IMMANUEL SCHOOL

Karnataka State Board — SSLC 2026–27

FA1 SCIENCE EXAMINATION PREPARATION

MOCK PAPER — ONE

Subject: Science | Total Marks: 40 | Duration: 1.5 Hours

Exam Date: 25 June 2026

SYLLABUS COVERED:

- **Physics:** Electricity — Ohm's Law, Circuits, Resistance, Power
- **Chemistry:** Chemical Equations & Reactions — Types, Balancing, Examples
- **Biology:** Life Processes — Nutrition, Respiration, Transportation, Excretion

GENERAL INSTRUCTIONS:

1. All questions are compulsory.
2. Read each question carefully before answering.
3. Draw neat, labelled diagrams wherever required.
4. Write the question number clearly before each answer.
5. Marks for each question are indicated in [ ].

SECTION A — VERY SHORT ANSWER (1 Mark Each)

(Objective / Fill in the blanks / True-False — 10 × 1 = 10 Marks)

Physics — Electricity

Q1. State Ohm's Law. **[1M]**

Ohm's Law: The electric current (I) flowing through a conductor is directly proportional to the potential difference (V) applied across its ends, provided the temperature and physical conditions remain constant. Mathematically: V = IR, where R is the resistance of the conductor.

Q2. What is the SI unit of electrical resistance? **[1M]**

The SI unit of electrical resistance is Ohm (Ω), named after German physicist Georg Simon Ohm.

Q3. Two resistors of 4Ω and 6Ω are connected in series. Find the equivalent resistance. **[1M]**

In series combination: R_total = R_1 + R_2 = 4 + 6 = 10 Ω
∴ The equivalent resistance = 10 Ω

Q4. Define electric power. **[1M]**

Electric power (P) is the rate at which electrical energy is consumed or dissipated in a circuit. P = VI = I^2R = V^2/R. Its SI unit is Watt (W).

Chemistry — Chemical Equations & Reactions

Q5. What is a balanced chemical equation? **[1M]**

A balanced chemical equation is one in which the number of atoms of each element is equal on both the reactant side and the product side, satisfying the Law of Conservation of Mass.

Q6. Give an example of a combination reaction. **[1M]**

Example of combination reaction: $2Mg + O_2 \rightarrow 2MgO$
Magnesium burns in oxygen to form magnesium oxide. Two reactants combine to form a single product.

Q7. Define a displacement reaction. **[1M]**

A displacement reaction is one in which a more reactive element displaces a less reactive element from its compound in solution. Example: $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$ (Iron displaces copper from copper sulphate solution).

Biology — Life Processes

Q8. Name the process by which green plants prepare their food. **[1M]**

Photosynthesis — Green plants prepare their food using sunlight, CO_2 (from air), and water (from soil), in the presence of chlorophyll. $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

Q9. What is the role of haemoglobin in the human body? **[1M]**

Haemoglobin is the red pigment present in red blood cells (RBCs). It carries oxygen from the lungs to all body cells and assists in transporting carbon dioxide back to the lungs for exhalation. It gives blood its red colour.

Q10. Name the excretory unit of the human kidney. **[1M]**

The functional and structural unit of the human kidney is the Nephron (also called the uriniferous tubule). Each kidney contains approximately one million nephrons.

SECTION B — SHORT ANSWER (2 Marks Each)

Answer in 2–4 sentences — 5 × 2 = 10 Marks

Q11. Differentiate between series and parallel connections of resistors. **[2M]**

Series Connection: (i) All resistors are connected end-to-end in a single path. (ii) Same current flows through each resistor. (iii) Total resistance increases: $R = R_1 + R_2 + R_3...$ (iv) If one element fails, the circuit breaks.

Parallel Connection: (i) All resistors are connected between two common points. (ii) Same potential difference across each resistor. (iii) Total resistance decreases: $1/R = 1/R_1 + 1/R_2...$ (iv) If one element fails, others continue to work.

Q12. What is a double displacement reaction? Give one example. **[2M]**

A double displacement reaction is one in which the ions of two compounds exchange places in aqueous solution to form two new compounds.

Example: $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow + 2NaCl$

Barium sulphate (white precipitate) is formed when sodium sulphate reacts with barium chloride. It is also called a precipitation reaction.

Q13. Explain the process of aerobic respiration with its equation. [2M]

Aerobic respiration occurs in the presence of oxygen. Glucose is completely oxidised to CO_2 and water, releasing a large amount of energy (ATP).
Equation: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy (38 ATP)
It takes place in the mitochondria of cells and is more efficient than anaerobic respiration.
Oxygen is used to break down glucose completely.

Q14. A bulb is rated 60W at 220V. Calculate the resistance of the bulb. [2M]

Given: Power P = 60 W, Voltage V = 220 V
Formula: $P = V^2/R \implies R = V^2/P$
$R = (220)^2 / 60 = 48400 / 60 = 806.7\ \Omega$
∴ The resistance of the bulb ≈ 806.7 Ω

Q15. What are the differences between autotrophic and heterotrophic nutrition? [2M]

Autotrophic Nutrition: Organisms prepare their own food from inorganic substances. They use sunlight (photosynthesis) or chemical energy (chemosynthesis). Example: Green plants, algae.
Heterotrophic Nutrition: Organisms cannot prepare their own food and depend on other organisms (plants or animals) for nutrition. Example: Humans, animals, fungi, most bacteria.

SECTION C — LONG ANSWER (3 Marks Each)

Answer in 5–8 sentences — 4 × 3 = 12 Marks

Q16. Describe Joule's Law of Heating. Derive the formula for heat produced. [3M]

Joule's Law of Heating states that the heat produced in a resistor is:
(i) Directly proportional to the square of current ($H \propto I^2$)
(ii) Directly proportional to the resistance ($H \propto R$)
(iii) Directly proportional to the time for which current flows ($H \propto t$)
Derivation: Work done by the source of emf = Charge × Potential difference
$W = Q \times V = It \times V$ [since $Q = It$]
Using $V = IR$: $W = I^2Rt$
This work is converted to heat: $H = I^2Rt$ (in Joules)
This is Joule's Law of Heating — widely used in electric heaters, geysers, and electric irons.

Q17. Explain the types of chemical reactions with one example each. [3M]

1. Combination Reaction: Two or more substances combine to form a single product. Example: $2H_2 + O_2 \rightarrow 2H_2O$

2. Decomposition Reaction: A single compound breaks down into two or more simpler substances. Example: $2H_2O \rightarrow 2H_2 + O_2$ (electrolysis)
3. Displacement Reaction: A more reactive metal displaces a less reactive metal. Example: $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
4. Double Displacement Reaction: Exchange of ions between two reactants. Example: $AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$
5. Oxidation-Reduction (Redox) Reaction: Simultaneous oxidation (loss of electrons) and reduction (gain of electrons). Example: $2Mg + O_2 \rightarrow 2MgO$ (Mg is oxidised, O is reduced)

Q18. Describe the process of transportation in human beings. **[3M]**

Transportation in humans is carried out by the circulatory system, which includes the heart, blood, and blood vessels.
Heart: A four-chambered muscular organ that pumps blood throughout the body. The right side pumps deoxygenated blood to the lungs (pulmonary circulation); the left side pumps oxygenated blood to the body (systemic circulation).
Blood: Acts as the transport medium. Components: (i) RBCs — carry oxygen via haemoglobin; (ii) WBCs — provide immunity; (iii) Platelets — help in clotting; (iv) Plasma — carries nutrients, CO_2, hormones.
Blood Vessels: (i) Arteries — carry blood away from the heart (oxygenated); (ii) Veins — carry blood towards the heart (deoxygenated); (iii) Capillaries — thin-walled, allow exchange of materials.
Double Circulation: Blood passes through the heart twice in one complete cycle, ensuring efficient oxygen delivery to all cells.

Q19. Three resistors of 2Ω, 3Ω, and 6Ω are connected in parallel. Find the equivalent resistance. If a potential difference of 6V is applied, find the total current. **[3M]**

Given: $R_1 = 2\Omega$, $R_2 = 3\Omega$, $R_3 = 6\Omega$, $V = 6V$
Parallel combination: $1/R = 1/R_1 + 1/R_2 + 1/R_3$
$1/R = 1/2 + 1/3 + 1/6 = 3/6 + 2/6 + 1/6 = 6/6 = 1$
$\therefore R = 1\ \Omega$ (Equivalent resistance = 1 Ω)
Total current: $I = V/R = 6/1 = 6$ A
∴ The total current flowing in the circuit = 6 A
Note: In parallel, equivalent resistance is always less than the smallest individual resistance ($1\Omega < 2\Omega$ ✓)

SECTION D — ESSAY / DIAGRAM (4 Marks Each)

Answer with diagram where applicable — 2 × 4 = 8 Marks

Q20. Explain photosynthesis in detail. Write the balanced equation and explain the light and dark reactions. **[4M]**

Photosynthesis is the process by which green plants manufacture food (glucose) using carbon dioxide, water, and sunlight energy in the presence of chlorophyll.

Balanced Equation: $6CO_2 + 6H_2O + \text{Light Energy} \rightarrow C_6H_{12}O_6 + 6O_2$

Conditions required: (i) Sunlight, (ii) Chlorophyll (in chloroplasts), (iii) CO_2 (from stomata), (iv) Water (from soil via roots)

Light Reactions (in Thylakoid membrane): Light energy splits water molecules (photolysis): $2H_2O \rightarrow 4H^+ + 4e^- + O_2$. ATP and NADPH are produced. Oxygen is released as a by-product.

Dark Reactions / Calvin Cycle (in Stroma): CO_2 is fixed using ATP and NADPH. Glucose ($C_6H_{12}O_6$) is synthesised. Does not directly require light.

Factors affecting photosynthesis: Light intensity, CO_2 concentration, temperature, water availability.

Significance: Primary source of food and oxygen for almost all living organisms on Earth.

[Draw a labelled diagram of a chloroplast showing Thylakoid and Stroma]

Q21. Explain the domestic electric circuit. What safety devices are used and why? **[4M]**

Domestic electric circuits carry current at 220V AC (50 Hz) in India. Electricity enters the home through a main supply cable and passes through a main switch and a meter.

Components of Domestic Circuit:

(i) Live Wire (Red/Brown): Carries current at high potential. Dangerous to touch.

(ii) Neutral Wire (Black/Blue): Completes the circuit at zero potential.

(iii) Earth Wire (Green/Yellow): Provides safety — diverts excess current to the earth.

Distribution: The circuit is divided into parallel branches (lighting, fans, appliances). All appliances connect in parallel so each receives 220V independently.

Safety Devices:

1. Fuse: A thin wire of low melting point (lead-tin alloy). Melts and breaks the circuit if current exceeds safe limit. Must be connected in series with the live wire.

2. MCB (Miniature Circuit Breaker): Automatically trips the circuit on overloading. Can be reset; more convenient than fuse.

3. Earthing: The metallic body of appliances is connected to earth. Prevents electric shock even if live wire accidentally touches the body.

Overloading occurs when too many appliances are used simultaneously. Short circuit occurs when live and neutral wires come into direct contact. Both are prevented by fuses/MCBs.

[Draw a neat labelled diagram of domestic wiring showing live, neutral, earth wires, switch, fuse, and appliances in parallel]

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FA1 SCIENCE EXAMINATION PREPARATION

MOCK PAPER — TWO

Subject: Science | Total Marks: 40 | Duration: 1.5 Hours

Exam Date: 25 June 2026

SYLLABUS COVERED:

- **Physics:** Electricity — Ohm's Law, Circuits, Resistance, Power
- **Chemistry:** Chemical Equations & Reactions — Types, Balancing, Examples
- **Biology:** Life Processes — Nutrition, Respiration, Transportation, Excretion

GENERAL INSTRUCTIONS:

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2. Read each question carefully before answering.
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SECTION A — VERY SHORT ANSWER (1 Mark Each)

(10 × 1 = 10 Marks)

Physics — Electricity

Q1. What happens to the resistance of a conductor when its length is doubled? **[1M]**

When the length of a conductor is doubled, its resistance also doubles. This is because $R \propto L$ (resistance is directly proportional to length). If $L \rightarrow 2L$, then $R \rightarrow 2R$.

Q2. Define 1 kilowatt-hour (kWh). **[1M]**

1 kilowatt-hour (kWh) is the commercial unit of electrical energy. It is the energy consumed by an electrical appliance of power 1 kilowatt (1000W) when used for 1 hour. 1 kWh = 3.6×10^6 J. It is also called 1 unit of electricity.

Q3. State the relationship between power, voltage, and current. **[1M]**

Electric Power $P = V \times I$, where V is the potential difference (voltage) in volts and I is the current in amperes. Also: $P = I^2R = V^2/R$. The SI unit of power is Watt (W).

Q4. Why are domestic appliances connected in parallel? **[1M]**

Domestic appliances are connected in parallel so that: (i) Each appliance gets the same voltage (220V). (ii) Each appliance can be switched on/off independently. (iii) Failure of one does not affect others. (iv) Total resistance decreases, allowing sufficient current to each.

Chemistry — Chemical Equations & Reactions

Q5. Balance the following equation: $H_2 + O_2 \rightarrow H_2O$ **[1M]**

Unbalanced: $H_2 + O_2 \rightarrow H_2O$
Balanced: $2H_2 + O_2 \rightarrow 2H_2O$
Check: H = 4 on both sides ✓, O = 2 on both sides ✓
This is also an example of a combination reaction.

Q6. What are exothermic reactions? Give one example. **[1M]**

Exothermic reactions are chemical reactions that release energy (heat/light) to the surroundings. The products have lower energy than the reactants.
Example: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + Heat (Burning of methane/natural gas)
Other examples: Burning of coal, respiration, neutralisation.

Q7. What is a precipitate in a chemical reaction? [1M]

A precipitate is an insoluble solid that separates out from the solution during a chemical reaction. It is usually indicated by a downward arrow (↓) after the formula. Example: $AgCl\downarrow$ formed when $AgNO_3$ reacts with NaCl solution.

Biology — Life Processes

Q8. What is dialysis and when is it used? [1M]

Dialysis is an artificial process used to clean blood when kidneys fail to function properly. Blood is passed through a dialysis machine (artificial kidney) containing a semipermeable membrane that filters out waste products (urea, excess salts). It mimics the kidney's filtration function.

Q9. Name the opening through which plants exchange gases. [1M]

Plants exchange gases through tiny pores called Stomata (singular: stoma), located mainly on the lower surface of leaves. Each stoma is surrounded by two guard cells that regulate its opening and closing. Plants also exchange gases through lenticels in the bark.

Q10. What is the difference between breathing and respiration? [1M]

Breathing: A physical process involving inhalation of O_2 and exhalation of CO_2. It occurs in the lungs. Also called ventilation.
Respiration: A biochemical process occurring inside cells (mitochondria) where glucose is oxidised to release energy (ATP). Breathing supplies O_2 needed for cellular respiration.

SECTION B — SHORT ANSWER (2 Marks Each)

5 × 2 = 10 Marks

Q11. A wire has resistance 10Ω. What is the resistance if its length is halved and cross-section area is doubled? [2M]

Given: Original R = 10Ω; new length = L/2; new area = 2A
Formula: R = ρL/A (ρ = resistivity, constant)
New R' = ρ(L/2)/(2A) = ρL/(4A) = R/4
R' = 10/4 = 2.5 Ω
∴ The new resistance = 2.5 Ω (reduced to one-fourth the original value)

Q12. What is a redox reaction? Identify oxidation and reduction in: $CuO + H_2 \rightarrow Cu + H_2O$ [2M]

A Redox reaction is one in which oxidation (loss of electrons/addition of oxygen) and reduction (gain of electrons/removal of oxygen) occur simultaneously.
In $CuO + H_2 \rightarrow Cu + H_2O$:
• $CuO \rightarrow Cu$: Copper gains electrons ($Cu^{2+} \rightarrow Cu^0$). Oxygen is removed from CuO. → REDUCTION of CuO
• $H_2 \rightarrow H_2O$: Hydrogen loses electrons. Oxygen is added to H_2. → OXIDATION of H_2
CuO is the oxidising agent; H_2 is the reducing agent.

Q13. Explain how the kidney performs its excretory function. **[2M]**

The kidney excretes metabolic waste (mainly urea) through the following steps:
1. Filtration: Blood enters glomerulus (a network of capillaries in Bowman's capsule). High pressure forces small molecules (water, glucose, urea, salts) into the Bowman's capsule forming the filtrate.
2. Reabsorption: As filtrate passes through the tubule, useful substances like glucose, amino acids, water, and salts are reabsorbed back into the blood.
3. Secretion: Additional waste products are secreted into the tubule from surrounding capillaries.
4. Urine Formation: The remaining concentrated liquid (urine) passes through the ureter to the urinary bladder for storage and eventually excreted through the urethra.

Q14. Calculate the cost of running a 1500W air conditioner for 8 hours per day for 30 days at Rs. 6 per unit. **[2M]**

Given: Power = 1500 W = 1.5 kW, Time = 8 hours/day, Days = 30, Rate = Rs. 6/unit
Energy consumed per day = P × t = 1.5 × 8 = 12 kWh
Total energy in 30 days = 12 × 30 = 360 kWh (units)
Total cost = 360 × 6 = Rs. 2160
∴ The electricity bill for the AC = Rs. 2,160 for 30 days

Q15. What are the differences between aerobic and anaerobic respiration? **[2M]**

Aerobic Respiration: (i) Occurs in the presence of O_2. (ii) Takes place in cytoplasm and mitochondria. (iii) Glucose is completely oxidised. (iv) End products: $CO_2 + H_2O$. (v) Yields 38 ATP (large energy). (vi) Example: Most animals and plants.
Anaerobic Respiration: (i) Occurs without O_2. (ii) Takes place only in cytoplasm. (iii) Glucose is incompletely broken down. (iv) End products: Ethanol + CO_2 (in yeast) or Lactic acid (in muscles). (v) Yields only 2 ATP (less energy). (vi) Example: Yeast, bacteria, muscle cells during intense exercise.

SECTION C — LONG ANSWER (3 Marks Each)

4 × 3 = 12 Marks

Q16. Describe the factors affecting resistance of a conductor. Write the formula. **[3M]**

Resistance (R) of a conductor depends on the following factors:

1. Length (L): $R \propto L$ — Resistance increases with length. A longer wire has more resistance as electrons face more collisions.

2. Area of Cross-Section (A): $R \propto 1/A$ — Resistance decreases with wider cross-section. Thicker wire allows more electrons to flow.

3. Nature of Material (Resistivity ρ): Different materials have different resistivities. Conductors like copper have very low ρ; insulators like rubber have very high ρ.

4. Temperature: For metallic conductors, resistance increases with temperature (more atomic vibrations hinder electron flow). For semiconductors, resistance decreases with temperature.

Combined Formula: $R = \rho L/A$

where ρ = resistivity (material property, SI unit: Ω·m), L = length (m), A = cross-sectional area (m^2)

Q17. Explain decomposition reactions with the three types and examples. **[3M]**

Decomposition reactions involve the breakdown of a single reactant into two or more simpler products. They are opposite to combination reactions.

1. Thermal Decomposition (by heat): A compound is decomposed by applying heat.

Example: $CaCO_3 \rightarrow CaO + CO_2$ (Limestone heated to form quicklime)

Example: $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$

2. Electrolytic Decomposition (Electrolysis): Decomposition by passage of electricity.

Example: $2H_2O \rightarrow 2H_2 + O_2$ (Water splits into hydrogen and oxygen by electricity)

3. Photodecomposition (by light): Decomposition caused by sunlight.

Example: $2AgCl \rightarrow 2Ag + Cl_2$ (Silver chloride decomposes in sunlight — used in photography)

Example: $2AgBr \rightarrow 2Ag + Br_2$ (Silver bromide in black-and-white photography)

Q18. Explain nutrition in human beings. Describe each step of digestion. **[3M]**

Human beings are heterotrophs showing holozoic nutrition — they ingest, digest, absorb, assimilate food, and egestion waste.

Steps of Digestion:

1. Ingestion (Mouth): Food is chewed by teeth and mixed with saliva (contains salivary amylase which breaks starch into maltose). Food is converted into a bolus.

2. Stomach: Gastric juice (HCl + pepsin + mucus) is secreted. HCl kills bacteria and creates acidic medium. Pepsin digests proteins into peptides. Food becomes chyme.

3. Small Intestine: Main site of digestion. Bile (from liver) emulsifies fats. Pancreatic juice digests carbohydrates, proteins, fats. Intestinal juice completes digestion. Nutrients absorbed by villi and microvilli into blood.

4. Large Intestine: Absorbs water and minerals from undigested food. Forms semi-solid faeces.

5. Egestion: Faeces expelled through the anus.

The liver produces bile; the pancreas is both exocrine (digestive enzymes) and endocrine (insulin, glucagon).

Q19. The resistance of a wire is 5Ω. A battery of 10V is connected. Find: (a) Current, (b) Power, (c) Energy consumed in 2 hours. **[3M]**

Given: R = 5Ω, V = 10V, t = 2 hours = 2 × 3600 = 7200 s

(a) Current: I = V/R = 10/5 = 2 A
(b) Power: P = VI = 10 × 2 = 20 W [or P = I^2R = 4 × 5 = 20 W ✓]
(c) Energy consumed: E = P × t = 20 × 7200 = 144,000 J = 1.44 × 10^5 J
In kWh: E = 20W × 2h = 40 Wh = 0.04 kWh
∴ I = 2A, P = 20W, Energy = 144,000 J (or 0.04 kWh)

SECTION D — ESSAY / DIAGRAM (4 Marks Each)

2 × 4 = 8 Marks

Q20. Explain the transportation of water and minerals in plants. What is transpiration? **[4M]**

Plants have two vascular tissues for transport: Xylem (for water and minerals) and Phloem (for food/sugar).
Water and Mineral Transport (Xylem):
1. Root Absorption: Root hairs absorb water from soil by osmosis and minerals by active transport.
2. Root Pressure: Water moves from cell to cell across the root cortex into xylem due to osmotic pressure generated in root cells.
3. Capillary Action and Cohesion-Tension: Water rises through narrow xylem tubes due to adhesion (water sticking to walls) and cohesion (water molecules sticking to each other). The main force is created by transpiration pull.
4. Transpiration Pull: Evaporation of water from leaves (stomata) creates a tension that pulls water upward through xylem, even to great heights in tall trees.
Transpiration: The loss of water vapour from aerial parts of plants (mainly through stomata) is called transpiration. Advantages: (i) Produces the pull that moves water upward. (ii) Cools the plant. (iii) Helps in mineral absorption.
Food Transport (Phloem): Prepared food (sucrose) from leaves is transported to all parts of the plant through phloem by active transport (requires energy), a process called translocation.
[Draw a diagram showing xylem in root and stem, with arrows indicating direction of water movement]

Q21. Explain corrosion and rancidity as chemical changes. How can they be prevented? **[4M]**

Both corrosion and rancidity are slow chemical changes (oxidation reactions) that cause deterioration of materials.
CORROSION: The gradual eating away of metals by their environment (usually through oxidation or reaction with atmospheric gases/moisture).
Most common example: Rusting of iron — $4Fe + 3O_2 + xH_2O \rightarrow 2Fe_2O_3 \cdot xH_2O$ (Rust = hydrated iron oxide, reddish-brown in colour).
Other examples: Green patina on copper and bronze (formation of $CuCO_3/Cu(OH)_2$); silver tarnishing (Ag_2S).
Prevention of Corrosion: (i) Painting or greasing. (ii) Galvanisation (coating iron with zinc — sacrificial protection). (iii) Electroplating. (iv) Alloying (stainless steel). (v) Using anti-rust chemicals.

RANCIDITY: The oxidation of fats and oils in food, producing unpleasant smell and taste. Oxidation of C–H bonds in fatty acids produces aldehydes and ketones.

Examples: Butter going bad, chips smelling stale.

Prevention of Rancidity: (i) Adding antioxidants (BHA, BHT, Vitamin C, Vitamin E). (ii) Storing in airtight containers (reduces O_2 contact). (iii) Refrigeration (slows oxidation). (iv) Flushing packaging with nitrogen gas (inert atmosphere). (v) Vacuum-packing chips and snacks.

Similarities: Both are oxidation processes; both can be slowed by reducing oxygen contact and using antioxidants.


IMMANUEL HIGH SCHOOL NAGAVARA
ARISE SHINE

IMPORTANT QUESTIONS & ANSWERS

From LBA (Learning By Activity) & Karnataka SSLC Previous Year Question Papers

For FA1 Preparation — Immanuel School | Science | 2026–27

PHYSICS — ELECTRICITY: Important Q&A

[Previous Year] Derive the expression for equivalent resistance when resistors are connected in series.

When resistors R_1, R_2, R_3 are in series, same current I flows through each.
By Ohm's Law: $V_1 = IR_1$, $V_2 = IR_2$, $V_3 = IR_3$
Total voltage: $V = V_1 + V_2 + V_3 = I(R_1 + R_2 + R_3)$
Since $V = IR_s$ (R_s = series equivalent): $IR_s = I(R_1 + R_2 + R_3)$
$\therefore R_s = R_1 + R_2 + R_3$ [Series equivalent = sum of all resistances]

[Previous Year] Derive the expression for equivalent resistance when resistors are in parallel.

When resistors R_1, R_2, R_3 are in parallel, same voltage V is applied across each.
By Ohm's Law: $I_1 = V/R_1$, $I_2 = V/R_2$, $I_3 = V/R_3$
Total current: $I = I_1 + I_2 + I_3 = V(1/R_1 + 1/R_2 + 1/R_3)$
Since $I = V/R_p$: $V/R_p = V(1/R_1 + 1/R_2 + 1/R_3)$
$\therefore 1/R_p = 1/R_1 + 1/R_2 + 1/R_3$ [Parallel: sum of reciprocals]
Note: R_p is always less than the smallest resistor.

[LBA Activity] How do you verify Ohm's Law using an electric circuit?

Apparatus: Battery, rheostat, ammeter (in series), voltmeter (in parallel), resistance wire, key.
Procedure: 1. Connect ammeter in series with the resistance R.
2. Connect voltmeter across R.
3. Use rheostat to vary current. Note corresponding V and I readings.
Observation: A graph of V vs I is a straight line passing through origin.
Conclusion: $V/I = R$ = constant, which verifies $V \propto I$ (Ohm's Law).
The slope of V-I graph gives the value of resistance R.

[Previous Year 2023] An electric lamp of 100Ω, a toaster of 50Ω, and a water filter of 500Ω are connected in parallel to 220V supply. Find current through each and total current.

V = 220V for each (parallel connection)
I_lamp = V/R = 220/100 = 2.2 A
I_toaster = 220/50 = 4.4 A
I_filter = 220/500 = 0.44 A
Total I = 2.2 + 4.4 + 0.44 = 7.04 A
Alternatively: $1/R_p = 1/100 + 1/50 + 1/500 = 5+10+1/500 = 16/500$; $R_p = 31.25\Omega$; $I = 220/31.25 \approx 7.04$ A ✓

[LBA / Previous Year] What is the heating effect of electric current? List its applications.

Heating Effect (Joule's Heating): When electric current passes through a conductor, electrical energy is converted to heat energy due to the resistance offered by the conductor. $H = I^2Rt$ (Joules).

Applications:

1. Electric Iron: Uses a heating element (nichrome wire) that heats due to high resistance.
2. Electric Heater/Room Heater: Nichrome coil converts electricity to heat.
3. Electric Bulb: Tungsten filament (very high melting point, 3380°C) glows at high temperature.
4. Electric Fuse: Low-melting-point wire melts and breaks the circuit during overloading.
5. Electric Toaster and Oven: Convert electrical energy to thermal energy for cooking.
6. Electric Welding: High current generates heat to melt and join metals.

[Previous Year 2024] Why do we use copper wires for electrical wiring but nichrome for heating elements?

Copper: (i) Very low resistivity ($\rho = 1.69 \times 10^{-8}\ \Omega \cdot m$) — produces very little heat. (ii) High electrical conductivity. (iii) Does not react with air. Ideal for wiring where heat generation is undesirable.

Nichrome (Nickel-Chromium alloy): (i) High resistivity — produces large amounts of heat. (ii) High melting point (~1400°C) — does not melt even at high temperatures. (iii) Does not oxidise at high temperatures — no coating needed.

Therefore, copper is used for wiring (efficient current flow with minimal heat loss) and nichrome for heating elements (maximum heat generation).

CHEMISTRY — CHEMICAL EQUATIONS & REACTIONS: Important Q&A

[Previous Year] What is the importance of balancing chemical equations?

1. Law of Conservation of Mass: Matter cannot be created or destroyed. Total mass of reactants = Total mass of products. Balancing ensures this law is obeyed.
2. Gives quantitative information about reactants and products (stoichiometry).
3. Shows the exact ratio in which substances react and are produced.
4. An unbalanced equation is scientifically incorrect.

Method of balancing: Hit and Trial (inspection) method — adjust coefficients until atom count on both sides is equal for every element.

[LBA / Previous Year] Classify the following reactions and give reasons: (a) $2H_2O_2 \rightarrow 2H_2O + O_2$ (b) $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

(a) $2H_2O_2 \rightarrow 2H_2O + O_2$: DECOMPOSITION REACTION

One compound (H_2O_2 = Hydrogen peroxide) breaks down into two simpler substances (water and oxygen). Specifically, it is a thermal/catalytic decomposition.

(b) $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$: DISPLACEMENT REACTION (also Redox reaction)

Iron (Fe) is more reactive than copper (Cu) and displaces copper from copper sulphate solution. Fe is oxidised (loses electrons); Cu^{2+} is reduced (gains electrons). The solution changes from blue ($CuSO_4$) to green ($FeSO_4$), and reddish copper deposits form.

[Previous Year 2023] What is the difference between exothermic and endothermic reactions?

Exothermic Reactions: Energy is released to the surroundings as heat or light. Products have lower energy than reactants. Temperature of surroundings increases.

Examples: (i) Burning of natural gas: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + Heat

(ii) Respiration: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy

(iii) Neutralisation of acid and base: $NaOH + HCl \rightarrow NaCl + H_2O$ + Heat

Endothermic Reactions: Energy is absorbed from the surroundings. Products have higher energy than reactants. Temperature of surroundings decreases.

Examples: (i) Decomposition of $CaCO_3$: $CaCO_3$ + Heat $\rightarrow CaO + CO_2$

(ii) Photosynthesis: $6CO_2 + 6H_2O$ + Light $\rightarrow C_6H_{12}O_6 + 6O_2$

(iii) Evaporation of water

[LBA Activity] Describe an activity to show that iron displaces copper from copper sulphate solution.

Aim: To demonstrate a displacement reaction using iron and copper sulphate.

Materials: Iron nail, copper sulphate solution (blue colour), beaker.

Procedure: 1. Take copper sulphate solution in a beaker (blue coloured).

2. Clean an iron nail with sandpaper and immerse it in the solution.

3. Observe the nail and solution over 20–30 minutes.

Observations: (i) A reddish-brown deposit (copper) forms on the iron nail.
(ii) The blue colour of the solution fades and turns greenish (ferrous sulphate).
Equation: $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$
Conclusion: Iron (more reactive) displaces copper (less reactive) from its salt solution. This demonstrates a displacement reaction and the activity series.

[Previous Year 2024] Explain why food packets are flushed with nitrogen gas.

Food packets (especially chips and fried snacks containing oils and fats) are flushed with nitrogen gas to prevent rancidity.
Reason: Fats and oils undergo oxidation (rancidity) in the presence of oxygen, producing compounds with unpleasant smell and taste.
Nitrogen is an inert (unreactive) gas. By replacing oxygen with nitrogen inside the packet:
1. The oxygen that would cause oxidation is removed.
2. Nitrogen does not react with the food.
3. Nitrogen prevents growth of aerobic microorganisms.
4. Nitrogen also prevents crushing by providing a cushion of gas.
This is a practical application of preventing oxidation in food preservation.

🌿 BIOLOGY — LIFE PROCESSES: Important Q&A

[Previous Year] What are the necessary conditions for photosynthesis? Describe the raw materials and products.

Conditions (Requirements) for Photosynthesis:

1. Sunlight (energy source — absorbed by chlorophyll)
2. Chlorophyll (green pigment — captures light energy; found in chloroplasts)
3. Carbon dioxide (from atmosphere through stomata)
4. Water (from soil absorbed by roots)

Balanced Equation: $6CO_2 + 6H_2O + \text{Light energy} \rightarrow C_6H_{12}O_6 + 6O_2$

Products: Glucose (food stored as starch) and Oxygen (released into atmosphere)

The process occurs in chloroplasts, mainly in the palisade cells of leaves.

Significance: (i) Produces food for all organisms. (ii) Releases O_2 — essential for aerobic respiration. (iii) Reduces CO_2 — helps maintain atmospheric balance.

[LBA Activity] Describe an activity to show that light is necessary for photosynthesis.

Aim: To prove that light is essential for photosynthesis (using starch test).

Materials: Potted plant, aluminium foil, iodine solution, ethanol.

Procedure: 1. Keep plant in dark for 2 days (to destarch it).

2. Cover part of one leaf with black/aluminium foil.
3. Place plant in sunlight for 3–4 hours.
4. Pluck the leaf. Remove chlorophyll by boiling in ethanol.
5. Wash with water. Add iodine solution.

Observation: (i) Covered part (no light) → No colour change (no starch).

(ii) Uncovered part (light present) → Blue-black colour (starch present).

Conclusion: Starch is formed only where light was available, proving light is essential for photosynthesis.

[Previous Year 2023] Explain the human respiratory system. What is the role of diaphragm in breathing?

Human Respiratory System: Consists of — Nostrils → Nasal cavity → Pharynx → Larynx (voice box) → Trachea (windpipe) → Bronchi → Bronchioles → Alveoli (in lungs)

Alveoli: Tiny air sacs in lungs with very thin walls and rich blood supply. Site of gaseous exchange — O_2 enters blood, CO_2 leaves blood.

Breathing Mechanism (Role of Diaphragm):

Inhalation: Diaphragm contracts and moves downward; intercostal muscles expand the ribcage outward. Chest volume increases; pressure decreases. Air rushes into lungs.

Exhalation: Diaphragm relaxes and moves upward; ribcage contracts. Chest volume decreases; pressure increases. Air is pushed out of lungs.

Gaseous Exchange: O_2 from alveolar air diffuses into blood capillaries. CO_2 from blood diffuses into alveolar air. This is driven by concentration gradient (diffusion).

Breathing rate at rest: ~15–18 times per minute.

[Previous Year 2024] What is blood pressure? How is it measured and what are normal values?

Blood Pressure (BP): The force exerted by blood against the walls of blood vessels (arteries) as it is pumped by the heart.
Systolic Pressure: Pressure during ventricular contraction (heart pumping). Higher value.
Diastolic Pressure: Pressure during ventricular relaxation (heart at rest). Lower value.
Normal BP: 120/80 mmHg (120 mmHg systolic / 80 mmHg diastolic)
Measurement: Using Sphygmomanometer (BP apparatus) and stethoscope. A cuff is inflated around the upper arm, then slowly deflated while listening for sounds (Korotkoff sounds).
Hypertension (High BP): > 140/90 mmHg. Can lead to stroke, heart attack, kidney failure.
Hypotension (Low BP): < 90/60 mmHg. Can cause dizziness and fainting.
Instrument used in modern times: Digital BP monitor.

[LBA / Previous Year] Explain the structure and function of the nephron.

Nephron is the structural and functional unit of the kidney. Each kidney contains ~1 million nephrons.
Parts of a Nephron:
1. Bowman's Capsule: Cup-shaped structure surrounding the glomerulus. Receives the filtrate.
2. Glomerulus: A knot of capillaries inside Bowman's capsule. High-pressure filtration of blood occurs here.
3. Proximal Convoluted Tubule (PCT): Reabsorbs glucose, amino acids, water, and useful salts.
4. Loop of Henle: Creates concentration gradient; further water reabsorption (important in water conservation).
5. Distal Convoluted Tubule (DCT): Selective reabsorption and secretion; maintains pH and ion balance.
6. Collecting Duct: Collects urine from multiple nephrons; further water reabsorption; carries urine to pelvis → ureter → bladder.
Function: Filtration → Reabsorption → Secretion → Excretion of urine (water + urea + uric acid + excess salts).

[Previous Year 2023] How does transportation occur in plants? Differentiate xylem and phloem.

Plants have two vascular systems for transportation:
XYLEM: Transports water and dissolved minerals from roots to all parts of the plant (upward movement).
- Composed of dead cells (tracheids and vessels)
- Movement is unidirectional (bottom to top)
- Force: Transpiration pull + capillary action + root pressure
PHLOEM: Transports prepared food (mainly sucrose) from leaves to all plant organs (bidirectional movement).
- Composed of living cells (sieve tubes and companion cells)
- Movement can be upward or downward
- Force: Active transport (requires energy/ATP)
The process of food transport through phloem is called Translocation.

QUICK REVISION — FORMULAE & KEY POINTS

Physics Formulae

$V = IR$ (Ohm's Law) | $R = \rho L/A$ | $P = VI = I^2R = V^2/R$
$H = I^2Rt$ (Joule's Law) | Energy (kWh) = P(kW) × t(h)
Series: $R = R_1+R_2+R_3$ | Parallel: $1/R = 1/R_1+1/R_2+1/R_3$

Chemistry Key Points

Types of Reactions: Combination | Decomposition | Displacement | Double Displacement | Redox
Exothermic: Heat released | Endothermic: Heat absorbed
Corrosion = oxidation of metals | Rancidity = oxidation of fats/oils
Balancing: Apply Law of Conservation of Mass — atoms on both sides must be equal

Biology Key Points

Life Processes: Nutrition | Respiration | Transportation | Excretion | Reproduction | Sensitivity | Growth
Photosynthesis: $6CO_2+6H_2O+light \rightarrow C_6H_{12}O_6+6O_2$ (in chloroplasts)
Aerobic: 38 ATP | Anaerobic: 2 ATP only | Respiration organ: Mitochondria
Blood: RBC (O_2 transport) | WBC (immunity) | Platelets (clotting) | Plasma (medium)
Nephron: Glomerulus → Bowman's → PCT → Loop of Henle → DCT → Collecting Duct

ALL THE BEST FOR YOUR FA1 EXAM!

Immanuel School | Science Department | 25 June 2026

"Work hard in silence, let success make the noise."