

NCERT Class 10 Science

Complete Study Guide

English Medium • BSEB / CBSE

Chapter-wise Key Notes • Objective Questions (MCQ) •
Subjective Questions (Very Short, Short & Long) with Answers

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Exam Tip: Write answers point-wise, draw neat diagrams and underline key words to score full marks.

Chapter 1

Chemical Reactions and Equations

Important Points & Notes

1. **Chemical reaction:** a change in which reactants turn into new products. Signs: change in state, change in colour, evolution of a gas, change in temperature, formation of a precipitate.
2. **Balanced equation:** number of atoms of each element is equal on both sides (Law of Conservation of Mass). Steps: write skeleton equation → count atoms → balance by putting coefficients (never change subscripts) → add state symbols (s), (l), (g), (aq).
3. **Combination reaction:** two or more substances form one product. $CaO + H_2O \rightarrow Ca(OH)_2$ + heat (slaking of lime); $2Mg + O_2 \rightarrow 2MgO$.
4. **Decomposition reaction:** one substance breaks into two or more. Thermal: $2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$; $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$. Electrolytic: $2H_2O \rightarrow 2H_2 + O_2$. Photolytic: $2AgCl \rightarrow 2Ag + Cl_2$ (sunlight).
5. **Displacement reaction:** a more reactive element displaces a less reactive one from its compound. $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$ (blue colour fades, brownish copper deposits).
6. **Double displacement:** exchange of ions between two compounds. $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow + 2NaCl$ (white precipitate). A reaction that forms an insoluble solid is a **precipitation reaction**.
7. **Exothermic** reactions release heat (burning, respiration, $CaO + H_2O$); **endothermic** reactions absorb heat (photosynthesis, decomposition of $CaCO_3$).
8. **Oxidation** = gain of oxygen / loss of hydrogen; **reduction** = loss of oxygen / gain of hydrogen. Both occur together → **redox reaction**. $CuO + H_2 \rightarrow Cu + H_2O$ (CuO is reduced, H_2 is oxidised).

9. **Corrosion** is slow eating up of metals by air, moisture or acids (rusting of iron needs both air and water). Prevention: painting, oiling, galvanisation (zinc coating), alloying. **Rancidity** is oxidation of fats and oils giving bad smell; prevented by antioxidants, air-tight containers, refrigeration and flushing chips packets with nitrogen.

Objective Questions (MCQ)

Q1. The reaction $CaO + H_2O \rightarrow Ca(OH)_2$ is a

(a) Decomposition reaction
(b) Combination and exothermic reaction
(c) Displacement reaction
(d) Endothermic reaction

Ans: (b) Combination and exothermic reaction

Q2. $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$ is an example of

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

Ans: (c) Displacement reaction

Q3. Brown fumes evolved on heating lead nitrate are of

(a) O_2
(b) NO_2
(c) PbO
(d) N_2

Ans: (b) NO_2

Q4. The balanced equation for $Fe + H_2O \rightarrow Fe_3O_4 + H_2$ is

(a) $Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$
(b) $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$
(c) $3Fe + 2H_2O \rightarrow Fe_3O_4 + 2H_2$
(d) $2Fe + 3H_2O \rightarrow Fe_3O_4 + 3H_2$

Ans: (b) $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

Q5. In $CuO + H_2 \rightarrow Cu + H_2O$, the substance oxidised is

(a) CuO
(b) H_2
(c) Cu
(d) H_2O

Ans: (b) H_2

Q6. Silver chloride turns grey in sunlight due to

(a) Oxidation of silver
(b) Formation of silver metal by decomposition
(c) Formation of silver oxide
(d) Reaction with moisture

Ans: (b) Formation of silver metal by decomposition

Q7. Galvanisation is the coating of iron with

(a) Zinc
(b) Copper
(c) Tin
(d) Aluminium

Ans: (a) Zinc

Q8. Rancidity of food can be slowed down by

(a) Keeping it open in air
(b) Adding antioxidants
(c) Heating it repeatedly
(d) Exposing it to sunlight

Ans: (b) Adding antioxidants

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. Why is a magnesium ribbon cleaned before burning in air?

Ans: To remove the protective layer of basic magnesium oxide from its surface so that it can burn easily.

Q2. What is a balanced chemical equation?

Ans: An equation in which the number of atoms of every element is the same on the reactant side and the product side.

Q3. Name the type of reaction when ferrous sulphate crystals are heated.

Ans: Thermal decomposition reaction.

Q4. Why are chips packets flushed with nitrogen gas?

Ans: To prevent oxidation (rancidity) of the oil/fat in the chips.

Short Answer Questions (2–3 marks)

Q1. Why should a chemical equation be balanced?

Ans: A chemical equation must be balanced to satisfy the **Law of Conservation of Mass**, which says that mass can neither be created nor destroyed in a chemical reaction. So the total number of atoms of each element must be equal on both sides.

Q2. Differentiate between displacement and double displacement reactions with one example each.

Ans: **Displacement:** a more reactive element replaces a less reactive element from its compound, e.g. $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$. **Double displacement:** two compounds exchange their ions to form two new compounds, e.g. $AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$.

Q3. What is corrosion? Mention two methods of preventing it.

Ans: Corrosion is the gradual damage of a metal by the action of air, moisture or chemicals on its surface, e.g. rusting of iron ($Fe_2O_3 \cdot xH_2O$). It can be prevented by (i) painting or oiling and (ii) galvanisation – coating iron with zinc.

Long Answer Questions (5 marks)

Q1. Explain the different types of chemical reactions with one balanced equation for each.

Ans: **1. Combination:** $2Mg + O_2 \rightarrow 2MgO$. **2. Decomposition:** $CaCO_3 \rightarrow CaO + CO_2$ (on heating). **3. Displacement:** $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$. **4. Double displacement:** $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow + 2NaCl$. **5. Redox:** $CuO + H_2 \rightarrow Cu + H_2O$, where one reactant is oxidised and the other is reduced. Combination reactions join substances; decomposition reactions break a substance; displacement reactions involve reactivity; double displacement involves exchange of ions and often gives a precipitate.

Q2. What is rancidity? Write its effects and any three methods of prevention.

Ans: Rancidity is the oxidation of fats and oils in food kept for a long time, which changes their smell and taste. **Effects:** bad smell and taste, food becomes unfit for eating. **Prevention:** (i) adding antioxidants such as BHA/BHT, (ii) storing food in air-tight containers, (iii) keeping it in a refrigerator, (iv) flushing packets with nitrogen gas, (v) avoiding exposure to light and heat.

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Chapter 2

Acids, Bases and Salts

Important Points & Notes

1. **Indicators:** litmus (acid turns blue litmus red; base turns red litmus blue), phenolphthalein (colourless in acid, pink in base), methyl orange (red in acid, yellow in base). Turmeric and China rose are natural indicators; **olfactory indicators** (onion, vanilla, clove) change smell.
2. **Acid + metal → salt + H_2** ($Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$; hydrogen burns with a 'pop' sound). **Base + metal** ($NaOH + Zn$) also gives H_2.
3. **Acid + metal carbonate/hydrogencarbonate → salt + CO_2 + H_2O.** CO_2 turns lime water milky ($Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$).
4. **Neutralisation:** acid + base → salt + water ($HCl + NaOH \rightarrow NaCl + H_2O$). Metal oxide + acid and non-metal oxide + base also form salt and water.
5. Acids give H^+ (H_3O^+) ions in water; bases soluble in water are called **alkalis**. Dilution of acid/base is exothermic – always add acid to water, never water to acid.
6. **pH scale (0–14):** pH < 7 acidic, pH = 7 neutral, pH > 7 basic. pH of lemon juice ≈ 2.2, blood ≈ 7.4, milk of magnesia ≈ 10. Strong acids/bases ionise fully (HCl, NaOH); weak ones ionise partly (CH_3COOH, NH_4OH).
7. **pH in daily life:** tooth decay starts below pH 5.5 (use basic toothpaste); acid rain pH < 5.6; stomach acidity relieved by antacids ($Mg(OH)_2$); bee-sting (methanoic acid) treated with baking soda; nettle sting neutralised with dock leaves.
8. **Common salt (NaCl)** → from brine: NaOH, Cl_2, H_2 by chlor-alkali process. **Bleaching powder** $CaOCl_2$ ($Ca(OH)_2 + Cl_2$). **Baking soda** $NaHCO_3$ ($NaCl + H_2O + CO_2 + NH_3$). **Washing soda** $Na_2CO_3 \cdot 10H_2O$. **Plaster of Paris** $CaSO_4 \cdot \frac{1}{2}H_2O$; gypsum $CaSO_4 \cdot 2H_2O$.

Objective Questions (MCQ)

Q1. A solution turns red litmus blue. Its pH is likely to be

(a) 1 (b) 4
(c) 5 (d) 10

Ans: (d) 10

Q2. Which gas is evolved when dilute HCl reacts with zinc?

(a) Oxygen (b) Hydrogen
(c) Carbon dioxide (d) Chlorine

Ans: (b) Hydrogen

Q3. The chemical formula of baking soda is

(a) Na_2CO_3 (b) $NaHCO_3$
(c) NaOH (d) $CaCO_3$

Ans: (b) $NaHCO_3$

Q4. Plaster of Paris is

(a) $CaSO_4 \cdot 2H_2O$ (b) $CaSO_4 \cdot \frac{1}{2}H_2O$
(c) $CaCO_3$ (d) $CaOCl_2$

Ans: (b) $CaSO_4 \cdot \frac{1}{2}H_2O$

Q5. Which of the following is a strong acid?

(a) Acetic acid (b) Citric acid
(c) Hydrochloric acid (d) Carbonic acid

Ans: (c) Hydrochloric acid

Q6. Tooth decay starts when the pH of the mouth falls below

(a) 7 (b) 6.5
(c) 5.5 (d) 4

Ans: (c) 5.5

Q7. Bleaching powder is produced by the action of chlorine on

(a) Dry slaked lime (b) Quick lime
(c) Limestone (d) NaOH

Ans: (a) Dry slaked lime

Q8. The pH of milk of magnesia is about

(a) 2 (b) 7

(c) 10 (d) 14

Ans: (c) 10

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. What happens to the colour of phenolphthalein in a basic solution?

Ans: It turns pink.

Q2. Why does dry HCl gas not change the colour of dry litmus paper?

Ans: Because HCl gives H^+ ions only in the presence of water.

Q3. Name the compound used to remove permanent hardness of water.

Ans: Washing soda ($Na_2CO_3 \cdot 10H_2O$).

Q4. Why should plaster of Paris be stored in a moisture-proof container?

Ans: It absorbs moisture and changes into hard gypsum, losing its setting property.

Short Answer Questions (2–3 marks)

Q1. Why is it advised to add acid to water and not water to acid while diluting?

Ans: Dissolving an acid or a base in water is highly exothermic. If water is added to concentrated acid, the heat released may make the mixture splash out and cause burns. Adding acid slowly to water dissipates the heat safely.

Q2. What is neutralisation? Give two uses in daily life.

Ans: The reaction between an acid and a base to form salt and water is neutralisation (HCl + NaOH → NaCl + H_2O). Uses: antacids ($Mg(OH)_2$) cure acidity in the stomach; baking soda relieves bee-sting; lime is added to acidic soil.

Q3. How is baking soda prepared? Write its two uses.

Ans: $NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$. Uses: (i) in baking powder to make cakes soft and spongy (releases CO_2 on heating); (ii) as an antacid; (iii) in soda-acid fire extinguishers.

Long Answer Questions (5 marks)

Q1. Explain the pH scale and its importance in everyday life.

Ans: The pH scale (0–14) measures the concentration of hydrogen ions in a solution. pH 7 is neutral (pure water), below 7 is acidic and above 7 is basic. Universal indicator shows different colours at different pH.
Importance: (1) Our body works within pH 7.0–7.8; (2) acid rain (pH < 5.6) harms aquatic life; (3) pH < 5.5 in the mouth causes tooth decay, so basic toothpastes are used; (4) soil pH decides crop growth; (5) stomach produces HCl for digestion and excess acid is neutralised by antacids; (6) bee stings and ant bites contain methanoic acid and are treated with mild bases.

Q2. Write the preparation, properties and uses of bleaching powder and plaster of Paris.

Ans: **Bleaching powder:** $Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$. Uses: bleaching cotton/linen, disinfecting drinking water, oxidising agent in industries.
Plaster of Paris: heating gypsum at 373 K: $CaSO_4 \cdot 2H_2O \rightarrow CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O$. When mixed with water it sets into hard gypsum: $CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O \rightarrow CaSO_4 \cdot 2H_2O$. Uses: plaster for fractured bones, toys, decorative materials, smoothing surfaces.

Chapter 3

Metals and Non-metals

Important Points & Notes

1. **Physical properties of metals:** lustrous, malleable, ductile, good conductors of heat and electricity, high melting point, sonorous, generally hard and solid (exceptions: Na and K are soft; Hg is liquid; Ga and Cs melt in the hand). **Non-metals:** dull, brittle, bad conductors (exception: graphite conducts; diamond has the highest refractive index), exception: iodine is lustrous.
2. **Chemical properties of metals:** with oxygen → metal oxides (basic); Al_2O_3 and ZnO are **amphoteric oxides** (react with both acids and bases). With water: Na, K react violently; Mg reacts with hot water; Al, Fe, Zn with steam to give oxide + H_2. With dilute acids: H_2 is released (not by Cu, Ag, Au).
3. **Reactivity series (decreasing):** K > Na > Ca > Mg > Al > Zn > Fe > Pb > [H] > Cu > Hg > Ag > Au. A more reactive metal displaces a less reactive metal from its salt solution.
4. **Ionic compounds** are formed by transfer of electrons between metal and non-metal (e.g. NaCl). Properties: solid and hard, high melting/boiling points, soluble in water, conduct electricity in molten or aqueous state but not in solid state.
5. **Occurrence:** minerals are natural compounds; those from which metal can be profitably extracted are **ores**. Gangue = earthy impurities.

6. **Extraction of metals:** low reactivity (Hg, Cu) → heating the sulphide in air (roasting) e.g. $2HgS + 3O_2 \rightarrow 2HgO + 2SO_2$; medium reactivity (Zn, Fe, Pb) → calcination/roasting then reduction with carbon; high reactivity (Na, Mg, Al) → **electrolytic reduction** of molten chloride/oxide. Thermite reaction: $Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$ + heat (welding of rail tracks).
7. **Refining:** electrolytic refining is the most common – impure metal is the anode, pure metal the cathode, and a salt solution of the metal the electrolyte (e.g. refining of copper).
8. **Corrosion and prevention:** rusting of iron, black coating on silver, green coating on copper. Prevention: painting, oiling, galvanisation, chrome plating, anodising, **alloying** (brass = Cu + Zn; bronze = Cu + Sn; solder = Pb + Sn; stainless steel = Fe + Ni + Cr).

Objective Questions (MCQ)

Q1. Which metal is liquid at room temperature?

(a) Sodium (b) Mercury
(c) Zinc (d) Gallium

Ans: (b) Mercury

Q2. The most reactive metal among the following is

(a) Cu (b) Fe
(c) Mg (d) Zn

Ans: (c) Mg

Q3. An amphoteric oxide among the following is

(a) Na_2O (b) Al_2O_3
(c) CuO (d) MgO

Ans: (b) Al_2O_3

Q4. Metals which can be extracted by simple heating of their ores are

(a) Na, Mg
(b) Fe, Zn
(c) Hg, Cu
(d) Al, Ca

Ans: (c) Hg, Cu

Q5. Which of the following is the alloy of copper and tin?

(a) Brass
(b) Bronze
(c) Solder
(d) Steel

Ans: (b) Bronze

Q6. Sodium is kept immersed in kerosene because

(a) It is heavy
(b) It reacts vigorously with air and moisture
(c) It is soluble in kerosene
(d) It is a liquid

Ans: (b) It reacts vigorously with air and moisture

Q7. The metal that does NOT liberate hydrogen on reacting with dilute HCl is

(a) Zn
(b) Mg
(c) Cu
(d) Fe

Ans: (c) Cu

Q8. The thermite reaction is used for

(a) Extraction of Cu
(b) Welding railway tracks
(c) Galvanisation
(d) Refining of Zn

Ans: (b) Welding railway tracks

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. Name two metals which can be cut with a knife.

Ans: Sodium (Na) and potassium (K).

Q2. What is an alloy?

Ans: A homogeneous mixture of two or more metals, or of a metal with a non-metal (e.g. brass).

Q3. Why do ionic compounds conduct electricity in molten state?

Ans: In the molten state the ions become free to move and carry charge.

Q4. What is aqua regia?

Ans: A freshly prepared 3:1 mixture of conc. HCl and conc. HNO_3, which can dissolve gold and platinum.

Short Answer Questions (2–3 marks)

Q1. Explain why aluminium oxide is called an amphoteric oxide. Give equations.

Ans: Aluminium oxide reacts with both acids and bases to form salt and water. $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$; $Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$. Hence it shows both acidic and basic behaviour.

Q2. Differentiate between roasting and calcination.

Ans: **Roasting:** heating a sulphide ore strongly in excess of air to convert it into oxide, e.g. $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$. **Calcination:** heating a carbonate ore strongly in limited/no air to convert it into oxide, e.g. $ZnCO_3 \rightarrow ZnO + CO_2$.

Q3. How is copper refined electrolytically?

Ans: Impure copper is made the anode and a thin strip of pure copper the cathode; acidified copper sulphate solution is the electrolyte. On passing current, copper from the anode dissolves into the solution and an equal amount of pure copper deposits on the cathode. Soluble impurities remain in solution and insoluble ones settle at the bottom as anode mud.

Long Answer Questions (5 marks)

Q1. Describe the extraction of metals according to their position in the reactivity series.

Ans: **(i) Low reactivity metals (Hg, Cu):** their sulphide ores are heated in air: $2HgS + 3O_2 \rightarrow 2HgO + 2SO_2$, then $2HgO \rightarrow 2Hg + O_2$. **(ii) Medium reactivity (Zn, Fe, Pb):** sulphide/carbonate ores are first converted into oxides by roasting/calcination and then reduced with carbon: $ZnO + C \rightarrow Zn + CO$. Highly reactive aluminium can also reduce oxides (thermite). **(iii) High reactivity (K, Na, Ca, Mg, Al):** cannot be reduced by carbon, so molten chlorides or oxides are electrolysed: at cathode $Na^+ + e^- \rightarrow Na$; at anode $2Cl^- \rightarrow Cl_2 + 2e^-$. Finally metals are refined, usually electrolytically.

Q2. What is corrosion? Explain the conditions for rusting of iron and the methods used to prevent it.

Ans: Corrosion is the slow destruction of metals by the action of air, moisture and chemicals. Rusting of iron needs both **oxygen (air)** and **water** and forms hydrated iron(III) oxide, $Fe_2O_3 \cdot xH_2O$ (reddish brown). **Prevention:** (1) painting and oiling to keep air and moisture away; (2) galvanisation – coating with zinc, which protects even if the coating is scratched; (3) electroplating with chromium, nickel or tin; (4) making alloys such as stainless steel; (5) anodising of aluminium.

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Chapter 4

Carbon and its Compounds

Important Points & Notes

1. Carbon (atomic no. 6, valency 4) forms **covalent bonds** by sharing electrons. Covalent compounds have low melting/boiling points and are generally poor conductors of electricity.
2. **Versatile nature of carbon:** (i) **catenation** – self-linking in long chains, branched chains and rings; (ii) **tetravalency** – bonding with four atoms, including O, H, N, S, Cl. Small size makes bonds strong and stable.
3. **Allotropes:** diamond (hardest, each C bonded to 4 C, insulator), graphite (layers, slippery, conducts electricity, used as lubricant/electrodes), fullerene C-60 (football-shaped).
4. **Hydrocarbons:** saturated (alkanes, C_nH_{2n+2}, single bonds), unsaturated (alkenes C_nH_{2n} – double bond; alkynes C_nH_{2n-2} – triple bond). **Homologous series:** members differ by $–CH_2–$ (14 u) and show similar chemical properties.
5. **Nomenclature:** prefix (word root: meth-, eth-, prop-, but-, pent-) + suffix (-ane, -ene, -yne); functional groups: alcohol –OH (-ol), aldehyde –CHO (-al), ketone >C=O (-one), carboxylic acid –COOH (-oic acid), halo group –Cl, –Br.
6. **Chemical properties:** *Combustion:* $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + heat (saturated burn with a clean flame, unsaturated with a sooty flame). *Oxidation:* ethanol → ethanoic acid with alkaline $KMnO_4$. *Addition:* hydrogenation of unsaturated compounds with Ni catalyst (vegetable oil → ghee). *Substitution:* $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$ (in sunlight).

7. **Ethanol (C_2H_5OH):** $2Na + 2C_2H_5OH \rightarrow 2C_2H_5ONa + H_2$; dehydration with conc. H_2SO_4 at 443 K gives ethene. Harmful effects of drinking alcohol; denatured alcohol is made unfit for drinking. **Ethanoic acid (CH_3COOH):** 5–8% solution is vinegar; freezing point 290 K (glacial acetic acid); reacts with $NaHCO_3$ to give CO_2; with alcohol gives a sweet-smelling **ester** (esterification): $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$. Ester + NaOH → alcohol + sodium salt (**saponification**, soap making).
8. **Soaps and detergents:** soap = sodium/potassium salt of long-chain fatty acids. Molecules have a hydrophilic head and hydrophobic tail and form **micelles** that trap oily dirt. Soap forms **scum** with hard water (Ca/Mg salts); detergents (sulphonate/ammonium salts) do not.

Objective Questions (MCQ)

Q1. The number of covalent bonds in a molecule of ethane (C_2H_6) is

(a) 6 (b) 7
(c) 8 (d) 9

Ans: (b) 7

Q2. The general formula of alkenes is

(a) C_nH_{2n+2} (b) C_nH_{2n}
(c) C_nH_{2n-2} (d) C_nH_n

Ans: (b) C_nH_{2n}

Q3. Which of these is the hardest natural substance?

(a) Graphite (b) Diamond
(c) Fullerene (d) Coal

Ans: (b) Diamond

Q4. The functional group present in ethanoic acid is

(a) –OH (b) –CHO
(c) –COOH (d) >C=O

Ans: (c) –COOH

Q5. Hydrogenation of vegetable oils uses which catalyst?

(a) Pt (b) Ni

(c) Fe (d) V_2O_5

Ans: (b) Ni

Q6. The reaction of ethanoic acid with ethanol in the presence of conc. H_2SO_4 forms

(a) Soap (b) An ester

(c) Ethene (d) An aldehyde

Ans: (b) An ester

Q7. Soap does not give lather easily with

(a) Soft water (b) Hard water

(c) Distilled water (d) Rain water

Ans: (b) Hard water

Q8. Which compound burns with a sooty flame?

(a) Ethane (b) Methane

(c) Ethyne (d) Propane

Ans: (c) Ethyne

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. What is catenation?

Ans: The property of carbon atoms to link with each other to form long chains, branched chains and rings.

Q2. Name the products formed when ethanol is heated with excess conc. H_2SO_4 at 443 K.

Ans: Ethene and water.

Q3. Write the molecular formula and name of the first member of the alkyne series.

Ans: C_2H_2 – ethyne (acetylene).

Q4. Why are carbon compounds poor conductors of electricity?

Ans: They are covalent compounds and contain no free ions or electrons.

Short Answer Questions (2–3 marks)

Q1. Why does carbon form compounds mainly by covalent bonds?

Ans: Carbon has four valence electrons. It cannot easily gain four electrons (C^{4-} would need a lot of energy) nor lose four electrons (C^{4+} needs enormous energy). So it shares electrons with other atoms and forms covalent bonds.

Q2. Differentiate between addition and substitution reactions with examples.

Ans: **Addition:** unsaturated hydrocarbons add atoms across the multiple bond, e.g. $CH_2{=}CH_2 + H_2 \rightarrow CH_3{-}CH_3$ (Ni). **Substitution:** saturated hydrocarbons replace one hydrogen by another atom, e.g. $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$ (sunlight).

Q3. Explain the cleansing action of soap.

Ans: A soap molecule has a hydrophilic (ionic) head and a hydrophobic (hydrocarbon) tail. In water, soap molecules arrange into **micelles** with the tails pointing inwards towards the oil/dirt and heads outwards in water. The oil is trapped at the centre of the micelle and is washed away with water.

Long Answer Questions (5 marks)

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Q1. What is a homologous series? Write its characteristics. Give the first four members of the alkane series.

Ans: A series of organic compounds having the same functional group and general formula, in which successive members differ by a $–CH_2–$ unit. **Characteristics:** (i) same general formula; (ii) successive members differ by CH_2 (14 u); (iii) similar chemical properties; (iv) gradual change in physical properties such as melting and boiling points with increasing molecular mass. **Alkanes:** methane CH_4, ethane C_2H_6, propane C_3H_8, butane C_4H_{10}.

Q2. Describe the chemical properties of ethanol and ethanoic acid with equations.

Ans: **Ethanol:** (1) with sodium: $2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2\uparrow$; (2) dehydration: $C_2H_5OH \rightarrow CH_2{=}CH_2 + H_2O$ (conc. H_2SO_4, 443 K); (3) oxidation to ethanoic acid using alkaline $KMnO_4$. **Ethanoic acid:** (1) with sodium carbonate/hydrogencarbonate: $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$; (2) esterification: $CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$; (3) reaction with a base: $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$.

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Chapter 5

Periodic Classification of Elements

Important Points & Notes

1. **Döbereiner's triads:** groups of three elements with similar properties; atomic mass of the middle element ≈ mean of the other two (e.g. Li, Na, K). **Newlands' law of octaves:** every eighth element has properties similar to the first (worked only up to calcium).
2. **Mendeleev's periodic law:** properties of elements are a periodic function of their **atomic masses**. He arranged elements in 8 groups and 6 periods and **left gaps** for undiscovered elements, predicting eka-aluminium (gallium) and eka-silicon (germanium).
3. **Limitations of Mendeleev's table:** position of hydrogen was uncertain; isotopes had no place; some elements with higher atomic mass were placed before those of lower mass (e.g. Co and Ni; Ar and K).
4. **Modern periodic law (Moseley):** properties of elements are a periodic function of their **atomic numbers**. The modern table has **18 groups** (vertical columns) and **7 periods** (horizontal rows).
5. **Trends along a period (left → right):** atomic size decreases (nuclear charge increases), metallic character decreases, non-metallic character increases, valency first increases then decreases, tendency to lose electrons decreases, electronegativity increases.
6. **Trends down a group:** atomic size increases (new shells added), metallic character increases, tendency to lose electrons increases, electronegativity decreases; valency remains the same.

7. **Valency** of an element is determined by the number of valence electrons (≤ 4) or 8 minus the number of valence electrons (> 4). Elements in the same group have the same number of valence electrons. Group 1: alkali metals, Group 2: alkaline earth metals, Group 17: halogens, Group 18: noble gases.
8. **Metals** are on the left and in the middle, **non-metals** on the right, and **metalloids** (B, Si, Ge, As, Sb, Te) along the zig-zag line between them. Period number = number of shells; group number (for 1,2) = valence electrons, (for 13–18) = valence electrons + 10.

Objective Questions (MCQ)

Q1. Who proposed the law of octaves?

(a) Döbereiner
(b) Newlands
(c) Mendeleev
(d) Moseley

Ans: (b) Newlands

Q2. The modern periodic table is based on

(a) Atomic mass
(b) Atomic number
(c) Mass number
(d) Number of neutrons

Ans: (b) Atomic number

Q3. The number of periods in the modern periodic table is

(a) 5
(b) 6
(c) 7
(d) 8

Ans: (c) 7

Q4. Atomic size across a period from left to right

(a) Increases
(b) Decreases
(c) Remains the same
(d) First increases then decreases

Ans: (b) Decreases

Q5. Which of these is a noble gas?

(a) Na (b) Cl

(c) Ar (d) Mg

Ans: (c) Ar

Q6. An element with atomic number 12 will be placed in group

(a) 1 (b) 2

(c) 12 (d) 13

Ans: (b) 2

Q7. Mendeleev's eka-aluminium is now known as

(a) Germanium (b) Scandium

(c) Gallium (d) Indium

Ans: (c) Gallium

Q8. Which element has the highest electronegativity?

(a) Cl (b) F

(c) O (d) N

Ans: (b) F

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. State Mendeleev's periodic law.

Ans: The properties of elements are a periodic function of their atomic masses.

Q2. Why do elements of the same group have similar properties?

Ans: They have the same number of valence electrons.

Q3. What is the valency of an element with atomic number 17?

Ans: 1 (electronic configuration 2, 8, 7).

Q4. Name two elements of the same period as sodium that are metals.

Ans: Magnesium and aluminium.

Short Answer Questions (2–3 marks)

Q1. What were the limitations of Dobereiner's triads?

Ans: Only a few triads could be identified; the idea could not be applied to all known elements, and many elements with similar properties did not fit into triads (e.g. the triad of F, Cl, Br did not obey the mean-mass rule).

Q2. How does atomic size vary in a period and in a group? Give reasons.

Ans: **In a period:** decreases, because nuclear charge increases and pulls the electrons closer while the number of shells remains the same. **In a group:** increases, because a new shell is added at each step down the group.

Q3. Write the electronic configuration of magnesium and state its group, period and valency.

Ans: Mg (Z = 12): 2, 8, 2. It has 2 valence electrons → Group 2; 3 shells → Period 3; valency = 2.

Long Answer Questions (5 marks)

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Q1. Explain the achievements and limitations of Mendeleev's periodic table.

Ans: **Achievements:** (1) arranged all known elements in order of increasing atomic mass in groups and periods; (2) left gaps for undiscovered elements and predicted their properties – eka-aluminium (gallium), eka-silicon (germanium), which later matched closely; (3) accommodated noble gases without disturbing the table; (4) corrected atomic masses of some elements. **Limitations:** (1) no fixed position for hydrogen; (2) isotopes of an element could not be placed separately; (3) atomic mass did not increase regularly from one element to the next; (4) some dissimilar elements were grouped together (e.g. Cu with Na).

Q2. State the modern periodic law. Explain the trends in valency, atomic size and metallic character in the modern periodic table.

Ans: **Modern periodic law:** properties of elements are a periodic function of their atomic numbers. **Valency:** in a period it increases from 1 to 4 and then decreases to 0; in a group it remains the same. **Atomic size:** decreases along a period (greater nuclear pull); increases down a group (extra shells). **Metallic character:** decreases along a period as the tendency to lose electrons falls; increases down a group as the outer electrons are farther from the nucleus and are lost more easily. Hence the most metallic elements are at the bottom-left (Cs, Fr) and the most non-metallic at the top-right (F).

Chapter 6

Life Processes

Important Points & Notes

1. **Life processes:** nutrition, respiration, transportation and excretion – needed to maintain the body and carry out repair. **Autotrophic nutrition** (plants): photosynthesis – $6CO_2 + 12H_2O \rightarrow$ (sunlight, chlorophyll) $C_6H_{12}O_6 + 6O_2 + 6H_2O$. Steps: absorption of light by chlorophyll, conversion of light energy to chemical energy and splitting of water, reduction of CO_2 to carbohydrates. CO_2 enters through **stomata**, whose opening/closing is controlled by guard cells.
2. **Heterotrophic nutrition:** holozoic (human, Amoeba), saprophytic (fungi), parasitic (Cuscuta, tapeworm). *Amoeba* engulfs food with pseudopodia (food vacuole).
3. **Human digestive system:** mouth (salivary amylase breaks starch → sugar) → oesophagus (peristalsis) → stomach (HCl, pepsin digests proteins, mucus protects the lining) → small intestine (liver: **bile** emulsifies fats; pancreas: trypsin for proteins, lipase for fats, amylase; intestinal juice completes digestion; **villi** absorb food) → large intestine (absorbs water) → anus.
4. **Respiration:** glucose → pyruvate in cytoplasm (glycolysis). **Aerobic**: pyruvate → $CO_2 + H_2O$ + 38 ATP in mitochondria; **anaerobic**: in yeast → ethanol + CO_2 + 2 ATP; in muscles → lactic acid. ATP is the energy currency of the cell.
5. **Human respiratory system:** nostrils → pharynx → larynx → trachea (rings of cartilage) → bronchi → bronchioles → **alveoli** (gas exchange). Haemoglobin carries oxygen. Aquatic animals breathe dissolved oxygen through gills (fish breathe faster as less O_2 is dissolved in water).

6. **Transportation in humans:** heart has four chambers (right atrium, right ventricle, left atrium, left ventricle) – **double circulation**. Arteries carry blood away from the heart (thick walls), veins bring it back (valves), capillaries exchange materials. Blood = plasma + RBC + WBC + platelets. Lymph carries digested fat and drains excess fluid. Blood pressure ≈ 120/80 mm Hg.
7. **Transportation in plants: xylem** carries water and minerals (root pressure and transpiration pull); **phloem** carries food (translocation, needs ATP). Transpiration cools the plant and helps water absorption.
8. **Excretion:** humans – kidneys (filtration in **nephron**: glomerulus + Bowman's capsule, tubular reabsorption, urine formed → ureter → bladder → urethra). Artificial kidney = **haemodialysis**. Plants excrete by shedding leaves/bark, gums, resins and release of O_2, CO_2 and water vapour.

Objective Questions (MCQ)

Q1. The raw materials for photosynthesis are

(a) Glucose and oxygen (b) CO_2 and water
(c) Starch and water (d) Oxygen and water

Ans: (b) CO_2 and water

Q2. Which enzyme in saliva digests starch?

(a) Pepsin (b) Trypsin
(c) Salivary amylase (d) Lipase

Ans: (c) Salivary amylase

Q3. The end product of anaerobic respiration in muscle cells is

(a) Ethanol (b) Lactic acid
(c) CO_2 (d) Pyruvate

Ans: (b) Lactic acid

Q4. Which blood vessel carries oxygenated blood from lungs to heart?

(a) Pulmonary artery (b) Pulmonary vein
(c) Vena cava (d) Aorta

Ans: (b) Pulmonary vein

Q5. The structural and functional unit of kidney is

(a) Neuron (b) Nephron
(c) Alveolus (d) Villus

Ans: (b) Nephron

Q6. The tissue that carries water and minerals in plants is

(a) Phloem (b) Xylem
(c) Cortex (d) Epidermis

Ans: (b) Xylem

Q7. Gaseous exchange in lungs takes place in

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

Ans: (c) Alveoli

Q8. Bile juice is secreted by

(a) Pancreas (b) Liver
(c) Stomach (d) Gall bladder

Ans: (b) Liver

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. Name the pigment which captures sunlight in photosynthesis.

Ans: Chlorophyll.

Q2. What is peristalsis?

Ans: The rhythmic wave-like contraction and relaxation of the muscles of the alimentary canal that pushes food forward.

Q3. Why is the diffusion rate of oxygen faster in lungs?

Ans: Alveoli have a very large surface area, thin walls and a rich blood supply.

Q4. Name the process by which plants lose water as vapour.

Ans: Transpiration.

Short Answer Questions (2–3 marks)

Q1. What are the differences between aerobic and anaerobic respiration?

Ans: **Aerobic:** takes place in the presence of oxygen; complete breakdown of glucose to CO_2 and H_2O in mitochondria; releases a large amount of energy (38 ATP). **Anaerobic:** in the absence of oxygen; incomplete breakdown giving ethanol + CO_2 (yeast) or lactic acid (muscles) in cytoplasm; releases less energy (2 ATP).

Q2. How is the small intestine designed to absorb digested food?

Ans: The inner wall of the small intestine has numerous finger-like projections called **villi**, which increase the surface area for absorption. Villi are richly supplied with blood vessels that take the absorbed food to each cell of the body.

Q3. Why is double circulation necessary in humans?

Ans: The right side of the heart receives deoxygenated blood and pumps it to the lungs, and the left side receives oxygenated blood and pumps it to the body. This separation prevents mixing of oxygenated and deoxygenated blood and provides a highly efficient supply of oxygen, which is needed to maintain a constant body temperature.

Long Answer Questions (5 marks)

Q1. Describe the process of nutrition in human beings with the help of the digestive tract.

Ans: Human beings have holozoic nutrition: **(1) Ingestion** through the mouth; teeth chew and saliva (salivary amylase) begins starch digestion. **(2)** The food passes through the oesophagus by peristalsis. **(3) Stomach:** gastric glands release HCl (makes the medium acidic and kills germs), pepsin (digests proteins) and mucus (protects the stomach lining). **(4) Small intestine:** the liver gives bile (makes food alkaline, emulsifies fats); the pancreas gives pancreatic juice with trypsin (proteins), lipase (fats) and amylase (starch); intestinal juice finishes digestion – carbohydrates → glucose, proteins → amino acids, fats → fatty acids and glycerol. **(5) Absorption** by villi. **(6)** The large intestine absorbs water and the unabsorbed waste is egested through the anus.

Q2. Describe the structure and working of a nephron. How does haemodialysis help kidney patients?

Ans: The **nephron** consists of a cluster of thin-walled capillaries called the **glomerulus** enclosed in the cup-shaped **Bowman's capsule**, and a long tubule. **Working:** (1) blood is filtered in the glomerulus – nitrogenous wastes (urea, uric acid), glucose, amino acids, salts and water enter the capsule; (2) in the tubule, useful substances such as glucose, amino acids, salts and water are selectively reabsorbed into the blood; (3) the remaining fluid is urine, which passes through the collecting duct to the ureter, is stored in the urinary bladder and is expelled via the urethra. **Haemodialysis:** when kidneys fail, the patient's blood is passed through an artificial kidney (dialyser) where nitrogenous wastes are removed by diffusion through a semi-permeable membrane into a dialysing fluid, and the cleaned blood is returned to the body.

Chapter 7

Control and Coordination

Important Points & Notes

1. **Neuron** is the structural and functional unit of the nervous system: **dendrites** receive information, the **cell body** processes it, the **axon** carries the impulse away; a **synapse** is the gap through which the impulse passes chemically from one neuron to the next.
2. **Reflex action:** sudden, automatic, involuntary response to a stimulus (touching a hot object). **Reflex arc** path: receptor → sensory neuron → spinal cord (relay neuron) → motor neuron → effector (muscle).
3. **Human brain: Forebrain** (cerebrum: thinking, memory, voluntary actions, senses; hypothalamus: hunger, thirst); **Midbrain** (involuntary movements of eye muscles); **Hindbrain** – cerebellum (balance, posture, coordination), pons and medulla (involuntary actions like heartbeat, breathing, blood pressure, salivation, vomiting).
4. **Protection of brain:** skull (bony box), **meninges** (three membranes) and **cerebrospinal fluid** (shock absorber). Spinal cord is protected by the vertebral column.
5. **Coordination in plants:** no nervous system; use chemical (hormones). **Tropic movements** are directional responses to stimuli: phototropism (shoot towards light), geotropism (roots downward), hydrotropism (roots toward water), chemotropism (pollen tube towards ovule). **Nastic movement:** non-directional, e.g. touch-me-not (*Mimosa pudica*) leaves droop on touch due to loss of water from cells.
6. **Plant hormones: Auxin** (cell elongation; helps shoot bend towards light), **Gibberellins** (stem growth), **Cytokinins** (cell division; found in fruits and seeds), **Abscisic acid** (inhibits growth, causes wilting, closes stomata), **Ethylene** (fruit ripening).

7. **Animal hormones (endocrine glands):** pituitary (master gland, growth hormone), thyroid (**thyroxine** – regulates metabolism; needs iodine; deficiency causes **goitre**), pancreas (**insulin** – controls blood sugar; deficiency causes diabetes), adrenal (**adrenaline** – 'fight or flight'), testes (testosterone), ovary (oestrogen).
8. **Feedback mechanism** regulates hormone secretion: e.g. when blood sugar rises, the pancreas releases more insulin; when it falls, insulin secretion decreases.

Objective Questions (MCQ)

Q1. The part of a neuron that carries impulses away from the cell body is

(a) Dendrite
(b) Axon
(c) Synapse
(d) Nucleus

Ans: (b) Axon

Q2. Which part of the brain controls posture and balance?

(a) Cerebrum
(b) Cerebellum
(c) Medulla
(d) Hypothalamus

Ans: (b) Cerebellum

Q3. The hormone responsible for fruit ripening is

(a) Auxin
(b) Cytokinin
(c) Ethylene
(d) Gibberellin

Ans: (c) Ethylene

Q4. Goitre is caused by the deficiency of

(a) Iron
(b) Iodine
(c) Calcium
(d) Vitamin A

Ans: (b) Iodine

Q5. The movement of a pollen tube towards the ovule is an example of

(a) Phototropism
(b) Geotropism
(c) Chemotropism
(d) Hydrotropism

Ans: (c) Chemotropism

Q6. Insulin is secreted by

(a) Thyroid
(b) Pancreas
(c) Pituitary
(d) Adrenal

Ans: (b) Pancreas

Q7. The path of a reflex arc is

(a) Receptor → motor neuron → effector
(b) Receptor → sensory neuron → spinal cord → motor neuron → effector
(c) Effector → spinal cord → receptor
(d) Receptor → brain → effector

Ans: (b) Receptor → sensory neuron → spinal cord → motor neuron → effector

Q8. Which hormone prepares the body to face an emergency?

(a) Thyroxine
(b) Insulin
(c) Adrenaline
(d) Oestrogen

Ans: (c) Adrenaline

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. What is a synapse?

Ans: The small gap between the axon end of one neuron and the dendrite of the next, where the impulse is transmitted chemically.

Q2. Name the hormone that promotes cell elongation in plants.

Ans: Auxin.

Q3. Why is the pituitary called the 'master gland'?

Ans: Because it controls the secretions of several other endocrine glands.

Q4. Name the part of the brain which controls vomiting and salivation.

Ans: Medulla (hindbrain).

Short Answer Questions (2–3 marks)

Q1. What is a reflex action? Give two examples.

Ans: A reflex action is a sudden, automatic and involuntary response to a stimulus, controlled mainly by the spinal cord and not the brain. Examples: withdrawing the hand on touching a hot object; blinking of the eyes in bright light; knee-jerk.

Q2. How does movement of leaves of the 'sensitive plant' differ from movement of a shoot towards light?

Ans: The movement of sensitive-plant leaves on touch is a **nastic (non-directional)** movement caused by changes in turgor – water leaves the cells and the leaf droops. The bending of a shoot towards light is a **tropic (directional)** movement caused by the hormone auxin, which collects on the shaded side and makes those cells grow longer.

Q3. Why is iodised salt recommended?

Ans: Iodine is necessary for the thyroid gland to make thyroxine, which regulates carbohydrate, protein and fat metabolism. Lack of iodine causes goitre (swollen neck). Iodised salt prevents this.

Long Answer Questions (5 marks)

Q1. Describe the main parts of the human brain and their functions. How is it protected?

Ans: **1. Forebrain:** the cerebrum is the main thinking part – it has sensory areas for hearing, smell, sight, touch, motor areas for voluntary muscles and association areas for memory and judgement; the hypothalamus controls hunger, thirst and body temperature. **2. Midbrain:** controls involuntary movements, e.g. of the eye muscles. **3. Hindbrain:** cerebellum maintains posture and balance and coordinates voluntary actions such as walking or picking up a pencil; pons and medulla control involuntary actions such as breathing, heartbeat, blood pressure, vomiting and salivation. **Protection:** the brain is kept in the bony box called the skull, surrounded by three membranes (meninges) and the cerebrospinal fluid which acts as a shock absorber.

Q2. Write the sources and functions of the plant hormones and of any four animal hormones.

Ans: **Plant hormones:** auxin – synthesised at shoot tips, promotes cell elongation; gibberellins – promote stem growth; cytokinins – promote cell division, high in fruits and seeds; abscisic acid – inhibits growth and causes wilting of leaves; ethylene – ripens fruits. **Animal hormones:** growth hormone (pituitary) – growth of body; thyroxine (thyroid) – regulates metabolism; insulin (pancreas) – lowers blood sugar; adrenaline (adrenal) – increases heartbeat and breathing in emergencies; testosterone (testes) – male secondary sexual characters; oestrogen (ovary) – female characters.

Chapter 8

How do Organisms Reproduce?

Important Points & Notes

1. **Reproduction** creates new individuals of the same species. **DNA copying** with minor variations produces **variation**, which helps species survive environmental changes.
2. **Asexual reproduction** (single parent, no gametes): **fission** (binary in *Amoeba*, multiple in *Plasmodium*), **fragmentation** (*Spirogyra*), **regeneration** (*Hydra*, *Planaria*), **budding** (*Hydra*, yeast), **spore formation** (*Rhizopus*), **vegetative propagation** (cutting – rose; layering – jasmine; grafting – mango; tissue culture).
3. **Sexual reproduction in flowering plants:** flower parts – sepals, petals, **stamen** (male: anther + filament) and **pistil** (female: stigma, style, ovary). **Pollination:** transfer of pollen from anther to stigma (self or cross; by wind, water, insects). **Fertilisation:** pollen tube carries male gamete to the ovule → zygote → embryo; ovule → seed, ovary → fruit.
4. **Human male reproductive system:** testes (in scrotum; produce sperms and testosterone; lower temperature needed), vas deferens, seminal vesicle, prostate gland (semen), urethra, penis.
5. **Human female reproductive system:** ovaries (produce eggs and hormones), oviduct/fallopian tube (fertilisation site), **uterus** (embryo develops), cervix, vagina. One egg is released every month by one ovary.
6. **Fertilisation and development:** sperm + egg → zygote in oviduct → embryo implants in the uterine wall → **placenta** (nutrition, oxygen, removal of waste to the mother's blood) → foetus. Gestation ≈ 9 months. If no fertilisation, the uterine lining breaks down and is shed as blood – **menstruation** (every 28 days approx.).

7. **Puberty:** boys – facial hair, voice breaking; girls – breast development, menstruation. **Reproductive health:** contraception – barrier (condom, diaphragm), chemical (oral pills), IUDs (copper-T), surgical (vasectomy, tubectomy). Condoms also protect from **STIs** (gonorrhoea, syphilis, warts, HIV-AIDS). Female foeticide lowers the sex ratio – a social evil.
8. **Difference:** asexual reproduction gives rapid multiplication and identical offspring (clones) but little variation; sexual reproduction gives variation due to mixing of genetic material from two parents, and promotes evolution.

Objective Questions (MCQ)

Q1. Binary fission is seen in

(a) Hydra (b) Amoeba
(c) Yeast (d) Rhizopus

Ans: (b) Amoeba

Q2. Budding in *Hydra* and yeast is a type of

(a) Sexual reproduction (b) Asexual reproduction
(c) Pollination (d) Fertilisation

Ans: (b) Asexual reproduction

Q3. In a flower, the male reproductive part is

(a) Pistil (b) Stamen
(c) Sepal (d) Ovary

Ans: (b) Stamen

Q4. Fertilisation in human beings takes place in

(a) Uterus (b) Vagina
(c) Oviduct (d) Ovary

Ans: (c) Oviduct

Q5. The structure that connects the embryo to the uterine wall is

(a) Cervix (b) Placenta

(c) Oviduct (d) Ovary

Ans: (b) Placenta

Q6. Vegetative propagation in mango is done by

(a) Cutting (b) Grafting

(c) Layering (d) Budding

Ans: (b) Grafting

Q7. Which one is a barrier method of contraception?

(a) Copper-T (b) Oral pills

(c) Condom (d) Vasectomy

Ans: (c) Condom

Q8. The testes are located outside the abdominal cavity because

(a) Sperm formation needs a lower temperature (b) They are large

(c) They need more space (d) Less blood is required

Ans: (a) Sperm formation needs a lower temperature

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. What is regeneration?

Ans: The ability of a fully differentiated organism to regrow lost body parts from cut pieces, e.g. *Planaria*.

Q2. Name the organ where the embryo develops in human females.

Ans: Uterus.

Q3. What is pollination?

Ans: The transfer of pollen grains from the anther to the stigma of a flower.

Q4. Name two sexually transmitted diseases.

Ans: Gonorrhoea and syphilis (also AIDS).

Short Answer Questions (2–3 marks)

Q1. Why is variation beneficial to the species?

Ans: Variations give some individuals the ability to survive changes in the environment (such as temperature rise or disease). Without variation, an entire population could be wiped out by a sudden change. Variations therefore help in the survival and evolution of species.

Q2. Differentiate between pollination and fertilisation.

Ans: **Pollination:** transfer of pollen from anther to stigma; it occurs outside the ovule. **Fertilisation:** fusion of male and female gametes to form a zygote; it occurs inside the ovule/ovary after the pollen tube reaches the ovule.

Q3. What is the role of the placenta?

Ans: The placenta is a disc-like tissue embedded in the uterine wall. It contains villi that provide a large surface area for the exchange of glucose, oxygen and other nutrients from the mother's blood to the embryo, and for removal of waste (CO_2, urea) from the embryo to the mother's blood.

Long Answer Questions (5 marks)

Q1. Describe the different methods of asexual reproduction in organisms with examples.

Ans: **(1) Fission:** a unicellular organism splits into two (binary fission in *Amoeba*) or many (multiple fission in *Plasmodium*). **(2) Fragmentation:** a multicellular organism breaks into pieces that grow into new individuals (*Spirogyra*). **(3) Regeneration:** an organism regrows lost parts from specialised cells (*Hydra*, *Planaria*). **(4) Budding:** a bud develops as an outgrowth, detaches and becomes a new organism (*Hydra*, yeast). **(5) Vegetative propagation:** new plants grow from roots, stems or leaves – e.g. rose by cutting, jasmine by layering, mango by grafting, potato by tubers, *Bryophyllum* from leaf notches. **(6) Spore formation:** thick-walled spores in sporangia germinate in favourable conditions (*Rhizopus*).

Q2. Describe the human female reproductive system. What happens if the egg is fertilised and if it is not?

Ans: The female reproductive system has a pair of **ovaries** (produce eggs and hormones oestrogen and progesterone), two **oviducts** (fallopian tubes), the **uterus** and the **vagina**. An egg is released from an ovary every month and moves into the oviduct. **If fertilised:** the zygote divides to form an embryo, which is implanted in the thick, vascular uterine lining; the placenta forms and nourishes the embryo for about nine months until the baby is born. **If not fertilised:** the egg lives for about one day; the thickened uterine lining is not needed, breaks down and is shed with blood and mucus through the vagina – **menstruation** – lasting 2–8 days, repeated about every 28 days.

Chapter 9

Heredity and Evolution

Important Points & Notes

1. **Heredity:** transmission of characters from parents to offspring. **Variation:** differences among individuals. **Genes** on chromosomes (DNA) are units of inheritance; each trait is controlled by two copies (alleles) – one from each parent.
2. **Mendel (Father of Genetics)** used garden pea (*Pisum sativum*). **Monohybrid cross** (tall × dwarf): F_1 all tall (Tt); F_2 phenotypic ratio **3 tall : 1 dwarf**, genotypic ratio 1 TT : 2 Tt : 1 tt. A dominant trait appears in F_1; the recessive trait reappears in F_2.
3. **Dihybrid cross** (round yellow × wrinkled green): F_1 all round yellow; F_2 ratio **9 : 3 : 3 : 1** (round-yellow : round-green : wrinkled-yellow : wrinkled-green) – shows independent inheritance of traits.
4. **Sex determination in humans:** 23 pairs of chromosomes; 22 pairs autosomes + 1 pair sex chromosomes. Female: XX; male: XY. Women produce only X eggs; men produce X or Y sperms. The sex of the child depends on the sperm: X → girl, Y → boy (50 : 50 chance).
5. **Acquired traits** (e.g. a beetle population's loss of weight due to starvation; cutting a mouse's tail) are not inherited as they do not change germ-cell DNA; **inherited traits** pass to the next generation.
6. **Evolution:** gradual change in the characteristics of populations over generations. Causes: variation, **natural selection** (best-adapted survive), **genetic drift** (random changes in gene frequency), geographical isolation → **speciation** (formation of a new species).

7. **Evidence for evolution: homologous organs** (same structure, different function – forelimbs of a human, bat, whale, frog) show common ancestry; **analogous organs** (different structure, same function – wings of a bird and bat/insect) show similar adaptation; **fossils** (age found by fossil dating – radio-carbon dating); **embryology**; evolution of complex organs in stages – feathers first for warmth, later for flight (dinosaurs → birds).
8. **Human evolution:** studied through excavations, time dating and DNA sequences; all humans (*Homo sapiens*) originated in Africa and spread across the world. Evolution is **not** 'progress' from lower to higher forms – it is the formation of diverse species; Charles Darwin proposed natural selection.

Objective Questions (MCQ)

Q1. The father of genetics is

(a) Darwin (b) Mendel
(c) Lamarck (d) Watson

Ans: (b) Mendel

Q2. In a monohybrid cross, the phenotypic ratio in F_2 is

(a) 1 : 1 (b) 3 : 1
(c) 9 : 3 : 3 : 1 (d) 1 : 2 : 1

Ans: (b) 3 : 1

Q3. The sex chromosomes of a human male are

(a) XX (b) XY
(c) YY (d) XO

Ans: (b) XY

Q4. Wings of a bird and wings of an insect are

(a) Homologous organs (b) Analogous organs
(c) Vestigial organs (d) Rudimentary organs

Ans: (b) Analogous organs

Q5. The F_2 phenotypic ratio of a dihybrid cross is

(a) 3 : 1 (b) 1 : 1 : 1 : 1

(c) 9 : 3 : 3 : 1 (d) 1 : 2 : 1

Ans: (c) 9 : 3 : 3 : 1

Q6. Who proposed the theory of natural selection?

(a) Mendel (b) Charles Darwin

(c) Lamarck (d) De Vries

Ans: (b) Charles Darwin

Q7. A trait which is expressed in the F_1 generation is called

(a) Recessive (b) Dominant

(c) Hybrid (d) Acquired

Ans: (b) Dominant

Q8. Fossil dating of an organism is done by

(a) Carbon-14 (b) Oxygen-16

(c) Hydrogen (d) Nitrogen

Ans: (a) Carbon-14

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. What is a gene?

Ans: A segment of DNA on a chromosome that codes for a particular protein/trait.

Q2. Which sex chromosome decides the sex of a child as male?

Ans: Y chromosome from the father's sperm.

Q3. What are homologous organs? Give an example.

Ans: Organs with the same basic structure but different functions, e.g. forelimbs of a human and a bat.

Q4. What is speciation?

Ans: Formation of a new species from an existing one due to isolation and variation.

Short Answer Questions (2–3 marks)

Q1. Differentiate between acquired and inherited traits.

Ans: **Inherited traits** are caused by changes in the DNA of germ cells and pass to the next generation (e.g. eye colour, height potential). **Acquired traits** are developed during the lifetime of an individual due to environment or experience (e.g. low weight from starvation, a cut tail) and are not passed on because germ-cell DNA does not change.

Q2. A cross was carried out between a tall pea plant (TT) and a dwarf plant (tt). Write the F_1 and F_2 results.

Ans: F_1: all tall plants (Tt). On self-pollination: F_2 = 1 TT : 2 Tt : 1 tt, i.e. 3 tall : 1 dwarf (phenotypic ratio); genotypic ratio 1 : 2 : 1.

Q3. How does the sex of a child get determined in human beings?

Ans: Women have two X chromosomes (XX) and every egg carries an X chromosome. Men have X and Y chromosomes (XY), so half the sperms carry X and half carry Y. If an X-sperm fertilises the egg, the child is a girl (XX); if a Y-sperm fertilises the egg, the child is a boy (XY). Thus the father's sperm decides the sex of the child.

Long Answer Questions (5 marks)

Q1. Explain Mendel's monohybrid cross with the help of a diagram/checkerboard. What laws were inferred?

Ans: Mendel crossed a pure tall pea plant (TT) with a pure dwarf plant (tt). **F_1:** all plants were tall (Tt) – tallness is dominant. When F_1 plants were self-pollinated (Tt × Tt), gametes T, t from each parent combine: **TT, Tt, Tt, tt** → F_2 contains 3 tall : 1 dwarf (genotypes 1 TT : 2 Tt : 1 tt). The dwarf trait that disappeared in F_1 reappeared in F_2. **Inferences:** (1) **Law of dominance** – in a heterozygote only the dominant trait is expressed; (2) **Law of segregation** – the two alleles separate during gamete formation and each gamete carries only one; (3) the dihybrid cross showed the **law of independent assortment** – traits are inherited independently (9 : 3 : 3 : 1).

Q2. What is evolution? Explain homologous organs, analogous organs and fossils as evidences of evolution.

Ans: Evolution is the gradual change in the characteristics of populations of living organisms over many generations leading to the formation of new species. **Homologous organs:** have the same basic structural plan but perform different functions, e.g. forelimbs of human (grasping), bat (flying), whale (swimming) – they show that these organisms evolved from a common ancestor. **Analogous organs:** have different origin and structure but perform similar functions, e.g. wings of a bird and an insect – they show similar adaptation, not common ancestry. **Fossils:** preserved remains or impressions of organisms of the past; deeper layers contain older fossils and the age can be found by radio-carbon dating. Fossils such as *Archaeopteryx* (reptile-like with feathers) show that birds evolved from reptiles.

Chapter 10

Light – Reflection and Refraction

Important Points & Notes

1. **Laws of reflection:** (i) angle of incidence = angle of reflection; (ii) incident ray, reflected ray and the normal lie in the same plane.
2. **Spherical mirrors:** concave (converging) and convex (diverging). Terms: pole (P), centre of curvature (C), radius of curvature (R), principal axis, principal focus (F). **Focal length f = R/2.**
3. **Image by concave mirror:** object at infinity → image at F, real, inverted, highly diminished; beyond C → between F and C, real, inverted, diminished; at C → at C, real, inverted, same size; between C and F → beyond C, real, inverted, enlarged; at F → at infinity, highly enlarged; between P and F → behind the mirror, virtual, erect, enlarged. **Convex mirror:** always virtual, erect, diminished image behind the mirror (used as rear-view mirror).
4. **Sign convention:** distances measured from the pole; to the right of the pole = positive, to the left = negative; heights above the axis = positive, below = negative. For a concave mirror f is negative; for a convex mirror f is positive.
5. **Mirror formula:** $1/v + 1/u = 1/f$. **Magnification:** $m = h'/h = -v/u$. Negative m means a real, inverted image; positive m means a virtual, erect image.
6. **Refraction:** bending of light when it passes from one medium to another due to change in speed. **Laws:** (i) incident ray, refracted ray and normal lie in the same plane; (ii) **Snell's law** – sin i / sin r = constant = n (refractive index). Refractive index n = speed of light in vacuum (c) / speed in medium (v). Light bends towards the normal on entering a denser medium.

7. **Lenses:** convex (converging; f positive) and concave (diverging; f negative). **Lens formula:** $1/v - 1/u = 1/f$; **magnification:** $m = v/u = h'/h$. **Power of lens:** $P = 1/f$ (f in metres); unit **dioptre (D)**. Convex lens has positive power, concave negative. For lenses in contact: $P = P_1 + P_2$.
8. **Uses:** concave mirror – shaving mirror, torch/headlight reflector, dentists' mirror, solar furnace; convex mirror – vehicle rear-view; convex lens – magnifying glass, cameras, spectacles for hypermetropia; concave lens – spectacles for myopia.

Objective Questions (MCQ)

Q1. The focal length of a spherical mirror of radius of curvature 30 cm is

(a) 15 cm
(b) 30 cm
(c) 60 cm
(d) 7.5 cm

Ans: (a) 15 cm

Q2. Which mirror is used as a rear-view mirror in vehicles?

(a) Concave
(b) Convex
(c) Plane
(d) Cylindrical

Ans: (b) Convex

Q3. An object is placed at the centre of curvature of a concave mirror. The image is formed

(a) At F
(b) At C, real and same size
(c) Beyond C
(d) Behind the mirror

Ans: (b) At C, real and same size

Q4. The refractive index of a medium is 1.5. The speed of light in it is ($c = 3 \times 10^8$ m/s)

(a) 2×10^8 m/s
(b) 4.5×10^8 m/s
(c) 1.5×10^8 m/s
(d) 3×10^8 m/s

Ans: (a) 2×10^8 m/s

Q5. The SI unit of power of a lens is

(a) Metre (b) Dioptre

(c) Watt (d) Joule

Ans: (b) Dioptre

Q6. A concave lens always forms an image which is

(a) Real and inverted (b) Virtual and erect

(c) Real and erect (d) Virtual and inverted

Ans: (b) Virtual and erect

Q7. The power of a convex lens of focal length 50 cm is

(a) +2 D (b) +0.5 D

(c) −2 D (d) +5 D

Ans: (a) +2 D

Q8. When light travels from air into glass, it

(a) Bends away from the normal (b) Bends towards the normal

(c) Does not bend (d) Reflects back

Ans: (b) Bends towards the normal

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. State the laws of reflection.

Ans: (i) Angle of incidence = angle of reflection. (ii) The incident ray, reflected ray and normal at the point of incidence lie in the same plane.

Q2. Define 1 dioptre of power.

Ans: The power of a lens whose focal length is 1 metre.

Q3. Why does a ray of light not bend when it enters a medium along the normal?

Ans: Because the angle of incidence is 0°, so the angle of refraction is also 0°; the ray goes straight.

Q4. What is the nature of the image formed by a plane mirror?

Ans: Virtual, erect, of the same size and laterally inverted.

Short Answer Questions (2–3 marks)

Q1. An object 5 cm high is placed 20 cm from a concave mirror of focal length 15 cm. Find the position, nature and size of the image.

Ans: u = −20 cm, f = −15 cm. 1/v = 1/f − 1/u = −1/15 + 1/20 = −1/60 → **v = −60 cm** (60 cm in front of the mirror). m = −v/u = −(−60)/(−20) = −3 → h′ = −3 × 5 = **−15 cm**. The image is real, inverted and enlarged (15 cm high).

Q2. Define refractive index. The refractive index of diamond is 2.42. What does this mean?

Ans: Refractive index is the ratio of the speed of light in vacuum to its speed in the medium (n = c/v). n = 2.42 means that the speed of light in diamond is 1/2.42 times its speed in vacuum, i.e. light travels 2.42 times slower in diamond.

Q3. A convex lens of focal length 10 cm forms an image of an object placed 15 cm away. Find the image distance and magnification.

Ans: u = −15 cm, f = +10 cm. 1/v = 1/f + 1/u = 1/10 − 1/15 = 1/30 → **v = +30 cm**. m = v/u = 30/(−15) = **−2**. The image is real, inverted and twice the size of the object, on the other side of the lens.

Long Answer Questions (5 marks)

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Q1. Draw ray diagrams (describe) for the image formed by a concave mirror when the object is placed (a) beyond C, (b) between C and F, (c) between P and F. State the nature of the image in each case.

Ans: **(a) Beyond C:** a ray parallel to the principal axis passes through F after reflection; a ray through C retraces its path. They meet between F and C. Image: real, inverted, diminished. **(b) Between C and F:** the rays meet beyond C. Image: real, inverted, enlarged. **(c) Between P and F:** the reflected rays diverge and appear to meet behind the mirror when produced backwards. Image: virtual, erect, enlarged – this is why a concave mirror is used as a shaving mirror and by dentists.

Q2. State the sign convention for spherical lenses and derive the relation between power and focal length. Calculate the power of a combination of two lenses of powers +3.5 D and −2.5 D.

Ans: **Sign convention:** all distances are measured from the optical centre; distances along the direction of incident light are positive and those opposite are negative; heights above the principal axis are positive and below are negative. Thus the object distance u is always negative, f is positive for a convex lens and negative for a concave lens. **Power:** the ability of a lens to converge or diverge light; P = 1/f where f is in metres. A shorter focal length means greater power. **Combination:** $P = P_1 + P_2$ = +3.5 D + (−2.5 D) = **+1.0 D**. The combination behaves as a convex lens of focal length 1 m.

Chapter 11

The Human Eye and the Colourful World

Important Points & Notes

1. **Parts of the human eye: cornea** (transparent front; most refraction takes place here), **iris** (controls pupil size), **pupil** (regulates light entering), **eye lens** (fine-tunes focus on the retina), **ciliary muscles** (change the lens curvature), **retina** (screen with rod and cone cells), **optic nerve** (carries signals to the brain). The image on the retina is real and inverted; the brain interprets it as erect.
2. **Accommodation:** the ability of the eye lens to adjust its focal length. **Far point** of normal eye = infinity; **near point** = 25 cm (least distance of distinct vision). Normal range of vision: 25 cm to infinity.
3. **Myopia (near-sightedness):** distant objects are not seen clearly; image forms in front of the retina; due to excessive curvature of the lens or elongated eyeball. Corrected by a **concave** lens.
4. **Hypermetropia (far-sightedness):** nearby objects are not seen clearly; image forms behind the retina; due to low curvature of the lens or a short eyeball. Corrected by a **convex** lens.
5. **Presbyopia:** weakening of ciliary muscles and loss of flexibility of the lens with age; both near and far vision are affected; corrected by **bifocal lenses**. **Cataract:** clouding of the eye lens, treated by surgery.
6. **Dispersion:** splitting of white light into seven colours (VIBGYOR – violet, indigo, blue, green, yellow, orange, red) by a glass prism, because each colour bends by a different angle – red the least and violet the most. Newton used two prisms to show that the spectrum can be recombined into white light.

7. **Rainbow:** formed by dispersion, refraction and internal reflection of sunlight in raindrops; seen when the Sun is behind the observer. **Atmospheric refraction:** twinkling of stars (changing refractive index of air layers); advance sunrise and delayed sunset by about 2 minutes; planets do not twinkle because they are nearer and act as extended sources.
8. **Scattering of light: Tyndall effect** – scattering of light by colloidal particles (path of sunlight through mist or a dense forest). The sky appears **blue** because shorter wavelengths (blue) scatter more; the Sun appears **red** at sunrise/sunset since light travels a longer path and blue is scattered away. Danger signals are red because red is scattered least.

Objective Questions (MCQ)

Q1. The least distance of distinct vision for a normal eye is

(a) 10 cm (b) 25 cm
(c) 50 cm (d) 1 m

Ans: (b) 25 cm

Q2. Myopia can be corrected by using a

(a) Convex lens (b) Concave lens
(c) Bifocal lens (d) Cylindrical lens

Ans: (b) Concave lens

Q3. The part of the eye which controls the amount of light entering is

(a) Cornea (b) Retina
(c) Iris (d) Lens

Ans: (c) Iris

Q4. Which colour of white light bends the least in a prism?

(a) Violet (b) Red
(c) Blue (d) Green

Ans: (b) Red

Q5. The blue colour of the sky is due to

(a) Dispersion (b) Scattering

(c) Reflection (d) Refraction

Ans: (b) Scattering

Q6. The twinkling of stars is due to

(a) Atmospheric refraction (b) Dispersion

(c) Total reflection (d) Diffraction

Ans: (a) Atmospheric refraction

Q7. In hypermetropia, the image of a nearby object is formed

(a) On the retina (b) In front of the retina

(c) Behind the retina (d) On the cornea

Ans: (c) Behind the retina

Q8. Danger signals are red because red light is

(a) Scattered the most (b) Scattered the least

(c) Dispersed the most (d) Absorbed fully

Ans: (b) Scattered the least

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. What is accommodation of the eye?

Ans: The ability of the eye lens to change its focal length to focus objects at different distances on the retina.

Q2. Name the defect of vision in which a person cannot see distant objects clearly.

Ans: Myopia (near-sightedness).

Q3. Why do planets not twinkle?

Ans: Planets are much closer and act as an extended collection of point sources, so the average variation of light from them is nil.

Q4. What is Tyndall effect?

Ans: Scattering of light by colloidal particles making the path of light beam visible.

Short Answer Questions (2–3 marks)

Q1. Differentiate between myopia and hypermetropia.

Ans: **Myopia:** distant objects are not clearly seen; image forms in front of the retina; far point is nearer than infinity; corrected by a concave lens.
Hypermetropia: nearby objects are not clearly seen; image forms behind the retina; near point is farther than 25 cm; corrected by a convex lens.

Q2. Why does the Sun appear reddish at sunrise and sunset?

Ans: At sunrise and sunset the Sun is near the horizon, so its light has to travel a longer path through the atmosphere. Blue and other short-wavelength lights are scattered away by the air particles, and mostly red light, which is scattered the least, reaches our eyes.

Q3. Explain how a rainbow is formed.

Ans: A rainbow is formed when sunlight falls on tiny water droplets in the atmosphere after rain. Each droplet acts as a small prism: light is refracted and dispersed on entering the drop, internally reflected at the back surface and refracted again on leaving. Different colours emerge at different angles and a band of colours (VIBGYOR) is seen with red on the outer edge, when the Sun is behind the observer.

Long Answer Questions (5 marks)

Q1. With a neat labelled description, explain the structure and working of the human eye.

Ans: Light enters the eye through the transparent **cornea**, where most of the refraction occurs. The **iris** (a dark muscular diaphragm) controls the size of the **pupil** and hence the amount of light entering. The **eye lens**, a flexible convex lens, focuses the light on the **retina**. The ciliary muscles adjust the curvature (and thus the focal length) of the lens to see near or distant objects (accommodation). The retina has light-sensitive **rod cells** (dim light) and **cone cells** (colour vision), which generate electrical signals carried to the brain by the **optic nerve**. The image on the retina is real and inverted, but the brain processes it so we see objects erect.

Q2. Explain the defects of vision – myopia, hypermetropia and presbyopia – their causes and corrections. A person has a far point at 80 cm. Which lens, and of what power, is needed to see distant objects clearly?

Ans: **Myopia:** cause – excessive curvature of the eye lens or elongation of the eyeball; image forms before the retina; correction – concave lens. **Hypermetropia:** cause – low curvature of the lens or too short an eyeball; image forms behind the retina; correction – convex lens. **Presbyopia:** cause – weakening of ciliary muscles with age; correction – bifocal lenses (concave upper part, convex lower part). **Numerical:** the far point is 80 cm, so the person is myopic. The lens must form the image of a distant object ($u = \infty$) at 80 cm: $v = -80$ cm $\rightarrow$ $f = -80$ cm $= -0.8$ m. Power $P = 1/f =$ **-1.25 D**, i.e. a concave lens of power -1.25 D.

Chapter 12

Electricity

Important Points & Notes

1. **Electric charge** unit: coulomb (C); charge of one electron = 1.6×10^{-19} C. **Current** I = Q/t; unit ampere (A); measured by an ammeter connected in **series**. Conventional current flows from positive to negative terminal (opposite to electron flow).
2. **Potential difference** V = W/Q; unit volt (V) – 1 V is the work of 1 J to move 1 C of charge between two points. Measured by a voltmeter connected in **parallel**. 1 V = 1 J/C.
3. **Ohm's law:** at constant temperature, current through a conductor is directly proportional to the potential difference across it: **V = IR**. R is resistance (unit ohm, Ω). The V–I graph is a straight line through the origin.
4. **Resistance** depends on length ($R \propto l$), area of cross-section ($R \propto 1/A$), nature of material and temperature: **$R = \rho l/A$**. Resistivity ρ (Ω m) depends on material and temperature, not on size. Alloys have higher resistivity than pure metals and do not oxidise easily – used in heating devices (nichrome) and bulb filaments (tungsten).
5. **Series combination:** $R_s = R_1 + R_2 + R_3$; same current, voltage divides. **Parallel combination:** $1/R_p = 1/R_1 + 1/R_2 + 1/R_3$; same voltage, current divides; total resistance is less than the smallest resistance. Household circuits are in parallel.
6. **Heating effect (Joule's law): $H = I^2Rt$** (joule). Applications: electric heater, iron, toaster, bulb, **fuse** (wire of low melting point, protects appliances from overloading/short circuit).
7. **Electric power:** $P = VI = I^2R = V^2/R$; unit watt (W); 1 kW = 1000 W. **Electrical energy** = P × t. Commercial unit: **1 kilowatt-hour (kWh) = 3.6×10^6 J** = 1 unit of electricity.

8. **Circuit symbols:** cell, battery, plug key (open/closed), resistor, variable resistance (rheostat), ammeter, voltmeter, wire joint, wire crossing without joint, bulb. Switch off appliances after use to save electricity.

Objective Questions (MCQ)

Q1. The SI unit of electric current is

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

Ans: (b) Ampere

Q2. The resistance of a wire of length 1 m and area of cross-section A is R. If the length is doubled, the resistance becomes

(a) R/2
(b) R
(c) 2R
(d) 4R

Ans: (c) 2R

Q3. Ohm's law gives the relation

(a) V = I/R
(b) V = IR
(c) I = VR
(d) R = VI

Ans: (b) V = IR

Q4. An ammeter is always connected in

(a) Parallel
(b) Series
(c) Either way
(d) Across the battery

Ans: (b) Series

Q5. The commercial unit of electrical energy is

(a) Joule
(b) Watt
(c) Kilowatt-hour
(d) Volt

Ans: (c) Kilowatt-hour

Q6. Which of the following has the lowest resistivity?

(a) Silver
(b) Nichrome
(c) Glass
(d) Iron

Ans: (a) Silver

Q7. The effective resistance of two 4 Ω resistors in parallel is

(a) 8 Ω (b) 4 Ω

(c) 2 Ω (d) 1 Ω

Ans: (c) 2 Ω

Q8. The heat produced in a resistor is proportional to

(a) I (b) I^2

(c) 1/I (d) I^3

Ans: (b) I^2

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. Define 1 volt.

Ans: The potential difference between two points is 1 volt when 1 joule of work is done in moving 1 coulomb of charge between them.

Q2. Why is tungsten used for the filament of electric bulbs?

Ans: It has a very high melting point (3380 °C) and high resistivity, so it can glow without melting.

Q3. Why are household appliances connected in parallel?

Ans: So that each appliance gets the same voltage, can be operated independently and the failure of one does not stop others.

Q4. What is the SI unit of resistivity?

Ans: Ohm-metre (Ω m).

Short Answer Questions (2–3 marks)

Q1. A current of 0.5 A flows through a wire for 10 minutes. Calculate the charge that flows.

Ans: Q = I × t = 0.5 A × (10 × 60) s = 0.5 × 600 = **300 C**.

Q2. Two resistors of 6 Ω and 3 Ω are connected in parallel across a 6 V battery. Find the equivalent resistance and the total current.

Ans: $1/R_p = 1/6 + 1/3 = 1/6 + 2/6 = 3/6 = 1/2 \rightarrow \mathbf{R_p = 2\ \Omega}$. Current $I = V/R = 6/2 = \mathbf{3\ A}$.

Q3. Why is a fuse wire connected in series with an electric appliance?

Ans: A fuse is a thin wire of low melting point. If excess current flows due to overloading or a short circuit, the wire heats up, melts and breaks the circuit, thereby protecting the appliance and wiring from damage or fire. It must be in series so that the whole current passes through it.

Long Answer Questions (5 marks)

Q1. State Ohm's law. Describe an experiment to verify it and draw the nature of the V–I graph. Derive the expression for the equivalent resistance of resistors in series.

Ans: Ohm's law: at constant temperature the current through a conductor is directly proportional to the potential difference across its ends ($V \propto I$, $V = IR$). **Verification:** connect a battery, a key, an ammeter (in series) and a nichrome wire, with a voltmeter in parallel across the wire. Vary the number of cells and note V and I each time. The ratio V/I is constant (= R) and the graph of V against I is a **straight line passing through the origin**. **Series:** for resistors R_1, R_2, R_3 in series, the same current I flows through each; $V = V_1 + V_2 + V_3 = IR_1 + IR_2 + IR_3 = I(R_1 + R_2 + R_3)$. Also $V = IR_s$, hence $\mathbf{R_s = R_1 + R_2 + R_3}$.

Q2. State Joule's law of heating. An electric heater of resistance 50 Ω draws a current of 4 A. Calculate the power and the heat produced in 30 minutes. If the heater runs 2 h daily, find the energy used in a month (30 days) in kWh.

Ans: **Joule's law:** the heat produced in a resistor is directly proportional to the square of the current, the resistance and the time: $H = I^2Rt$. **Power:** $P = I^2R = 16 \times 50 =$ **800 W**. **Heat in 30 min:** $H = P \times t = 800 \times 1800 =$ **1.44×10^6 J**. **Energy per month:** 0.8 kW × 2 h × 30 = **48 kWh** (48 units).

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Chapter 13

Magnetic Effects of Electric Current

Important Points & Notes

1. **Magnetic field lines:** imaginary lines showing the field; they emerge from the North pole and merge at the South pole outside the magnet, and form closed curves; never intersect; closer lines mean a stronger field; the tangent at any point gives the direction of the field.
2. **Oersted's experiment:** a current-carrying wire deflects a compass needle – electric current produces a magnetic field. **Right-hand thumb rule:** hold the wire in the right hand with the thumb along the current; the curled fingers show the direction of the magnetic field.
3. **Field due to current:** straight wire – concentric circles; circular loop – field is strongest at the centre (increases with current and number of turns); **solenoid** (coil of many circular turns) – field inside is uniform, like a bar magnet. An iron core inside a solenoid makes an **electromagnet**.
4. **Force on a current-carrying conductor in a magnetic field** is maximum when current is perpendicular to the field. Direction is given by **Fleming's left-hand rule**: forefinger = magnetic field, middle finger = current, thumb = force (all mutually perpendicular).
5. **Electric motor** converts electrical energy into mechanical energy: a rectangular coil in a magnetic field with a **split-ring commutator** that reverses the current direction every half-rotation so that the coil keeps rotating in the same direction. Used in fans, mixers, washing machines.
6. **Electromagnetic induction:** a changing magnetic field (relative motion between a coil and magnet) induces an emf/current in the coil (Faraday). Direction of the induced current: **Fleming's right-hand rule** (forefinger = field, thumb = motion, middle finger = current).

7. **Electric generator** converts mechanical energy into electrical energy by rotating a coil in a magnetic field. **AC generator** has slip rings; **DC generator** has a split-ring commutator. In India AC has a frequency of **50 Hz** (direction changes every 1/100 s); it is easy to transmit over long distances without much loss.
8. **Domestic circuits:** live wire (red, 220 V), neutral wire (black), earth wire (green) connected to a metal plate deep in the earth. **Earthing** protects from electric shocks by letting leakage current flow to earth. **Fuse** prevents damage from overloading and short circuits. Short circuit: live and neutral wires touch; overloading: too many appliances on one circuit.

Objective Questions (MCQ)

Q1. The direction of magnetic field around a current-carrying wire is given by

(a) Fleming's left-hand rule
(b) Right-hand thumb rule
(c) Ohm's law
(d) Lenz's law

Ans: (b) Right-hand thumb rule

Q2. Magnetic field lines inside a bar magnet go from

(a) North to South
(b) South to North
(c) East to West
(d) They don't exist

Ans: (b) South to North

Q3. The device that converts mechanical energy into electrical energy is

(a) Electric motor
(b) Generator
(c) Transformer
(d) Galvanometer

Ans: (b) Generator

Q4. The frequency of AC supplied in India is

(a) 25 Hz
(b) 50 Hz
(c) 60 Hz
(d) 100 Hz

Ans: (b) 50 Hz

Q5. The colour of the earth wire in domestic circuits is

(a) Red (b) Black

(c) Green (d) Blue

Ans: (c) Green

Q6. Which rule gives the direction of force on a current-carrying conductor in a magnetic field?

(a) Fleming's right-hand rule (b) Fleming's left-hand rule

(c) Right-hand thumb rule (d) Maxwell's rule

Ans: (b) Fleming's left-hand rule

Q7. The function of the split-ring commutator in an electric motor is to

(a) Reverse the direction of current (b) Increase the current

(c) Stop the motor (d) Reduce friction

Ans: (a) Reverse the direction of current

Q8. The magnetic field due to a solenoid carrying current inside it is

(a) Zero (b) Non-uniform

(c) Uniform (d) Weakest at the centre

Ans: (c) Uniform

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. State the right-hand thumb rule.

Ans: Imagine holding a current-carrying straight conductor in your right hand with the thumb pointing along the current; the fingers wrapped around the conductor give the direction of the magnetic field.

Q2. What is electromagnetic induction?

Ans: The production of an induced current in a coil due to a change in the magnetic field linked with it.

Q3. What is the function of an earth wire?

Ans: It provides a low-resistance path for leakage current to flow to the ground, protecting the user from electric shock.

Q4. Why does a compass needle get deflected near a current-carrying wire?

Ans: Because the current produces a magnetic field around the wire that exerts a force on the magnetic needle.

Short Answer Questions (2–3 marks)

Q1. List the properties of magnetic field lines.

Ans: (i) They emerge from the North pole and end at the South pole outside the magnet, and inside the magnet go from S to N, forming closed loops. (ii) The tangent at any point gives the direction of the field. (iii) They never intersect each other. (iv) Closer lines represent a stronger field.

Q2. What is a solenoid? How can the strength of its magnetic field be increased?

Ans: A solenoid is a coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder. Its field can be increased by (i) increasing the current, (ii) increasing the number of turns per unit length and (iii) placing a soft-iron core inside (electromagnet).

Q3. Explain the principle of an electric generator.

Ans: An electric generator works on the principle of **electromagnetic induction**: when a coil is rotated in a magnetic field, the magnetic flux through it changes and an emf is induced. The direction and magnitude of the induced current change with rotation, giving alternating current.

Long Answer Questions (5 marks)

Q1. Describe the construction and working of an electric motor with a labelled diagram (describe).

Ans: **Principle:** a current-carrying coil placed in a magnetic field experiences a force/torque. **Construction:** a rectangular coil ABCD of insulated copper wire is placed between the poles of a strong permanent magnet. Its ends are connected to the two halves of a **split-ring commutator**, which touch carbon brushes connected to a battery. **Working:** current flows through the coil. By Fleming's left-hand rule the forces on arms AB and CD are in opposite directions, so the coil rotates. After half a rotation the commutator reverses the current direction, so the forces continue to push the coil in the same direction, thus producing continuous rotation. Uses: fans, refrigerators, washing machines, mixers.

Q2. Differentiate between AC and DC. Explain the working of an AC generator. Draw/describe the domestic electric circuit.

Ans: **DC** flows in one direction only (batteries); **AC** reverses direction periodically (50 Hz in India – every 1/100 s). **AC generator:** a rotating rectangular coil in the field of a permanent magnet; its ends are connected to two **slip rings** in contact with carbon brushes. During the first half of rotation the current flows in one direction, in the second half it reverses, giving alternating current. **Domestic circuit:** electricity comes from the pole through two wires – live (red, 220 V) and neutral (black) – to the main fuse and the meter in the house. Appliances are connected in parallel; each has a switch. The metallic body of high-power appliances (geyser, refrigerator) is connected through the third pin to the green earth wire. Separate circuits are used for 5 A (lighting, fans) and 15 A (heater, AC) loads, each protected by a fuse.

Chapter 14

Sources of Energy

Important Points & Notes

1. **A good source of energy** would: do a large amount of work per unit mass/volume, be easily accessible, easy to store and transport, and be economical.
2. **Fossil fuels** (coal, petroleum, natural gas) are non-renewable, take millions of years to form and cause air pollution (CO_2, SO_2, NO_x) and global warming. **Thermal power plants** burn fossil fuels to produce steam which drives turbines; **hydro power plants** use the potential energy of stored water – renewable but dams displace people and submerge land.
3. **Bio-mass and biogas:** cow-dung, plant residue and sewage are decomposed anaerobically to produce **biogas** (mainly methane, 75%), a clean fuel; the slurry left behind is a good manure.
4. **Wind energy:** wind turbines (speed above 15 km/h) convert kinetic energy of wind into electricity; needs large open areas, high initial cost; wind-energy farms use many turbines.
5. **Solar energy:** the Sun gives ~1.4 kW/m^2 (solar constant). **Solar cooker** – plane mirror reflector, glass cover and black-painted box; **solar cell** – made from silicon; each produces about 0.5–1 V; many cells joined form a **solar panel**. Used in satellites, remote areas, calculators, traffic signals.
6. **Energy from the sea: tidal energy** (dams across narrow sea openings), **wave energy** (kinetic energy of waves), **OTEC** – ocean thermal energy from temperature difference (≥ 20 °C) between surface and deeper water. **Geothermal energy:** heat from molten rocks inside the earth to make steam (hot springs).

7. **Nuclear energy: fission** – heavy nucleus (uranium-235) splits into lighter nuclei releasing huge energy ($E = mc^2$); used in nuclear power plants (Tarapur, Kota, Kalpakkam). **Fusion** – hydrogen nuclei fuse to form helium (Sun's source of energy) at very high temperature. Problems: nuclear waste disposal, risk of accidents (Chernobyl, Fukushima).
8. **Environmental consequences:** burning of fuels causes pollution. **Renewable** (solar, wind, hydro, biogas, tidal) vs **non-renewable** (coal, petroleum, natural gas). Choice of energy source depends on cost, efficiency, environmental impact, and local availability.

Objective Questions (MCQ)

Q1. Which of the following is a non-renewable source of energy?

(a) Wind (b) Solar
(c) Coal (d) Biogas

Ans: (c) Coal

Q2. The major constituent of biogas is

(a) Ethane (b) Methane
(c) Propane (d) Hydrogen

Ans: (b) Methane

Q3. The energy of the Sun is produced by

(a) Nuclear fission (b) Nuclear fusion
(c) Chemical reaction (d) Combustion

Ans: (b) Nuclear fusion

Q4. Solar cells are made of

(a) Germanium (b) Silicon
(c) Copper (d) Aluminium

Ans: (b) Silicon

Q5. Tidal energy depends on the

(a) Wind
(b) Gravitational pull of the moon and sun
(c) Heat of Earth
(d) Sunlight

Ans: (b) Gravitational pull of the moon and sun

Q6. Which is an example of a fossil fuel?

(a) Wood
(b) Cow dung
(c) Petroleum
(d) Biogas

Ans: (c) Petroleum

Q7. The nuclear power plant in Tarapur is based on

(a) Fusion
(b) Fission
(c) Combustion
(d) Hydroelectricity

Ans: (b) Fission

Q8. Wind energy farms are located where the wind speed is at least

(a) 5 km/h
(b) 10 km/h
(c) 15 km/h
(d) 30 km/h

Ans: (c) 15 km/h

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. Name two renewable sources of energy.

Ans: Solar energy and wind energy (also hydro, biogas, tidal).

Q2. What is the full form of OTEC?

Ans: Ocean Thermal Energy Conversion.

Q3. Write the formula by which nuclear energy released can be calculated.

Ans: $E = mc^2$ (Einstein's mass–energy relation).

Q4. Why is biogas considered a good fuel?

Ans: It burns without smoke, has high heating capacity, leaves no residue, and the slurry is a good manure.

Short Answer Questions (2–3 marks)

Q1. What are the disadvantages of burning fossil fuels?

Ans: Burning fossil fuels produces CO_2 (global warming), SO_2 and NO_x (acid rain, respiratory problems) and soot. These fuels are limited and non-renewable, so they should be conserved.

Q2. Explain the working of a solar cooker.

Ans: A solar cooker has a box painted black inside (black absorbs heat) with a transparent glass lid. A plane mirror reflector directs sunlight into the box. The heat is trapped inside (glass prevents heat loss – like a greenhouse). Temperature rises to 100–140 °C and cooks food slowly.

Q3. Differentiate between nuclear fission and nuclear fusion.

Ans: **Fission:** a heavy nucleus (U-235) splits into two lighter nuclei with the release of energy and neutrons; occurs at ordinary temperature; used in nuclear reactors and bombs. **Fusion:** two light nuclei (hydrogen isotopes) combine to form a heavier nucleus (helium) releasing more energy; needs extremely high temperature (~10^7 K); source of the Sun's energy.

Long Answer Questions (5 marks)

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Q1. What is biogas? Describe how it is produced in a biogas plant and mention its advantages.

Ans: Biogas is a mixture of gases (methane about 75%, CO_2, H_2, H_2S) produced by anaerobic decomposition of cow-dung, agricultural waste and sewage. **Plant:** a mixing tank (dung + water slurry) → slurry is fed into a brick/concrete **digester** (sealed tank) where anaerobic bacteria break down complex compounds over a few days to produce gas → gas collects in the gas tank (dome) from which a pipe supplies it for cooking or lighting → spent slurry is taken out through an outlet and used as manure. **Advantages:** smokeless, high heating value, no residue, saves wood, preserves nitrogen-rich manure, helps in waste disposal and reduces pollution.

Q2. Discuss solar energy – its advantages, limitations and devices used to harness it. Why are solar cells costly?

Ans: Devices: solar cooker, solar water heater, solar cells/panels (convert sunlight directly into electricity), solar furnaces, solar street lights. **Advantages:** renewable, free, non-polluting, useful in remote areas, satellites and space probes; panels have no moving parts and need little maintenance. **Limitations:** available only in the daytime and sunny weather; needs large areas; the efficiency of solar cells is low (10–20%). **Cost:** the special grade silicon used is expensive and the process of making solar cells is costly; cells are connected with silver wiring, which further raises the cost.

Chapter 15

Our Environment

Important Points & Notes

1. **Ecosystem:** all interacting organisms (**biotic** – producers, consumers, decomposers) of an area together with the non-living (**abiotic**) components such as temperature, rainfall, soil, wind. Types: natural (forest, pond, lake) and artificial (garden, crop field, aquarium).
2. **Producers** (green plants, blue-green algae) make food by photosynthesis. **Consumers:** herbivores (primary), carnivores (secondary and tertiary), omnivores, parasites. **Decomposers** (bacteria, fungi) break down dead remains and recycle nutrients – they are the 'cleaning agents' of the environment.
3. **Food chain:** a sequence in which one organism eats another (Grass → Deer → Lion). Each step is a **trophic level**. **Food web:** a network of many interconnected food chains.
4. **Flow of energy:** one-way, from the Sun → producers → consumers. Only about **10%** of energy is passed to the next trophic level (**10% law**, Lindeman); the rest is lost as heat in respiration. Hence food chains are short (3–4 trophic levels); more energy is available at lower trophic levels – so eating plant-based food is more energy efficient.
5. **Biological magnification:** accumulation of harmful non-biodegradable chemicals (pesticides like DDT) at successive trophic levels – maximum concentration in the top consumers (humans). E.g. pesticides washed from farms enter water → plants → fish → birds/humans.

6. **Ozone (O_3) layer:** a protective layer in the stratosphere formed by UV breaking O_2 into atoms: $O_2 \rightarrow O + O$; $O + O_2 \rightarrow O_3$. It absorbs harmful UV radiation (skin cancer, cataract, genetic damage). **CFCs** (refrigerators, ACs, aerosols) deplete ozone; the **Montreal protocol** (UNEP, 1987) froze CFC production.
7. **Waste: biodegradable** (broken down by bacteria – vegetable peels, paper, cotton, wood) and **non-biodegradable** (plastics, DDT, glass, metals, polythene) which persist in the environment, harm soil fertility, clog drains and kill animals. Waste management: segregation, composting, recycling, reducing use of plastics.
8. **Human activities and the environment:** deforestation, overgrazing, pollution, and use of chemicals damage ecosystems. Bio-degradable waste can be converted to compost and biogas.

Objective Questions (MCQ)

Q1. In a food chain, the first trophic level is always occupied by

(a) Herbivores (b) Carnivores
(c) Producers (d) Decomposers

Ans: (c) Producers

Q2. According to the 10% law, the amount of energy passed to the next trophic level is

(a) 1% (b) 10%
(c) 50% (d) 90%

Ans: (b) 10%

Q3. Which of the following is a biodegradable waste?

(a) Plastic bag (b) Glass bottle
(c) Vegetable peels (d) DDT

Ans: (c) Vegetable peels

Q4. The ozone layer is present in the

(a) Troposphere (b) Stratosphere

(c) Mesosphere (d) Ionosphere

Ans: (b) Stratosphere

Q5. Chemicals responsible for depletion of ozone are

(a) CFCs (b) CO_2

(c) CH_4 (d) N_2

Ans: (a) CFCs

Q6. The highest concentration of pesticide in a food chain is found in

(a) Producers (b) Herbivores

(c) Top carnivores/humans (d) Decomposers

Ans: (c) Top carnivores/humans

Q7. Which of the following is an artificial ecosystem?

(a) Forest (b) Pond

(c) Aquarium (d) Lake

Ans: (c) Aquarium

Q8. Decomposers include

(a) Grass and trees (b) Bacteria and fungi

(c) Lions (d) Insects only

Ans: (b) Bacteria and fungi

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. What is a trophic level?

Ans: Each step of a food chain where energy is transferred, e.g. producers, herbivores, carnivores.

Q2. Why are decomposers called 'nature's cleaners'?

Ans: They break down dead plants/animals and waste into simple substances, recycling nutrients to the soil.

Q3. Name the compound that is responsible for ozone depletion.

Ans: Chlorofluorocarbons (CFCs).

Q4. What is biological magnification?

Ans: The increase in concentration of non-biodegradable harmful chemicals at successive trophic levels of a food chain.

Short Answer Questions (2–3 marks)

Q1. Why are food chains generally short (3–4 trophic levels)?

Ans: Only about 10% of energy is transferred to the next trophic level; the rest is lost as heat to the environment. After 3–4 levels, very little usable energy remains to support further levels.

Q2. What is the importance of the ozone layer? How is it being damaged?

Ans: The ozone layer shields the Earth from harmful ultraviolet radiation of the Sun, which can cause skin cancer, cataract and damage to crops and plankton. It is damaged by chlorofluorocarbons (CFCs) used in refrigerators, air conditioners, fire extinguishers and aerosol sprays. The 1987 UNEP agreement limited CFC production.

Q3. Differentiate between biodegradable and non-biodegradable substances with two examples each.

Ans: **Biodegradable** substances are broken down by microorganisms into harmless materials, e.g. fruit peels, paper, cotton cloth. **Non-biodegradable** substances cannot be broken down by natural processes and persist in the environment, e.g. plastics, DDT, glass.

Long Answer Questions (5 marks)

Q1. Explain the flow of energy in an ecosystem. State the 10 percent law with an example.

Ans: Energy flows in **one direction** in an ecosystem: Sun → producers → primary consumers → secondary consumers → tertiary consumers. Green plants capture about 1% of the solar energy by photosynthesis. When a herbivore eats plants, only about **10%** of the energy is available to it; the rest is used in life processes or lost as heat. This is the **10% law** (Lindeman). **Example:** if producers (grass) have 10,000 J of energy, herbivores (deer) get 1000 J, carnivores (lion) get 100 J and top carnivores get 10 J. Since energy is lost at each step, the number of trophic levels is limited and the energy cannot be recycled.

Q2. What is biological magnification? Why is the concentration of harmful chemicals maximum in human beings? Explain with a food chain.

Ans: Biological magnification is the progressive increase in the concentration of non-biodegradable chemicals (like pesticides, DDT, heavy metals) at each successive trophic level of a food chain. **Reason:** these chemicals are absorbed from the soil/water by plants along with nutrients and cannot be broken down or excreted; they get stored in body tissues and are transferred to the next consumer in a more concentrated form. Humans are at the top of many food chains and eat food from different trophic levels (cereals, vegetables, milk, fish, meat), so the highest concentrations accumulate in their bodies. **Example:** pesticide in water → algae → small fish → large fish → fish-eating birds/humans (concentration rises at each step). Wheat, vegetables, pulses and fruits in India contain different amounts of pesticide residues.

Chapter 16

Management of Natural Resources

Important Points & Notes

1. **Why manage resources?** Resources (forests, wildlife, water, coal, petroleum) are limited; careful use ensures that they last for the future and benefit all people equally, with minimal damage to the environment. **Sustainable development** meets present needs without harming future generations.
2. **Ganga Action Plan (1985):** started to reduce pollution in the river Ganga caused by sewage, industrial effluents and cremations. High **coliform bacteria** (found in human intestines) in the water indicates sewage contamination. Other pollutants: heavy metals, plastic.
3. **The 3 R's: Reduce** (use less – switch off unused lights, repair leaking taps), **Reuse** (use again – envelopes, bottles), **Recycle** (convert waste into new items – paper, plastic, glass, metals). Also **Refuse** and **Repurpose**.
4. **Forests and wildlife** are **biodiversity hot spots**. **Stakeholders:** local people, the government (Forest Department), industrialists, and wildlife and nature enthusiasts. Conflicts arise from over-exploitation (e.g. teak, timber, tendu leaves, bamboo).
5. **Community participation: Bishnoi community** of Rajasthan (Amrita Devi Bishnoi, 1731, protected Khejri trees – Amrita Devi Bishnoi Wildlife Protection Award); **Chipko Andolan** (Garhwal, 1970s) – hugging trees; **Arabari forest** (West Bengal) – the Forest Department involved villagers in protecting Sal forests, with benefits like fodder and fuel-wood.

6. **Water harvesting:** traditional systems – **khadin**, **bundhis** (Rajasthan), **johads**, **ahars** and **pynes** (Bihar), **kulhs** (Himachal Pradesh), **tanks** (Tamil Nadu), **ponds** and **tankas**. Benefits: recharge groundwater, no evaporation loss like surface water, no risk of submerging land or displacing people, water stored remains pure.
7. **Dams:** store water for irrigation, power generation and drinking water (Tehri, Sardar Sarovar). **Problems:** displacement of people (Narmada Bachao Andolan), loss of forests and wildlife, social/economic costs, unequal distribution of benefits. Smaller check dams are preferred by many.
8. **Coal and petroleum:** formed from remains of living organisms over millions of years – exhaustible. Use them judiciously: use public transport, carpool, switch off lights, use CFL/LED, solar energy, efficient stoves; burning releases CO_2, CO, SO_2 and NO_x causing global warming and acid rain.

Objective Questions (MCQ)

Q1. The Ganga Action Plan was launched in

(a) 1975 (b) 1985
(c) 1995 (d) 2005

Ans: (b) 1985

Q2. The 3 R's stand for

(a) Reduce, Reuse, Recycle (b) Reduce, Repair, Recycle
(c) Remove, Reuse, Recycle (d) Reduce, Reuse, Repair

Ans: (a) Reduce, Reuse, Recycle

Q3. The Chipko Andolan is associated with

(a) Water conservation (b) Protection of trees
(c) Wildlife protection (d) Soil erosion

Ans: (b) Protection of trees

Q4. Khadin and johads are traditional systems of

(a) Forest conservation
(b) Water harvesting
(c) Energy generation
(d) Waste management

Ans: (b) Water harvesting

Q5. Presence of which bacteria in water indicates sewage contamination?

(a) Coliform
(b) Rhizobium
(c) Lactobacillus
(d) Nostoc

Ans: (a) Coliform

Q6. The Amrita Devi Bishnoi Wildlife Protection Award is related to the

(a) Chipko movement
(b) Bishnoi community's protection of Khejri trees
(c) Ganga Action Plan
(d) Narmada Bachao Andolan

Ans: (b) Bishnoi community's protection of Khejri trees

Q7. Which of the following is a non-renewable resource?

(a) Forest
(b) Water
(c) Coal
(d) Wind

Ans: (c) Coal

Q8. Which of the following is NOT an advantage of water harvesting?

(a) Recharge of groundwater
(b) No evaporation loss
(c) Displacement of people
(d) Water remains pure

Ans: (c) Displacement of people

Subjective Questions

Very Short Answer Questions (1–2 marks)

Q1. What is meant by sustainable development?

Ans: Development that meets present needs without compromising the ability of future generations to meet their needs.

Q2. Name two products obtained from forests that are used by local people.

Ans: Fuel-wood and fodder (also bamboo, medicinal herbs, tendu leaves).

Q3. Name the traditional water-harvesting system of Bihar.

Ans: Ahars and pynes.

Q4. What is the aim of the Ganga Action Plan?

Ans: To reduce pollution in the river Ganga and improve its water quality.

Short Answer Questions (2–3 marks)

Q1. Why should we conserve forests and wildlife?

Ans: Forests are biodiversity hot spots that maintain ecological balance, prevent soil erosion, help in rainfall, absorb CO_2 and supply many products. Conserving them also preserves the genetic diversity of plants and animals needed for the stability of ecosystems and for future generations.

Q2. What are the advantages of water harvesting?

Ans: (i) Recharges groundwater and raises the water table; (ii) water stored underground does not evaporate; (iii) the stored water does not spread diseases or breeding of mosquitoes; (iv) it does not displace people or submerge land; (v) it gives a local, low-cost water supply, and prevents soil erosion and flooding.

Q3. State any four ways in which you can reduce the use of resources in your daily life.

Ans: (i) Switch off lights and fans when not needed; (ii) repair leaking taps and avoid wastage of water; (iii) use a bicycle or public transport instead of private vehicles; (iv) use cloth/jute bags instead of plastic; (v) recycle paper and reuse bottles/envelopes.

Long Answer Questions (5 marks)

Q1. Why is there a need for the management of natural resources? Describe the role of people's participation in the conservation of forests with examples.

Ans: **Need:** natural resources are limited and unequally distributed; their exploitation by growing population and industries leads to destruction; management ensures their long-term use for all, with minimal damage to the environment. **People's participation:** (1) **Bishnoi community (Rajasthan):** in 1731, Amrita Devi Bishnoi and 363 others sacrificed their lives protecting Khejri trees; the government has instituted the Amrita Devi Bishnoi Wildlife Protection Award. (2) **Chipko Andolan (Garhwal, 1970s):** villagers hugged trees to prevent contractors from felling them. (3) **Arabari (West Bengal):** the Forest Department involved villagers in protecting degraded Sal forest, allowing them grazing and fuelwood; the forest recovered and villagers' income increased. These show that when local people are partners, forests are better conserved.

Q2. Explain the traditional methods of water harvesting in India. What are the advantages and disadvantages of large dams?

Ans: **Water harvesting methods: Khadin, bundhis and tankas** (Rajasthan), **johads** (earthen check dams), **ahars and pynes** (Bihar – channels and embankments to collect rainwater for irrigation), **kulhs** (Himachal Pradesh), **tanks** (Tamil Nadu), **kattas** (Karnataka). **Advantages of large dams:** irrigation of crops through canals, generation of hydroelectricity, continuous water supply for cities and flood control. **Disadvantages:** (1) social problems – displacement of a large number of people with inadequate rehabilitation; (2) ecological problems – large-scale deforestation and loss of biodiversity; (3) economic problems – huge public money is spent while benefits do not reach everyone equally (e.g. Narmada Bachao Andolan against Sardar Sarovar Dam); (4) siltation and loss of fertility of downstream land.



Thank You & Best of Luck!

Revise every chapter, practise the questions again and again – success will follow. Share this guide with your friends.

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