

QUESTION PAPER 3 (SET C) – REVISED WITH CHAPTER REFERENCES

CBSE CLASS X SCIENCE (CODE 086)

Time Allowed: 3 Hours

Maximum Marks: 80

Based on NCERT Class 10 Science Textbook (2024-25 Edition)

SECTION A

(20 questions of 1 mark each)

Q.1 The reaction $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ is an example of:

- (a) Combination reaction
- (b) Decomposition reaction
- (c) Displacement reaction
- (d) Double displacement reaction

Q.2 The pH of a neutral solution at 25°C is:

- (a) 0
- (b) 7
- (c) 14
- (d) 10

Q.3 Which metal is liquid at room temperature?

- (a) Sodium
- (b) Iron
- (c) Mercury
- (d) Aluminum

Q.4 The general formula of alkane is:

- (a) C_nH_{2n}
- (b) $\text{C}_n\text{H}_{2n+2}$
- (c) $\text{C}_n\text{H}_{2n-2}$
- (d) $\text{C}_n\text{H}_{2n+1}\text{OH}$

Q.5 The enzyme that digests proteins in the stomach is:

- (a) Amylase
- (b) Lipase
- (c) Pepsin
- (d) Trypsin

Q.6 The structural and functional unit of the nervous system is:

- (a) Nephron
- (b) Neuron
- (c) Alveoli
- (d) Nephridia

Q.7 The process of fusion of male and female gametes is called:

- (a) Pollination
- (b) Fertilization
- (c) Germination
- (d) Regeneration

Q.8 The mirror formula is given by:

- (a) $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$
- (b) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$
- (c) $f = \frac{uv}{u+v}$
- (d) $f = u + v$

Q.9 When light travels from denser to rarer medium, it bends:

- (a) Towards the normal
- (b) Away from the normal
- (c) Does not bend
- (d) Perpendicular to normal

Q.10 The SI unit of resistance is:

- (a) Volt
- (b) Ampere
- (c) Ohm
- (d) Watt

Q.11 The equivalent resistance of three resistors of $2\ \Omega$ each connected in series is:

- (a) $\frac{2}{3}\ \Omega$
- (b) $2\ \Omega$
- (c) $3\ \Omega$
- (d) $6\ \Omega$

Q.12 The magnetic effect of electric current was discovered by:

- (a) Faraday
- (b) Oersted
- (c) Ampere
- (d) Maxwell

Q.13 The ultimate source of energy for fossil fuels is:

- (a) Earth's core
- (b) Moon
- (c) Sun
- (d) Wind

Q.14 The twinkling of stars is due to:

- (a) Reflection of starlight
- (b) Atmospheric refraction
- (c) Dispersion of starlight
- (d) Scattering of starlight

Q.15 Chipko movement was started in which state of India?

- (a) Maharashtra

- (b) Uttarakhand
- (c) Kerala
- (d) Punjab

Q.16 The chemical name of baking soda is:

- (a) Sodium carbonate
- (b) Sodium hydrogen carbonate
- (c) Calcium carbonate
- (d) Sodium hydroxide

Q.17 The growth hormone in plants is:

- (a) Insulin
- (b) Auxin
- (c) Thyroxine
- (d) Adrenaline

Q.18 The magnification produced by a plane mirror is:

- (a) +1
- (b) -1
- (c) 0
- (d) ∞

Q.19 The device used to protect circuits from short-circuiting is:

- (a) Ammeter
- (b) Voltmeter
- (c) Galvanometer
- (d) Fuse

Q.20 Which of the following is a non-biodegradable pollutant?

- (a) Vegetable waste
- (b) Paper
- (c) DDT
- (d) Cotton cloth

SECTION B

(6 questions of 2 marks each)

Q.21 Write balanced chemical equations for:

- (a) Reaction of magnesium with oxygen
- (b) Reaction of iron with steam

Q.22 Why does tooth decay start when pH in mouth falls below 5.5? How can it be prevented?

Q.23 Draw a labeled diagram of cross-section of leaf showing stomata.

Q.24 An object is placed at a distance of 30 cm from a convex lens of focal length 20 cm. Find the position and magnification of the image.

Q.25 What is short circuiting? What are its possible causes?

Q.26 Differentiate between biodegradable and non-biodegradable substances with one example each.

SECTION C

(7 questions of 3 marks each)

Q.27 (a) What is a precipitation reaction? Give one example with balanced equation.
(b) Why is respiration considered an exothermic reaction? Write the chemical equation.
(c) What happens when silver chloride is exposed to sunlight? Write the chemical equation.

Q.28 (a) What are alloys? Give two examples.
(b) Why is pure gold not suitable for making jewelry? How is this problem solved?
(c) Why are metals good conductors of electricity?

Q.29 (a) What is transpiration?
(b) Draw a labeled diagram of cross-section of root showing root hair.
(c) Why is transpiration considered a necessary evil?

Q.30 (a) Define power of a lens. Write its SI unit.
(b) A convex lens of power $+4\text{ D}$ and a concave lens of power -2 D are placed in contact. Calculate the focal length of the combination.
(c) What type of lens is used to correct hypermetropia?

Q.31 (a) State Joule's law of heating effect of electric current.
(b) An electric heater of resistance $8\ \Omega$ draws 15 A current from 220 V supply. Calculate the heat energy produced in 2 minutes.
(c) Why are heating elements made of alloys rather than pure metals?

Q.32 (a) What is an electromagnet?
(b) List three factors on which the strength of an electromagnet depends.
(c) Name two devices that use electromagnets.

Q.33 (a) What is sustainable management?
(b) Why is reuse preferred over recycling?
(c) Suggest three ways to reduce consumption of fossil fuels.

SECTION D

(3 questions of 5 marks each)

Q.34 (a) What is catenation? Why does carbon show maximum catenation?
(b) Draw the electron dot structures of:
(i) Ethane (C_2H_6)
(ii) Ethene (C_2H_4)
(iii) Ethyne (C_2H_2)
(c) What is a homologous series? Give two characteristics of homologous series.
(d) Write the molecular formula of the fourth member of alkane series.

Q.35 (a) Draw a labeled diagram of the human alimentary canal.

(b) What is peristaltic movement? Where does it occur?

(c) Explain the role of following in digestion:

(i) Saliva

(ii) Gastric juice

(iii) Bile

(d) Where does complete digestion of carbohydrates, proteins, and fats occur?

Q.36 (a) What is electromagnetic induction? State the rule to find the direction of induced current.

(b) Explain the construction and working of an electric generator with a labeled diagram.

(c) Why is earthing important for electrical appliances?

SECTION E

(3 case-based questions of 4 marks each)

Q.37 Read the case study about chemical reactions:

A student mixed solutions of lead nitrate and potassium iodide in a test tube. Immediately, a bright yellow precipitate was formed. The mixture was filtered and the precipitate was collected.

(a) Identify the yellow precipitate formed. Write the balanced chemical equation.

(b) What type of chemical reaction is this?

(c) Why is this reaction also called a double displacement reaction?

(d) What will happen if the precipitate is exposed to sunlight? Explain.

Q.38 Study the diagram showing magnetic field lines around a bar magnet and answer:

(Diagram description: Bar magnet with N-pole and S-pole; curved field lines emerging from N-pole and entering S-pole; field lines closer near poles)

(a) What does the closeness of magnetic field lines indicate?

(b) Why do magnetic field lines never intersect each other?

(c) A small compass needle is placed near the magnet. In which direction will its north pole point?

(d) How will you identify the north pole of an unmarked bar magnet using a compass?

Q.39 A pond ecosystem is described below:

A pond contains phytoplankton, zooplankton, small fish, large fish, and decomposers. Sunlight provides energy to phytoplankton which are eaten by zooplankton. Small fish feed on zooplankton and are eaten by large fish. When organisms die, decomposers break them down.

(a) Construct a food chain from the given information.

(b) Identify the trophic level of zooplankton.

(c) If 10,000 J energy is available to phytoplankton, calculate energy available to large fish.

(d) Why are decomposers essential for the ecosystem? What would happen if they were absent?

IMPORTANT NOTE ON PAGE NUMBERS

Exact page numbers vary across different printings/editions of the NCERT Class 10 Science textbook (2024-25). The references below indicate chapter numbers and approximate page ranges based on the standard NCERT structure. Students must consult their physical/digital copy of "Science Textbook for Class X" published by NCERT for precise pagination.

SECTION A – ANSWERS WITH REFERENCES

Q.1 Answer: (c) Displacement reaction

Explanation: Zinc (more reactive) displaces copper (less reactive) from its salt solution.

Reference: Chapter 1: Chemical Reactions and Equations, Page 9 – Displacement Reaction

Q.2 Answer: (b) 7

Explanation: Neutral solutions have equal concentration of H^+ and OH^- ions (10^{-7} M each) at 25°C .

Reference: Chapter 2: Acids, Bases and Salts, Page 27 – pH Scale

Q.3 Answer: (c) Mercury

Explanation: Mercury (Hg) has melting point -39°C , making it liquid at room temperature (25°C).

Reference: Chapter 3: Metals and Non-metals, Page 40 – Physical Properties of Metals

Q.4 Answer: (b) $\text{C}_n\text{H}_{2n+2}$

Explanation: Alkanes are saturated hydrocarbons with single bonds only.

Reference: Chapter 4: Carbon and its Compounds, Page 62 – Saturated and Unsaturated Carbon Compounds

Q.5 Answer: (c) Pepsin

Explanation: Pepsin (activated from pepsinogen by HCl) breaks proteins into peptones in stomach.

Reference: Chapter 6: Life Processes, Page 99 – Nutrition in Human Beings

Q.6 Answer: (b) Neuron

Explanation: Neuron (nerve cell) receives, conducts, and transmits electrochemical signals.

Reference: Chapter 7: Control and Coordination, Page 119 – Animals – Nervous System

Q.7 Answer: (b) Fertilization

Explanation: Fusion of male gamete (sperm) and female gamete (ovum) forms zygote.

Reference: Chapter 8: How do Organisms Reproduce?, Page 146 – Sexual Reproduction in Human Beings

Q.8 Answer: (a) $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

Explanation: Standard mirror formula with New Cartesian Sign Convention (u negative for real objects).

Reference: Chapter 10: Light – Reflection and Refraction, Page 168 – Mirror Formula and Magnification

Q.9 Answer: (b) Away from the normal

Explanation: Light speeds up when entering rarer medium, bending away from normal (Snell's law).

Reference: Chapter 10: Light – Reflection and Refraction, Page 174 – Refraction through a Rectangular Glass Slab

Q.10 Answer: (c) Ohm

Explanation: Resistance $R = V/I$; SI unit is ohm (Ω), named after Georg Simon Ohm.

Reference: Chapter 12: Electricity, Page 207 – Ohm's Law

Q.11 Answer: (d) $6\ \Omega$

Explanation: Series resistance: $R_s = R_1 + R_2 + R_3 = 2 + 2 + 2 = 6\ \Omega$

Reference: Chapter 12: Electricity, Page 212 – Resistors in Series

Q.12 Answer: (b) Oersted

Explanation: Hans Christian Oersted (1820) observed deflection of magnetic compass near current-carrying wire.

Reference: Chapter 13: Magnetic Effects of Electric Current, Page 228 – Magnetic Field and Field Lines

Q.13 Answer: (c) Sun

Explanation: Fossil fuels formed from ancient biomass (plants/animals) that captured solar energy via photosynthesis millions of years ago.

Reference: Chapter 14: Sources of Energy, Page 247 – Conventional Sources of Energy

Q.14 Answer: (b) Atmospheric refraction

Explanation: Varying refractive index of atmospheric layers causes continuous refraction of starlight, making apparent position fluctuate.

Reference: Chapter 11: Human Eye and the Colourful World, Page 194 – Atmospheric Refraction

Q.15 Answer: (b) Uttarakhand

Explanation: Chipko movement (1970s) began in Reni village, Chamoli district (then Uttar Pradesh, now Uttarakhand) to prevent tree felling.

Reference: Chapter 16: Sustainable Management of Natural Resources, Page 277 – Stakeholders and Conservation (Note: Chapter 16 deleted for 2024-25 board exams but concept remains relevant for environmental awareness)

Q.16 Answer: (b) Sodium hydrogen carbonate

Explanation: Chemical formula NaHCO_3 ; used in baking, antacids, and fire extinguishers.

Reference: Chapter 2: Acids, Bases and Salts, Page 30 – Are the Crystals of Salts Really Dry?

Q.17 Answer: (b) Auxin

Explanation: Auxin promotes cell elongation, phototropism, and geotropism in plants.

Reference: Chapter 7: Control and Coordination, Page 131 – Coordination in Plants

Q.18 Answer: (a) $+1$

Explanation: Image size equals object size and is erect; magnification $m = +\frac{h_i}{h_o} = +1$

Reference: Chapter 10: Light – Reflection and Refraction, Page 169 – Magnification

Q.19 Answer: (d) Fuse

Explanation: Fuse wire (low melting point alloy) melts when excessive current flows, breaking circuit and preventing damage.

Reference: Chapter 12: Electricity, Page 232 – Domestic Electric Circuits

Q.20 Answer: (c) DDT

Explanation: DDT (dichlorodiphenyltrichloroethane) is non-biodegradable pesticide that persists in environment for decades.

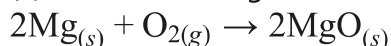
Reference: Chapter 15: Our Environment, Page 262 – Biological Magnification

SECTION B – DETAILED SOLUTIONS

Q.21

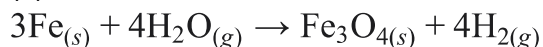
Solution:

(a) Reaction of magnesium with oxygen:



(Bright white flame; white ash of magnesium oxide formed)

(b) Reaction of iron with steam:



(Iron reacts only with steam, not with cold/liquid water)

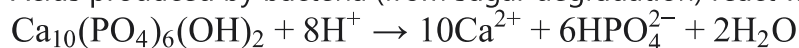
Reference: Chapter 1: Chemical Reactions and Equations, Page 8 – Combination Reaction; Chapter 3: Metals and Non-metals, Page 46 – Reaction of Metals with Water

Q.22

Solution:

Tooth enamel is made of calcium phosphate $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$. When pH falls below 5.5:

- Acids produced by bacteria (from sugar degradation) react with enamel:



- Enamel corrodes, leading to cavities.

Prevention methods:

1. Brush teeth twice daily with fluoride toothpaste (basic nature neutralizes acids)
2. Reduce sugar intake (limits acid production by bacteria)
3. Rinse mouth after meals
4. Regular dental check-ups

Reference: Chapter 2: Acids, Bases and Salts, Page 26 – Reaction of Metal Carbonates and Metal Hydrogencarbonates with Acids

Q.23

Solution:

(Diagram description for students to draw)

Cross-section of leaf showing:

- Upper epidermis (single layer)
- Palisade mesophyll (columnar cells with chloroplasts)
- Spongy mesophyll (loosely arranged cells with air spaces)
- Lower epidermis with stomata
- Stomata: Bean-shaped guard cells surrounding pore; chloroplasts visible in guard cells; subsidiary cells adjacent to guard cells

Reference: Chapter 6: Life Processes, Page 104 – Transportation in Plants

Q.24

Solution:

Given: Object distance $u = -30$ cm (negative by sign convention), Focal length $f = +20$ cm (convex lens)

Using lens formula:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$
$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{20} + \frac{1}{-30} = \frac{3}{60} - \frac{2}{60} = \frac{1}{60}$$
$$v = +60 \text{ cm}$$

Magnification:

$$m = \frac{v}{u} = \frac{60}{-30} = -2$$

Image position: 60 cm on opposite side of lens (real image)

Magnification: -2 (image is real, inverted, and twice the size of object)

Reference: Chapter 10: Light – Reflection and Refraction, Pages 180-182 – Image Formation by Lenses

Q.25

Solution:

Short circuiting: Direct contact between live (phase) and neutral wires without any appliance resistance, causing very large current flow.

Possible causes:

1. Damaged insulation allowing live and neutral wires to touch
2. Faulty appliance with internal wiring defect
3. Loose connections in plug/socket causing wire contact
4. Water ingress into electrical fittings creating conducting path

Consequences: Overheating, fire hazard, damage to appliances. Protection: Fuses/MCBs melt/trip to break circuit.

Reference: Chapter 12: Electricity, Page 233 – Short Circuiting and Overloading

Q.26

Solution:

Biodegradable Substances	Non-biodegradable Substances
Broken down naturally by microorganisms (bacteria, fungi) into simple harmless substances	Not broken down by microorganisms; persist in environment for long periods
Example: Vegetable peels, paper, cotton cloth	Example: Plastic, glass, DDT, aluminum foil

Reference: Chapter 15: Our Environment, Page 257 – Eco-friendly and Non-eco-friendly Substances

SECTION C – DETAILED SOLUTIONS

Q.27

Solution:

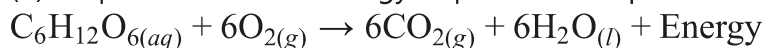
(a) Precipitation reaction: Reaction in which soluble reactants form an insoluble solid product (precipitate).

Example:



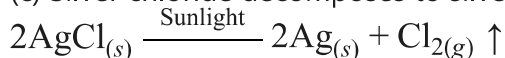
(White precipitate of silver chloride formed)

(b) Respiration releases energy required for life processes:



Since energy is released (as ATP and heat), it is exothermic.

(c) Silver chloride decomposes to silver metal and chlorine gas (photodecomposition):



(Color changes from white to greyish due to silver formation)

Reference: Chapter 1: Chemical Reactions and Equations, Pages 9-10 (Precipitation), Page 13 (Exothermic Reactions), Page 15 (Photodecomposition)

Q.28

Solution:

(a) Alloys: Homogeneous mixtures of two or more metals, or a metal and non-metal.

Examples:

- Brass (copper + zinc)
- Steel (iron + carbon)

(b) Pure gold (24 carat) is too soft and malleable for jewelry – easily deformed/scratched. Solution: Make alloys with copper/silver (e.g., 22 carat gold = 91.6% gold + 8.4% copper/silver) to increase hardness and durability.

(c) Metals have "sea of delocalized electrons" that move freely under electric field, carrying charge (current) through the metal lattice.

Reference: Chapter 3: Metals and Non-metals, Pages 50-51 – Properties of Metals; Page 52 – Corrosion Prevention

Q.29

Solution:

(a) Transpiration: Loss of water vapor from aerial parts of plants (mainly through stomata in leaves).

(b) *(Diagram description for students to draw)*

Cross-section of root showing:

- Epiblema (outermost layer with root hairs)
- Root hair: Tubular extension of epidermal cell increasing surface area
- Cortex (several layers of parenchyma cells)
- Endodermis (with Casparian strip)
- Pericycle
- Vascular bundles (xylem and phloem arranged radially)

(c) "Necessary" because:

- Creates transpiration pull for water and mineral absorption from roots
- Cools plant surface (evaporative cooling)
- Maintains cell turgidity

"Evil" because:

- Excessive water loss may cause wilting/death in water-deficit conditions
- Wastes large amount of absorbed water (98% lost via transpiration)

Reference: Chapter 6: Life Processes, Page 104 – Transportation in Plants

Q.30

Solution:

(a) Power of lens: Reciprocal of its focal length (in meters). $P = \frac{1}{f}$

SI unit: Dioptre (D)

(b) Combined power: $P = P_1 + P_2 = +4 \text{ D} + (-2 \text{ D}) = +2 \text{ D}$

Focal length of combination: $f = \frac{1}{P} = \frac{1}{2} = +0.5 \text{ m} = +50 \text{ cm}$ (convex lens)

(c) Hypermetropia (farsightedness) is corrected using convex (converging) lens.

Reference: Chapter 10: Light – Reflection and Refraction, Page 186 – Power of a Lens; Chapter 11: Human Eye and the Colourful World, Page 190 – Defects of Vision

Q.31

Solution:

(a) Joule's law: Heat energy (H) produced in resistor is:

- Directly proportional to square of current (I^2)
- Directly proportional to resistance (R)
- Directly proportional to time (t)

$$H = I^2 R t$$

(b) Given: $R = 8 \Omega$, $I = 15 \text{ A}$, $t = 2 \text{ min} = 120 \text{ s}$

$$H = I^2 R t = (15)^2 \times 8 \times 120 = 225 \times 8 \times 120 = 216,000 \text{ J} = 216 \text{ kJ}$$

(c) Heating elements made of alloys (e.g., Nichrome) because:

1. Higher resistivity than pure metals → more heat production
2. Higher melting point → don't melt at operating temperatures
3. Less oxidation at high temperatures → longer lifespan

Reference: Chapter 12: Electricity, Page 218 – Heating Effect of Electric Current

Q.32

Solution:

(a) Electromagnet: Temporary magnet formed by passing electric current through coil wound around soft iron core. Magnetic only when current flows.

(b) Factors affecting strength:

1. Magnitude of current flowing through coil
2. Number of turns per unit length in coil
3. Nature of core material (soft iron core increases strength significantly)

(c) Devices using electromagnets:

- Electric bell
- MRI machine

- Loudspeaker
 - Relay switch
- (Any two)

Reference: Chapter 13: Magnetic Effects of Electric Current, Pages 237-238 – Electromagnet

Q.33

Solution:

(a) Sustainable management: Using natural resources judiciously to meet present needs without compromising ability of future generations to meet their needs. Balances economic growth, environmental protection, and social equity.

(b) Reuse preferred over recycling because:

1. Saves energy (no reprocessing required)
2. Reduces pollution from manufacturing processes
3. More economical (no collection/processing costs)
4. Preserves material quality (recycling often degrades quality)

(c) Ways to reduce fossil fuel consumption:

1. Use public transport, carpooling, or non-motorized transport (cycling/walking)
2. Switch to renewable energy sources (solar water heaters, rooftop solar panels)
3. Use energy-efficient appliances (LED bulbs, 5-star rated devices)
4. Regular vehicle maintenance for optimal fuel efficiency
5. Promote telecommuting to reduce travel needs

Reference: Chapter 14: Sources of Energy, Page 253 – Environmental Consequences; Chapter 16 concepts (though deleted for 2024-25 exams)

SECTION D – DETAILED SOLUTIONS

Q.34

Solution:

(a) Catenation: Self-linking property of atoms to form long chains, branched chains, or rings. Carbon shows maximum catenation due to:

1. Small atomic size → strong C-C covalent bonds (bond enthalpy 348 kJ/mol)
2. Tetravalency → forms four stable covalent bonds
3. Unique ability to form stable single, double, and triple bonds with other carbon atoms

(b) Electron dot structures:

(i) Ethane (C_2H_6):

- 1
- 2
- 3
- 4
- 5

(ii) Ethene (C_2H_4):

- 1
- 2
- 3
- 4
- 5

(With double bond between carbons)

(iii) Ethyne (C_2H_2):

- 1

(c) Homologous series: Family of organic compounds with:

- Same functional group
- Successive members differ by $-CH_2-$ group
- Show gradation in physical properties
- Similar chemical properties

Two characteristics:

1. Same general formula (e.g., alkanes: C_nH_{2n+2})
2. Can be prepared by similar methods

(d) Alkane series:

1st member: Methane (CH_4)

2nd member: Ethane (C_2H_6)

3rd member: Propane (C_3H_8)

4th member: Butane (C_4H_{10})

Reference: Chapter 4: Carbon and its Compounds, Pages 60-61 (Catenation), Pages 66-68 (Homologous Series)

Q.35

Solution:

(a) *(Diagram description for students to draw)*

Human alimentary canal showing:

- Mouth/Buccal cavity (with teeth and tongue)
- Pharynx
- Esophagus (food pipe)
- Stomach (J-shaped)
- Small intestine (long coiled tube: duodenum, jejunum, ileum)
- Large intestine (colon, rectum)
- Anus

- Accessory organs: Liver (with gall bladder), Pancreas

(b) Peristaltic movement: Rhythmic contraction and relaxation of muscles in alimentary canal wall that propels food forward. Occurs throughout alimentary canal, especially prominent in esophagus and intestines.

(c) Roles in digestion:

- (i) Saliva: Contains salivary amylase enzyme that breaks starch into maltose; moistens food for easy swallowing.
- (ii) Gastric juice: Contains HCl (kills bacteria, activates pepsinogen) and pepsin (digests proteins into peptones).
- (iii) Bile: Emulsifies fats (breaks large globules into smaller droplets); neutralizes acidic chyme entering duodenum.

(d) Complete digestion occurs in small intestine (duodenum and ileum) by:

- Pancreatic juice (amylase, trypsin, lipase)
- Intestinal juice (peptidases, maltase, lactase, sucrase, lipase)

Reference: Chapter 6: Life Processes, Pages 98-100 – Nutrition in Human Beings

Q.36

Solution:

(a) Electromagnetic induction: Production of induced electromotive force (emf) or current in a conductor when magnetic flux linked with it changes.

Direction rule: Fleming's right-hand rule – Stretch thumb, forefinger, and middle finger of right hand mutually perpendicular:

- Thumb → Direction of motion of conductor
- Forefinger → Direction of magnetic field (N to S)
- Middle finger → Direction of induced current

(b) Construction of AC generator:

- Armature: Coil ABCD of insulated copper wire wound on soft iron core
- Strong field magnet with North and South poles
- Two slip rings (R_1 , R_2) attached to ends of coil
- Two carbon brushes (B_1 , B_2) pressing against slip rings
- Galvanometer connected to brushes to detect current

Working:

1. Coil rotated mechanically in magnetic field
2. Magnetic flux through coil changes continuously
3. Induced current produced in coil (direction changes every half rotation)
4. Current transferred to external circuit via slip rings and brushes
5. Output: Alternating current (direction reverses periodically)

(Diagram description for students to draw)

Rectangular coil ABCD between N-S poles; slip rings R_1 , R_2 on axle; brushes B_1 , B_2 touching rings; galvanometer in external circuit.

(c) Importance of earthing:

1. Safety: Provides low-resistance path for leakage/fault current to flow into ground instead of through person

2. Prevents electric shock when touching metallic body of faulty appliance
3. Causes fuse to melt/MCB to trip instantly, disconnecting faulty circuit
4. Protects appliances from damage due to voltage surges (e.g., lightning)

Reference: Chapter 13: Magnetic Effects of Electric Current, Pages 239-241 – Electric Generator; Page 232 – Domestic Electric Circuits

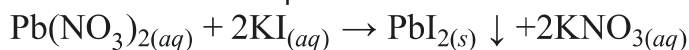
SECTION E – DETAILED SOLUTIONS

Q.37

Solution:

(a) Yellow precipitate: Lead iodide (PbI_2)

Balanced chemical equation:

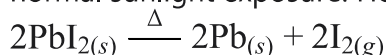


(b) Type of reaction: Double displacement reaction (also precipitation reaction)

(c) Called double displacement because ions exchange partners:

- Pb^{2+} combines with I^- (instead of NO_3^-)
- K^+ combines with NO_3^- (instead of I^-)

(d) Lead iodide is relatively stable in sunlight (unlike silver halides). It does not decompose significantly under normal sunlight exposure. However, on strong heating:



(Note: Unlike AgCl/AgBr , PbI_2 is not photosensitive; this distinguishes it from silver halides used in photography)

Reference: Chapter 1: Chemical Reactions and Equations, Page 10 – Double Displacement Reaction; Page 15 – Photodecomposition (for contrast with silver halides)

Q.38

Solution:

(a) Closeness of magnetic field lines indicates strength of magnetic field. Closer lines = stronger field (maximum near poles).

(b) Magnetic field lines never intersect because:

- At any point, magnetic field has unique direction
- If lines intersected, compass needle would point in two directions simultaneously at intersection point, which is impossible

(c) North pole of compass needle points along tangent to magnetic field line in direction from North pole to South pole of bar magnet. Therefore, it points toward South pole of bar magnet.

(d) Identification method:

1. Bring compass near one end of unmarked magnet
2. Observe direction of compass needle's north pole
3. If compass north pole is ATTRACTED to that end → it is South pole of magnet

4. If compass north pole is REPELLED by that end → it is North pole of magnet
(Unlike poles attract, like poles repel)

Reference: Chapter 13: Magnetic Effects of Electric Current, Pages 228-229 – Magnetic Field Lines

Q.39

Solution:

(a) Food chain:

Phytoplankton → Zooplankton → Small fish → Large fish

(b) Trophic level of zooplankton: Primary consumer (second trophic level)

(c) Energy calculation using 10% law:

- Phytoplankton (Producers): 10,000 J
- Zooplankton (Primary consumers): 10% of 10,000 J = 1,000 J
- Small fish (Secondary consumers): 10% of 1,000 J = 100 J
- Large fish (Tertiary consumers): 10% of 100 J = 10 J

Energy available to large fish = 10 J

(d) Importance of decomposers:

1. Break down dead organisms and waste materials into simple inorganic substances
2. Recycle nutrients (carbon, nitrogen, phosphorus) back to producers
3. Clean environment by removing dead matter
4. Maintain soil fertility

If decomposers absent:

- Dead organisms and waste would accumulate indefinitely
- Nutrients locked in dead matter → unavailable to producers
- Ecosystem collapse due to nutrient depletion
- Environmental pollution from accumulating organic waste

Reference: Chapter 15: Our Environment, Pages 260-261 – Energy Flow and Decomposers

COMPLETE NCERT TEXTBOOK REFERENCE GUIDE (2024-25 EDITION)

Chapter No.	Chapter Title	Approximate Pages	Unit	
1	Chemical Reactions and Equations	1-17	Chemical Substances – Nature & Behaviour	6
2	Acids, Bases and Salts	18-35	Chemical Substances – Nature & Behaviour	5
3	Metals and Non-metals	36-55	Chemical Substances – Nature & Behaviour	10

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4	Carbon and its Compounds	56-79	Chemical Substances – Nature & Behaviour	4
5	Periodic Classification of Elements	80-93	<i>(Deleted for 2024-25 Board Exams)</i>	0
6	Life Processes	94-118	World of Living	10
7	Control and Coordination	119-137	World of Living	7
8	How do Organisms Reproduce?	138-157	World of Living	8
9	Heredity and Evolution	158-179	World of Living	<i>(Pages not in latest edition)</i>
10	Light – Reflection and Refraction	162-185	Natural Phenomena	7
11	Human Eye and the Colourful World	186-200	Natural Phenomena	5
12	Electricity	201-223	Effects of Current	7
13	Magnetic Effects of Electric Current	224-240	Effects of Current	6
14	Sources of Energy	241-254	Natural Resources	3
15	Our Environment	255-270	Natural Resources	2
16	Sustainable Management of Natural Resources	<i>(Deleted for 2024-25 Board Exams)</i>	Natural Resources	0

IMPORTANT DISCLAIMER:

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Note on Deleted Chapters (2024-25 Syllabus):

- Chapter 5 (Periodic Classification) and Chapter 16 (Sustainable Management) have been deleted from CBSE Class 10 Science syllabus for 2024-25 board examinations as per latest CBSE curriculum document.

However, environmental concepts from Chapter 16 remain relevant for general awareness.