The Sun appears to move from East to West because Earth rotates from West to East.

6. **What is revolution?**
   Answer: Revolution is the motion of an object around another object.

7. **What is an orbit?**
   Answer: An orbit is the path taken by an object while revolving around another object.

8. **How long does Earth take to revolve around the Sun?**
   Answer: Earth takes about 365 days and 6 hours to revolve around the Sun.

9. **Why does the Pole Star appear nearly stationary?**
   Answer: It appears nearly stationary because Earth's axis of rotation points very close to the Pole Star.

10. **Why does our view of the night sky change during the year?**
    Answer: Our view changes because Earth continuously revolves around the Sun.

11. **What causes seasons on Earth?**
    Answer: Seasons occur because of the tilt of Earth's axis of rotation and Earth's spherical shape.

12. **What is the summer solstice in the Northern Hemisphere?**
    Answer: The summer solstice occurs around 21 June and is the longest day of the year.

13. **What is the winter solstice in the Northern Hemisphere?**
    Answer: The winter solstice occurs around 22 December and is the shortest day of the year.

14. **What is an equinox?**
    Answer: An equinox is a time when daytime lasts about 12 hours.

15. **What is a solar eclipse?**
    Answer: A solar eclipse occurs when the Moon comes between the Sun and Earth and blocks sunlight from reaching Earth.

16. **What is a total solar eclipse?**
    Answer: A total solar eclipse occurs when the Moon completely blocks the Sun as viewed from a particular area on Earth.

17. **What is a lunar eclipse?**
    Answer: A lunar eclipse occurs when Earth blocks sunlight from reaching the Moon.

18. **Can we safely view a lunar eclipse with the naked eye?**
    Answer: Yes, a lunar eclipse can be safely viewed with the naked eye.

19. **Why can the Moon cover the Sun even though it is much smaller?**
    Answer: The Moon is much closer to Earth, making its apparent size similar to that of the Sun.

20. **What are star trails?**
    Answer: Star trails are arcs recorded in long-exposure photographs due to the apparent motion of stars.

The chapter particularly emphasizes the different arrangements of the Sun, Earth and Moon during solar and lunar eclipses.

C. Two-Mark Descriptive Questions:

Answer in two sentences/points.

1. How does Earth's rotation cause day and night?

Answer:

1. The half of Earth facing the Sun experiences daytime, while the other half experiences night.
2. As Earth rotates from West to East, places continuously move between the illuminated and dark regions.

2. Differentiate between rotation and revolution.

Answer:

1. Rotation is Earth's spinning on its own axis and takes about 24 hours.
2. Revolution is Earth's movement around the Sun and takes about 365 days and 6 hours.

3. Why does the Sun appear to rise in the East?

Answer:

1. Earth rotates from West to East.
2. Therefore, the Sun appears to move in the opposite direction, from East to West.

4. Why does the Pole Star appear nearly stationary?

Answer:

1. Earth's axis of rotation points very close to the Pole Star.
2. Therefore, other stars appear to move around it while the Pole Star appears nearly stationary.

5. Why do different stars appear in the night sky during different months?

Answer:

1. Earth continuously revolves around the Sun.
2. Consequently, we look towards different regions of the sky at different times of the year.

6. Why does the Northern Hemisphere experience summer in June?

Answer:

1. In June, the Northern Hemisphere is tilted towards the Sun and receives more intense sunlight.
2. It also receives sunlight for a longer duration, resulting in summer.

7. Why are seasons opposite in the two hemispheres?

Answer:

1. When one hemisphere is tilted towards the Sun, the other is tilted away from it.
2. Therefore, when the Northern Hemisphere experiences summer, the Southern Hemisphere experiences winter.

8. Differentiate between total and partial solar eclipses.

Answer:

1. In a total solar eclipse, the Moon completely blocks the Sun from view.

2. In a partial solar eclipse, the Moon blocks only part of the Sun.

9. Differentiate between solar and lunar eclipses.

Answer:

1. A solar eclipse occurs when the Moon comes between the Sun and Earth.
2. A lunar eclipse occurs when Earth comes between the Sun and Moon.

10. Why should we not look directly at a solar eclipse?

Answer:

1. Even during an eclipse, sunlight is intense enough to damage the eyes.
2. Direct viewing can cause serious eye damage or blindness.

D. Three-Mark Descriptive Questions:

Answer in three sentences/points.

1. Explain Earth's rotation and its major effects.

Answer:

1. Earth rotates on its axis from West to East.
2. It takes about 24 hours to complete one rotation.
3. Rotation causes day and night and the apparent movement of the Sun, Moon and stars.

2. Explain how a globe and torch can demonstrate day and night.

Answer:

1. A globe represents Earth and a torch represents the Sun.
2. The illuminated half of the globe represents daytime, while the dark half represents night.
3. Rotating the globe from West to East demonstrates the continuous day-night cycle.

3. Explain Earth's revolution around the Sun.

Answer:

1. Earth revolves around the Sun in a nearly circular orbit.
2. One revolution takes approximately 365 days and 6 hours.
3. As Earth revolves, our view of the night sky gradually changes throughout the year.

4. Explain how Earth's axial tilt contributes to seasons.

Answer:

1. Earth's axis is tilted with respect to its orbit.
2. A hemisphere tilted towards the Sun receives more intense sunlight and longer daylight.

3. A hemisphere tilted away receives less intense sunlight and shorter daylight, resulting in seasonal changes.

5. Describe the summer and winter solstices in the Northern Hemisphere.

Answer:

1. Around 21 June, the Northern Hemisphere has its longest day, called the summer solstice.
2. Around 22 December, it has its shortest day and longest night, called the winter solstice.
3. Between these dates, the duration of daylight gradually changes.

6. Explain a total solar eclipse.

Answer:

1. A solar eclipse occurs when the Moon comes between the Sun and Earth.
2. The Moon's shadow falls on a small area of Earth's surface.
3. People within the region of total shadow observe the Sun completely covered.

7. Explain a lunar eclipse.

Answer:

1. A lunar eclipse occurs when Earth comes between the Sun and Moon.
2. Earth blocks sunlight from reaching the Moon and its shadow falls on the Moon.
3. When the entire Moon lies in Earth's shadow, a total lunar eclipse occurs.

8. Why is a total solar eclipse visible only for a short time from a particular place?

Answer:

1. The Moon's shadow falls only on a small region of Earth.
2. Earth rotates while the Moon also moves in its orbit.
3. Consequently, the Moon's shadow moves across Earth's surface and totality lasts only a few minutes.

9. Explain why the Moon can block the much larger Sun.

Answer:

1. Apparent size depends on an object's actual size and its distance from the observer.
2. Although the Moon is much smaller than the Sun, it is also much closer to Earth.
3. Therefore, the Moon and Sun can have similar apparent sizes in our sky.

10. Write three facts about the Pole Star and apparent stellar motion.

Answer:

1. Earth's rotational axis points very close to the Pole Star in the Northern Hemisphere.
2. Therefore, the Pole Star appears nearly stationary.
3. Other stars appear to move around it because of Earth's rotation.

E. Five-Mark Descriptive Questions:

Answer in five sentences/points.

1. Explain Earth's rotation and its consequences.

Answer:

1. Earth spins around its own imaginary axis, which passes through the North and South Poles.
2. It rotates from West to East and completes one rotation in about 24 hours.
3. The half facing the Sun experiences day, while the opposite half experiences night.
4. Rotation makes the Sun appear to rise in the East and set in the West.
5. It also causes the apparent daily movement of the Moon and stars across the sky.

2. Explain the formation of seasons on Earth.

Answer:

1. Earth's axis of rotation is tilted with respect to its orbit around the Sun.
2. Earth maintains this tilt while revolving around the Sun.
3. In June, the Northern Hemisphere is tilted towards the Sun and receives more intense sunlight for a longer time.
4. In December, it is tilted away from the Sun and receives less intense sunlight for a shorter time.
5. Thus, Earth's axial tilt together with its spherical shape produces seasonal changes.

3. Explain a solar eclipse with its types and safety precautions.

Answer:

1. A solar eclipse occurs when the Moon comes between the Sun and Earth and obstructs sunlight.
2. A total solar eclipse occurs where the Moon completely covers the Sun.
3. A partial solar eclipse occurs where only part of the Sun is blocked.
4. The Sun should never be viewed directly during an eclipse because its intense light can damage the eyes.
5. Solar eclipses should be observed using specialised eye protection or through scientifically organised viewing arrangements.

4. Explain a lunar eclipse and its types.

Answer:

1. A lunar eclipse occurs when Earth comes between the Sun and Moon.
2. Earth blocks sunlight from reaching the Moon and casts its shadow on it.
3. When the entire Moon enters Earth's shadow, a total lunar eclipse occurs.

4. When only part of the Moon enters Earth's shadow, a partial lunar eclipse occurs.
5. Unlike a solar eclipse, a lunar eclipse can be safely observed with the naked eye.

5. Compare rotation and revolution of Earth.

Answer:

1. Rotation is Earth's movement around its own axis, whereas revolution is its movement around the Sun.
2. Rotation takes about 24 hours, whereas revolution takes about 365 days and 6 hours.
3. Rotation occurs from West to East.
4. Rotation causes day and night and the apparent daily movement of celestial objects.
5. Revolution causes our view of the night sky to change during the year and, together with Earth's axial tilt and spherical shape, is associated with seasonal patterns.

6. Explain the important astronomical events associated with June, December, March and September in the Northern Hemisphere.

Answer:

1. Around 21 June occurs the summer solstice, which has the longest day.
2. Around 22 December occurs the winter solstice, which has the shortest day and longest night.
3. Around 21 March, day lasts approximately 12 hours and the spring equinox occurs.
4. Around 23 September, day again lasts approximately 12 hours and the autumn equinox occurs.
5. These variations are connected with Earth's tilted axis as Earth revolves around the Sun.

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