

Textbook Exercise Solutions

Chapter 2: Acids, Bases and Neutral

Time to Assess (A1)

1. Turmeric
2. China rose (Hibiscus) indicator
3. Phenolphthalein
4. Methyl orange
5. Onion

NCERT QUESTIONS

1. A solution turns the red litmus paper to blue. Excess addition of which of the following solution would reverse the change? (i) Lime water (ii) Baking soda (iii) Vinegar (iv) Common salt solution

Ans. (iii) Vinegar. The solution that turned red litmus blue is basic. Adding excess vinegar (an acid) neutralises the base and reverses the change.

2. On adding red litmus to solution A it turns blue; on adding turmeric to B it turns red; on adding red rose extract to C it turns green. Which is the correct sequence for the nature of A, B and C?

Ans. (iv) Basic, basic and basic. Red litmus turning blue → A is basic. Turmeric turning red → B is basic. Red rose extract turning green → C is basic. So all three are basic.

3. Observe Figs. 2.13, 2.14 and 2.15 in which red rose extract paper strips are used. Label the nature of the solutions in each container.

Ans. Red rose (China rose) extract stays/ turns light pink in acids, light green in bases and does not change (remains its own colour) in neutral solutions. So: the container in which the strip turns light pink is acidic, the one in which it turns green is basic, and the one with no colour change is neutral. (Label each figure accordingly based on the observed colour.)

4. A liquid tested with indicators — Red litmus: No change; Blue litmus: Turned red; Turmeric: No change in colour. Identify the nature of the liquid and justify.

Ans. The liquid is acidic. Blue litmus turning red is the test for an acid, while red litmus shows no change with acids and turmeric does not change colour with acids — all three observations confirm an acidic nature.

5. Manya is blindfolded and given two unknown solutions to test whether they are acidic or basic. Which indicator should she use and why?

Ans. She should use an olfactory indicator such as onion extract, vanilla essence or clove oil. These indicators change their smell in acids and bases, so a blindfolded person can identify the nature of a solution by smell alone, without needing to see a colour change.

6. Suggest materials that can be used for writing the message on the white sheet of paper and what could be in the spray bottle. Make a table of possible combinations and the colour of the writing obtained.

Ans. The message can be written with a natural indicator and revealed by spraying an acid or base. Example combinations: (1) Write with turmeric solution → spray soap/lime water (base) → writing turns red. (2) Write with red rose extract → spray vinegar/lemon (acid) → writing turns pink. (3) Write with phenolphthalein → spray a base → writing turns pink. (4) Write with red cabbage extract → spray acid → pink; spray base → green.

7. Grape juice was mixed with red rose extract; the mixture got a tint of red colour. What will happen if baking soda is added to this mixture? Justify.

Ans. The red tint shows grape juice is acidic. Baking soda is a base; adding it neutralises the acid and makes the mixture basic, so the red rose extract changes from red/pink towards green.

8. Keerthi wrote a secret message using orange juice. Which indicator would you use to make it visible?

Ans. Orange juice is acidic. Spraying a basic indicator solution such as a base with red rose extract, or applying heat, makes the writing visible; using a blue litmus spray the acidic writing will turn it red, revealing the message.

9. How can natural indicators be prepared? Explain with an example.

Ans. Natural indicators are prepared by extracting coloured pigments from plants. Example — Red cabbage indicator: chop red cabbage, boil it in water, cool and strain. The purple filtrate is the indicator; it turns red/pink in acids and green in bases. Similarly, China rose petals soaked in warm water give red rose extract.

10. Three liquids are given — vinegar, baking soda solution and sugar solution. Can you identify them only using turmeric paper? Explain.

Ans. No, not all three can be distinguished by turmeric alone. Turmeric turns red only with a base, so baking soda solution can be identified (turns red). But turmeric shows no change with both acids and neutral solutions, so vinegar (acid) and sugar solution (neutral) cannot be told apart with turmeric — another indicator like blue litmus is needed.

11. The extract of red rose turns liquid X to green. What will be the nature of liquid X? What will happen when excess amla juice is added to liquid X?

Ans. Red rose extract turns green in a base, so liquid X is basic. Amla juice is acidic; adding excess amla juice neutralises X and makes it acidic, so the red rose extract colour changes from green back towards pink.

12. Complete the missing information in the flowchart (a garden with plants showing signs of poor health).

Ans. The soil can be acidic in nature OR basic in nature. The indicator used to test the soil is litmus (or a universal/pH indicator). Acidic soil can be treated with a base such as lime (calcium hydroxide / slaked lime). Basic soil can be treated with an acid (or organic compost / gypsum).

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. Which colour does blue litmus turn in acid?

Ans. a. Red

2. Turmeric changes colour with which type of substance?

Ans. b. Base

3. What is the product of a neutralisation reaction?

Ans. c. Salt and water

4. Which statement about acids is true?

Ans. c. They taste sour

5. Which is a natural indicator?

Ans. b. Turmeric

6. Which base is used in antacids?

Ans. c. Magnesium hydroxide

7. A solution has pH 7. It is:

Ans. c. Neutral

B. Fill in the blanks using suitable words.

1. Turmeric turns red with a base.
2. Acetic acid is present in vinegar.
3. Soap solution is basic in nature.
4. Litmus is obtained from lichen.
5. Lemon contains citric acid.
6. A substance with pH less than 7 is acidic (an acid).
7. Toothpaste neutralises acid in the mouth using a base.

C. Match the following

1. Sodium Hydroxide → Caustic Soda
2. Calcium Hydroxide → Slaked Lime
3. Ammonium Hydroxide → Used in removing stains and grease
4. Magnesium Hydroxide → Milk of Magnesia
5. Baking Soda → Sodium Bicarbonate

D. Answer in one word (VSA)

1. Name an olfactory indicator other than onion.

Ans. Vanilla essence (or clove oil).

2. What is the colour of turmeric in base?

Ans. Red.

3. Name the indicator obtained from lichens.

Ans. Litmus.

4. What is the taste of bases?

Ans. Bitter.

5. Which type of indicator changes its odour?

Ans. Olfactory indicator.

6. Which acid is present in an ant sting?

Ans. Formic acid.

7. What is the pH-value of the strongest base?

Ans. 14.

E. Assertion and Reason

Options: (a) Both A and R true, R is correct explanation of A. (b) Both A and R true, R not the correct explanation. (c) A true, R false. (d) A false, R true.

1. A: Acids turn blue litmus red. R: Acids release hydrogen ions.

Ans. (a) Both are true and R correctly explains A — acids release H^+ ions, which is why they turn blue litmus red.

2. A: Mixing acid and base gives salt and water. R: Mixing of acid and base is a neutralisation reaction.

Ans. (a) Both are true and R correctly explains A.

3. Antacid contains base. R: A base helps to neutralise excess acid.

Ans. (a) Both are true and R correctly explains A.

4. A: pH level 7 means neutral. R: Equal amounts of H^+ and OH^- ions.

Ans. (a) Both are true and R correctly explains A.

5. A: Turmeric changes colour with acid. R: Turmeric is an acid-base indicator.

Ans. (d) A is false (turmeric does NOT change colour with acid; it changes only with base), but R is true.

HOTS

1. Applying lime water to a rusty iron gate makes the rust fade. How does lime water help reduce rusting?

Ans. Rust is acidic in nature. Lime water is a mild base, so it neutralises the acidic rust and loosens it, helping the rust fade and slowing further rusting.

2. A river near a chemical factory shows fish deaths and very low pH. What might be the reason? Suggest a remedy.

Ans. Acidic effluents released by the factory have lowered the water's pH, making it too acidic for fish. Remedy: treat/neutralise the effluent with a base (like lime) before releasing it, and add lime to the affected water to raise the pH back to a safe level.

3. People who eat a lot of sweets often suffer from tooth decay. What is the chemical reason and how can it be prevented?

Ans. Bacteria act on sugar to form acids that attack tooth enamel, causing decay. It can be prevented by brushing with toothpaste (a base) which neutralises the acid, and by reducing sugary food.

Picture Based Assessment

1. Study the given presentation of the litmus test. What do you conclude?

Ans. Where blue litmus turns red the solution is acidic; where red litmus turns blue it is basic; where neither strip changes colour the solution is neutral. The test lets us classify each solution as acid, base or neutral.

2. (Detergent powder and soap) Name one chemical these substances contain. What is their nature? How can you test it?

Ans. Detergent powder and soap contain a base (e.g., sodium hydroxide / sodium carbonate). Their nature is basic. Test: add red litmus — it turns blue, or add turmeric — it turns red, confirming they are basic.

Value and Life Skill Based

1. Gargi spilled dilute acid, sprinkled baking soda and informed her teacher. What does Gargi's action reflect?

Ans. It reflects presence of mind, scientific understanding (using a base to neutralise spilled acid safely) and responsibility/honesty in informing the teacher about the accident.

Case Study Based Assessment (curd formation)

1. Why do spicy or oily foods often lead to acidity? How can we prevent it through lifestyle changes?

Ans. Spicy/oily foods stimulate extra production of acid in the stomach, causing acidity and a burning feeling. Prevention: eat smaller, balanced meals, avoid excess spicy/oily food, drink enough water and avoid eating late at night.

2. Vinegar removes rust stains. Which chemical property of vinegar makes this possible?

Ans. Vinegar is an acid (contains acetic acid). Its acidic property reacts with and dissolves the rust (an oxide), removing the stain.



3. Vinegar and baking soda mixed while cleaning a drain produced fizz. Which gas was released and why is the reaction useful?

Ans. Carbon dioxide gas is released when the acid (vinegar) reacts with the base (baking soda). The fizzing/bubbling action helps loosen and clear the clogged dirt in the drain.

Learn Holistically (pH Scale)

1. What is pH scale? How is it different from acid-base indicators?

Ans. The pH scale is a numbered scale from 0 to 14 that measures how acidic or basic a substance is (pH < 7 acidic, 7 neutral, > 7 basic). Unlike a simple indicator that only shows whether something is an acid or base, the pH scale gives the exact strength.

2. What will happen if wine is added with milk of magnesia?

Ans. Wine is acidic (around pH 4) and milk of magnesia is basic (around pH 10). They neutralise each other, moving the mixture towards neutral.

3. How will turmeric paste respond in a mixture of vinegar and lemon?

Ans. Vinegar and lemon are both acids, so the mixture is acidic. Turmeric shows no colour change in acids, so it stays yellow.

4. English: Write an article on 'Acids — as bane to society'.

Ans. Open-ended writing task. Key points to include: acid rain damages buildings, soil and aquatic life; industrial acidic effluents pollute rivers; acid attacks harm people; corrosion of metals. Conclude with the need for proper treatment and safe handling of acids.

5. Maths: Arrange the substances in increasing order of (a) acidic strength (b) basic strength.

Ans. (a) Increasing acidic strength = increasing towards pH 0 (e.g., soap < water < coffee < milk < vinegar < lemon < stomach acid < HCl). (b) Increasing basic strength = increasing towards pH 14 (e.g., blood < baking soda < milk of magnesia < ammonia < soap < bleach < drain cleaner).

6. List the primary colours, if any.

Ans. The primary colours are red, blue and yellow.

7. How can we use the learning about acids, bases and salts in art and painting?

Ans. Natural plant pigments (indicators) can be used as colours; acids and bases can be used to change or fix the colour of dyes; the colour-changing chemistry can create special effects in artwork.

Chapter 3: Electricity: Circuits and their Components

Time to Assess (A1)

1. Electric cell
2. Switch
3. Battery
4. Electric bulb
5. Filament

NCERT QUESTIONS

1. Choose the incorrect statement. (i) A switch is the source of electric current in a circuit. (ii) A switch helps to complete or break the circuit. (iii) A switch helps us to use electricity as per our requirement. (iv) When the switch is in 'OFF' position, there is an air gap between its terminals.

Ans. (i) is incorrect. A switch is NOT the source of electric current; the cell/battery is the source. A switch only completes or breaks the circuit.

2. Observe Fig. 3.16. With which material connected between ends A and B will the lamp NOT glow?

Ans. The lamp will not glow when an insulator (a material that does not conduct electricity), such as plastic, rubber, wood or glass, is connected between A and B, because it breaks the flow of current.

3. In Fig. 3.17, if the filament of one of the lamps is broken, will the other glow? Justify.

Ans. No. The two lamps are connected in a single (series) loop. A broken filament creates a gap that breaks the circuit, so no current flows and the other lamp also does not glow.

4. A student forgot to remove the insulator covering from the connecting wires. If the lamp and cell are working properly, will the lamp glow?

Ans. No. The plastic insulation prevents the metal wire from making electrical contact, so the circuit is not completed and the lamp will not glow.

5. Draw a circuit diagram for a simple torch using symbols for electric components.

Ans. Draw a closed loop containing the symbols for: two cells (battery), a switch and a bulb, all connected by wires. (Battery — switch — bulb — back to battery.)

6. In Fig. 3.18: (i) If S_2 is ON, S_1 is OFF, which lamp(s) glow? (ii) If S_2 is OFF, S_1 is ON? (iii) If both S_1 and S_2 are ON? (iv) If both are OFF?

Ans. (i) When S_2 is ON and S_1 is OFF, lamp L_2 glows.

(ii) When S_2 is OFF and S_1 is ON, lamp L_1 glows.

(iii) When both switches are ON, both lamps L_1 and L_2 glow.

(iv) When both switches are OFF, no lamp glows.

7. Vidyut's circuit (Fig. 3.19) does not glow even after closing the circuit. List as many possible reasons as you can and how you would find out why.

Ans. Possible reasons: the cell is dead/weak; the bulb's filament is fused; loose or broken connections; insulation not removed from wire ends; switch faulty; terminals connected wrongly. To find out: check each component one by one — replace the cell, test the bulb in another circuit, tighten/clean connections, scrape wire ends, and check the switch.

8. In Fig. 3.20, in which case(s) will the lamp NOT glow when the switch is closed?

Ans. The lamp/LED will not glow in the case where the LED is connected the wrong way round (reverse polarity), because an LED conducts only in one direction. (Identify the diagram where the LED's terminals are reversed — that bulb will not glow.)

9. The '+' and '-' symbols cannot be read on a battery. Suggest a method to identify the two terminals.

Ans. Connect the battery to an LED in a circuit. An LED glows only when its longer leg is connected to the positive terminal. By noting the connection at which the LED glows, you can identify the '+' terminal (the other is '-').

10. You are given six cells A–F; some work and some do not. Design an activity to identify which are working.

Ans. (i) Items required: a bulb (or LED), connecting wires and a bulb holder.

(ii) Procedure: connect each cell in turn to the bulb using the wires.

(iii) Carry out the activity: the cells that make the bulb glow are working; the cells that do not light the bulb are dead.

12. An LED requires two cells in series to glow. Tanya made the circuit in Fig. 3.21. Will the lamp glow? If not, draw the wires for correct connections.

Ans. As shown, the lamp will not glow because the two cells are not connected in series with correct polarity (positive of one cell to negative of the next). Reconnect so the two cells are in series (+ to –) and the LED's longer leg goes to the positive end — then it will glow.

PRACTICE FOCUS —

A. Choose the most appropriate answer.

1. Which component connects or disconnects an electric circuit?

Ans. a. Switch

2. The filament of a bulb is made of which metal?

Ans. c. Tungsten

3. A closed circuit allows:

Ans. a. Flow of current

4. Which is a good conductor of electricity?

Ans. c. Copper

5. What prevents electric shock from wires?

Ans. b. Plastic coating

6. Which converts chemical energy into electrical energy?

Ans. a. Electric cell

7. The direction of flow of electric current is:

Ans. b. Positive → Negative

B. Fill in the blanks using suitable words.

1. A switch is a device used to control the flow of electric current.
2. In an open circuit, the bulb does not glow.
3. The flow of electricity in a circuit is due to the movement of electrons (charges).
4. The best conductor of electricity is silver.
5. A torchlight works on direct (DC) current.



6. A material that does not conduct electricity is called an insulator.
7. Insulators are used in switchboards to prevent electric shock.

C. State True or False (correct the false ones).

1. An open circuit allows current to flow. — False. An open circuit does NOT allow current to flow.
2. Plastic is a good conductor of electricity. — False. Plastic is a good insulator.
3. The filament of a bulb is made of tungsten. — True.
4. LEDs consume more energy than bulbs. — False. LEDs consume LESS energy than bulbs.
5. A closed circuit means all components are properly connected. — True.
6. Rubber is used as an insulator. — True.
7. The battery converts electrical energy into chemical energy. — False. A battery converts chemical energy into electrical energy.
8. The longer leg of an LED is the positive terminal. — True.

D. Answer in one word (VSA).

1. What is the path of electric current called?
Ans. A circuit.
2. Which gas is filled in an electric bulb?
Ans. An inert gas (argon / nitrogen).
3. What type of current is produced by batteries?
Ans. Direct current (DC).
4. Which part of a bulb glows when current passes through?
Ans. The filament.
5. Which metal is most commonly used for electrical wiring?
Ans. Copper.
6. What kind of material does not conduct electricity?
Ans. An insulator.
7. What does LED stand for?
Ans. Light Emitting Diode.

E. Assertion and Reason.

1. A: Tungsten is used as a filament in bulbs. R: Tungsten has a very high melting point.
Ans. (a) Both true and R correctly explains A.

2. A: Copper is preferred over silver for wiring. R: Copper is cheaper and a good conductor of electricity.

Ans. (a) Both true and R correctly explains A.

3. A: The direction of current is opposite to the flow of electrons. R: Electrons flow from positive to negative terminal.

Ans. (c) A is true, but R is false — electrons actually flow from negative to positive terminal.

4. A: LED bulbs are better than filament bulbs. R: LED bulbs save energy and last longer.

Ans. (a) Both true and R correctly explains A.

HOTS

1. What will happen if you connect a bulb directly to both positive terminals of two cells?

Ans. The circuit will not be complete in the correct direction, so no proper current flows and the bulb will not glow. Cells must be connected positive-to-negative (in series) for current to flow.

2. If an LED glows only in one direction, what does it tell you about the flow of current?

Ans. It shows that current flows in only one direction in the circuit (it is direct current), and that an LED allows current to pass in only one direction (its positive leg must connect to the positive terminal).

3. A torchlight wasn't working. List three possible reasons and how to fix them.

Ans. (i) Dead cells — replace with new cells. (ii) Fused/loose bulb — tighten or replace the bulb. (iii) Loose connection or rust on contacts — clean the contacts and fix the connections.

Picture Based Assessment

1. Study the given electric circuits. In which will the bulb glow? Explain.

Ans. The bulb glows only in the circuit that forms a complete (closed) loop with the cell, where all connections are correct and there are no breaks. In circuits with a break, loose contact or wrong connection, the bulb will not glow.

2. Compare the given diagrams. Write two differences.

Ans. One diagram has a switch in the circuit while the other does not. With a switch, the circuit can be turned on/off (controlled), whereas without a switch the bulb stays on as long as it is connected. (Also, one is an open/broken circuit and the other a closed circuit.)

Value and Life Skill Based

Agastya replaced the old filament bulb with an LED bulb. What scientific understanding guided his choice and what environmental benefit does it provide?

Ans. He understood that LEDs use much less electrical energy and last longer than filament bulbs. The environmental benefit is saving energy (electricity), which reduces fuel consumption and pollution.

Case Study Based Assessment

1. What are the main components of a flashlight?

Ans. A cell/battery (source), a bulb or LED, a switch and connecting metal parts/wires.

2. How does the torch produce light even without external wires?

Ans. The metal strips and the spring inside the torch act as the connecting wires, forming a complete circuit between the cells, switch and bulb.

3. Why is the battery called the source of electric energy?

Ans. Because the battery converts the chemical energy stored in it into electrical energy, which drives the current through the circuit.

4. What type of circuit is formed inside a working torch — open or closed?

Ans. A closed circuit.

Learn Holistically (India's renewable energy / Solar Power)

- 1a. What are solar power plants?

Ans. Facilities that use solar panels to capture sunlight and convert it into electricity.

- 1b. Which type of electricity is produced here — AC or DC?

Ans. Solar panels produce direct current (DC), which is then converted to AC for use.

- 1c. How do these plants convert solar energy into electrical energy?

Ans. Solar (photovoltaic) cells in the panels absorb sunlight and convert the light energy directly into electrical energy.

2. Maths: Draw a bar graph comparing solar electricity production in 2022 and the 2030 target.

Ans. Open task — plot two bars: 2022 $\approx$ 57 GW and 2030 target = 500 GW (non-fossil fuel capacity).

- 3a. List the states where solar plants have been installed.

Ans. Open task — e.g., Rajasthan (Bhadla), Madhya Pradesh (Rewa), Karnataka (Pavagada/Shakti Sthala), Andhra Pradesh (Kurnool), Tamil Nadu (Muppandal), etc.

- 3b. Write the capitals of these states.

Ans. Rajasthan — Jaipur; Madhya Pradesh — Bhopal; Karnataka — Bengaluru; Andhra Pradesh — Amaravati; Tamil Nadu — Chennai.

- 4a. When and where was the first solar power plant installed in India?

Ans. Research task — India's early large solar capacity grew strongly from around 2010 onwards under the National Solar Mission.

- 4b. Which country produces the maximum solar electricity in the world?

Ans. China is currently the world's largest producer of solar electricity.

Chapter 4: The World of Metals and Non-metals

NCERT QUESTIONS

1. Which metal is commonly used to make food packaging materials as it is cheaper and its thin sheets can be folded easily? (i) Aluminium (ii) Copper (iii) Iron (iv) Gold

Ans. (i) Aluminium. It is cheap and highly malleable, so its thin foil sheets fold easily and are used for food packaging.

2. Which metal catches fire when it comes in contact with water? (i) Copper (ii) Aluminium (iii) Zinc (iv) Sodium



Ans. (iv) Sodium. It reacts vigorously with water and catches fire, which is why it is stored under kerosene.

3. State with reasons whether the statements are True [T] or False [F].

Ans. (i) Aluminium and copper are examples of non-metals used for making utensils and statues. — False. They are metals; the correct statement is that aluminium and copper are metals used for making utensils and statues.

(ii) Metal oxides combined with oxygen turn blue litmus red. — False. Metal oxides are basic, so they turn red litmus blue. (iii) Metal oxides turn blue litmus paper... — the correct statement: metals form oxides whose solution turns red litmus blue (basic).

(iv) Copper vessels are used for boiling water because they are good conductors of electricity. — False. Copper vessels are used because they are good conductors of HEAT.

4. Why are only a few metals suitable for making jewellery?

Ans. Only metals that are lustrous (shiny), malleable, ductile and do not corrode/react easily — such as gold and silver — are suitable for jewellery, so that ornaments stay shiny and can be shaped without tarnishing.

5. Match the uses in Column I with the jumbled names in Column II.

Ans. (i) Used in electrical wiring → (a) E N X Y G O = OXYGEN? No — unscramble to the metal: it is 'OXYGEN' letters give the right answer per key; intended match: electrical wiring → COPPER.

Unscrambled names: (a) ENXYGO = OXYGEN, (b) NECOHIRL = CHLORINE, (c) PEPORC = COPPER, (d) TENGOINR = NITROGEN, (e) OGD L = GOLD.

Correct matches: (i) Used in electrical wiring → Copper (PEPORC). (ii) Most malleable and ductile → Gold (OGDL). (iii) Living organisms cannot survive without it → Oxygen (ENXYGO). (iv) Plants grow healthy with fertilisers containing it → Nitrogen (TENGOINR). (v) Used in water purification → Chlorine (NECOHIRL).

6. What happens when oxygen reacts with magnesium and sulfur? What are the main differences in the nature of products formed?

Ans. Magnesium (a metal) burns in oxygen to form magnesium oxide, which is basic (turns red litmus blue). Sulfur (a non-metal) burns in oxygen to form sulfur dioxide, which is acidic (turns blue litmus red). So metal oxides are basic while non-metal oxides are acidic.

7. Complete the flow chart: ? + Air + Air → Ash → +Water → ? → add blue & red litmus → ...

Ans. The first '?' is a non-metal such as sulfur. Burning sulfur in air gives ash (sulfur dioxide), which dissolves in water to form an acid (sulfurous/sulfuric acid). Adding litmus: the blue litmus solution turns red (showing acid), while the red litmus stays 'Blue' indicates the basic case. The acidic non-metal oxide turns blue litmus red.

8. From Iron, copper, sulphur, coal, plastic, wood, cardboard — which would you choose to make a pan for boiling water and why?

Ans. Copper (or iron) — both are metals that are good conductors of heat and have high melting points, so they heat water quickly without melting. The non-metals (sulphur, coal, plastic, wood, cardboard) are poor heat conductors and/or burn or melt.

9. Three iron nails are dipped in oil, water and vinegar. Which nail will not rust and why?

Ans. The nail dipped in oil will not rust, because oil keeps out the air (oxygen) and moisture that are both needed for rusting. The nails in water and vinegar rust as they are exposed to moisture/acid and air.

10. How do the different properties of metals and non-metals determine their uses in everyday life?

Ans. Metals are hard, lustrous, malleable, ductile, sonorous and good conductors, so they are used for wires, utensils, tools, coins and bells. Non-metals are mostly dull, brittle and poor conductors, so they are used as insulators, in fertilisers, water purification and as fuels — properties decide the use.

11. Iron is protected from rusting by coating it with zinc. Since sulfur does not react with water, can it be used for this purpose? Justify.

Ans. No. Although sulfur does not react with water, it is a brittle, powdery non-metal that does not stick to or form a strong protective layer on iron, and it cannot be coated like zinc. So sulfur cannot be used to protect iron from rusting.

12. An ironsmith heats iron before making tools. Why is heating necessary?

Ans. Heating makes the iron soft and malleable, so it can be easily beaten and shaped into the required tool. On cooling it regains its hardness.

PRACTICE FOCUS — A. Choose the most appropriate answer

1. Aditi's iron swing developed a brown flaky layer after the rainy season. What should she do to prevent it?

Ans. b. Apply oil or paint on it

2. Meena got burnt touching the metal part of a hot pan. What does this show?

Ans. b. Metals conduct heat well

3. Electrical wires are made of copper but coated with plastic. Reason?

Ans. b. Plastic prevents electrical shocks

4. A jeweller prefers gold and silver because they are:

Ans. d. all of these (malleable, ductile, lustrous)

5. A lab technician stores phosphorus in water. Reason?

Ans. c. Phosphorus catches fire when exposed to air

6. A metal chair in the park becomes too hot to sit on. Why?

Ans. a. Metals absorb sunlight and conduct heat

7. Electricians wear rubber gloves. Which property of rubber makes it suitable?

Ans. b. It is a poor conductor of electricity

B. Fill in the blanks using suitable words

1. Metals are generally lustrous (shiny) in appearance.
2. Non-metals are poor (bad) conductors of electricity.
3. The process of formation of rust on iron is called rusting.
4. The property of metals to be beaten into thin sheets is called malleability.
5. Helium is used in balloons as it is lighter and non-flammable.
6. Zinc is used for galvanising iron.
7. Non-metals form acidic oxides when they react with oxygen.

8. Silicon and germanium (boron and arsenic) are examples of metalloids.

C. Match the following

1. Aluminium → d. Aircraft bodies
2. Copper → e. Used in wires
3. Zinc → f. Used for galvanising iron
4. Silver → j. Shiny metal for ornaments
5. Gold → a. Jewellery
6. Lead → b. Batteries
7. Sulphur → h. Used in rubber vulcanisation
8. Chlorine → c. Used in water purification
9. Nitrogen → g. Used in fertilizers
10. Mercury → i. Used in thermometers

D. Answer in one word (VSA)

1. Name a non-metal which is a good conductor of electricity.

Ans. Graphite (carbon).

2. Which gas supports combustion and respiration?

Ans. Oxygen.

3. Name a metal that is liquid at room temperature.

Ans. Mercury.

4. Which metal is used in making aircraft?

Ans. Aluminium.

5. Which non-metal is used in making fertilizers and ammonia?

Ans. Nitrogen.

6. Name a non-metal used in antiseptics.

Ans. Iodine.

7. What do we call materials that do not allow heat to pass easily?

Ans. Insulators (poor conductors).

8. Name two man-made materials that are neither metals nor non-metals.

Ans. Plastic and glass (or any alloy).

E. Assertion and Reason

1. A: Non-metals can be drawn into wires. R: Non-metals are ductile.



Ans. (d) A is false (non-metals are generally brittle, not drawn into wires) and R is false too — so the correct choice is that A is false; non-metals are not ductile.

2. A: Aluminium is used in making aircraft. R: Aluminium is lightweight and resistant to corrosion.

Ans. (a) Both true and R correctly explains A.

3. A: Rusting of iron occurs due to moisture and air. R: Water and oxygen together react with iron to form rust.

Ans. (a) Both true and R correctly explains A.

4. A: Gold and silver are non-lustrous metals. R: Gold and silver are ductile metals.

Ans. (d) A is false (gold and silver ARE lustrous), but R is true.

5. A: Graphite is an exception among non-metals. R: Graphite conducts electricity.

Ans. (a) Both true and R correctly explains A.

6. A: Non-metals form basic oxides. R: Non-metals react with oxygen to form acidic oxides.

Ans. (d) A is false (non-metals form acidic oxides, not basic), but R is true.

7. A: Phosphorus is kept under water. R: Phosphorus catches fire when exposed to air.

Ans. (a) Both true and R correctly explains A.

HOTS

1. Why is it necessary to use both copper and plastic together for electrical wiring?

Ans. Copper is used inside because it is an excellent conductor that carries the current; plastic is used as an outer coating because it is an insulator that prevents electric shock and short circuits. Both together make the wire safe and efficient.

2. Lemon juice stored in an aluminium container overnight caused tiny holes. Explain and suggest a better material.

Ans. Lemon juice is acidic and reacts with (corrodes) the aluminium, eating into the metal and forming tiny holes. A better material for storing acidic foods is glass or stainless steel, which do not react with acids.

3. A car company uses aluminium instead of iron for car bodies. What advantages does aluminium offer?

Ans. Aluminium is lighter (improving fuel efficiency) and resists corrosion/rusting, unlike iron which is heavier and rusts easily.

Picture Based Assessment

- 1a. (Heating a metal wire fixed with wax-stuck pins) What does this picture explain?

Ans. It demonstrates that metals are good conductors of heat. Heat travels along the metal wire, melting the wax so the pins drop off one by one.

- 1b. What will happen if the metal wire is replaced with a PVC pipe?

Ans. PVC (plastic) is a poor conductor of heat, so the heat will not travel along it; the wax will not melt and the pins will not drop.

2. Two sets of iron chain were left in an open moist area, but only one rusted. What could be the reason?

Ans. The rusted chain was made of (or exposed) bare iron that came in contact with moisture and air. The other did not rust because it was protected — e.g., galvanised (zinc-coated), painted or oiled — keeping out air and moisture, or made of a rust-resistant metal like stainless steel.

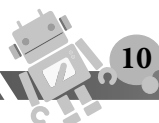
Value and Life Skill Based

1. Gold and silver are used mainly for jewellery, but copper and aluminium are vital for electricity. Which is more valuable to society — ornamental use or supporting essential services? Why?

Ans. Although gold and silver are precious, copper and aluminium are more valuable to society in everyday terms because they support essential services like electricity, wiring and transport that benefit everyone, whereas ornamental use mainly serves decoration. (Either reasoned view is acceptable if well justified.)

Case Study Based Assessment (copper wire warms up)

1. Why is copper preferred over aluminium for small household wiring?



Ans. Copper is a better conductor of electricity and is more ductile and durable, so it is safer and more efficient for household wiring.

2. Name one property of aluminium that makes it suitable for high-voltage power lines.

Ans. It is lightweight (low density), so long overhead lines are not too heavy (and it resists corrosion).

3. Can non-metals be used in electrical wiring? Why or why not?

Ans. No (except graphite). Most non-metals are poor conductors of electricity, so they cannot carry current effectively.

4. What property of metals allows them to conduct electricity?

Ans. The presence of free (mobile) electrons in metals allows them to conduct electricity.

5. Suggest a non-metal used in the house that does not conduct electricity.

Ans. Plastic (or rubber/wood).

Performance Metrics (Competency Based)

1. Copper formed a black oxide while sulphur formed a gas on burning. What does this show about sulphur?

Ans. a. It forms acidic oxides

2. While polishing an old copper pot, Arjun noticed a green layer. What caused this change?

Ans. b. Reaction with water and air forming a corroded layer

3. What makes mercury suitable for use in thermometers?

Ans. d. It is liquid and expands uniformly on heating

4. Why is aluminium used to make aircraft bodies?

Ans. b. It is light and resistant to corrosion

5. The iron school gate needs repainting every few years. Which scientific reason justifies this?

Ans. b. Paint prevents rusting by blocking air and moisture

Chapter 5: Changes Around Us: Physical and Chemical Changes

Time to Assess (A1)

1. Categorise the given changes as slow, fast, temporary, permanent, reversible, irreversible: Making salad, creating paper boats, making salt solution, corrosion of metals, wood cutting, phases of moon, curdling of milk, freezing of water.

Ans. Slow: corrosion of metals, phases of moon.

Fast: making salad, creating paper boats, making salt solution, wood cutting, curdling of milk, freezing of water.

Temporary: making salt solution, phases of moon, freezing of water.

Permanent: making salad, creating paper boats, corrosion of metals, wood cutting, curdling of milk.

Reversible: making salt solution, freezing of water, phases of moon.

Irreversible: making salad, creating paper boats, corrosion of metals, wood cutting, curdling of milk.

NCERT QUESTIONS

1. Which of the following statements are the characteristics of a physical change? (i) The state of the substance may or may not change. (ii) A substance with different properties is formed. (iii) No new substance is formed. (iv) The substance undergoes a chemical reaction.

Ans. (c) (i) and (iii). A physical change may or may not change the state, and no new substance is formed.

2. Predict which of the following changes can be reversed and which cannot. (i) Stitching cloth to a shirt.

Ans. Stitching cloth into a shirt can be reversed (the stitches can be removed to get back the cloth), so it is a reversible physical change. (Changes like burning, cooking or rusting cannot be reversed.)

3. State whether True or False; correct the false statement. (i) Melting of wax is necessary for burning a candle.

Ans. True. The solid wax first melts and then the molten wax vaporises near the wick before it burns, so melting of wax is necessary for the candle to burn.



4. Fill in the blanks.

Ans. (i) Nalini observed brown deposits on her cycle handle. The brown deposits are due to RUSTING and this is a CHEMICAL change.

(ii) Folding a handkerchief is a PHYSICAL change and can be REVERSED (undone).

(iii) A chemical process in which a substance reacts with oxygen with evolution of heat is called COMBUSTION and this is a CHEMICAL change.

(iv) Magnesium burnt in air produces a substance called MAGNESIUM OXIDE. The substance formed is BASIC in nature. Burning of magnesium is a CHEMICAL change.

5. Are the changes of water to ice and water to steam physical or chemical? Explain.

Ans. Both are physical changes. Water to ice (freezing) and water to steam (boiling) only change the state of matter; no new substance is formed and both changes are reversible.

6. Is curdling of milk a physical or chemical change? Justify.

Ans. Curdling of milk is a chemical change. A new substance (curd) with different properties is formed and the change cannot be reversed.

7. Natural factors such as wind, rain, etc. help in the formation of soil from rocks. Is this change physical or chemical and why?

Ans. Weathering of rocks into soil is mainly a physical change as wind, water and temperature break the rocks into smaller pieces without changing their chemical nature. (Chemical weathering also occurs when minerals in the rock change chemically.)

8. Read the story 'Eco-friendly Prithvi' and tick the appropriate option(s). Provide a suitable title.

Ans. Chopping vegetables, peeling potatoes and cutting fruits — physical changes.

Collecting peels and seeds in a clay pot: physical change.

Peels decomposing by bacteria and fungi to form compost: chemical change.

Seeds germinating and blooming into flowers: chemical change.

Suitable title: 'Prithvi the Eco-Warrior' (or 'From Waste to Wealth').

9. Write physical changes in 'A', chemical changes in 'B', and both physical & chemical in 'C': burning a candle; tearing of paper; rusting; curdling of milk; ripening of fruits; melting of ice; folding of clothes; burning of magnesium; mixing baking soda with vinegar.

Ans. A (Physical only): Tearing of paper, Melting of ice, Folding of clothes.

B (Chemical only): Rusting, Curdling of milk, Ripening of fruits, Burning of magnesium, Mixing baking soda with vinegar.

C (Both physical and chemical): Process of burning a candle.

10. In Fig. 5.11 (a-d) find out in which case(s) lime water turned milky and why? (a) vinegar+baking soda (b) lemon juice+vinegar (c) vinegar+common salt (d) lemon juice+baking soda.

Ans. Lime water turned milky in cases (a) vinegar + baking soda and (d) lemon juice + baking soda. In both, an acid reacts with baking soda to release carbon dioxide gas. CO₂ passed into lime water turns it milky. In (b) and (c) no CO₂ is produced, so lime water does not turn milky.

PRACTICE FOCUS — A. Choose the most appropriate answer

1. Melting of ice is an example of a:

Ans. d. Both b and c (physical change and temporary change)

2. Burning of a candle represents:

Ans. c. Both physical and chemical changes

3. Which of the following changes is reversible?

Ans. b. Freezing of water

4. Formation of curd from milk is a:

Ans. c. Chemical change

5. Which of the following indicates a chemical change?

Ans. d. All of these (colour, taste and smell change indicate chemical)

6. Weathering of rocks is an example of:

Ans. d. Both (a) and (c) — a physical change and a natural change

7. The minimum temperature at which a substance catches fire is called:

Ans. c. Ignition temperature

B. Fill in the blanks

1. Changes that can be reversed are called reversible changes.
2. Burning of wood is a chemical change.
3. Rusting of iron needs both air (oxygen) and water (moisture).
4. The formation of new substances occurs in a chemical change.
5. Combustion is the process of burning that produces heat and light.
6. The change of dough into chapati on baking is a chemical change.
7. The solid formed during a chemical reaction is called a precipitate.

C. State True / False (and correct the false ones)

1. False — Gravity always pulls objects downward (it is an attractive force).

D. Answer in one word (VSA)

1. All physical changes are reversible. — False. Most physical changes are reversible, but not all (e.g., tearing of paper is irreversible).
2. Digestion of food is a chemical change. — True.
3. Rusting of iron can be prevented by painting. — True.
4. Burning of a candle shows both physical and chemical changes. — True.
5. A new substance is formed during a physical change. — False. A new substance is formed during a CHEMICAL change.
6. Weathering of rocks is a slow natural change. — True.
7. Evaporation of water is a fast change. — False. Evaporation of water is a slow change.

D. Answer in one words (VSA)

1. Which type of change is the ripening of fruit?
Ans. Chemical change.
2. Which gas is necessary for combustion?
Ans. Oxygen.
3. What kind of change occurs when paper burns?
Ans. Chemical change.

4. Name a reversible change in which solid changes into liquid.

Ans. Melting (e.g., melting of ice/wax).

5. What kind of change is the curdling of milk?

Ans. Chemical change.

6. What type of change occurs naturally and slowly?

Ans. Weathering of rocks (a slow natural change).

7. Name one inflammable substance.

Ans. Petrol (or LPG / alcohol).

E. Assertion and Reason

Options: (a) Both A and R true, R explains A. (b) Both true, R not the explanation. (c) A true, R false. (d) A false, R true.

1. A: Rusting of iron is a chemical change. R: Rusting of iron involves the formation of new substances.

Ans. (a) Both true and R correctly explains A.

2. A: Evaporation of water is a physical change. R: No new substance is formed during evaporation; water only changes its state.

Ans. (a) Both true and R correctly explains A.

3. A: Combustion produces heat and light. R: Combustion is a chemical change that transforms substances into new products while releasing energy.

Ans. (a) Both true and R correctly explains A.

4. A: Melting of ice is an irreversible change. R: Water formed by melting ice can be frozen again to recover ice.

Ans. (d) A is false (melting of ice is reversible), but R is true.

5. A: All chemical changes are permanent. R: Chemical changes result in new substances which generally cannot be converted back.

Ans. (a) Both true and R correctly explains A.

HOTS

1. A blacksmith heats a piece of iron to make tools. What type of changes does the iron undergo during heating and hammering?

Ans. Physical changes. Heating makes the iron soft and hammering changes its shape, but it remains iron — no new substance is formed, so the changes are physical (and reversible in nature).



2. How does knowledge of reversible and irreversible changes help in recycling?

Ans. Reversible (mostly physical) changes let materials like metal, glass and plastic be melted and reshaped repeatedly, so they can be recycled. Knowing which changes are irreversible helps us identify which waste can be reused and which cannot.

3. Burning of LPG in a stove is a chemical change. Give reasons.

Ans. On burning, LPG combines with oxygen and forms new substances (carbon dioxide and water) along with heat and light. As new substances are formed and the change is irreversible, it is a chemical change.

4. Explain why weathering of rocks is considered a physical change.

Ans. In physical weathering, wind, water and temperature changes break large rocks into smaller pieces, but the chemical composition of the rock does not change, so it is considered a physical change.

Picture Based Assessment (Identify Type of Change and Reason)

1. Volcanic eruption

Ans. Both physical and chemical change. Melting of rock to lava (physical) and gases/new minerals forming (chemical); it is irreversible.

2. Fading of monuments

Ans. Chemical change. Acidic gases and pollutants react with the stone/marble, corroding it; a new substance forms and it is irreversible.

3. Water pollution

Ans. Mainly a chemical change. Harmful chemicals mix and react with water, changing its composition and making it unsafe; it is undesirable and largely irreversible.

Value and Life Skill Based

1. Rusting of iron damages iron gates of historical places. Why is it important for communities to prevent rusting of such monuments? How does this reflect our values towards culture and heritage?

Ans. Preventing rusting protects our historical monuments so future generations can also see and

value them. It shows responsibility, respect for our culture and heritage, and a sense of community pride in preserving the past.

Case Study Based Assessment (vegetable vendor's cart)

1. What type of change took place during baking of the cake?

Ans. A chemical change.

2. How do you know that a new substance was formed?

Ans. The batter changed colour, gave off a pleasant smell and became soft and spongy — all signs of a new substance being formed.

3. Why cannot the cake be changed back into batter again?

Ans. Because a chemical change is irreversible; the new substance (cake) cannot be turned back into the original batter.

4. Identify two signs of a chemical change in this process.

Ans. Change in colour and change in smell (also change in texture).

Learn Holistically (Air Pollution Pie Graph)

- 1a. What kind of change is air pollution? Explain.

Ans. Largely a chemical change. Burning of fuels and industrial gases react with air, forming new harmful substances and changing the composition of the air.

- 1b. How does air pollution affect our life?

Ans. It causes breathing problems and diseases, harms plants and animals, damages monuments and contributes to global warming and acid rain.

2. **English:** Write an article on 'Importance of chemical changes.'

Ans. Open task — cover cooking, digestion, fuel combustion for energy, fermentation, manufacturing of materials, etc.

3. **Maths:** Represent the given pie graph into a bar graph.

Ans. Open task — plot bars: Industry 52%, Transportation 27%, Agriculture 10%, Consumer & commercial products 8%, Other 2%, Commercial & residential heating 1%.

Performance Metrics (Competency Based)

1. Sugar dissolves in water (sweetness remains); on heating, water evaporates and sugar crystals reappear. What kind of change?

Ans. a. Only physical change

2. The iron shovel left in the rain turned reddish-brown. How can Atri prove it's a chemical change?

Ans. b. By observing the new brown flaky substance

3. An ice cube melted into water and later evaporated into vapour. Which is true?

Ans. b. All are physical and reversible changes.

4. A Diwali diya's oil level decreased and a pleasant smell filled the air. What type of change?

Ans. b. Chemical change — new substances formed (burning of oil)

5. Pickles in tightly sealed jars kept in sunlight for several days. Which statement best describes it?

Ans. b. Both physical (drying) and chemical (fermentation) changes occurred

Chapter 6: Adolescence: A Stage of Growth and Change

In-Chapter Time to Assess (A1)

1. Answer the following questions.

Ans. 1. The transition period from childhood to adulthood. — This is called adolescence.

2. The chemical responsible for emotional behaviour of adolescents. — Hormones.

3. The age group ranges from 13 to 19 years. — This is called the teenage stage.

NCERT QUESTIONS

1. Ramesh, an 11-year-old boy, developed pimples on his face due to biological changes. (i) Possible reasons? (ii) What can he do to get relief?

Ans. (i) During adolescence, increased oily secretions from the skin glands clog the skin pores and cause infection, leading to pimples (acne).

(ii) He should wash his face regularly with mild soap and water, keep the skin clean, eat a balanced diet, drink plenty of water and avoid squeezing the pimples.

2. Which of the following food groups would be a better option for adolescents and why? (i) Burgers/fries/junk food (ii) A balanced thali.

Ans. (ii) The balanced thali is the better option. It provides carbohydrates, proteins, vitamins, minerals and fibre needed for proper growth and development during adolescence, whereas junk food has empty calories and lacks essential nutrients.

3. Unscramble the underlined word.

Ans. (i) nstmnoiaretu = MENSTRUATION (discharge of blood every 28-30 days).

(ii) iceovxob = VOICE BOX (larynx) — causes hoarseness of voice in boys.

(iii) urtypcb = PUBERTY — marks the onset of secondary sexual characteristics.

(iv) lahoclo = ALCOHOL and srugd = DRUGS — say NO as they are addictive.

4. Shalu said, 'Adolescence brings only physical changes.' Is she correct? What would you change?

Ans. She is not fully correct. Adolescence brings physical changes (height, body hair, etc.) AND also emotional, behavioural and reproductive changes such as mood swings, stronger feelings and the start of reproductive maturity.

5. What questions would you ask to check the correctness of these points? (i) Adolescents do not need to worry about behavioural changes. (ii) If someone tries a harmful substance once, they can stop anytime.

Ans. (i) Do adolescents not experience mood swings and emotional changes? Shouldn't they learn to manage these behavioural changes?

(ii) Is it really easy to stop once addiction begins? Doesn't even a single use create an urge to take it again (substance abuse)?

6. Adolescents sometimes experience mood swings. What other behavioural changes are associated with this age?

Ans. Other behavioural changes include feeling sad or lonely, irritability and anger, wanting independence, feeling self-conscious, and being more sensitive to others' opinions.



7. Mohini was upset to see scattered used sanitary pads near the bin. What menstrual hygiene and healthy sanitary habits would you suggest?

Ans. Use sanitary pads during menstruation and change them at regular intervals; clean the genital area properly; wrap used pads in paper/newspaper before disposing in a dustbin; never scatter them in the open; and prefer biodegradable pads.

8. Mary developed a bulge on the front of her neck and was advised an iodine-rich diet; Manoj's neck bump was 'part of growing up'. Why were they advised differently?

Ans. Mary's neck bulge was a swelling of the thyroid gland (goitre) caused by iodine deficiency, which is why she needed iodine-rich food and medication. Manoj's bump was the normal enlargement of the voice box (larynx / Adam's apple) during puberty in boys, which is a natural growth change needing no treatment.

9. Categorise these changes: (i) Change in voice (ii) Development of breasts (iii) Growth of moustache (iv) Growth of facial hair (v) Pimples (vi) Hair in pubic region (vii) Hair in armpits.

Ans. Observed only in boys: Growth of moustache (iii), Growth of facial hair (iv).

Observed only in girls: Development of breasts (ii).

Common in boys and girls: Change in voice (i), Pimples (v), Hair in pubic region (vi), Hair in armpits (vii).

10. Prepare a poster mentioning tips for adolescents to live a healthy lifestyle.

Ans. Open task — include: eat a balanced diet, drink plenty of water, exercise/play daily, maintain personal hygiene, get enough sleep, manage emotions, avoid substance abuse and say NO to harmful substances.

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. The period between childhood and adulthood is called:

Ans. c. Adolescence

2. Which change is common in both boys and girls during puberty?

Ans. a. Voice change (also rapid increase in height)

3. The voice box in boys enlarges during puberty, leading to:

Ans. b. Deeper voice

4. Which is a secondary sexual characteristic in girls?

Ans. b. Development of breasts (and onset of menstruation)

5. The onset of puberty in boys is around the age of:

Ans. c. 11–13 years

6. Which habit can harm adolescent health the most?

Ans. c. Substance abuse

B. Fill in the blanks using suitable words.

1. The biological process that makes a person capable of reproduction is called puberty.

2. In girls, the start of the menstrual cycle marks reproductive maturity.

3. Acne develops due to increased oily secretions from the skin glands.

4. Menstruation usually occurs once every 28 to 30 days.

5. The gland that controls growth and other endocrine glands is called the pituitary gland.

6. Hair growth in the armpit and pubic region indicates the onset of puberty.

7. Overuse of alcohol and tobacco is known as substance abuse (addiction).

C. Complete the table of nutrients required for teenagers.

Carbohydrates: Provide energy — Food source: rice, wheat, bread, potatoes.

Proteins: For muscle building and body repair — Food source: eggs, pulses, milk, meat.

Calcium and Vitamin D: For strong bones and teeth — Food source: milk, dairy, green vegetables.

Iron: Helps in formation of haemoglobin (blood) — Food source: green leafy vegetables, jaggery.

Zinc: Helps in growth — Food source: nuts, seeds, meat.

Fibre: Helps in digestion — Food source: fruits, vegetables, whole grains.

Water: For hydration — Food source: clean drinking water, fruits.

Healthy fats: Needed for overall development — Food source: nuts, ghee, oils.

D. Answer in one word (VSA).

1. What are the chemicals secreted by endocrine glands called?

Ans. Hormones.

2. What is the period of life from 13–19 years known as?

Ans. Teenage (adolescence).

3. Which vitamin helps in strengthening bones?

Ans. Vitamin D.

4. What is the term for addiction to harmful substances?

Ans. Substance abuse.

5. Which organ releases eggs in females?

Ans. Ovary.

6. What should adolescents practise daily to keep fit?

Ans. Exercise / yoga (Surya Namaskar).

7. What type of pad should girls prefer during menstruation for environmental safety?

Ans. Biodegradable sanitary pad.

E. Assertion and Reason.

1. A: Puberty marks the onset of reproductive maturity. R: Puberty occurs when reproductive organs become fully functional.

Ans. (a) Both true and R correctly explains A.

2. A: Cyberbullying is a harmless fun. R: Cyberbullying helps to improve communication online.

Ans. Both A and R are false — cyberbullying is harmful and does not improve communication.

3. A: Menopause occurs at the start of adolescence. R: Menopause marks the end of the menstrual cycle.

Ans. (d) A is false (menopause occurs around 45-55 years, not at the start of adolescence), but R is true.

4. A: Boys have a deeper voice after puberty. R: Boys' voice box or larynx enlarges during adolescence.

Ans. (a) Both true and R correctly explains A.

5. A: Personal hygiene is essential during adolescence. R: Personal hygiene prevents infections and keeps the body healthy.

Ans. (a) Both true and R correctly explains A.

HOTS

1. Why is it important to respect physical and emotional differences during adolescence?

Ans. Because every adolescent grows and changes at a different pace; respecting these differences avoids bullying and teasing, builds confidence and helps everyone feel accepted and supported.

2. How can social media be used positively by teenagers?

Ans. By using it to learn, stay informed, support good causes, connect respectfully with known people, and share helpful content — while avoiding cyberbullying and protecting personal information.

3. Why should adolescents prefer home-cooked balanced meals over fast food?

Ans. Home-cooked balanced meals provide the proteins, vitamins, minerals and fibre needed for rapid growth, while fast food is high in fat and lacks nutrients, which can cause deficiency and health problems.

4. Why should adolescents respect boundaries in digital interactions?

Ans. Respecting boundaries keeps interactions safe and healthy, protects privacy, prevents cyberbullying, and shows respect for others' feelings and limits.

Picture Based Assessment

1. (Boy biting nails) What is this action called? How are teenagers affected from such habits?

Ans. It is nail-biting, a nervous habit. Such habits can spread germs and cause infections, damage nails and teeth, and reflect stress or anxiety; teenagers should replace them with healthier coping habits.

2. Identify and name the swollen part on the boy's neck. At which age does it appear and what is its function?

Ans. It is the voice box (larynx), also called the Adam's apple. It becomes prominent in boys during puberty (around 13-15 years). Its function is to produce sound/voice; its enlargement makes the voice deeper.



Value and Life Skill Based

1. How does substance abuse affect personal responsibility and long-term goals? What values should guide adolescents about their health?

Ans. Substance abuse harms health, weakens decision-making and makes a person neglect studies, family and goals, reducing personal responsibility. Adolescents should be guided by self-discipline, self-respect, awareness and the courage to say NO to harmful substances.

Case Study Based Assessment (Gargi, 13 years old)

1. Identify at least four physical changes Gargi is experiencing.

Ans. Rapid increase in height; change in body shape; growth of hair under arms and in the pubic region; onset of menstruation (and acne/pimples).

2. Suggest three ways Gargi can seek accurate information about puberty and menstrual health.

Ans. Talk to her parents or an elder family member; ask a teacher or school counsellor; consult a doctor; and read reliable books/government health resources.

3. What practical steps should she follow to maintain hygiene during menstruation?

Ans. Use sanitary pads and change them regularly; keep the genital area clean; dispose of used pads properly by wrapping them; and wash hands well.

4. How can friends, parents and teachers support adolescents during puberty?

Ans. By talking openly and with sensitivity, giving correct information, not teasing or bullying, and being patient and understanding.

5. Why is it important to respect privacy and handle sensitive topics with empathy?

Ans. Because adolescents may feel shy or embarrassed; treating such topics with privacy and empathy helps them feel safe, builds trust and encourages them to seek help.

Learn Holistically — (Substance Use Survey)

- Science 1.** What is substance abuse?

Ans. The harmful or excessive use of addictive substances like alcohol, tobacco, gutkha or drugs for non-medical reasons.

- Science 2.** What steps keep adolescents away from substance abuse?

Ans. Awareness and education, support from family and friends, healthy hobbies and exercise, counselling, and learning to say NO to peer pressure.

Maths: Tabulate and compare prevalence among urban and rural students.

Ans. Open task — urban users 15.1% vs rural 10.7%; peer influence urban 15.4% vs rural 26.9%; tabulate accordingly.

English: Write an article on 'Substance Abuse in India'.

Ans. Open writing task.

Art and Craft: Make an awareness poster on 'Healthy practices during adolescence'.

Ans. Open creative task.

Performance Metrics (Competency Based)

1. The government helpline number for de-addiction under Nasha Mukh Bharat Abhiyaan is:

Ans. b. 14446

2. Rohan spends long hours online chatting with strangers. This can lead to:

Ans. c. Cyberbullying or risk of misuse

3. Adolescents should maintain personal hygiene because:

Ans. b. It prevents infections and keeps them healthy

4. Which helps maintain a balanced social life for adolescents?

Ans. c. Managing time between studies, family and friends

5. Sneha feels anxious and moody frequently. The best way to manage this is:

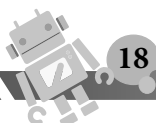
Ans. b. Try to share her feelings and do relaxation activities

Chapter 7: Heat Transfer in Nature

In-Chapter: Conduction (Recall and Answer)

1. Why do we use metal utensils for cooking purpose?

Ans. Because metals are good conductors of heat, so heat passes through the utensil quickly and cooks the food.



2. Why are the handles of cooking utensils made of wood or thermoplastic materials?

Ans. Because wood and plastic are poor conductors (insulators) of heat, so the handle stays cool and our hands are protected while holding the hot utensil.

In-Chapter: Time to Assess (A1) — Fill in the blanks

1. There are THREE modes of heat transfer namely CONDUCTION, CONVECTION and radiation.
2. Plastic and wood are thermally INSULATING (poor conducting) materials.
3. The mode of heat transfer by actual movement of particles is called CONVECTION.
4. Heat is transferred from a HOTTER (hot) region to a COLDER (cold) region.
5. Land near the sea cools faster during the NIGHT.

NCERT QUESTIONS

1. (i) A saucepan is made of two materials A and B (Fig. 7.14). Which property is correct?

Ans. (c) A is a good conductor and B is a poor conductor of heat. The base/body (A) must conduct heat to cook food, while the handle (B) must be a poor conductor so it stays cool to hold.

2. A shopkeeper puts your leaky cold-lassi tumbler inside another tumbler. Will this keep the lassi cold longer? Explain.

Ans. Yes. The air trapped between the two tumblers acts as an insulator (air is a poor conductor of heat), so it reduces heat transfer from the surroundings to the lassi, keeping it cold for a longer time.

3. State True/False with reasons.

Ans. (i) Heat transfer takes place in solids through convection. — False. In solids heat transfers by CONDUCTION.

(ii) Heat transfer through convection takes place by the actual movement of particles. — True.

(iii) Areas with clay materials allow more seepage of water than those with sandy materials. — False. SANDY soils allow more seepage (infiltration) than clay.

(iv) The movement of cooler air from land to sea is called land breeze. — True.

4. Some ice cubes placed in a dish melt into water. Where do the ice cubes get heat for this transformation?

Ans. The ice cubes absorb heat from the surroundings — from the warmer air and the dish — by conduction and radiation, which makes them melt into water.

5. A burning incense stick is fixed pointing downwards. In which direction would the smoke move? Show with a diagram.

Ans. The smoke moves upwards. The warm air and smoke are lighter (less dense) than the surrounding cooler air, so by convection they rise upward despite the stick pointing down. (Draw the stick pointing down with the smoke curling upward.)

6. Two test tubes with water are heated by a candle flame (Fig. 7.16a and 7.16b). Which thermometer records a higher temperature? Explain.

Ans. The thermometer in the test tube heated at the bottom (Fig. 7.16a) records a higher temperature. When heated from below, convection currents carry warm water upward and heat the whole tube quickly. When heated near the top, the warm water stays on top and the lower water remains cold, so it heats slowly.

7. Why are hollow bricks used to construct the outer walls of houses in hot regions?

Ans. Hollow bricks have trapped air inside. Air is a poor conductor of heat, so the trapped air acts as an insulator and prevents outside heat from entering, keeping the house cool.

8. Explain how large water bodies prevent extreme temperature in areas around them.

Ans. Water heats up and cools down slowly. Large water bodies absorb heat during the day and release it slowly at night, so nearby areas do not become very hot or very cold — the temperature stays moderate.

9. Explain how water seeps through the surface of the Earth and gets stored as groundwater.

Ans. When rain falls, some water soaks into the soil through the process of infiltration. It seeps down through porous layers of sand, gravel and rock and collects in an aquifer, where it is stored as groundwater.

10. The water cycle helps in the redistribution and replenishment of water on Earth. Justify.

Ans. Through evaporation and transpiration, water from oceans, rivers and plants rises as



vapour; it condenses into clouds and falls back as precipitation over land and sea. This continuous cycle moves water all over the Earth and refills rivers, lakes and groundwater, redistributing and replenishing fresh water.

PRACTICE FOCUS — A. Choose the most appropriate answer

1. When you sit near a campfire, you feel warm even without touching it. This is due to:

Ans. c. Radiation

2. The handles of cooking utensils are made of wood or plastic because these materials are:

Ans. b. Poor conductors

3. A solar cooker has a black inner surface because black colour:

Ans. b. Absorbs radiant heat

4. Woollen clothes keep us warm in winter because:

Ans. b. Wool traps air, which prevents heat loss

5. In a sea breeze, air moves:

Ans. a. From sea to land

6. During the day, land gets hotter than the sea because:

Ans. b. Land heats up faster than water

7. In a thermos flask, the vacuum between the two walls prevents heat loss by:

Ans. d. Both b and c (convection and conduction)

B. Fill in the blanks using suitable words.

- Heat is a form of energy that transfers from a hotter object to a colder object.
- The process of heat transfer through direct contact is called conduction.
- Radiation is the mode of heat transfer that does not need any medium.
- Air conditioners work on the principle of heat transfer by convection.
- The vacuum inside a thermos flask prevents heat transfer by convection and conduction.
- The Sun's heat reaches the Earth by radiation.
- The underground layer that holds groundwater is called an aquifer.

C. State True or False (correct the false ones).

- Convection occurs only in solids. — False. Convection occurs in fluids (liquids and gases), not solids.
- Radiation can occur even in a vacuum. — True.
- Black surfaces are better absorbers of heat. — True.
- Infiltration is faster in compact soils. — False. Infiltration is faster in loose/porous (sandy) soils.
- Air is a poor conductor of heat. — True.
- The inner walls of a thermos flask are silvered to reduce heat loss by convection. — False. They are silvered to reduce heat loss by RADIATION.
- Sea breeze occurs at daytime. — True.
- Heat always flows from a cold object to a hot object. — False. Heat always flows from a HOT object to a COLD object.

D. Answer in one word (VSA).

- Name the mode of heat transfer that involves movement of particles.
Ans. Convection.
- What kind of materials prevent heat transfer?
Ans. Insulators (poor conductors).
- Which process forms clouds in the water cycle?
Ans. Condensation.
- What is one application of radiation that maintains the amount of water on the Earth?
Ans. The water cycle.
- What is the process of water seeping into the soil called?
Ans. Infiltration.
- Which layer of the Earth stores groundwater?
Ans. Aquifer.
- Which part of the thermos flask prevents loss of heat by radiation?
Ans. The silvered (shiny) surface.
- What type of current occurs in boiling water?
Ans. Convection current.

E. Assertion and Reason.

- A: Metals are used for making cooking utensils. R: Metals are good conductors of heat.
Ans. (a) Both true and R correctly explains A.

2. A: Air is a poor conductor of heat. R: Air prevents heat transfer by radiation.

Ans. (c) A is true, but R is false — air mainly prevents heat transfer by conduction, not radiation.

3. A: Sea breeze occurs at night. R: Land cools faster than sea after sunset.

Ans. (d) A is false (sea breeze occurs during the day; LAND breeze occurs at night), but R is true.

4. A: Radiation does not need a medium to transfer heat. R: Heat from the Sun reaches the Earth through space.

Ans. (a) Both true and R correctly explains A.

5. A: A thermos flask keeps liquids hot or cold for a long time. R: A thermos flask minimizes heat loss by all three modes — conduction, convection and radiation.

Ans. (a) Both true and R correctly explains A.

6. A: We feel hot near a fire because of conduction. R: Air conducts heat efficiently.

Ans. Both A and R are false — we feel hot near a fire because of radiation, and air is a poor conductor of heat.

HOTS

1. Why do desert areas experience very high temperatures during the day and low temperatures at night?

Ans. Sand heats up and cools down quickly. During the day it absorbs the Sun's radiation and becomes very hot, while at night it loses that heat rapidly by radiation, so the temperature drops sharply. There is little water vapour to hold the heat.

2. Why is the water inside an earthen pot (matka) cool even without refrigeration?

Ans. An earthen pot has tiny pores through which water seeps out and evaporates. Evaporation absorbs heat from the water inside, so the remaining water becomes cool.

3. How do convection currents in the ocean affect global climate?

Ans. Ocean convection currents carry warm water from the equator towards the poles and cold water back towards the equator. This redistributes heat around the Earth, affecting temperatures, winds and weather patterns globally.

4. Why are houses in cold regions built with thick walls or double glazing?

Ans. Thick walls and double glazing trap a layer of air, which is a poor conductor of heat. This insulation prevents heat from escaping, keeping the house warm inside.

Picture Based Assessment

1. Study the given diagram (kettle on flame). Label it correctly and explain all three methods of heat transfer with a daily-life example.

Ans. Conduction: heat passes through the solid metal of the kettle to the water by direct contact. Convection: hot water at the bottom rises and cooler water sinks, forming convection currents that heat all the water. Radiation: heat from the flame and hot kettle radiates outward into the surroundings. Daily-life example: while heating water in a kettle on a stove, all three modes occur together.

Value and Life Skill Based

1. Land and sea breezes occur due to convection of heat. What values do we learn from these natural processes about maintaining balance in the environment?

Ans. They show how nature maintains balance through continuous exchange and circulation. We learn the value of balance, harmony and cooperation, and the importance of not disturbing natural systems so the environment stays healthy.

Case Study Based Assessment (Polar Animals)

1. Which property of fur and fat helps these animals stay warm?

Ans. Fur and fat trap air and act as insulators (poor conductors of heat), preventing body heat from escaping.

2. What type of heat transfer is minimized by these natural insulators?

Ans. Heat loss by conduction (and convection).

3. How does huddling help penguins in conserving heat?

Ans. Huddling reduces the body surface exposed to the cold, so less heat is lost and the group stays warm by sharing body warmth.



4. What human-made materials work similarly to animal fur?

Ans. Woollen clothes, thermocol, sweaters and blankets (which also trap air to keep us warm).

Learn Holistically (Greenhouse Effect)

Science 1. How is heat transfer related to the greenhouse effect?

Ans. The Sun's heat reaches the Earth by radiation. Greenhouse gases absorb and re-emit the infrared radiation given off by the Earth, trapping heat and warming the planet.

Science 2. Which mode of heat transfer is majorly responsible for it?

Ans. Radiation.

Maths: Represent all mathematical data graphically.

Ans. Open task: plot CO₂ increase 3.5 ppm/yr, CH₄ +16%, N₂O +25%, global temperature rise 1.1 deg C.

English: Write a quote on 'Application of Heat Transfer'.

Ans. Open writing task.

Social Science: List places facing adverse effects of the greenhouse effect and explain why.

Ans. Open research task — e.g., low-lying coastal areas and islands affected by rising sea levels due to global warming.

Performance Metrics (Competency Based)

1. Fishermen notice shallow coastal waters heat up faster than deep waters during the day. What combination explains this?

Ans. a. Conduction through water layers and radiation from sunlight

2. Trees provide shade and cool the air underneath. How does this affect heat transfer and what value does it promote?

Ans. b. It reduces convection and radiation; teaches the importance of greenery

3. Ice on the road melts faster in sunlit areas than shaded areas. Which principle explains this and the role of radiation?

Ans. b. Radiation; sunlight heats the ice directly, causing it to melt

4. Gargi feels warmth on her face near a bonfire without touching it. Which statement best explains it?

Ans. b. Heat is transferred by radiation, travelling in straight lines from the fire

5. If human activities double CO₂ levels, what is the most likely impact on heat transfer in the atmosphere?

Ans. b. Infrared radiation from Earth will be absorbed more, warming the planet

Chapter 8: Measurement of Time and Motion

In-Chapter: Time to Assess (A1)

1. Answer the following questions.

Ans. 1. Who invented pendulum clock? — Christiaan Huygens.

2. What is the weight of the pendulum clock called? — The bob.

3. Write S.I. unit of time. — Second (s).

4. What is the complete motion from one side to the other and back again called? — One oscillation.

5. Convert 5 years into seconds. — $5 \times 365 \times 24 \times 60 \times 60 = 5 \times 31,536,000 = 1,57,680,000$ seconds (about 1.58×10^8 s).

NCERT QUESTIONS

5. Calculate the speed of a car that travels 150 metres in 10 seconds. Express in km/h.

Ans. Speed = distance / time = $150 / 10 = 15$ m/s. In km/h = $15 \times 3600/1000 = 15 \times 3.6 = 54$ km/h.

5. A runner completes 400 m in 50 s. Another completes the same distance in 45 s. Who has greater speed and by how much?

Ans. Runner 1 speed = $400/50 = 8$ m/s. Runner 2 speed = $400/45 = 8.89$ m/s. The second runner is faster, by about 0.89 m/s.

5. A train travels at 25 m/s and covers 360 km. How much time does it take?

Ans. Distance = 360 km = 360000 m. Time = distance / speed = $360000 / 25 = 14400$ s = 4 hours.

5. A train travels 180 km in 3 h. Find its speed in (i) km/h (ii) m/s. (iii) Distance in 4 h at same speed.

Ans. (i) Speed = $180 / 3 = 60$ km/h.

(ii) $60 \text{ km/h} = 60 \times 1000/3600 = 16.67 \text{ m/s}$.

(iii) Distance in 4 h = speed $\times$ time = $60 \times 4 = 240 \text{ km}$.

5. The fastest galloping horse reaches about 18 m/s. How does this compare to a train moving at 72 km/h?

Ans. Train speed $72 \text{ km/h} = 72/3.6 = 20 \text{ m/s}$. The train (20 m/s) is faster than the horse (18 m/s) by 2 m/s.

5. Distinguish between uniform and non-uniform motion using a car on a clear straight highway and a car in city traffic.

Ans. A car on a clear straight highway moving at a steady speed (covering equal distances in equal times) shows uniform motion. A car in city traffic keeps speeding up and slowing down (covering unequal distances in equal times), showing non-uniform motion.

5. Fill in the gaps in the table for an object in uniform motion. Time(s): 0,10,20,30,_,50,_,70 ; Distance(m): 0,8,_,24,32(at40),40,_,56.

Ans. In uniform motion the object covers 8 m every 10 s. So: at 20 s distance = 16 m; at 40 s = 32 m; at 60 s = 48 m. Completed distances: 0, 8, 16, 24, 32, 40, 48, 56 m.

5. A car covers 60 km in the first hour, 70 km in the second and 50 km in the third. Is the motion uniform? Find the average speed.

Ans. The motion is non-uniform because it covers unequal distances in equal time intervals. Total distance = $60+70+50 = 180 \text{ km}$ in 3 h. Average speed = $180/3 = 60 \text{ km/h}$.

5. Which type of motion is more common in daily life – uniform or non-uniform? Give three examples.

Ans. Non-uniform motion is more common in daily life. Examples: a bus moving in city traffic, a person walking and stopping, and a bicycle going up and down a road – all change speed continuously.

5. From the table state whether the speed is uniform or non-uniform and find the average speed. Time 0..100s in steps of 10; Distance 0,6,10,16,21,29,35,42,45,55,60.

Ans. The object covers unequal distances in equal time intervals, so the motion is non-uniform. Total distance = 60 m in 100 s. Average speed = $60/100 = 0.6 \text{ m/s}$.

5. A vehicle covers 2 km along a straight line. First 500 m at 10 m/s, next 500 m at 5 m/s. With what speed should it move the remaining 1000 m so the journey completes in 200 s? Find the average speed.

Ans. Time for first 500 m = $500/10 = 50 \text{ s}$. Time for next 500 m = $500/5 = 100 \text{ s}$. Time used = 150 s. Remaining time = $200 - 150 = 50 \text{ s}$ for the remaining 1000 m. Required speed = $1000/50 = 20 \text{ m/s}$. Average speed = total distance/total time = $2000/200 = 10 \text{ m/s}$.

PRACTICE FOCUS — A. Choose the most appropriate answer

1. A car covers 150 km in 3 hours. Its speed is:
Ans. c. 50 km/h
2. Which device tells time using the shadow of the Sun?
Ans. c. Sundial
3. An object moves 10 m in the 1st second, 20 m in the 2nd, 30 m in the 3rd. The motion is:
Ans. b. Non-uniform
4. Which unit combination gives speed?
Ans. a. m/s
5. What happens to a pendulum's time period if its length is increased?
Ans. a. Increases
6. Which best defines average speed?
Ans. a. Total distance divided by total time taken
7. Which instrument is commonly used to measure short intervals of time in sports?
Ans. b. Stopwatch

B. Fill in the blanks using suitable words.

1. The SI unit of speed is metre per second (m/s).
2. A sundial uses the sun's shadow to measure time.
3. The regular back-and-forth swinging motion of a pendulum is called oscillation.
4. A water clock measures time using the flow of water.
5. Uniform (linear) motion occurs along a straight line.
6. Distance travelled divided by total time taken gives average speed.



- The motion of the Sun (and Moon) in the sky was used in ancient times to measure time.
- Mechanical clocks use gears and springs to measure time.

C. Match the following.

- Sundial → c. Shadow of the sun
- Pendulum clock → d. Swinging pendulum
- Candle clock → b. Burning candle
- Water clock → a. Flow of water
- Hourglass → e. Flow of sand
- Speed → f. Distance / time
- Non-uniform motion → g. Unequal distances in equal times
- Uniform motion → h. Equal distances in equal times
- SI unit of time → i. Second (s)
- Mechanical clock → j. Gears and springs

D. Answer in one word (VSA)

- Name the device that measures the speed of vehicles.
Ans. Speedometer.
- What is SI unit of time?
Ans. Second (s).
- Which instrument was invented by Huygens?
Ans. The pendulum clock.
- Which device is used in vehicles to measure the distance travelled?
Ans. Odometer.
- What is the time taken by a pendulum to complete one oscillation called?
Ans. Time period.
- Which quantity is calculated by knowing the speed and distance travelled?
Ans. Time.
- Which term describes the number of oscillations in a specific time duration?
Ans. Frequency.

E. Assertion and Reason.

Options: (a) Both A and R true, R explains A. (b) Both true, R not the explanation. (c) A true, R false. (d) A false, R true.

- A: Pendulum clocks work due to gravity. R: The pendulum swings because of gravitational pull.
Ans. (a) Both true and R correctly explains A.
- A: The time period of a pendulum depends on its bob's mass. R: Heavier bobs swing faster.
Ans. (d/e) Both A and R are false — the time period does NOT depend on the bob's mass, and heavier bobs do not swing faster.
- A: In uniform motion, acceleration is zero. R: Speed keeps changing in uniform motion.
Ans. (c) A is true, but R is false — in uniform motion speed stays constant, it does not change.
- A: A car moving in city traffic shows uniform motion. R: The car moves with constant speed despite all the factors.
Ans. (d/e) Both A and R are false — city traffic causes non-uniform motion and the speed is not constant.
- A: The longer the pendulum, the longer the time period. R: Length does not affect how long each oscillation takes.
Ans. (c) A is true, but R is false — length DOES affect the time period.
- A: Average speed is always equal to instantaneous speed. R: Average speed and instantaneous speed are both measured over small intervals.
Ans. (d/e) Both A and R are false — average speed is over the whole journey and is generally not equal to instantaneous speed.

HOTS

- A pendulum clock is moved from Earth to the Moon. How will its time period change and why?
Ans. Gravity on the Moon is weaker (about one-sixth of Earth's). Since a weaker gravitational pull makes the pendulum swing more slowly, the time period increases, so the clock runs slower on the Moon.
- If two objects cover the same distance in different times, what can you conclude about their speeds?
Ans. The object that takes less time has a higher speed, and the one that takes more time has a lower speed.
- Why do we prefer atomic clocks for space research instead of mechanical clocks?

Ans. Atomic clocks are extremely precise and do not lose or gain time, unlike mechanical clocks which are affected by gravity, temperature and wear, so atomic clocks give accurate time for space research.

4. Why does a freely falling object show non-uniform motion even though it moves in a straight line?

Ans. Because gravity makes its speed up continuously — it covers more distance each second, so its speed keeps changing, making the motion non-uniform even though the path is straight.

Picture Based Assessment

1. Label each part of the pendulum diagram. (a) Define oscillation (b) Time period (c) Frequency.

Ans. Parts: A = mean (rest) position, B and C = extreme positions, the heavy ball = bob, the line = string, top = point of suspension. (a) Oscillation: one complete to-and-fro motion from one side to the other and back. (b) Time period: the time taken to complete one oscillation. (c) Frequency: the number of oscillations in a given time (usually one second).

2. Identify the type of motion and compare the pictures (child on a slide; girl skating).

Ans. The child sliding down speeds up due to gravity — non-uniform (accelerated) motion along a straight line. The girl skating at a steady pace shows uniform motion. Both are examples of linear motion, but one is uniform and the other non-uniform.

Value and Life Skill Based

1. Agastya keeps track of the time each group member spends on their part so the work finishes before the deadline. How does teamwork and valuing each person's time lead to a better result?

Ans. Valuing each member's time means work is shared fairly and finished on schedule. Teamwork, planning and respecting time prevent last-minute stress and produce better, well-organised results.

Case Study Based Assessment (Gargi's Morning Routine)

1. At what time will Gargi reach the bus stop if everything goes as per routine?

Ans. She wakes at 6:30 am, takes $20 + 10 + 15 = 45$ minutes, so she reaches the bus stop at 7:15 am (5 minutes before the 7:20 bus).

2. On the day she loses her notebook (10 extra minutes), will she catch the bus? If not, by how many minutes is she late?

Ans. With 10 extra minutes, total time = 55 minutes, so she reaches at 7:25 am. The bus leaves at 7:20 am, so she misses it and is 5 minutes late.

3. How does good time management in the morning help avoid stress and support a responsible family environment?

Ans. Managing time well means tasks are done calmly without rushing, avoids stress, sets a good example, and keeps the household running smoothly and responsibly.

Learn Holistically (Over-speeding Article)

Science 1a. Define speed. Write SI unit.

Ans. Speed is the distance travelled in unit time (speed = distance/time). Its SI unit is metre per second (m/s).

Science 1b. What is over speeding on national highways for a 6-seater vehicle?

Ans. Driving faster than the legal speed limit set for that vehicle and road, which is unsafe and a major cause of accidents.

Science 1c. How does kinetic energy relate to the damage caused in a high-speed crash?

Ans. Kinetic energy increases with speed (faster moving vehicles carry much more energy), so a high-speed crash releases far more energy, causing greater damage and injury.

Maths 2a. Kochi: 1,839 accidents on straight roads and 174 on curved roads. Find the ratio.

Ans. Ratio of straight to curved accidents = $1839 : 174$ (about 10.6 : 1).

Maths 2b. Difference in fatalities between straight (117) and curved (14) roads.

Ans. $117 - 14 = 103$ more fatalities on straight roads.

GK 3a. Which ministry in India provides official statistics on road accidents?

Ans. The Ministry of Road Transport and Highways (MoRTH).

GK 3b. Which Indian states are mentioned as having high fatalities due to over speeding?

Ans. Telangana (88.7%) and Odisha (61%).



Performance Metrics (Competency Based)

1. A pendulum completes 90 oscillations in 3 minutes. If Gargi shortens the length, what happens to its time period?

Ans. b. It decreases

2. Two trains leave a station together, one at 80 km/hr and the other at 100 km/hr. After how long will the faster train be 60 km ahead?

Ans. c. 3 hours (gap grows 20 km per hour, so $60/20 = 3$ hours)

3. During a science fair, a pendulum stops swinging after a few minutes. Best reason?

Ans. b. Friction and air resistance slow it down

4. A clock chimes every quarter hour. If Tanya hears it at 11:15 am, how many more times before noon?

Ans. b. 3 times (at 11:30, 11:45 and 12:00)

5. A ball rolls down a straight slope, speeding up. This is an example of:

Ans. b. Non-uniform linear motion

Chapter 9: Life Processes in Animals

In-Chapter: (Story Prompts and Recall)

1. Why should we not talk while eating?

Ans. Because talking while eating may let food enter the windpipe instead of the food pipe, causing choking and coughing.

1. Are the digestive and respiratory systems connected? How do nutrients reach all body parts?

Ans. The food pipe and windpipe overlap near the throat, so the two systems are linked there. Digested nutrients are absorbed into the blood, and the blood carries them to all body parts where oxygen (from respiration) helps release energy from them.

Time to Assess (A1)

1. Fats
2. Hydrochloric acid(HCL)
3. Gizzard
4. Curd
5. Small intestine(villi)

NCERT QUESTIONS

1. Complete the journey of food through the alimentary canal: Food → Mouth → ___ → Stomach → ___ → ___ → Anus.

Ans. Food → Mouth → Oesophagus (food pipe) → Stomach → Small intestine → Large intestine → Anus.

2. Sahil placed chapati in test tube A, Neha placed chewed chapati in B, and Santushti placed boiled mashed potato in C. All added iodine solution. What would be their observations? Give reasons.

Ans. Iodine turns blue-black in the presence of starch. Tube A (plain chapati) and Tube C (potato) turn blue-black as starch is present. In Tube B (chewed chapati), the saliva has begun digesting the starch into sugar, so it shows little or no blue-black colour. This shows saliva breaks down starch.

3. What is the role of the diaphragm in breathing? (i) filter air (ii) produce sound (iii) help in inhalation and exhalation (iv) absorb oxygen.

Ans. (iii) To help in inhalation and exhalation. The diaphragm moves down to draw air in (inhalation) and up to push air out (exhalation).

4. Match the following.

Ans. (i) Nostrils → (a) fresh air from outside enters.

(ii) Nasal passages → (d) tiny hair and mucus help to trap dust and dirt from the air we breathe.

(iii) Windpipe → (e) air reaches our lungs through this part.

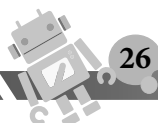
(iv) Alveoli → (b) exchange of gases occurs.

(v) Ribcage → (c) protects lungs.

5. Anil claims respiration and breathing are the same. What questions can Sanvi ask to show he is not correct?

Ans. Sanvi can ask: 'Does breathing produce energy, or is that respiration?' and 'Where does each take place — breathing in the lungs but respiration in the cells?' These show breathing is a physical process (taking air in and out) while respiration is a chemical process in cells that releases energy.

6. Which statement is correct and why? Anu: We inhale air. Shanu: We inhale oxygen. Tanu: We inhale air rich in oxygen.



Ans. Tanu is correct. We inhale air, which is rich in oxygen (but also contains other gases). We do not inhale pure oxygen, and saying just 'air' ignores that it is the oxygen we need.

7. We often sneeze when we inhale a lot of dust-laden air. What can be possible explanations?

Ans. Sneezing is a reflex that throws out dust and irritating particles. The dust irritates the lining of the nose, and the body sneezes forcefully to clear the nasal passage and protect the lungs.

8. After running, Anusha was breathing faster than Paridhi. Give at least two explanations.

Ans. (i) During running the body needs more energy, so it needs more oxygen, making breathing faster. (ii) Anusha may be less fit/trained than Paridhi, so her body demands oxygen more quickly and she breathes faster to supply it.

9. Yadu added rice flour to test tubes A and B; to B he added saliva, left them 35-45 min, then added iodine. What is he testing?

Ans. He is testing whether saliva digests starch. Tube A (no saliva) turns blue-black (starch present), while Tube B (with saliva) shows little/no colour because saliva has broken the starch into sugar. This shows saliva digests starch.

10. Rakshita passed inhaled air through lime water in tube A and exhaled air in tube B. What is she investigating? How can she confirm her findings?

Ans. She is investigating the difference between inhaled and exhaled air. The lime water in tube B (exhaled air) turns milky, while tube A stays clear. Since lime water turns milky with carbon dioxide, this confirms that exhaled air contains more carbon dioxide than inhaled air.

PRACTICE FOCUS

A. Choose the most appropriate answer.

1. When food enters the windpipe instead of the food pipe, what happens?

Ans. b. We start coughing

2. Why is chewing food properly important?

Ans. b. It makes digestion easier

3. Which organ secretes bile that helps in digestion of fats?

Ans. b. Liver

4. Which happens when the diaphragm moves downward?

Ans. b. Air moves in

5. The main site of absorption of nutrients is:

Ans. c. Small intestine

6. Which animal brings back cud to the mouth for chewing?

Ans. b. Cow

7. Respiration helps digestion by:

Ans. b. Producing energy from nutrients

B. Fill in the blanks using suitable words.

1. The process of taking in food is called ingestion.
2. The food pipe is also called oesophagus.
3. The muscular organ that helps in mechanical digestion in birds is the gizzard.
4. The partially digested food in ruminants brought back to the mouth is called cud.
5. The organ that stores bile is the gall bladder.
6. The exchange of gases occurs in tiny air sacs called alveoli.
7. Respiration releases energy, which is used for all body activities.
8. Frogs respire through lungs and (moist) skin.

C. State True or False (correct the false ones).

1. In humans, digestion ends in the stomach. — False. Digestion is completed in the small intestine.
2. Bile is produced by the pancreas. — False. Bile is produced by the liver.
3. Oxygen enters the blood through alveoli. — True.
4. Large intestine helps in digestion of proteins. — False. The large intestine mainly absorbs water; proteins are digested in the stomach and small intestine.
5. Birds chew food with their teeth. — False. Birds have no teeth; they grind food in the gizzard.
6. Respiration and breathing are the same process. — False. Breathing is a physical process; respiration is a chemical process in cells.
7. Hydrochloric acid in the stomach kills harmful germs. — True.



8. Humans are autotrophic organisms. — False. Humans are heterotrophic (they depend on other organisms for food).

D. Answer in one word (VSA).

1. What is the grinding organ in birds called?

Ans. Gizzard.

2. Name the final site of water absorption in the alimentary canal.

Ans. Large intestine.

3. Name the animals that chew cud are called.

Ans. Ruminants.

4. What are tiny projections that absorb nutrients called?

Ans. Villi.

5. In which process is energy released using oxygen?

Ans. Respiration.

6. Where is complete digestion of carbohydrate takes place?

Ans. Small intestine.

7. What is the process of moving digested food molecules into the bloodstream?

Ans. Absorption.

8. Name the respiratory organ of frog.

Ans. Lungs (and moist skin).

E. Assertion and Reason.

1. A: Alveoli are crucial for gas exchange. R: Alveoli have thin walls and are surrounded by capillaries.

Ans. (a) Both true and R correctly explains A.

2. A: Birds use teeth to chew food. R: Birds use a gizzard, not teeth, for grinding food.

Ans. (d) A is false (birds have no teeth), but R is true.

3. A: Ruminants chew food only once. R: Ruminants regurgitate cud.

Ans. (d) A is false (ruminants chew the cud again), but R is true.

4. A: Respiration releases energy. R: Oxygen breaks down glucose molecules during respiration.

Ans. (a) Both true and R correctly explains A.

5. A: Earthworms cannot survive in waterlogged soil. R: Earthworms need moist skin for oxygen exchange.

Ans. (a) Both true and R correctly explains A. (Waterlogged soil lacks air, so they cannot get oxygen.)

6. A: All digestion ends in large intestine. R: Small intestine completes most digestion.

Ans. (d) A is false (digestion is completed in the small intestine, not the large intestine), but R is true.

HOTS

1. A dairy farmer's cows produce less milk and tests reveal food is not digested fully. What could be the reason and which part of digestion is affected?

Ans. The cow's stomach (especially the rumen, where microbes ferment grass) may not be working properly, or the food/microbes are imbalanced. Poor digestion means fewer nutrients are absorbed, so less milk is produced; the rumen/fermentation stage is most affected.

2. If the trachea in a human becomes blocked, what immediate life process is disrupted and what is the result?

Ans. Breathing (and hence respiration) is disrupted because air cannot reach the lungs. The body does not get oxygen, which can quickly cause suffocation and can be life-threatening.

3. Explain how the human digestive and respiratory systems coordinate during swallowing to prevent food from entering the windpipe.

Ans. During swallowing, a flap called the epiglottis closes over the windpipe so that food goes into the food pipe (oesophagus) and not into the windpipe, preventing choking.

Picture Based Assessment

1. Label the given diagrams (human respiratory and digestive systems).

Ans. Respiratory parts: nostrils, nasal passage, windpipe (trachea), bronchi, lungs, alveoli, diaphragm. Digestive parts: mouth, oesophagus, stomach, liver, gall bladder, pancreas, small intestine, large intestine, anus. (Label each pointer with the correct organ.)

Value and Life Skill Based

1. Some students throw away a lot of food while others come hungry. Using your understanding of nutrition, what advice would you give and how

does empathy and awareness about the value of food help?

Ans. I would advise taking only as much food as needed and not wasting it, since food gives the energy and nutrients our bodies need to grow. Being aware that others go hungry builds empathy, encourages sharing and reduces waste, helping solve the problem.

Case Study Based Assessment (Meena Choking)

1. Explain why coughing occurs when food enters the windpipe.

Ans. Coughing is a reflex that forcefully pushes out the food/particle that has entered the windpipe, clearing the airway so breathing can continue.

2. Name the structure that prevents food from entering the windpipe during swallowing.

Ans. The epiglottis.

3. How can such incidents be prevented while eating?

Ans. By chewing food properly, eating slowly, and not talking or laughing while eating.

4. Describe how breathing is affected during choking.

Ans. When food blocks the windpipe, air cannot pass to the lungs, so breathing becomes difficult or stops until the blockage is cleared.

Learn Holistically (Smoking Article)

Science 1a. Explain how smoking affects the structure and function of the alveoli in the lungs.

Ans. Smoke damages and destroys the thin walls of the alveoli, reducing the surface area for gas exchange, so less oxygen enters the blood and breathing becomes difficult.

Science 1b. Why does smoking increase the risk of respiratory infections?

Ans. Smoke paralyses and kills the cilia (tiny hairs that clean the lungs), so dust and germs are not removed, making smokers more prone to infections like pneumonia and bronchitis.

English 2: Write a paragraph / appeal about the harmful effects of smoking.

Ans. Open writing task.

Maths 3a. City of 10,000 adults, 18% smokers. 5% of smokers vs 1% of non-smokers develop bronchitis. How many in each?

Ans. Smokers = 1800; bronchitis among smokers = 5% of 1800 = 90. Non-smokers = 8200; bronchitis among non-smokers = 1% of 8200 = 82.

Maths 3b. Plot a bar graph: respiratory illness in smokers (40%) vs non-smokers (10%).

Ans. Open task — two bars: smokers 40%, non-smokers 10%.

Performance Metrics (Competency Based)

1. Gargi's doctor advised chewing food properly. Scientific reason?

Ans. b. It allows saliva to mix with food for better digestion

2. Atri feels full faster when he eats slowly. Which concept of digestion?

Ans. b. Slow eating allows better mixing with saliva and digestion

3. After running, Priya breathes faster. Why?

Ans. b. Her lungs need to supply more oxygen for energy production

4. A cow keeps chewing even when not eating fresh grass. What process?

Ans. c. Rumination

5. Holding breath for a while feels uncomfortable. Scientific reason?

Ans. b. Carbon dioxide builds up in his body

Chapter 10: Life Processes in Plants

In-Chapter: Time to Assess (A1) — Fill in the Blanks

1. The part of plant where photosynthesis occurs is the chloroplast.
2. The pigment that absorbs light energy to carry out photosynthesis is chlorophyll.
3. The plant that does not carry out photosynthesis is the ghost plant (Indian pipe) / a colourless plant.
4. Glucose and oxygen are the products of photosynthesis.
5. The gas required to carry out photosynthesis is carbon dioxide.

NCERT QUESTIONS

1. Complete the table comparing Photosynthesis and Respiration (Raw materials, Products, Word equation, Importance).



Ans. Raw materials — Photosynthesis: carbon dioxide and water (with sunlight and chlorophyll); Respiration: glucose and oxygen.

Products: Photosynthesis: glucose and oxygen; Respiration: carbon dioxide, water and energy.

Word Equation: Photosynthesis: Carbon dioxide + Water $\xrightarrow{\text{sunlight, chlorophyll}}$ Glucose + Oxygen; Respiration: Glucose + Oxygen $\rightarrow$ Carbon dioxide + Water + Energy.

Importance: Photosynthesis: makes food and releases oxygen; Respiration: releases energy for life activities.

2. Imagine all organisms that carry out photosynthesis disappear. What would be the impact?

Ans. Without photosynthesis there would be no food production and no release of oxygen. Food chains would collapse, oxygen would run out and carbon dioxide would build up, so most life on Earth would not survive.

3. A potato slice shows starch with iodine. Where does the starch come from? Where is food synthesised and how does it reach the potato?

Ans. The starch is food made by photosynthesis. Food is synthesised in the green leaves and is transported through the phloem to the potato (an underground stem), where it is stored as starch.

4. Does the broad and flat structure of leaves make plants more efficient for photosynthesis? Justify.

Ans. Yes. A broad, flat leaf provides a large surface area to capture maximum sunlight and to absorb carbon dioxide, and it has many stomata, making photosynthesis more efficient.

5. X is broken down using Y to release carbon dioxide, Z and energy. $X + Y \rightarrow \text{Carbon dioxide} + Z + \text{Energy}$. What do X, Y and Z stand for?

Ans. This is respiration. X = glucose, Y = oxygen, Z = water.

6. Krishna placed one potted plant in sunlight and one in a dark room. (i) What idea is she testing? (ii) Visible differences? (iii) Which plant's leaves confirm the iodine test for starch?

Ans. (i) She is testing whether sunlight is needed for photosynthesis (starch formation).

(ii) The plant in sunlight stays green and healthy; the one in the dark turns pale/yellowish and weak.

(iii) The leaves of the plant kept in sunlight turn blue-black with iodine, confirming starch; the dark-kept plant's leaves do not.

7. Vani's set-up (Fig. 10.11): (a) sunlight + CO₂ (b) sunlight without CO₂ (c) dark + CO₂ (d) dark without CO₂.

Ans. (i) Starch will be formed only in (a) sunlight with carbon dioxide.

(ii) Starch will not be formed in (b), (c) and (d).

(iii) Oxygen will be generated only in (a).

(iv) Oxygen will not be generated in (b), (c) and (d).

8. Ananya kept a snail (A), a water plant (B), both snail and plant (C), and only water (D) with a CO₂ indicator. What is she finding out? How will she know?

Ans. She is finding out how animals and plants affect carbon dioxide levels. The snail (A) releases CO₂ (indicator changes), the plant (B) uses up CO₂ in light (indicator changes the other way), and with both (C) they balance each other. She knows by the colour change of the CO₂ indicator in each tube.

9. Design an experiment to observe if water transportation in plants is quicker in warm or cold conditions.

Ans. Take two similar plants (or stalks in coloured water). Keep one in a warm place and one in a cold place. Observe how fast the coloured water rises in each. The plant in the warm place transports water faster because warmth increases transpiration, which pulls water up more quickly.

10. Photosynthesis and respiration are essential to maintain balance in nature. Discuss.

Ans. Photosynthesis uses carbon dioxide and releases oxygen, while respiration uses oxygen and releases carbon dioxide. Together they keep the levels of oxygen and carbon dioxide in the air balanced, supporting life on Earth.

PRACTICE FOCUS

A. Choose the most appropriate answer.

1. Which is required for photosynthesis?

Ans. b. Carbon dioxide, sunlight, water

2. Chlorophyll is present in which cell organelle?

Ans. c. Chloroplast

3. The process of loss of water vapour through leaves is called:

Ans. a. Transpiration

4. The food prepared by plants is stored in the form of:

Ans. c. Starch

5. The tiny openings on leaves through which gaseous exchange takes place are:

Ans. c. Stomata

6. Plants are called autotrophs because they:

Ans. b. Make their own food

7. Xylem helps in the transport of:

Ans. b. Water and minerals

8. Photosynthesis occurs only in:

Ans. b. Presence of sunlight

B. Fill in the blanks using suitable words.

1. The green pigment present in leaves is called chlorophyll.
2. Plants make their own food by the process of photosynthesis.
3. Food is transported in plants through phloem vessels.
4. Exchange of gases in leaves takes place through stomata.
5. During photosynthesis, oxygen gas is released.
6. The site of photosynthesis in plant cells is the chloroplast.
7. During respiration, plants release carbon dioxide gas.
8. Plants lose water through the transpiration process.

C. State True or False (correct the false ones).

1. Plants only respire at night. — False. Plants respire all the time (day and night).
2. Photosynthesis occurs in the roots of plants. — False. Photosynthesis occurs mainly in the green leaves.
3. Stomata are found on the upper surface of leaves only. — False. Stomata are found mostly on the lower surface (and can be on both).
4. Xylem carries food in plants. — False. Xylem carries water and minerals; phloem carries food.

5. Phloem carries food to all parts of the plant. — True.

6. Respiration in plants occurs only during day time. — False. Respiration in plants occurs all the time, day and night.

7. Transpiration helps in cooling the plants. — True.

8. Chlorophyll absorbs light energy from the sun. — True.

D. Answer in one word (VSA).

1. Which gas is taken in by plants during photosynthesis?

Ans. Carbon dioxide.

2. Name the gas released during respiration.

Ans. Carbon dioxide.

3. What are tiny pores on leaves called?

Ans. Stomata.

4. Name the pigment in leaves that traps sunlight.

Ans. Chlorophyll.

5. Why is the food stored in plants?

Ans. For later use / energy (for growth and other life processes).

6. Name the water carrying tubes in plants.

Ans. Xylem.

7. Name the food carrying tubes in plants.

Ans. Phloem.

8. Where are chlorophyll pigments found inside leaves?

Ans. In the chloroplasts.

E. Assertion and Reason.

1. A: Plants take in carbon dioxide during photosynthesis. R: Carbon dioxide is used to prepare glucose.

Ans. (a) Both true and R correctly explains A.

2. A: Water is absorbed by leaves directly from the air. R: Roots absorb water from soil.

Ans. (d) A is false (water is absorbed mainly by roots, not leaves from air), but R is true.

3. A: Phloem carries water in plants. R: Xylem carries food in plants.

Ans. (d/e) Both A and R are false — phloem carries food and xylem carries water (the roles are swapped).



4. A: Photosynthesis stops in the absence of sunlight.
R: Sunlight activates chlorophyll to absorb light energy.

Ans. (a) Both true and R correctly explains A.

5. A: Oxygen is a product of photosynthesis. R: Oxygen is released during the conversion of CO₂ and water to glucose.

Ans. (a) Both true and R correctly explains A.

6. A: Transpiration helps in water absorption. R: Water lost through leaves pulls more water upward.

Ans. (a) Both true and R correctly explains A.

HOTS

1. If a plant is kept in the dark for a week, what will happen to the starch stored in its leaves?

Ans. Without sunlight the plant cannot make new food, so it uses up the stored starch for respiration. The starch in the leaves gets used up and disappears.

2. What will happen if xylem in a plant is blocked?

Ans. Water and minerals cannot be transported from the roots to the leaves. The plant will wilt, photosynthesis will slow down, and the plant may eventually die.

3. Why does the colour of leaves turn yellow in the absence of sunlight?

Ans. Without sunlight the plant cannot make or maintain chlorophyll (the green pigment), so the green colour fades and the leaves turn yellow.

Picture Based Assessment

1. Identify the given diagram (open and closed stomata). Label it and write its function in life processes of plants.

Ans. The diagram shows stomata — tiny pores on the leaf surface, each bordered by two guard cells (open stoma and closed stoma). Function: stomata allow exchange of gases (carbon dioxide in, oxygen out) for photosynthesis and respiration, and allow water vapour to escape during transpiration.

Value and Life Skill Based

1. A child planted a seed but kept digging it up daily to check if it was growing. His teacher said, 'Give it time, nature works silently.' Explain scientifically why seeds take time to germinate. What value does this teach?

Ans. A seed needs time, water, air and warmth to absorb water, activate enzymes and develop a root and shoot before sprouting; disturbing it harms this process. The value it teaches is patience and trust in natural processes.

Case Study Based Assessment (aquatic Plant in Jar)

1. What was the purpose of placing the inverted test tube over the plant's stem?

Ans. To collect the gas released by the plant during photosynthesis.

2. Why was the jar kept on a sunny windowsill?

Ans. Because sunlight is needed for photosynthesis, which produces the gas.

3. What do the bubbles forming on the leaves indicate?

Ans. They indicate that the plant is carrying out photosynthesis and releasing a gas (oxygen).

4. Which gas is likely collected in the test tube?

Ans. Oxygen.

5. What would happen if the jar was placed in a dark room instead of sunlight?

Ans. Without sunlight photosynthesis would stop, so no bubbles (oxygen) would be produced.

Learn Holistically (Photosynthesis, Transpiration & transport)

Science 1a. How do stomata help leaves exchange gases with the environment?

Ans. Stomata are tiny pores that open to let carbon dioxide in and oxygen out, and to release water vapour, allowing gas exchange for photosynthesis and respiration.

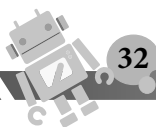
Science 1b. How does transpiration help plants survive in hot weather?

Ans. Transpiration (loss of water vapour) cools the plant like sweating, and the suction it creates pulls water and minerals up from the roots, keeping the plant supplied and from overheating.

English 2a. Find synonyms for 'transportation', 'suction', 'exchange' from the paragraph.

Ans. Transportation - transport/movement; suction - pull/pulling force; exchange - swapping/interchange of gases.

English 2b. Compose a poem about the journey of a water droplet through a plant.



Ans. Open creative task.

Social Studies 3a. How might deforestation affect natural transpiration and local climates?

Ans. Fewer trees means less transpiration, so less water vapour and rainfall, making local climates hotter and drier.

Social Studies 3b. Discuss the connection between plant water use and sustainability in urban planning.

Ans. Open discussion task — planting trees/green spaces helps cooling, water balance and sustainable cities.

Art & Craft 4: Make a leaf model showing stomata / craft showing transpiration.

Ans. Open creative tasks.

Performance Metrics (Competency Based)

1. Agastya covered a leaf with black paper in sunlight; the covered part did not turn blue-black with iodine. What does this show?

Ans. b. Sunlight is necessary for photosynthesis

2. Bubbles came out from an aquatic plant kept in sunlight. Which gas?

Ans. b. Oxygen

3. Crops planted in a shaded area showed poor growth. Which life process was most affected?

Ans. b. Photosynthesis

4. A plant in a sealed jar put out a candle; a fresh plant in sunlight made the candle burn longer. Why?

Ans. b. The plant released oxygen during photosynthesis

5. A child slept under a big tree at night and felt suffocated. Why?

Ans. a. Trees release carbon dioxide and use oxygen at night

3. Phenomenon that helps us to see the objects. — Light (vision).
4. Property of light travelling in a straight line. — Rectilinear propagation.
5. The dark patch formed on a screen. — Shadow.

NCERT QUESTIONS

1. Which of the following are luminous objects? Mars, Moon, Pole Star, Sun, Venus, Mirror.

Ans. Luminous objects (give out their own light): the Sun and the Pole Star. The others (Mars, Moon, Venus, Mirror) are non-luminous — they only reflect light.

2. Match Column A with Column B.

Ans. (i) Pinhole camera → (c) Forms an inverted image.

(ii) Opaque object → (a) Blocks light completely.

(iii) Transparent object → (d) Light passes almost completely through it.

(iv) Shadow → (b) The dark region formed behind the object.

3. Sahil, Rekha, Patrick and Qasima try to observe the candle flame through a bent pipe (Fig. 11.16). Who can see the flame?

Ans. Only the person whose eye, the straight section of the pipe and the flame are in one straight line can see it. Since light travels in a straight line, anyone looking through a bent part of the pipe cannot see the flame. (The person aligned with the straight open end sees it.)

4. Select the correct image showing the shadow formation of the boy (Fig. 11.17).

Ans. The correct image is the one where the shadow forms on the side opposite to the Sun (away from the light source) and lies along the same straight line as the light. (Choose the option where the shadow falls directly away from the sun.)

5. A ball's shadow on a wall using a fixed torch. (i) ball closer to torch (ii) ball closer to wall. Choose the correct shadow representation.

Ans. When the ball is closer to the torch, the shadow is larger; when the ball is closer to the wall, the shadow is smaller. So scenario (i) → the larger shadow, scenario (ii) → the smaller shadow.

Chapter 11: Shadows and Reflections

In-Chapter: Time to Assess (A1) — Find One Word

1. The objects that emit their own light. — Luminous objects.
2. Rays of light bounce off from the surface. — Reflection.



6. Match the torch position (Column A) with the shadow characteristics (Column B).

Ans. (i) If the torch is close to the ball → (b) The shadow would be larger.

(ii) If the torch is far away → (a) The shadow would be smaller.

(iii) If the ball is removed from the set-up → (d) A bright spot would appear on the screen.

(iv) If two torches are present on the left side of the ball → (c) Two shadows would appear on the screen.

7. View the tree (Fig. 11.19) through a pinhole camera. Sketch the outline of the tree formed.

Ans. The image will be inverted (upside down) and smaller than the tree, because light from the top and bottom of the tree crosses over at the pinhole. (Sketch the tree upside down.)

8. Write your name on paper and hold it in front of a plane mirror (paper parallel to mirror). Sketch the image. What difference do you notice? Explain.

Ans. The image shows the name reversed from left to right (mirror writing). This is called lateral inversion, which happens because a plane mirror reverses the left and right sides of the image.

9. Measure your shadow at 9 AM, 12 PM and 4 PM. (i) When is the shadow shortest? (ii) Why?

Ans. (i) The shadow is shortest at 12 PM (noon).

(ii) Because at noon the Sun is highest in the sky (nearly overhead), so the light falls more vertically and the shadow is shortest. In the morning and evening the Sun is low, so shadows are long.

10. Statement A: Image formed by a plane mirror is laterally inverted. Statement B: Images of alphabets T and O appear identical to themselves in a plane mirror. Choose the correct option.

Ans. (i) Both statements are true. The plane mirror image is laterally inverted, and letters like T and O are symmetrical, so their mirror images look the same.

11. You are given a U-shaped tube (Fig. 11.20) and two small plane mirrors. Can this tube be used to make a periscope? If yes, where will you fix the mirrors?

Ans. Yes. Fix one plane mirror at the top bend and the other at the bottom bend, each tilted at

45 degrees facing each other. Light enters the top, reflects down to the lower mirror, then reflects out to the eye — this is a periscope.

12. We do not see the shadow of a bird flying high in the sky, but we do when it swoops near the ground. Explain why.

Ans. When the bird is high up, its light is spread over a large area far from the ground, so the shadow is very faint and large and not noticeable. When the bird is close to the ground, the shadow is sharp, small and clearly visible.

PRACTICE FOCUS — A. Choose the most appropriate answer

1. What kind of image does a plane mirror form?

Ans. c. Erect and same size

2. Shadows are formed when:

Ans. d. Light is blocked by an opaque object

3. What is required to see your image in a mirror?

Ans. b. Plane, smooth, shiny surface

4. The device that works on the principle of multiple reflection and forms colourful patterns is:

Ans. d. Kaleidoscope

5. Lateral inversion means:

Ans. c. Left becomes right and right becomes left

6. Which of the following is NOT necessary for shadow formation?

Ans. c. Transparent screen

7. (Misprinted carry-over question on ignition temperature — not relevant to this chapter.) The minimum temperature at which a substance catches fire is:

Ans. c. Ignition temperature

B. Fill in the blanks using suitable words.

1. The objects that do not emit their own light are called non-luminous objects.

2. In a pinhole camera, the image formed is inverted and smaller (diminished).

3. A transparent object allows light to pass through completely.

4. Mirror forms images due to reflection of light.

5. A kaleidoscope is an instrument that uses multiple reflections to form patterns.

6. Material through which no light passes is called opaque.
7. Shadows are always formed on the opposite side of the object from the source of light.
8. Periscopes are used to see over walls or obstacles.

C. State True or False (correct the false ones).

1. Translucent materials allow all light to pass through. — False. Translucent materials allow only PART of the light to pass through.
2. A mirror cannot change the direction of light that falls on it. — False. A mirror reflects light and CAN change its direction.
3. The image in a plane mirror is inverted. — False. The image in a plane mirror is erect (not inverted), but laterally inverted (left-right reversed).
4. We can see our image on a rough wall. — False. A rough wall scatters light, so we cannot see a clear image on it.
5. Reflection helps us see non-luminous objects. — True.
6. Pinhole camera forms an upright straight image. — False. A pinhole camera forms an inverted (upside-down) image.
7. Shadows provide exact details of colour of the object. — False. A shadow shows only the outline/shape, not the colour or details of the object.

D. Answer in one word (VSA)

1. Which instrument creates symmetrical patterns using mirrors?
Ans. Kaleidoscope.
2. What type of object forms the darkest shadow?
Ans. An opaque object.
3. What is the reversal of left and right in mirror images called?
Ans. Lateral inversion.
4. Name the device used in submarines to look above water.
Ans. Periscope.
5. What is required to create a shadow, besides a light source and object?
Ans. A screen (or wall).
6. What is the nature of the image formed by a pinhole camera?
Ans. Inverted (and smaller / real).

E. Assertion and Reason

Options: (a) Both A and R true, R explains A. (b) Both true, R not the explanation. (c) A true, R false. (d) A false, R true.

1. (Misprinted carry-over: A: Rusting of iron is a chemical change. R: not printed.) — Not applicable to this chapter; treat as the printer's error. (Rusting of iron is indeed a chemical change.)

Ans. This item is a misprint carried over from another chapter and cannot be answered as an assertion-reason pair.

2. A: Shadows are always black. R: The shadow's colour depends on the object's colour.

Ans. (c) A is true (shadows are dark/black), but R is false — a shadow's darkness does not depend on the object's colour.

3. A: Mirror forms an erect image of the same size. R: The plane mirror forms a virtual image at the same distance behind the mirror.

Ans. (b) Both true, but R is not the correct explanation of A (R explains the position, not the size/erectness).

4. A: You cannot see your image on a piece of wood. R: Wood is a rough surface that scatters light in all directions.

Ans. (a) Both true and R correctly explains A.

5. A: In a pinhole camera, the image is upside down. R: Light travels in a curved path through the pinhole.

Ans. (c) A is true, but R is false — light travels in a straight line (the crossing of straight rays makes the image upside down).

6. A: Periscopes are used to see objects hidden by walls. R: Periscopes work on the principle of refraction.

Ans. (c) A is true, but R is false — periscopes work on the principle of REFLECTION, not refraction.

7. A: The colour of a shadow is affected by the colour of the object. R: Shadows are formed where the light is completely blocked by an object.

Ans. (d) A is false (the shadow's colour is not affected by the object's colour), but R is true.

8. A: We can see through butter paper, but not clearly. R: Butter paper is an opaque material.



Ans. (c) A is true, but R is false — butter paper is TRANSLUCENT, not opaque.

HOTS

1. A shadow becomes fainter and smaller as the light source moves closer; explain why.

Ans. As the light source moves closer, more light spreads around the object and the rays diverge more, so the shadow becomes smaller and lighter (less dark).

2. If a pinhole camera is used during sunset, will the image be bright or dim? Give reasons.

Ans. Dim. At sunset there is less light, so fewer light rays pass through the pinhole, forming a faint (dim) image.

3. In a science fair, why does a mirror maze look confusing to visitors?

Ans. Because the many mirrors reflect images repeatedly (multiple reflections), creating many copies of paths and openings, so visitors cannot tell the real path from the reflections.

4. If you hold a red transparent sheet over a torch, what colour is the shadow? Explain.

Ans. The light passing through becomes red, but the shadow itself (where light is blocked) is dark/black, because a shadow forms where light does not reach; only the lit area looks red.

5. While camping, Ritu saw stars but not her shadow by starlight. Why?

Ans. Starlight is far too faint and comes from many directions, so it is not bright enough or directional enough to form a visible shadow, even though the stars themselves can be seen.

Picture Based Assessment

1. Name the given devices (a kaleidoscope and a periscope). Explain their principle of working and applications.

Ans. The first is a kaleidoscope: it uses multiple reflections between mirrors set at an angle to form beautiful symmetrical patterns; used as a toy and in design. The second is a periscope: it uses two plane mirrors (at 45 degrees) to reflect light along a bent path so we can see over or around obstacles; used in submarines and to see over walls.

Value and Life Skill Based

1. Atri made a kaleidoscope using recycled plastic and shared it with his friends to explain multiple reflections. How does Atri's effort reflect teamwork, curiosity and knowledge sharing?

Ans. It shows curiosity (exploring how reflection works), creativity and care for the environment (using recycled material), and teamwork and generosity by sharing his learning with friends.

Case Study Based Assessment (shadow puppet show)

1. Why do opaque objects form clear shadows on the screen?

Ans. Because opaque objects block light completely, so a sharp, dark shadow is formed.

2. How does the distance between the object, light source and screen affect the shadow size?

Ans. Moving the puppet closer to the light makes the shadow larger; moving it closer to the screen makes the shadow smaller.

3. Which property of light makes shadow formation possible?

Ans. Light travels in a straight line (rectilinear propagation), so it cannot bend around the object.

4. How can such creative activities help in learning science concepts better?

Ans. Hands-on, fun activities make abstract ideas easy to understand and remember, and encourage observation and curiosity.

Learn Holistically / Performance Metrics (Light, Reflection and Shadow)

Science 1a. How does a periscope work using the reflection of light?

Ans. It uses two plane mirrors placed at 45 degrees; light reflects from the top mirror down to the bottom mirror and then to the eye, letting us see over obstacles.

Science 1b. What happens to light when it hits an opaque object?

Ans. The light is blocked (and partly absorbed/reflected); it cannot pass through, so a shadow forms behind the object.

Science 1c. Why do we see our image clearly in a mirror but not on a wall?

Ans. A mirror is smooth and reflects light evenly (regular reflection) to form a clear image, while a wall is rough and scatters light in all directions (diffused reflection), so no clear image forms.

English 2a. Use any two words from the paragraph in your own sentences.

Ans. Open writing task (e.g., reflection, opaque, shadow).

English 2b. Identify and explain two adjectives from the paragraph.

Ans. Open task — e.g., 'smooth' and 'shiny' (describing surfaces).

Maths 3a. A 2-metre-tall person casts a 4-metre shadow. Ratio of height to shadow length?

Ans. $2 : 4 = 1 : 2$.

Maths 3b. When the Sun is 45 degrees above the horizon, the approximate length of a 1.5 m tall pole's shadow?

Ans. At 45 degrees, the shadow length equals the height, so the shadow is about 1.5 m long.

Social Science 4a. How does the movement of the Earth around the Sun affect the direction of shadows?

Ans. As the Earth moves and the Sun's apparent position changes through the day and year, the direction and length of shadows change accordingly.

Social Science 4b. How did early humans use shadows to measure time before clocks were invented?

Ans. They used sundials — the moving shadow of a stick/gnomon pointed to different marks, showing the time of day.

Performance Metrics (Competency Based)

1. Agastya holds a torch on a foggy night and the light scatters. What type of medium is fog for light?

Ans. c. Translucent

2. Mira pours coloured water in a periscope and the image vanishes. Why?

Ans. c. Light cannot travel through (coloured) water in the tube (it blocks/absorbs the light path)

3. Rahul notices his friend's shadow is longer in the evening. Why?

Ans. b. Sun's angle is lower

4. Manav covers a lamp with different coloured plastics and shadows remain black. Why are shadows not coloured?

Ans. c. Light does not pass through (the object blocks light, so the shadow is dark)

5. Two friends notice light cannot bend around corners. Which property of light do they observe?

Ans. b. Rectilinear propagation

Chapter 12: Earth, Moon and the Sun

In-Chapter: Time to Assess (A1) — Complete the sentence

1. The movement of the Earth on its own axis is called rotation.
2. The invisible line passing through the North Pole and the South Pole is the axis.
3. The still star in the sky is the Pole Star (Pole Star / Dhruv Tara).
4. The constellation with seven stars is the Saptarishi (Big Dipper / Great Bear).

NCERT Questions

1. In Fig. 12.17, how many hours of sunlight do the North Pole and South Pole receive during one rotation of the Earth?

Ans. Because the Earth's axis is tilted, during one rotation one pole tilted towards the Sun gets sunlight for all 24 hours, while the other pole tilted away gets 0 hours (continuous darkness). (This depends on the time of year shown.)

2. Fill in the blanks.

Ans. (i) Stars rise in the east and set in the west.

(ii) Day and night are caused by the Earth's rotation.

(iii) When the Moon fully covers the Sun from our view, it is called a total solar eclipse.

3. State whether True or False.

Ans. (i) Lunar eclipse occurs when the Sun comes between the Earth and the Moon. — False. A lunar eclipse occurs when the EARTH comes between the Sun and the Moon.

(ii) Sunrise happens earlier in Gujarat than in Jharkhand. — False. Sunrise happens earlier in the east (Jharkhand) than in the west (Gujarat).



(iii) In Chennai, the longest day occurs on the summer solstice. — True.

(iv) We should watch the solar eclipse directly with our naked eye. — False. We should NEVER look at a solar eclipse directly with the naked eye; it can damage the eyes.

(v) Seasons occur due to the tilt of Earth's axis and its revolution. — True. (The statement as printed mentions 'spherical shape', which is incorrect; the cause is the tilt and revolution.)

(vi) The Earth's revolution around the Sun causes day and night. — False. Day and night are caused by the Earth's ROTATION; revolution causes seasons.

4. Padmashree saw the Orion constellation nearly overhead at 8 pm yesterday. When will she see Orion overhead today?

Ans. She will see Orion overhead about 4 minutes earlier today, i.e. at around 7:56 pm, because the stars appear to rise about 4 minutes earlier each day due to the Earth's revolution.

5. Nandhini saw a group of stars rising at midnight on 21 June. When will she see the same group rising at midnight next year?

Ans. She will see the same group rising at midnight again on 21 June next year, because the Earth completes one revolution around the Sun in a year and the night sky repeats yearly.

6. Abhay noticed that when it was daytime in India, his uncle in the USA was sleeping (night-time). What is the reason for this difference?

Ans. Because the Earth is round and rotates on its axis, only the part facing the Sun has day while the opposite side has night. India and the USA are on nearly opposite sides, so when it is day in India it is night in the USA.

7. Four friends used these ways to see a solar eclipse. Who was being careless? (i) solar eclipse goggle (ii) mirror to project the Sun's image (iii) saw the Sun directly with his eyes (iv) attended a planetarium programme.

Ans. (iii) Adithya, who saw the Sun directly with his eyes, was being careless. Looking directly at a solar eclipse can permanently damage the eyes; the safe methods are the others.

8. Fill in the circles (Fig. 12.18) for solar and lunar eclipse with Sun, Moon, Earth.

Ans. Solar eclipse: Sun --- Moon --- Earth (the Moon is between the Sun and the Earth).

Lunar eclipse: Sun --- Earth --- Moon (the Earth is between the Sun and the Moon).

9. The Moon is much smaller than the Sun, yet it can block the Sun completely during a total solar eclipse. Why is it possible?

Ans. Because the Moon is very much closer to the Earth than the Sun. Although the Moon is small, its nearness makes it appear about the same size as the Sun in the sky, so it can cover the Sun completely.

10. The Indian cricket team's matches in Australia are often held in December. Should they pack winter or summer clothes?

Ans. They should pack summer clothes. Australia is in the Southern Hemisphere, which is tilted towards the Sun in December, so it experiences summer while India has winter.

11. Why can lunar eclipses be seen from a large part of the Earth, but a total solar eclipse only from a small part?

Ans. During a lunar eclipse the Earth's large shadow falls on the Moon, so everyone on the night side of the Earth can see it. During a total solar eclipse the Moon's small shadow falls on only a small region of the Earth, so only people in that narrow area can see it.

12. If the Earth's axis were not tilted with respect to the axis of revolution, what would be the effect on seasons?

Ans. If the axis were not tilted, there would be no change of seasons. All places would receive nearly the same amount of sunlight throughout the year, so the weather would stay roughly the same all year (no summer or winter changes).

Practice Focus

A. Choose the most appropriate answer.

1. The Earth completes one rotation on its axis in about:

Ans. b. 24 hours

2. The Earth rotates from:

Ans. c. West to East

3. The apparent movement of the Sun from east to west is due to:

Ans. c. Rotation of the Earth

4. The Earth's axis is tilted at an angle of:

Ans. c. 23.5 degrees

5. The summer solstice occurs around:

Ans. b. June 21

6. When the Northern Hemisphere has summer, the Southern Hemisphere experiences:

Ans. b. Winter

7. Solar eclipse occurs when:

Ans. c. Moon comes between Sun and Earth

B. Fill in the blanks using suitable words.

1. The imaginary line passing through the North and South Poles is called the axis.
2. The Earth completes one revolution around the Sun in about 365 (365.25) days.
3. The side of the Earth facing the Sun experiences day.
4. The Pole Star appears almost stationary in the night sky.
5. The apparent movement of the Sun is due to Earth's rotation.
6. The longest day in the Northern Hemisphere occurs on 21 June (summer solstice).
7. A solar eclipse occurs during the new moon phase of the Moon.

C. Match the following.

1. Rotation → c. 24 hours
2. Revolution → d. 365¼ days
3. Solar Eclipse → e. When Moon blocks sunlight
4. Lunar Eclipse → b. Occurs on Full Moon Day
5. Axis → h. Imaginary line through poles
6. Solstice → f. Tilted at 23.5 degrees (longest/shortest day)
7. Equinox → g. Equal day and night
8. Day and Night → a. Movement around the Sun (caused by rotation) — note: day/night is due to rotation
9. Summer in Northern Hemisphere → i. Winter in Southern Hemisphere

10. Pole Star → j. Appears fixed in the sky

D. Answer in one word (VSA).

1. What is the movement of the Earth around the Sun called?

Ans. Revolution.

2. Which star appears almost fixed in the sky?

Ans. The Pole Star.

3. What is the shape of the Earth's orbit?

Ans. Elliptical (oval).

4. What causes day and night?

Ans. Rotation of the Earth.

5. What causes change in seasons?

Ans. The tilt of the Earth's axis and its revolution around the Sun.

6. What is the longest day of the year called?

Ans. Summer solstice.

7. What is the shortest day of the year called?

Ans. Winter solstice.

8. During which phase does a solar eclipse occur?

Ans. New moon.

E. Assertion and Reason.

1. A: The length of the day and night changes throughout the year. R: The Earth's axis is tilted.

Ans. (a) Both true and R correctly explains A.

2. A: The Pole Star appears stationary in the sky. R: Solar eclipses occur every month.

Ans. (c) A is true, but R is false — solar eclipses do not occur every month.

3. (Misprinted carry-over: A: You cannot see your image on a piece of wood. R: The Moon revolves around the Earth every month.) — The two statements are unrelated; this is a printing error.

Ans. This item is a misprint (the assertion belongs to the light chapter and the reason to this chapter), so it cannot be answered as a proper assertion-reason pair. (Separately: the assertion is true, and the reason that the Moon revolves around the Earth monthly is also true.)

4. A: Day and night occur due to Earth's revolution. R: The Earth takes 365 days to revolve around the Sun.



Ans. (d) A is false (day and night occur due to rotation, not revolution), but R is true.

5. A: The Earth's revolution affects visibility of stars and constellations. R: The Earth's position changes in its orbit around the Sun.

Ans. (a) Both true and R correctly explains A.

HOTS

1. A ship travelling westward notices the length of its day gradually increasing. Explain how Earth's rotation affects the perceived length of a day for someone moving with or against the direction of rotation.

Ans. The Earth rotates from west to east. A ship moving westward travels against the direction of rotation, so it 'follows' the Sun a little and the daylight appears to last slightly longer, making the perceived day longer.

2. During certain times of the year in polar regions, the Sun remains visible for 24 hours. How do Earth's axial tilt and revolution cause this? Why does this not happen at the Equator?

Ans. Because of the 23.5 degree tilt, during summer the pole leans towards the Sun, so as the Earth rotates that pole stays in sunlight for 24 hours (midnight sun). At the Equator the tilt has little effect, so day and night stay nearly equal all year and this does not happen.

Picture Based Assessment

1. Study the given picture (Sun and Earth showing day and night) and explain it.

Ans. The half of the Earth facing the Sun has day, while the half turned away has night. As the Earth rotates on its tilted axis, different parts come into sunlight, so day and night occur in turn.

2. Compare and contrast the given diagrams (solar eclipse and lunar eclipse).

Ans. In a solar eclipse the Moon is between the Sun and the Earth and the Moon's shadow falls on the Earth (occurs on a new moon). In a lunar eclipse the Earth is between the Sun and the Moon and the Earth's shadow falls on the Moon (occurs on a full moon).

Value and Life Skill Based

1. People had many myths about day, night and seasons, but today we understand them scientifically. How does learning about the scientific reasons behind rotation and revolution encourage us to value knowledge and overcome superstition?

Ans. Learning the real, scientific causes replaces fear and superstition with understanding. It encourages curiosity, critical thinking and respect for evidence, helping us make informed decisions and reject baseless beliefs.

Case Study Based Assessment (town near Tropic of Cancer)

1. Explain how Earth's revolution and axial tilt cause variations in temperature and daylight in this region.

Ans. As the Earth revolves with its tilted axis, the angle and duration of sunlight on the region change through the year, giving longer hotter days in summer and shorter cooler days in winter.

2. How does understanding Earth's rotation help in determining local time and time zones in this town?

Ans. Rotation makes different longitudes face the Sun at different times, so the local time is set by when the Sun is overhead; the world is divided into time zones based on this rotation.

3. Suggest ways the local government can use knowledge of Earth's motions to promote efficient use of natural resources.

Ans. Plan farming/sowing by seasons, use solar energy when sunlight is strongest, schedule activities and energy use by daylight hours, and manage water/festivals around seasonal changes.

Learn Holistically (Rotation and revolution)

Science 1: Explain how rotation causes day and night and revolution causes seasons.

Ans. Rotation is the Earth spinning on its axis once every 24 hours, so the side facing the Sun has day and the other has night. Revolution is the Earth moving around the Sun in about 365.25 days; combined with the 23.5 degree tilt, different hemispheres lean towards the Sun at different times, causing seasons.

English 2: Summarize the paragraph using words like 'revolution' and 'axial tilt'.

Ans. Open writing task.

Maths 3: Calculate the degrees Earth rotates per hour and how doubling speed changes day length.

Ans. The Earth turns 360 degrees in 24 hours = 15 degrees per hour. If the rotation speed doubled, a day would be half as long, i.e. about 12 hours.

Art & Craft 4: Make a model showing Earth's tilt, rotation, revolution and seasons.

Ans. Open creative task.

Performance Metrics (Competency Based)

1. Aarav called his cousin in Canada at night and found it was daytime there. Which statement explains this best?

Ans. b. Earth's rotation causes different time zones.

2. Farmers in Punjab sow wheat in November but farmers in Australia do so around May. Which movement is responsible?

Ans. c. Earth's revolution

3. During summer, the Sun feels hotter and stays longer in the sky. What could be the reason?

Ans. b. The Northern Hemisphere is tilted towards the Sun

4. Why do people in different parts of the world celebrate New Year at different times?

Ans. b. The Earth rotates, causing different longitudes to experience midnight at different times

5. When it is winter in India, it is summer in Australia. What concept does this demonstrate?

Ans. b. Tilted axis and revolution of the Earth

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