# AIIMS B.Sc Nursing Chemistry

## Sample Paper – 5

**Duration: 36 Minutes** **Maximum Marks: 30**

### Instructions

- This paper contains **30 Multiple Choice Questions (single correct answer)**, modelled on the Chemistry section of the **AIIMS B.Sc Nursing** entrance.
- Each correct answer carries **+1 mark**. $\frac{1}{3}$ **mark is deducted** for every wrong answer, and an unattempted question gets **0 marks**.
- Only **one** option is correct. The paper covers physical, inorganic, and organic chemistry.
- Personal calculators, log tables, mobile phones, and other electronic gadgets are strictly prohibited.

**Q1.** In a water molecule ($H_2O$, molar mass $= 18$ g mol$^{-1}$), the mass percent of oxygen (atomic mass of O $= 16$) is closest to:

(A) $11.1\%$

(B) $88.9\%$

(C) $50.0\%$

(D) $66.7\%$

**Q2.** The number of molecules present in $2$ g of hydrogen gas ($H_2$, molar mass $= 2$ g mol$^{-1}$) is (Avogadro number $= 6.022 \times 10^{23}$):

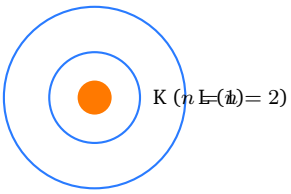
(A) $6.022 \times 10^{23}$

(B) $3.011 \times 10^{23}$

(C) $1.2 \times 10^{24}$

(D) $6.022 \times 10^{22}$

**Q3.** The shells of an atom are shown below. The maximum number of electrons that a completely filled L shell ($n = 2$) can hold, given by $2n^2$, is:




(A) 2

(B) 18

(C) 8

(D) 32

**Q4.** The number of valence electrons (electrons in the outermost shell) present in an atom of a group-16 element, such as oxygen or sulphur, is:

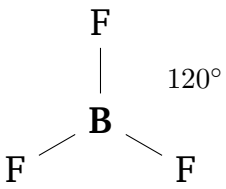
(A) 2

(B) 4

(C) 8

(D) 6

**Q5.** The structure of a boron trifluoride ($BF_3$) molecule, in which boron has no lone pair and is bonded to three fluorine atoms, is shown. The shape of the molecule is:




(A) trigonal planar

(B) trigonal pyramidal

(C) tetrahedral

(D) bent

**Q6.** In a boron trifluoride ($BF_3$) molecule, the boron atom forms three $\sigma$ bonds and has no lone pair. The hybridization of the boron atom is:

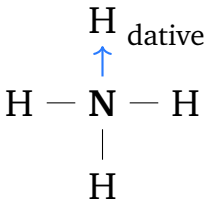
(A) $sp$

(B) $sp^2$

(C) $sp^3$

(D) $sp^3d$

**Q7.** A coordinate (dative) bond, in which both shared electrons come from the same atom, is present in the ammonium ion ($NH_4^+$) shown below. A coordinate bond is also present in which of the following ions?




(A) $Cl^-$

(B) $Na^+$

(C) $O^{2-}$

(D) $H_3O^+$

**Q8.** Among the period-3 elements sodium (Na), magnesium (Mg), aluminium (Al) and silicon (Si), the element with the largest atomic radius is:

(A) Na

(B) Mg

(C) Al

(D) Si

**Q9.** In the modern periodic table, the alkali metals (lithium, sodium, potassium, and so on) all belong to which group?

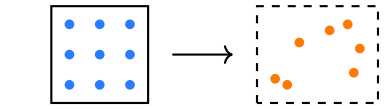
(A) Group 2

(B) Group 1

(C) Group 17

(D) Group 18

**Q10.** In the change shown below, an orderly solid is converted into a disorderly gas. The sign of the entropy change ($\Delta S$) for the formation of a gas from solids or liquids is:



solid (ordered) gas (disordered)

(A) zero

(B) cannot be decided

(C) positive

(D) negative

**Q11.** For a chemical reaction that has reached a state of equilibrium at constant temperature and pressure, the value of the Gibbs free energy change ($\Delta G$) is:

(A) always positive

(B) always negative

(C) infinite

(D) zero

**Q12.** For a reaction at equilibrium, $A + B \rightleftharpoons C + D$, what happens to the equilibrium when the concentration of reactant $A$ is increased (Le Chatelier's principle)?

(A) it shifts in the forward direction, towards the products

(B) it shifts in the backward direction, towards the reactants

(C) no shift takes place

(D) the value of the equilibrium constant increases

**Q13.** The hydrogen-ion concentration $[H^+]$ of an aqueous solution whose pH is $3$ (using $\text{pH} = -\log_{10}[H^+]$) is:

(A) $10^{-11}$ M

(B) $3$ M

(C) $10^{-3}$ M

(D) $10^{3}$ M

**Q14.** According to the Bronsted–Lowry theory, the conjugate acid of the hydroxide ion ($OH^-$) is:

(A) $O^{2-}$

(B) $H_2O$

(C) $H_3O^+$

(D) $OH^-$

**Q15.** The oxidation number of chlorine in hypochlorous acid (HClO), where H is $+1$ and O is $-2$, is:

(A) $+1$

(B) $-1$

(C) $+3$

(D) $+5$

**Q16.** In terms of electron transfer, oxidation is best defined as the:

(A) gain of electrons

(B) gain of hydrogen

(C) loss of electrons

(D) gain of oxygen by reduction

**Q17.** The number of moles of electrons required to deposit $1$ mole of aluminium from a solution containing $Al^{3+}$ ions ($Al^{3+} + 3e^- \rightarrow Al$) is:

(A) $1$

(B) $2$

(C) $6$

(D) $3$

**Q18.** When a stock solution is diluted by adding water (the number of moles of solute staying constant), the relation used to find the new concentration is:

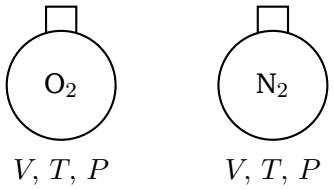
(A) $M_1V_2 = M_2V_1$

(B) $M_1V_1 = M_2V_2$

(C) $M_1M_2 = V_1V_2$

(D) $\dfrac{M_1}{V_1} = \dfrac{M_2}{V_2}$

**Q19.** Two identical flasks at the same temperature and pressure are shown, one holding oxygen and the other holding nitrogen. According to Avogadro's law, the two flasks contain:




(A) an equal number of molecules

(B) an equal mass of gas

(C) different numbers of molecules

(D) an equal number of atoms only

**Q20.** The oxidation state of platinum in the complex ion $[PtCl_4]^{2-}$ (each chloride ligand carries a charge of $-1$) is:

(A) $+4$

(B) $0$

(C) $+2$

(D) $-2$

**Q21.** The complex ion $[Ag(NH_3)_2]^+$ has the arrangement of ligands (L) around the central silver atom shown below. The coordination number of silver in this complex is:

L — **Ag** — L
linear

(A) $4$

(B) $6$

(C) $3$

(D) $2$

**Q22.** Which one of the following elements is an alkaline earth metal (a member of group 2)?

(A) Sodium

(B) Calcium

(C) Aluminium

(D) Potassium

**Q23.** Ethanol ($CH_3CH_2OH$) and dimethyl ether ($CH_3OCH_3$) both have the molecular formula $C_2H_6O$ but different structures. They are best described as:

(A) functional isomers

(B) geometrical isomers

(C) the same compound

(D) homologues

**Q24.** The IUPAC name of the compound propanone, $CH_3COCH_3$ (the simplest ketone), is:

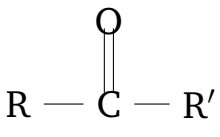
(A) propanal

(B) propan-1-ol

(C) propan-2-one

(D) propanoic acid

**Q25.** The structure of a ketone is shown below, with the central carbon double-bonded to oxygen and single-bonded to two carbon atoms. The functional group characteristic of ketones is the:



(>C=O group)

(A) hydroxyl, $-OH$

(B) carboxyl, $-COOH$

(C) amino, $-NH_2$

(D) carbonyl, $>C{=}O$

**Q26.** Which one of the following compounds is aromatic (a planar, cyclic, conjugated ring obeying the $(4n + 2)$ rule)?

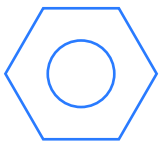
(A) ethane ($C_2H_6$)

(B) benzene ($C_6H_6$)

(C) cyclohexane ($C_6H_{12}$)

(D) propene ($C_3H_6$)

**Q27.** In the benzene ring shown below, with delocalised $\pi$ electrons represented by the inner circle, the hybridization of each carbon atom is:



(A) $sp^3$

(B) $sp$

(C) $sp^2$

(D) $sp^3d$

**Q28.** The functional group that characterises the class of organic compounds called amines is the:

(A) amino group, $-NH_2$

(B) hydroxyl group, $-OH$

(C) carbonyl group, $>C=O$

(D) carboxyl group, $-COOH$

**Q29.** Glucose ($C_6H_{12}O_6$), the simple sugar that cannot be hydrolysed into smaller carbohydrate units, is classified as a:

(A) disaccharide

(B) polysaccharide

(C) protein

(D) monosaccharide

**Q30.** Common soap is the sodium or potassium salt of a:

(A) strong mineral acid

(B) simple sugar

(C) long-chain fatty acid

(D) amino acid

## Detailed Solutions

**Q1.**

### Solution

**Concept — Mass percent of an element:** The mass percent of an element in a compound tells what fraction of the compound's total mass is contributed by that element. It is found from the formula

$$\text{mass \% of element} = \frac{\text{(mass of that element in one mole)}}{\text{(molar mass of the compound)}} \times 100.$$

For water, $H_2O$, the molar mass is $2 \times (1) + 16 = 18$ g mol$^{-1}$, of which the single oxygen atom contributes $16$ g.

**Given:** molar mass of $H_2O = 18$ g mol$^{-1}$; mass of oxygen in one mole $= 16$ g.

**Step 1 — Write the formula:** $\text{mass \% O} = \dfrac{\text{mass of O}}{\text{molar mass of } H_2O} \times 100.$

**Step 2 — Substitute the data with units:** $= \dfrac{16\ \text{g}}{18\ \text{g}} \times 100.$

**Step 3 — Evaluate:** $= 0.889 \times 100 = 88.9\%$ (the two hydrogens make up the remaining $11.1\%$).

**Why each other option is wrong:**

- (A) $11.1\%$ is the mass percent of *hydrogen* $(2/18)$, not oxygen.
- (C) $50.0\%$ would only hold if oxygen and hydrogen had equal masses, which they do not.
- (D) $66.7\%$ is the *atom* fraction of hydrogen (2 of 3 atoms), not a mass percent.

**Key point:** Mass percent uses *masses*, not atom counts. In water, oxygen dominates the mass ($16$ out of $18$), so it is about $88.9\%$ oxygen by mass even though there are twice as many hydrogen atoms.

**Final Answer:** $88.9\% \Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q1

## Q2.

### Solution

**Concept — Moles, mass, and Avogadro's number:** To count molecules in a sample, first find the number of moles using $n = \dfrac{\text{mass}}{\text{molar mass}}$, then multiply by Avogadro's number $N_A = 6.022 \times 10^{23}$, since one mole contains $N_A$ molecules. Hydrogen gas exists as diatomic $H_2$, whose molar mass is $2$ g mol$^{-1}$.

**Given:** mass $= 2$ g; molar mass $M(H_2) = 2$ g mol$^{-1}$; $N_A = 6.022 \times 10^{23}$.

**Step 1 — Find the moles:** $n = \dfrac{m}{M} = \dfrac{2 \text{ g}}{2 \text{ g mol}^{-1}} = 1$ mol.

**Step 2 — Convert moles to molecules:** number of molecules $= n \times N_A = 1 \times 6.022 \times 10^{23}$.

**Step 3 — Evaluate:** $= 6.022 \times 10^{23}$ molecules.

**Why each other option is wrong:**

- (B) $3.011 \times 10^{23}$ corresponds to $0.5$ mol, i.e. $1$ g of $H_2$.
- (C) $1.2 \times 10^{24}$ corresponds to $2$ mol, i.e. $4$ g of $H_2$.
- (D) $6.022 \times 10^{22}$ corresponds to $0.1$ mol, i.e. $0.2$ g.

**Key point:** Because $H_2$ has a molar mass of just $2$ g mol$^{-1}$, a $2$ g sample is exactly one mole. If asked for *atoms*, multiply once more by $2$ to get $1.2 \times 10^{24}$ atoms.

**Final Answer:** $6.022 \times 10^{23}$ molecules $\Rightarrow$ A

**Answer: (A)** Go Back to Q2

## Q3.

### Solution

**Concept — Capacity of a shell ($2n^2$):** Electrons occupy shells labelled by the principal quantum number $n$ (K for $n = 1$, L for $n = 2$, M for $n = 3$). The maximum number of electrons a shell can hold is $2n^2$, which comes from $n^2$ orbitals in the shell multiplied by two electrons per orbital (Pauli's exclusion principle).

**Step 1 — Identify $n$:** the L shell is the second shell, so $n = 2$.

**Step 2 — Apply $2n^2$:** $2 \times (2)^2 = 2 \times 4$.

**Step 3 — Evaluate:** $= 8$ electrons. (The L shell holds $2s^2\,2p^6 = 8$ electrons when full.)

**Why each other option is wrong:**

- (A) $2$ is the capacity of the K shell ($n = 1$): $2 \times 1^2 = 2$.
- (B) $18$ is the M shell ($n = 3$): $2 \times 3^2 = 18$.
- (D) $32$ is the N shell ($n = 4$): $2 \times 4^2 = 32$.

**Key point:** The shell capacities run K= 2, L= 8, M= 18, N= 32. The L shell's $8$ electrons are why the octet rule works so well for period-2 elements.

**Final Answer:** $8$ electrons $\Rightarrow$ C

**Answer: (C)** Go Back to Q3

## Q4.

### Solution

**Concept — Valence electrons and group number:** The valence electrons are the electrons in the outermost shell, and they decide an element's chemical behaviour. For the main-group (s- and p-block) elements, the number of valence electrons equals the group number's units digit: groups 13–18 have $3, 4, 5, 6, 7, 8$ valence electrons respectively. Group 16 (the oxygen family, or chalcogens) therefore has $6$ valence electrons, configuration $ns^2\, np^4$.

**Step 1 — Identify the group:** group 16 contains O, S, Se, and so on.

**Step 2 — Write the outer configuration:** $ns^2\, np^4$, which has $2 + 4 = 6$ electrons in the outer shell.

**Step 3 — Conclusion:** a group-16 atom has $6$ valence electrons, so it needs $2$ more to complete its octet (hence the typical $-2$ ions like $O^{2-}$).

**Why each other option is wrong:**

- (A) $2$ valence electrons is characteristic of group 2 (alkaline earth metals).
- (B) $4$ valence electrons is characteristic of group 14 (the carbon family).
- (C) $8$ valence electrons describes a completed octet (the noble gases of group 18).

**Key point:** For main-group elements, valence electrons $=$ group number $-10$ (for groups 13–18). Group 16 $\rightarrow$ $6$ valence electrons, which is why these elements commonly form a $-2$ oxidation state.

**Final Answer:** $6$ valence electrons $\Rightarrow$ D

**Answer: (D)** Go Back to Q4

## Q5.

**Solution**

**Concept — VSEPR shape of $BF_3$:** VSEPR theory predicts shape from the number of electron domains (bonding pairs plus lone pairs) around the central atom. Boron has only $3$ valence electrons; in $BF_3$ all three form B–F bonds, leaving *no* lone pair. With three bonding domains and no lone pair, the three bonds spread out as far apart as possible.

**Step 1 — Count electron domains:** three B–F bonds, zero lone pairs $= 3$ domains.

**Step 2 — Electron geometry:** three domains arrange themselves at $120^\circ$ in a single plane.

**Step 3 — Molecular shape:** since there is no lone pair to distort the picture, the shape is trigonal planar, with all four atoms in one plane and F–B–F angles of $120^\circ$.

**Why each other option is wrong:**

- (B) Trigonal pyramidal needs four domains with one lone pair, as in $NH_3$.
- (C) Tetrahedral needs four bonding domains, as in $CH_4$.
- (D) Bent needs two bonds and one or two lone pairs, as in $H_2O$.

**Key point:** $BF_3$ is the textbook example of an electron-deficient, lone-pair-free central atom giving a symmetric trigonal planar shape. This symmetry also makes $BF_3$ non-polar despite its polar B–F bonds.

**Final Answer:** Trigonal planar $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q5

## Q6.

**Solution**

**Concept — Hybridisation from electron domains:** The hybridisation of a central atom equals its number of $\sigma$ bonds plus lone pairs (its electron domains): $2 \to sp$, $3 \to sp^2$, $4 \to sp^3$. In $BF_3$, boron forms three $\sigma$ bonds to fluorine and has no lone pair.

**Step 1 — Count the domains on boron:** three B–F $\sigma$ bonds $+$ zero lone pairs $= 3$ electron domains.

**Step 2 — Assign the hybridisation:** three domains $\Rightarrow$ $sp^2$. One $2s$ and two $2p$ orbitals of boron mix to give three equivalent $sp^2$ hybrid orbitals.

**Step 3 — Geometry check:** the three $sp^2$ orbitals point to the corners of an equilateral triangle at $120°$, matching the trigonal planar shape of $BF_3$.

**Why each other option is wrong:**

- (A) $sp$ (two domains) would give a linear molecule, as in $BeCl_2$.
- (C) $sp^3$ (four domains) would give a tetrahedral arrangement, as in $CH_4$.
- (D) $sp^3d$ (five domains) requires $d$-orbitals and applies to species such as $PCl_5$, not to boron.

**Key point:** Shape and hybridisation go together: three domains with no lone pair $\Rightarrow$ $sp^2$ $\Rightarrow$ trigonal planar. $BF_3$ is the standard $sp^2$ example among inorganic molecules.

**Final Answer:** $sp^2 \Rightarrow$ B

**Answer: (B)** Go Back to Q6

## Q7.

### Solution

**Concept — Coordinate (dative) bond:** A coordinate or dative bond is a covalent bond in which *both* shared electrons are supplied by the *same* atom (the donor), rather than one from each atom. It forms when an atom with a lone pair donates that pair to an atom or ion that is short of electrons. In $NH_4^+$, nitrogen's lone pair is donated to an $H^+$, making the fourth N–H bond a coordinate bond.

**Step 1 — Look for a lone-pair donor and an electron-poor acceptor in each option:** a coordinate bond needs both.

**Step 2 — Examine $H_3O^+$ (hydronium):** it forms when a water molecule donates one of oxygen's lone pairs to an $H^+$ ($H_2O + H^+ \rightarrow H_3O^+$). That third O–H bond is a coordinate bond, exactly parallel to $NH_4^+$.

**Step 3 — Conclusion:** of the choices, only $H_3O^+$ contains a coordinate bond.

**Why each other option is wrong:**

- (A) $Cl^-$ is a single monatomic ion; it has no bonds at all, coordinate or otherwise.
- (B) $Na^+$ is a bare cation with no bonds.
- (C) $O^{2-}$ is a monatomic anion with no internal bonds.

**Key point:** A coordinate bond requires a molecule or polyatomic ion in which

one atom donates a lone pair. $NH_4^+$ and $H_3O^+$ are the two classic examples; once formed, all the bonds become identical.

**Final Answer:** $H_3O^+ \Rightarrow$ D

**Answer: (D)** Go Back to Q7

## Q8.

### Solution

**Concept — Atomic radius across a period:** Across a period (left to right) electrons are added to the same outermost shell while the nuclear charge rises by one with each element. The stronger nuclear pull draws the outer shell inward, so the atomic radius *decreases* from left to right. The leftmost element of a period is therefore the largest.

**Given:** the period-3 elements Na ($Z = 11$), Mg ($Z = 12$), Al ($Z = 13$), Si ($Z = 14$).

**Step 1 — Order by position:** all four are in the same period, arranged Na $\rightarrow$ Mg $\rightarrow$ Al $\rightarrow$ Si from left to right.

**Step 2 — Apply the trend:** radius decreases left to right, so Na (the leftmost, lowest nuclear charge in this set) is the largest and Si (the rightmost) is the smallest.

**Step 3 — Conclusion:** sodium has the largest atomic radius.

**Why each other option is wrong:**

- (B) Mg lies to the right of Na, so it is smaller than Na.
- (C) Al is further right still, hence smaller.
- (D) Si is the rightmost of the four and so has the smallest radius.

**Key point:** Within a period, the atom on the *left* is the biggest because it has the least nuclear charge pulling on the same outer shell. (Down a group the opposite happens: radius grows as new shells are added.)

**Final Answer:** Na $\Rightarrow$ A

**Answer: (A)** Go Back to Q8

## Q9.

**Solution**

**Concept — Groups of the periodic table:** A group is a vertical column of the periodic table; elements in the same group share the same number of valence electrons and similar chemistry. The alkali metals (Li, Na, K, Rb, Cs, Fr) all have a single valence electron, configuration $ns^1$, and form $+1$ ions.

**Step 1 — Identify the defining feature:** alkali metals have one electron in their outermost $s$ subshell ($ns^1$).

**Step 2 — Match to the group number:** one valence electron corresponds to group 1, the first column of the table.

**Step 3 — Conclusion:** the alkali metals belong to group 1.

**Why each other option is wrong:**

- (A) Group 2 is the alkaline earth metals (Be, Mg, Ca...), which have two valence electrons.
- (C) Group 17 is the halogens (F, Cl, Br...).
- (D) Group 18 is the noble gases (He, Ne, Ar...).

**Key point:** Group 1 = alkali metals ($ns^1$, very reactive, form $+1$ ions); they are the most reactive metals because that lone outer electron is lost easily. Note hydrogen sits at the top of group 1 but is a non-metal.

**Final Answer:** Group 1 $\Rightarrow$ B

**Answer: (B)** Go Back to Q9

## Q10.

**Solution**

**Concept — Entropy and disorder:** Entropy ($S$) is a measure of the disorder or randomness of a system. The entropy change is $\Delta S = S_{\text{final}} - S_{\text{initial}}$. Gases are far more disordered than liquids, which are more disordered than solids ($S_{\text{gas}} \gg S_{\text{liquid}} > S_{\text{solid}}$), because gas molecules move freely and occupy a much larger volume.

**Step 1 — Compare initial and final disorder:** the process turns ordered solids or liquids into a freely moving gas, so the system becomes much more disordered.

**Step 2 — Apply the definition:** since $S_{\text{final}}$ (gas) $>$ $S_{\text{initial}}$ (solid/liquid), $\Delta S =$ (larger) $-$ (smaller) $> 0$.

**Step 3 — Conclusion:** producing a gas from solids or liquids gives a *positive* entropy change.

**Why each other option is wrong:**

- (A) Zero $\Delta S$ would mean no change in disorder, but forming a gas clearly increases disorder.
- (B) "Cannot be decided" is wrong; the increase in randomness on forming a gas is unambiguous.
- (D) A negative $\Delta S$ would mean the system became *more* ordered, the opposite of what happens here.

**Key point:** Whenever the number of moles of gas increases (or a gas is formed from condensed phases), $\Delta S$ is positive. Reactions that produce gas are entropy-favoured.

**Final Answer:** Positive $\Rightarrow$ C

**Answer: (C)** Go Back to Q10

## Q11.

### Solution

**Concept — Gibbs free energy and equilibrium:** The Gibbs free energy change $\Delta G$ measures the spontaneity of a process at constant temperature and pressure. A negative $\Delta G$ drives the reaction forward, a positive $\Delta G$ drives it backward, and when the system reaches equilibrium there is no net drive in either direction, so $\Delta G = 0$.

**Step 1 — State the criterion:** $\Delta G < 0$ means spontaneous forward; $\Delta G > 0$ means non-spontaneous; $\Delta G = 0$ means the system is balanced.

**Step 2 — Apply it at equilibrium:** at equilibrium the forward and reverse rates are equal and the free energy is at its minimum, so there is no further change.

**Step 3 — Conclusion:** at equilibrium, $\Delta G = 0$ (and correspondingly $\Delta G^\circ = -RT \ln K$ relates the standard value to the equilibrium constant).

**Why each other option is wrong:**

- (A) A positive $\Delta G$ describes a non-spontaneous reaction, not one already at equilibrium.
- (B) A negative $\Delta G$ describes a reaction still moving forward spontaneously, not yet at equilibrium.

- (C) $\Delta G$ is a finite thermodynamic quantity; it is never infinite.

**Key point:** At equilibrium $\Delta G = 0$: the system sits at the bottom of its free-energy curve, with no net tendency to move either way. Do not confuse $\Delta G$ (which is $0$ at equilibrium) with $\Delta G^\circ$ (the standard value, which is generally non-zero).

**Final Answer:** Zero $\Rightarrow$ D

**Answer: (D)** Go Back to Q11

## Q12.

### Solution

**Concept — Le Chatelier's principle (concentration):** If a system at equilibrium is disturbed, it shifts so as to partly oppose the disturbance. Increasing the concentration of a reactant means the system tries to use up the added reactant, so it shifts in the forward direction to convert more reactant into product.

**Step 1 — Identify the disturbance:** the concentration of reactant $A$ is increased in $A + B \rightleftharpoons C + D$.

**Step 2 — Apply the principle:** to oppose the increase in $A$, the equilibrium consumes the extra $A$ by moving forward, producing more $C$ and $D$.

**Step 3 — Conclusion:** the equilibrium shifts in the forward direction, towards the products.

**Why each other option is wrong:**

- (B) A backward shift would be caused by *adding product* or *removing reactant*, not by adding reactant.
- (C) "No shift" is wrong; adding a reactant always disturbs the balance of concentrations.
- (D) The equilibrium constant $K$ depends only on temperature; changing a concentration shifts the position of equilibrium but does *not* change $K$.

**Key point:** Add a reactant $\rightarrow$ forward shift; add a product $\rightarrow$ backward shift. The constant $K$ itself changes only with temperature, never with concentration.

**Final Answer:** Forward, towards the products $\Rightarrow$ A

**Answer: (A)** Go Back to Q12

## Q13.

**Solution**

**Concept — pH and hydrogen-ion concentration:** pH is defined as $\text{pH} = -\log_{10}[\text{H}^+]$. Rearranging gives $[\text{H}^+] = 10^{-\text{pH}}$. So the hydrogen-ion concentration is found by raising $10$ to the power of the negative of the pH value.

**Given:** $\text{pH} = 3$.

**Step 1 — Rearrange the formula:** $[\text{H}^+] = 10^{-\text{pH}}$.

**Step 2 — Substitute:** $[\text{H}^+] = 10^{-3}$ M.

**Step 3 — Interpret:** $10^{-3}$ M $= 0.001$ M, an acidic solution (pH below 7).

**Why each other option is wrong:**

- (A) $10^{-11}$ M is the *hydroxide* concentration $[\text{OH}^-]$ here (since $[\text{H}^+][\text{OH}^-] = 10^{-14}$), not $[\text{H}^+]$.
- (B) $3$ M confuses the pH *number* with a concentration.
- (D) $10^{3}$ M has the sign of the exponent wrong; concentration cannot be that large here.

**Key point:** $[\text{H}^+] = 10^{-\text{pH}}$. A pH of $3$ means $[\text{H}^+] = 10^{-3}$ M. Each unit drop in pH multiplies $[\text{H}^+]$ by ten.

**Final Answer:** $10^{-3}$ M $\Rightarrow$ $\boxed{\text{C}}$

**Answer: (C)** Go Back to Q13

## Q14.

**Solution**

**Concept — Conjugate acid–base pairs:** In the Bronsted–Lowry theory, an acid donates a proton ($\text{H}^+$) and a base accepts one. When a base *gains* a proton, the species formed is its *conjugate acid*. So the conjugate acid of the hydroxide ion is found by adding one $\text{H}^+$ to $\text{OH}^-$.

**Step 1 — Add one proton to $\text{OH}^-$:** $\text{OH}^- + \text{H}^+ \rightarrow \text{H}_2\text{O}$.

**Step 2 — Identify the product:** the species formed is water, $\text{H}_2\text{O}$.

**Step 3 — Conclusion:** $\text{H}_2\text{O}$ is the conjugate acid of $\text{OH}^-$.

**Why each other option is wrong:**

- (A) $\text{O}^{2-}$ is the conjugate *base* of $\text{OH}^-$ (formed by *removing* a proton), not its

conjugate acid.

- (C) $H_3O^+$ would require adding *two* protons to $OH^-$, which is not a single conjugate-acid step.
- (D) $OH^-$ is the original species itself, not its conjugate acid.

**Key point:** Conjugate acid = original species + $H^+$; conjugate base = original − $H^+$. Hydroxide and water form a conjugate pair ($OH^-$ base, $H_2O$ acid).

**Final Answer:** $H_2O \Rightarrow$ B

**Answer: (B)** Go Back to Q14

## Q15.

### Solution

**Concept — Oxidation number rules:** In a neutral compound the oxidation numbers of all atoms add up to zero. Hydrogen bonded to a non-metal is $+1$ and oxygen is normally $-2$. The unknown oxidation number is then found algebraically.

**Given:** HClO (hypochlorous acid), a neutral molecule; H $= +1$, O $= -2$.

**Step 1 — Assign known values and let Cl be $x$:** $(+1) + x + (-2) = 0$.

**Step 2 — Simplify:** $1 + x - 2 = 0 \Rightarrow x - 1 = 0$.

**Step 3 — Solve:** $x = +1$, so chlorine is in the $+1$ oxidation state.

**Why each other option is wrong:**

- (B) $-1$ is the oxidation number of chlorine in chlorides such as HCl or NaCl, not in HClO.
- (C) $+3$ is chlorine in chlorous acid, $HClO_2$.
- (D) $+5$ is chlorine in chloric acid, $HClO_3$.

**Key point:** As the number of oxygens rises across HClO, $HClO_2$, $HClO_3$, $HClO_4$, the oxidation state of chlorine climbs $+1, +3, +5, +7$. Always set the sum of oxidation numbers to zero for a neutral molecule.

**Final Answer:** Oxidation number of Cl $= +1 \Rightarrow$ A

**Answer: (A)** Go Back to Q15

## Q16.

**Solution**

**Concept — Oxidation in terms of electrons:** The modern, electronic definition of redox states that oxidation is the *loss* of electrons and reduction is the *gain* of electrons. A handy memory aid is OIL RIG: "Oxidation Is Loss, Reduction Is Gain" (of electrons). When a species loses electrons, its oxidation number increases.

**Step 1 — Recall the definition:** oxidation $=$ loss of electrons.

**Step 2 — Confirm with an example:** in $\mathrm{Na} \rightarrow \mathrm{Na}^{+} + e^{-}$, sodium loses one electron and is therefore oxidised; its oxidation number rises from $0$ to $+1$.

**Step 3 — Conclusion:** oxidation is defined as the loss of electrons.

**Why each other option is wrong:**

- (A) Gain of electrons is the definition of *reduction*, the opposite of oxidation.
- (B) Gain of hydrogen is an older definition of *reduction* (loss of hydrogen is oxidation), not oxidation.
- (D) "Gain of oxygen by reduction" is self-contradictory; gain of oxygen is oxidation, and it is not reduction.

**Key point:** Use OIL RIG. Oxidation $=$ loss of electrons $=$ increase in oxidation number. The species that is oxidised acts as the reducing agent.

**Final Answer:** Loss of electrons $\Rightarrow$ $\boxed{\text{C}}$

**Answer: (C)** Go Back to Q16

## Q17.

**Solution**

**Concept — Electrons per ion in electrolysis:** To deposit a metal from its ion, each ion must gain a number of electrons equal to the magnitude of its charge. For $\mathrm{M}^{n+} + ne^{-} \rightarrow \mathrm{M}$, depositing one mole of metal needs $n$ moles of electrons. Aluminium ions carry a $+3$ charge.

**Given:** the half-reaction $\mathrm{Al}^{3+} + 3e^{-} \rightarrow \mathrm{Al}$.

**Step 1 — Read the charge on the ion:** $\mathrm{Al}^{3+}$ needs $3$ electrons to become a neutral Al atom.

**Step 2 — Scale up to one mole:** depositing $1$ mole of Al atoms therefore needs $3$ moles of electrons.

**Step 3 — Conclusion:** 3 moles of electrons are required (equivalent to $3 \times 96500 = 289500$ C of charge).

**Why each other option is wrong:**

- (A) 1 mole of electrons would only deposit a $+1$ metal such as Ag or Na, not $Al^{3+}$.
- (B) 2 moles of electrons would deposit a $+2$ metal such as $Cu^{2+}$ or $Zn^{2+}$.
- (C) 6 moles of electrons would deposit *two* moles of aluminium, not one.

**Key point:** Moles of electrons = (moles of metal) $\times$ (charge on the ion). For $Al^{3+}$ this is $1 \times 3 = 3$ moles of electrons per mole of aluminium.

**Final Answer:** 3 moles of electrons $\Rightarrow$ D

**Answer: (D)** Go Back to Q17

## Q18.

### Solution

**Concept — The dilution formula:** Diluting a solution means adding solvent (water) without changing the amount of solute. Since moles of solute = molarity $\times$ volume ($n = M \times V$), and this amount stays constant during dilution, the moles before equal the moles after: $M_1V_1 = M_2V_2$, where subscript 1 is the concentrated stock and subscript 2 is the diluted solution.

**Step 1 — State the conserved quantity:** the number of moles of solute is unchanged on dilution.

**Step 2 — Express moles before and after:** moles before $= M_1V_1$; moles after $= M_2V_2$.

**Step 3 — Set them equal:** $M_1V_1 = M_2V_2$. This is the dilution relation.

**Why each other option is wrong:**

- (A) $M_1V_2 = M_2V_1$ pairs the wrong molarity with the wrong volume and does not conserve moles.
- (C) $M_1M_2 = V_1V_2$ multiplies the two molarities together, which has no physical meaning here.
- (D) $\frac{M_1}{V_1} = \frac{M_2}{V_2}$ implies molarity is proportional to volume, the opposite of dilution behaviour.

**Key point:** $M_1V_1 = M_2V_2$ works because moles of solute are conserved. As volume

goes up on dilution, molarity goes down in the same proportion.

**Final Answer:** $M_1V_1 = M_2V_2 \Rightarrow$ B

**Answer: (B)** Go Back to Q18

## Q19.

### Solution

**Concept — Avogadro's law:** Avogadro's law states that equal volumes of all gases, measured at the same temperature and pressure, contain equal numbers of molecules. Equivalently, at fixed $T$ and $P$ the volume of a gas is directly proportional to its number of moles ($V \propto n$), independent of the identity of the gas.

**Given:** two flasks of equal volume $V$, at the same $T$ and $P$, one of $O_2$ and one of $N_2$.

**Step 1 — Apply the law:** since $V$, $T$, and $P$ are identical for both flasks, they must contain the same number of moles, and hence the same number of molecules.

**Step 2 — Note the mass difference:** the *number* of molecules is equal, but the masses differ because $O_2$ ($32$ g mol$^{-1}$) is heavier than $N_2$ ($28$ g mol$^{-1}$).

**Step 3 — Conclusion:** the two flasks contain an equal number of molecules.

**Why each other option is wrong:**

- (B) Equal mass is wrong; equal numbers of *different* molecules have different masses ($O_2$ heavier than $N_2$).
- (C) "Different numbers of molecules" directly contradicts Avogadro's law.
- (D) Although each diatomic molecule has $2$ atoms (so atom counts also match here), the law is stated in terms of *molecules*; option (A) is the correct general statement.

**Key point:** Same $V$, $T$, $P \Rightarrow$ same number of molecules, whatever the gas. This is why one mole of any gas occupies the same molar volume ($22.4$ L at STP).

**Final Answer:** Equal number of molecules $\Rightarrow$ A

**Answer: (A)** Go Back to Q19

## Q20.

### Solution

**Concept — Oxidation state in a complex ion:** In a coordination complex, the sum of the central metal's oxidation state and the charges of all the ligands equals the overall charge on the complex ion. Solving for the metal's oxidation state: (metal) + (sum of ligand charges) = (charge of complex).

**Given:** the complex ion $[PtCl_4]^{2-}$; each $Cl^-$ ligand has charge $-1$; overall charge $= -2$.

**Step 1 — Let the oxidation state of Pt be $x$ and total the ligand charges:** four chlorides give $4 \times (-1) = -4$.

**Step 2 — Set up the charge balance:** $x + (-4) = -2$.

**Step 3 — Solve:** $x = -2 + 4 = +2$. Platinum is in the $+2$ oxidation state.

**Why each other option is wrong:**

- (A) $+4$ would be platinum in $[PtCl_6]^{2-}$ (six chlorides, overall $-2$), not the tetrachloro ion.
- (B) $0$ ignores the overall $-2$ charge of the ion.
- (D) $-2$ would require the ligand charges to sum to zero, but four chlorides give $-4$.

**Key point:** Always balance: (oxidation state of metal) + (total ligand charge) = (charge of the complex). For $[PtCl_4]^{2-}$ this gives Pt $= +2$.

**Final Answer:** Oxidation state of Pt $= +2 \Rightarrow$ C

**Answer: (C)** Go Back to Q20

## Q21.

### Solution

**Concept — Coordination number:** The coordination number of the central metal in a complex is the number of ligand donor atoms directly bonded (coordinated) to it. It is simply a count of the metal–ligand bonds, regardless of the charges involved.

**Given:** the complex ion $[Ag(NH_3)_2]^+$, in which silver is bonded to two ammonia ligands.

**Step 1 — Count the ligands bonded to silver:** there are two $NH_3$ molecules,

each donating one lone pair to Ag through its nitrogen atom.

**Step 2 — Identify the geometry:** two monodentate ligands give a coordination number of 2, and such complexes are linear (L–Ag–L at $180^\circ$).

**Step 3 — Conclusion:** the coordination number of silver is 2.

**Why each other option is wrong:**

- (A) 4 is the coordination number of a tetrahedral or square-planar complex, such as $[Ni(CN)_4]^{2-}$.
- (B) 6 is the coordination number of an octahedral complex, such as $[Co(NH_3)_6]^{3+}$.
- (C) 3 does not match; there are clearly two ammonia ligands, not three.

**Key point:** Coordination number = number of donor atoms attached to the metal. Two monodentate ligands $\Rightarrow$ coordination number 2 $\Rightarrow$ linear geometry, as in $[Ag(NH_3)_2]^+$.

**Final Answer:** Coordination number $= 2 \Rightarrow \boxed{D}$

**Answer: (D)** Go Back to Q21

## Q22.

### Solution

**Concept — Alkaline earth metals:** The alkaline earth metals are the elements of group 2: beryllium, magnesium, calcium, strontium, barium and radium. Each has two valence electrons ($ns^2$) and typically forms a $+2$ ion. They are reactive metals, though less so than the group-1 alkali metals.

**Step 1 — Recall the members of group 2:** Be, Mg, **Ca**, Sr, Ba, Ra.

**Step 2 — Test each option:** calcium (Ca) is in group 2; sodium and potassium are in group 1 (alkali metals); aluminium is in group 13.

**Step 3 — Conclusion:** calcium is the alkaline earth metal in the list.

**Why each other option is wrong:**

- (A) Sodium is a group-1 *alkali* metal (one valence electron), not an alkaline earth metal.
- (C) Aluminium is a group-13 metal (three valence electrons).
- (D) Potassium is a group-1 *alkali* metal.

**Key point:** Alkaline earth metals = group 2 ($ns^2$, form $+2$ ions): Be, Mg, Ca, Sr, Ba, Ra. Do not confuse them with the group-1 alkali metals (Na, K).

**Final Answer:** Calcium $\Rightarrow$ B

**Answer: (B)** Go Back to Q22

## Q23.

### Solution

**Concept — Functional isomerism:** Isomers are compounds with the same molecular formula but different structures. *Functional isomers* (functional group isomers) have the same molecular formula but belong to *different* classes of compounds because they contain different functional groups. Ethanol and dimethyl ether both have the formula $C_2H_6O$.

**Step 1 — Compare their structures:** ethanol, $CH_3CH_2OH$, contains a hydroxyl ($-OH$) group and is an alcohol; dimethyl ether, $CH_3OCH_3$, contains an ether linkage (C–O–C) and is an ether.

**Step 2 — Note the same formula:** both have molecular formula $C_2H_6O$ ($2$ C, $6$ H, $1$ O).

**Step 3 — Classify the relationship:** same formula but different functional groups (alcohol vs ether) $\Rightarrow$ they are functional isomers.

**Why each other option is wrong:**

- (B) Geometrical (cis–trans) isomerism arises from restricted rotation about a double bond or ring, which is not the case here.
- (C) They are not the same compound; an alcohol and an ether have very different properties.
- (D) Homologues differ by a $CH_2$ unit and share the *same* functional group; these two have different groups, so they are not homologues.

**Key point:** Same molecular formula + different functional group = functional isomers. The classic example is ethanol (an alcohol) and dimethyl ether (an ether), both $C_2H_6O$.

**Final Answer:** Functional isomers $\Rightarrow$ A

**Answer: (A)** Go Back to Q23

## Q24.

**Solution**

**Concept — IUPAC naming of ketones:** A ketone has a carbonyl group (>C=O) bonded to two carbon atoms. In IUPAC nomenclature, ketones take the suffix "-one", and the position of the carbonyl carbon is shown by a locant. Propanone, $CH_3COCH_3$, has a three-carbon chain with the carbonyl on the middle (second) carbon.

**Step 1 — Count the carbons in the longest chain:** three carbons ⇒ "propan-" as the root.

**Step 2 — Locate the carbonyl and add the suffix:** the C=O is on carbon 2, and the ketone suffix is "-one", giving propan-2-one.

**Step 3 — Conclusion:** the IUPAC name is propan-2-one (its common name is acetone).

**Why each other option is wrong:**

- (A) Propanal is the *aldehyde* $CH_3CH_2CHO$ (suffix "-al"), not a ketone.
- (B) Propan-1-ol is an *alcohol*, $CH_3CH_2CH_2OH$ (suffix "-ol").
- (D) Propanoic acid is the *carboxylic acid* $CH_3CH_2COOH$ (suffix "-oic acid").

**Key point:** Ketones end in "-one" with the carbonyl locant; the simplest ketone, $CH_3COCH_3$, is propan-2-one (acetone). The "2" shows the carbonyl is on the central carbon.

**Final Answer:** Propan-2-one ⇒ $\boxed{C}$

**Answer: (C)** Go Back to Q24

## Q25.

**Solution**

**Concept — The carbonyl group of ketones:** A functional group is the reactive part of a molecule that defines its class. In a ketone the defining feature is the carbonyl group, >C=O, a carbon doubly bonded to oxygen, in which that carbonyl carbon is attached to *two* other carbon atoms (R and R′).

**Step 1 — Read the structure:** the central carbon has a double bond to oxygen and single bonds to two carbon groups, i.e. R–CO–R′.

**Step 2 — Name the group:** the C=O unit is called the carbonyl group; when it sits between two carbons, the compound is a ketone.

**Step 3 — Conclusion:** the functional group characteristic of ketones is the carbonyl group, >C=O.

**Why each other option is wrong:**

- (A) The hydroxyl group $-$OH belongs to alcohols, with no C=O.
- (B) The carboxyl group $-$COOH (carbonyl + hydroxyl on one carbon) belongs to carboxylic acids.
- (C) The amino group $-NH_2$ belongs to amines.

**Key point:** A carbonyl (>C=O) between two carbon atoms = ketone; a carbonyl carrying an H ($-$CHO) = aldehyde. Both contain a carbonyl, but its neighbours decide the class.

**Final Answer:** Carbonyl, >C=O $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q25

## Q26.

### Solution

**Concept — Aromaticity:** A compound is aromatic if it is cyclic, planar, fully conjugated (each ring atom contributes a $p$ orbital to a continuous $\pi$ system), and contains $(4n + 2)$ delocalised $\pi$ electrons (Huckel's rule, with $n = 0, 1, 2, \ldots$). Benzene, $C_6H_6$, is the prototype: a flat six-membered ring with $6$ delocalised $\pi$ electrons ($4n + 2$ with $n = 1$).

**Step 1 — Test for a conjugated planar ring:** benzene is a planar hexagonal ring with alternating (delocalised) double bonds.

**Step 2 — Count the $\pi$ electrons:** benzene has $6$ $\pi$ electrons $= 4(1) + 2$, satisfying Huckel's rule.

**Step 3 — Conclusion:** benzene is aromatic.

**Why each other option is wrong:**

- (A) Ethane ($C_2H_6$) is a saturated open-chain alkane with no ring and no $\pi$ system.
- (C) Cyclohexane ($C_6H_{12}$) is a saturated ring with only single bonds, so it is not conjugated and not aromatic.
- (D) Propene ($C_3H_6$) is an open-chain alkene with a single isolated double bond, not a conjugated ring.

**Key point:** Aromatic = cyclic + planar + conjugated + $(4n + 2)$ $\pi$ electrons.

Benzene meets all four conditions with its $6$ delocalised $\pi$ electrons; saturated rings such as cyclohexane do not.

**Final Answer:** Benzene $\Rightarrow$ B

**Answer: (B)** Go Back to Q26

## Q27.

### Solution

**Concept — Hybridisation of benzene carbons:** The hybridisation of a carbon equals its number of $\sigma$ bonds plus lone pairs. In benzene each carbon is bonded to two neighbouring carbons and to one hydrogen (three $\sigma$ bonds, no lone pair), and the leftover unhybridised $p$ orbital joins the delocalised $\pi$ ring.

**Step 1 — Count the $\sigma$ bonds on one ring carbon:** two C–C $\sigma$ bonds $+$ one C–H $\sigma$ bond $= 3$ $\sigma$ bonds, no lone pairs $= 3$ electron domains.

**Step 2 — Assign the hybridisation:** three domains $\Rightarrow$ $sp^2$. Each carbon's unhybridised $p$ orbital is perpendicular to the ring and overlaps sideways with its neighbours to form the delocalised $\pi$ cloud (the inner circle).

**Step 3 — Geometry:** each carbon is trigonal planar at $120^\circ$, so the whole benzene ring is flat and regular.

**Why each other option is wrong:**

- (A) $sp^3$ (four $\sigma$ bonds) would describe a saturated carbon, as in cyclohexane, not benzene.
- (B) $sp$ (two domains) describes a carbon with a triple bond, as in ethyne.
- (D) $sp^3d$ requires $d$-orbitals and never applies to carbon.

**Key point:** Every carbon in benzene is $sp^2$ hybridised, planar at $120^\circ$, with one $p$ orbital left over for the delocalised $\pi$ system that gives benzene its aromatic stability.

**Final Answer:** $sp^2$ $\Rightarrow$ C

**Answer: (C)** Go Back to Q27

## Q28.

**Solution**

**Concept — The amino group:** Each class of organic compound is recognised by its functional group. Amines are derivatives of ammonia ($NH_3$) in which one or more hydrogens are replaced by carbon groups, and they are characterised by the amino group, $-NH_2$ (nitrogen with a lone pair, which makes amines basic).

**Step 1 — Recall the structure of an amine:** a primary amine is R–$NH_2$, e.g. methylamine $CH_3NH_2$.

**Step 2 — Identify the defining group:** the nitrogen-containing $-NH_2$ group is what marks the compound as an amine; its lone pair makes amines weakly basic.

**Step 3 — Conclusion:** the functional group of amines is the amino group, $-NH_2$.

**Why each other option is wrong:**

- (B) The hydroxyl group $-OH$ characterises alcohols.
- (C) The carbonyl group $>C{=}O$ characterises aldehydes and ketones.
- (D) The carboxyl group $-COOH$ characterises carboxylic acids.

**Key point:** Amines = the $-NH_2$ (amino) group, the basic, nitrogen-bearing group derived from ammonia. Amino acids, which build proteins, contain both an $-NH_2$ and a $-COOH$ group.

**Final Answer:** Amino group, $-NH_2 \Rightarrow \boxed{A}$

**Answer: (A)** Go Back to Q28

## Q29.

**Solution**

**Concept — Classification of carbohydrates:** Carbohydrates are classified by how many simple sugar units they yield on hydrolysis. *Monosaccharides* are the simplest sugars and *cannot* be hydrolysed into smaller carbohydrates; disaccharides yield two monosaccharide units; polysaccharides yield many. Glucose, $C_6H_{12}O_6$, cannot be broken down into a simpler sugar.

**Step 1 — Test for hydrolysis:** glucose does not break down into any smaller carbohydrate unit; it is already a single sugar unit.

**Step 2 — Match to the class:** a sugar that cannot be hydrolysed further is a monosaccharide.

**Step 3 — Conclusion:** glucose is a monosaccharide (in fact an aldohexose, with six carbons and an aldehyde group).

**Why each other option is wrong:**

- (A) A disaccharide (such as sucrose or maltose) hydrolyses into *two* monosaccharides; glucose does not.
- (B) A polysaccharide (such as starch or cellulose) is a long polymer of *many* glucose units; glucose itself is just one such unit.
- (C) A protein is a polymer of amino acids, not a carbohydrate at all.

**Key point:** Monosaccharides (glucose, fructose) are the simplest sugars and cannot be hydrolysed further. Sucrose = glucose + fructose (a disaccharide); starch = many glucose units (a polysaccharide).

**Final Answer:** Monosaccharide $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q29

## Q30.

### Solution

**Concept — Composition of soap:** Soap is made by alkaline hydrolysis (saponification) of fats and oils, which are esters of long-chain fatty acids with glycerol. Boiling a fat with a strong base such as NaOH or KOH gives glycerol plus the *sodium or potassium salt of the long-chain fatty acid*, and that salt is soap, e.g. sodium stearate $C_{17}H_{35}COONa$.

**Step 1 — Recall the saponification reaction:** fat + NaOH $\rightarrow$ glycerol + sodium salt of a fatty acid (soap).

**Step 2 — Identify the acid involved:** the acid part comes from a long-chain (typically 12 to 18 carbon) fatty acid such as stearic or palmitic acid.

**Step 3 — Conclusion:** soap is the sodium or potassium salt of a long-chain fatty acid.

**Why each other option is wrong:**

- (A) A strong mineral acid (such as HCl or $H_2SO_4$) gives ordinary inorganic salts, not soap.
- (B) A simple sugar is a carbohydrate and has nothing to do with soap.
- (D) An amino acid is the building block of proteins, not the source of soap.

**Key point:** Soap = sodium/potassium salt of a long-chain fatty acid, made by

saponifying fats with alkali. The long hydrocarbon tail (non-polar) and ionic head (polar) are what let soap clean grease.

**Final Answer:** Long-chain fatty acid $\Rightarrow$ C

**Answer: (C)** Go Back to Q30

# Answer Key

| Q | Ans | Q | Ans | Q | Ans | Q | Ans | Q | Ans |
|---|---|---|---|---|---|---|---|---|---|
| 1 | B | 2 | A | 3 | C | 4 | D | 5 | A |
| 6 | B | 7 | D | 8 | A | 9 | B | 10 | C |
| 11 | D | 12 | A | 13 | C | 14 | B | 15 | A |
| 16 | C | 17 | D | 18 | B | 19 | A | 20 | C |
| 21 | D | 22 | B | 23 | A | 24 | C | 25 | D |
| 26 | B | 27 | C | 28 | A | 29 | D | 30 | C |