Grade – 7 Science (Mastermind)

Chapter 1 – The Ever – Evolving World of Science

Assessment Corner

A. Tick (✓) the correct option

1. c) Organic acids
2. b) Copper
3. a) Reversible physical change
4. b) Condensation
5. b) Photosynthesis
6. d) Vitamin D
7. b) Moon between Sun and Earth
8. a) Second
9. c) Sulphur
10. b) Chemical to Light

B. Fill in the blanks

1. Photosynthesis
2. Sublimation
3. pH scale
4. Life
5. Shadow

C. True or False

1. False
2. False
3. False

4. True
5. False

D. Match the following

1. Evaporation — d) Liquid to gas
2. Freezing — c) Liquid to solid
3. Condensation — b) Gas to liquid
4. Sublimation — a) Solid to gas
5. Melting — e) Solid to liquid

E. Answer in brief

1. A physical change is a change in which only the form or appearance of a substance changes, but its chemical composition remains the same.
2. Photosynthesis is the process by which green plants use sunlight, carbon dioxide, and water to make food and release oxygen.
3. Burning of paper is an example of an irreversible change.
4. Water is called a universal solvent because it can dissolve many substances.
5. Day and night are caused by the rotation of the Earth on its axis.

F. Answer in detail

1. Heat causes physical changes by changing the state of matter. For example, ice melts into water on heating and water freezes into ice on cooling. These changes are reversible because the substance remains the same.
2. A battery-powered circuit consists of a battery, wires, and a device like a bulb. The battery provides electrical energy, which flows through wires and lights the bulb. It works only when the circuit is complete.
3. Photosynthesis is the process by which green plants prepare their food. They use sunlight, water, and carbon dioxide in the presence of chlorophyll. This process produces glucose and releases oxygen.
4. Reversible changes can be undone, like melting of ice. Irreversible changes cannot be reversed, like burning paper. Reversible changes

usually involve physical changes, while irreversible changes often involve chemical changes.

5. In ancient times, shadows were used to measure time using sundials. As the Sun moves, the position of the shadow changes. This helped people estimate time before clocks were invented.

Competency-Based Questions

A. Assertion–Reason

1. a
2. a
3. a
4. c
5. a

B. Case Study

1. b) Evaporation
2. b) Condensation
3. c) Precipitation
4. b) Infiltration
5. b) Transpiration

C. Art Integration (Idea Answer)

Art can be used to connect science and creativity by making models or drawings of scientific ideas. For example, a paper plane model can show how flight works. Using colors, diagrams, and storytelling makes learning more interesting and easy to understand.

Light and shadow can be used to create models showing day and night. By using a torch and a globe, we can demonstrate Earth's rotation. This helps explain scientific concepts in a creative way.

D. Critical Thinking

Example: The change of seasons is a natural phenomenon. To study it, we can observe temperature, sunlight, and weather patterns over time. We should record data regularly and carefully to ensure accuracy.

Science requires continuous questioning and learning. Even after finding answers, new questions arise. This helps in solving real-life problems like climate change and improving our understanding of the world.

E. Subject Link

1. Electricity has changed human life by making work easier and faster. It is used in homes, industries, and communication. Learning about it helps us use energy wisely and responsibly.
2. Early humans used shadows to tell time. Understanding Earth's rotation helps in studying geography and astronomy. Combining knowledge from different subjects helps explain natural events clearly.

Chapter 2 – Exploring Substances: Acidic, Basic and Neutral

NCERT Corner

Q1.
(iii) Vinegar

Q2.
(iii) Basic, acidic and basic

Q3.

1. Basic solution
2. Neutral solution
3. Acidic solution

Q4. The liquid is acidic in nature because blue litmus turns red, while red litmus and turmeric show no change.

Q5. Manya should use litmus paper because it easily distinguishes between acids and bases by colour change.

Q6. Example: Lemon juice (acid) and baking soda (base) can be used. When sprayed with an indicator like turmeric, colour changes reveal the hidden message.

Q7. The mixture will turn green because baking soda is basic, and red rose extract turns green in basic solutions.

Q8. The message can be revealed by using turmeric indicator, which changes colour in the presence of a base.

Q9. Natural indicators are prepared from plant extracts. For example, red cabbage juice changes colour in acidic and basic solutions.

Q10. Yes, using turmeric paper:
Vinegar shows no change (acid), baking soda turns it red (base), and sugar shows no change (neutral).

Q11. Liquid X is basic. On adding amla juice (acid), it will become neutral and the colour will change back.

Q12.
The soil can be acidic in nature.
The soil can be basic in nature.
Indicator: Litmus paper or pH paper
Acidic soil is treated with lime.
Basic soil is treated with organic matter or compost.

Assessment Corner

A. Tick (✓) the correct option

1. c
2. b
3. c
4. c
5. c
6. c
7. c
8. b
9. b
10. b

B. Fill in the blanks

1. neutralisation
2. brick red
3. Mineral
4. base
5. pink

C. True or False

1. True
2. False
3. True
4. True
5. True

D. Match the following

1. b
2. a
3. c
4. d
5. e

E. Answer in brief

1. Acids are substances that taste sour and turn blue litmus red. Examples are citric acid and lactic acid.
2. Bases are substances that taste bitter and feel soapy. They are used in making soap and toothpaste.
3. Indicators are substances that show colour change to identify acids and bases. Examples are turmeric and red cabbage juice.
4. A pH value of 7 indicates a neutral substance.
5. Neutralisation is a reaction in which an acid reacts with a base to form salt and water.

F. Answer in detail

1. Organic acids are found in living organisms like citric acid in lemon. Mineral acids are strong acids like hydrochloric acid. Organic acids are weak, while mineral acids are stronger.
2. Bases taste bitter and feel soapy. They turn red litmus blue and react with acids to form salt and water. Bases are used in cleaning and industries.
3. Indicators help identify acids and bases by colour change. Natural indicators include turmeric and red cabbage juice, while synthetic indicators include phenolphthalein and methyl orange.
4. Neutralisation is useful in daily life, like treating indigestion and soil treatment. It is also used in industries to neutralise waste.
5. Acid burns should be washed with water and treated with a mild base like baking soda. Safety precautions include wearing gloves and careful handling.

G. Brain Teaser

1. Wash the area with water and apply a mild base like baking soda to neutralise the acid.
2. The farmer can add lime to neutralise acidic soil and improve fertility.

Competency-Based Questions

A. Assertion–Reason

1. a
2. b
3. a
4. a
5. d

B. Case Study

1. c
2. c
3. c
4. d
5. c

C. Art Integration (Answer idea)

1. Natural indicators like turmeric and red cabbage show colour changes. Using charts or models makes the concept easy and interesting.

2. Ashwin and Keerthi visited a science fair and decided to test different liquids using red cabbage juice as an indicator. When they added lemon juice, it turned red, showing it was an acid. When they tested soap solution, it turned green, showing it was a base. Distilled water showed no change, so they understood it was neutral. They also mixed an acid and a base and observed neutralisation. Through their experiment, they learned that indicators help identify substances easily. Storytelling helps students connect emotionally and makes learning more enjoyable and memorable.

D. Critical Thinking

1. In daily life, lemon juice is an acid and is used in cooking because it adds a sour taste and helps preserve food. Soap is a base and is used for cleaning because it removes grease and dirt. Toothpaste is also a base and helps neutralise acids in the mouth, protecting teeth. Soap feels slippery because bases react with oils on the skin. Understanding acids and bases helps us make better choices for health and household activities.

2. As an environmental scientist, I would collect water samples from different areas of the river and test them using indicators and pH scale. I would observe the color change and measure the pH to identify whether the water is acidic or basic. Based on the results, I would suggest neutralising harmful wastes before releasing them into the river. Scientists have the responsibility to protect the environment, report accurate results, and ensure public safety while dealing with pollution.

E. Subject Link

1. After conducting the experiment, I would write a report including an introduction, materials, method, observations, and conclusion. I would mention that lemon juice turned the indicator red, soap solution turned it green, and distilled water showed no change. I would conclude that natural indicators help identify acids and bases. Writing a report helps in organizing thoughts clearly and improves understanding of scientific concepts.

2. Sulphuric acid is widely used in industries like fertiliser production and oil refining, which helps in economic growth and job creation. However, it can also cause pollution and health problems if not handled properly. To balance growth and environmental protection, industries should use proper waste treatment

methods and follow strict rules. Governments should make policies to control pollution and promote safe industrial practices.

Chapter 3 – Electricity: Circuits and their Components

NCERT Corner – Let Us Enhance Our Learning

Q1.
(i) is incorrect because a switch is not the source of electric current.

Q2.The lamp will not glow if an insulator (like plastic or rubber) is connected between A and B.

Q3. No, the other lamp will not glow because the circuit is broken when one filament is broken.

Q4. No, the lamp will not glow because the insulating covering prevents current flow.

Q5.A circuit diagram should include a cell, switch, bulb, and connecting wires using standard symbols.

Q6.
(i) No lamp will glow.
(ii) No lamp will glow.
(iii) Both L_1 and L_2 will glow.
(iv) No lamp will glow.

Q7.
Possible reasons:

- The bulb may be fused
- The battery may be dead
- Loose connections
- Broken wire

To find out: Check each component one by one and replace faulty parts.

Q8. The lamp will not glow in cases (c) and (d).

Q9. Method: Connect the battery in a circuit with a bulb. The terminal that allows the bulb to glow correctly identifies polarity.

Q10.
(i) Items: Bulb, wires, holder
(ii) Procedure: Connect each cell in the circuit and observe
(iii) Working cells will make the bulb glow

Q11. No, the LED will not glow. It must be connected correctly with proper polarity (positive to the longer terminal).

Exploratory Projects

1. If the power supply is disrupted for two days, I would not be able to use electrical appliances like lights, fans, and air conditioners. I would face difficulty in charging my mobile phone and using the internet. Cooking with electric appliances like induction or microwave would not be possible. Watching television and studying at night would also become difficult. Daily life would become uncomfortable and less efficient without electricity.

2. To run a toy fan using a solar panel, I would connect the wires of the solar panel to the motor of the fan. The positive wire of the solar panel should be connected to the positive terminal of the motor, and the negative wire to the negative terminal. When sunlight falls on the solar panel, it generates electricity, which makes the motor rotate and the fan starts moving. This shows how solar energy can be converted into electrical energy.

3. After visiting an electrical shop, I found that there are different types of cells, such as dry cells, button cells, rechargeable cells, and lithium-ion batteries. Dry cells are used in torches and remote controls. Button cells are used in watches and calculators. Rechargeable cells are used in toys and emergency lights. Lithium-ion batteries are used in mobile phones and laptops. Each cell is used according to the requirements of the device.

4. (i) Objects which are electrical insulators only:
Objects like plastic bottle, rubber, wooden chairs, and glass are electrical insulators because they do not allow electricity to pass through them.

(ii) Objects which are electrical conductors only:
Objects like copper wire, aluminium foil, iron nail, and steel spoon are conductors because they allow electricity to pass through them.

(iii) Objects made of both conductors and insulators:
Objects like electric wire, charger, electric iron, and plug are made of both conductors and insulators. The inner part is made of metal (conductor) and the outer covering is made of plastic or rubber (insulator) for safety.

Assessment Corner

A. Tick (✓) the correct option

1. c
2. b
3. a
4. b
5. b
6. b
7. b
8. b
9. b
10. b

B. Fill in the blanks

1. (+) plus
2. conductors
3. filament
4. plastic or rubber
5. electric

C. True or False

1. True
2. False

3. True
4. True
5. True

D. Match the following

1. b
2. a
3. c
4. d
5. e

E. Answer in brief

1. An electric cell is a device that supplies electrical energy.
2. Metals are used for wires because they are good conductors of electricity.
3. Conductors allow current to pass through them. Examples are copper and aluminium.
4. Electric wires have an insulating cover to prevent electric shocks.
5. A switch opens or closes a circuit to control the flow of current.

F. Answer in detail

1. A simple circuit consists of a cell, bulb, and wires. When connected properly, current flows and the bulb glows.
2. Conductors allow electricity to pass, while insulators do not. Examples: copper (conductor), rubber (insulator).
3. An LED works when current flows in one direction. It must be connected with correct polarity to glow.
4. Copper is preferred because it is a good conductor and cheaper than silver and gold.
5. Safety precautions include keeping hands dry, using insulated wires, and avoiding loose connections.

G. Brain Teaser

1. The circuit will not work because plastic is an insulator and blocks current.

2. Incorrect connection of cells will stop current flow or reduce efficiency.

Competency-Based Questions

A. Assertion–Reason

1. c
2. a
3. a
4. a
5. a

B. Case Study

1. d
2. a
3. a
4. c
5. c

C. Art Integration

1. I would design a poster showing important safety tips like not touching switches with wet hands, not inserting objects into sockets, and switching off appliances when not in use. I would use symbols such as a danger sign, lightning bolt, and crossed-out unsafe actions. Bright colours like red for danger and green for safety would be used to attract attention. Art helps communicate science concepts clearly by making them easy to understand and remember through visuals.

2. In the diagram or comic strip, I would show a battery, switch, bulb, and connecting wires. I would draw arrows to show the flow of electricity from the battery to the bulb when the switch is closed. I would also show that when the switch is open, the circuit breaks and the bulb does not glow. Visual storytelling improves understanding by simplifying complex ideas and making learning more engaging.

D. Critical Thinking

1. Copper is preferred for making electrical wires because it is a very good conductor of electricity and allows current to pass easily. It is also flexible and can be drawn into thin wires without breaking. Materials like plastic or wood are not used because they are insulators and do not allow electricity to pass through them. Copper is also safe and durable for household wiring.

2. If a lamp does not glow even when the circuit appears complete, there may be a loose connection, a fused bulb, or a dead battery. I would check each part of the circuit one by one, such as replacing the bulb, checking the battery, and ensuring all wires are properly connected. I would also test the switch to see if it is working properly. By testing each component step by step, I can identify and fix the problem.

E. Subject Link

1. Using renewable energy sources like solar and wind helps reduce pollution because they do not produce harmful gases like carbon dioxide. In contrast, coal and natural gas release pollutants that harm the environment and cause global warming. Renewable energy is important because it is clean, sustainable, and helps protect our environment for the future.

2. Understanding electrical circuits helps in subjects like physics, where we study current and energy, and in technology, where we use electrical devices. It is also useful in geography to understand power distribution and energy resources. For example, knowledge of circuits helps in repairing electrical appliances at home and using devices safely in daily life.

Chapter 4 – The World of Metals and Non-Metals

NCERT Corner

Q1. (i) Aluminium

Aluminium is commonly used for food packaging because it is light in weight, inexpensive, and highly malleable. It can be easily rolled into thin sheets without breaking. It is also resistant to corrosion and does not react with food, making it safe for packaging.

Q2. (iv) Sodium

Sodium is a highly reactive metal. When it comes in contact with water, it reacts violently and produces heat along with hydrogen gas. This hydrogen gas catches fire, making the reaction dangerous. Therefore, sodium is stored in kerosene to prevent contact with air and water.

Q3.

(i) False – Aluminium and copper are metals, not non-metals.
(ii) False – Metal oxides are basic in nature, not acidic.
(iii) True – Oxygen is essential for respiration.
(iv) True – Copper is a good conductor of heat, so it is used for boiling water.

Q4. Only a few metals are suitable for making jewellery because they are lustrous, corrosion-resistant, and easy to shape. Metals like gold and silver do not react easily with air or moisture, so they do not lose their shine. They are also malleable and ductile, which makes them easy to design into ornaments.

Q5.

(i) Used in electrical wiring → Copper
(ii) Most malleable and ductile → Gold
(iii) Living organisms cannot survive without it → Oxygen
(iv) Plants grow healthy with fertilisers → Nitrogen
(v) Used in water purification → Chlorine

Q6. When magnesium reacts with oxygen, it forms magnesium oxide, which is basic in nature. When sulphur reacts with oxygen, it forms sulphur dioxide, which is acidic in nature. Thus, metal oxides are basic, while non-metal oxides are acidic.

Q7.

Magnesium + Air + Heat → Ash
Ash + Water → Basic solution

When tested with litmus:

- Blue litmus shows no change
- Red litmus turns blue

Q8. Iron or copper is most suitable for making a pan because these metals are good conductors of heat. They allow heat to spread evenly, making cooking efficient. They are also strong and durable, which makes them suitable for daily use.

Q9. The iron nail dipped in oil will not rust because oil prevents contact with air and moisture. Since both air and water are required for rusting, blocking them prevents rust formation.

Q10. The uses of metals and non-metals depend on their properties. Metals are used in electrical wiring because they are good conductors of electricity. They are used in making utensils because they conduct heat well and are strong. Non-metals are used in fertilisers and medicines because of their chemical properties. Thus, properties decide their practical uses.

Q11. No, sulphur cannot be used to prevent rusting because it does not form a protective layer on iron. In contrast, zinc forms a protective coating over iron, which prevents rusting. Therefore, galvanisation is effective, but sulphur is not.

Q12. Heating makes iron soft and increases its malleability. This allows the iron to be easily hammered and shaped into different tools. Without heating, iron would be too hard to shape.

Assessment Corner

A. MCQs

1. b) Malleability
2. c) Gold
3. c) Sonority
4. c) They stay cool and prevent burns
5. b) Mercury
6. b) Copper
7. c) Both air and water
8. d) All of these
9. c) Basic oxide
10. b) Acidic Solution

B. Fill in the blanks

1. ductility.
2. rust.
3. heat and electricity.
4. galvanisation.
5. Sulphur dioxide

C. True or False

1. False
2. True
3. True
4. False
5. False

D. Match the following

1. Malleability → c. Hammered into thin sheets
2. Ductility →a. Ability to stretch into wires
3. Rust → b. Formation of rust on iron
4. Galvanisation → d. Coating iron with zinc
5. Sonority →e. Produces ringing sound when struck

E. Answer in Brief

1. Rusting is a chemical reaction in which iron reacts with oxygen and moisture to form a reddish-brown substance called rust, which weakens the metal.

2. Metals are good conductors of heat because they have free electrons that transfer heat energy quickly through the metal.

3. Sodium and potassium are two soft metals that can be cut easily with a knife.

4. Galvanisation is the process of coating iron with zinc to protect it from rusting.

5. Electricians use plastic or rubber handles because these materials are insulators and protect them from electric shocks.

F. Answer in Detail

1. Malleability is the property of a metal that allows it to be beaten into thin sheets without breaking. Ductility is the property that allows a metal to be drawn into thin wires. For example, aluminium is malleable, while copper is ductile. Both properties show how metals can be shaped easily.

2. Rusting is a chemical process in which iron reacts with oxygen and water to form rust. Both oxygen and moisture are necessary for rusting to occur. If either of them is absent, rusting does not take place. This process weakens the iron over time.

3. Metals are sonorous because they produce a ringing sound when struck. This happens due to their strong internal structure, which allows vibrations to travel easily. Non-metals do not have this property.

4. Metals react with oxygen to form basic oxides, while non-metals form acidic oxides. Some metals react with water to produce hydrogen gas and heat, but most non-metals do not react with water.

5. Rusting can be prevented by applying paint, oil, or grease on iron surfaces. It can also be prevented by galvanisation, where iron is coated with zinc. These methods prevent contact with air and moisture.

G. Brain Teaser

1. Mercury is considered a metal because it shows metallic properties such as conductivity, even though it is liquid at room temperature.

2. Sodium is highly reactive and reacts quickly with air and water, so it is stored in kerosene to prevent such reactions. Aluminium forms a protective oxide layer on its surface, which prevents further reaction.

Competency-Based Questions

Assertion–Reason Answers

1. a
2. d
3. a
4. a
5. d

Case Study Answers

1. c
2. b
3. b
4. c
5. b

C. Art Integration

1. I would design a large, colourful poster showing polluted and clean environments side by side. I would use dark colours like black and grey to represent pollution, such as smoke, dirty water, and plastic waste, and bright colours like green and blue to show clean air, water, and nature. Symbols like factories, vehicles, and garbage would represent pollutants, while trees and rivers would show a healthy environment. Art can raise awareness by visually showing the harmful effects of pollution and encouraging people to take action.

2. In the skit, the main characters would be a family and nature elements like water, air, and soil. The conflict would show people wasting water, cutting trees, and polluting the air. The resolution would show them understanding the importance of conservation and adopting habits like saving water and planting trees. Performing arts help connect emotionally because it makes people feel the impact of environmental damage and motivate them to act responsibly.

D. Critical Thinking

1. A metal that does not rust should be resistant to air and moisture and should not react easily with oxygen. It should be strong, durable, and long-lasting. Such a metal can be used in making bridges, buildings, vehicles, and machines. It would reduce maintenance costs and increase safety, which is beneficial both economically and environmentally.

2. Metals vs non-metals in use

Metals are strong, durable, and good conductors, so they are used in making tools, wires, and machines. Non-metals are lighter and often safer as they are insulators, so they are used in handles, coverings, and packaging. However, metals can be expensive and may rust, while some non-metals may not be very

strong. The choice of material depends on the purpose, cost, safety, and durability required for the product.

E. Subject Link

1. To reduce plastic waste, I would spread awareness in the community through meetings and posters. I would encourage people to use cloth bags and avoid single-use plastics. I would organize collection drives and recycling programs. I would involve students, families, and local authorities to work together. Skills like communication, teamwork, and leadership would help manage the project successfully.

2. I would create awareness by explaining the importance of saving water and electricity through discussions and demonstrations. I would suggest simple actions like turning off taps, switching off lights, and using energy-efficient devices. If people show less interest, I would motivate them by giving real-life examples and benefits. Clear communication and patience would help in making others understand and follow these practices.

Chapter 5 Change Around Us: Physical and Chemical

NCERT Corner

Q1. (c) (i) and (iii)

A physical change may involve a change in state, but no new substance is formed. The composition of the substance remains the same, so it can often be reversed.

Q2.

(i) Stitching cloth to a shirt – **Irreversible**, because it cannot return to original cloth form easily.
(ii) Twisting of straight string – **Reversible**, as it can be untwisted.
(iii) Making idlis from batter – **Irreversible**, new substance formed.
(iv) Dissolving sugar in water – **Reversible**, can recover sugar by evaporation.
(v) Drawing water from a well – **Reversible**, no change in substance.
(vi) Ripening of fruits – **Irreversible**, chemical change occurs.
(vii) Boiling water in open pan – **Reversible**, steam can condense.
(viii) Rolling up a mat – **Reversible**, can be unrolled.

(ix) Grinding wheat into flour – **Irreversible**, cannot get original grains.
(x) Formation of soil from rocks – **Irreversible**, long-term natural change.

Q3. True / False

(i) True
(ii) False – condensation is a physical change
(iii) True
(iv) True

Q4. Fill in the blanks

(i) Rusting, chemical
(ii) Physical, reversible
(iii) Combustion, chemical
(iv) Magnesium oxide, basic, chemical

Q5. These are physical changes because no new substance is formed and the process is reversible.

Q6. Curdling of milk is a chemical change because a new substance (curd) is formed and it cannot be reversed.

Q7. It is both physical and chemical change because rocks break into smaller pieces (physical) and also undergo chemical reactions over time.

Q8.

- Chopping vegetables → Physical change
- Collecting peels → Physical change
- Decomposition → Chemical change
- Germination and growth → Chemical change

Q9.

A (Physical):
Tearing paper, melting ice, folding clothes

B (Chemical):
Rusting, curdling milk, burning magnesium

C (Both):
Burning candle (wax melts + burns)

Q10. (a) and (d)

Because carbon dioxide is produced in these reactions, which turns lime water milky due to the formation of calcium carbonate.

Exploratory Projects

1. When lemon juice is used to write on paper, the message becomes invisible after drying. When the paper is heated, the message appears in brown colour because lemon juice undergoes a chemical change due to heat. This change is irreversible because the original invisible ink cannot be brought back again.

2. To reduce landslides and rock erosion, we should plant more trees as their roots hold the soil firmly. We should avoid cutting trees and control deforestation. Building strong retaining walls in hilly areas can prevent soil from sliding. Proper drainage systems should be made to control water flow. These steps can help protect life and property.

3. In the kitchen, some changes are physical and some are chemical. Cutting vegetables and melting butter are physical changes because no new substance is formed and they can be reversed in some cases. Cooking food and curdling of milk are chemical changes because new substances are formed and these changes cannot be reversed. Thus, both physical and chemical changes take place in the kitchen.

4. Yeast helps in making bread soft and fluffy through the process of fermentation. It converts sugar into carbon dioxide gas and alcohol. The carbon dioxide gas gets trapped in the dough and makes it rise. This is a chemical change because new substances are formed and the process cannot be reversed.

Yeast experiment (Balloon activity)

When yeast is added to a sugar solution in a bottle and covered with a balloon, the balloon starts to inflate after some time. This happens because yeast produces carbon dioxide gas during fermentation. When this gas is passed into lime water, the lime water turns milky, showing the presence of carbon dioxide. From this experiment, we conclude that yeast produces carbon dioxide gas. The formation of gas is a chemical change, while the inflation of the balloon is a physical change.

5. Chameleons change their colour to blend with their surroundings or to show emotions like anger or fear. This change can be reversed as they can change

their colour again depending on the situation. Therefore, it is a reversible change.

Assessment Corner

A. MCQs

1. c) Physical
2. d) Carbon dioxide
3. c) Burning wood
4. b) Carbon dioxide
5. b) Iron oxide
6. d) Burning a candle
7. c) Ignition temperature
8. c) Chemical change
9. b) Weathering of rocks
10. b) Physical and reversible change

B. Fill in the blanks

1. Carbon dioxide
2. Oxygen
3. Chemical
4. Physical
5. Iron oxide

C. True or False

1. False
2. False
3. False
4. True

D. Match the following

1. Combustion → b. Burning of magnesium
2. Chemical weathering →d. Reaction of minerals with water
3. Physical change →c. Melting ice
4. Rust → a. Iron oxide
5. Carbon dioxide →e. Turns lime water milky

E. Answer in Brief

1. A physical change is a change in which no new substance is formed and only the form or appearance of a substance changes.

2. When lime water reacts with carbon dioxide, it turns milky due to the formation of calcium carbonate.

3. A candle stops burning when covered with a glass tumbler because oxygen supply is cut off, and combustion cannot continue without oxygen.

4. No, rusting cannot be reversed easily because it is a chemical change that forms a new substance.

5. Ignition temperature is the minimum temperature at which a substance starts burning.

F. Answer in Detail

1. A physical change is a change in which no new substance is formed and the change is usually reversible. For example, melting of ice is a physical change. A chemical change is a change in which one or more new substances are formed and the change is usually irreversible. For example, rusting of iron is a chemical change.

2. When vinegar reacts with baking soda, carbon dioxide gas is produced along with other substances. This reaction shows fizzing due to gas formation. It proves that a chemical change has occurred because a new substance is formed.

3. Combustion is a chemical change because a substance reacts with oxygen and produces new substances like carbon dioxide and water vapour. Heat and light are also released, which confirms it is a chemical reaction.

4. Desirable changes are useful changes that benefit us, such as cooking food or making curd from milk. Undesirable changes are harmful changes, such as rusting of iron or spoiling of food.

5. Weathering breaks rocks into smaller pieces through physical and chemical processes. Over time, these particles mix with organic matter to form soil, which is essential for plant growth.

G. Brain Teaser

1. Tearing paper is a physical change because no new substance is formed. Burning paper is a chemical change because new substances like ash and gases are produced.

2. When a candle is covered, the oxygen supply reduces. Since oxygen is necessary for combustion, the flame goes out.

Competency-Based Question

Assertion–Reason Answers

1. d
2. a
3. c
4. a
5. d

Case Study Answers

1. c
2. b
3. c
4. b
5. c

C. Art Integration

1. I would design a poster or comic strip showing examples like melting ice as a physical change and burning wood as a chemical change. I would use simple drawings and labels to show that physical changes do not form new substances, while chemical changes do. Bright colours and step-by-step visuals would make the differences clear. Art helps students understand and remember concepts better by making learning visual and engaging.

2. I would create a 3D model showing the stages of rusting, such as iron reacting with air and moisture to form rust. I would use materials like cardboard, colours, and labels to explain each stage clearly. Integrating art with science makes learning more interesting and helps students understand complex processes easily through visual representation.

D. Critical Thinking

1. I do not agree that all changes that produce heat are chemical changes. Some physical changes can also produce heat, such as rubbing hands together. Chemical changes usually involve the formation of new substances, like burning wood. Therefore, producing heat alone does not always mean a chemical change.

2. When a candle burns, both physical and chemical changes occur together. The melting of wax is a physical change because it can be reversed, while the burning of wax is a chemical change because new substances like carbon dioxide and water are formed. We can distinguish these changes by observing whether a new substance is formed or not. Careful observation and comparison help in better understanding scientific concepts.

E. Subject Link

1. Weathering and erosion cause both physical and chemical changes on Earth's surface. These processes break rocks into smaller pieces and help in soil formation. For example, wind and water slowly wear down rocks over time. These slow changes shape landscapes and are important for plant growth and agriculture.

2. Burning fossil fuels causes chemical changes and releases gases like carbon dioxide, which contribute to climate change. Understanding combustion helps us reduce pollution by using cleaner energy sources like solar and wind. Sustainable practices like saving energy and reducing fuel use can help protect the environment and reduce harmful effects.

Chapter 6 – Adolescence: A Stage of Growth and Change

NCERT Corner

Q1. (i) Reason:
Pimples develop due to increased activity of oil (sebaceous) glands caused by hormonal changes during adolescence. Excess oil blocks skin pores and leads to pimples.

(ii) Remedy:
Ramesh should keep his face clean, wash it regularly with mild soap, avoid oily food, and maintain proper hygiene.

Q2. Option (b) is better because it represents a balanced diet containing nutrients like proteins, vitamins, minerals, and carbohydrates, which are essential for proper growth during adolescence.

Q3.

(i) Menstruation
(ii) Voice box
(iii) Puberty
(iv) Alcohol and drugs

Q4. No, Shalu is not correct. Adolescence includes not only physical changes but also emotional, mental, and behavioural changes.

Q5.

(i) Is it true that behaviour does not change during adolescence?
(ii) Can harmful substances really be controlled once addiction begins?

Q6. Adolescents may experience mood swings, increased sensitivity, confusion, desire for independence, and sometimes anxiety or stress.

Q7. Used sanitary pads should be wrapped properly and disposed of in bins. Cleanliness should be maintained, and pads should be changed regularly to prevent infections.

Q8. Mary may have had a goitre (iodine deficiency), while Manoj's neck swelling (Adam's apple) is a normal change in boys. Hence, treatment was different.

Q9.

Only in boys:

- Growth of moustache
- Growth of facial hair

- Change in voice

Only in girls:

- Development of breasts

Common in both:

- Pimples
- Hair in the pubic region
- Hair in armpits

Q10. Poster points

- Eat a balanced diet
- Maintain hygiene
- Exercise regularly
- Avoid drugs and alcohol
- Get proper sleep

Exploratory Projects

1. Interview on mental health

To understand mental health awareness, I would ask the following questions:

1. What does youth face the common mental health problems today?
2. How can students manage stress and anxiety effectively?
3. What role do schools and families play in supporting mental health?
4. What are some early signs of mental health issues?
5. How can we remove the stigma related to mental health in society?

These questions help in gaining awareness and understanding ways to improve mental well-being.

2. The play would show a young girl forced into early marriage and facing health and emotional problems. It would highlight how child marriage affects education, freedom, and overall development. The story would end with awareness and support from society to stop such practices. This play spreads

awareness about the harmful effects of child marriage, especially on the health of young girls.

3. On 21 June, a small yoga camp can be organised with the help of teachers. Students can practice simple asanas like Tadasana, Vrikshasana, and Pranayama. Yoga helps in improving physical health, concentration, and mental peace. Regular practice of yoga promotes a healthy and balanced lifestyle.

Assessment Corner

A. MCQs

1. b) Puberty
2. c) Testosterone
3. c) Adolescence
4. c) Calcium
5. c) Breast development
6. c) Wrap in paper and place in a dustbin
7. b) Drug and substance abuse
8. c) Endocrine glands
9. d) Water
10. d) Both (b) and (c)

B. Fill in the blanks

1. Adolescence
2. Estrogen
3. Calcium
4. Personal
5. Hormones

C. True / False

1. False

2. True
3. False
4. True
5. False

D. Match the following

1. Testosterone →b. Hormone in boys
2. Menstruation →c. Reproductive change in girls
3. Estrogen →a. Hormones in girls
4. Physical exercise →e. Boosts mental & physical fitness
5. Cyber safety →d. Responsible online use

E. Answer in Brief

1. Adolescence is the period of transition between childhood and adulthood marked by physical, emotional, and mental changes.

2. Secondary sexual characteristics are features that develop during puberty and distinguish males and females, such as voice change in boys and breast development in girls.

3. Maintaining hygiene during menstruation prevents infections and ensures good health.

4. Adolescents often experience mood swings and increased sensitivity.

5. A balanced diet is important because it provides nutrients required for rapid growth and development during adolescence.

F. Answer in Detail

1. Hormones are chemical substances produced by endocrine glands that control changes during adolescence. They regulate growth, the development of reproductive organs, and the appearance of secondary sexual characteristics. Hormones also influence emotional and behavioural changes.

2. During puberty, boys develop facial hair, a deeper voice, and increased muscle growth. Girls develop breasts and begin menstruation. In both, there is a rapid increase in height, growth of body hair, and development of reproductive organs.

3. Physical activity helps adolescents maintain fitness, improves mental health, reduces stress, and supports proper growth and development of bones and muscles.

4. Substance abuse affects both body and mind. It can damage organs, reduce concentration, lead to addiction, and negatively impact behaviour and decision-making.

5. Adolescents can maintain a healthy social life by respecting others, communicating properly, avoiding harmful influences, and following safe online behaviour.

G. Brain Teaser

1. Myths can be challenged through education, awareness programs, open discussions, and scientific understanding.

2. You should refuse firmly because such substances are addictive and harmful to health.

Competency-Based Questions

Assertion–Reason

1. c
2. a
3. d
4. a
5. d

Case Study

1. b
2. c
3. b
4. c
5. c

C. Art Integration

1. I would design a comic strip showing two adolescents discussing menstrual hygiene and the importance of using clean sanitary products. The comic would also show how to resist harmful substances by making healthy choices and saying no to peer pressure. Simple dialogues and visuals would help break taboos and spread awareness. Storytelling through art helps people understand sensitive topics easily and encourages safe practices.

2. I would create a collage showing physical, emotional, and social changes during adolescence using pictures, colours, and symbols. It would include growth, mood changes, friendships, and responsibilities. Creating such artwork helps adolescents express their feelings and understand their personal development. It also encourages self-reflection and builds confidence.

D. Critical Thinking

1. Myths about menstruation can reduce girls' confidence and prevent them from participating in daily activities. These beliefs can also spread fear and misinformation. Scientific education can help people understand that menstruation is a natural biological process. Awareness programs and open discussions can help challenge and change these misconceptions in society.

2. Media literacy helps teenagers identify reliable and correct information from the large amount of content available online. It protects them from false or misleading information, especially about health and puberty. In the digital age, this skill is important to make informed decisions and develop a correct understanding. It helps build critical thinking and responsible use of information.

E. Subject Link

1. Understanding scientific facts about physical and emotional changes during adolescence helps develop tolerance and respect for others. It promotes better relationships and mutual understanding in society. It also helps individuals accept themselves and others with confidence. This knowledge supports healthy social behaviour.

2. Today I noticed changes in my body and emotions, and I felt both confused and curious. I learned that these changes are part of growing up and are controlled by hormones. Understanding this made me feel more confident and less worried. Writing about my experiences helps me express my feelings clearly. Combining science with personal writing improves both understanding and emotional awareness.

Chapter 7 – Heat Transfer in Nature

NCERT Corner

Q1.

(i) d) A is a poor conductor, and B is a good conductor of heat
(ii) b) Pins I and II will fall earlier than pins III and IV
(iii) c) On the ceiling

Q2. Yes, this arrangement helps to keep the lassi cold for a longer time because the outer tumbler reduces heat transfer from the surroundings, acting as an insulating layer.

Q3. True / False

(i) False
(ii) True
(iii) False
(iv) False

Q4. Ice cubes get heat from the surroundings, such as air, the container, and nearby objects.

Q5. Smoke will move upwards because hot air rises due to convection currents.

Q6. The thermometer in figure (b) will record a higher temperature because convection causes hot water to rise upwards.

Q7. Hollow bricks trap air, and air is a poor conductor of heat, so they keep houses cooler.

Q8. Large water bodies heat and cool slowly, preventing extreme temperatures in nearby areas.

Q9. Water seeps into the ground through infiltration and gets stored between rocks and soil as groundwater.

Q10. The water cycle continuously circulates water through evaporation, condensation, and precipitation, ensuring redistribution and replenishment.

Exploratory Projects

1. A recharge pit is constructed by digging a deep pit in the ground and filling it with layers of gravel, sand, and stones. Rainwater from rooftops or nearby areas

is directed into this pit through pipes. The water slowly seeps into the ground and increases the groundwater level. This method helps in conserving water, preventing water wastage, and reducing water scarcity. It is an effective and eco-friendly way to store rainwater for future use.

2. When a thin paper strip is tightly wrapped around a metallic rod and heated with a candle while rotating, the paper does not burn easily. This is because the metal rod absorbs the heat and conducts it away from the paper. As a result, the paper does not reach its ignition temperature. This shows that metals are good conductors of heat.

3. When a spiral-shaped paper is suspended above a burning candle, it starts rotating. This happens because hot air rises upward from the flame, creating convection currents. The rising hot air pushes the spiral paper, causing it to move and rotate. This demonstrates the transfer of heat through convection in air.

Assessment Corner

A. MCQs

1. c) Copper
2. c) Sun
3. c) Radiation
4. b) Afternoon
5. b) Sand
6. c) Metals conduct heat efficiently
7. c) Condensation
8. c) It expands and becomes lighter
9. b) Recharge pits
10. c) Ladakh

B. Fill in the blanks

1. Radiation
2. Sea breeze
3. Poor
4. Infiltration
5. Condensation

C. True / False

1. False
2. False
3. True
4. True
5. True

D. Match the following

1. Conduction → c. Metal utensils
2. Convection → a. Transfer through liquid/gas
3. Radiation → b. No medium needed
4. Infiltration → e. Water enters soil
5. Ice stupa →d. Cold desert solution

E. Answer in Brief

1. Conduction is the transfer of heat through a material without the movement of the material itself.

2. Air is a poor conductor because its particles are far apart, so heat cannot transfer easily.

3. The Sun provides energy for evaporation, which drives the water cycle.

4. Infiltration is the process by which water enters the soil from the surface.

5. We feel warm due to radiation, which transfers heat without a medium.

F. Answer in Detail

1. Convection is the transfer of heat by the movement of particles in liquids and gases. When water or air is heated, it becomes lighter and rises, while cooler, denser parts sink. This creates convection currents. For example, boiling water and sea breeze formation.

2. In conduction, heat passes through a metal rod from the hot end to the cold end without movement of the rod itself. The particles transfer energy by vibrations and collisions.

3. The water cycle involves evaporation of water due to the Sun's heat, condensation to form clouds, and precipitation as rain. Water then returns to oceans and groundwater, completing the cycle.

4. During the day, land heats faster than water, causing warm air to rise and cooler air from the sea to move in (sea breeze). At night, land cools faster, and air moves from land to sea (land breeze).

5. Groundwater is stored in the pores of soil and rocks. Excessive use, deforestation, and reduced rainfall decrease groundwater levels, while rainwater harvesting helps replenish it.

G. Brain Teaser

1. Light-coloured clothes reflect heat, keeping the body cooler.

2. Houses should use insulating materials like hollow bricks, proper ventilation, and light-coluored roofs to reduce heat absorption.

Competency-Based Questions

Assertion–Reason

1. c
2. c
3. a
4. d
5. a

Case Study

1. c
2. d
3. b

4. b
5. b

C. Art Integration

1. I would create a poster showing conduction, convection, and radiation with real-life examples. Conduction can be shown by heating a metal rod, convection by boiling water where hot water rises, and radiation by heat coming from the Sun. I would use arrows and labels to explain each process clearly. This poster would help students understand heat transfer simply and visually.

2. I would draw a colourful diagram showing evaporation, condensation, precipitation, infiltration, and groundwater collection. I would show the Sun heating water bodies to cause evaporation, clouds forming through condensation, and rain falling as precipitation. Arrows would show the movement of water through each stage. This diagram helps in understanding the continuous cycle of water on Earth.

D. Critical Thinking

1. Even though radiation does not need a medium, space has no atmosphere to trap heat. Heat received from the Sun quickly escapes, so we feel cold in space. On Earth, the atmosphere helps retain heat and keeps the temperature balanced. Therefore, a lack of atmosphere makes space extremely cold.

2. The house made of hollow bricks will be more comfortable in summer because hollow bricks trap air, which is a poor conductor of heat. This reduces heat transfer into the house. In contrast, metal roofing conducts heat quickly, making the house hotter. Therefore, hollow bricks provide better insulation.

E. Subject Link

1. Gangtok has a cooler climate due to its location in the mountains, while Kerala has a warm and humid climate due to its coastal location. These differences affect daily life, clothing, and housing styles. People in Gangtok use warm clothes and insulated houses, while people in Kerala use light clothes and houses with good ventilation. Thus, climate influences lifestyle and living conditions.

2. Varahamihira contributed to the study of weather and climate through his observations and writings. He studied rainfall patterns, seasons, and natural changes. His work shows that ancient knowledge was based on careful observation and is connected to modern science. It highlights the importance of combining traditional knowledge with scientific understanding.

Chapter 8 – Measurement of Time and Motion

NCERT Corner

Q1. Speed of car

Speed = Distance ÷ Time
= 150 m ÷ 10 s = 15 m/s

Convert to km/h → 15 × 3.6 = **54 km/h**

Q2. Runner comparison

Runner 1 speed = 400 ÷ 50 = 8 m/s
Runner 2 speed = 400 ÷ 45 ≈ 8.89 m/s

Second runner is faster by ≈ 0.89 m/s

Q3. Train time

Time = Distance ÷ Speed
= 360 km ÷ 25 m/s

Convert speed → 25 m/s = 90 km/h

Time = 360 ÷ 90 = **4 hours**

Q4. Train calculations

Speed = 180 ÷ 3 = 60 km/h

(i) **60 km/h**
(ii) 60 ÷ 3.6 = **16.67 m/s**
(iii) Distance in 4 h = 60 × 4 = **240 km**

Q5. Horse vs train

Horse = 18 m/s = 18 × 3.6 = 64.8 km/h

Train = 72 km/h

Train is faster by 7.2 km/h

Q6.

A car on a straight highway moves with constant speed, so it shows uniform motion.
A car in city traffic keeps changing speed, so it shows non-uniform motion.

Q7.

Uniform motion → equal increase

Distances:
0, 8, **16**, 24, 32, 40, **48**, 56

Q8. No, the motion is not uniform because distances covered in equal time are different.

Q9.

Non-uniform motion is more common in daily life.
Examples:

- A bus in traffic
- Walking with stops
- Cycling on uneven roads

Q10. Complex speed

First 500 m → time = 500 ÷ 10 = 50 s
Next 500 m → time = 500 ÷ 5 = 100 s

Total used = 150 s
Remaining time = 200 − 150 = 50 s
Remaining distance = 1000 m

Required speed = 1000 ÷ 50 = **20 m/s**

Average speed = Total distance ÷ total time
= 2000 ÷ 200 = **10 m/s**

Q11. Table analysis

Distances are unequal → **Non-uniform motion**

Total distance = 60 m
Total time = 100 s

Average speed = 60 ÷ 100 = **0.6 m/s**

EXPLORATORY PROJECTS

Q1. Floating Bowl Water Clock

Aim:
To make a simple water clock using a floating bowl.

Materials Required:
Small bowl, bucket of water, pin/needle, stopwatch

Procedure:

1. Take a small bowl and make a tiny hole at the bottom.
2. Fill a bucket with water.
3. Place the bowl gently on the water.
4. Water slowly enters the bowl through the hole.
5. Note the time taken for the bowl to sink.
6. Repeat using bowls of different sizes and holes.

Observation:

- Bigger hole → bowl sinks faster
- Smaller hole → bowl sinks slower

Conclusion:
By adjusting the hole size, we can measure time. A proper setup can take about 24 minutes.

Q2.

Aim:
To measure pulse rate and use it to estimate time.

Activity:

1. Sit calmly and count pulse beats for 1 minute.
2. Example: 72 beats per minute
3. Now use pulse to measure time:
    - 36 beats ≈ 30 seconds
    - 72 beats ≈ 1 minute

A child lost a watch in a forest but used their pulse beats to estimate time and reach home safely.

Conclusion:
Pulse acts like a natural clock.

Q3. Reasons for differences:

- Human error in counting
- Air resistance
- Improper release (pushing instead of letting go)
- Length not measured correctly

How to control:

- Use the same length every time
- Release gently without push
- Take multiple readings and average them
- Use the stopwatch carefully

Conclusion:
Errors can be reduced by careful and repeated measurements.

Q4. Swing as a Pendulum

Aim:
To study the time period of a swing.

Procedure:

1. Measure time for 10 oscillations
2. Time period = Total time ÷ 10
3. Repeat with:
    - Different children (weights)
    - Different swing lengths

Observations:

- Weight does **not** affect time period

- Longer swing → more time period

Conclusion:

- Time period depends on **length**, not weight
- Yes, a swing acts like a **pendulum**

Q5. Olympic Race Speed Comparison

Method:
Speed = Distance ÷ Time

Example (approx):

- 100 m → ~10 s → 10 m/s
- 200 m → ~20 s → 10 m/s
- 400 m → ~45 s → ~8.9 m/s

Observation:

- Speed is highest in the **100 m race**

Conclusion:
Short-distance races have higher speeds because athletes can maintain maximum energy for a shorter time.

Assessment Corner

A. MCQs

1. c) Second
2. b) Water clock
3. b) Time period
4. b) Flow of sand
5. b) Speed = Distance / Time

6. c) Atomic clock
7. a) km/h or m/s
8. a) 50 km/h
9. c) Uniform linear motion
10. a) 24 minutes

B. Fill in the blanks

1. s
2. Oscillatory motion
3. Distance / Time
4. Sundial
5. Short

C. True / False

1. False
2. True
3. True
4. False
5. True

D. Match the following

1. Sundial → c. Shadow position
2. Hourglass → a. Flow of sand
3. Water clock →d. Flow of water
4. Candle clock →b. Burning candle
5. Atomic clock →e. Vibrations of atoms

E. Answer in Brief

1. Water clocks were important because they helped measure time even when sunlight was not available.

2. The time period of a pendulum is the time taken to complete one full oscillation.

3. In uniform motion, equal distances are covered in equal intervals of time, while in non-uniform motion, they are not.

4. Ancient people used water clocks, candle clocks, and hourglasses to measure time without sunlight.

5.One second is defined as the time taken for 9,192,631,770 vibrations of a cesium atom.

F. Answer in Detail

1. A simple pendulum measures time based on its regular oscillations. The time taken for one complete oscillation is constant for a given length. By counting the number of oscillations, we can measure time accurately. Therefore, pendulums are used in clocks.

2. Ancient civilizations used sundials to measure time based on the position of shadows. When sunlight was not available, they used water clocks, candle clocks, and hourglasses. These devices measured time using the flow of water, burning of wax, or falling sand.

3. Speed is defined as the distance covered per unit time. It is calculated using the formula speed = distance ÷ time. If any two values are known, the third can be calculated. For example, if a car travels 100 km in 2 hours, its speed is 50 km/h.

4. An hourglass measures time using sand flowing from one chamber to another through a narrow passage. The sand flows at a constant rate, so a fixed amount of time is measured each time it empties.

5. Precise time measurement is important in sports to determine winners when differences are very small. In medicine, it helps in monitoring heart rate, giving medicines at correct intervals, and performing accurate treatments.

G. Brain Teaser

1.

5 seconds/hour × 24 hours = 120 seconds = 2 minutes

The clock will be 2 minutes fast, which can disturb daily schedules.

2. Average speed of train

Average speed = Total distance ÷ total time

Let distance = 2d

Time = d/60 + d/40
= (2d + 3d) / 120 = 5d/120

Average speed = 2d ÷ (5d/120)
= 240/5 = 48 km/h

Competency-Based Questions

Assertion–Reason

1. a
2. a
3. c
4. d
5. c

Case Study

1. b
2. c
3. b
4. d
5. b

Chapter 9 - Life Processes in Animals

NCERT Corner

Q1.

Food → Mouth → Oesophagus → Stomach → Small intestine → Large intestine → Anus

Q2.

- Test tube A (chapati) → Blue-black (starch present)
- Test tube B (chewed chapati) → Light blue or no change (saliva breaks starch)
- Test tube C (boiled potato) → Blue-black (starch present)

Reason: Saliva contains an enzyme (amylase) that breaks down starch.

Q3. (iii) To help in inhalation and exhalation

Q4.

- Nostrils → (a) Fresh air enters
- Nasal passages → (d) Trap dust and dirt
- Windpipe → (e) Air reaches lungs
- Alveoli → (b) Exchange of gases
- Ribcage → (c) Protects lungs

Q5.

- Is breathing only a movement of air, or does it produce energy?
- Does respiration occur inside cells?
- Can breathing happen without energy release?

This exposes the gap: breathing ≠ respiration

Q6. We inhale air

Because air contains oxygen + other gases.

Q7. Sneezing removes dust and irritants trapped in nasal passages. It is a protective reflex.

Q8.

- Anusha may have lower stamina
- Her body may need more oxygen
- She may be less physically fit

Q9. He is testing the effect of saliva on starch digestion.

Iodine turns blue-black only when starch is present.
Tube with saliva → no blue-black → starch broken.

Q10.

She is testing the presence of carbon dioxide in exhaled air.

Confirmation: Lime water turns milky due to CO_2.

Assessment Corner

A. MCQs

1. b) Exchange of gases
2. b) Mouth
3. c) Nasal hairs and mucus
4. b) Alveoli
5. c) Oxygen
6. b) Liver
7. b) Small intestine
8. b) Contracts and moves downward
9. b) Fish
10. c) Respiration

B. Fill in the blanks

1. Digestion
2. Rib cage
3. Alveoli
4. Energy
5. Peristalsis

C. True / False

1. False
2. True

3. False
4. True
5. False

D. Match the following

1. Alveoli →b. Gas exchange sacs
2. Liver → c. Secretes bile
3. Pancreas → a. Digestive enzyme
4. Saliva →d. Breaks down starch
5. Gills → e. Breathing organ in fish

E. Answer in Brief

1. Breathing is the physical movement of air in and out of the lungs, while respiration is a chemical process that releases energy from food.

2. The liver and pancreas secrete digestive juices into the small intestine.

3. The diaphragm contracts and moves downward during inhalation, increasing chest space and allowing air to enter the lungs.

4. Breathing through the nose is better because it filters dust, warms, and moistens the air.

5. Food moves to the small intestine, where digestion is completed and nutrients are absorbed.

F. Answer in Detail

1. Food enters the mouth where it is chewed and mixed with saliva. It then passes through the oesophagus into the stomach, where it is partially digested. From the stomach, food moves into the small intestine where digestion is completed and nutrients are absorbed. The remaining waste passes into the large intestine and is finally removed through the anus.

2. Gas exchange occurs in the alveoli of the lungs. Oxygen from inhaled air diffuses into the blood, while carbon dioxide from the blood diffuses into the alveoli and is exhaled. This process ensures that oxygen reaches body cells for energy production.

3. Animals living in water, like fish, use gills to extract oxygen from water. Land animals use lungs to breathe air. Gills are adapted to absorb dissolved oxygen, while lungs are adapted to take oxygen from air.

4. Saliva contains enzymes that begin the digestion of carbohydrates by breaking starch into simpler sugars. It also moistens food, making it easier to swallow.

5. A model using a bottle, balloons, and rubber sheet demonstrates breathing. The balloons act as lungs and the rubber sheet acts as the diaphragm. When the sheet is pulled down, the balloons inflate, showing inhalation. When pushed up, they deflate, showing exhalation.

G. Brain Teaser

1. Ruminants chew their food multiple times to properly digest tough plant material like cellulose.

2.Smoking damages lungs, reduces oxygen intake, and can cause diseases like bronchitis and lung cancer. It also decreases overall health and stamina.

Competency-Based Questions

Assertion–Reason

1. a
2. c
3. a
4. d
5. a

Case Study

1. b
2. b
3. b
4. b
5. c

C. ART INTEGRATION

1. Respiratory System Diagram & Explanation
A labelled diagram/model should include nostrils, trachea, lungs, alveoli, and diaphragm with arrows showing air movement.

Explanation:
The artwork helps in understanding the process of breathing and gas exchange. Oxygen enters through nostrils, passes through the trachea, and reaches the lungs. In the alveoli, oxygen enters the blood and carbon dioxide is removed. The use of colours and labels makes the concept clear and easy to remember. Artistic representation improves visualization and learning of scientific concepts.

2. Comic Strip – Journey of Food

Answer:
The comic should show:

- Ingestion in mouth (chewing)
- Movement through food pipe
- Digestion in stomach
- Absorption in small intestine
- Respiration in cells (energy release)

Explanation:
Storytelling through a comic simplifies complex processes like digestion and respiration. It helps learners understand step-by-step processes in an interesting and engaging way.

D. CRITICAL THINKING

1. Effect of Thickened Alveoli

Answer:
If alveoli walls become thick, oxygen exchange decreases. Less oxygen reaches body cells, so less energy is produced. The person may feel tired and have breathing difficulty.

Measures:

- Avoid smoking and pollution
- Regular exercise
- Healthy diet

- Medical treatment if required

2. Fish vs Amphibians

Answer:

- **Fish:**
  Breathe through gills, live in water
- **Amphibians:**
  Breathe through lungs and skin, live both on land and in water

Analysis:
These differences help them survive in their environments. Changes in habitat (like water pollution or drying ponds) can affect their survival.

Conservation Measures:

- Reduce water pollution
- Protect natural habitats
- Avoid overuse of chemicals

E. SUBJECT LINK

1. Cellular Respiration + Lime Water Test

Answer:
Cellular respiration is the process in which glucose reacts with oxygen to produce carbon dioxide, water, and energy.

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + Energy$$

Experiment:
When exhaled air is passed through lime water, it turns milky due to carbon dioxide.

Reason:
Carbon dioxide reacts with lime water to form calcium carbonate, which is milky.

2. Pollution and Respiratory System

Pollution and smoking damage the lungs and reduce breathing efficiency. They can cause diseases like asthma and bronchitis.

Environmental Link:
Air pollution harms both humans and nature.

Action Plan:

- Plant more trees
- Reduce vehicle use
- Avoid burning waste
- Spread awareness

Chapter 10 Life Process in Plants

NCERT Corner

Q1.

Feature	**Photosynthesis**	**Respiration**
Raw materials	Carbon dioxide + Water	Glucose + Oxygen
Products	Glucose + Oxygen	Carbon dioxide + Water + Energy
Word equation	$CO_2 + H_2O \rightarrow$ Glucose + O_2 (in sunlight, chlorophyll)	Glucose + $O_2 \rightarrow CO_2 + H_2O$ + Energy
Importance	Makes food for plants	Releases energy for life processes

Q2.

- No food production
- Oxygen levels drop
- Food chain collapses

- Life on Earth cannot survive

Q3.

- Starch comes from photosynthesis in leaves
- Food is transported to the potato via the phloem
- Stored as starch in potato

Q4. Broad and flat leaves provide larger surface area, allowing more sunlight absorption → higher photosynthesis efficiency.

Q5.

X + Y → Carbon dioxide + Z + Energy

- X = Glucose
- Y = Oxygen
- Z = Water

This is respiration

Q6.

(i) Testing idea: Sunlight is necessary for photosynthesis

(ii) Differences:

- Sunlight plant → green, healthy
- Dark plant → pale, weak

(iii) Iodine test:
Only sunlight plant leaves turn blue-black

Q7.

(i) Starch formed: (a) Sunlight + CO_2
(ii) No starch: (b), (c), (d)
(iii) Oxygen produced: (a)
(iv) No oxygen: (b), (c), (d)

Q8. Conclusion:

- Snail releases CO_2
- Plant uses CO_2 and releases O_2
- Shows balance between respiration & photosynthesis

Q9. Water moves faster in sunlight (due to transpiration pull)

Q10. Photosynthesis and respiration maintain oxygen–carbon dioxide balance in nature.

EXPLORATORY PROJECTS

1. Bottle Garden

In a closed bottle garden, plants can survive without external air or water supply. This is because:

- Plants use carbon dioxide for photosynthesis.
- They release oxygen, which is used for respiration.
- Water evaporates and condenses inside the bottle, so it gets recycled.

Conclusion:
Photosynthesis and respiration help maintain balance inside the closed system.

2. Importance of Plant Processes

Photosynthesis, respiration, and transport of water and food are essential for plant growth.

- Photosynthesis prepares food.
- Respiration releases energy.
- Transport system carries water and nutrients to all parts of the plant.

Conclusion:
All these processes work together to keep the plant alive and growing.

3. Visit to Greenhouse

In a greenhouse, conditions are controlled to help plants grow better.

- **Light:** Provided using sunlight or artificial lights
- **Water:** Given in proper amount through irrigation
- **Carbon dioxide:** Maintained for photosynthesis

Conclusion:
Controlled conditions increase plant growth and productivity.

Assessment Corner

A. MCQs

1. c) Leaf
2. b) Chlorophyll
3. c) Underside of leaf
4. b) Carbon dioxide
5. c) Starch
6. c) Xylem
7. b) Cannot prepare food
8. d) Stomata
9. c) Respiration
10. b) Transporting food

B. Fill in the blanks

1. Photosynthesis
2. Oxygen
3. Xylem
4. Oxygen
5. Starch

C. True / False

1. False
2. True
3. True
4. False
5. False

D. Match the following

1. Starch → c. Stored food in plants
2. Carbon dioxide →d. Enters during photosynthesis
3. Oxygen → a. Released in respiration
4. Xylem → e. Transports water
5. Chlorophyll →b. Leaf pigment

E. Answer in Brief

1. Tiny pores on leaves for gas exchange.

2. Sunlight, carbon dioxide, and water.

3. Transports water and minerals from roots to leaves.

4. Absorbs sunlight needed for photosynthesis.

5. Turns milky when exposed to carbon dioxide.

F. Answer in Detail

1. Photosynthesis is the process by which green plants make food using sunlight.

Word equation:
Carbon dioxide + Water → Glucose + Oxygen (in presence of sunlight and chlorophyll)

2.

- Take a potted plant and keep it in dark for 2 days (destarching).
- Cover part of a leaf with black paper.
- Keep the plant in sunlight for a few hours.
- Test the leaf with iodine solution.

Observation:

- Covered part does not turn blue-black.
- Uncovered part turns blue-black.

Conclusion:
Light is necessary for photosynthesis.

3. Role of Stomata

Stomata are small pores on the leaf.

- They help in transpiration (loss of water).
- They allow gas exchange (CO_2 enters, O_2 exits).

4.

- Xylem: Carries water and minerals from roots to leaves.
- Phloem: Carries food from leaves to other parts of the plant.

5.

- Take an aquatic plant in water.
- Place an inverted test tube over it.
- Keep it in sunlight.
- Gas collects in the test tube.

Test:
The gas supports burning → it is oxygen.

Conclusion:
Oxygen is released during photosynthesis.

G. BRAIN TEASERS

1. Non-green patches do not have chlorophyll, so photosynthesis does not occur there. Hence, no starch is formed.

2.
If stomata are blocked:

- No gas exchange
- No transpiration
- Photosynthesis decreases

Result: Plant growth will be affected.

Competency-Based Questions

Assertion–Reason

1. c
2. a
3. d
4. a
5. a

Case Study

1. b) To detect starch
2. c) Carbon dioxide
3. c) It did not receive sunlight
4. c) Leaves
5. c) Sunlight is necessary for starch production

C. ART INTEGRATION

1. Integrating traditional Indian art in subjects like Science and Mathematics helps students understand concepts better.

- It makes learning interesting and creative.
- Students learn about Indian culture and heritage.
- It improves imagination and thinking skills.

Conclusion:
Art integration makes learning enjoyable and meaningful.

2. Art Integrated Learning promotes:

- Experiential learning (learning by doing)
- Better understanding of concepts
- Increased student participation
- Improved memory and retention

Conclusion:
AIL helps students learn in a fun and effective way.

D. CRITICAL THINKING

1.
Critical thinking helps students:

- Understand information clearly
- Analyze facts and ideas
- Make correct decisions

Conclusion:
It helps students become independent and responsible learners.

2. Role of Socratic questioning
Socratic questioning helps students:

- Think deeply about a topic
- Ask questions and explore ideas
- Improve problem-solving skills

Conclusion:
It makes classroom learning more interactive and thoughtful.

E. SUBJECT LINK

1. Emotional intelligence helps students:

- Understand their feelings
- Build good relationships
- Handle stress and conflicts

Conclusion:
It improves both behaviour and academic performance.

2.
Decision-making skills help students:

- Choose the right actions
- Avoid negative peer pressure
- Make informed choices

Conclusion:
Good decision-making leads to better life choices and success.

Chapter 11: Light, Shadows & Reflections

NCERT CORNER

Q1. Sun, Pole Star
(They emit their own light. Moon, Mars, Venus, mirror do not.)

Q2.

Column A	Column B
(i) Pinhole	(c) Forms an inverted image
(ii) Opaque object	(a) Blocks light completely
(iii) Transparent object	(d) Light passes almost completely
(iv) Shado	(b) Dark region formed behind object

Q3. Only the person whose eye is in a straight line with the candle (i.e., **Sahil**)
(Because light travels in a straight line.)

Q4. (c)
(Shadow direction is opposite to sunlight direction.)

Q5. Shadow of ball (i) & (ii)

Answer:

- Ball closer to torch → larger shadow
- Ball closer to wall → smaller shadow

Q6.

Column A	Column B
(i) Torch close to ball	(b) Shadow larger
(ii) Torch far away	(a) Shadow smaller
(iii) Ball removed	(d) Bright spot
(iv) Two torches	(c) Two shadows

Q7. The image will be inverted (upside down).

Q8. The image shows lateral inversion (left-right reversal).

Q9.

(i) Shortest shadow: 12 PM
(ii) Reason: Sun is overhead, so shadow becomes minimal.

Q10. (i) Both statements are true

Q11. Yes
Mirrors should be fixed at 45° angles at both ends.

Q12. Shadow not seen when bird is high because it is very faint and spread out. When bird comes closer → shadow becomes clear and visible.

EXPLORATORY PROJECTS

1. Fireflies were seen earlier in many areas, but now they are rarely seen. This is because of air pollution, light pollution, and the use of pesticides. Their natural habitats are also being destroyed.
So, the number of fireflies has decreased due to human activities.

2. When the torch is covered with coloured transparent paper, the light changes its colour. The shadow formed also appears in that colour. When different coloured papers are used, different coloured shadows are seen.
So, the colour of the shadow depends on the colour of light.

3. When two plane mirrors are placed at an angle, more than one image is formed. The number of images depends on the angle between the mirrors. When the mirrors are parallel, many images are formed.
So, two mirrors can produce multiple images.

4. A small mirror can form the image of a large object. This is because the mirror reflects light from the object into our eyes. The size of the mirror does not affect the size of the image.
So, even a small mirror can show a large object.

ASSESSMENT CORNER

A. MCQs

1. b
2. b
3. c
4. b
5. a
6. c
7. c
8. b
9. b
10. a

B. Fill in the blanks

1. Straight
2. Virtual
3. Shadow
4. Inverted
5. Luminous

C. True / False

1. False
2. False
3. True
4. False
5. False

D. Match the following

1 c

2 d

3 a

4 b

5 e

E.

1. Lateral inversion is the sidewise reversal of an image in a plane mirror, where the left side appears right and the right side appears left.

2. The mirror reflects light rays, and our brain traces them backward in straight lines. This makes the image appear behind the mirror, though it is not actually there.

3.

- Pinhole camera → real, inverted image (can be obtained on a screen)
- Plane mirror → virtual, erect image (cannot be obtained on a screen)

4. The Sun is the main source of natural light on Earth.

5. Because it is a virtual image, formed by apparent intersection of light rays, not actual convergence.

F. Answer in Detail

1.

Light travels in a straight line, which can be shown using this experiment:

- Take three cardboard sheets and make small holes at the same position in each.
- Place them in a straight line.
- Put a candle behind the last sheet.

2. Formation:
A shadow is formed when an opaque object blocks the path of light.

Factors affecting shadow:

1. **Distance between light source and object**
    - Closer to light → larger shadow
    - Far from light → smaller shadow

2. **Distance between object and screen**
    - Closer to screen → sharper shadow
    - Far → blurred shadow
3. **Position of light source**
    - Changes direction and length of shadow
4. **Shape of object**
    - Shadow has the same outline as the object

3.

- Image is virtual (cannot be caught on screen)
- Image is erect (upright)
- Image is same size as the object
- Image is at same distance behind mirror as object is in front
- Shows lateral inversion

4. A pinhole camera works on the principle that light travels in straight lines.

- Light from the object passes through a small hole.
- Rays cross at the pinhole.
- An inverted image forms on the screen inside the box.

Key points:

- Image is real and inverted
- Smaller hole → sharper image
- Larger hole → brighter but blurred image

5. Function:
A periscope uses two plane mirrors placed at 45° angles. Light reflects from one mirror to another and reaches the eye.

Working Principle:
Based on the **reflection of light**.

Uses:

- In submarines to see above water

- By soldiers to see over walls

In crowded places to see over obstacles

COMPETENCY-BASED QUESTIONS

A. Assertion–Reason

1. **a)** Both A and R are true, and R is the correct explanation of A
2. **a)** Both A and R are true, and R is the correct explanation of A
3. **d)** A is false, but R is true
4. **a)** Both A and R are true, and R is the correct explanation of A
5. **b)** Both A and R are true, but R is not the correct explanation of A

B. Case Study

1. **b)** The image is virtual
2. **b)** Light travels in a straight line
3. **b)** The light rays cross after passing through the pinhole
4. **c)** It shows lateral inversion
5. **b)** Image becomes blurry

C. ART INTEGRATION

1. Plan for Art Project

The art project will be based on reflection and symmetry. I will draw patterns like a kaleidoscope using shapes and mirrors. I will use colours to show repeated designs. Reflection of light will be shown using mirror lines.
This will help to understand how light reflects and forms patterns.

2. Use of Kaleidoscope Patterns

Patterns made by a kaleidoscope can be used in clothes and buildings. These designs are beautiful and symmetrical. Science and art together help in creating new and creative designs.
This improves creativity and innovation.

D. CRITICAL THINKING

1. A plane mirror forms a virtual and upright image. The image is not actually reversed front to back. It only appears left-right reversed. This is called lateral

inversion.
So, the image is not distorted but correctly formed.

2. In a pinhole camera, light travels in straight lines and crosses at the hole. This makes the image inverted and real. In a plane mirror, light reflects and forms an upright image.
So, both form images differently due to light behaviour.

E. SUBJECT LINK

1. Light travels in straight lines and follows the law of reflection. The angle of incidence is equal to the angle of reflection. These angles can be measured using a protractor.
This helps in making devices like mirrors and periscopes.

2. The human eye forms images like a pinhole camera. Light enters the eye and forms an image on the retina. Both form inverted images. The brain makes the image appear upright.
So, the eye and pinhole camera work in a similar way.

Chapter- 12 Earth, Moon & Sun

NCERT CORNER

Q1. Both North Pole and South Pole receive about 24 hours of sunlight (in that position shown).

Q2.

(i) East, West
(ii) Rotation
(iii) Total

Q3. True / False

(i) False
(ii) True
(iii) False
(iv) False

(v) True
(vi) False

Q4. She will see Orion about 4 minutes earlier → around 7:56 pm.

Q5. Same group will be seen after one year (next 21 June).

Q6. Due to Earth's rotation → different parts face Sun at different times.

Q7.(iii) Aditya (looked directly at Sun → dangerous)

Q8. Solar eclipse: Sun – Moon – Earth
Lunar eclipse: Sun – Earth – Moon

Q9. Because Moon is much closer to Earth, so it appears same size as Sun.

Q10. Summer clothes (December = summer in Australia)

Q11.

Lunar → seen from large area (Earth's shadow large)
Solar → small area (Moon's shadow small)

Q12. No seasons; same climate all year.

EXPLORATORY PROJECT

(i) At different positions of the globe around the lamp, the amount of light falling on the Northern and Southern Hemispheres changes. Sometimes the Northern Hemisphere gets more light, and sometimes the Southern Hemisphere gets more light. At one position, both hemispheres receive almost equal light.
This shows that sunlight is not evenly distributed on Earth throughout the year.

(ii) When the globe is rotated, different parts of the Earth experience different lengths of day and night. In some positions, the days are longer and nights are shorter. In other positions, nights are longer and days are shorter.
This shows that the length of day and night changes at different times.

(iii) When the activity is repeated at different positions, the pattern of day and night keeps changing. The hemisphere tilted towards the lamp has longer days, while the other has longer nights.
This explains the reason for changing seasons on Earth.

ASSESSMENT CORNER

A. MCQs

1. b
2. b
3. b
4. b
5. b
6. b
7. a
8. b
9. b
10. c

B. Fill in the blanks

1. 365
2. Equal
3. 23.5°
4. Total
5. Summer

C. True / False

1. False
2. True
3. False
4. False
5. False

D. Match the following

1 Rotation	b
2 Revolution	a
3 Orbit	e
4 Solar Eclipse	c
5 Axis	d

E. Answer in Brief

1. Rotation is the spinning movement of the Earth on its own axis.
It takes about 24 hours and causes day and night.

2. Revolution is the movement of the Earth around the Sun in a fixed path called an orbit.
It takes about 365 days and 6 hours to complete one revolution.

3.

We experience seasons because:

- The Earth's axis is tilted (23.5°)
- The Earth revolves around the Sun

Due to this, different parts of Earth receive different amounts of sunlight at different times of the year.

4. The Moon is much smaller than the Sun, but it is much closer to the Earth. Because of this, it appears almost the same size as the Sun and can completely block it during a solar eclipse.

5.

- Never look directly at the Sun
- Use certified solar filters or eclipse glasses
- Use projection methods (like pinhole camera)
- Avoid sunglasses or naked-eye viewing

F. Answer in Detail

1.

The Earth rotates from west to east on its axis. This rotation causes different parts of the Earth to face the Sun at different times.

- The side facing the Sun experiences day
- The opposite side experiences night
- As Earth keeps rotating, day turns into night and night into day

Thus, rotation is responsible for the regular cycle of day and night.

2.

As the Earth revolves around the Sun:

- Its position in space keeps changing
- Different constellations become visible at different times

For example:

- Some stars are seen in summer
- Others are seen in winter

This happens because Earth is facing different directions in space during its orbit, so the night sky appears to change over the year.

3.

Seasons are caused by two main factors:

1. Tilt of Earth's axis (23.5°)
2. Revolution around the Sun

Explanation:

- When the Northern Hemisphere tilts towards the Sun → summer
- When it tilts away → winter
- When neither hemisphere tilts strongly → spring or autumn

Because of this tilt, sunlight falls at different angles, changing temperature and day length.

4.

Solar Eclipse	**Lunar Eclipse**
Moon comes between Sun and Earth	Earth comes between Sun and Moon

Solar Eclipse	Lunar Eclipse
Occurs during the day	Occurs at night
Sun is partially or fully blocked	Moon appears dark or reddish
Seen from a small area	Seen from a large area

5

Mercury and Venus:

- Are much farther from Earth than the Moon
- Appear very small in the sky

Because of this:

- They cannot cover the entire Sun
- They only pass in front of it (called transit)

Hence, they cannot cause total solar eclipses.

G. BRAIN TEASER

1. If the Earth's axis was not tilted, there would be no seasons. All places on Earth would receive equal sunlight throughout the year. Days and nights would be almost equal everywhere.
So, there would be no summer, winter, or rainy seasons.

2. The apparent size of an object depends on its actual size and its distance from us. If an object appears large enough, it can completely cover another object, causing an eclipse. If it appears smaller, it only passes in front of it and forms a transit.
So, apparent size decides whether we see an eclipse or a transit.

COMPETENCY-BASED

Assertion Reason

1. c
2. a
3. a

4. d
5. a

Case Study

1. b
2. a
3. b
4. b
5. c

C. ART INTEGRATION

1.

In the drawing, the Earth is shown at sunrise, noon, and sunset. The Sun is shown in different positions in the sky. At sunrise and sunset, shadows are long. At noon, the shadow is shortest. Trees and objects are drawn to show shadow changes.
This visual helps us understand that Earth rotates and causes changes in shadows and time of day.

2. In the story, the Moon or a star explains how it appears to move across the sky. This movement is due to the rotation and revolution of the Earth. The comic shows the changing positions of the Earth and sky objects.
This helps in understanding how celestial bodies appear to move. Storytelling makes learning easy and interesting.

D. CRITICAL THINKING

1.

If the Earth stopped rotating, one side would have continuous day and the other side would have continuous night. The day side would become very hot, and the night side would become very cold. This would affect weather, plants, animals, and human life.
So, Earth’s rotation is necessary for balance of life.

2.

The Moon appears the same size as the Sun because it is much closer to the Earth. Even though the Sun is very large, it is very far away. This makes their apparent sizes similar.
This helps scientists predict eclipses and understand space events.

E. SUBJECT LINK

1.

The Earth revolves around the Sun and is tilted on its axis. Because of this, different parts of Earth receive different amounts of sunlight. Places near the equator get almost equal sunlight throughout the year. Places away from the equator have more seasonal changes.
This causes different climates and seasons.

2. The Earth takes about 365 days and 6 hours to complete one revolution. These extra 6 hours are added every year. After 4 years, they become one extra day, called a leap year.
This keeps our calendar correct and helps in accurate time measurement.