

Model Question Paper 1
Half-Yearly Examination 2026-27
SCIENCE

Time Allowed: 3 Hours

Maximum Marks: 80

General Instructions:

1. This question paper has 5 sections: A, B, C, D and E.
2. Section A has 20 objective type questions carrying 1 mark each.
3. Section B has 6 questions carrying 2 marks each. Answers to these should not exceed 40-50 words each.
4. Section C has 7 questions carrying 3 marks each. Answers to these should not exceed 60-80 words each.
5. Section D has 3 questions carrying 5 marks each. Answers to these should not exceed 120 words each.
6. Section E has 3 source/case-based questions carrying 4 marks each with sub-parts.
7. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the choices in such questions.
8. Wherever necessary, neat and labelled diagrams should be drawn.

SECTION A

Question numbers 1 to 20 carry 1 mark each. Choose the most appropriate answer.

1. A silver article turns black when kept exposed to air for a few days. This is because it reacts with: [1]
- (a) Oxygen present in air
 - (b) Hydrogen sulphide present in air
 - (c) Nitrogen present in air
 - (d) Carbon dioxide present in air

Answer: (b) — Hydrogen sulphide present in air (tarnishing of silver, Ag_2S formation).

2. Masons prepare mortar by mixing quicklime (CaO) with water. During this process, a large amount of heat is evolved. This reaction is an example of: [1]

- (a) Exothermic combination reaction
- (b) Endothermic decomposition reaction
- (c) Exothermic displacement reaction
- (d) Endothermic combination reaction

Answer: (a) — Exothermic combination reaction: $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{heat}$.

3. A farmer finds that his field has become too acidic for a good crop yield. To neutralise the soil, he should treat it with: [1]

- (a) Common salt (NaCl)
- (b) Slaked lime (Ca(OH)_2)
- (c) Sugar
- (d) Vinegar

Answer: (b) — Slaked lime, Ca(OH)_2 — a base that neutralises excess soil acidity.

4. The pH of human gastric juice, which helps digest food in the stomach, is usually between 1.5 and 2.5. Gastric juice is therefore: [1]

- (a) Strongly alkaline
- (b) Weakly alkaline
- (c) Weakly acidic
- (d) Strongly acidic

Answer: (d) — Strongly acidic (contains dilute HCl).

5. Jewellers make ornaments from an alloy of gold and copper rather than pure gold mainly because pure gold is: [1]

- (a) Too costly to shape
- (b) Too soft for ornaments
- (c) Non-reactive with skin
- (d) A poor conductor

Answer: (b) — Too soft — alloying with copper/silver hardens it.

6. A blacksmith heats an iron rod red-hot and beats it with a hammer into thin, flat tools. This property of metals — being beaten into thin sheets — is called: [1]

- (a) Ductility
- (b) Malleability
- (c) Sonorousness
- (d) Conductivity

Answer: (b) — Malleability.

7. Utensils for cooking and aircraft body parts are often made from a metal that does NOT react with dilute HCl to liberate hydrogen gas. This metal is: [1]

- (a) Zinc
- (b) Magnesium
- (c) Copper
- (d) Iron

Answer: (c) — Copper — it lies below hydrogen in the reactivity series.

8. During breathing in human beings, exchange of oxygen and carbon dioxide between blood and air takes place in the: [1]

- (a) Trachea
- (b) Alveoli
- (c) Bronchi
- (d) Larynx

Answer: (b) — Alveoli (thin-walled, richly supplied with blood vessels).

9. A patient with kidney failure is put on dialysis. The dialysis machine artificially performs the function that is normally carried out in the nephron by the: [1]

- (a) Glomerulus and Bowman's capsule together (filtration and selective reabsorption)
- (b) Glomerulus only
- (c) Urethra
- (d) Ureter

Answer: (a) — Filtration and selective reabsorption occurring in the glomerulus/Bowman's capsule and tubule.

10. On a hot afternoon, the stomata of a plant close to reduce water loss. This opening and closing of stomata is mainly controlled by changes in the _____ of the guard cells. [1]

- (a) Chlorophyll content
- (b) Turgor pressure
- (c) Nuclear size
- (d) Cell wall thickness

Answer: (b) — Turgor pressure of guard cells.

11. When your hand accidentally touches a hot vessel, you pull it away instantly, even before you feel the pain. This quick, involuntary response is an example of a: [1]

- (a) Voluntary action
- (b) Reflex action
- (c) Hormonal response

(d) Growth movement

Answer: (b) — Reflex action.

12. A hormone secreted by the pancreas lowers blood sugar level; its insufficient secretion or action leads to diabetes. This hormone is: [1]

(a) Adrenaline

(b) Insulin

(c) Thyroxine

(d) Testosterone

Answer: (b) — Insulin.

13. An accident damages a part of a cyclist's brain, after which he can no longer balance himself on the cycle even though his muscles are otherwise fine. The damaged part is most likely the: [1]

(a) Cerebrum

(b) Cerebellum

(c) Medulla

(d) Spinal cord

Answer: (b) — Cerebellum — controls posture, balance and coordination of voluntary movements.

14. Electricians always connect a fuse of appropriate rating in household circuits. The main purpose of the fuse is to: [1]

(a) Increase the current in the circuit

(b) Protect appliances by breaking the circuit during a short-circuit/overload

(c) Reduce the household voltage

(d) Increase the resistance of appliances

Answer: (b) — It melts and breaks the circuit during short-circuit/overload, protecting appliances.

15. Two resistors of 4Ω and 6Ω are connected in parallel. Their equivalent resistance is: [1]

(a) 10Ω

(b) 2.4Ω

(c) 24Ω

(d) 1.5Ω

Answer: (b) — $1/R = 1/4 + 1/6 = 5/12 \Rightarrow R = 2.4\Omega$.

16. An electric bulb is rated '100 W, 220 V'. The current drawn by the bulb in normal use and its resistance are respectively close to: [1]

(a) 0.45 A, 484Ω

(b) 2.2 A, 100Ω

(c) 0.45 A, 220Ω

(d) 4.5 A, 48Ω

Answer: (a) — $I = P/V = 100/220 \approx 0.45\text{ A}$; $R = V/I = 220/0.45 \approx 484\Omega$.

17. A ray of light travelling from air into water bends towards the normal at the point of incidence. This happens because water is: [1]

(a) Optically rarer than air

(b) Optically denser than air

(c) Opaque

(d) Translucent only

Answer: (b) — Optically denser than air, so light slows down and bends towards the normal.

18. A dentist uses a mirror that gives an enlarged, erect (virtual) image of a tooth. For this, the mirror is a concave mirror and the tooth (object) must be placed: [1]

(a) Beyond the centre of curvature C

(b) At the focus F

- (c) Between the pole P and the focus F
(d) Exactly at C

Answer: (c) — Between pole and focus — gives a magnified, virtual, erect image.

19. This question consists of two statements — Assertion (A) and Reason (R). Choose the correct option: [1]

Assertion (A): Convex mirrors are preferred as rear-view/side mirrors in vehicles.

Reason (R): A convex mirror always forms a virtual, erect and diminished image of objects placed in front of it, giving the driver a wider field of view.

- (a) Both A and R are true, and R is the correct explanation of A
(b) Both A and R are true, but R is NOT the correct explanation of A
(c) A is true, but R is false
(d) A is false, but R is true

Answer: (a) — Both true; R correctly explains A.

20. This question consists of two statements — Assertion (A) and Reason (R). Choose the correct option: [1]

Assertion (A): A strong solution of sodium hydroxide gradually loses its basic strength when left exposed to air for a long time.

Reason (R): Sodium hydroxide absorbs carbon dioxide from air and reacts with it to form sodium carbonate, decreasing the concentration of free OH⁻ ions.

- (a) Both A and R are true, and R is the correct explanation of A
(b) Both A and R are true, but R is NOT the correct explanation of A
(c) A is true, but R is false
(d) A is false, but R is true

Answer: (a) — Both true; R correctly explains A ($2\text{NaOH} + \text{CO}_2 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$).

SECTION B

Question numbers 21 to 26 carry 2 marks each.

21. In the laboratory, dilute sulphuric acid is added to zinc granules taken in a test tube, and a gas is evolved which burns with a 'pop' sound. Write the balanced chemical equation for this reaction and state its type. [2]

Marking Scheme / Value Points:

- $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2\uparrow$ (balanced equation) — 1 mark
- Type: Displacement reaction (zinc displaces hydrogen) — 1 mark

22. A milkman adds a small amount of baking soda to fresh milk before it is transported long distances in summer. (a) Why does he do this? (b) What change would this bring about in the pH of milk? [2]

Marking Scheme / Value Points:

- (a) Baking soda is a mild base; it delays the souring of milk by neutralising the lactic acid produced by bacteria — 1 mark
- (b) It shifts the pH of milk slightly towards the alkaline (basic) side — 1 mark

23. Pickles and other acidic foods are stored in plastic or glass containers, but never for long in copper or brass vessels. Explain why, giving the relevant chemical reaction. [2]

Marking Scheme / Value Points:

- Acids in pickle react with copper (and brass, which contains copper) forming toxic copper salts — 1 mark
- Example equation: acid (e.g. acetic acid) reacts with copper to form copper salts which can cause food poisoning — 1 mark (any correct illustrative equation/explanation accepted)

24. State two functions each of xylem and phloem in a flowering plant. [2]

Marking Scheme / Value Points:

- Xylem: conducts water and minerals from roots to leaves; provides mechanical support to the plant — 1 mark

- Phloem: transports food (sucrose) prepared in leaves to all other parts of the plant (translocation); in either direction as needed — 1 mark

25. When you walk from a brightly lit room into a dim room, the pupil of your eye automatically widens after a few seconds. Name the type of muscle responsible for this action and briefly explain how the change occurs. [2]

Marking Scheme / Value Points:

- Involuntary (smooth) muscles of the iris — 1 mark
- In dim light, the radial muscles of the iris contract, pulling the pupil open (dilating it) to let in more light; this is an automatic, involuntary response, not under conscious control — 1 mark

26. Two resistors, each of $4\ \Omega$, are connected (i) in series, and (ii) in parallel, across a 6 V battery. Calculate the current drawn from the battery in each case. [2]

Marking Scheme / Value Points:

- (i) Series: $R = 4 + 4 = 8\ \Omega$; $I = V/R = 6/8 = 0.75\ \text{A}$ — 1 mark
- (ii) Parallel: $1/R = 1/4 + 1/4 = 1/2 \Rightarrow R = 2\ \Omega$; $I = V/R = 6/2 = 3\ \text{A}$ — 1 mark

SECTION C

Question numbers 27 to 33 carry 3 marks each.

27. A few drops of silver nitrate solution are added to a solution of sodium chloride in a test tube; a white precipitate is formed immediately. (a) Write the balanced chemical equation for the reaction. (b) Identify the type of reaction. (c) Name another type of reaction to which this reaction also belongs. [3]

Marking Scheme / Value Points:

- (a) $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl}\downarrow + \text{NaNO}_3$ — 1 mark
- (b) Double displacement reaction — 1 mark
- (c) Precipitation reaction — 1 mark

28. Common salt (sodium chloride) is an important raw material for a number of chemicals used in daily life. Name the chemical manufactured from it in each case and state one use: (a) an antacid ingredient used to relieve acidity, (b) a chemical used to disinfect drinking water and bleach clothes, (c) a chemical used in the manufacture of glass and detergents. [3]

Marking Scheme / Value Points:

- (a) Baking soda, NaHCO_3 — used as antacid / in cooking — 1 mark
- (b) Bleaching powder, CaOCl_2 — used to disinfect water / bleach cotton and linen — 1 mark
- (c) Washing soda, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ — used in manufacture of glass, soap, detergents — 1 mark

29. Sodium metal is always stored in kerosene oil in the laboratory. Explain why, and write the balanced equation for the reaction of sodium with water. [3]

Marking Scheme / Value Points:

- Sodium is highly reactive and reacts vigorously (even explosively) with oxygen and moisture in air; storing under kerosene prevents contact with them — 1.5 marks
- $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2\uparrow$ (reaction is highly exothermic) — 1.5 marks

30. Explain what is meant by 'double circulation' of blood in the human body, and state one reason why it is essential for warm-blooded animals like humans. [3]

Marking Scheme / Value Points:

- Blood passes through the heart twice in one complete cycle: once through the pulmonary circulation (heart $\rightarrow$ lungs $\rightarrow$ heart) and once through the systemic circulation (heart $\rightarrow$ body $\rightarrow$ heart) — 2 marks
- It keeps oxygenated and deoxygenated blood almost completely separate, allowing efficient, high-pressure oxygen supply needed to maintain a constant, high body temperature — 1 mark

31. Using the example of accidentally touching a hot object, describe the pathway of a reflex arc, naming all the parts of the nervous system involved in the correct order. [3]

Marking Scheme / Value Points:

- Receptor (skin) detects the stimulus → sensory neuron carries impulse to spinal cord — 1 mark
- Relay/connector neuron in the spinal cord passes the impulse to a motor neuron (spinal cord acts quickly without waiting for brain) — 1 mark
- Motor neuron carries impulse to effector (muscle of hand/arm), which contracts and withdraws the hand — 1 mark

32. State Ohm's law. A wire of resistance R is cut into two equal halves. What is the resistance of each half, and what is the equivalent resistance when both halves are joined in parallel? [3]

Marking Scheme / Value Points:

- Ohm's law: at constant temperature, $V \propto I$, i.e. $V = IR$ — 1 mark
- Each half has resistance $R/2$ (resistance is proportional to length) — 1 mark
- Equivalent resistance in parallel = $(R/2 \times R/2)/(R/2 + R/2) = R/4$ — 1 mark

33. A student wants to use a concave mirror to obtain a real, inverted image that is exactly the same size as the object. Where should the object be placed? Draw a labelled ray diagram to justify your answer. [3]

Marking Scheme / Value Points:

- Object should be placed at the centre of curvature, C — 1 mark
- Image formed: at C , real, inverted, same size as object — 1 mark
- Correct labelled ray diagram showing two rays converging at C on the other side — 1 mark

SECTION D

Question numbers 34 to 36 carry 5 marks each.

34. A shopkeeper has two unlabelled bottles, one containing vinegar (dilute acetic acid) and the other a baking soda solution. (a) How can he identify each using only blue and red litmus paper? (b) Write the balanced equation when the two solutions are mixed. (c) Name the gas evolved and describe a test to confirm its identity. (d) State the type of reaction taking place. [5]

OR

A student sets up an experiment by placing clean iron nails in a solution of copper sulphate. (a) State the colour change observed in the solution and on the nails. (b) Write the balanced chemical equation. (c) Name the type of reaction. (d) Explain, using the reactivity series, why this reaction occurs, and state one real-life application of such reactions.

Marking Scheme / Value Points:

- (a) Vinegar turns blue litmus red (acidic); baking soda solution turns red litmus blue (basic) — 1 mark
- (b) $\text{CH}_3\text{COOH} + \text{NaHCO}_3 \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2\uparrow$ — 1.5 marks
- (c) Carbon dioxide; passing the gas through lime water turns it milky — 1.5 marks
- (d) Double displacement reaction (also a neutralisation-type reaction between an acid and a base salt) — 1 mark

OR (value points):

- (a) Blue colour of solution fades; nails get a brownish/reddish coating — 1 mark
- (b) $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$ — 1.5 marks
- (c) Displacement reaction — 1 mark
- (d) Iron is more reactive than copper, so it displaces copper from its salt solution; such reactions are used in the extraction/refining of metals and in preventing corrosion by sacrificial protection — 1.5 marks

35. Metals differ widely in their reactivity, and this decides how they are extracted from their ores. Explain, with one example each, how metals of (a) low reactivity, (b) medium reactivity, and (c) high reactivity are obtained in their pure form. Also state why sodium and potassium are never found free in nature. [5]

OR

Copper obtained by the reduction of its ore is not pure enough for use in electrical wires. Describe, step by step, how impure copper is purified by electrolytic refining, naming the electrodes, electrolyte and what happens to impurities. State why this level of purity matters for electrical use.

Marking Scheme / Value Points:

- (a) Low reactivity (e.g. gold, silver): found in free/native state; require little or no processing — 1.5 marks
- (b) Medium reactivity (e.g. iron, zinc, copper): obtained by reduction of their oxides, usually with carbon (e.g. $\text{Fe}_2\text{O}_3 + \text{C} \rightarrow \text{Fe} + \text{CO}_2$, roasting/calcination followed by reduction) — 2 marks
- (c) High reactivity (e.g. sodium, potassium, calcium, aluminium): obtained by electrolytic reduction of their molten ores/salts — 1 mark
- Sodium and potassium are so reactive that they combine readily with oxygen and moisture in air/water and are never found in the free state in nature — 0.5 mark

OR (value points):

- Anode: impure copper block; Cathode: thin strip of pure copper; Electrolyte: acidified copper sulphate solution — 1.5 marks
- On passing current, copper from the anode dissolves into the electrolyte as Cu^{2+} ions and an equal amount of pure copper deposits on the cathode — 1.5 marks
- Insoluble impurities settle below the anode as 'anode mud'; soluble impurities remain in solution — 1 mark
- High-purity copper is needed because impurities increase electrical resistance and reduce conductivity, causing energy loss/heating in wires — 1 mark

36. Describe the structure of a nephron and explain, in sequence, how urine is formed in the human kidney. Explain, in this context, why a patient with complete kidney failure needs to undergo dialysis. [5]

OR

Explain the process of nutrition in human beings from the mouth to the small intestine, mentioning the role of at least three digestive enzymes/juices. Why is it advised that we should chew our food thoroughly before swallowing?

Marking Scheme / Value Points:

- Nephron structure: glomerulus (cluster of capillaries) enclosed in Bowman's capsule, leading into a long tubule — 1 mark
- Filtration: blood pressure forces water, glucose, amino acids, salts and urea from glomerulus into Bowman's capsule — 1 mark
- Selective reabsorption: useful substances (glucose, amino acids, most water, some salts) are reabsorbed back into blood as filtrate flows through the tubule — 1.5 marks
- Remaining filtrate (urine, containing urea, excess salts and water) passes to the ureter, bladder and is expelled via the urethra — 0.5 mark
- In kidney failure, waste cannot be filtered from blood naturally; a dialysis machine artificially filters the patient's blood by passing it through a semi-permeable membrane against a fluid of suitable composition to remove urea and excess substances — 1 mark

OR (value points):

- Mouth: saliva (containing salivary amylase) begins starch digestion; teeth and tongue mix and chew food into a bolus — 1 mark
- Stomach: gastric glands secrete HCl (kills germs, activates pepsin) and pepsin (digests proteins) — 1 mark
- Small intestine: bile from liver emulsifies fats; pancreatic juice (trypsin, lipase, amylase) digests proteins, fats and carbohydrates further; intestinal juice completes digestion — 2 marks
- Chewing thoroughly increases the surface area of food, allowing salivary amylase to act better and easing further digestion and absorption — 1 mark

SECTION E

Question numbers 37 to 39 are source/case-based questions carrying 4 marks each. Attempt any 4 out of the 5 sub-parts in each question, unless stated otherwise.

Case Study 1 — Question 37 [4 Marks]

Whenever we eat spicy or oily food, the stomach sometimes produces excess hydrochloric acid, leading to acidity and a burning sensation. Doctors often recommend antacid tablets, which contain mild bases such as magnesium hydroxide, to relieve the discomfort. At home, a pinch of baking soda (sodium hydrogen carbonate) dissolved in water is a common remedy for the same problem, as it also neutralises excess acid in the stomach.

(i) Name the acid present in human gastric juice. [1]

Answer: Dilute hydrochloric acid (HCl).

(ii) What type of chemical reaction occurs when an antacid neutralises excess acid in the stomach? [1]

Answer: A neutralisation reaction (acid + base $\rightarrow$ salt + water).

(iii) Write the chemical formulae of milk of magnesia and baking soda. [1]

Answer: Milk of magnesia: $\text{Mg}(\text{OH})_2$; Baking soda: NaHCO_3 .

(iv) Why should antacid tablets not be taken in excessive amounts? [1]

OR What would happen to the pH of the stomach contents immediately after taking an antacid?

Answer: Taking too much antacid can over-neutralise stomach acid, making the stomach too alkaline, which disturbs digestion (since some acid is needed to activate digestive enzymes like pepsin).

OR Answer: The pH would rise (move towards neutral/slightly alkaline) as the excess acid gets neutralised.

Case Study 2 — Question 38 [4 Marks]

Meera's grandfather has recently been diagnosed with type-2 diabetes. His doctor explained that a gland in his abdomen is not producing enough of a certain hormone, causing his blood glucose level to remain high. The doctor advised him to control his diet, walk regularly, and take his prescribed medicine on time, warning that poorly managed diabetes can, over the years, damage the kidneys and the eyes.

(i) Name the hormone whose deficiency (or reduced action) causes diabetes. [1]

Answer: Insulin.

(ii) Name the gland that secretes this hormone. Is this gland exocrine, endocrine, or both? [1]

Answer: Pancreas; it is both exocrine (secretes digestive juice) and endocrine (secretes insulin and glucagon).

(iii) State the normal function of this hormone in the body. [1]

Answer: It lowers blood glucose level by promoting the uptake and utilisation/storage of glucose by body cells (e.g. as glycogen in liver and muscles).

(iv) Suggest one reason why regular exercise helps a diabetic patient manage his blood glucose level. [1]

OR Name one hormone secreted by the adrenal gland during a stressful situation and state one of its effects on the body.

Answer: Exercise increases glucose uptake and utilisation by muscle cells (independent of insulin to some extent), which helps lower blood glucose levels.

OR Answer: Adrenaline; it increases heart rate and breathing rate, diverting blood to skeletal muscles, preparing the body for 'fight or flight'.

Case Study 3 — Question 39 [4 Marks]

A household uses the following electrical appliances every day: two bulbs of 60 W each for 5 hours, one electric iron of 1000 W for 1 hour, and one fan of 100 W for 10 hours. The electricity supply company charges Rs 6 per unit (kWh) of energy consumed, and bills the household once every 30 days.

(i) Define the commercial unit of electrical energy, 1 kWh. [1]

Answer: 1 kWh (1 'unit') is the energy consumed when an appliance of power 1 kilowatt is used for 1 hour.

(ii) Calculate the total energy consumed per day by all the appliances, in kWh. [1]

Answer: Bulbs: $2 \times 60 \times 5 = 600$ Wh; Iron: $1000 \times 1 = 1000$ Wh; Fan: $100 \times 10 = 1000$ Wh. Total = 2600 Wh = 2.6 kWh/day.

(iii) Calculate the electricity bill for 30 days at the given rate. [1]

Answer: Energy for 30 days = $2.6 \times 30 = 78$ kWh (units). Bill = $78 \times \text{Rs } 6 = \text{Rs } 468$.

(iv) Suggest one practical way this family could reduce its monthly electricity consumption. [1]

OR State one difference between electrical energy and electrical power.

Answer: Any valid suggestion, e.g. replacing bulbs with LEDs, reducing iron/fan usage time, switching off appliances when not needed.

OR Answer: Electrical power is the rate at which electrical energy is consumed/dissipated (measured in watts); electrical energy is the total work done over a period of time (measured in joules or kWh) = power $\times$ time.

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