

Class 12 Chemistry: Previous Year Questions, Chapter-wise

1241 CBSE board exam questions, 2022–2026 · 10 chapters · sorted by question type

Each question shows its exam year and marks. A question repeated across paper sets appears once. Questions that need a figure from the original paper are left out. Questions only, no answers. Chapter headings link to free notes and MCQs for that chapter on studynos.co.in.

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1 Solutions

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MULTIPLE CHOICE AND ASSERTION-REASON (67)

Q1. CBSE 2026 · 1 mark Which of the following colligative properties can preferably determine the molar mass of proteins ?

- (a) Relative lowering of vapour pressure
- (b) Osmotic pressure
- (c) Elevation of boiling point
- (d) Depression of freezing point

Q2. CBSE 2026 · 1 mark For an electrolyte consisting of a monovalent cation and a monovalent anion undergoing dissociation in water, the van't Hoff factor (i) is :

- (a) less than 1
- (b) equal to 1
- (c) greater than 1
- (d) greater than 2

Q3. CBSE 2026 · 1 mark Which of the following solutions will have the lowest freezing point in water?

- (a) 0.1 M Glucose
- (b) 0.1 M CaCl₂
- (c) 0.1 M KCl
- (d) 0.1 M Urea

Q4. CBSE 2026 · 1 mark Assertion (A): It is not possible to separate the components of an azeotrope by fractional distillation. Reason (R): Components of an azeotrope have the same composition in liquid and vapour phase and boil at a constant temperature.

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

Q5. CBSE 2026 · 1 mark Which of the following solutions will have the highest osmotic pressure?

- (a) 0.1 M KCl
- (b) 0.1 M CaCl₂
- (c) 0.1 M Glucose
- (d) 0.1 M Urea

Q6. CBSE 2026 · 1 mark Assertion (A): Components of azeotropes are easily separated by fractional distillation. Reason (R): Components of an azeotrope have same composition in liquid and vapour phase.

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

Q7. CBSE 2026 · 1 mark Assertion (A) : It is not possible to separate the components of an azeotrope by fractional distillation. Reason (R) : Minimum boiling azeotrope is formed by the solutions showing large positive deviation from Raoult's law.

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

Q8. CBSE 2026 · 1 mark The boiling point of an azeotropic mixture of water and ethanol is less than that of pure water and ethanol. The mixture shows:

- (a) positive deviation from Raoult's Law.
- (b) negative deviation from Raoult's Law.
- (c) no deviation from Raoult's Law.
- (d) that the solution is an ideal solution.

Q9. CBSE 2026 · 1 mark The mole fraction of a solute in 2.0 molal aqueous solution is:

- (a) 1.87
- (b) 0.347
- (c) 0.0347
- (d) 0.00347



Q10. CBSE 2026 · 1 mark The boiling point of an azeotropic mixture of water and nitric acid is more than that of pure water and nitric acid. The mixture shows :

- (a) no deviation from Raoult's law
- (b) that solution is an ideal solution
- (c) positive deviation from Raoult's law
- (d) negative deviation from Raoult's law

Q11. CBSE 2026 · 1 mark 1 mole of liquid A and 2 moles of liquid B make a solution having a total vapour pressure 40 torr. The vapour pressure of pure A and pure B are 30 torr and 45 torr respectively. The above solution :

- (a) is an ideal solution.
- (b) shows negative deviation from Raoult's Law.
- (c) shows positive deviation from Raoult's Law.
- (d) is a maximum boiling azeotrope.

Q12. CBSE 2026 · 1 mark The boiling point of one molal NaCl solution, assuming NaCl to be completely dissociated in water is: (K_b for water = $0.52 \text{ K kg mol}^{-1}$)

- (a) 100.52°C (b) 101.04°C (c) 100.04°C (d) 101.52°C

Q13. CBSE 2026 · 1 mark When a liquid and its vapour are at equilibrium and the pressure is suddenly decreased:

- (a) vapour pressure of the solution increases
- (b) heating occurs (c) cooling occurs
- (d) equilibrium remains unaffected

Q14. CBSE 2025 · 1 mark An azeotropic mixture of two liquids has a boiling point higher than that of either of the two liquids when it

- (a) obeys Raoult's law
- (b) shows positive deviation from Raoult's law
- (c) shows negative deviation from Raoult's law
- (d) obeys Henry's law

Q15. CBSE 2025 · 1 mark Solubility of gases in liquid decreases with increase in

- (a) pressure (b) volume (c) number of solute particles
- (d) temperature

Q16. CBSE 2025 · 1 mark The value of Henry's constant K_H is:

- (a) greater for gases with higher solubility
- (b) greater for gases with lower solubility
- (c) constant for all gases
- (d) not related to the solubility of gases

Q17. CBSE 2025 · 1 mark Which of the following aqueous solutions will have the highest freezing point?

- (a) 1.0 M KCl (b) 1.0 M Na_2SO_4 (c) 1.0 M Glucose
- (d) 1.0 M AlCl_3

Q18. CBSE 2025 · 1 mark While doing qualitative analysis in chemistry lab, Abhishek added yellow coloured potassium chromate solution into a test tube. He was surprised to see the colour of the solution changing immediately to orange. He realised that the test tube was not clean and contained a few drops of some liquid. Which of the following substances will be the most likely liquid to be present in the test tube before adding potassium chromate solution?

- (a) Sodium hydrogen carbonate solution
- (b) Methyl orange solution (c) Sodium hydroxide solution
- (d) HCl solution

Q19. CBSE 2025 · 1 mark Assertion (A): Henry's law constant (K_H) decreases with increase in temperature. Reason (R): As the temperature increases, solubility of gases in liquids decreases.

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

Q20. CBSE 2025 · 1 mark The freezing point of one molal KCl solution, assuming KCl to be completely dissociated in water, is : (K_f for water = $1.86 \text{ K kg mol}^{-1}$)

- (a) -3.72°C (b) $+3.72^\circ\text{C}$ (c) -1.86°C (d) $+2.72^\circ\text{C}$

Q21. CBSE 2025 · 1 mark A solution of acetone in ethanol :

- (a) obeys Raoult's law. (b) forms an ideal solution.
- (c) shows a positive deviation from Raoult's law.
- (d) shows a negative deviation from Raoult's law.

Q22. CBSE 2025 · 1 mark A solution of acetone in chloroform:

- (a) obeys Raoult's law. (b) forms azeotrope.
- (c) shows a positive deviation from Raoult's law.
- (d) shows a negative deviation from Raoult's law.

Q23. CBSE 2025 · 1 mark On mixing 30 mL of acetone with 20 mL of chloroform, the total volume of solution is:

- (a) equal to 10 mL (b) less than 50 mL
- (c) greater than 50 mL (d) equal to 50 mL

Q24. CBSE 2025 · 1 mark Which of the following solutions will have the highest boiling point in water ?

- (a) 1% KCl (b) 1% glucose (c) 1% urea (d) 1% CaCl_2

Q25. CBSE 2025 · 1 mark Assertion (A): Cooking time is reduced in pressure cooker. Reason (R): Boiling point of water inside the pressure cooker is elevated.

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

Q26. CBSE 2025 · 1 mark Which of the following solution in water will have the lowest freezing point ?

- (a) 1% KCl (b) 1% glucose (c) 1% urea (d) 1% CaCl_2



Q27. CBSE 2025 · 1 mark Assertion (A): Cooking time is reduced in pressure cooker. Reason (R): Boiling point of water inside the pressure cooker is lowered down.

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

Q28. CBSE 2025 · 1 mark Which of the following aqueous solutions will have the highest osmotic pressure?

- (a) 1% KCl (b) 1% glucose (c) 1% urea (d) 1% CaCl₂

Q29. CBSE 2025 · 1 mark Assertion (A): Aquatic species are more comfortable in cold water than in warm water. Reason (R): Solubility of oxygen gas in water decreases with increase in temperature.

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

Q30. CBSE 2024 · 1 mark For an electrolyte undergoing association in a solvent, the v factor:

- (a) is always greater than one (b) has negative value
- (c) has zero value (d) is always less than one

Q31. CBSE 2024 · 1 mark Assertion (A): When NaCl is added to water a depression in freezing point is observed. Reason (R): NaCl undergoes dissociation in water.

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

Q32. CBSE 2024 · 1 mark Phenol forms a dimer in benzene with a degree of association of 0.54. Its degree of association is:

- (a) 0.54 (b) 0.46 (c) 0.92 (d) 0.27

Q33. CBSE 2024 · 1 mark Assertion (A): When NaCl is added in water, elevation in boiling point is observed. Reason (R): Elevation in boiling point is a colligative property.

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

Q34. CBSE 2024 · 1 mark The system that forms maximum boiling azeotrope is:

- (a) CS₂ and acetone (b) Benzene and toluene
- (c) Ethanol and acetone (d) Chloroform and acetone

Q35. CBSE 2024 · 1 mark Assertion (A): ΔH_{mix} for an ideal solution is not equal to zero. Reason (R): A-B interactions in an ideal solution are same as between A-A and B-B interactions.

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

Q36. CBSE 2024 · 1 mark The relative lowering of vapour pressure of an aqueous solution containing non-volatile solute is 0.0225. The mole fraction of the non-volatile solute is:

- (a) 0.80 (b) 0.725 (c) 0.15 (d) 0.0225

Q37. CBSE 2024 · 1 mark On mixing 10 mL of acetone with 50 mL of chloroform, the total volume of the solution will be:

- (a) < 60 mL (b) > 60 mL (c) = 60 mL (d) = 100 mL

Q38. CBSE 2024 · 1 mark A 1% solution is prepared by dissolving 1 g of sucrose (Molar mass = 342 g mol⁻¹) in 6 solution of the solute is :

- (a) 34.2 g mol⁻¹ (b) 57 g mol⁻¹ (c) 114 g mol⁻¹
- (d) 3.42 g mol⁻¹

Q39. CBSE 2024 · 1 mark Assertion (A): Addition of ethylene glycol to water lowers its freezing point. Reason (R): Ethylene glycol is insoluble in water due to lack of its ability to form hydrogen bonds with water molecules.

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

Q40. CBSE 2024 · 1 mark A 1% solution of solute in 6 solution of sucrose (molar mass = 342 g mol⁻¹). The molar mass of solute is:

- (a) 34.2 g mol⁻¹ (b) 57 g mol⁻¹ (c) 114 g mol⁻¹
- (d) 3.42 g mol⁻¹

Q41. CBSE 2024 · 1 mark Assertion (A): $\Delta_{\text{mix}}H$ and $\Delta_{\text{mix}}V$ are zero for non-ideal solutions. Reason (R): Solute-solvent interactions are not same as pure solute-solute and pure solvent-solvent interactions in non-ideal solutions.

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

Q42. CBSE 2024 · 1 mark A solution is prepared by dissolving a 1% solution of sucrose (molar mass = 342 g mol⁻¹). The molar mass of the solute is:

- (a) 34.2 g mol⁻¹ (b) 57 g mol⁻¹ (c) 114 g mol⁻¹
- (d) 3.42 g mol⁻¹



Q43. CBSE 2024 · 1 mark Assertion (A): ΔH_{mix} and ΔV_{mix} are zero for an ideal solution. Reason (R): A solution which obeys Raoult's law over the entire range of concentration is called an ideal solution.

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

Q44. CBSE 2023 · 1 mark The colligative property used for the determination of molar mass of polymers and proteins is:

- (a) Osmotic pressure
- (b) Depression in freezing point
- (c) Relative lowering in vapour pressure
- (d) Elevation in boiling point

Q45. CBSE 2023 · 1 mark Low concentration of oxygen in the blood and tissues of people living at high altitude is due to:

- (a) High atmospheric pressure
- (b) Low temperature
- (c) Low atmospheric pressure
- (d) Both low temperature and high atmospheric pressure

Q46. CBSE 2023 · 1 mark On dissolving ammonium chloride in water at room temperature, the solution feels cool to touch. Under which of the following conditions does salt dissolve faster?

- (a) Powdered salt in cold water
- (b) Powdered salt in hot water
- (c) Salt crystals in cold water
- (d) Salt crystals in hot water

Q47. CBSE 2023 · 1 mark Value of Henry's constant K_H :

- (a) increases with decrease in temperature
- (b) decreases with increase in temperature
- (c) increases with increase in temperature
- (d) remains constant

Q48. CBSE 2023 · 1 mark Assertion (A): Osmotic pressure is a colligative property. Reason (R): Osmotic pressure is proportional to the molality.

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

Q49. CBSE 2023 · 1 mark An azeotropic mixture of two liquids will have a boiling point lower than either of the two liquids when it

- (a) shows a negative deviation from Raoult's law
- (b) forms an ideal solution
- (c) shows a positive deviation from Raoult's law
- (d) is saturated

Q50. CBSE 2023 · 1 mark Assertion (A): Elevation in boiling point is a colligative property. Reason (R): The lowering of vapour pressure of solution causes elevation in boiling point.

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

Q51. CBSE 2023 · 1 mark Solubility of gas in liquid decreases with increase in

- (a) Pressure
- (b) Temperature
- (c) Volume
- (d) Number of solute molecules

Q52. CBSE 2023 · 1 mark Assertion (A): The enthalpy of mixing ΔH_{mix} is equal to zero for an ideal solution. Reason (R): For an ideal solution the interaction between solute and solvent molecules is stronger than the interactions between solute-solute or solvent-solvent molecules.

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

Q53. CBSE 2023 · 1 mark Which of the following colligative property is used to find the molar mass of proteins?

- (a) Osmotic pressure
- (b) Elevation in boiling point
- (c) Depression in freezing point
- (d) Relative lowering of vapour pressure

Q54. CBSE 2023 · 1 mark Isotonic solutions have:

- (a) same osmotic pressure
- (b) same boiling point
- (c) same melting point
- (d) same vapour pressure

Q55. CBSE 2023 · 1 mark Kohlrausch gave the following relation for strong electrolyte: $\Lambda = \Lambda^\circ - A\sqrt{C}$. Which of the following equality holds true?

- (a) $\Lambda^\circ = \Lambda$ as $C \rightarrow 0$
- (b) $\Lambda^\circ = \Lambda$ as $C \rightarrow \infty$
- (c) $\Lambda = \Lambda^\circ$ as $C \rightarrow 0$
- (d) $\Lambda = \Lambda^\circ$ as $C \rightarrow 1$

Q56. CBSE 2023 · 1 mark Which one of the following pairs will not form an ideal solution?

- (a) Benzene and Toluene
- (b) Nitric acid and Water
- (c) Hexane and Heptane
- (d) Ethyl chloride and Ethyl bromide

Q57. CBSE 2023 · 1 mark A compound undergoes complete tetramerization in a given organic solvent. Van't Hoff factor i is:

- (a) 40
- (b) 0.25
- (c) 0.125
- (d) 20



Q58. CBSE 2023 · 1 mark Assertion (A): When NaCl is added to water, a depression in freezing point is observed. Reason (R): The lowering of vapour pressure of a solution causes depression in the freezing point.

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

Q59. CBSE 2023 · 1 mark A compound undergoes complete dimerization in a given organic solvent. The Van't Hoff factor is:

- (a) 20 (b) 05 (c) 025 (d) 10

Q60. CBSE 2023 · 1 mark Assertion (A): When glucose is added to water, an elevation in boiling point is observed. Reason (R): The lowering of vapour pressure causes elevation in the boiling point.

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

Q61. CBSE 2023 · 1 mark A compound $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ undergoes complete dissociation in water. The van't Hoff factor is:

- (a) 9 (b) 6 (c) 3 (d) 4

Q62. CBSE 2023 · 1 mark Assertion (A): When NaCl is added to water, a depression in freezing point is observed. Reason (R): The vapour pressure of solution is increased which causes depression in freezing point.

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

Q63. CBSE 2023 · 1 mark 1 mole of liquid A and 2 moles of liquid B make a solution having a total vapour pressure 40 torr. The vapour pressure of pure A and pure B are 45 torr and 30 torr respectively. The above solution

- (a) is an ideal solution (b) shows positive deviation
- (c) shows negative deviation
- (d) is a maximum boiling azeotrope

Q64. CBSE 2023 · 1 mark If molality of a dilute solution is doubled, the value of the molal elevation constant (K_b) will be

- (a) halved (b) doubled (c) tripled (d) unchanged

Q65. CBSE 2023 · 1 mark Which of the following aqueous solution will have highest boiling point?

- (a) 1.0 M KCl (b) 1.0 M K_2SO_4 (c) 2.0 M KCl
- (d) 2.0 M K_2SO_4

Q66. CBSE 2023 · 1 mark The unit of molar conductivity is

- (a) $\text{S cm}^{-2} \text{ mol}^{-1}$ (b) $\text{S cm}^2 \text{ mol}^{-1}$ (c) $\text{S}^{-1} \text{ cm}^2 \text{ mol}^{-1}$
- (d) $\text{S cm}^2 \text{ mol}$

Q67. CBSE 2023 · 1 mark Out of the following 1.0 M aqueous solutions, which one will show largest freezing point depression?

- (a) NaCl (b) Na_2SO_4 (c) $\text{C}_6\text{H}_{12}\text{O}_6$ (d) $\text{Al}_2(\text{SO}_4)_3$

VERY SHORT ANSWER (29)

Q68. CBSE 2026 · 2 marks State Raoult's law for a solution containing volatile components. Write any two characteristics of a solution which obeys Raoult's law at all concentrations.

Q69. CBSE 2026 · 2 marks What type of deviation from Raoult's law is shown by a mixture of phenol and aniline? Give reason. What will happen to the boiling point of the solution on mixing phenol and aniline?

Q70. CBSE 2026 · 2 marks What type of deviation from Raoult's law is shown by mixture of ethanol and acetone? Give reason. What will happen to the boiling point of the solution on mixing ethanol and acetone?

Q71. CBSE 2026 · 2 marks What type of deviation is shown by a mixture of chloroform and acetone from Raoult's law? Give reason. What will happen to the boiling point of the solution on mixing chloroform and acetone?

Q72. CBSE 2026 · 2 marks Explain why, on addition of 1 mol of KCl to 1 litre of water, the boiling point of water increases, while the addition of 1 mol of methyl alcohol to 1 litre of water decreases the boiling point.

Q73. CBSE 2026 · 2 marks (a) Explain the following with the help of Henry's law: (i) Bends (ii) Anoxia

Q74. CBSE 2026 · 2 marks (a) Explain the following with the help of Henry's law: (i) Bends (ii) Anoxia OR (b) How does sprinkling of salt help in clearing the snow covered roads in hilly areas? Write the name of the colligative property involved in this process.

Q75. CBSE 2026 · 2 marks (a) 1.00 molal aqueous solution of trichloroacetic acid is heated to its boiling point. Boiling point of this solution was found to be 100.18°C . Calculate the van't Hoff factor for trichloroacetic acid. (Given : K_b for water = $0.512 \text{ K kg mol}^{-1}$)

Q76. CBSE 2026 · 2 marks (a) 1.00 molal aqueous solution of trichloroacetic acid is heated to its boiling point. Boiling point of this solution was found to be 100.18°C . Calculate the van't Hoff factor for trichloroacetic acid. (Given: K_b for water = $0.512 \text{ K kg mol}^{-1}$) OR (b) State Henry's law. Calculate the mole fraction of CO_2 in water at 298 K under 760 mm Hg. (Given: K_H for CO_2 in H_2O at 298 K = $1.25 \times 10^6 \text{ mm Hg}$)

Q77. CBSE 2025 · 2 marks (a) Calculate the elevation of boiling point of a solution when 3 g of CaCl_2 (Molar mass = 111 g mol^{-1}) was dissolved in 260 g of water, assuming that CaCl_2 undergoes complete dissociation. (K_b for water = $0.52 \text{ K kg mol}^{-1}$)

Q78. CBSE 2025 · 2 marks State Henry's law. Why are aquatic species more comfortable in cold water as compared to warm water?



Q79. CBSE 2025 · 2 marks State Raoult's law for a solution containing volatile components. Why is the vapour pressure of an aqueous solution of glucose lower than that of water?

Q80. CBSE 2025 · 2 marks Define osmotic pressure. Why is measurement of osmotic pressure method preferred for the determination of molar masses of macromolecules such as proteins and polymers?

Q81. CBSE 2025 · 2 marks What is meant by positive deviation from Raoult's law? Give an example. What type of azeotrope is formed by positive deviation?

Q82. CBSE 2025 · 2 marks What is meant by negative deviation from Raoult's law? Give an example. What type of azeotrope is formed by negative deviation?

Q83. CBSE 2025 · 2 marks (a) A and B liquids on mixing show rise in temperature. Which type of deviation from Raoult's law is there and why? (b) Why can azeotropic mixture not be separated by fractional distillation?

Q84. CBSE 2024 · 2 marks A 6% solution of glucose (molar mass = 180 g mol⁻¹) is isotonic with 25% solution of an unknown organic substance. Calculate the molecular weight of the unknown organic substance.

Q85. CBSE 2024 · 2 marks A 4% solution of urea (molar mass = 60 g mol⁻¹) is isotonic with 52% solution of an unknown organic substance. Calculate the molecular weight of the unknown organic substance.

Q86. CBSE 2024 · 2 marks A 3% solution of glucose (molar mass = 180 g mol⁻¹) is isotonic with 25% solution of an unknown organic substance. Calculate the molecular weight of the unknown organic substance.

Q87. CBSE 2024 · 2 marks (a) Define molal depression constant. How is it related to enthalpy of fusion?

Q88. CBSE 2024 · 2 marks Define molal depression constant. How is it related to enthalpy of fusion? OR What type of deviation is shown by ethanol and acetone mixture? Give reason. What type of azeotropic mixture is formed by that deviation?

Q89. CBSE 2023 · 2 marks A solution is prepared by dissolving 10 g of non-volatile solute in 200 g of water. It has a vapour pressure of 31.84 mm Hg at 308 K. Calculate the molar mass of the solute. (Vapour pressure of pure water at 308 K = 32 mm Hg)

Q90. CBSE 2023 · 2 marks The vapour pressure of pure liquid X and pure liquid Y at 25°C are 120 mm Hg and 160 mm Hg respectively. If equal moles of X and Y are mixed to form an ideal solution, calculate the vapour pressure of the solution.

Q91. CBSE 2023 · 2 marks Give reasons for the following: (a) Aquatic animals are more comfortable in cold water in comparison to warm water. (b) Sprinkling of salt helps in clearing the snow-covered roads in hilly areas.

Q92. CBSE 2023 · 2 marks On mixing liquid X and liquid Y, volume of the resulting solution decreases. The resulting solution shows what kind of deviation from Raoult's law? What change in temperature would you observe after mixing liquids X and Y?

Q93. CBSE 2023 · 2 marks How does the mixture of ethanol and acetone show deviation from Raoult's law? Give reason.

Q94. CBSE 2023 · 2 marks What is shown by a mixture of ethanol and acetone? Give reason.

Q95. CBSE 2023 · 2 marks Do ethanol and acetone form an azeotrope? Give reason.

Q96. CBSE 2023 · 2 marks Why is a mixture of ethanol and acetone unable to show the ideal behavior of Raoult's law? Give reason.

SHORT ANSWER (21)

Q97. CBSE 2026 · 3 marks Calculate the molarity and molality of a KI solution if the density of 20% (mass/mass) aqueous solution of KI is 1.2 g mL⁻¹. [Given : Molar mass of KI = 166 g mol⁻¹]

Q98. CBSE 2026 · 3 marks Calculate the boiling point of a solution containing 0.61 g of benzoic acid (Molar mass = 122 g mol⁻¹) in 5 g of CS₂ in which it dimerises to the extent of 88%. The boiling point and K_b of CS₂ are 46.2°C and 2.3 K kg mol⁻¹ respectively.

Q99. CBSE 2026 · 3 marks When 1.5 g of a non-volatile solute was dissolved in 90 g of benzene, the boiling point of benzene got raised from 353.23 K to 353.93 K. Calculate the molar mass of the solute. (Given K_b for benzene = 2.52 K kg mol⁻¹)

Q100. CBSE 2026 · 3 marks A solution containing 8.0 g of a non-volatile solute in 100 g of diethyl ether boils at 36.86 °C whereas pure diethyl ether boils at 35.60 °C. Determine the molar mass of the solute. (K_b for diethyl ether = 2.02 K kg mol⁻¹)

Q101. CBSE 2026 · 3 marks 60 g of glucose is dissolved in 250 g of water. Calculate the freezing point of this solution. (molar mass of glucose = 180 g mol⁻¹, K_f for water = 1.86 K kg mol⁻¹)

Q102. CBSE 2026 · 3 marks An antifreeze solution is prepared by dissolving 31 g of ethylene glycol (Molar mass = 62 g mol⁻¹) in 600 g of water. Calculate the freezing point of the solution. (K_f for water = 1.86 K kg mol⁻¹)

Q103. CBSE 2026 · 3 marks Calculate the vapour pressure of a solution containing 61 g of benzoic acid (molar mass = 122 g mol⁻¹) dissolved in 500 g of benzene when the vapour pressure of pure benzene at this temperature of experiment is 66 torr. Assume complete dimerization of benzoic acid in benzene.

Q104. CBSE 2025 · 3 marks An aqueous solution of NaOH was made and its molar mass from the measurement of osmotic pressure at 27°C was found to be 25 g mol⁻¹. Calculate the percentage dissociation of NaOH in this solution. [Atomic mass: Na = 23 u, O = 16 u, H = 1 u]

Q105. CBSE 2025 · 3 marks An aqueous solution of NaOH was made and its molar mass from the measurement of osmotic pressure at 25°C was found to be 28 g mol⁻¹. Calculate the percentage dissociation of NaOH in this solution. [Atomic mass: Na = 23.0 u, O = 16.0 u, H = 1.0 u]

Q106. CBSE 2025 · 3 marks (a) Shweta mixed two liquids A and B of 10 mL each. After mixing, the volume of the solution was found to be 20.2 mL. (i) Why was there a volume change after mixing the liquids? (ii) Will there be an increase or decrease of temperature after mixing? (iii) Give one example for this type of solution.



Q107. CBSE 2025 · 1 mark Shweta mixed two liquids A and B of 10 mL each. After mixing, the volume of the solution was found to be 20.2 mL. Why was there a volume change after mixing the liquids ?

Q108. CBSE 2025 · 3 marks Vapour pressure of pure water at 298 K is 24.8 mm Hg. Calculate the lowering in vapour pressure of an aqueous solution which freezes at -0.3°C . (K_f of water = $1.86\text{ K kg mol}^{-1}$)

Q109. CBSE 2025 · 3 marks 03 g of acetic acid (Molar mass = 60 g mol^{-1}) dissolved in 30 g of benzene shows a depression in freezing point equal to 0.45°C . Calculate the percentage association of acid if it forms a dimer in the solution. (Given : K_f for benzene = $5.12\text{ K kg mol}^{-1}$)

Q110. CBSE 2024 · 3 marks The vapour pressure of a solvent at 283 K is 100 mm Hg. Calculate the vapour pressure of a dilute solution containing 1 mole of a strong electrolyte AB in 50 moles of the solvent at 283 K (assuming complete dissociation of solute AB).

Q111. CBSE 2024 · 3 marks A solution is prepared by dissolving 5 g of a non-volatile solute in 200 g of water. It has a vapour pressure of 31.84 mm Hg at 300 K. Calculate the molar mass of the solute. (Vapour pressure of pure water at 300 K = 32 mm Hg)

Q112. CBSE 2023 · 3 marks (a) Differentiate between Ideal solution and Non-ideal solution. (b) 30 g of urea is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.

Q113. CBSE 2023 · 3 marks Give reason: (a) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers. (b) Aquatic animals are more comfortable in cold water than in warm water. (c) Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.

Q114. CBSE 2023 · 3 marks When 19.5 g of $\text{F}-\text{CH}_2-\text{COOH}$ (Molar mass = 78 g mol^{-1}), is dissolved in 500 g of water, the depression in freezing point is observed to be 1°C . Calculate the degree of dissociation of $\text{F}-\text{CH}_2-\text{COOH}$. [Given: K_f for water = $1.86\text{ K kg mol}^{-1}$]

Q115. CBSE 2023 · 3 marks 0.3 g of acetic acid ($M = 60\text{ g mol}^{-1}$) dissolved in 30 g of benzene shows a depression in freezing point equal to 0.45°C . Calculate the percentage association of acid if it forms a dimer in the solution. (Given: K_f for benzene = $5.12\text{ K kg mol}^{-1}$)

Q116. CBSE 2023 · 3 marks If benzoic acid ($M = 122\text{ g mol}^{-1}$) is associated into a dimer when dissolved in benzene and the osmotic pressure of a solution of 6.1 g of benzoic acid in 100 mL benzene is 6.5 atm at 27°C , then what is the percentage association of benzoic acid? (Given: $R = 0.0821\text{ L atm K}^{-1}\text{ mol}^{-1}$)

Q117. CBSE 2022 · 3 marks Write three differences between Lyophobic sol and Lyophilic sol.

LONG ANSWER (7)

Q118. CBSE 2026 · 5 marks (a) (i) Calculate the freezing point of a solution when 10.5 g of MgBr_2 was dissolved in 250 g of water, assuming MgBr_2 undergoes complete dissociation. (Given : Molar mass of $\text{MgBr}_2 = 184\text{ g mol}^{-1}$, K_f for water = $1.86\text{ K kg mol}^{-1}$) (ii) Write two differences between ideal and non-ideal solutions.

Q119. CBSE 2026 · 5 marks (a) (i) Calculate the freezing point of a solution when 10.5 g of MgBr_2 was dissolved in 250 g of water, assuming MgBr_2 undergoes complete dissociation. (Given: Molar mass of $\text{MgBr}_2 = 184\text{ g mol}^{-1}$, K_f for water = $1.86\text{ K kg mol}^{-1}$) (ii) Write two differences between ideal and non-ideal solutions. OR (b) (i) A solution is prepared by dissolving 0.025 g of potassium sulphate in 2 L of water at 27°C . Assuming potassium sulphate is completely dissociated, determine its osmotic pressure. (Given: $R = 0.082\text{ L atm K}^{-1}\text{ mol}^{-1}$, Molar mass of $\text{K}_2\text{SO}_4 = 174\text{ g mol}^{-1}$) (ii) What type of azeotrope will be formed by a solution of acetone and chloroform? Give reason.

Q120. CBSE 2025 · 5 marks (A) (a) Calculate the boiling point of solution when 6 g of MgSO_4 (Molar mass = 120 g mol^{-1}) was dissolved in 200 g of water, assuming the complete dissociation of MgSO_4 . (K_b for water = $0.52\text{ K kg mol}^{-1}$). (b) State Raoult's law for a solution containing volatile components. How Raoult's law is a special case of Henry's law ?

Q121. CBSE 2024 · 5 marks (a) (i) At the same temperature, CO_2 gas is more soluble in water than O_2 gas. Which one of them will have higher value of K_H and why? (ii) How does the size of blood cells change when placed in an aqueous solution containing more than 0.9% (mass/volume) sodium chloride? (iii) 1 molal aqueous solution of an electrolyte A_2B_3 is 60% ionized. Calculate the boiling point of the solution. (Given : K_b for $\text{H}_2\text{O} = 0.52\text{ K kg mol}^{-1}$)

Q122. CBSE 2024 · 5 marks (a) (i) At the same temperature, CO_2 gas is more soluble in water than O_2 gas. Which one of them will have higher value of K_H and why?

Q123. CBSE 2023 · 5 marks (a) (i) Why is boiling point of 1M NaCl solution more than that of 1M glucose solution? (ii) A non-volatile solute 'X' (molar mass = 50 g mol^{-1}) when dissolved in 78g of benzene reduced its vapour pressure to 90%. Calculate the mass of X dissolved in the solution. (iii) Calculate the boiling point elevation for a solution prepared by adding 10g of MgCl_2 to 200g of water assuming MgCl_2 is completely dissociated.

Q124. CBSE 2023 · 5 marks (a) (i) Why is boiling point of 1M NaCl solution more than that of 1M glucose solution? (ii) A non-volatile solute 'X' (molar mass = 50 g mol^{-1}) when dissolved in 78g of benzene reduced its vapour pressure to 90%. Calculate the mass of X dissolved in the solution. (iii) Calculate the boiling point elevation for a solution prepared by adding 10g of MgCl_2 to 200g of water assuming MgCl_2 is completely dissociated. (K_b for Water = $0.512\text{ K kg mol}^{-1}$, Molar mass $\text{MgCl}_2 = 95\text{ g mol}^{-1}$)

CASE-BASED (3)

CASE STUDY · CBSE 2026

Osmosis is a process by which the molecules of a solvent pass from a solution of low solute concentration to a solution of high



solute concentration through a semi-permeable membrane. Osmotic pressure is a colligative property. When the applied pressure on a solution exceeds its osmotic pressure, reverse osmosis occurs. When two solutions are separated by a semipermeable membrane and they have same osmotic pressure they are said to be isotonic. Of the two solutions separated by a semipermeable membrane, if one is a lower osmotic pressure, it is said to be hypotonic relative to the second solution. If it has a higher osmotic pressure, than the second solution, it is said to be hypertonic relative to the second solution. The osmotic pressure associated with the fluid inside the blood cell is equivalent to that of 0.9% (mass/volume) sodium chloride solution called normal saline solution and it is safe to inject intravenously. Osmotic pressure is vital in daily life and nature. It helps in explain, why IV fluids match blood's osmotic pressure, its also the principle behind food preservation using salt or sugar.

Q125. CBSE 2026 · 4 marks Calculate the amount of CaCl_2 ($i = 2.59$) dissolved in 2.46 litre of water such that its osmotic pressure is 0.70 atm at 27°C . [Given: $R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$, molar mass of $\text{CaCl}_2 = 111 \text{ g mol}^{-1}$]

CASE STUDY · CBSE 2025

According to the generally accepted definition of the ideal solution there are equal interaction forces acting between molecules belonging to the same or different species. (This is equivalent to the statement that the activity of the components

equals the concentration.) Strictly speaking, this condition is fulfilled only in exceptional cases for mixtures (optical isomers, isotopic mixtures of an element, hydrocarbon mixtures). It is still usual to talk about ideal solutions as limiting cases in reality since very dilute solutions behave ideally with respect to the solvent. This view is further supported by the fact that Raoult's law empirically found for describing the behaviour of the solvent in dilute solutions can be deduced thermodynamically via the assumption of ideal behaviour of the solvent.

Q126. CBSE 2025 · 2 marks (a) Give one example of miscible liquid pair which shows negative deviation from Raoult's law. What is the reason for such deviation?

CASE STUDY · CBSE 2023

Rahul set-up an experiment to find resistance of aqueous KCl solution for different concentrations at 298 K using a conductivity cell connected to a Wheatstone bridge. He fed the Wheatstone bridge with a.c. power in the audio frequency range 550 to 5000 cycles per second. Once the resistance was calculated from null point he also calculated the conductivity K and molar conductivity Λ_m and recorded his readings in tabular form. S.No. Conc.(M) $k \text{ S cm}^{-1}$ $\Lambda_m \text{ S cm}^2 \text{ mol}^{-1}$. 1. 1.00 111.3 $\times 10^{-3}$ 111.3. 2. 0.10 12.9 $\times 10^{-3}$ 129.0. 3. 0.01 1.41 $\times 10^{-3}$ 141.0

Q127. CBSE 2023 · 1 mark Why does conductivity increase though the conductivity decrease with dilution?

2 Electrochemistry

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (60)

Q1. CBSE 2026 · 1 mark The standard electrode potentials of three metals A, B and C are, respectively, + 0.34 V, - 1.18 V and - 0.25 V. The correct order of reducing power of these metals is :

- (a) $B > C > A$ (b) $A > B > C$ (c) $C > B > A$ (d) $A > C > B$

Q2. CBSE 2026 · 1 mark What will happen during the electrolysis of aqueous solution of CuCl_2 by using platinum electrodes?

- (a) Cu will deposit at Anode
(b) H_2 gas will be released at cathode
(c) O_2 gas will be released at anode
(d) Cl_2 gas will be released at anode

Q3. CBSE 2026 · 1 mark How many Faradays are required to reduce 1 mol of $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} in acidic medium?

- (a) 2 (b) 3 (c) 6 (d) 4

Q4. CBSE 2026 · 1 mark How the conductivity varies on decreasing concentration for both weak and strong electrolytes ?

- (a) It increases for weak electrolyte and decreases for strong electrolyte.
(b) It decreases for weak electrolyte and increases for strong electrolyte.
(c) It increases for both weak and strong electrolytes.
(d) It decreases for both weak and strong electrolytes.

Q5. CBSE 2026 · 1 mark Consider the following reaction: $\text{Zn (s)} + \text{Ag}_2\text{O (s)} + \text{H}_2\text{O (l)} \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Ag (s)} + 2\text{OH}^{-}(\text{aq})$. Given: $E^\circ_{\text{Ag}^+/\text{Ag}} = 0.80 \text{ V}$, $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$. $\Delta_r G^\circ$ for the above reaction is:

- (a) - 301.080 kJ mol^{-1} (b) + 310.080 kJ mol^{-1}
(c) -326.070 kJ mol^{-1} (d) -375.060 kJ mol^{-1}

Q6. CBSE 2026 · 1 mark Consider the following reaction: $\text{Zn (s)} + \text{Ag}_2\text{O (s)} + \text{H}_2\text{O (l)} \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Ag (s)} + 2\text{OH}^{-}(\text{aq})$. Given: $E^\circ_{\text{Ag}^+/\text{Ag}} = 0.80 \text{ V}$, $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$. $\Delta_r G^\circ$ for the above reaction is:

- (a) - 301.080 kJ mol^{-1} (b) + 310.080 kJ mol^{-1}
(c) -326.070 kJ mol^{-1} (d) -375.060 kJ mol^{-1}

Q7. CBSE 2026 · 1 mark On electrolysis of very dilute aqueous solution of NaCl using platinum electrodes:

- (a) H_2 gas is evolved at anode.
(b) Na is produced at cathode.
(c) O_2 gas is evolved at anode.
(d) H_2 gas is evolved at cathode.

Q8. CBSE 2026 · 1 mark Consider the following cell at 298 K: $\text{Mg (s)} | \text{Mg}^{2+} (1.0 \text{ M}) || \text{Cu}^{2+} (1.0 \text{ M}) | \text{Cu (s)}$. How can we increase the emf of the cell using the same substances?

- (a) By decreasing only the $[\text{Mg}^{2+}]$ to 0.1 M
(b) By decreasing only the $[\text{Cu}^{2+}]$ to 0.1 M
(c) By increasing both $[\text{Mg}^{2+}]$ and $[\text{Cu}^{2+}]$ to 2.0 M
(d) By increasing only the $[\text{Mg}^{2+}]$ to 2.0 M



Q9. CBSE 2026 · 1 mark Assertion (A): $E^\circ \text{Cu}^{2+}/\text{Cu}$ has positive value (+ 0.34 V). Reason (R): It is due to low $\Delta_{\text{hyd}}H^\circ$ and high $\Delta_{\text{a}}H^\circ$.

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

Q10. CBSE 2026 · 1 mark Assertion (A): $E^\circ \text{Mn}^{2+}/\text{Mn}$ value is highly negative. Reason (R): Because Mn^{2+} is highly stable due to half-filled 3d5 configuration.

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

Q11. CBSE 2025 · 1 mark Kohlrausch gave the following relation for strong electrolytes at low concentration: $\Lambda_m = \Lambda_0 m - AC$. Which of the following equality holds true ?

- (a) $\Lambda_m = \Lambda_0 m$ as $C \rightarrow A$ (b) $\Lambda_m = \Lambda_0 m$ as $C \rightarrow 0$
 (c) $\Lambda_m = \Lambda_0 m$ as $C \rightarrow \infty$ (d) $\Lambda_m = \Lambda_0 m$ as $C \rightarrow 1$

Q12. CBSE 2025 · 1 mark $\Delta_r G^\circ$ and E_{cell} for a spontaneous reaction will respectively be

- (a) positive and positive (b) positive and negative
 (c) negative and positive (d) negative and negative

Q13. CBSE 2025 · 1 mark In an electrochemical cell, the following reaction takes place: $2\text{Cu}^+ (\text{aq}) + \text{Zn} (\text{s}) \rightarrow 2\text{Cu} (\text{s}) + \text{Zn}^{2+} (\text{aq})$, $E^\circ_{\text{cell}} = 1.28 \text{ V}$. As the reaction progresses, what will happen to the overall voltage of the cell?

- (a) Voltage will remain constant.
 (b) It will decrease as $[\text{Zn}^{2+}]$ increases.
 (c) It will increase as $[\text{Cu}^+]$ increases.
 (d) It will increase as $[\text{Zn}^{2+}]$ increases.

Q14. CBSE 2025 · 1 mark What amount of electric charge is required for the reduction of 1 mole of MnO_4^- into Mn^{2+} ?

- (a) 1 F (b) 5 F (c) 4 F (d) 6 F

Q15. CBSE 2025 · 1 mark Assertion (A): Electrolysis of aqueous NaCl gives H_2 at cathode and Cl_2 at anode. Reason (R): Chlorine has higher oxidation potential than H_2O .

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

Q16. CBSE 2025 · 1 mark The product of the oxidation of I^- with MnO_4^- in alkaline medium is:

- (a) IO_4^- (b) I_2 (c) IO^- (d) IO_3^-

Q17. CBSE 2025 · 1 mark In an electrochemical cell, the following reaction takes place: $2\text{Ag}^+ (\text{aq}) + \text{Mg} (\text{s}) \rightarrow 2\text{Ag} (\text{s}) + \text{Mg}^{2+} (\text{aq})$, $E_{\text{cell}} = 2.96 \text{ V}$. As the reaction progresses, what will happen to the overall voltage of the cell?

- (a) Voltage will remain constant.
 (b) It will decrease as $[\text{Mg}^{2+}]$ increases.
 (c) It will increase as $[\text{Ag}^+]$ increases.
 (d) It will increase as $[\text{Mg}^{2+}]$ increases.

Q18. CBSE 2025 · 1 mark What amount of electric charge is required for the oxidation of 1 mole of H_2O to O_2 ?

- (a) 1F (b) 2F (c) 3F (d) 4F

Q19. CBSE 2025 · 1 mark In an electrochemical cell, the following reaction takes place: $2\text{Cu}^+ (\text{aq}) + \text{Zn} (\text{s}) \rightarrow 2\text{Cu} (\text{s}) + \text{Zn}^{2+} (\text{aq})$ with $E^\circ_{\text{cell}} = 1.28 \text{ V}$. As the reaction progresses, what will happen to the overall voltage of the cell?

- (a) Voltage will remain constant.
 (b) It will decrease as $[\text{Zn}^{2+}]$ increases.
 (c) It will increase as $[\text{Cu}^+]$ increases.
 (d) It will increase as $[\text{Zn}^{2+}]$ increases.

Q20. CBSE 2025 · 1 mark What amount of electric charge is required for the oxidation of 1 mole of FeO to Fe_2O_3 ?

- (a) 1F (b) 2F (c) 3F (d) 4F

Q21. CBSE 2025 · 1 mark Match the type of cell given in Column I with their use given in Column II. Column I: i. Lead storage cell ii. Mercury cell iii. Dry cell iv. Fuel cell Column II: a. Wall clock b. Apollo Space Programme c. Wrist watch d. Inverter

- (a) i-a, ii-b, iii-c, iv-d (b) i-d, ii-c, iii-a, iv-b
 (c) i-c, ii-d, iii-b, iv-a (d) i-b, ii-a, iii-d, iv-c

Q22. CBSE 2025 · 1 mark Assertion (A): For measuring resistance of an ionic solution an AC source is used. Reason (R): Concentration of ionic solution will change if DC source is used.

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

Q23. CBSE 2025 · 1 mark While doing qualitative analysis in chemistry lab, Abhishek added yellow coloured potassium chromate solution into a test tube. He was surprised to see the colour of the solution changing immediately to orange. He realised that the test tube was not clean and contained a few drops of some liquid. Which of the following substances will be the most likely liquid to be present in the test tube before adding potassium chromate solution?

- (a) Sodium hydrogen carbonate solution
 (b) Methyl orange solution (c) Sodium hydroxide solution
 (d) HCl solution

Q24. CBSE 2025 · 1 mark Which of the following cell converts the energy of combustion of fuel into electrical energy ?

- (a) Mercury cell (b) Fuel cell (c) Dry cell
 (d) Lead storage cell



Q25. CBSE 2025 · 1 mark A galvanic cell can behave like an electrolytic cell when

- (a) $E_{\text{cell}} = E_{\text{ext}}$ (b) $E_{\text{ext}} > E_{\text{cell}}$ (c) $E_{\text{cell}} > E_{\text{ext}}$
(d) $E_{\text{cell}} = 0$

Q26. CBSE 2025 · 1 mark We cannot measure the resistance of an ionic solution using DC because:

- (a) it changes the composition of the solution.
(b) it can cause sparks and shocks.
(c) it does not affect the composition of the solution.
(d) it converts electrolytic cell to galvanic cell.

Q27. CBSE 2025 · 1 mark During electrolysis of dilute H_2SO_4 , using platinum electrodes, the gas evolved at the anode is :

- (a) H_2 gas (b) O_2 gas (c) SO_2 gas (d) SO_3 gas

Q28. CBSE 2025 · 1 mark Kohlrausch gave the following relation for strong electrolytes: $\Lambda_m = \Lambda^\circ_m - A\sqrt{C}$. Which of the following equality holds true ?

- (a) $\Lambda_m = \Lambda^\circ_m$ as $C \rightarrow 1$ (b) $\Lambda_m = \Lambda^\circ_m$ as $C \rightarrow 0$
(c) $\Lambda_m = \Lambda^\circ_m$ as $C \rightarrow \infty$ (d) $\Lambda_m = \Lambda^\circ_m$ as $C \rightarrow A$

Q29. CBSE 2025 · 1 mark A conductivity cell usually consists of two:

- (a) Copper electrodes (b) Platinum electrodes
(c) Zinc electrodes (d) Iron electrodes

Q30. CBSE 2024 · 1 mark The equilibrium $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$ exists in:

- (a) basic medium (b) acidic medium (c) neutral medium
(d) does not exist

Q31. CBSE 2024 · 1 mark During electrolysis of aqueous solution of NaCl :

- (a) H_2 (g) is liberated at cathode
(b) Na is formed at cathode (c) O_2 (g) is liberated at anode
(d) Cl_2 (g) is liberated at cathode

Q32. CBSE 2024 · 1 mark The product of oxidation of SO_3^{2-} with MnO_4^- in acidic medium is:

- (a) SO_2 (b) SO_4^{2-} (c) S_2 (d) $\text{S}_2\text{O}_3^{2-}$

Q33. CBSE 2024 · 1 mark During electrolysis of aqueous CuCl_2 :

- (a) H_2 (g) is liberated at cathode
(b) Cu is formed at cathode (c) O_2 (g) is liberated at anode
(d) Cl_2 (g) is liberated at cathode

Q34. CBSE 2024 · 1 mark The unit of cell constant is:

- (a) ohm cm^{-1} (b) ohm^{-1} (c) cm^{-1} (d) $\text{ohm}^{-1} \text{cm}^2 \text{mol}^{-1}$

Q35. CBSE 2024 · 1 mark During the electrolysis of aqueous NaCl , the cathodic reaction is :

- (a) Oxidation of Cl ion (b) Reduction of Na^+ ion
(c) Oxidation of H_2O (d) Reduction of H_2O

Q36. CBSE 2024 · 1 mark Which of the following is a secondary cell?

- (a) Dry cell (b) Lead storage cell (c) Mercury cell
(d) Daniell cell

Q37. CBSE 2024 · 1 mark Which of the following cells is used in hearing aids?

- (a) Dry cell (b) Mercury cell (c) Nickel-cadmium cell
(d) Fuel cell

Q38. CBSE 2023 · 1 mark The correct cell to represent the following reaction is: $\text{Zn} + 2\text{Ag}^+ \rightarrow \text{Zn}^{2+} + 2\text{Ag}$

- (a) $2\text{Ag} | \text{Ag}^+ || \text{Zn} || \text{Zn}^{2+}$ (b) $\text{Ag}^+ | \text{Ag} || \text{Zn}^{2+} | \text{Zn}$
(c) $\text{Ag} | \text{Ag}^+ || \text{Zn} | \text{Zn}^{2+}$ (d) $\text{Zn} | \text{Zn}^{2+} || \text{Ag}^+ | \text{Ag}$

Q39. CBSE 2023 · 1 mark ΔG and E_{cell} for a spontaneous reaction will be:

- (a) positive, negative (b) negative, negative
(c) negative, positive (d) positive, positive

Q40. CBSE 2023 · 1 mark $\text{Ag}^+ (\text{aq}) + \text{e}^- \rightarrow \text{Ag} (\text{s})$ $E^\circ = +0.80 \text{ V}$ $\text{Fe}^{2+} (\text{aq}) + 2\text{e}^- \rightarrow \text{Fe} (\text{s})$ $E^\circ = -0.44 \text{ V}$ Find the cell E° for: $\text{Fe} (\text{s}) + 2\text{Ag}^+ (\text{aq}) \rightarrow \text{Fe}^{2+} (\text{aq}) + 2\text{Ag} (\text{s})$

- (a) 1.6 V (b) 1.16 V (c) 2.04 V (d) 1.24 V

Q41. CBSE 2023 · 1 mark Which of the following solutions of KCl will have the highest value of molar conductivity?

- (a) 0.01 M (b) 1 M (c) 0.5 M (d) 0.1 M

Q42. CBSE 2023 · 1 mark Assertion (A): Conductivity decreases with decrease in concentration of electrolyte. Reason (R): Number of ions per unit volume that carry the current in a solution decreases on dilution.

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

Q43. CBSE 2023 · 1 mark Which of the following relations is incorrect?

- (a) $R = 1/(k \times l/a)$ (b) $G = k \times a/l$ (c) $G = k \times l/a$
(d) $m = k/c$

Q44. CBSE 2023 · 1 mark Assertion (A): Molar conductivity decreases with increase in concentration. Reason (R): When concentration approaches zero, the molar conductivity is known as limiting molar conductivity.

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

Q45. CBSE 2023 · 1 mark Assertion (A): Electrolysis of aqueous solution of NaCl gives chlorine gas at anode instead of oxygen gas. Reason (R): Formation of oxygen gas at anode requires overpotential.

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



Q46. CBSE 2023 · 1 mark Kohlrausch gave the following relation for strong electrolyte: $\Lambda = \Lambda_0 - A\sqrt{C}$. Which of the following equality holds true?

- (a) $\Lambda_0 = \Lambda$ as $C \rightarrow A$ (b) $\Lambda_0 = \Lambda$ as $C \rightarrow 0$
(c) $\Lambda_0 = \Lambda$ as $C \rightarrow \infty$ (d) $\Lambda_0 = \Lambda$ as $C \rightarrow 1$

Q47. CBSE 2023 · 1 mark KMnO_4 acts as an oxidising agent in alkaline medium. When alkaline KMnO_4 is treated with KI, iodide ion is oxidised to:

- (a) I_2 (b) IO^- (c) IO_3^- (d) IO_4^-

Q48. CBSE 2023 · 1 mark The cathode reaction during the charging of a lead storage battery leads to the:

- (a) formation of PbSO_4 (b) reduction of Pb^{2+} to Pb^{4+}
(c) formation of PbO_2 and Pb
(d) deposition of Pb at the anode

Q49. CBSE 2023 · 1 mark How many Faradays are required to reduce 1 mol of MnO_4^- to Mn^{2+} ?

- (a) 4 (b) 3 (c) 6 (d) 5

Q50. CBSE 2023 · 1 mark Assertion (A): λ_m for weak electrolytes shows a sharp decrease when the electrolytic solution is diluted. Reason (R): For weak electrolytes, degree of dissociation increases with dilution of solution.

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

Q51. CBSE 2023 · 1 mark The number of faradays passed through a solution of CuSO_4 to produce 1 mol of Cu and O_2 will be:

- (a) 10 (b) 40 (c) 80 (d) 20

Q52. CBSE 2023 · 1 mark Assertion (A): λ_m for weak electrolytes shows a sharp increase when the electrolytic solution is diluted. Reason (R): For weak electrolytes, degree of dissociation decreases with dilution of solution.

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

Q53. CBSE 2023 · 1 mark Corrosion of iron is:

- (a) a decomposition process (b) a photochemical process
(c) an electrochemical process (d) a reduction process

Q54. CBSE 2023 · 1 mark Assertion (A): Limiting molar conductivity (Λ_m) is obtained by the extrapolation of the Λ_m versus $C^{1/2}$ curve of strong electrolyte. Reason (R): Λ_m for weak electrolytes is obtained by using Kohlrausch law.

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

Q55. CBSE 2023 · 1 mark Assertion (A): $\text{Cu}/2\text{Cu}^+ \text{E}^\circ$ is positive (+0.34 V). Reason (R): Copper has high $\Delta_{\text{hyd}} H$ and low $\Delta_{\text{hydr}} H$.

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

Q56. CBSE 2023 · 1 mark A voltaic cell is made by connecting two half cells represented by half equations below: $\text{Sn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Sn}(\text{s})$ $E = -0.14 \text{ V}$; $\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$ $E = +0.77 \text{ V}$. Which statement is correct about this voltaic cell?

- (a) Fe^{2+} is oxidised and the voltage of the cell is -0.91 V
(b) Sn is oxidised and the voltage of the cell is 0.91 V
(c) Fe^{2+} is oxidised and the voltage of the cell is 0.91 V
(d) Sn is oxidised and the voltage of the cell is 0.63 V

Q57. CBSE 2023 · 1 mark Which of the following cell was used in Apollo space programme?

- (a) Mercury cell (b) Daniel cell (c) $\text{H}_2\text{-O}_2$ Fuel cell
(d) Dry cell

Q58. CBSE 2023 · 1 mark Consider the following standard electrode potential values: $\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$ $E = +0.77 \text{ V}$ and $\text{MnO}_4^-(\text{aq}) + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l})$ $E = +1.51 \text{ V}$. What is the cell potential for the redox reaction?

- (a) -2.28 V (b) -0.74 V (c) $+0.74 \text{ V}$ (d) $+2.28 \text{ V}$

Q59. CBSE 2023 · 1 mark A voltaic cell is made by connecting two half cells represented by half equations below: $\text{Sn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Sn}(\text{s})$ $E = -0.14 \text{ V}$ and $\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$ $E = +0.77 \text{ V}$. Which statement is correct about this voltaic cell?

- (a) Fe^{2+} is oxidised and the voltage of the cell is -0.91 V
(b) Sn is oxidised and the voltage of the cell is 0.91 V
(c) Fe^{2+} is oxidised and the voltage of the cell is 0.91 V
(d) Sn is oxidised and the voltage of the cell is 0.63 V

Q60. CBSE 2023 · 1 mark Consider the following standard electrode potential values: $\text{Sn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Sn}(\text{s})$ $E = -0.14 \text{ V}$ and $\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$ $E = +0.77 \text{ V}$. What is the cell reaction and potential for the spontaneous reaction that occurs?

- (a) $2\text{Fe}^{2+}(\text{aq}) + \text{Sn}^{2+}(\text{aq}) \rightarrow 2\text{Fe}^{3+}(\text{aq}) + \text{Sn}(\text{s})$ $E = -0.91 \text{ V}$
(b) $2\text{Fe}^{3+}(\text{aq}) + \text{Sn}(\text{s}) \rightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{Sn}^{2+}(\text{aq})$ $E = +0.91 \text{ V}$
(c) $2\text{Fe}^{2+}(\text{aq}) + \text{Sn}^{2+}(\text{aq}) \rightarrow 2\text{Fe}^{3+}(\text{aq}) + \text{Sn}(\text{s})$ $E = +0.91 \text{ V}$
(d) $2\text{Fe}^{3+}(\text{aq}) + \text{Sn}(\text{s}) \rightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{Sn}^{2+}(\text{aq})$ $E = +1.68 \text{ V}$



VERY SHORT ANSWER (26)

Q61. CBSE 2026 · 2 marks (a) Name the cell which was used in the Apollo space programme for providing electrical power. (b) Define limiting molar conductivity.

Q62. CBSE 2026 · 2 marks (a) Name any two materials other than hydrogen that can be used as fuel in fuel cells. (b) Define molar conductivity.

Q63. CBSE 2026 · 2 marks (a) Name the cell used in hearing aids and watches. (b) Define conductivity. Why is direct current (DC) not used for the measurement of resistance of an ionic solution?

Q64. CBSE 2025 · 2 marks (a) Why does the cell potential of mercury cell remains constant throughout its life? (b) Calculate the degree of dissociation (α) of CH_3COOH if Λ_m and Λ_m^∞ of CH_3COOH are $50 \text{ S cm}^2 \text{ mol}^{-1}$ and $400 \text{ S cm}^2 \text{ mol}^{-1}$ respectively.

Q65. CBSE 2025 · 2 marks Using the E° values of P and Q, predict which one is better for coating the surface of iron [$E^\circ(\text{Fe}^{2+} \rightarrow \text{Fe}) = -0.44 \text{ V}$] to prevent corrosion and why? $E^\circ(\text{P}^{2+} \rightarrow \text{P}) = -2.37 \text{ V}$, $E^\circ(\text{Q}^{2+} \rightarrow \text{Q}) = -0.14 \text{ V}$

Q66. CBSE 2025 · 2 marks Define fuel cell. Give two advantages of fuel cell over ordinary cell.

Q67. CBSE 2025 · 2 marks Name and define the cell which was used for providing electric power in the Apollo space programme. Also write its one advantage.

Q68. CBSE 2025 · 2 marks Based on the data given: Concentration of KCl solution in mol/L (1.000, 0.100, 0.010), Conductivity at 298.15 K in S cm^{-1} (0.1113, 0.0129, 0.00141), Molar Conductivity at 298.15 K in $\text{S cm}^2 \text{ mol}^{-1}$ (111.3, 129.0, 141.0). Give plausible reason for the variation of conductivity and molar conductivity with concentration.

Q69. CBSE 2024 · 2 marks Calculate the potential of Iron electrode in which the concentration of Fe^{2+} ion is 0.01 M. ($E^\circ(\text{Fe}^{2+}/\text{Fe}) = -0.45 \text{ V}$ at 298 K) [Given: $\log 10 = 1$]

Q70. CBSE 2024 · 2 marks Calculate the potential of Iron electrode in which the concentration of Fe^{2+} ion is 0.01 M. ($E^\circ(\text{Fe}^{2+}/\text{Fe}) = -0.45 \text{ V}$ at 298 K) [Given: $\log 10 = 1$]

Q71. CBSE 2023 · 2 marks What is meant by conductivity? Give an application.

Q72. CBSE 2023 · 2 marks On diluting two electrolytes A and B 5 times, the molar conductivity of A becomes 25 while that of B is 1.5. Which of the two electrolytes is strong? Justify your answer graphically.

Q73. CBSE 2023 · 2 marks Complete the following equations: (a) $4\text{MnO}_2 + 2\text{NO}_5 + 6\text{H}^+ \rightarrow$ (b) $\text{Cr}_2\text{O}_7 + 14\text{H}^+ + 6\text{e}^- \rightarrow$

Q74. CBSE 2023 · 2 marks (a) The E° value for the $\text{Mn}^{3+}/\text{Mn}^{2+}$ couple is much more positive than that for $\text{Cr}^{3+}/\text{Cr}^{2+}$ couple or $\text{Fe}^{3+}/\text{Fe}^{2+}$ couple. How would you account for this? (b) Complete the following equation: $4\text{MnO}_2 + 16\text{H}^+ + 24\text{e}^- \rightarrow 2\text{O}_2\text{C}_5\ldots$

Q75. CBSE 2023 · 2 marks (a) On diluting two electrolytes A and B their λ_m values are $5 \text{ S cm}^2 \text{ mol}^{-1}$ and $1.5 \text{ S cm}^2 \text{ mol}^{-1}$ respectively. Which of the two electrolytes is strong? Justify your answer graphically. OR (b) The electrical resistance of a column of 0.05 mol L^{-1} NaOH solution of diameter 1 cm and length 50 cm is $5.55 \times 10^{-3} \text{ ohm}$. Calculate the conductivity.

Q76. CBSE 2023 · 2 marks (a) Calculate $\Delta_r G$ for the cell reaction at 25°C : $\text{Zn} | \text{Zn}^{2+} || \text{Cd}^{2+} | \text{Cd}$. Given that: $E^\circ(\text{Zn}/2\text{Zn}) = -0.76 \text{ V}$, $E^\circ(\text{Cd}/2\text{Cd}) = -0.40 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$. OR (b) The electrical resistance of a column of 0.05 mol L^{-1} NaOH solution of diameter 1 cm and length 50 cm is $5.55 \times 10^{-3} \text{ ohm}$. Calculate the conductivity.

Q77. CBSE 2023 · 2 marks Complete the following equations: (a) $4\text{MnO}_2 + 2\text{NO}_3^- + 6\text{H}^+ \rightarrow$ (b) $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow$

Q78. CBSE 2023 · 2 marks Give reasons: (i) Mercury cell delivers a constant potential during its life time. (ii) In the experimental determination of electrolytic conductance, Direct Current (DC) is not used.

Q79. CBSE 2023 · 2 marks (a) Give reasons: (i) Mercury cell delivers a constant potential during its life time. (ii) In the experimental determination of electrolytic conductance, Direct Current (DC) is not used. OR (b) Define fuel cell with an example. What advantages do the fuel cells have over primary and secondary batteries?

Q80. CBSE 2023 · 2 marks Define fuel cell and write its two advantages.

Q81. CBSE 2023 · 2 marks Name the cell which: (a) was used in Apollo Space programme. (b) is used in automobiles and inverters. (c) is suitable for hearing aids and watches. (d) does not give a steady potential and is used in transistors.

Q82. CBSE 2023 · 2 marks (a) (i) What should be the signs (positive/negative) for E_{cell} and ΔG for a spontaneous redox reaction occurring under standard conditions? (ii) State Faraday's first law of electrolysis.

Q83. CBSE 2023 · 2 marks (a)(i) What should be the signs (positive/negative) for E_{cell} and G for a spontaneous redox reaction occurring under standard conditions?

Q84. CBSE 2022 · 2 marks Define molar conductivity for the solution of an electrolyte. How does it vary with concentration?

Q85. CBSE 2022 · 2 marks The resistance and conductivity of a conductivity cell containing 0.001 M KCl solution at 298 K are 1200Ω and $1.5 \times 10^{-4} \text{ S cm}^{-1}$. Calculate its cell constant and molar conductivity.

Q86. CBSE 2022 · 2 marks In a plot of m against the square root of concentration ($C^{1/2}$) for strong and weak electrolyte, the value of limiting molar conductivity of a weak electrolyte cannot be obtained graphically. Suggest a way to obtain this value. Also state the related law, if any.

SHORT ANSWER (29)

Q87. CBSE 2026 · 3 marks Define conductivity and molar conductivity for a solution of an electrolyte. Why does the conductivity of a solution decrease with decrease in concentration?



Q88. CBSE 2026 · 3 marks Answer the following: (i) Why is the Equilibrium Constant (Kc) related to E°_{cell} and not to E_{cell} ? (ii) Two metals 'A' and 'B' have standard electrode potential values of -0.24 V and $+0.80$ V respectively. Which of these will liberate hydrogen gas from dil. H_2SO_4 ? (iii) Write the cell reaction which occurs in lead storage battery when it is in charging.

Q89. CBSE 2026 · 3 marks Calculate emf of the following cell at 298 K: $\text{Sn} | \text{Sn}^{2+} (0.001 \text{ M}) || \text{H}^+ (0.01 \text{ M}) | \text{H}_2(\text{g}) (1 \text{ bar}) | \text{Pt}(\text{s})$. Given: $E^\circ_{\text{Sn}^{2+}/\text{Sn}} = -0.14$ V, $E^\circ_{\text{H}^+/\text{H}_2} = 0.00$ V [$\log 10 = 1$]

Q90. CBSE 2026 · 3 marks Calculate emf of the following cell at 298 K: $\text{Sn} | \text{Sn}^{2+} (0.001 \text{ M}) || \text{H}^+ (0.01 \text{ M}) | \text{H}_2(\text{g}) (1 \text{ bar}) | \text{Pt}(\text{s})$. Given: $E^\circ_{\text{Sn}^{2+}/\text{Sn}} = -0.14$ V, $E^\circ_{\text{H}^+/\text{H}_2} = 0.00$ V [$\log 10 = 1$]

Q91. CBSE 2026 · 3 marks State Kohlrausch's law of independent migration of ions. With the help of a curve, explain why it is not easy to determine λ_m for weak electrolytes by extrapolating the concentration – molar conductivity curve, as it is for strong electrolytes.

Q92. CBSE 2026 · 3 marks Answer the following questions: (a) Why is direct current (DC) not used to measure the resistance of an ionic solution? (b) Why are the products of electrolysis different for the electrolysis of aqueous solution of AgNO_3 with silver electrodes and electrolysis of aqueous solution of AgNO_3 with platinum electrodes? (c) Why are magnesium blocks fixed to the iron pipelines carrying water?

Q93. CBSE 2026 · 3 marks (a) Why is direct current (DC) not used to measure the resistance of an ionic solution? (b) Why are the products of electrolysis different for the electrolysis of aqueous solution of AgNO_3 with silver electrodes and electrolysis of aqueous solution of AgNO_3 with platinum electrodes? (c) Why are magnesium blocks fixed to the iron pipelines carrying water?

Q94. CBSE 2026 · 3 marks Calculate emf of the following cell at 298 K: $\text{Cr}(\text{s}) | \text{Cr}^{3+}(\text{aq}) (0.1 \text{ M}) || \text{Fe}^{2+}(\text{aq}) (0.01 \text{ M}) | \text{Fe}(\text{s})$ (Given: $E^\circ_{\text{Cr}^{3+}/\text{Cr}} = -0.74$ V, $E^\circ_{\text{Fe}^{2+}/\text{Fe}} = -0.44$ V, [$\log 10 = 1$])

Q95. CBSE 2026 · 3 marks Calculate emf of the following cell at 298 K: $\text{Al}(\text{s}) | \text{Al}^{3+}(\text{aq}) (0.1 \text{ M}) || \text{Ni}^{2+}(\text{aq}) (0.01 \text{ M}) | \text{Ni}(\text{s})$. (Given: $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25$ V, $E^\circ_{\text{Al}^{3+}/\text{Al}} = -1.66$ V, [$\log 10 = 1$])

Q96. CBSE 2026 · 3 marks Calculate emf of the following cell at 298 K: $\text{Zn}(\text{s}) | \text{Zn}^{2+}(\text{aq}) (0.1 \text{ M}) || \text{Ag}^+(\text{aq}) (0.01 \text{ M}) | \text{Ag}(\text{s})$ (Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76$ V, $E^\circ_{\text{Ag}^+/\text{Ag}} = +0.80$ V, [$\log 10 = 1$])

Q97. CBSE 2025 · 3 marks Calculate $\Delta_r G^\circ$ and $\log K_C$ for the following cell at 25°C : $\text{Zn} | \text{Zn}^{2+} || \text{Cd}^{2+} | \text{Cd}$ Given that: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76$ V, $E^\circ_{\text{Cd}^{2+}/\text{Cd}} = -0.40$ V $1 \text{ F} = 96500 \text{ C mol}^{-1}$.

Q98. CBSE 2025 · 3 marks Calculate the cell voltage of the voltaic cell which is set up by joining following half-cells at 25°C : $\text{Al} / \text{Al}^{3+} (0.001 \text{ M})$ and $\text{Ni} / \text{Ni}^{2+} (0.1 \text{ M})$. Given: $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25$ V, $E^\circ_{\text{Al}^{3+}/\text{Al}} = -1.66$ V

Q99. CBSE 2025 · 3 marks Calculate the cell voltage of the voltaic cell which is set up by joining the following half-cells at 25°C : $\text{Al} / \text{Al}^{3+} (0.001 \text{ M})$ and $\text{Ni} / \text{Ni}^{2+} (0.001 \text{ M})$. Given: $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25$ V, $E^\circ_{\text{Al}^{3+}/\text{Al}} = -1.66$ V

Q100. CBSE 2025 · 3 marks Calculate the cell voltage of the voltaic cell which is set up by joining the following half-cells at 25°C : $\text{Al} / \text{Al}^{3+} (0.002 \text{ M})$ and $\text{Ni} / \text{Ni}^{2+} (0.002 \text{ M})$. Given: $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25$ V, $E^\circ_{\text{Al}^{3+}/\text{Al}} = -1.66$ V, $\log 5 = 0.6990$

Q101. CBSE 2025 · 3 marks Give reasons for the following: (a) The pH of aqueous NaCl increases when it is electrolysed. (b) Unlike dry cell, mercury cell has a constant cell potential through its lifetime. (c) Conductivity of solution decreases with dilution.

Q102. CBSE 2025 · 3 marks Write the name of the cell which is generally used in inverters. Write the reactions taking place at anode and cathode of this cell, when it is in use.

Q103. CBSE 2025 · 3 marks (a) Write the name of the cell which is generally used in inverters. Write the reactions taking place at anode and cathode of this cell, when it is in use. OR (b) Explain why electrolysis of an aqueous solution of NaCl gives H_2 gas at cathode and Cl_2 gas at anode? Write overall reaction. (Given: $E^\circ_{\text{Na}^+/\text{Na}} = -2.71$ V, $E^\circ_{\text{H}_2\text{O}/\text{H}_2} = -0.83$ V, $E^\circ_{\text{Cl}_2/2\text{Cl}^-} = +1.36$ V, $E^\circ_{\text{O}_2/\text{H}_2\text{O}} = +1.23$ V)

Q104. CBSE 2024 · 3 marks When a certain conductivity cell was filled with 0.05 M KCl solution, it has a resistance of 100 ohm at 25°C . When the same cell was filled with 0.02 M AgNO_3 solution, the resistance was 90 ohm . Calculate the conductivity and molar conductivity of AgNO_3 solution. (Given: Conductivity of 0.05 M KCl solution = $1.35 \times 10^{-2} \text{ ohm}^{-1}\text{cm}^{-1}$)

Q105. CBSE 2024 · 3 marks When a certain conductivity cell was filled with 0.05 M KCl solution, it has a resistance of 100 ohm at 25°C . When the same cell was filled with 0.02 M AgNO_3 solution, the resistance was 90 ohm . Calculate the conductivity and molar conductivity of AgNO_3 solution. (Given: Conductivity of 0.05 M KCl solution = $1.35 \times 10^{-2} \text{ ohm}^{-1}\text{cm}^{-1}$)

Q106. CBSE 2024 · 3 marks Calculate emf of the following cell: $\text{Zn}(\text{s}) | \text{Zn}^{2+} (0.1 \text{ M}) || \text{Sn}^{2+} (0.001 \text{ M}) | \text{Sn}(\text{s})$ [$\log 10 = 1$]

Q107. CBSE 2024 · 3 marks The conductivity of 0.2 M solution of KCl is $2.48 \times 10^{-2} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation (α). Given: $\lambda^\circ_{\text{K}} = 73.5 \text{ S cm}^2 \text{ mol}^{-1}$, $\lambda^\circ_{\text{Cl}} = 76.5 \text{ S cm}^2 \text{ mol}^{-1}$

Q108. CBSE 2024 · 3 marks The conductivity of 0.2 M solution of KCl is $2.48 \times 10^{-2} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation (α). Given: $\lambda^\circ_{\text{K}} = 73.5 \text{ S cm}^2 \text{ mol}^{-1}$, $\lambda^\circ_{\text{Cl}} = 76.5 \text{ S cm}^2 \text{ mol}^{-1}$

Q109. CBSE 2024 · 3 marks The conductivity of 0.2 M solution of KCl is $2.48 \times 10^{-2} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation (α). Given: $\lambda^\circ_{\text{K}} = 73.5 \text{ S cm}^2 \text{ mol}^{-1}$ and $\lambda^\circ_{\text{Cl}} = 76.5 \text{ S cm}^2 \text{ mol}^{-1}$

Q110. CBSE 2022 · 2 marks Calculate the degree of dissociation (α) of CH_3COOH if Λ_m and Λ°_m of CH_3COOH are $48 \text{ S cm}^2 \text{ mol}^{-1}$ and $400 \text{ S cm}^2 \text{ mol}^{-1}$ respectively.

Q111. CBSE 2022 · 3 marks Calculate the emf of the following cell: $\text{Zn}(\text{s}) | \text{Zn}^{2+} (0.01 \text{ M}) || (0.001 \text{ M}) \text{Ag}^+ | \text{Ag}(\text{s})$ Given: $E^\circ_{\text{Zn}/\text{Zn}^{2+}} = -0.76$ V and $E^\circ_{\text{Ag}/\text{Ag}^+} = +0.80$ V [$\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 10 = 1$]



Q112. CBSE 2022 · 3 marks Calculate the emf of the following cell : $\text{Zn (s)}|\text{Zn}^{2+} (0.01 \text{ M})||\text{Ag}^+ (0.001 \text{ M})|\text{Ag (s)}$ Given : $E^\circ(\text{Zn}/\text{Zn}^{2+}) = -0.76 \text{ V}$ and $E^\circ(\text{Ag}/\text{Ag}^+) = +0.80 \text{ V}$ [$\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 10 = 1$]

Q113. CBSE 2022 · 3 marks Write the Nernst equation and calculate emf of the following cell at 298 K: $\text{Cr}|\text{Cr}^{3+} (0.1 \text{ M})||\text{Fe}^{2+} (0.01 \text{ M})|\text{Fe}$ Given: Cr^{3+}/Cr $E^\circ = -0.75 \text{ V}$; Fe^{2+}/Fe $E^\circ = -0.45 \text{ V}$ ($\log 10 = 1$)

Q114. CBSE 2022 · 3 marks Write the Nernst equation and calculate the emf of the following cell at 298 K: $\text{Zn}|\text{Zn}^{2+} (0.001 \text{ M})||\text{H}^+ (0.01 \text{ M})|\text{H}_2 (\text{g}) (1 \text{ bar})|\text{Pt (s)}$ Given: Zn^{2+}/Zn $E^\circ = -0.76 \text{ V}$, $2\text{H}^+/\text{H}_2$ $E^\circ = 0.00 \text{ V}$ [$\log 10 = 1$]

Q115. CBSE 2022 · 3 marks Write the Nernst equation and calculate the emf of the following cell at 298 K: $\text{Zn}|\text{Zn}^{2+} (0.1 \text{ M})||\text{Cd}^{2+} (0.01 \text{ M})|\text{Cd}$ Given: $\text{E}^\circ\text{Zn}^{2+}/\text{Zn} = -0.76 \text{ V}$, $\text{E}^\circ\text{Cd}^{2+}/\text{Cd} = -0.40 \text{ V}$ ($\log 10 = 1$)

LONG ANSWER (36)

Q116. CBSE 2026 · 5 marks Write the Nernst equation and calculate the emf of the following cell at 298 K : $\text{Mg (s)}|\text{Mg}^{2+} (0.001 \text{ M})||\text{Cu}^{2+} (0.0001 \text{ M})|\text{Cu (s)}$ Given : $\text{E}^\circ\text{Mg}^{2+}/\text{Mg} = -2.36 \text{ V}$, $\text{E}^\circ\text{Cu}^{2+}/\text{Cu} = +0.34 \text{ V}$ [$\log 10 = 1$]

Q117. CBSE 2026 · 5 marks From the given data of E values, answer the following questions: $\text{E}^\circ(\text{M}^{2+}/\text{M})$ V: Cr -1.18, Mn -0.91, Fe -1.18, Co -0.44, Ni -0.28, Cu -0.25, Cu +0.34. (I) Why $\text{E}^\circ(\text{M}^{2+}/\text{M})$ show irregular trend in the above values? (II) Why is $\text{E}^\circ(\text{Cu}^{2+}/\text{Cu})$ value exceptionally positive? (III) Why $\text{E}^\circ(\text{Mn}^{2+}/\text{Mn})$ value is highly negative?

Q118. CBSE 2026 · 5 marks Calculate emf and ΔG for the following cell at 298 K: $\text{Mg(s)} / \text{Mg}^{2+}(0.01 \text{ M}) // \text{Ag}^+(0.001 \text{ M}) / \text{Ag(s)}$. Given: $\text{E}^\circ(\text{Mg}^{2+}/\text{Mg}) = -2.37 \text{ V}$, $\text{E}^\circ(\text{Ag}^+/\text{Ag}) = +0.80 \text{ V}$. [$1 \text{ F} = 96500 \text{ C mol}^{-1}$, $\log 10 = 1$]

Q119. CBSE 2026 · 5 marks Calculate emf and ΔG for the following cell at 298 K: $\text{Mg(s)} / \text{Mg}^{2+}(0.01 \text{ M}) // \text{Ag}^+(0.001 \text{ M}) / \text{Ag(s)}$. Given: $\text{E}^\circ(\text{Mg}^{2+}/\text{Mg}) = -2.37 \text{ V}$, $\text{E}^\circ(\text{Ag}^+/\text{Ag}) = +0.80 \text{ V}$ [Note: $1 \text{ F} = 96500 \text{ C mol}^{-1}$, $\log 10 = 1$]

Q120. CBSE 2026 · 5 marks The conductivity of 0.1 mol L⁻¹ solution of NaCl is $1.06 \times 10^{-2} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation. (Given: $\lambda^\circ(\text{Na}^+) = 50.1 \text{ S cm}^2 \text{ mol}^{-1}$, $\lambda^\circ(\text{Cl}^-) = 76.5 \text{ S cm}^2 \text{ mol}^{-1}$). Following cell reaction occurs in a galvanic cell: $2\text{Ag}^+(\text{aq}) + \text{Zn(s)} \rightarrow 2\text{Ag(s)} + \text{Zn}^{2+}(\text{aq})$ $\text{E}^\circ(\text{cell}) = +1.56 \text{ V}$. Predict the direction of flow of current. Differentiate between a primary battery and a secondary battery.

Q121. CBSE 2026 · 5 marks (a) The conductivity of 0.1 mol L⁻¹ solution of NaCl is $1.06 \times 10^{-2} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation. $\lambda^\circ\text{Na}^+ = 50.1 \text{ S cm}^2 \text{ mol}^{-1}$, $\lambda^\circ\text{Cl}^- = 76.5 \text{ S cm}^2 \text{ mol}^{-1}$ (b) (i) Following cell reaction occurs in a galvanic cell : $2\text{Ag}^+(\text{aq}) + \text{Zn(s)} \rightarrow 2\text{Ag(s)} + \text{Zn}^{2+}(\text{aq})$ $\text{E}^\circ(\text{cell}) = +1.56 \text{ V}$. Predict the direction of flow of current. (ii) Differentiate between a primary battery and a secondary battery.

Q122. CBSE 2026 · 5 marks (a) The conductivity of 0.1 mol L⁻¹ solution of NaCl is $1.06 \times 10^{-2} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation. (Given: $\lambda^\circ\text{Na}^+ = 50.1 \text{ S cm}^2 \text{ mol}^{-1}$, $\lambda^\circ\text{Cl}^- = 76.5 \text{ S cm}^2 \text{ mol}^{-1}$) (b) (i) Following cell reaction occurs in a galvanic cell: $2\text{Ag}^+(\text{aq}) + \text{Zn(s)} \rightarrow 2\text{Ag(s)} + \text{Zn}^{2+}(\text{aq})$ $\text{E}^\circ(\text{cell}) = +1.56 \text{ V}$. Predict the direction of flow of current. (ii) Differentiate between a primary battery and a secondary battery.

Q123. CBSE 2026 · 5 marks Calculate the electrode potential of a half-cell for zinc electrode dipping in 0.01 M ZnSO₄ solution at 25°C. Given: $\text{E}^\circ(\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V}$ [$\log 10 = 1$]. Write anode, cathode and overall reaction involved in dry cell. Equilibrium constant (K_c) is related to $\text{E}^\circ\text{cell}$, but not to E_{cell} . Why?

Q124. CBSE 2026 · 5 marks (a) (i) Calculate the electrode potential of a half-cell for zinc electrode dipping in 0.01 M ZnSO₄ solution at 25°C. Given: $\text{E}^\circ(\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V}$ [$\log 10 = 1$]

Q125. CBSE 2026 · 5 marks (a) Calculate the electrode potential of a half-cell for zinc electrode dipping in 0.01 M ZnSO₄ solution at 25°C. Given: $\text{E}^\circ(\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V}$ [$\log 10 = 1$] (ii) Write anode, cathode and overall reaction involved in dry cell. (iii) Equilibrium constant (K_c) is related to $\text{E}^\circ\text{cell}$, but not to E_{cell} . Why ?

Q126. CBSE 2026 · 5 marks (a)(i) Calculate E_{cell} for the following reaction which is at equilibrium: $\text{Cu (s)} + 2\text{Ag}^+(\text{aq}) \rightleftharpoons \text{Cu}^{2+}(\text{aq}) + 2\text{Ag (s)}$. Equilibrium constant (K_c) for the cell is 1015. [Given: $\log 10 = 1$] (ii) Write anode, cathode and overall reaction of lead storage battery when it is in use. (iii) How much electricity is required in coulombs for the oxidation of 1 mol of FeO to Fe₂O₃?

Q127. CBSE 2026 · 5 marks (a)(i) Calculate $\text{E}^\circ\text{cell}$ for the following reaction which is at equilibrium: $\text{Cu (s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Ag (s)}$. Equilibrium constant (K_c) for the cell is 1015. [Given: $\log 10 = 1$] (ii) Write anode, cathode and overall reaction of lead storage battery when it is in use. (iii) How much electricity is required in coulombs for the oxidation of 1 mol of FeO to Fe₂O₃?

Q128. CBSE 2025 · 5 marks (a)(i) For a galvanic cell, the following half reactions are given. Decide, which will remain as reduction reaction and which will be reversed to become an oxidation reaction. Give reason for your answer. (I) $\text{Cr}^{3+} + 3\text{e}^- \rightarrow \text{Cr(s)}$; $E = -0.74 \text{ V}$ (II) $\text{Fe}^{2+} + 2\text{e}^- \rightarrow \text{Fe(s)}$; $E = -0.44 \text{ V}$

Q129. CBSE 2025 · 5 marks For a galvanic cell, the following half reactions are given. Decide, which will remain as reduction reaction and which will be reversed to become an oxidation reaction. Give reason for your answer. (I) $\text{Cr}^{3+} + 3\text{e}^- \rightarrow \text{Cr(s)}$; $E = -0.74 \text{ V}$ (II) $\text{Fe}^{2+} + 2\text{e}^- \rightarrow \text{Fe(s)}$; $E = -0.44 \text{ V}$. Represent the cell in which the following reaction takes place: $\text{Mg(s)} + 2\text{Ag}^+ (0.001 \text{ M}) \rightarrow \text{Mg}^{2+} (0.100 \text{ M}) + 2\text{Ag(s)}$. Calculate E_{cell} if $\text{E}^\circ\text{cell} = 3.17 \text{ V}$. ($\log 10 = 1$)

Q130. CBSE 2025 · 5 marks (a) (i) Calculate E_{cell} of a galvanic cell in which the following reaction takes place at 25°C: $\text{Zn(s)} + \text{Pb}^{2+} (0.02 \text{ M}) \rightarrow \text{Zn}^{2+} (0.1 \text{ M}) + \text{Pb(s)}$ [Given: $\text{E}^\circ\text{Zn}^{2+}/\text{Zn} = -0.76 \text{ V}$, $\text{E}^\circ\text{Pb}^{2+}/\text{Pb} = -0.13 \text{ V}$; $\log 2 = 0.3010$, $\log 4 = 0.6021$, $\log 5 = 0.6990$]. (ii) State Faraday's first law of electrolysis. How much electricity, in terms of Faraday, is required to reduce one mol of MnO_4^- to Mn^{2+} ion ?



Q131. CBSE 2025 · 5 marks (a) (i) Calculate E_{cell} of a galvanic cell in which the following reaction takes place at 25°C: $\text{Zn(s)} + \text{Pb}^{2+}(\text{0.02 M}) \rightarrow \text{Zn}^{2+}(\text{0.1 M}) + \text{Pb(s)}$ [Given: $E^\circ_{\text{Zn}/\text{Zn}^{2+}} = -0.76 \text{ V}$, $E^\circ_{\text{Pb}/\text{Pb}^{2+}} = -0.13 \text{ V}$; $\log 2 = 0.3010$, $\log 4 = 0.6021$, $\log 5 = 0.6990$] OR (b) (i) The resistance of a conductivity cell containing 0.001 M KCl solution at 298 K is 1000 ohm. What is the cell constant if conductivity of 0.001 M KCl solution at 298 K is $0.125 \times 10^{-3} \text{ S cm}^{-1}$?

Q132. CBSE 2025 · 5 marks Calculate E°_{cell} of a galvanic cell in which the following reaction takes place at 25°C: $\text{Zn(s)} + \text{Pb}^{2+}(\text{0.02 M}) \rightarrow \text{Zn}^{2+}(\text{0.1 M}) + \text{Pb(s)}$ [Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $E^\circ_{\text{Pb}^{2+}/\text{Pb}} = -0.13 \text{ V}$; $\log 2 = 0.3010$, $\log 4 = 0.6021$, $\log 5 = 0.6990$]

Q133. CBSE 2025 · 5 marks Calculate the emf of the following cell at 25°C: $\text{Zn(s)}|\text{Zn}^{2+}(\text{0.1 M})||\text{H}^+(\text{0.01 M})|\text{H}_2(\text{g})(1 \text{ bar}), \text{Pt(s)}$. (Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $E^\circ_{\text{H}^+/\text{H}_2} = 0.00 \text{ V}$, $\log 10 = 1$). State Faraday's second law of electrolysis. How much electricity is required in terms of Faraday for the reduction of 1 mol of $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} ?

Q134. CBSE 2025 · 3 marks Calculate the emf of the following cell at 25°C: $\text{Zn(s)}|\text{Zn}^{2+}(\text{0.1 M})||\text{H}^+(\text{0.01 M})|\text{H}_2(\text{g})(1 \text{ bar}), \text{Pt(s)}$ [Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $E^\circ_{\text{H}_2/\text{H}^+} = 0.00 \text{ V}$, $\log 10 = 1$]

Q135. CBSE 2025 · 5 marks (a) (i) Calculate the emf of the following cell at 25°C: $\text{Zn(s)}|\text{Zn}^{2+}(\text{0.1 M})||\text{H}^+(\text{0.01 M})|\text{H}_2(\text{g})(1 \text{ bar}), \text{Pt(s)}$ [Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $E^\circ_{\text{H}^+/\text{H}_2} = 0.00 \text{ V}$, $\log 10 = 1$] (ii) State Faraday's second law of electrolysis. How much electricity is required in terms of Faraday for the reduction of 1 mol of $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} ?

Q136. CBSE 2024 · 5 marks (a) (i) The resistance of 0.05 M CH_3COOH solution is found to be 100 ohm. If the cell constant is 0.0354 cm^{-1} , calculate the molar conductivity of the acetic acid solution. (ii) How much charge in Faraday is required for the reduction of 1 mol of MnO_4^- to Mn^{2+} ?

Q137. CBSE 2024 · 5 marks (a) The resistance of 0.05 M CH_3COOH solution is found to be 100 ohm. If the cell constant is 0.0354 cm^{-1} , calculate the molar conductivity of the acetic acid solution. (b) State Faraday's law. How many Faradays are required for the reduction of 1 mol of MnO_4^- to Mn^{2+} ?

Q138. CBSE 2024 · 5 marks (a) (i) Calculate emf of the following cell at 25°C: $\text{Zn(s)}|\text{Zn}^{2+}(\text{0.001M})||\text{Cd}^{2+}(\text{0.1 M})|\text{Cd(s)}$ Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $E^\circ_{\text{Cd}^{2+}/\text{Cd}} = -0.40 \text{ V}$ [$\log 10 = 1$]

Q139. CBSE 2024 · 5 marks Calculate emf of the following cell at 25°C: $\text{Zn(s)}|\text{Zn}^{2+}(\text{0.001M})||\text{Cd}^{2+}(\text{0.1 M})|\text{Cd(s)}$. Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $E^\circ_{\text{Cd}^{2+}/\text{Cd}} = -0.40 \text{ V}$ [$\log 10 = 1$] OR State Faraday's second law of electrolysis. How will the pH of aqueous NaCl solution be affected when it is electrolysed?

Q140. CBSE 2024 · 5 marks Calculate emf of the following cell at 25°C: $\text{Zn(s)}|\text{Zn}^{2+}(\text{0.001M})||\text{Cd}^{2+}(\text{0.1 M})|\text{Cd(s)}$. Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $E^\circ_{\text{Cd}^{2+}/\text{Cd}} = -0.40 \text{ V}$ [$\log 10 = 1$]

Q141. CBSE 2023 · 5 marks (a) (i) Write an expression for the limiting molar conductivity of an acetic acid on the basis of Kohlrausch law. (ii) Calculate the maximum work and $\log K_c$ for the given reaction at 298 K: $\text{Ni(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Ni}^{2+}(\text{aq}) + 2\text{Ag(s)}$. Given: $\text{Ni}/\text{Ni}^{2+} E^\circ = -0.25 \text{ V}$, $\text{Ag}^+/\text{Ag} E^\circ = +0.80 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$

Q142. CBSE 2023 · 5 marks (a) (i) Write an expression for the molar conductivity of acetic acid at infinite dilution according to Kohlrausch law. (ii) Calculate the maximum work and $\log K_c$ for the given reaction at 298 K: $\text{Ni(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Ni}^{2+}(\text{aq}) + 2\text{Ag(s)}$. Given: $E^\circ_{\text{Ni}/\text{Ni}^{2+}} = -0.25 \text{ V}$, $E^\circ_{\text{Ag}/\text{Ag}^+} = +0.80 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$ OR (b) (i) Write Faraday's first law of electrolysis. How many Faradays of electric charge are required for the reduction of 1 mol Cu^{2+} to Cu ? (ii) Calculate emf of the following cell at 298 K: $\text{Mg(s)}|\text{Mg}^{2+}(\text{0.1 M})||\text{Cu}^{2+}(\text{0.1 M})|\text{Cu(s)}$. [$E^\circ_{\text{cell}} = +2.71 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$, $\log 10 = 1$]

Q143. CBSE 2023 · 5 marks (a) (i) Write an expression for the limiting molar conductivity of acetic acid. (ii) Calculate the maximum work and $\log K_c$ for the given reaction at 298 K: $\text{Ni(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Ni}^{2+}(\text{aq}) + 2\text{Ag(s)}$. Given: $E^\circ_{\text{Ni}/\text{Ni}^{2+}} = -0.25 \text{ V}$, $E^\circ_{\text{Ag}/\text{Ag}^+} = +0.80 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$. OR (b) (i) How many Faraday of electricity, in terms of Faraday, is required for the reduction of 1 mol Cu^{2+} to Cu ? (ii) Calculate emf of the following cell at 298 K for $\text{Mg(s)}|\text{Mg}^{2+}(\text{0.1 M})||\text{Cu}^{2+}(\text{0.1 M})|\text{Cu(s)}$. [$E^\circ_{\text{cell}} = +2.71 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$, $\log 10 = 1$]

Q144. CBSE 2023 · 5 marks Conductivity of $2 \times 10^{-3} \text{ M}$ methanoic acid is $8 \times 10^{-5} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation if Λ°_m for methanoic acid is $404 \text{ S cm}^2 \text{ mol}^{-1}$.

Q145. CBSE 2023 · 5 marks Conductivity of $2 \times 10^{-3} \text{ M}$ methanoic acid is $8 \times 10^{-5} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation if Λ°_m for methanoic acid is $404 \text{ S cm}^2 \text{ mol}^{-1}$. Calculate the $\Delta_r G$ and $\log K_c$ for the given reaction at 298 K: $\text{Ni(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Ni}^{2+}(\text{aq}) + 2\text{Ag(s)}$. Given: $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25 \text{ V}$, $E^\circ_{\text{Ag}^+/\text{Ag}} = +0.80 \text{ V}$, $1 \text{ F} = 96500 \text{ C mol}^{-1}$.

Q146. CBSE 2023 · 5 marks (a) Conductivity of $2 \times 10^{-3} \text{ M}$ methanoic acid is $8 \times 10^{-5} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation if Λ°_m for methanoic acid is $404 \text{ S cm}^2 \text{ mol}^{-1}$. (b) Calculate the $\Delta_r G$ and $\log K_c$ for the given reaction at 298 K: $\text{Ni(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Ni}^{2+}(\text{aq}) + 2\text{Ag(s)}$ Given: $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25 \text{ V}$, $E^\circ_{\text{Ag}^+/\text{Ag}} = +0.80 \text{ V}$; $1 \text{ F} = 96500 \text{ C mol}^{-1}$.

Q147. CBSE 2023 · 5 marks (a) Calculate the emf of the following cell at 25°C: $\text{Zn(s)}|\text{Zn}^{2+}(\text{0.1 M})||\text{H}^+(\text{0.01 M})|\text{H}_2(\text{g})(1 \text{ bar}), \text{Pt(s)}$ [Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $E^\circ_{\text{H}^+/\text{H}_2} = 0.00 \text{ V}$, $\log 10 = 1$]

Q148. CBSE 2023 · 5 marks (a) Calculate the emf of the following cell at 25°C: $\text{Zn(s)}|\text{Zn}^{2+}(\text{0.1 M})||\text{H}^+(\text{0.01 M})|\text{H}_2(\text{g})(1 \text{ bar}), \text{Pt(s)}$. (Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$, $E^\circ_{\text{H}^+/\text{H}_2} = 0.00 \text{ V}$, $\log 10 = 1$) (b) State Kohlrausch law of independent migration of ions. Why does the conductivity of a solution decrease with dilution?

Q149. CBSE 2023 · 5 marks Calculate the emf of the following cell at 25°C: $\text{Zn(s)}|\text{Zn}^{2+}(\text{0.1 M})||\text{H}^+(\text{0.01 M})|\text{H}_2(\text{g})(1 \text{ bar}), \text{Pt(s)}$

Q150. CBSE 2023 · 5 marks (a) (i) Calculate the emf of the following cell at 298 K: $\text{Al(s)}|\text{Al}^{3+}(\text{0.001 M})||\text{Ni}^{2+}(\text{0.1 M})|\text{Ni(s)}$. [Given: $E^\circ_{\text{Al}/\text{Al}^{3+}} = -1.66 \text{ V}$, $E^\circ_{\text{Ni}/\text{Ni}^{2+}} = -0.25 \text{ V}$, $\log 10 = 1$]

Q151. CBSE 2023 · 5 marks (a) (i) Calculate the emf of the following cell at 298 K: $\text{Al(s)}|\text{Al}^{3+}(\text{0.001 M})||\text{Ni}^{2+}(\text{0.1 M})|\text{Ni(s)}$. [Given: $E^\circ_{\text{Al}/\text{Al}^{3+}} = -1.66 \text{ V}$, $E^\circ_{\text{Ni}/\text{Ni}^{2+}} = -0.25 \text{ V}$, $\log 10 = 1$] (ii) With the help of a graph explain why it is not possible to determine Λ°_m for a weak electrolyte by extrapolating the molar conductivity (Λ_m) versus $C^{1/2}$ curve as for strong electrolyte.



CASE-BASED (3)**CASE STUDY · CBSE 2026**

Electrochemistry is the study of the relationship between chemical energy and electrical energy. Many spontaneously occurring chemical reactions liberate electrical energy. In electrolysis, electrical energy is converted directly into chemical energy. The product of an electrolytic reaction depends on the nature of the material being electrolysed and the type of electrode used. Oxidising and reducing species present in the electrolytic cell and their standard electrode potential too, affect the products of electrolysis. Electrolysis plays an important role in most people's daily lives, whether it is for the manufacturing of aluminium, electroplating of metals, or the synthesis of chemical compounds. Michael Faraday was the first scientist who proposed two laws to explain the quantitative aspects of electrolysis, popularly known as Faraday's laws of electrolysis. Faraday's laws of electrolysis provide a basis for mathematical analysis of the mass deposited at electrodes and the amount of charge passed through them. Faraday's laws are fundamental in various applications, including electroplating, metal extraction, battery technology and chemical synthesis. These laws also help in environmental monitoring and in various chemistry experiments.

Q152. CBSE 2026 · 4 marks (a) Predict the products of electrolysis in each of the following : (i) An aqueous solution of CuCl_2 with platinum electrodes. (ii) A concentrated solution of H_2SO_4 with platinum electrodes.

CASE STUDY · CBSE 2024

Batteries and fuel cells are very useful forms of galvanic cell. Any battery or cell that we use as a source of electrical energy is basically a galvanic cell. However, for a battery to be of practical use it should be reasonably light, compact and its voltage should not vary appreciably during its use. There are mainly two types of batteries—primary batteries and secondary batteries. In the primary batteries, the reaction occurs only once and after use over a period of time the battery becomes dead and cannot be reused again, whereas the secondary batteries are rechargeable. Production of electricity by thermal plants is not a very efficient method and is a major source of pollution. To solve this problem, galvanic cells are designed in such a way that energy of combustion of fuels is directly converted into electrical energy, and these are known as fuel cells. One such fuel cell was used in the Apollo space programme.

Q153. CBSE 2024 · 4 marks (a) How do primary batteries differ from secondary batteries?

CASE STUDY · CBSE 2023

Rahul set-up an experiment to find resistance of aqueous KCl solution for different concentrations at 298 K using a conductivity cell connected to a Wheatstone bridge. He fed the Wheatstone bridge with a.c. power in the audio frequency range 550 to 5000 cycles per second. Once the resistance was calculated from null point he also calculated the conductivity κ and molar conductivity λ_m and recorded his readings in tabular form.

Q154. CBSE 2023 · 1 mark (a) Why does conductivity decrease with dilution?

3 Chemical Kinetics

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (70)

Q1. CBSE 2026 · 1 mark The rate of a reaction is doubled when the concentration of the reactant is doubled. The order of the reaction is :

- (a) 0 (b) 1 (c) 2 (d) 0.5

Q2. CBSE 2026 · 1 mark Assertion (A) : Rate of reaction increases with an increase in temperature. Reason (R) : Number of effective collisions decreases with an increase in temperature.

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

Q3. CBSE 2026 · 1 mark Which of the following curve represents the first order reaction?

- (a) A (b) B (c) C (d) D

Q4. CBSE 2026 · 1 mark For a reaction: $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$, the rate of reaction with respect to NH_3 is

- (a) $+1/3 \, d[\text{NH}_3]/dt$ (b) $-1/2 \, d[\text{NH}_3]/dt$ (c) $+1/4 \, d[\text{NH}_3]/dt$
 (d) $+1/2 \, d[\text{NH}_3]/dt$

Q5. CBSE 2026 · 1 mark Identify the correct statement:

- (a) Molecularity of a reaction is an experimental quantity.
 (b) For complex reactions molecularity has no meaning.
 (c) Molecularity of a reaction can be zero or even a fraction.
 (d) Molecularity more than three is very common in chemical reactions.

Q6. CBSE 2026 · 1 mark The order for the given reaction is: $\text{A} + 2\text{B} \rightarrow \text{Products}$, $\text{Rate} = k[\text{A}]^{1/2}[\text{B}]$

- (a) 1.5 (b) 1 (c) 0.5 (d) 2

Q7. CBSE 2026 · 1 mark Assertion (A): The molecularity of the given reaction is 2. $2\text{HI} \rightarrow \text{H}_2 + \text{I}_2$. Reason (R): Two molecules of the reactants are involved in simultaneous collision between them.

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



Q8. CBSE 2026 · 1 mark For a reaction $3A \rightarrow 2B$, the rate of reaction $+d[B]/dt$ is equal to:

- (a) $-3/2 d[A]/dt$ (b) $-2/3 d[A]/dt$ (c) $-1/3 d[A]/dt$
(d) $+d[A]/2 dt$

Q9. CBSE 2026 · 1 mark Assertion (A): Order of reaction is applicable to elementary as well as complex reactions. Reason (R): Order of a reaction is an experimental quantity.

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

Q10. CBSE 2026 · 1 mark For the reaction $2A \rightarrow 3B$, the rate of reaction $+d[B]/dt$ is equal to :

- (a) $3/2 \times (-d[A]/dt)$ (b) $2/3 \times (-d[A]/dt)$ (c) $1/2 \times (-d[A]/dt)$
(d) $3 \times (d[A]/dt)$

Q11. CBSE 2026 · 1 mark Assertion (A): Order of reaction is not applicable for elementary reaction but applicable for complex reaction. Reason (R): Order of reaction is an experimental quantity.

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

Q12. CBSE 2026 · 1 mark The half-life periods of decomposition of NH_3 for different initial pressures are given below: p (torr) 704, 75, 34.5; $t_{1/2}$ (min) 80, 80, 80. The order of the reaction is :

- (a) zero order (b) first order (c) 0.5 (d) second order

Q13. CBSE 2026 · 1 mark The rate of a first order reaction is $5.6 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$, when the concentration of reactant is 0.2 mol L^{-1} . The rate constant 'k' is:

- (a) $5.6 \times 10^{-3} \text{ s}^{-1}$ (b) $2.8 \times 10^{-4} \text{ s}^{-1}$ (c) $2.8 \times 10^{-5} \text{ s}^{-1}$
(d) $2.8 \times 10^{-3} \text{ s}^{-1}$

Q14. CBSE 2026 · 1 mark Assertion (A): For complex reaction, order of reaction is given by the slowest step. Reason (R): Order of a reaction is an experimental quantity.

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

Q15. CBSE 2026 · 1 mark Assertion (A): For complex reaction, order of reaction is given by the fast step. Reason (R): Order of reaction is determined experimentally.

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

Q16. CBSE 2026 · 1 mark Assertion (A): For complex reaction, order of reaction is given by the slowest step. Reason (R): Order of reaction is not applicable for the complex reaction.

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

Q17. CBSE 2026 · 1 mark Half-life ($t_{1/2}$) of a first order reaction is 1386 s. The value of rate constant is :

- (a) $0.5 \times 10^4 \text{ s}^{-1}$ (b) $5.0 \times 10^{-4} \text{ s}^{-1}$ (c) $0.5 \times 10^{-5} \text{ s}^{-1}$
(d) $0.5 \times 10^{-2} \text{ s}^{-1}$

Q18. CBSE 2025 · 1 mark The rate of reaction $X + Y \rightarrow \text{products}$, is given by the equation $\text{Rate} = k[X][Y]$. If Y is taken in large excess, the order of the reaction would be

- (a) 0 (b) 1 (c) 2 (d) 1/2

Q19. CBSE 2025 · 1 mark Assertion (A): In a first order reaction, if the concentration of the reactant is doubled, its half-life is also doubled. Reason (R): The half-life of a reaction does not depend upon the initial concentration of the reactant in a first order reaction.

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

Q20. CBSE 2025 · 1 mark The role of a catalyst is to change:

- (a) equilibrium constant (b) enthalpy of reaction
(c) Gibbs energy of reaction
(d) activation energy of reaction

Q21. CBSE 2025 · 1 mark The unit of rate and rate constant are same for a :

- (a) First order reaction (b) Second order reaction
(c) Zero order reaction (d) Third order reaction



Q22. CBSE 2025 · 1 mark Assertion (A) : Hydrolysis of an ester follows first order kinetics. Reason (R) : The concentration of water does not get altered much during the reaction.

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

Q23. CBSE 2025 · 1 mark The value of rate constant for a pseudo first order reaction:

- (a) depends only on temperature.
 (b) depends on the concentration of reactants present in small amount.
 (c) depends on the concentration of reactants present in large excess.
 (d) is not dependent on the concentration of reactants.

Q24. CBSE 2025 · 1 mark Assertion (A): Order of the reaction can be zero or fractional. Reason (R): We cannot determine order from balanced chemical equation.

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

Q25. CBSE 2025 · 1 mark In the Arrhenius equation $k = Ae^{(-E_a/RT)}$, 'A' represents:

- (a) effective collisions (b) frequency factor
 (c) fraction of collisions (d) threshold energy

Q26. CBSE 2025 · 1 mark Assertion (A): Molecularity of reaction is determined experimentally. Reason (R): Molecularity is applicable only for an elementary reaction and not for a complex reaction.

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

Q27. CBSE 2025 · 1 mark The activation energy (E_a) of a reaction can be determined from the slope of which of the following plots ?

- (a) $\ln k$ vs. T (b) $\ln(k/T)$ vs. T (c) $\ln k$ vs. $1/T$
 (d) $\ln(T/k)$ vs. $1/T$

Q28. CBSE 2025 · 1 mark Unit of rate constant 'k' for a second order reaction is :

- (a) s^{-1} (b) $\text{mol L}^{-1} s^{-1}$ (c) $\text{mol}^{-1} \text{L s}^{-1}$ (d) $\text{mol}^{-2} \text{L s}^{-1}$

Q29. CBSE 2025 · 1 mark Which of the following represents the fraction of molecules with energies equal to or greater than E_a ?

- (a) $e^{(-E_a/RT)}$ (b) $e^{(T-E_a/RT)}$ (c) $e^{(T+E_a/RT)}$
 (d) $e^{(E_a+E/RT)}$

Q30. CBSE 2025 · 1 mark Which of the following is the slope of the first order reaction in the plot of $\ln[R]$ vs. time?

- (a) $+k$ (b) $+k/2.303$ (c) $-k$ (d) $-k/2.303$

Q31. CBSE 2024 · 1 mark In the Arrhenius equation, when $\log k$ is plotted against $1/T$, a straight line is obtained whose:

- (a) slope is AR and intercept is E_a .
 (b) slope is A and intercept is aER .
 (c) slope is $aERT$ and intercept is $\log A$.
 (d) slope is $R/303 \cdot 2aE$ and intercept is $\log A$.

Q32. CBSE 2024 · 1 mark A reaction $A_2 + B_2 \rightarrow 2AB$ occurs by the following mechanism: $A_2 \rightarrow A + A$ (slow); $A + B_2 \rightarrow AB + B$ (fast); $A + B \rightarrow AB$ (fast). Its order would be:

- (a) 1 (b) 2 (c) Zero (d) $1/2$

Q33. CBSE 2024 · 1 mark A zero-order reaction is one whose rate is independent of:

- (a) Presence of light (b) Concentration of the reactant
 (c) Temperature of the reaction (d) Pressure of the reaction

Q34. CBSE 2024 · 1 mark The addition of catalyst during a chemical reaction alters which of the following quantities of the reaction?

- (a) Enthalpy (b) Activation energy (c) Entropy
 (d) Internal energy

Q35. CBSE 2024 · 1 mark For the elementary reaction $P \rightarrow Q$, when the concentration of P is doubled, the rate of reaction becomes 8 times. The order of the reaction is:

- (a) 3 (b) 4 (c) 2 (d) 1

Q36. CBSE 2024 · 1 mark Half-life period of a first order reaction is 1386 seconds. The rate constant (k) of the reaction is:

- (a) $0.5 \times 10^{-3} s^{-1}$ (b) $5.0 \times 10^{-3} s^{-1}$
 (c) $5 \times 10^{-2} s^{-1}$ (d) $0.5 \times 10^{-2} s^{-1}$

Q37. CBSE 2024 · 1 mark The rate of the reaction $2A + B_2 \rightarrow 2AB$ is given by $\text{Rate} = k[A]^2[B_2]$. The value of rate constant (k) can be increased by:

- (a) increasing the concentration of A
 (b) increasing the concentration of B
 (c) increasing the temperature (d) all the above three

Q38. CBSE 2024 · 1 mark For a certain reaction $R \rightarrow \text{products}$, a plot of $\log [R]$ vs. time gives a straight line with a slope of $-1.25 s^{-1}$. The order of the reaction is:

- (a) One (b) Zero (c) Two (d) Fractional

Q39. CBSE 2024 · 1 mark For a zero order reaction $A \rightarrow \text{products}$, $t_{1/2}$ is:

- (a) $[A]_0/k$ (b) $0.693/k$ (c) $[A]_0/2k$ (d) $[A]_0^2/2k$

Q40. CBSE 2024 · 1 mark When a catalyst increases the rate of a chemical reaction, then the rate constant (k) :

- (a) remains constant (b) decreases (c) increases
 (d) may increase or decrease depending on the order of the reaction



Q41. CBSE 2024 · 1 mark Assertion (A): Order of reaction and molecularity are always same for complex reactions. Reason (R): Order is determined experimentally and molecularity is applicable only for elementary reactions.

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

Q42. CBSE 2024 · 1 mark When the initial concentration of a reactant is doubled in the reaction, the half life period remains same. The order of reaction is:

- (a) First (b) Second (c) Zero (d) 1/2

Q43. CBSE 2024 · 1 mark Assertion (A): Rate of reaction increases with increase in temperature. Reason (R): Number of effective collisions increase with increase in temperature.

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

Q44. CBSE 2024 · 1 mark The half-life of a first-order reaction with rate constant (k) of 3 min^{-1} is:

- (a) 0.693 min (b) 2.31 min (c) 6.93 min (d) 0.231 min

Q45. CBSE 2024 · 1 mark Assertion (A): Rate of reaction decreases with increase in temperature. Reason (R): Number of effective collisions increases with increase in temperature.

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

Q46. CBSE 2023 · 1 mark Which of the following is affected by catalyst?

- (a) ΔH (b) ΔG (c) E_a (d) ΔS

Q47. CBSE 2023 · 1 mark The order of the reaction $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$ is:

- (a) 2 (b) 1 (c) 0 (d) 3

Q48. CBSE 2023 · 1 mark Assertion (A): The molecularity of the reaction $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$ appears to be 2. Reason (R): Two molecules of the reactants are involved in the given elementary reaction. Select the correct answer.

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

Q49. CBSE 2023 · 1 mark A first order reaction takes 30 minutes for 50% completion. The value of rate constant k would be:

- (a) $2.5 \times 10^{-3} \text{ min}^{-1}$ (b) $2.75 \times 10^{-4} \text{ min}^{-1}$
- (c) $1.25 \times 10^{-3} \text{ min}^{-1}$ (d) $2.31 \times 10^{-3} \text{ min}^{-1}$

Q50. CBSE 2023 · 1 mark Assertion (A): The molecularity of the reaction $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$ appears to be 2. Reason (R): Two molecules of the reactants are involved in the given elementary reaction.

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

Q51. CBSE 2023 · 1 mark The slope in the plot of $\ln[R]$ vs. time for a first order reaction is

- (a) $+k/2.303$ (b) $-k$ (c) $-k/2.303$ (d) $+k$

Q52. CBSE 2023 · 1 mark For the reaction $3\text{A} \rightarrow 2\text{B}$, rate of reaction $+d[\text{B}]/dt$ is equal to

- (a) $-3/2 d[\text{A}]/dt$ (b) $-2/3 d[\text{A}]/dt$ (c) $-1/3 d[\text{A}]/dt$
- (d) $+2 d[\text{A}]/dt$

Q53. CBSE 2023 · 1 mark The slope in the plot of $[\text{R}]$ vs. time for a zero order reaction is

- (a) $+k/2.303$ (b) $-k$ (c) $-k/2.303$ (d) $+k$

Q54. CBSE 2023 · 1 mark For a reaction $2\text{A} \rightarrow 3\text{B}$, rate of reaction $-d[\text{A}]/dt$ is equal to

- (a) $+3/2 d[\text{B}]/dt$ (b) $+2/3 d[\text{B}]/dt$ (c) $+1/3 d[\text{B}]/dt$
- (d) $+2 d[\text{B}]/dt$

Q55. CBSE 2023 · 1 mark The slope in the plot of $\log R/R_0$ vs. time for a first order reaction is

- (a) $+k/2.303$ (b) $+k$ (c) $-k/2.303$ (d) $-k$

Q56. CBSE 2023 · 1 mark For the reaction $3\text{A} \rightarrow 2\text{B}$, rate of reaction $-d[\text{A}]/dt$ is equal to

- (a) $+(3/2) \times d[\text{B}]/dt$ (b) $+(2/3) \times d[\text{B}]/dt$
- (c) $+(1/3) \times d[\text{B}]/dt$ (d) $+(1/2) \times d[\text{B}]/dt$

Q57. CBSE 2023 · 1 mark The unit of the rate of reaction is the same as that of the rate constant for a:

- (a) first order reaction (b) second order reaction
- (c) zero order reaction (d) it cannot be same

Q58. CBSE 2023 · 1 mark Assertion (A): Order and molecularity of a reaction are always same. Reason (R): Complex reactions involve a sequence of elementary reactions and the slowest step is rate determining.

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



Q59. CBSE 2023 · 1 mark The rate of reaction $A + B \rightarrow \text{Products}$, is given by the equation $r = k[A][B]$. If B is taken in large excess, the order of reaction would be:

- (a) 2 (b) 0 (c) 1 (d) Cannot be predicted

Q60. CBSE 2023 · 1 mark The half-life of a reaction is doubled when the initial concentration is doubled. The order of the reaction is:

- (a) 1 (b) 2 (c) 4 (d) 0

Q61. CBSE 2023 · 1 mark The half-life for a zero order reaction equals:

- (a) R/k_2 (b) $2R/k_2^{1/2}$ (c) k_2/R_2 (d) k_2/R

Q62. CBSE 2023 · 1 mark In a reaction, the initial concentration of the reactants increases four fold and the rate becomes sixteen times its initial value. The order of the reaction is:

- (a) 2.0 (b) 3.5 (c) 1.5 (d) 2.5

Q63. CBSE 2023 · 1 mark For the reaction $A + 2B \rightarrow C + D$, the rate law is given by $r = k[A][B]^2$, the concentration of A is kept constant while that of B is doubled. The rate of the reaction will:

- (a) double (b) become half (c) not change (d) quadruple

Q64. CBSE 2023 · 1 mark If the initial concentration is reduced to $1/4$ th in a zero order reaction, then the time taken for half the reaction to complete:

- (a) remains the same (b) reduces to one-fourth
(c) increases four times (d) doubles

Q65. CBSE 2023 · 1 mark For a zero order reaction of the type $A \rightarrow \text{products}$, the rate equation may be expressed as:

- (a) $t = [A]/k_0$ (b) $t = [A]_0/k$ (c) $t = [A]_0/2k$ (d) $t = [A]_0^2/2k$

Q66. CBSE 2023 · 1 mark The number of molecules that react with each other in an elementary reaction is a measure of the:

- (a) activation energy of the reaction
(b) order of the reaction (c) stoichiometry of the reaction
(d) molecularity of the reaction

Q67. CBSE 2023 · 1 mark The following experimental rate data were obtained for a reaction carried out at 25 °C: $A(g) + B(g) \rightarrow C(g) + D(g)$. What are the orders with respect to A(g) and B(g)?

- (a) Zero; Second (b) First; Zero (c) Second; Zero
(d) Second; First

Q68. CBSE 2023 · 1 mark Assertion (A): For a zero order reaction the unit of rate constant and rate of reaction are same. Reason (R): Rate of reaction for zero order reaction is independent of concentration of reactant.

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

Q69. CBSE 2023 · 1 mark Assertion (A): The half life of a reaction is the time in which the concentration of the reactant is reduced to one half of its initial concentration. Reason (R): In first order kinetics when concentration of reactant is doubled, its half life is doubled.

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

Q70. CBSE 2023 · 1 mark Assertion (A): Order of reaction is applicable to elementary as well as complex reactions. Reason (R): For a complex reaction molecularity has no meaning.

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

VERY SHORT ANSWER (33)

Q71. CBSE 2026 · 2 marks Write any two differences between the order of a reaction and molecularity of a reaction.

Q72. CBSE 2026 · 2 marks Following reaction takes place in one step: $2A + B \rightarrow 2C$. How will the rate of above reaction change if the volume of the reaction vessel is decreased to one third of its original volume? Will there be any change in the order of reaction with the reduced volume?

Q73. CBSE 2026 · 2 marks The concentration of the reactant is reduced from 0.6 mol L⁻¹ to 0.2 mol L⁻¹ in 5 minutes in a first order reaction. Calculate rate constant of the reaction. ($\log 3 = 0.48$)

Q74. CBSE 2026 · 2 marks Define activation energy. Write the unit of rate constant for (i) zero order reaction, (ii) second order reaction.

Q75. CBSE 2026 · 2 marks (a) Define Collision frequency. (b) Write the units of (i) first order reaction and (ii) zero order reaction

Q76. CBSE 2026 · 2 marks (a) Define Effective collision. (b) Write the unit of (i) second order reaction and (ii) zero order reaction

Q77. CBSE 2026 · 2 marks For a reaction $A + B \rightarrow \text{Products}$, the rate law is: $\text{Rate} = k[A][B]^{3/2}$. Write the overall order of the reaction. Can this reaction be an elementary reaction? Give reason in support of your answer.

Q78. CBSE 2026 · 2 marks For a reaction $A + B \rightarrow \text{Products}$, the rate law is: $\text{Rate} = (3/2)k[A][B]^2$. Write the overall order of the reaction. Can this reaction be an elementary reaction? Give reason in support of your answer.

Q79. CBSE 2026 · 2 marks For a reaction $A + B \rightarrow \text{Products}$, the rate law is: $\text{Rate} = (3/2)k[A][B]$. Write the overall order of the reaction. Can this reaction be an elementary reaction? Give reason in support of your answer.



Q80. CBSE 2026 · 2 marks (a) Reactions of which order will show the rate to be independent of the concentration of the reactant? Give one example of this order. (b) State the condition under which a bimolecular reaction may be kinetically a first order reaction.

Q81. CBSE 2025 · 2 marks (a) A reaction is second order in 'A' and first order in 'B'. How is the rate affected when the concentrations of both 'A' and 'B' are doubled? (b) Write the unit of 'k' for zero order reaction.

Q82. CBSE 2025 · 2 marks (a) The reaction between A₂ (g) and B₂ (g) was carried out in a sealed isothermal container. The rate law for the reaction was found to be: Rate = k[A₂][B₂]. If 1 mole of A₂ (g) was added to the reaction chamber and the temperature was kept constant, then predict the change in rate of the reaction and the rate constant.

Q83. CBSE 2025 · 2 marks (a) Write the rate law expression for the reaction $2\text{HI} \rightarrow \text{H}_2 + \text{I}_2$, if the order of the reaction is zero.

Q84. CBSE 2025 · 2 marks Define rate constant and identify the reaction order which has a rate constant of $4.5 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$.

Q85. CBSE 2025 · 2 marks Give any two differences between order and molecularity of a reaction.

Q86. CBSE 2025 · 2 marks State a condition under which a bimolecular reaction is kinetically first order reaction. Give an example. For which type of reactions, do order and molecularity have the same value?

Q87. CBSE 2025 · 2 marks Why is molecularity applicable only for elementary reactions and order is applicable for elementary as well as complex reactions?

Q88. CBSE 2024 · 2 marks Define molecularity of the reaction. State any one condition in which a bimolecular reaction may be kinetically of first order.

Q89. CBSE 2024 · 2 marks Write two differences between order of reaction and molecularity of reaction.

Q90. CBSE 2024 · 2 marks A first order reaction has a rate constant $1.25 \times 10^{-3} \text{ s}^{-1}$. How long will 5 g of this reactant take to reduce to 2.5 g? [$\log 2 = 0.301$, $\log 3 = 0.4771$, $\log 4 = 0.6021$]

Q91. CBSE 2024 · 2 marks (a) In a reaction, when the concentration of a reactant is tripled, the rate of the reaction becomes twenty-seven times. What is the order of the reaction?

Q92. CBSE 2024 · 2 marks When the initial concentration of a reactant is tripled, the reaction rate becomes twenty-seven times. What is the order of the reaction? OR State a condition under which a bimolecular reaction is kinetically a first-order reaction. Give an example of such a reaction.

Q93. CBSE 2024 · 2 marks If the concentration of a reactant in a reaction becomes twenty-seven times, the rate of reaction becomes twenty-seven times. What is the order of the reaction?

Q94. CBSE 2023 · 2 marks The conversion of molecule A to B followed second order kinetics. If concentration of A increased to three times, how will it affect the rate of formation of B?

Q95. CBSE 2023 · 2 marks (a) The conversion of molecule A to B followed second order kinetics. If concentration of A increased to three times, how will it affect the rate of formation of B? (b) Define Pseudo first order reaction with an example.

Q96. CBSE 2023 · 2 marks A chemical reaction $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ in gas phase was carried out in a closed vessel. The concentration of NO₂ was found to increase by $5 \times 10^{-3} \text{ mol L}^{-1}$ in 10 seconds. Calculate: (a) the rate of formation of NO₂, and (b) the rate of consumption of N₂O₅.

Q97. CBSE 2023 · 2 marks The following data were obtained for the reaction: $2\text{NO}_2(\text{g}) + \text{F}_2(\text{g}) \rightarrow 2\text{NO}_2\text{F}(\text{g})$. Experiment No. 1: [NO₂]/M = 0.2, [F₂]/M = 0.05, Initial rate $\text{M min}^{-1} = 6 \times 10^{-3}$. Experiment No. 2: [NO₂]/M = 0.4, [F₂]/M = 0.05, Initial rate $\text{M min}^{-1} = 12 \times 10^{-2}$. Experiment No. 3: [NO₂]/M = 0.8, [F₂]/M = 0.10, Initial rate $\text{M min}^{-1} = 48 \times 10^{-2}$. Determine the overall order of reaction.

Q98. CBSE 2023 · 2 marks The half-life of a first order reaction is 60 minutes. How long will it take to consume 90% of the reactant?

Q99. CBSE 2023 · 2 marks The rate constant for the first order decomposition of N₂O₅ is given by the following equation: $\log k = 236 - (\text{TK}/1024)$. Calculate E_a for this reaction. [R = 8.314 J K⁻¹ mol⁻¹]

Q100. CBSE 2023 · 2 marks The rate constant for the first order decomposition of N₂O₅ is given by the following equation: $\log k = 23.6 - 1024/T(\text{K})$. Calculate E_a for this reaction. [R = 8.314 J K⁻¹ mol⁻¹]

Q101. CBSE 2023 · 2 marks What happens to the rate constant k and activation energy E_a as the temperature of a chemical reaction is increased? Justify.

Q102. CBSE 2022 · 2 marks In a reaction $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$, the concentration of N₂O₅ decreases from 0.5 mol L⁻¹ to 0.4 mol L⁻¹ in 10 minutes. Calculate the average rate of this reaction and rate of production of NO₂ during this period.

Q103. CBSE 2022 · 2 marks A reaction is first order in X and second order in Y. (i) How is the rate affected on increasing the concentration of Y three times? (ii) How is the rate affected when the concentrations of both X and Y are doubled?

SHORT ANSWER (29)

Q104. CBSE 2026 · 3 marks A first order reaction is 50% complete in 20 minutes. Calculate the time for 75% completion of the reaction. [$\log 4 = 0.6$]

Q105. CBSE 2026 · 3 marks For the first order thermal decomposition reaction, following data was obtained: $\text{C}_2\text{H}_5\text{Cl}(\text{g}) \rightarrow \text{C}_2\text{H}_4(\text{g}) + \text{HCl}(\text{g})$. S. No. Time(s) Total Pressure (atm) 1 0 0.30 2 30 0.50. Calculate rate constant. [Given: $\log 3 = 0.48$]

Q106. CBSE 2026 · 3 marks The half-life period of a radioactive element is 1.5×10^{10} years. Calculate the time in which the activity of the element is reduced to 75% of its original value. [Given: $\log 2 = 0.30$, $\log 3 = 0.48$, $\log 4 = 0.60$]



Q107. CBSE 2026 · 3 marks Consider the decomposition of hydrogen peroxide (H_2O_2) as per the equation given below: $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ (I- catalyst). The mechanism for this reaction was found to be: Step I: $\text{H}_2\text{O}_2 + \text{I}^- \rightarrow \text{H}_2\text{O} + \text{IO}^-$ (slow). Step II: $\text{H}_2\text{O}_2 + \text{IO}^- \rightarrow \text{H}_2\text{O} + \text{I}^- + \text{O}_2$ (fast). (a) Write the rate law expression. (b) Determine the order of reaction with respect to H_2O_2 , I^- and overall order of reaction. (c) What is the molecularity of the reaction in Step II?

Q108. CBSE 2026 · 3 marks Consider the decomposition of hydrogen peroxide (H_2O_2) as per the equation given below: $2\text{H}_2\text{O}_2 \xrightarrow{[\text{I}], \text{Alkaline medium}} 2\text{H}_2\text{O} + \text{O}_2$. The mechanism for this reaction was found to be: Step I: $\text{H}_2\text{O}_2 + \text{I}^- \rightarrow \text{H}_2\text{O} + \text{IO}^-$ (slow), Step II: $\text{H}_2\text{O}_2 + \text{IO}^- \rightarrow \text{H}_2\text{O} + \text{I}^- + \text{O}_2$ (fast). (a) Write the rate law expression. (b) Determine the order of reaction with respect to H_2O_2 , I^- and overall order of reaction. (c) What is the molecularity of the reaction in Step II?

Q109. CBSE 2026 · 3 marks (a) Define order of a reaction. (b) The rate for the following reaction is given by: $\text{A} + \text{B} \rightarrow \text{C}$, Rate = $k[\text{A}][\text{B}]^2$. (i) How is the rate of reaction affected if we double the concentration of B? (ii) Write the overall order of a reaction if 'A' is present in large excess.

Q110. CBSE 2026 · 3 marks The rate of the chemical reaction doubles when the temperature is raised from 298 K to 308 K. Calculate activation energy (E_a) for this reaction assuming that it does not change with temperature. (Given: $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$, $\log 2 = 0.30$)

Q111. CBSE 2026 · 3 marks The rate of a particular reaction quadruples when the temperature increases from 293 K to 313 K. Calculate the energy of activation (E_a) of the reaction assuming that it does not change with temperature. (Given: $\log 4 = 0.60$, $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

Q112. CBSE 2026 · 3 marks The rate of a particular reaction quadruples when the temperature increases from 300 K to 320 K. Calculate the energy of activation (E_a) of the reaction assuming that it does not change with temperature. (Given: $\log 4 = 0.60$, $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

Q113. CBSE 2025 · 3 marks The rate constant of a first order reaction increases from 0.04 s^{-1} to 0.08 s^{-1} when the temperature increases from 27°C to 37°C . Calculate the energy of activation (E_a). [Given: $2.303R = 19.15 \text{ J K}^{-1} \text{ mol}^{-1}$] [$\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 4 = 0.6021$]

Q114. CBSE 2025 · 3 marks For the reaction $\text{A} + \text{B} \rightarrow \text{Products}$, the following initial rates were obtained at various initial concentrations of reactants: Sl. No. 1: $[\text{A}] = 0.1 \text{ mol L}^{-1}$, $[\text{B}] = 0.1 \text{ mol L}^{-1}$, Initial rate = $0.05 \text{ mol L}^{-1} \text{ s}^{-1}$; Sl. No. 2: $[\text{A}] = 0.2 \text{ mol L}^{-1}$, $[\text{B}] = 0.1 \text{ mol L}^{-1}$, Initial rate = $0.10 \text{ mol L}^{-1} \text{ s}^{-1}$; Sl. No. 3: $[\text{A}] = 0.1 \text{ mol L}^{-1}$, $[\text{B}] = 0.2 \text{ mol L}^{-1}$, Initial rate = $0.05 \text{ mol L}^{-1} \text{ s}^{-1}$. Determine the order of the reaction with respect to A and B and overall order of the reaction.

Q115. CBSE 2025 · 3 marks For the reaction $\text{A} + \text{B} \rightarrow \text{Products}$, the following initial rates were obtained at various initial concentrations of reactants: Sl. No. 1: $[\text{A}]/\text{mol L}^{-1} = 0.1$, $[\text{B}]/\text{mol L}^{-1} = 0.1$, Initial rate/ $\text{mol L}^{-1} \text{ s}^{-1} = 0.05$; Sl. No. 2: $[\text{A}]/\text{mol L}^{-1} = 0.2$, $[\text{B}]/\text{mol L}^{-1} = 0.1$, Initial rate/ $\text{mol L}^{-1} \text{ s}^{-1} = 0.10$; Sl. No. 3: $[\text{A}]/\text{mol L}^{-1} = 0.1$, $[\text{B}]/\text{mol L}^{-1} = 0.2$, Initial rate/ $\text{mol L}^{-1} \text{ s}^{-1} = 0.05$. Determine the order of the reaction with respect to A and B and overall order of the reaction.

Q116. CBSE 2025 · 3 marks The rate of a reaction: $\text{A} + \text{B} \rightarrow \text{product}$ is given below as a function of different initial concentrations of A and B. Calculate the order of the reaction with respect to A and B. Determine the rate constant of the reaction.

Q117. CBSE 2025 · 3 marks The following data were obtained during the first order thermal decomposition of N_2O_5 (g) at constant volume: $2\text{N}_2\text{O}_5 (\text{g}) \rightarrow 2\text{N}_2\text{O}_4 (\text{g}) + \text{O}_2 (\text{g})$. S.No. Time/s Total Pressure/atm: 1) 0 0.5, 2) 100 0.625. Calculate rate constant. (Given: $\log 2 = 0.3010$, $\log 10 = 1$)

Q118. CBSE 2025 · 3 marks The following data were obtained during the first order thermal decomposition of N_2O_5 (g) at constant volume: $2\text{N}_2\text{O}_5 (\text{g}) \rightarrow 2\text{N}_2\text{O}_4 (\text{g}) + \text{O}_2 (\text{g})$. S.No. 1: Time 0 s, Total Pressure 0.5 atm; S.No. 2: Time 100 s, Total Pressure 0.625 atm. Calculate rate constant. [Given: $\log 2 = 0.3010$, $\log 10 = 1$]

Q119. CBSE 2024 · 3 marks The following initial rate data were obtained for the reaction: $2\text{NO}(\text{g}) + \text{Br}_2(\text{g}) \rightarrow 2\text{NOBr}(\text{g})$. Expt. No. 1: $[\text{NO}] = 0.05$, $[\text{Br}_2] = 0.05$, Rate = 1.0×10^{-3} . Expt. No. 2: $[\text{NO}] = 0.05$, $[\text{Br}_2] = 0.15$, Rate = 3.0×10^{-3} . Expt. No. 3: $[\text{NO}] = 0.15$, $[\text{Br}_2] = 0.05$, Rate = 9.0×10^{-3} . (a) What is the order with respect to NO and Br_2 in the reaction? (b) Calculate the rate constant (k). (c) Determine the rate of reaction when concentration of NO and Br_2 are 0.4 M and 0.2 M, respectively.

Q120. CBSE 2024 · 3 marks The following initial rate data were obtained for the reaction: $2\text{NO}(\text{g}) + \text{Br}_2(\text{g}) \rightarrow 2\text{NOBr}(\text{g})$. Expt. No. | $[\text{NO}]/\text{mol L}^{-1}$ | $[\text{Br}_2]/\text{mol L}^{-1}$ | Initial Rate ($\text{mol L}^{-1} \text{ s}^{-1}$) | 1 | 0.05 | 0.05 | 1.0×10^{-3} | 2 | 0.05 | 0.15 | 3.0×10^{-3} | 3 | 0.15 | 0.05 | 9.0×10^{-3} | (a) What is the order with respect to NO and Br_2 in the reaction? (b) Calculate the rate constant (k). (c) Determine the rate of reaction when concentration of NO and Br_2 are 0.4 M and 0.2 M, respectively.

Q121. CBSE 2024 · 3 marks The rate of a gaseous reaction triples when temperature is increased from 17°C to 27°C . Calculate the energy of activation for this reaction. [Given: $2.303 R = 19.15 \text{ J K}^{-1} \text{ mol}^{-1}$, $\log 3 = 0.48$]

Q122. CBSE 2024 · 3 marks The rate of a gaseous reaction triples when temperature is increased from 17°C to 27°C . Calculate the energy of activation for this reaction. [Given: $2.303 R = 19.15 \text{ J K}^{-1} \text{ mol}^{-1}$, $\log 3 = 0.48$]

Q123. CBSE 2024 · 3 marks A first-order reaction is 25% complete in 40 minutes. Calculate the value of rate constant. In what time will the reaction be 80% complete? Given: $\log 2 = 0.30$, $\log 3 = 0.48$, $\log 4 = 0.60$, $\log 5 = 0.69$

Q124. CBSE 2023 · 3 marks A first order reaction is 50% complete in 30 minutes at 300 K and in 10 minutes at 320 K. Calculate activation energy (E_a) for the reaction. [$R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$] [Given: $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 4 = 0.6021$]



Q125. CBSE 2023 · 3 marks The rate of a reaction doubles when temperature changes from 27°C to 37°C. Calculate energy of activation for the reaction. ($R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$) (Given: $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 4 = 0.6021$)

Q126. CBSE 2023 · 3 marks The rate of a reaction doubles when temperature changes from 27°C to 37°C. Calculate energy of activation for the reaction. ($R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

Q127. CBSE 2023 · 3 marks The following data were obtained during the first order thermal decomposition of $\text{C}_2\text{H}_5\text{Cl}$ at a constant volume: $\text{C}_2\text{H}_5\text{Cl}(\text{g}) \rightarrow \text{C}_2\text{H}_4(\text{g}) + \text{HCl}(\text{g})$. Experiment 1: Time = 0 s, Total pressure = 0.4 atm. Experiment 2: Time = 100 s, Total pressure = 0.6 atm. Calculate the rate constant. [Given: $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 4 = 0.6021$]

Q128. CBSE 2023 · 3 marks (a) For the reaction $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ at 318 K calculate the rate of reaction if rate of disappearance of $\text{N}_2\text{O}_5(\text{g})$ is $1.4 \times 10^{-3} \text{ m s}^{-1}$.

Q129. CBSE 2023 · 3 marks (a) For the reaction $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ at 318 K calculate the rate of reaction if rate of disappearance of $\text{N}_2\text{O}_5(\text{g})$ is $1.4 \times 10^{-3} \text{ m s}^{-1}$. (b) For a first order reaction derive the relationship $t_{99\%} = 2t_{90\%}$

Q130. CBSE 2022 · 2 marks In the given reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$, the rate of formation of NH_3 is $3.6 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$. Calculate: (i) rate of reaction, and (ii) rate of disappearance of $\text{H}_2(\text{g})$.

Q131. CBSE 2022 · 3 marks A first order reduction takes 30 minutes for 75% decomposition. Calculate $t_{1/2}$. Given: [$\log 2 = 0.3$, $\log 3 = 0.48$, $\log 4 = 0.6$, $\log 5 = 0.7$]

Q132. CBSE 2022 · 3 marks A first order reaction takes 30 minutes for 75% decomposition. Calculate $t_{1/2}$. Given: [$\log 2 = 0.3$, $\log 3 = 0.48$, $\log 4 = 0.6$, $\log 5 = 0.7$]

LONG ANSWER (2)

Q133. CBSE 2025 · 3 marks (a) (i) The initial concentration of N_2O_5 in the first order reaction: $\text{N}_2\text{O}_5(\text{g}) \rightarrow 2\text{NO}_2(\text{g}) + 1/2 \text{O}_2(\text{g})$ was $1.2 \times 10^{-2} \text{ mol L}^{-1}$. The concentration of N_2O_5 after 60 minutes was $0.2 \times 10^{-2} \text{ mol L}^{-1}$. Calculate the rate constant of the reaction at 318 K. [$\log 6 = 0.778$]

Q134. CBSE 2025 · 5 marks (a) (i) The initial concentration of N_2O_5 in the first order reaction: $\text{N}_2\text{O}_5(\text{g}) \rightarrow 2\text{NO}_2(\text{g}) + 1/2 \text{O}_2(\text{g})$ was $1.2 \times 10^{-2} \text{ mol L}^{-1}$. The concentration of N_2O_5 after 60 minutes was $0.2 \times 10^{-2} \text{ mol L}^{-1}$. Calculate the rate constant of the reaction at 318 K. [$\log 6 = 0.778$]. (ii) Account for the following: (I) We cannot determine the order of a reaction by taking into consideration the balanced chemical equation. (II) A bimolecular reaction may become kinetically of first order under a specified condition.

CASE-BASED (2)

CASE STUDY · CBSE 2023

The rate of reaction is concerned with decrease in concentration of reactants or increase in the concentration of products per unit time. It can be expressed as instantaneous rate at a particular instant of time and average rate over a large interval of time. Mathematical representation of rate of reaction is given by rate law. Rate constant and order of a reaction can be determined from rate law or its integrated rate equation.

Q135. CBSE 2023 · 4 marks (i) What is average rate of reaction?

CASE STUDY · CBSE 2022

The rate law for a chemical reaction relates the reaction rate with the concentrations or partial pressures of the reactants. For a general reaction $a\text{A} + b\text{B} \rightarrow \text{C}$ with no intermediate steps in its reaction mechanism, meaning that it is an elementary reaction, the rate law is given by $r = k[\text{A}]^x[\text{B}]^y$, where $[\text{A}]$ and $[\text{B}]$ express the concentrations of A and B in moles per litre. Exponents x and y vary for each reaction and are determined experimentally. The value of k varies with conditions that affect reaction rate, such as temperature, pressure, surface area, etc. The sum of these exponents is known as overall reaction order. A zero order reaction has a constant rate that is independent of the concentration of the reactants. A first order reaction depends on the concentration of only one reactant. A reaction is said to be second order when the overall order is two. Once we have determined the order of the reaction, we can go back and plug in one set of our initial values and solve for k .

Q136. CBSE 2022 · 1 mark Calculate the overall order of a reaction which has the following rate expression: Rate = $k[\text{A}]^{1/2}[\text{B}]^{3/2}$

4 The d and f Block Elements

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (71)

Q1. CBSE 2026 · 1 mark Which of the following is not a transition metal?

- (a) Hg (b) Cu (c) Ag (d) Pt

Q2. CBSE 2026 · 1 mark Assertion (A) : Transition metals have high melting points. Reason (R) : Transition metals have incompletely filled d-orbitals.

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



Q3. CBSE 2026 · 1 mark Which of the following is most basic?

- (a) Mn_2O_7 (b) MnO_2 (c) MnO (d) Mn_2O_3

Q4. CBSE 2026 · 1 mark Assertion (A): Actinoids show irregularities in their electronic configurations. Reason (R): In actinoids 5f, 6d and 7s orbitals are of comparable energies.

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

Q5. CBSE 2026 · 1 mark Which of the following transition metals has lowest enthalpy of atomisation?

- (a) Cr (b) V (c) Mn (d) Fe

Q6. CBSE 2026 · 1 mark Assertion (A) : Actinoids show irregularities in their electronic configurations. Reason (R) : Due to varying stabilities of f0, f7 and f14 occupancies of the 5f orbitals.

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

Q7. CBSE 2026 · 1 mark Electronic configuration of chromium is:

- (a) $[\text{Ar}] 3d^4 4s^1$ (b) $[\text{Ar}] 3d^4 4s^2$ (c) $[\text{Ar}] 3d^5 4s^1$
(d) $[\text{Ar}] 3d^5 4s^2$

Q8. CBSE 2026 · 1 mark Assertion (A): Zinc, cadmium and mercury are not considered as transition elements. Reason (R): These elements have completely filled orbitals in their ground state as well as in their common oxidation states.

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

Q9. CBSE 2026 · 1 mark In aqueous solution, $\text{Cr}_2\text{O}_7^{2-}$ ion converts to which of the following in alkaline medium?

- (a) Cr^{3+} (b) CrO_4^{2-} (c) CrO (d) CrO_3

Q10. CBSE 2026 · 1 mark Assertion (A): Separation of Zr and Hf is difficult. Reason (R): Because Zr and Hf lie in the same group of the periodic table.

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

Q11. CBSE 2026 · 1 mark In aqueous acidified solution, CrO_4^{2-} ion converts to which of the following?

- (a) CrO_3 (b) Cr^{3+} (c) $\text{Cr}_2\text{O}_7^{2-}$ (d) CrO

Q12. CBSE 2026 · 1 mark Assertion (A): Separation of Zr and Hf is difficult. Reason (R): Zr and Hf have almost identical atomic and ionic radii due to lanthanoid contraction.

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

Q13. CBSE 2026 · 1 mark Manganate ion is paramagnetic due to the presence of:

- (a) one unpaired electron (b) two unpaired electrons
(c) three unpaired electrons (d) fully paired electrons

Q14. CBSE 2026 · 1 mark Assertion (A): $\text{Eo}(\text{Sc}^{3+}/\text{Sc}^{2+})$ has low value. Reason (R): Because of the stability of Sc^{3+} ion which has a noble gas configuration.

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

Q15. CBSE 2026 · 1 mark Which property of transition metals enables them to form alloys?

- (a) High ionization enthalpy (b) Similar atomic radii
(c) Catalytic property (d) Complex formation

Q16. CBSE 2026 · 1 mark Which of the following d-orbitals experience more repulsion in the crystal field splitting of octahedral complex?

- (a) dxy, dyz, dxz (b) dx^2-y^2 , dz^2 (c) dxy, dx^2-y^2
(d) dxz, dz^2

Q17. CBSE 2026 · 1 mark Actinoids show larger number of oxidation states:

- (a) because they are radioactive in nature
(b) because they have large atomic numbers
(c) because they have large atomic masses
(d) due to comparable energies of 5f, 6d and 7s orbitals

Q18. CBSE 2026 · 1 mark Assertion (A) : Highest oxidation state of Mn is +7 in first series of transition elements. Reason (R) : Transition metals exhibit variable oxidation states.

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

Q19. CBSE 2025 · 1 mark Which of the following transition metals does not show variable oxidation states?

- (a) Cu (b) Sc (c) Ti (d) Fe



Q20. CBSE 2025 · 1 mark Assertion (A): Zinc is not regarded as a transition element. Reason (R): Zinc has completely filled 3d orbitals in its ground state as well as in its oxidised state.

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

Q21. CBSE 2025 · 1 mark Out of Fe^{3+} , Sc^{3+} , Cr^{3+} and Co^{3+} ions, the one which is colourless in aqueous solution is: [Atomic number: Fe = 26, Sc = 21, Cr = 24, Co = 27]

- (a) Sc^{3+} (b) Fe^{3+} (c) Cr^{3+} (d) Co^{3+}

Q22. CBSE 2025 · 1 mark Out of the following statements, the incorrect statement is:

- (a) La is actually an element of transition series.
- (b) Zr and Hf have almost identical atomic radii because of lanthanoid contraction.
- (c) Ionic radius decreases from La^{3+} to Lu^{3+} ion.
- (d) Lanthanoids are radioactive in nature.

Q23. CBSE 2025 · 1 mark The product of the oxidation of I^- with MnO_4^- in alkaline medium is:

- (a) IO_4^- (b) I_2 (c) IO^- (d) IO_3^-

Q24. CBSE 2025 · 1 mark Assertion (A): Cuprous salts are diamagnetic. Reason (R): Cuprous ion has completely filled 3d-orbitals.

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

Q25. CBSE 2025 · 1 mark Out of Ti^{3+} , Cr^{3+} , Mn^{2+} and Ni^{2+} ions, the one which has the highest magnetic moment is: [Atomic number: Ti = 22, Cr = 24, Mn = 25, Ni = 28]

- (a) Ti^{3+} (b) Cr^{3+} (c) Mn^{2+} (d) Ni^{2+}

Q26. CBSE 2025 · 1 mark Assertion (A): Cuprous salts are diamagnetic. Reason (R): In cuprous ion, 3d-orbitals are partially filled.

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

Q27. CBSE 2025 · 1 mark Out of Ti^{3+} , Cr^{3+} , Fe^{2+} and Ni^{2+} ions, the one which is the most stable ion in aqueous solution is: [Atomic number: Ti = 22, Cr = 24, Fe = 26, Ni = 28]

- (a) Ti^{3+} (b) Cr^{3+} (c) Fe^{2+} (d) Ni^{2+}

Q28. CBSE 2025 · 1 mark Out of the following statements, the correct statement is:

- (a) La is actually not an element of transition series.
- (b) Zr and Hf have almost identical atomic radii.
- (c) Lanthanoids are radioactive.
- (d) Ionic radius increases from La^{3+} to Lu^{3+} .

Q29. CBSE 2025 · 1 mark Which of the following properties of transition metals enables them to behave as catalysts?

- (a) High melting point (b) High ionisation enthalpy
- (c) Alloy formation (d) Variable oxidation states

Q30. CBSE 2025 · 1 mark In which of the following groups are both ions coloured in aqueous solution? I. Cu^+ II. Ti^{4+} III. Co^{2+} IV. Fe^{2+} [Atomic number: Cu = 29, Ti = 22, Co = 27, Fe = 26]

- (a) I and II (b) II and III (c) III and IV (d) I and IV

Q31. CBSE 2025 · 1 mark Which of the following is the softest metal?

- (a) Zn (b) Sc (c) Cu (d) Fe

Q32. CBSE 2025 · 1 mark Assertion (A): Actinoids show wide range of oxidation states. Reason (R): Actinoids are radioactive in nature.

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

Q33. CBSE 2025 · 1 mark Assertion (A): Actinoids show wide range of oxidation states. Reason (R): This is due to comparable energies of 5f, 6d and 7s orbitals.

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

Q34. CBSE 2025 · 1 mark Which of the following transition metals has the highest melting point?

- (a) Sc (b) Cr (c) Mn (d) Zn

Q35. CBSE 2025 · 1 mark Assertion (A): Actinoid contraction is greater from element to element than lanthanoid contraction. Reason (R): Actinoids show wide range of oxidation states.

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

Q36. CBSE 2025 · 1 mark Which of the following transition metal ion is not coloured?

- (a) Cu^+ (b) Ni^{2+} (c) Co^{2+} (d) V^{3+}



Q37. CBSE 2025 · 1 mark Assertion (A): Actinoids show irregularities in their electronic configurations. Reason (R): Actinoids are radioactive in nature.

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

Q38. CBSE 2025 · 1 mark Among the following outermost electronic configurations of transition metals, which one shows the highest oxidation state ?

- (a) $3d^6 4s^2$ (b) $3d^5 4s^1$ (c) $3d^5 4s^2$ (d) $3d^3 4s^2$

Q39. CBSE 2025 · 1 mark Assertion (A): Actinoids show irregularities in their electronic configurations. Reason (R): This is due to varying stability of f_0 , f_7 and f_{14} configurations.

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

Q40. CBSE 2025 · 1 mark With increase in atomic number, the melting point of transition metals:

- (a) first increases and then decreases
- (b) increases continuously
- (c) first decreases and then increases (d) remains constant

Q41. CBSE 2025 · 1 mark Assertion (A): First ionisation enthalpy of Cr is lower than that of Zn. Reason (R): Zinc is a non-transition element.

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

Q42. CBSE 2024 · 1 mark Which one of the following first row transition elements is expected to have the highest third ionization enthalpy?

- (a) Iron ($Z = 26$) (b) Manganese ($Z = 25$)
- (c) Chromium ($Z = 24$) (d) Vanadium ($Z = 23$)

Q43. CBSE 2024 · 1 mark Assertion (A): Separation of Zr and Hf is difficult. Reason (R): Zr and Hf have similar radii due to lanthanoid contraction.

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

Q44. CBSE 2024 · 1 mark The most stable oxidation state of Iron is:

- (a) +2 (b) +3 (c) +4 (d) -2

Q45. CBSE 2024 · 1 mark Assertion (A): Transition metals have high enthalpy of atomization. Reason (R): This is because transition metals have low melting points.

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

Q46. CBSE 2024 · 1 mark Assertion (A): Separation of Zr and Hf is difficult. Reason (R): Zr and Hf are radioactive.

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

Q47. CBSE 2024 · 1 mark When MnO_2 is fused with KOH in air, it gives:

- (a) $KMnO_4$ (b) K_2MnO_4 (c) Mn_2O_7 (d) Mn_2O_3

Q48. CBSE 2024 · 1 mark The correct order for the increasing oxidizing power in 3d series of transition elements is:

- (a) $MnO_4^- < Cr_2O_7^{2-} < VO_2^+$ (b) $Cr_2O_7^{2-} < VO_2^+ < MnO_4^-$
- (c) $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$ (d) $VO_2^+ < MnO_4^- < Cr_2O_7^{2-}$

Q49. CBSE 2024 · 1 mark Transition elements form alloys easily because they have:

- (a) same electronic configuration
- (b) same enthalpies of atomisation
- (c) same oxidation states (d) nearly the same atomic size

Q50. CBSE 2024 · 1 mark Which of the following elements of 3d series of transition elements has the lowest aH_o ?

- (a) Sc (b) Cr (c) Cu (d) Zn

Q51. CBSE 2023 · 1 mark The most common and stable oxidation state of a Lanthanoid is:

- (a) +2 (b) +3 (c) +4 (d) +6

Q52. CBSE 2023 · 1 mark Lanthanoid contraction is due to increase in:

- (a) atomic number (b) shielding by 4f electrons
- (c) effective nuclear charge (d) atomic radius

Q53. CBSE 2023 · 1 mark Which of the following characteristics of transition metals is associated with their catalytic activity?

- (a) Paramagnetic nature (b) Colour of hydrated ions
- (c) High enthalpy of atomisation
- (d) Variable oxidation states

Q54. CBSE 2023 · 1 mark Assertion (A): Copper is a non-transition element. Reason (R): Copper has completely filled d-orbitals in its ground state.

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



Q55. CBSE 2023 · 1 mark Which one among the following metals of 3d series has the lowest melting point ?

- (a) Fe (b) Mn (c) Zn (d) Cu

Q56. CBSE 2023 · 1 mark Assertion (A): Transition metals have high enthalpy of atomisation. Reason (R): Greater number of unpaired electrons in transition metals results in weak metallic bonding.

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

Q57. CBSE 2023 · 1 mark Which of the following transition metals shows + 1 and + 2 oxidation states?

- (a) Mn (b) Zn (c) Sc (d) Cu

Q58. CBSE 2023 · 1 mark Assertion (A): Transition metals show their highest oxidation state with oxygen. Reason (R): The ability of oxygen to form multiple bonds to metals.

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

Q59. CBSE 2023 · 1 mark Among the following outermost configurations of transition metals which one shows the highest oxidation state?

- (a) $3d^3 4s^2$ (b) $3d^5 4s^1$ (c) $3d^5 4s^2$ (d) $3d^6 4s^2$

Q60. CBSE 2023 · 1 mark Assertion (A): Zinc is not regarded as a transition element. Reason (R): In zinc, 3d orbitals are completely filled in its ground state as well as in its oxidised state.

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

Q61. CBSE 2023 · 1 mark Which of the following transition metals does not show variable oxidation state?

- (a) Ti (b) Cr (c) Cu (d) Sc

Q62. CBSE 2023 · 1 mark Which of the following ions has the maximum number of unpaired d-electrons?

- (a) Fe^{3+} (b) V^{3+} (c) Ti^{3+} (d) Sc^{3+}

Q63. CBSE 2023 · 1 mark Assertion (A): Fe^{2+} acts as a reducing agent. Reason (R): Fe^{3+} state is stable due to $3d^5$ configuration.

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

Q64. CBSE 2023 · 1 mark The ions of metals of Group 12 (Zn, Cd and Hg) have completely filled d orbitals and so they:

- (a) behave like semiconductors
(b) are very high melting solids
(c) do not behave like transition metals
(d) behave like superconductors

Q65. CBSE 2023 · 1 mark Assertion (A): Zr and Hf have almost identical radii. Reason (R): Both Zr and Hf exhibit similar properties.

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

Q66. CBSE 2023 · 1 mark The interstitial compounds of transition metals are:

- (a) softer (b) more ductile (c) harder
(d) more metallic than the metal itself

Q67. CBSE 2023 · 1 mark Assertion (A): Manganese shows the highest oxidation state of +7 in 3d series. Reason (R): Transition metals show variable oxidation states.

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

Q68. CBSE 2023 · 1 mark Which of the following Cu^{2+} halide is not known?

- (a) $CuBr_2$ (b) CuI_2 (c) $CuCl_2$ (d) CuF_2

Q69. CBSE 2023 · 1 mark Which property of transition metals enables them to behave as catalysts?

- (a) High melting point (b) High ionisation enthalpy
(c) Alloy formation (d) Variable oxidation states

Q70. CBSE 2023 · 1 mark In the two tetrahedral structures of dichromate ion

- (a) 4 Cr – O bonds are equivalent in length
(b) 6 Cr – O bonds are equivalent in length
(c) All Cr – O bonds are equivalent in length
(d) All Cr – O bonds are non-equivalent

Q71. CBSE 2023 · 1 mark Which of the following ions has the electronic configuration $3d^6$?

- (a) Ni^{3+} (b) Co^{3+} (c) Mn^{2+} (d) Mn^{3+}

VERY SHORT ANSWER (7)

Q72. CBSE 2026 · 2 marks First ionization enthalpy of Cr is lower than that of Zn. Why? Mention any one property of the transition elements which makes them good catalysts.

Q73. CBSE 2026 · 2 marks (a) Why is third ionization enthalpy of manganese very high ? (b) Why Zn, Cd and Hg are not regarded as transition elements ?



Q74. CBSE 2026 · 2 marks (a) Why second ionization enthalpies of chromium and copper are exceptionally higher than those of their neighbouring elements? (b) Why transition elements form interstitial compounds?

Q75. CBSE 2024 · 2 marks (a) What is lanthanoid contraction? Actinoid contraction is greater from element to element than lanthanoid contraction. Why?

Q76. CBSE 2024 · 2 marks (a) What is lanthanoid contraction? Actinoid contraction is greater from element to element than lanthanoid contraction. Why? OR (b) Why do transition metals have high enthalpy of atomization? Which element of 3d-series has lowest enthalpy of atomization?

Q77. CBSE 2024 · 2 marks Complete the following ionic equations: (a) $42\text{MnO}_4^- + 35\text{SO}_3^{2-} + 6\text{H}^+ \rightarrow$

Q78. CBSE 2024 · 2 marks Complete and balance the following chemical equations: (a) $4\text{MnO}_4^- + 4\text{H}^+ \rightarrow$ (b) $27\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{Fe}^{2+} \rightarrow$

SHORT ANSWER (13)

Q79. CBSE 2026 · 3 marks Complete and balance the following equations: (i) $2\text{KMnO}_4 \rightarrow \text{K}_2\text{MnO}_4 + \dots$ (ii) $\text{Na}_2\text{Cr}_2\text{O}_7 + 2\text{KCl} \rightarrow \dots$ Why is it difficult to separate lanthanoid elements in pure state?

Q80. CBSE 2026 · 3 marks (a) Complete and balance the following equations: (i) $4\text{FeCr}_2\text{O}_4 + 8\text{Na}_2\text{CO}_3 + 7\text{O}_2 \rightarrow$ (ii) $5\text{Fe}^{2+} + \text{MnO}_4^- + 8\text{H}^+ \rightarrow$ (b) Explain why actinoid contraction is greater from element to element than lanthanoid contraction.

Q81. CBSE 2026 · 3 marks (a) Complete and balance the following equations: (i) $2\text{Na}_2\text{CrO}_4 + 2\text{H}^+ \rightarrow$ (ii) $5\text{S}^{2-} + 2\text{MnO}_4^- + 16\text{H}^+ \rightarrow$ (b) Why is chemistry of actinoids complicated as compared to lanthanoids?

Q82. CBSE 2025 · 3 marks Give explanation for each of the following observations: (a) With the same d-orbital configuration (d^4), Mn^{3+} ion is an oxidising agent whereas Cr^{2+} ion is a reducing agent. (b) Actinoid contraction is greater from element to element than that among lanthanoids. (c) Transition metals form large number of interstitial compounds with H, B, C and N.

Q83. CBSE 2023 · 3 marks (a) On the basis of crystal field theory write the electronic configuration for d^5 ion with a weak ligand for which $0 < P$.

Q84. CBSE 2022 · 3 marks From the given E° values of the first row transition elements ($\text{Cr} = -0.91$, $\text{Mn} = -1.18$, $\text{Fe} = -0.44$, $\text{Co} = -0.28$, $\text{Ni} = -0.25$, $\text{Cu} = +0.34$, $\text{Zn} = -0.76$ V), answer the following questions: (i) Why is $E^\circ(\text{M}^{2+}/\text{M})$ value highly negative as compared to other elements for Mn? (ii) What is the reason for the irregularity in the above E° values? (iii) Why is $E^\circ(\text{Cu}^{2+}/\text{Cu})$ value exceptionally positive?

Q85. CBSE 2022 · 3 marks Account for the following: (i) Transition metals and their compounds show catalytic activities. (ii) Zn, Cd and Hg are non-transition elements. (iii) Zr and Hf are of almost identical atomic radii.

Q86. CBSE 2022 · 3 marks From the given $E^\circ(\text{M}^{2+}/\text{M})$ values of the first row transition elements ($\text{Cr}: -0.91$, $\text{Mn}: -1.18$, $\text{Fe}: -0.44$, $\text{Co}: -0.28$, $\text{Ni}: -0.25$, $\text{Cu}: +0.34$, $\text{Zn}: -0.76$ V), answer the following questions: (i) Why is $\text{Mn}/2\text{Mn}^{2+}$ E° value highly negative as compared to other elements? (ii) What is the reason for the irregularity in the above E° values? (iii) Why is $\text{Cu}/2\text{Cu}^{+}$ E° value exceptionally positive?

Q87. CBSE 2022 · 3 marks (i) Which ion amongst the following is colourless and why? Ti^{4+} , Cr^{3+} , V^{3+} (Atomic number of Ti = 22, Cr = 24, V = 23) (ii) Why is Mn^{2+} much more resistant than Fe^{2+} towards oxidation? (iii) Highest oxidation state of a metal is shown in its oxide or fluoride only. Justify the statement.

Q88. CBSE 2022 · 3 marks (a) (i) Silver atom has completely filled d-orbitals in its ground state, it is still considered to be a transition element. Justify the statement. (ii) Why are $\Delta H_f^\circ/\text{M}^{2+}$ values of Mn and Zn more negative than expected? (iii) Why do transition metals form alloys?

Q89. CBSE 2022 · 3 marks (a) (i) Silver atom has completely filled d-orbitals in its ground state, it is still considered to be a transition element. Justify the statement. (ii) Why are $M^\wedge(\text{M}/E_2)$ values of Mn and Zn more negative than expected? (iii) Why do transition metals form alloys?

Q90. CBSE 2022 · 3 marks (b) (i) Calculate the spin only magnetic moment of the complex $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$. (Atomic number of Fe = 26) (ii) Which out of the following two complexes is more stable and why? $[\text{CoF}_6]^{3-}$, $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$ (iii) Write the IUPAC name of the given complex: $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$

Q91. CBSE 2022 · 3 marks (a) (i) Silver atom has completely filled d-orbitals in its ground state, it is still considered to be a transition element. Justify the statement. (ii) Why are M^{2+}/M E° values of Mn and Zn more negative than expected? (iii) Why do transition metals form alloys?

LONG ANSWER (34)

Q92. CBSE 2026 · 5 marks Define transition elements. Mention any two characteristics of transition elements.

Q93. CBSE 2026 · 5 marks (a) (i) From the given data of E values, answer the following questions: (I) Why $E(\text{M}^{2+}/\text{M})$ show irregular trend in the above values? (II) Why is $E(\text{Cu}^{2+}/\text{Cu})$ value exceptionally positive? (III) Why $E(\text{Mn}^{2+}/\text{Mn})$ value is highly negative? (ii) Write the ionic equations for the oxidising action of potassium permanganate for its reaction with I^- in both acidic and alkaline solutions.

Q94. CBSE 2026 · 5 marks (a) (i) From the given data of E values, answer the following questions: (I) Why $E \text{ M}^{2+}/\text{M}$ show irregular trend in the above values? (II) Why is $E \text{ Cu}^{2+}/\text{Cu}$ value exceptionally positive? (III) Why $E \text{ Mn}^{2+} / \text{Mn}$ value is highly negative?

Q95. CBSE 2026 · 5 marks Describe giving reason which one of the following pairs has the property indicated: (I) Fe or Cu – higher melting point (II) Ti^{3+} or Sc^{3+} – coloured in aqueous solution (III) Cr or Zn – higher third ionisation enthalpy. Write the ionic equations for the oxidizing action of MnO_4^- – in acidic medium with: (I) Fe^{2+} ion (II) I^- ion



Q96. CBSE 2026 · 5 marks (a) (i) Describe giving reason which one of the following pairs has the property indicated: (I) Fe or Cu – higher melting point (II) Ti^{3+} or Sc^{3+} – coloured in aqueous solution (III) Cr or Zn – higher third ionisation enthalpy

Q97. CBSE 2026 · 5 marks (a) Describe giving reason which one of the following pairs has the property indicated: (I) Fe or Cu – higher melting point (II) Ti^{3+} or Sc^{3+} – coloured in aqueous solution (III) Cr or Zn – higher third ionisation enthalpy (ii) Write the ionic equations for the oxidizing action of MnO_4^- in acidic medium with: (I) Fe^{2+} ion (II) I^- ion

Q98. CBSE 2026 · 5 marks (a)(i) Account for the following: (I) MnO is basic while Mn_2O_7 is acidic. (II) Iron has higher enthalpy of atomization than that of copper. (III) Mn^{3+} is a stronger oxidising agent than Cr^{3+} . (ii) How do you prepare potassium dichromate from sodium chromate? Write balanced chemical equation for each step.

Q99. CBSE 2026 · 5 marks (a) (i) (I) Why do transition metals show variable oxidation states? (II) Out of Mn^{2+} and Ti^{2+} which will be more paramagnetic and why? [Atomic No.: $Ti = 22$, $Mn = 25$] (III) Which ion is the strongest oxidising agent in the options given below: Cr^{3+} , V^{3+} , Mn^{3+} . Give reason. [Atomic No.: $Cr = 24$, $V = 23$, $Mn = 25$] (ii) Complete and balance the following equations: (I) $2MnO_2 + 4KOH + O_2 \rightarrow$ (II) $5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \rightarrow$

Q100. CBSE 2026 · 5 marks (a) (i) (I) Why do transition metals show variable oxidation states? (I) Out of Mn^{2+} and Ti^{2+} which will be more paramagnetic and why? [Atomic No.: $Ti = 22$, $Mn = 25$] (III) Which ion is the strongest oxidising agent in the options given below: Cr^{3+} , V^{3+} , Mn^{3+} . Give reason. [Atomic No.: $Cr = 24$, $V = 23$, $Mn = 25$] (ii) Complete and balance the following equations: (I) $2MnO_2 + 4KOH + O_2 \rightarrow$ (II) $5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \rightarrow$

Q101. CBSE 2025 · 5 marks (A) (a) Account for the following: (i) Transition metals and their compounds show catalytic activities. (ii) Mn^{3+} is a strong oxidising agent. (iii) Cu^+ is not stable in aqueous solution. (b) Write the preparation of $KMnO_4$ from Pyrolusite ore (MnO_2).

Q102. CBSE 2025 · 5 marks (a)(i) When pyrolusite ore is fused with KOH , in presence of air, a dark green coloured product 'A' is obtained which changes to purple coloured compound 'B' in acidic medium. (I) Write the formulae of 'A' and 'B'. (II) Write the ionic equation for the reaction when compound 'B' reacts with Fe^{2+} in acidic medium.

Q103. CBSE 2025 · 5 marks When pyrolusite ore is fused with KOH , in presence of air, a dark green coloured product 'A' is obtained which changes to purple coloured compound 'B' in acidic medium. (I) Write the formulae of 'A' and 'B'. (II) Write the ionic equation for the reaction when compound 'B' reacts with Fe^{2+} in acidic medium. Give reasons: (I) Ce^{4+} in aqueous solution is a good oxidising agent. (II) The actinoid contraction is greater from element to element than lanthanoid contraction. (III) E° (Zn^{2+}/Zn) value is more negative than expected, whereas E° (Cu^{2+}/Cu) is positive.

Q104. CBSE 2025 · 2 marks When pyrolusite ore is fused with KOH , in presence of air, a dark green coloured product 'A' is obtained which changes to purple coloured compound 'B' in acidic medium. Write the formulae of 'A' and 'B'.

Q105. CBSE 2025 · 5 marks (a) (i) Account for the following: (I) Orange colour of $Cr_2O_7^{2-}$ ion changes to yellow when treated with an alkali. (II) Zn, Cd and Hg are non-transition elements. (III) E° value for Mn^{3+}/Mn^{2+} couple is highly positive (+1.57 V) as compared to Cr^{3+}/Cr^{2+} . (ii) What happens when: (I) Manganate ion undergoes disproportionation reaction in acidic medium? (II) $KMnO_4$ is heated?

Q106. CBSE 2025 · 5 marks (a) (i) Account for the following: (I) Orange colour of $Cr_2O_7^{2-}$ ion changes to yellow when treated with an alkali. (II) Zn, Cd and Hg are non-transition elements. (III) E° value for Mn^{3+}/Mn^{2+} couple is highly positive (+1.57 V) as compared to Cr^{3+}/Cr^{2+} .

Q107. CBSE 2025 · 5 marks Account for the following: (I) Orange colour of $Cr_2O_7^{2-}$ ion changes to yellow when treated with an alkali. (II) Zn, Cd and Hg are non-transition elements. (III) E° value for Mn^{3+}/Mn^{2+} couple is highly positive (+1.57 V) as compared to Cr^{3+}/Cr^{2+} .

Q108. CBSE 2025 · 5 marks Account for the following: (I) The E° (Mn^{2+}/Mn) value for manganese is highly negative, whereas E° (Mn^{3+}/Mn^{2+}) is highly positive. (II) Actinoids show wide range of oxidation states. (III) Transition metals have high melting points. Complete the following ionic equations: (I) $5SO_3^{2-} + 2MnO_4^- + 6H^+ \rightarrow$ (II) $2MnO_4^- + H_2O + I^- \rightarrow$

Q109. CBSE 2025 · 1 mark Account for the following: (I) The E° (Mn^{2+}/Mn) value for manganese is highly negative, whereas E° (Mn^{3+}/Mn^{2+}) is highly positive.

Q110. CBSE 2025 · 5 marks (a) (i) Account for the following: (I) The E° (Mn^{2+}/Mn) value for manganese is highly negative, whereas E° (Mn^{3+}/Mn^{2+}) is highly positive. (II) Actinoids show wide range of oxidation states. (III) Transition metals have high melting points. (ii) Complete the following ionic equations: (I) $5SO_3^{2-} + 2MnO_4^- + 6H^+ \rightarrow$ (II) $2MnO_4^- + H_2O + I^- \rightarrow$

Q111. CBSE 2024 · 5 marks (a)(i) Account for the following: (1) The melting and boiling points of Zn, Cd and Hg are low. (2) Of the d^4 species, Cr^{2+} is strongly reducing while Mn^{3+} is strongly oxidizing. (3) E° value of Cu^{2+}/Cu is +0.34 V. (ii) Complete and balance the following chemical equations: (1) $KMnO_4$ (heat) $\rightarrow$ (2) $Cr_2O_7^{2-} + 6I^- + 14H^+ \rightarrow$

Q112. CBSE 2024 · 5 marks (a) (i) Account for the following: (1) The melting and boiling points of Zn, Cd and Hg are low. (2) Of the d^4 species, Cr^{2+} is strongly reducing while Mn^{3+} is strongly oxidizing. (3) E° value of Cu^{2+}/Cu is +0.34 V.

Q113. CBSE 2023 · 5 marks Assign reason for each of the following: (i) Manganese exhibits the highest oxidation state of +7 among the 3d series of transition elements. (ii) Transition metals and their compounds are generally found to be good catalysts in chemical reactions. (iii) Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4) Mn^{3+} is an oxidising agent. (iv) Zn has lowest enthalpy of atomization. (v) Cu^+ is unstable in an aqueous solution.



Q114. CBSE 2023 · 5 marks (a) (i) In 3d series, which transition element has positive M^{2+}/M value and why? (ii) Name a member of lanthanide series which is well-known to show +4 oxidation state. (b) Give reason: (i) The highest oxidation state is exhibited in oxoanions of transition metals. (ii) HCl is not used to acidify $KMnO_4$ solution.

Q115. CBSE 2023 · 5 marks Account for the following: (i) E° value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} . (ii) Sc^{3+} is colourless whereas Ti^{3+} is coloured in an aqueous solution. (iii) Actinoids show wide range of oxidation states. (iv) Write the chemical equations for the preparation of $KMnO_4$ from MnO_2 .

Q116. CBSE 2023 · 5 marks Account for the following: (i) E° value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} . (ii) Sc^{3+} is colourless whereas Ti^{3+} is coloured in an aqueous solution. (iii) Actinoids show wide range of oxidation states. Write the chemical equations for the preparation of $KMnO_4$ from MnO_2 .

Q117. CBSE 2023 · 5 marks (I) Account for the following: (i) E° value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} . (ii) Sc^{3+} is colourless whereas Ti^{3+} is coloured in an aqueous solution. (iii) Actinoids show wide range of oxidation states. (II) Write the chemical equations for the preparation of $KMnO_4$ from MnO_2 . OR (I) Account for the following: (i) Transition metals form alloys. (ii) Ce^{4+} is a strong oxidising agent. (II) Write one similarity and one difference between chemistry of Lanthanoids and Actinoids. (III) Complete the following ionic equation: $Cr_2O_7^{2-} + 2OH^- \rightarrow$

Q118. CBSE 2023 · 5 marks (a) (i) Account for the following: (1) Transition metals form complex compounds. (2) The Mn^{2+}/Mn value for manganese is highly negative whereas Mn^{3+}/Mn^{2+} is highly positive. (3) Cu^+ ion is unstable in aqueous solution. (ii) Write the equations involved in the preparation of $KMnO_4$ from Pyrolusite ore (MnO_2).

Q119. CBSE 2023 · 5 marks (a) (i) Account for the following: (1) Transition metals form complex compounds. (2) The M^{2+}/M value for manganese is highly negative whereas $2Mn^{3+}/3Mn$ is highly positive. (3) Cu^+ ion is unstable in aqueous solution. (ii) Write the equations involved in the preparation of $KMnO_4$ from Pyrolusite ore (MnO_2).

Q120. CBSE 2023 · 5 marks Give reasons: (1) Transition metals form complex compounds. (2) The $Mn^{2+}/Mn^{3+}/E^\circ$ value for manganese is highly negative whereas $Mn^{3+}/Mn^{2+}/E^\circ$ is highly positive. (3) Cu^+ ion is unstable in aqueous solution.

Q121. CBSE 2023 · 5 marks (a) (i) Account for the following: (1) Zn^{2+} salts are colourless while Ni^{2+} salts are coloured. (2) Cr^{2+} is a strong reducing agent. (3) Transition metals and their compounds show catalytic activities.

Q122. CBSE 2023 · 5 marks (a) (i) Account for the following: (1) Zn^{2+} salts are colourless while Ni^{2+} salts are coloured. (2) Cr^{2+} is a strong reducing agent. (3) Transition metals and their compounds show catalytic activities. (ii) Write the ionic equations for the oxidizing action of MnO_4^- in acidic medium with (1) I^- ion, and (2) Fe^{2+} ion.

Q123. CBSE 2023 · 5 marks (a) (i) Account for the following: (1) Zn^{2+} salts are colourless while Ni^{2+} salts are coloured. (2) Cr^{2+} is a strong reducing agent. (3) Transition metals and their compounds show catalytic activities. (ii) Write the ionic equations for the oxidizing action of $4MnO_4^-$ in acidic medium with (1) I^- ion, and (2) Fe^{2+} ion.

Q124. CBSE 2023 · 5 marks (a) A transition element X has electronic configuration $[Ar] 4s^2 3d^3$. Predict its likely oxidation states. (b) Complete the reaction mentioning all the products formed: $2KMnO_4 + \text{heat} \rightarrow$ (c) Account for the following: (i) In the 3d transition series, zinc has the lowest enthalpy of atomisation, (ii) Cu^+ ion is unstable in aqueous solution, (iii) Actinoids show more number of oxidation states than lanthanoids.

Q125. CBSE 2023 · 5 marks (a) Write the number of unpaired electrons in Cr^{3+} . (Atomic number of Cr = 24) (b) Complete the reaction mentioning all the products formed: $Cr_2O_7^{2-} + 3H_2S + 8H^+ \rightarrow$ (c) Account for the following: (i) Mn^{2+} is more stable than Fe^{2+} towards oxidation to +3 state. (ii) Copper has exceptionally positive $E^{M^{2+}/M}$ value. (iii) Eu^{2+} with electronic configuration $[Xe] 4f^7 6s^2$ is a strong reducing agent.

CASE-BASED (2)

CASE STUDY · CBSE 2024

Transition metals have incomplete d-subshell either in neutral atom or in their ions. The presence of partly filled d-orbitals in their atoms makes transition elements different from that of the non-transition elements. With partly filled d-orbitals, these elements exhibit certain characteristic properties such as display of a variety of oxidation states, formation of coloured ions and entering into complex formation with a variety of ligands. The transition metals and their compounds also exhibit catalytic properties and paramagnetic behaviour. The transition metals are very hard and have low volatility. An examination of the $2^\circ M/M$ values shows the varying trends.

Q126. CBSE 2024 · 4 marks (a) On what basis can we say that Cu is a transition element but Zn is not? (Atomic number: Cu = 29, Zn = 30)

CASE STUDY · CBSE 2024

The involvement of $(n-1)d$ electrons in the behaviour of transition elements impart certain distinct characteristics to these elements. Thus, in addition to variable oxidation states, they exhibit paramagnetic behaviour, catalytic properties and tendency for the formation of coloured ions. The transition metals react with a number of non-metals like oxygen, nitrogen and halogens. $KMnO_4$ and $K_2Cr_2O_7$ are common examples. The two series of inner transition elements, lanthanoids and actinoids, constitute the f-block of the periodic table. In the lanthanoids, there is regular decrease in atomic size with increase in atomic number due to the imperfect shielding effect of 4f-orbital electrons which causes contraction.

Q127. CBSE 2024 · 4 marks (a) Why do transition metals and their compounds act as good catalysts?



5 Coordination Compounds

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (58)

Q1. CBSE 2026 · 1 mark The secondary valency of Co in $[\text{Co}(\text{en})_3]_2(\text{SO}_4)_3$ is :

- (a) 12 (b) 2 (c) 3 (d) 6

Q2. CBSE 2026 · 1 mark The secondary valency of Co in the complex $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]^{2+}$ is

- (a) 5 (b) 1 (c) 4 (d) 2

Q3. CBSE 2026 · 1 mark The secondary valency of Pt in $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$ is

- (a) 6 (b) 5 (c) 4 (d) 2

Q4. CBSE 2026 · 1 mark The correct IUPAC name of the complex $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ is:

- (a) diamminedichloridoplatinum (IV)
(b) diamminedichloridoplatinum (II)
(c) dichloridodiammineplatinum (IV)
(d) dichloridodiammineplatinum (II)

Q5. CBSE 2026 · 1 mark Which of the following is heteroleptic complex?

- (a) $[\text{Co}(\text{NH}_3)_6]^{3+}$ (b) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (c) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
(d) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$

Q6. CBSE 2026 · 1 mark The oxidation number of Co in $[\text{Co}(\text{en})_3]_2(\text{SO}_4)_3$ is:

- (a) +3 (b) +2 (c) +4 (d) +6

Q7. CBSE 2026 · 1 mark According to Werner's theory, the primary valencies of the central metal atom:

- (a) are satisfied by neutral molecules or negative ions.
(b) are equal to its coordination number.
(c) are satisfied by negative ions. (d) are non-ionisable.

Q8. CBSE 2026 · 1 mark The oxidation number of Co in $[\text{Co}(\text{NH}_3)_5(\text{ONO})]\text{SO}_4$ is:

- (a) +3 (b) +2 (c) +4 (d) +6

Q9. CBSE 2026 · 1 mark The oxidation number of Pt in $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$ is:

- (a) +3 (b) +4 (c) +2 (d) +6

Q10. CBSE 2026 · 1 mark Which of the following d-orbitals experience more repulsion in the crystal field splitting of octahedral complex?

- (a) d_{xy} , d_{yz} , d_{zx} (b) $d_{x^2-y^2}$, d_{z^2} (c) d_{xy} , $d_{x^2-y^2}$
(d) d_{zx} , d_{z^2}

Q11. CBSE 2026 · 1 mark The chelating ligand used for the treatment of lead poisoning is:

- (a) Ethane-1,2-diamine (b) Oxalate ion
(c) Dimethylglyoxime (d) EDTA

Q12. CBSE 2026 · 1 mark Which of the following d-orbitals experience more repulsion in the crystal field splitting of tetrahedral complex?

- (a) $d_{x^2-y^2}$, d_{z^2} (b) $d_{x^2-y^2}$, d_{xy} (c) d_{xy} , d_{yz} , d_{z^2}
(d) d_{xy} , d_{yz} , d_{zx}

Q13. CBSE 2026 · 1 mark Number of possible stereoisomers for the complex $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$ will be:

- (a) 3 (b) 4 (c) 2 (d) 1

Q14. CBSE 2026 · 1 mark The coordination number of Co in $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ is:

- (a) 4 (b) 3 (c) 6 (d) 2

Q15. CBSE 2026 · 1 mark Which of the following ligands forms a chelate complex?

- (a) Ammonia (b) Water (c) NO_2^- (d) Oxalate ion

Q16. CBSE 2025 · 1 mark According to Werner's theory of coordination compounds:

- (a) Primary valences are ionisable.
(b) Secondary valences are ionisable.
(c) Both primary and secondary valences are non-ionisable.
(d) Both primary and secondary valences are ionisable.

Q17. CBSE 2025 · 1 mark Which of the following complex ion is not optically active?

- (a) $[\text{Co}(\text{ox})_3]^{3-}$ (b) $\text{cis}-[\text{Co}(\text{en})_2\text{Cl}_2]^+$
(c) $\text{trans}-[\text{Co}(\text{en})_2\text{Cl}_2]^+$ (d) $[\text{Co}(\text{en})_3]^{3+}$

Q18. CBSE 2025 · 1 mark Coordination number of Fe in $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$ is:

- (a) 6 (b) 3 (c) 4 (d) 5

Q19. CBSE 2025 · 1 mark Which of the following complexes shows geometrical isomerism?

- (a) $[\text{Co}(\text{NH}_3)_6]^{3+}$ (b) $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ (c) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$
(d) $[\text{Co}(\text{NH}_3)_5(\text{ONO})]^{2+}$

Q20. CBSE 2025 · 1 mark Which of the following complexes show linkage isomerism?

- (a) $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ (b) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Br}_2$
(c) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$ (d) $[\text{Co}(\text{NH}_3)_5(\text{ONO})]^{2+}$

Q21. CBSE 2025 · 1 mark The primary and secondary valences of Co in $[\text{Co}(\text{en})_3]\text{Cl}_3$ respectively are:

- (a) 3, 3 (b) 0, 3 (c) 6, 3 (d) 3, 6

Q22. CBSE 2025 · 1 mark The number of moles of AgCl precipitated when excess AgNO_3 solution is mixed with one mole of $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ is:

- (a) 0 (b) 1 (c) 2 (d) 3

Q23. CBSE 2025 · 1 mark The number of moles of AgCl precipitated when excess AgNO_3 solution is mixed with one mole of $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$ is:

- (a) 1 (b) 0 (c) 2 (d) 3



Q24. CBSE 2025 · 1 mark The number of moles of AgCl precipitated when excess AgNO₃ solution is mixed with one mole of [Co(NH₃)₆]Cl₃ is:

- (a) 0 (b) 3 (c) 6 (d) 4

Q25. CBSE 2024 · 1 mark Ligand EDTA⁴⁻ is an example of a:

- (a) Monodentate ligand (b) Didentate ligand
(c) Tridentate ligand (d) Polydentate ligand

Q26. CBSE 2024 · 1 mark Which of the following ligand forms chelate complex?

- (a) C₂O₄²⁻ (b) Cl⁻ (c) NO₂⁻ (d) NH₃

Q27. CBSE 2024 · 1 mark The coordination number of Co in [Co(en)₃]³⁺ is:

- (a) 3 (b) 4 (c) 5 (d) 6

Q28. CBSE 2024 · 1 mark Which one of the following complexes is non-ionisable?

- (a) [Co(NH₃)₃Cl₃] (b) [Co(NH₃)₄Cl₂]Cl
(c) [Co(NH₃)₅Cl]Cl₂ (d) [Co(NH₃)₆]Cl₃

Q29. CBSE 2024 · 1 mark The type of isomerism shown by the complex [CoCl₂(en)₂]⁺ is:

- (a) Linkage isomerism (b) Geometrical isomerism
(c) Coordination isomerism (d) Ionization isomerism

Q30. CBSE 2024 · 1 mark Which one of the following hybrid states is associated with low spin complex?

- (a) sp³d (b) sp³ (c) sp³d² (d) d²sp³

Q31. CBSE 2024 · 1 mark Which of the following is diamagnetic in nature ? [Atomic number : Co = 27]

- (a) Co³⁺, octahedral complex with strong field ligand
(b) Co³⁺, octahedral complex with weak field ligand
(c) Co³⁺, in a square planar complex
(d) Co³⁺, in a tetrahedral complex

Q32. CBSE 2024 · 1 mark Which of the following ligands can show linkage isomerism in a coordination compound?

- (a) NH₃ (b) SO₄ (c) NO₂ (d) C₂O₄

Q33. CBSE 2024 · 1 mark On adding AgNO₃ solution to 1 mole of complex NiCl₂ · 4NH₃, two moles of AgCl are formed. The secondary valency of Ni in the complex will be:

- (a) 4 (b) 2 (c) 3 (d) 6

Q34. CBSE 2024 · 1 mark On adding AgNO₃ solution to 1 mole of CoCl₃ · 4NH₃, one mole of AgCl is precipitated. The secondary valency of Co is:

- (a) 6 (b) 4 (c) 3 (d) 7

Q35. CBSE 2023 · 1 mark The compounds [Co(SO₄)(NH₃)₅]Br and [Co(Br)(NH₃)₅]SO₄ represent:

- (a) optical isomerism (b) linkage isomerism
(c) ionisation isomerism (d) coordination isomerism

Q36. CBSE 2023 · 1 mark Assertion (A): Low spin tetrahedral complexes are rarely observed. Reason (R): Crystal field splitting energy is less than pairing energy for tetrahedral complexes. Select the correct answer.

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

Q37. CBSE 2023 · 1 mark Assertion (A): EDTA is used to determine hardness of water. Reason (R): EDTA is a bidentate ligand.

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

Q38. CBSE 2023 · 1 mark Assertion (A): Low spin tetrahedral complexes are rarely observed. Reason (R): Crystal field splitting energy is less than pairing energy for tetrahedral complexes.

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

Q39. CBSE 2023 · 1 mark The oxidation state of Fe in [Fe(CO)₅] is

- (a) +2 (b) 0 (c) +3 (d) +5

Q40. CBSE 2023 · 1 mark The formula of the complex dichloridobis(ethane-1, 2-diamine) platinum (IV) nitrate is

- (a) [PtCl₂(en)₂(NO₃)₂] (b) [PtCl₂(en)₂](NO₃)₂
(c) [PtCl₂(en)₂(NO₃)]NO₃ (d) [Pt(en)₂(NO₃)₂]Cl₂

Q41. CBSE 2023 · 1 mark What is the secondary valency of Cobalt in [Co(en)₂Cl₂]⁺?

- (a) 6 (b) 4 (c) 2 (d) 8

Q42. CBSE 2023 · 1 mark Which of the following ligands is an ambidentate ligand?

- (a) CO (b) NO₂ (c) NH₃ (d) H₂O

Q43. CBSE 2023 · 1 mark The formula of the complex Iron (III) hexacyanidoferrate (II) is:

- (a) Fe₂[Fe(CN)₆]₃ (b) Fe₄[Fe(CN)₆]₃ (c) Fe[Fe(CN)₆]
(d) Fe₃[Fe(CN)₆]₂

Q44. CBSE 2023 · 1 mark How many ions are produced in the solution from the complex [Ni(NH₃)₆]Cl₂?

- (a) 4 (b) 3 (c) 2 (d) 5

Q45. CBSE 2023 · 1 mark Which of the following species is not expected to be a ligand?

- (a) CO (b) +4NH (c) NH₃ (d) H₂O



Q46. CBSE 2023 · 1 mark Which of the following is the most stable complex species?

- (a) $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$ (b) $[\text{Fe}(\text{CN})_6]^{3-}$ (c) $[\text{Fe}(\text{CO})_5]$
(d) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$

Q47. CBSE 2023 · 1 mark Optical isomerism is not shown by the complex:

- (a) $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ (trans form) (b) $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ (cis form)
(c) $[\text{Cr}(\text{ox})_3]^{3-}$ (d) $[\text{Cr}(\text{en})_3]^{3+}$

Q48. CBSE 2023 · 1 mark Which of the following is a polydentate ligand?

- (a) NH_3 (b) $\text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{NH}_2$ (c) EDTA^{4-} (d) $\text{C}_2\text{O}_4^{2-}$

Q49. CBSE 2023 · 1 mark Which of the following coordination compounds exhibits linkage isomerism?

- (a) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ (b) $[\text{Co}(\text{NH}_3)_5(\text{CO}_3)]\text{Cl}$
(c) $[\text{Co}(\text{NH}_3)_5\text{NO}_2](\text{NO}_3)_2$ (d) $[\text{Co}(\text{en})_3]\text{Cl}_3$

Q50. CBSE 2023 · 1 mark $[\text{Co}(\text{NH}_3)_5\text{NO}_3]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{NO}_3$ exhibit:

- (a) linkage isomerism (b) ionization isomerism
(c) optical isomerism (d) coordination isomerism

Q51. CBSE 2023 · 1 mark In which of the following does the central atom exhibit an oxidation state of +3?

- (a) $\text{K}_2[\text{Ni}(\text{CN})_4]$ (b) $\text{K}_4[\text{Fe}(\text{CN})_6]$ (c) $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$
(d) $[\text{Cu}(\text{NH}_3)_4]^{2+}$

Q52. CBSE 2023 · 1 mark What type of isomerism is shown by the following pair of complex compounds? $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$ and $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$

- (a) Linkage isomerism (b) Hydrate isomerism
(c) Coordination isomerism (d) Ionization isomerism

Q53. CBSE 2023 · 1 mark In which of the following does the central atom exhibit an oxidation state of +4?

- (a) $\text{K}_2[\text{Ni}(\text{CN})_4]$ (b) $[\text{Cu}(\text{NH}_3)_4]^{2+}$ (c) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$
(d) $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$

Q54. CBSE 2023 · 1 mark The compounds $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$, $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$ and $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl} \cdot 2\text{H}_2\text{O}$ exhibit:

- (a) Linkage isomerism (b) Geometrical isomerism
(c) Ionization isomerism (d) Hydrate isomerism

Q55. CBSE 2023 · 1 mark The magnetic moment of $[\text{NiCl}_4]^{2-}$

- (a) 1.82 BM (b) 2.82 BM (c) 4.42 BM (d) 5.46 BM

Q56. CBSE 2023 · 1 mark Assertion (A): Trans $[\text{CrCl}_2(\text{ox})_2]^{3-}$ shows optical isomerism. Reason (R): Optical isomerism is common in octahedral complexes involving didentate ligands.

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

Q57. CBSE 2023 · 1 mark Assertion (A): EDTA is a hexadentate ligand. Reason (R): EDTA has 2 nitrogen and 4 oxygen donor atoms.

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

Q58. CBSE 2023 · 1 mark Assertion (A): $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Cl}$ gives a white precipitate with silver nitrate solution. Reason (R): The complex dissociates to give Cl^- and SO_4^{2-} ions.

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

VERY SHORT ANSWER (22)

Q59. CBSE 2026 · 2 marks Define the following terms : (a) Ambidentate ligand (b) Crystal field splitting energy

Q60. CBSE 2026 · 2 marks Write IUPAC names of the following coordination compounds: (i) $[\text{Ag}(\text{NH}_3)_2][\text{Ag}(\text{CN})_2]$ (ii) $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$

Q61. CBSE 2026 · 2 marks Define coordination number. Indicate the type of isomerism exhibited by the following complex: $[\text{Co}(\text{en})_3]\text{Cl}_3$

Q62. CBSE 2026 · 2 marks (a) Define didentate ligand. Give an example. (b) Indicate the type of isomerism exhibited by the given complex : $[\text{Pt}(\text{NH}_3)(\text{H}_2\text{O})\text{Cl}_2]$

Q63. CBSE 2026 · 2 marks (a) Define coordination number. (b) Indicate the type of isomerism exhibited by the following complex: $[\text{Co}(\text{en})_3]\text{Cl}_3$

Q64. CBSE 2026 · 2 marks Write IUPAC names of the following compounds: (i) $[\text{PtCl}_2(\text{en})_2]\text{SO}_4$ (ii) $(\text{NH}_4)_2[\text{CoF}_4]$

Q65. CBSE 2026 · 2 marks Write IUPAC names of the following compounds: (a) $[\text{Cr}(\text{NH}_3)_4(\text{ONO})\text{Cl}]\text{NO}_3$ (b) $\text{Na}[\text{Ag}(\text{CN})_2]$

Q66. CBSE 2026 · 2 marks Write the formulas for the following coordination compounds: (a) Mercury(II) tetrathiocyanato-S-cobaltate(III) (b) Dichloridobis(ethane-1,2-diamine) platinum(IV) nitrate

Q67. CBSE 2026 · 2 marks Write IUPAC names of the following compounds: (a) $[\text{Ag}(\text{NH}_3)_2][\text{Ag}(\text{CN})_2]$ (b) $[\text{Co}(\text{en})_3]^{2+}(\text{SO}_4)_3$

Q68. CBSE 2025 · 2 marks $\text{PtCl}_4 \cdot 2\text{KCl}$ doesn't give precipitate of AgCl with AgNO_3 solution. Write the structural formula and IUPAC name of the complex.

Q69. CBSE 2025 · 2 marks $\text{PdCl}_2 \cdot 2\text{KCl}$ does not give precipitate of AgCl with AgNO_3 solution. Write the structural formula and IUPAC name of the complex.

Q70. CBSE 2025 · 2 marks (a) Write IUPAC names of the following coordination compounds: (i) $[\text{CoCl}_2(\text{en})_2]\text{SO}_4$ (ii) $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$



Q71. CBSE 2025 · 2 marks (a) Write IUPAC names of the following coordination compounds: (i) $[\text{CoCl}_2(\text{en})_2]\text{SO}_4$ (ii) $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$ OR (b) Differentiate between: (i) Double salt and Complex compound (ii) Didentate ligand and Ambidentate ligand

Q72. CBSE 2025 · 2 marks Write the IUPAC name of the complex $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$. Draw the structure of geometrical isomer of this complex which is optically inactive.

Q73. CBSE 2025 · 2 marks (a) Write the IUPAC name of the complex $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$. Draw the structure of geometrical isomer of this complex which is optically inactive. OR (b) (i) Write the formula of the following coordination compound: Pentaamminecarbonatocobalt(III)chloride (ii) Write the IUPAC name of the linkage isomer of the complex $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$.

Q74. CBSE 2023 · 2 marks Write the IUPAC names of the following: (i) $[\text{Co}(\text{NH}_3)_5(\text{ONO})]^{2+}$ (ii) $\text{K}_2[\text{NiCl}_4]$

Q75. CBSE 2023 · 2 marks (a) Write the IUPAC names of the following: (i) $[\text{Co}(\text{NH}_3)_5(\text{ONO})]^{2+}$ (ii) $\text{K}_2[\text{NiCl}_4]$ OR (b) (i) What is a chelate complex? Give one example. (ii) What are heteroleptic complexes? Give one example.

Q76. CBSE 2023 · 2 marks Write IUPAC names of the following coordination entities: (a) $[\text{Co}(\text{NH}_3)_4\text{Cl}(\text{NO}_2)]\text{Cl}$ (b) $[\text{PtCl}_2(\text{en})_2]^{2+}$

Q77. CBSE 2023 · 2 marks Write IUPAC names of the following coordination entities: (a) $[\text{Cr}(\text{NH}_3)_3(\text{H}_2\text{O})_3]\text{Cl}_3$ (b) $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3]$

Q78. CBSE 2023 · 2 marks Write IUPAC names of the following: (a) $[\text{Co}(\text{en})_2(\text{H}_2\text{O})(\text{CN})]^{2+}$ (b) $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$

Q79. CBSE 2023 · 2 marks (a) Which of the following species cannot act as a ligand? Give reason. OH^- , NH_4 , CH_3NH_2 , H_2O

Q80. CBSE 2023 · 2 marks (a) Which of the following species cannot act as a ligand? Give reason. OH^- , 4NH , CH_3NH_2 , H_2O (b) The complex $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$ is red in colour. Give IUPAC name of its linkage isomer.

SHORT ANSWER (31)

Q81. CBSE 2026 · 3 marks Give reasons : (i) Why are low spin tetrahedral complexes not formed ? (ii) Why is $[\text{Co}(\text{en})_3]^{3+}$ complex more stable than $[\text{Co}(\text{NH}_3)_6]^{3+}$? (iii) Why are geometrical isomers not possible for tetrahedral complexes having two different types of unidentate ligands coordinated to the central metal ion ?

Q82. CBSE 2026 · 3 marks $[\text{Co}(\text{NH}_3)_6]^{3+}$ is diamagnetic whereas $[\text{CoF}_6]^{3-}$ is paramagnetic. Justify the statement. [Atomic number of Co = 27]. Write the electronic configuration for d4 ion if $\Delta_o > P$ on the basis of crystal field theory.

Q83. CBSE 2026 · 3 marks (a) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ is paramagnetic whereas $[\text{Fe}(\text{CO})_5]$ is diamagnetic. Justify the statement. [Atomic number of Fe = 26] (b) On the basis of crystal field theory write the electronic configuration for d4 ion if $0 < P$.

Q84. CBSE 2026 · 3 marks (a) Explain why $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ is strongly paramagnetic whereas $[\text{Fe}(\text{CN})_6]^{3-}$ is weakly paramagnetic. [Atomic number of Fe = 26] (b) On the basis of crystal field theory, write the electronic configuration for d5 ion for which $0 < P$.

Q85. CBSE 2026 · 3 marks Answer the following questions about the complexes $[\text{NiCl}_4]^{2-}$ and $[\text{Ni}(\text{CN})_4]^{2-}$: (i) Write the hybridization involved in each case. (ii) Which of them is the inner orbital complex and which one is the outer orbital complex? (iii) Compare their magnetic behaviour. [Atomic number: Ni = 28]

Q86. CBSE 2026 · 3 marks (a) When a coordination compound $\text{CoCl}_3 \cdot 6\text{NH}_3$ is mixed with excess of AgNO_3 solution, 3 moles of AgCl are precipitated per mole of the compound. Write the structural formula of the complex, IUPAC name, its hybridisation and magnetic behaviour on the basis of valence bond theory.

Q87. CBSE 2026 · 3 marks (a) When a coordination compound $\text{CoCl}_3 \cdot 6\text{NH}_3$ is mixed with excess of AgNO_3 solution, 3 moles of AgCl are precipitated per mole of the compound. Write the structural formula of the complex, IUPAC name, its hybridisation and magnetic behaviour on the basis of valence bond theory. OR (b) (i) How many geometrical isomers are possible in each of the following complexes? (I) $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$ (II) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ (ii) $[\text{Co}(\text{NH}_3)_6]^{3+}$ is an inner orbital complex whereas $[\text{Ni}(\text{NH}_3)_6]^{2+}$ is an outer orbital complex. Why? [Atomic number: Co = 27, Ni = 28] (iii) Write the formula of Wilkinson catalyst and its use.

Q88. CBSE 2026 · 3 marks (a) Write the IUPAC name of the following complex : $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3]$. (b) Differentiate between homoleptic complex and heterolytic complex. (c) Which type of isomerism is exhibited by the following complex : $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$

Q89. CBSE 2026 · 3 marks (a) A coordination compound $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ is mixed with excess of AgNO_3 solution, two moles of AgCl are precipitated per mole of the compound. Write the structural formula of the coordination compound. (b) Write the oxidation state and hybridisation of the central metal in the following complex : $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ [Atomic number of Fe = 26]. (c) Why is $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ coloured ? [Atomic number of Ni = 28]

Q90. CBSE 2026 · 3 marks (a) Write the IUPAC name of the given complex: $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$ (b) Define polydentate ligand. Give an example. (c) Mention the type of isomerism exhibited by the given complex: $[\text{Co}(\text{en})_3]\text{Cl}_3$

Q91. CBSE 2026 · 3 marks (a) A coordination compound $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ is mixed with excess of AgNO_3 solution, one mole of AgCl is precipitated per mole of the compound. Write the structural formula of the coordination compound. (b) Write the oxidation state and hybridisation of the central metal in the given complex: $[\text{Fe}(\text{CN})_6]^{3-}$. [Atomic number: Fe = 26] (c) Why is $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ coloured? [Atomic number: Ti = 22]

Q92. CBSE 2026 · 3 marks (a) Write the IUPAC name of the given complex: $\text{K}_2[\text{Zn}(\text{OH})_4]$ (b) Differentiate between a double salt and a complex. (c) Mention the type of isomerism exhibited by the following complex: $[\text{Pt}(\text{NH}_3)(\text{H}_2\text{O})\text{Cl}_2]$

Q93. CBSE 2026 · 3 marks (a) A coordination compound $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ is mixed with excess of AgNO_3 solution, three moles of AgCl are precipitated per mole of the compound. Write the structural formula of the coordination compound. (b) Write the oxidation state and hybridisation of the central metal in the given complex: $[\text{Cr}(\text{NH}_3)_6]^{3+}$. [Atomic number: Cr = 24] (c) Why is $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ colourless?



Q94. CBSE 2025 · 3 marks (a) When a co-ordination compound $\text{CoCl}_3 \cdot 6\text{NH}_3$ is mixed with excess of AgNO_3 solution, 3 moles of AgCl are precipitated per mole of the compound. Write (i) Structural formula of the complex (ii) IUPAC name of the complex (iii) Hybridization of the complex using valence bond theory [Atomic number: Co = 27] OR (b) (i) Write IUPAC name of $[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{ONO})]$. (ii) Why $[\text{Co}(\text{en})_3]^{3+}$ is more stable complex than $[\text{Co}(\text{NH}_3)_6]^{3+}$? (iii) Predict the hybridization of $[\text{Ni}(\text{CO})_4]$ on the basis of valence bond theory. [Atomic number : Ni = 28]

Q95. CBSE 2025 · 3 marks (a) What is meant by crystal field splitting energy? For a d_4 ion, write the configuration if (i) $\Delta_o < P$, and (ii) $\Delta_o > P$. (b) Explain why in tetrahedral coordination entities, low spin configurations are rarely observed.

Q96. CBSE 2025 · 3 marks Based on Valence Bond Theory, explain the geometry and magnetic character of $[\text{NiCl}_4]^{2-}$. [Atomic number: Ni = 28] Draw the possible isomers of $[\text{Co}(\text{en})_2\text{Cl}_2]^+$.

Q97. CBSE 2025 · 1 mark Write the name and structure of a hexadentate ligand.

Q98. CBSE 2025 · 3 marks (a) Answer the following about the complexes $[\text{FeF}_6]^{3-}$ and $[\text{Fe}(\text{CN})_6]^{4-}$: (i) Write the hybridization involved in each case. (ii) Which of them is the outer orbital complex and which one is the inner orbital complex? (iii) Compare their magnetic behaviour. [Atomic number : Fe = 26]

Q99. CBSE 2025 · 3 marks (a) Answer the following about the complexes $[\text{FeF}_6]^{3-}$ and $[\text{Fe}(\text{CN})_6]^{4-}$: (i) Write the hybridization involved in each case. (ii) Which of them is the outer orbital complex and which one is the inner orbital complex? (iii) Compare their magnetic behaviour. [Atomic number: Fe = 26] OR (b) (i) What happens to the colour of complex $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ when heated gradually? (ii) Write the electronic configuration for d_5 ion if $o < P$. (iii) Write the hybridization and magnetic behaviour of the complex $[\text{Ni}(\text{CO})_4]$. [Atomic number: Ni = 28]

Q100. CBSE 2024 · 3 marks (a) Write the formula for the following coordination compound: Potassium tetrahydroxidozincate (II) (b) Arrange the following complexes in the increasing order of conductivity of their solution: $[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$, $[\text{Cr}(\text{NH}_3)_3\text{Cl}_3]$, $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ (c) Identify the type of isomerism exhibited by the following complexes: (i) $[\text{Co}(\text{NH}_3)_5\text{NO}_2]^{2+}$ (ii) $[\text{Co}(\text{en})_3]\text{Cl}_3$

Q101. CBSE 2023 · 3 marks Draw the geometrical isomers of $[\text{Co}(\text{en})_2\text{Cl}_2]^{2+}$. Which geometrical isomer of $[\text{Co}(\text{en})_2\text{Cl}_2]^{2+}$ is not optically active and why?

Q102. CBSE 2023 · 3 marks Draw the geometrical isomers of $[\text{Co}(\text{en})_2\text{Cl}_2]^{2+}$. Which geometrical isomer of $[\text{Co}(\text{en})_2\text{Cl}_2]^{2+}$ is not optically active and why? Write the hybridisation and magnetic behaviour of $[\text{CoF}_6]^{3-}$. [Given : Atomic number of Co = 27]

Q103. CBSE 2023 · 3 marks (a) Draw the geometrical isomers of $[\text{Co}(\text{en})_2\text{Cl}_2]^{2+}$. Which geometrical isomer of $[\text{Co}(\text{en})_2\text{Cl}_2]^{2+}$ is not optically active and why? (b) Write the hybridisation and magnetic behaviour of $[\text{CoF}_6]^{3-}$. [Given: Atomic number of Co = 27]

Q104. CBSE 2023 · 3 marks Answer any three of the following questions: (a) Explain the type of hybridization in $[\text{Fe}(\text{CN})_6]^{3-}$ on the basis of valence bond theory. (Given: Atomic number of Fe = 26) (b) Draw the geometrical isomers of $[\text{PtCl}_2(\text{en})_2]^{2+}$ ion. (c) $[\text{NiCl}_4]^{2-}$ is paramagnetic while $[\text{Ni}(\text{CO})_4]$ is diamagnetic though both are tetrahedral. Why? (d) Name the type of isomerism when ambidentate ligands are attached to central metal ion. Give one example of ambidentate ligand.

Q105. CBSE 2023 · 3 marks (a) On the basis of crystal field theory write the electronic configuration for d_5 ion with a strong field ligand for which $\Delta_o > P$.

Q106. CBSE 2023 · 3 marks (b) Explain $[\text{Fe}(\text{CN})_6]^{3-}$ is an inner orbital complex whereas $[\text{FeF}_6]^{3-}$ is an outer orbital complex.

Q107. CBSE 2023 · 3 marks (a) On the basis of crystal field theory, write the electronic configuration for d_4 with a strong field ligand for which $\Delta_o > P$. (b) A solution of $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ is green but a solution of $[\text{Ni}(\text{CO})_4]$ is colourless. Explain.

Q108. CBSE 2022 · 3 marks Write the hybridisation and magnetic character of the following complexes: (i) $[\text{NiCl}_4]^{2-}$ (ii) $[\text{Co}(\text{NH}_3)_6]^{3+}$ (iii) $[\text{FeF}_6]^{3-}$ [Atomic number: Ni = 28, Co = 27, Fe = 26]

Q109. CBSE 2022 · 3 marks (i) Write the electronic configuration of d_5 on the basis of crystal field splitting theory if $\Delta_o < P$. (ii) $[\text{Fe}(\text{CN})_6]^{3-}$ is weakly paramagnetic whereas $[\text{Fe}(\text{CN})_6]^{4-}$ is diamagnetic. Give reason to support this statement. [Atomic no.: Fe = 26] (iii) Write the number of ions produced from the complex $[\text{Co}(\text{NH}_3)_6]\text{Cl}_2$ in solution.

Q110. CBSE 2022 · 3 marks (a) (i) Write the electronic configuration of d_4 on the basis of crystal field splitting theory, if $\Delta_o < P$. (ii) $[\text{Ni}(\text{CN})_4]^{2-}$ with square-planar structure is diamagnetic and $[\text{NiCl}_4]^{2-}$ with tetrahedral geometry is paramagnetic. Give reason to support the statement. [Atomic number: Ni = 28] (iii) Write the number of ions produced in the solution from the following complex: $[\text{PtCl}_2(\text{NH}_3)_4]\text{Cl}_2$

Q111. CBSE 2022 · 3 marks (a) (i) Write the electronic configuration of d_4 on the basis of crystal field splitting theory if $\Delta_o > P$. (ii) $[\text{Co}(\text{NH}_3)_6]^{3+}$ is an inner orbital complex whereas $[\text{Ni}(\text{NH}_3)_6]^{2+}$ is an outer orbital complex. (Atomic number: Co = 27, Ni = 28) (iii) Write the number of ions produced from the complex $[\text{Pt}(\text{NH}_3)_6]\text{Cl}_4$ in solution.

LONG ANSWER (6)

Q112. CBSE 2025 · 1 mark (a) (i) Give reasons: (I) $[\text{Ni}(\text{CO})_4]$ is diamagnetic whereas $[\text{NiCl}_4]^{2-}$ is paramagnetic. [Atomic number: Ni = 28]

Q113. CBSE 2025 · 1 mark (a)(i)(I) Give reasons: $[\text{Ni}(\text{CO})_4]$ is diamagnetic whereas $[\text{NiCl}_4]^{2-}$ is paramagnetic. [Atomic number: Ni = 28]



Q114. CBSE 2025 · 5 marks (a) (i) Give reasons: (I) $[\text{Ni}(\text{CO})_4]$ is diamagnetic whereas $[\text{NiCl}_4]^{2-}$ is paramagnetic. [Atomic number: $\text{Ni} = 28$] (II) CO is a stronger complexing agent than NH_3 . (III) The trans isomer of complex $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ is optically inactive. (ii) Using Crystal Field theory, write the number of unpaired electrons in octahedral complexes of Fe^{3+} in the presence of: (I) Strong field ligand. (II) Weak field ligand. [Atomic number: $\text{Fe} = 26$]

Q115. CBSE 2024 · 5 marks (a) How is the crystal field splitting energy for octahedral complex (Δ_o) related to that of tetrahedral complex (Δ_t)?

Q116. CBSE 2024 · 5 marks Answer any five of the following: (a) How is the crystal field splitting energy for octahedral complex (Δ_o) related to that of tetrahedral complex (Δ_t)? (b) Write the IUPAC name of the following complex: $[\text{PtCl}_2(\text{en})_2](\text{NO}_3)_2$ (c) Write the geometry and magnetic behaviour of the complex $[\text{Ni}(\text{CO})_4]$ on the basis of Valency Bond Theory (VBT). (d) What type of isomerism is shown by the complex $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$? (e) For the coordination compound on the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_o < P$. Is the coordination compound a high spin or low spin complex? (f) Out of $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$, which complex is heteroleptic and why? (g) Draw the structures of optical isomers of $[\text{PtCl}_2(\text{en})_2]^{2+}$.

Q117. CBSE 2024 · 5 marks (a) Write the IUPAC name of the complex : $[\text{Co}(\text{H}_2\text{O})(\text{CN})(\text{en})_2]^{2+}$

CASE-BASED (11)

CASE STUDY · CBSE 2026

The Valence Bond Theory (VBT) explains the formation, magnetic behaviour and geometry of coordination compounds. The Crystal Field Theory (CFT) of coordination compounds is based on the effect of different crystal fields (provided by the ligands taken as point charges), on the degeneracy of d-orbital energies of the central metal atom/ion. The splitting of the d-orbitals provides different electronic arrangements in strong and weak crystal fields.

Q118. CBSE 2026 · 4 marks In octahedral crystal field, energies of which d-orbitals will be raised when ligands approach the central metal atom/ion? Give reason in support of your answer.

Q119. CBSE 2026 · 4 marks (a) In octahedral crystal field, energies of which d-orbitals will be raised when ligands approach the central metal atom/ion? Give reason in support of your answer. (2 marks)

CASE STUDY · CBSE 2025

Werner proposed the concept of a primary valence and a secondary valence for a metal ion. The primary valences are normally ionisable and are satisfied by negative ions. The secondary valences are non-ionisable. These are satisfied by neutral molecules or negative ions. The secondary valency is equal to the co-ordination number and is normally fixed for a metal. The Valence Bond Theory (VBT) explains the formation,

magnetic behaviour and geometrical shapes of co-ordination compounds whereas the Crystal Field Theory (CFT) is based on the effect of different crystal fields on the degeneracy of d-orbitals energies of the central metal atom / ion.

Q120. CBSE 2025 · 4 marks (a) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ is paramagnetic while $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic. Explain why ? [Atomic number : $\text{Cr} = 24$, $\text{Ni} = 28$]

CASE STUDY · CBSE 2025

Werner's coordination theory in 1893 was the first attempt to explain the bonding in coordination complexes. It must be remembered that this theory was put forward before the electron had been discovered by J.J. Thomson in 1897, and before the electronic theory of valency. Werner did not have any of the modern instrumental techniques and all his studies were made using simple experimental techniques. Werner was able to explain the nature of bonding in complexes and he concluded that in complexes, the metal shows two different sorts of valency: primary and secondary. Primary valences are normally ionisable whereas secondary valences are non ionisable.

Q121. CBSE 2025 · 4 marks (a) One mole of $\text{CrCl}_3 \cdot 4\text{H}_2\text{O}$ precipitates one mole of AgCl when treated with excess of AgNO_3 solution. Write (i) the structural formula of the complex, and (ii) the secondary valency of Cr .

CASE STUDY · CBSE 2025

The Crystal Field Theory (CFT) of coordination compounds is based on the effect of different crystal fields (provided by the ligands taken as point charges) on the degeneracy of d-orbital energies of the central metal atom/ion. The splitting of the d-orbitals provides different electronic arrangements in strong and weak crystal fields. In tetrahedral coordination entity formation, the d-orbital splitting is smaller as compared to the octahedral entity.

Q122. CBSE 2025 · 4 marks On the basis of CFT, explain why $[\text{Ti}(\text{H}_2\text{O})_6]\text{Cl}_3$ complex is coloured ? What happens on heating the complex $[\text{Ti}(\text{H}_2\text{O})_6]\text{Cl}_3$? Give reason. [Atomic no. : $\text{Ti} = 22$]

CASE STUDY · CBSE 2024

The Valence Bond Theory (VBT) explains the formation, magnetic behaviour and geometrical shapes of coordination compounds whereas for coordination compounds is based on the effect of different crystal fields (provided by ligands taken as point charges), on the degeneracy of d-orbital energies of the central metal atom/ion. The splitting of the d-orbitals provides different electronic arrangements in strong and weak crystal fields. The crystal field theory attributes the colour of the coordination compounds to d-d transition of the electron. Coordination compounds find extensive applications in metallurgical processes, analytical and medicinal chemistry.



Q123. CBSE 2024 · 4 marks (a) What is crystal field splitting energy?

CASE STUDY · CBSE 2024

The Valence Bond Theory (VBT) explains the formation, magnetic behaviour and geometrical shapes of coordination compounds whereas Crystal Field Theory for coordination compounds is based on the effect of different crystal fields (provided by ligands taken as point charges), on the degeneracy of d-orbital energies of the central metal atom/ion. The splitting of the d-orbitals provides different electronic arrangements in strong and weak crystal fields. The crystal field theory attributes the colour of the coordination compounds to d-d transition of the electron. Coordination compounds find extensive applications in metallurgical processes, analytical and medicinal chemistry.

Q124. CBSE 2024 · 4 marks (a) What is crystal field splitting energy?

CASE STUDY · CBSE 2024

The Valence Bond Theory (VBT) explains the formation, magnetic behaviour and geometrical shapes of coordination compounds whereas the crystal field theory for coordination compounds is based on the effect of different crystal fields (provided by ligands taken as point charges), on the degeneracy of d-orbital energies of the central metal atom/ion. The splitting of the d-orbitals provides different electronic arrangements in strong and weak crystal fields. The crystal field theory attributes the colour of the coordination compounds to d-d transition of the electron. Coordination compounds find extensive applications in metallurgical processes, analytical and medicinal chemistry.

Q125. CBSE 2024 · 1 mark What is crystal field splitting energy?

CASE STUDY · CBSE 2023

In coordination compounds, metals show two types of linkages, primary and secondary. Primary valencies are ionisable and are satisfied by negatively charged ions. Secondary valencies are non-ionisable and are satisfied by neutral or negative ions having lone pair of electrons. Primary valencies are non-directional while secondary valencies decide the shape of the complexes.

Q126. CBSE 2023 · 1 mark (i) If $\text{PtCl}_2 \cdot 2\text{NH}_3$ does not react with AgNO_3 , what will be its formula?

CASE STUDY · CBSE 2023

Coordination compounds are widely present in the minerals, plant and animal worlds and are known to play many important functions in the area of analytical chemistry, metallurgy, biological systems and medicine. Alfred Werner postulated the use of two types of linkages (primary and secondary), by a metal atom/ion in a coordination compound. He predicted the geometrical shapes of a large number of coordination entities using the property of isomerism. The Valence Bond Theory (VBT) explains the formation, magnetic behaviour and geometrical shapes of coordination compounds. It, however, fails to describe the optical properties of these compounds. The Crystal Field Theory (CFT) explains the effect of different crystal fields (provided by the ligands taken as point charges) on the degeneracy of d-orbital energies of the central metal atom/ion.

Q127. CBSE 2023 · 1 mark When a coordination compound $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ is mixed with AgNO_3 solution, 2 moles of AgCl are precipitated per mole of the compound. Write the structural formula of the complex and secondary valency for Nickel ion.

CASE STUDY · CBSE 2023

Coordination compounds are widely present in the minerals, plant and animal worlds and are known to play many important functions in the area of analytical chemistry, metallurgy, biological systems and medicine. According to Alfred Werner's theory, coordination compounds consist of a central metal atom/ion surrounded by a fixed number of ligands (primary and secondary valencies). By using the property of isomerism, he predicted the geometrical shapes of a large number of coordination entities. The Valence Bond Theory (VBT) explains the formation, magnetic behaviour and geometrical shapes of coordination compounds. However, it fails to describe the optical properties of these compounds. The Crystal Field Theory (CFT) explains the effect of different crystal fields (provided by the ligands taken as point charges) on the degeneracy of d-orbital energies of the central metal atom/ion.

Q128. CBSE 2023 · 4 marks When a coordination compound $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ is mixed with AgNO_3 solution, 2 moles of AgCl are precipitated per mole of the compound. Write the structural formula of the complex and secondary valency for Nickel ion.

6 Haloalkanes and Haloarenes

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (49)

Q1. CBSE 2026 · 1 mark Chloroform, in the presence of air and sunlight, produces a poisonous gas known as :

- (a) Phosgene (b) Phosphine (c) Tear gas (d) Mustard gas

Q2. CBSE 2026 · 1 mark $(\text{CH}_3)_3\text{C}-\text{OC}_2\text{H}_5$ on reaction with HI gives
(a) $(\text{CH}_3)_3\text{C}-\text{I}$ and $\text{C}_2\text{H}_5-\text{I}$ (b) $(\text{CH}_3)_3\text{C}-\text{OH}$ and $\text{C}_2\text{H}_5-\text{I}$
(c) $(\text{CH}_3)_3\text{C}-\text{I}$ and $\text{C}_2\text{H}_5-\text{OH}$ (d) $(\text{CH}_3)_3\text{C}-\text{OH}$ and $\text{C}_2\text{H}_5-\text{OH}$



Q3. CBSE 2026 · 1 mark Consider the following compounds: Chlorobenzene (I), 2,4,6-trinitrochlorobenzene (II), 2,4-dinitrochlorobenzene (III), 4-nitrochlorobenzene (IV). The correct order of increasing ease of nucleophilic substitution reactions of these compounds is :

- (a) $I < IV < III < II$ (b) $I < III < IV < II$ (c) $II < III < IV < I$
(d) $IV < III < II < I$

Q4. CBSE 2026 · 1 mark Oxidation of chloroform by air in the presence of sunlight produces a poisonous gas known as:

- (a) Mustard gas (b) Tear gas (c) Chlorine gas
(d) Phosgene gas

Q5. CBSE 2026 · 1 mark The position of – Br in the compound can be classified as :

- (a) Vinylic (b) Allylic (c) Benzylic (d) Aryl

Q6. CBSE 2026 · 1 mark Which of the following is not correct for S_N1 reaction?

- (a) Follows first order kinetics
(b) Favoured by polar protic solvents
(c) Proceeds through the formation of carbocation
(d) Results in inversion of configuration

Q7. CBSE 2026 · 1 mark Consider the following reaction and identify A and B : $CH_3Cl + NaI$ (in dry acetone) $\rightarrow A + B$

- (a) $A = CH_3I$, $B = NaCl$ (b) $A = CH_3OH$, $B = NaCl$
(c) $A = CH_3CHO$, $B = NaCl$ (d) $A = C_2H_6$, $B = CH_3I$

Q8. CBSE 2026 · 1 mark Consider the following reaction and identify A and B: $CH_3Cl + NaI$ (dry acetone) $\rightarrow A + B$

- (a) $A = CH_3I$, $B = NaCl$ (b) $A = CH_3OH$, $B = NaCl$
(c) $A = CH_3CHO$, $B = NaCl$ (d) $A = C_2H_6$, $B = CH_3I$

Q9. CBSE 2025 · 1 mark The conversion of an alkyl halide into an alcohol by aqueous NaOH is classified as

- (a) an addition reaction (b) a substitution reaction
(c) a dehydrohalogenation reaction
(d) a dehydration reaction

Q10. CBSE 2025 · 1 mark The synthesis of alkyl fluoride is best accomplished by

- (a) Sandmeyer reaction (b) Finkelstein reaction
(c) Wurtz reaction (d) Swarts reaction

Q11. CBSE 2025 · 1 mark Assertion (A): $(CH_3)_3C-O-CH_3$ gives $(CH_3)_3C-I$ and CH_3OH on treatment with HI. Reason (R): The reaction occurs by S_N1 mechanism.

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

Q12. CBSE 2025 · 1 mark Assertion (A): Nucleophilic substitution reaction of chlorobenzene is easier than that of chloroethane. Reason (R): C–Cl bond in chlorobenzene has partial double bond character due to resonance.

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

Q13. CBSE 2025 · 1 mark Out of 2-Bromobutane, 1-Bromobutane, 2-Bromopropane and 1-Bromopropane, the molecule which is chiral in nature is:

- (a) 2-Bromobutane (b) 1-Bromobutane
(c) 2-Bromopropane (d) 1-Bromopropane

Q14. CBSE 2025 · 1 mark Polyhalogen compounds have wide application in industries and agriculture. DDT is also a very important polyhalogen compound. It is a:

- (a) greenhouse gas (b) fertilizer
(c) biodegradable insecticide
(d) non-biodegradable insecticide

Q15. CBSE 2025 · 1 mark Assertion (A): n-Butyl chloride has higher boiling point than n-Butyl bromide. Reason (R): C – Cl bond is more polar than C – Br bond.

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

Q16. CBSE 2025 · 1 mark Which of the following molecules is chiral in nature?

- (a) 1-chloropropane (b) 2-chloropropane
(c) 1-chlorobutane (d) 2-chlorobutane

Q17. CBSE 2025 · 1 mark The treatment of ethyl bromide with alcoholic silver nitrite gives:

- (a) ethyl nitrite (b) nitroethane (c) nitromethane
(d) ethene

Q18. CBSE 2025 · 1 mark Assertion (A): The boiling points of alkyl halides decrease in the order $RI > RBr > RCl > RF$. Reason (R): The van der Waals forces of attraction decrease in the order $RI > RBr > RCl > RF$.

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

Q19. CBSE 2025 · 1 mark Which of the following compounds would be hydrolysed by aqueous KOH most easily ?

- (a) $CH_2 = CH - Br$ (b) $CH_3 - CH_2 - Br$
(c) $CH_3 - CH - CH_3$ (with Br) (d) $CH_2 = CH - CH_2 - Br$



Q20. CBSE 2025 · 1 mark Which reagents are required for one step conversion of chlorobenzene to toluene?

- (a) $\text{NaNO}_2 + \text{HCl}$ (b) $\text{CH}_3\text{Cl}/\text{Anhydrous AlCl}_3$
(c) $\text{CH}_3\text{Cl}/\text{Fe}$, Dark (d) CH_3Cl , Na, Dry ether

Q21. CBSE 2025 · 1 mark Which reagents are required for one step conversion of Chlorobenzene to Diphenyl?

- (a) Chlorobenzene, Na, Dry ether
(b) Benzene, Anhydrous AlCl_3 (c) Chlorobenzene/ Fe , Dark
(d) $\text{NaNO}_2 + \text{HCl}$

Q22. CBSE 2025 · 1 mark Which of the following haloalkanes react with aqueous KOH most rapidly by SN_1 reaction ?

- (a) 2-Chlorobutane (b) 1-Bromobutane
(c) 2-Bromo-2-Methylpropane
(d) 2,2-Dimethyl-1-Chloropropane

Q23. CBSE 2025 · 1 mark The synthesis of alkyl fluoride is best carried out by :

- (a) Finkelstein reaction (b) Swarts reaction
(c) Sandmeyer reaction (d) Wurtz reaction

Q24. CBSE 2025 · 1 mark Which of the following haloalkanes is most reactive towards SN_2 reaction?

- (a) $\text{CH}_3 - \text{CH}_2 - \text{I}$ (b) $\text{CH}_3 - \text{CH}_2 - \text{Br}$ (c) $\text{CH}_3 - \text{CH}_2 - \text{Cl}$
(d) $\text{CH}_3 - \text{CH}_2 - \text{F}$

Q25. CBSE 2024 · 1 mark Which of the following alkyl halides will undergo SN_1 reaction most readily?

- (a) $(\text{CH}_3)_3\text{CI}$ (b) $(\text{CH}_3)_3\text{CCI}$ (c) $(\text{CH}_3)_3\text{CBr}$ (d) $(\text{CH}_3)_3\text{CF}$

Q26. CBSE 2024 · 1 mark Assertion (A): p-nitroaniline is a weaker base than p-toluidine. Reason (R): The electron withdrawing effect of NO_2 group in p-nitroaniline makes it a weaker base.

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

Q27. CBSE 2024 · 1 mark $(\text{CH}_3)_2\text{CHOCH}_3$ when treated with HI gives :

- (a) $(\text{CH}_3)_2\text{CHI} + \text{CH}_3\text{OH}$ (b) $(\text{CH}_3)_2\text{CHOH} + \text{CH}_3\text{I}$
(c) $(\text{CH}_3)_2\text{CHI} + \text{CH}_3\text{I}$ (d) $(\text{CH}_3)_2\text{CHOH} + \text{CH}_3\text{OH}$

Q28. CBSE 2023 · 1 mark The synthesis of alkyl fluoride is best obtained from:

- (a) Free radicals (b) Swartz reaction
(c) Sandmeyer reaction (d) Finkelstein reaction

Q29. CBSE 2023 · 1 mark In the reaction $\text{R-OH} + \text{HCl} \rightarrow \text{R-Cl} + \text{H}_2\text{O}$ (with 2ZnCl_2), what is the correct order of reactivity of alcohol?

- (a) $1 < 2 < 3$ (b) $1 > 3 > 2$ (c) $1 > 2 > 3$ (d) $3 > 1 > 2$

Q30. CBSE 2023 · 1 mark In the reaction $\text{R-OH} + \text{HCl} \xrightarrow{(\text{ZnCl}_2)} \text{R-Cl} + \text{H}_2\text{O}$, what is the correct order of reactivity of alcohol?

- (a) $1 < 2 < 3$ (b) $1 > 3 > 2$ (c) $1 > 2 > 3$ (d) $3 > 1 > 2$

Q31. CBSE 2023 · 1 mark The species that attacks benzene in following is:

- (a) Cl (b) AlCl_4^- (c) AlCl_3 (d) Cl^+

Q32. CBSE 2023 · 1 mark The conversion of an alkyl halide into an alkene by alcoholic KOH is classified as

- (a) a substitution reaction (b) an addition reaction
(c) a dehydrohalogenation reaction
(d) a dehydration reaction

Q33. CBSE 2023 · 1 mark Racemisation occurs in

- (a) SN_1 reaction (b) SN_2 reaction
(c) Neither SN_1 nor SN_2 reaction
(d) SN_2 reaction as well as SN_1 reaction

Q34. CBSE 2023 · 1 mark Which of the following reactions are feasible?

- (a) $\text{CH}_3\text{CH}_2\text{Br} + \text{Na} + \text{O-C(CH}_3)_3 \rightarrow \text{CH}_3\text{CH}_2\text{-O-C(CH}_3)_3$
(b) $(\text{CH}_3)_3\text{CCl} + \text{Na} + \text{O-CH}_2\text{CH}_3 \rightarrow \text{CH}_3\text{CH}_2\text{-O-C(CH}_3)_3$
(c) Both (a) and (b) (d) Neither (a) nor (b)

Q35. CBSE 2023 · 1 mark Assertion (A): Nucleophilic substitution of iodoethane is easier than chloroethane. Reason (R): Bond enthalpy of C-I bond is less than that of C-Cl bond.

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

Q36. CBSE 2023 · 1 mark Which of the following belongs to the class of Vinyl halides ?

- (a) $\text{CH}_2 = \text{CHCH}_2\text{CH}_2\text{Cl}$ (b) $\text{CH}_2 = \text{C}(\text{Br}) - \text{CH}_3$
(c) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{Br}$ (d) $\text{CH} \equiv \text{C} - \text{Br}$

Q37. CBSE 2023 · 1 mark Retention of configuration is observed in

- (a) SN_1 reaction (b) SN_2 reaction
(c) Neither SN_1 nor SN_2 reaction
(d) SN_2 reaction as well as SN_1 reaction

Q38. CBSE 2023 · 1 mark Assertion (A): Chlorobenzene is resistant to electrophilic substitution reaction. Reason (R): C-Cl bond in chlorobenzene acquires partial double bond characters due to resonance.

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

Q39. CBSE 2023 · 1 mark Auto oxidation of chloroform in air and sunlight produces a poisonous gas known as

- (a) Tear gas (b) Mustard gas (c) Phosgene gas
(d) Chlorine gas

Q40. CBSE 2023 · 1 mark Inversion of configuration occurs in

- (a) SN_2 reaction (b) SN_1 reaction
(c) Neither SN_2 nor SN_1 reaction
(d) SN_1 as well as SN_2 reaction



Q41. CBSE 2023 · 1 mark Assertion (A): Chlorobenzene is resistant to nucleophilic substitution reaction at room temperature.

Reason (R): C-Cl bond gets weaker due to resonance.

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

Q42. CBSE 2023 · 1 mark Assertion (A): Nucleophilic substitution of iodoethane is easier than chloroethane. Reason (R): Bond energy of C-Cl bond is less than C-I bond.

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

Q43. CBSE 2023 · 1 mark Which of the following has the highest melting point?

- (a) o-Dichlorobenzene (b) m-Dichlorobenzene
 (c) p-Dichlorobenzene (d) All have the same melting point

Q44. CBSE 2023 · 1 mark Benzene diazonium chloride on hydrolysis gives:

- (a) Phenol (b) Chlorobenzene (c) Benzene (d) Aniline

Q45. CBSE 2023 · 1 mark Which of the following belongs to the class of alkyl halides?

- (a) $\text{CH}_2 = \text{CH} - \text{Cl}$ (b) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{Cl}$
 (c) $\text{CH}_2 = \text{CH} - \text{Cl}|\text{CH} - \text{CH}_3$ (d) $\text{CH} \equiv \text{C} - \text{CH}_2 - \text{Cl}$

Q46. CBSE 2023 · 1 mark Reaction of 1-phenyl-2-chloropropane with alcoholic KOH gives mainly:

- (a) 1-phenylpropene (b) 3-phenylpropene
 (c) 1-phenylpropan-3-ol (d) 1-phenylpropan-2-ol

Q47. CBSE 2023 · 1 mark Assertion (A): Monobromination of aniline can be conveniently done by protecting the amino group by acetylation. Reason (R): Acetylation decreases the activating effect of the amino group.

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

Q48. CBSE 2023 · 1 mark Which of the following molecules has a chiral centre correctly labelled with an asterisk (*)?

- (a) $\text{CH}_3\text{C}^*\text{HBrCH}_3$ (b) $\text{CH}_3\text{C}^*\text{HClCH}_2\text{Br}$
 (c) $\text{HOCH}_2\text{C}^*\text{H}(\text{OH})\text{CH}_2\text{OH}$ (d) $\text{CH}_3\text{C}^*\text{Br}_2\text{CH}_3$

Q49. CBSE 2023 · 1 mark Which of the following would not be a good choice for reducing nitrobenzene to aniline?

- (a) LiAlH_4 (b) H_2/Ni (c) Fe and HCl (d) Sn and HCl

VERY SHORT ANSWER (19)

Q50. CBSE 2026 · 2 marks What happens when : (a) n-butyl chloride is treated with alcoholic KOH ? (b) Chlorobenzene is treated with CH_3Cl in the presence of anhydrous AlCl_3 ?

Q51. CBSE 2026 · 2 marks Why are haloarenes less reactive towards nucleophilic substitution reaction? Give two reasons.

Q52. CBSE 2026 · 2 marks Draw the structure of the given compound: 4-Bromo-3-methylpent-2-ene. What happens when chloroethane is treated with aqueous potassium hydroxide?

Q53. CBSE 2026 · 2 marks (a) Draw the structure of the given compound : 4-Bromo-3-methylpent-2-ene (b) What happens when chloroethane is treated with aqueous potassium hydroxide ?

Q54. CBSE 2026 · 2 marks For the compound having molecular formula $\text{C}_4\text{H}_9\text{Br}$, write: (a) the isomer which is most reactive towards SN_1 displacement. (b) the isomer which, on reacting with Na metal in the presence of dry ether, gives 2,5-Dimethylhexane.

Q55. CBSE 2026 · 2 marks Draw the structures of major product(s) in each of the following reactions: (b) $\text{CH}_3\text{CH} = \text{C}(\text{CH}_3)_2 + \text{HBr}$

Q56. CBSE 2026 · 2 marks (a) Complete the equation: $2\text{NH}_2^- + (\text{N}^+\text{Cl}_2) + \text{H}^+ \rightarrow ?$ (b) How will you convert chlorobenzene to p-chloroaniline?

Q57. CBSE 2025 · 2 marks Draw the structures of product(s) in each of the following reactions: (a) $\text{CH}_3-\text{CH}=\text{CH}_2$ with NO_2 , heat, (b) Cl with Br_2 , anhydrous AlCl_3 , then with CH_3COCl

Q58. CBSE 2025 · 2 marks Why are haloarenes less reactive towards nucleophilic substitution reaction ? How does the presence of nitro ($-\text{NO}_2$) group at ortho- and para-positions in haloarenes increase the reactivity towards nucleophilic substitution reaction ?

Q59. CBSE 2024 · 2 marks (a) Which one of the following pairs of substances undergoes SN_1 reaction faster and why? $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{Cl}$ OR $\text{CH}_2=\text{CH}-\text{CH}_2-\text{Cl}$

Q60. CBSE 2024 · 2 marks (a) Which halogen compound in the following pair will react faster in SN_2 reactions and why ? $\text{CH}_3\text{CH}_2\text{I}$ OR $\text{CH}_3\text{CH}_2\text{Br}$

Q61. CBSE 2024 · 2 marks Which halogen compound in the following pair will react faster in SN_1 reaction and why? Why is the dipole moment of chlorobenzene lower than that of cyclohexyl chloride?

Q62. CBSE 2024 · 2 marks Which halogen compound in the following pair will react faster in SN_2 reaction and why?

Q63. CBSE 2023 · 2 marks Identify A, B and C in the following reactions: (a) $\text{CH}_3-\text{CH}(\text{OH})-\text{CH}_3 + \text{PCl}_5 \rightarrow \text{A} + \text{AgCN} \rightarrow \text{B}$ (b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} + \text{KOH}$ (ethanol) $\rightarrow \text{C} + \text{HBr}$

Q64. CBSE 2023 · 2 marks Write the main product formed when: (a) n-Butyl chloride is treated with alc. KOH. (b) 2,4,6-Trinitrochlorobenzene is subjected to hydrolysis.



Q65. CBSE 2023 · 2 marks An alkyl halide (A) of molecular formula $C_6H_{13}Cl$ on treatment with alcoholic KOH gives two isomeric alkenes (B) and (C) of molecular formula C_6H_{12} . Both alkenes on hydrogenation give 2,3-dimethylbutane. Write the structures of (A), (B) and (C).

Q66. CBSE 2023 · 2 marks Which of the following is an appropriate set of reactants for the preparation of 1-methoxy-4-nitrobenzene and why?

Q67. CBSE 2023 · 2 marks (b) Write equations for: Reaction of chlorobenzene with CH_3Cl / anhyd. $AlCl_3$

Q68. CBSE 2023 · 2 marks Why haloarenes are not reactive towards nucleophilic substitution reaction? Give two reasons.

SHORT ANSWER (22)

Q69. CBSE 2026 · 3 marks Write two differences between SN_1 and SN_2 reactions. Out of chlorobenzene and 2,4,6-trinitrochlorobenzene, which one is more reactive towards nucleophilic substitution reactions?

Q70. CBSE 2026 · 3 marks Compound 'X' with molecular formula C_4H_9Br reacts with aqueous KOH to give an alcohol. The rate of this reaction depends only on the concentration of the compound 'X'. When an optically active isomer 'Y' of the compound 'X' was treated with aqueous KOH solution, the rate of reaction was found to be dependent on concentration of compound 'Y' and aqueous KOH both. (a) Write down the structural formula of both 'X' and 'Y'. (b) Out of 'X' and 'Y', which one will undergo racemisation and why? (c) Out of 'X' and 'Y', which one will form product with inversion of configuration and why?

Q71. CBSE 2026 · 3 marks (a) Write the IUPAC name of the given compound: $CH_3CH(CH_3)CH(Br)CH_3$ (b) Define Racemisation. (c) The boiling points of the alkyl halides with the same alkyl group decrease in the given order: $RI > RBr > RCl > RF$. Explain the above statement.

Q72. CBSE 2026 · 3 marks Give reasons for the following: (a) Alkyl halides, though polar, yet their solubility in water is very low. (b) p-Dichlorobenzene has higher melting point than those of o- and m-isomers. (c) CH_3-I is more reactive than CH_3-Br towards SN_2 reactions.

Q73. CBSE 2026 · 3 marks Answer the following: (a) Which isomer of C_4H_9Br is most reactive towards SN_1 reaction? (b) Predict the alkene that would be formed by dehydrohalogenation of 1-Bromo-1-methylcyclohexane. (c) Although chlorine shows strong $-I$ effect, yet it is ortho- and para-directing in electrophilic aromatic substitution reactions. Why?

Q74. CBSE 2026 · 3 marks (a) Which isomer of C_4H_9Br is most reactive towards SN_1 reaction? (b) Predict the alkene that would be formed by dehydrohalogenation of 1-Bromo-1-methylcyclohexane. (c) Although chlorine shows strong $-I$ effect, yet it is ortho- and para-directing in electrophilic aromatic substitution reactions. Why?

Q75. CBSE 2025 · 3 marks Define Racemization. Out of SN_1 and SN_2 reactions, which is accompanied by racemization? Give reason in support of your answer.

Q76. CBSE 2025 · 3 marks (a) Account for the following: (i) Allyl chloride is hydrolysed more readily than n-propyl chloride. (ii) Isocyanides are formed when alkyl halides are treated with silver cyanide. (iii) Methyl chloride reacts faster with OH^- ion in SN_2 reaction than t-butyl chloride.

Q77. CBSE 2025 · 3 marks Account for the following: (a) The $C-Cl$ bond length in chlorobenzene is shorter than that in methyl chloride. (b) Grignard reagents should be prepared under anhydrous conditions. (c) In case of optically active alkyl halides, SN_1 reactions are accompanied by racemisation.

Q78. CBSE 2025 · 3 marks Among the following, which will have inversion of configuration on reaction with aqueous alkali and why? (i) 1-chloropropane OR (ii) 2-chloro-2-methylpropane. Which of the following (A) or (B) will be the major product in the reaction given: $CH_3-CH_2-CH(Br)-CH_3 + alc. KOH \rightarrow CH_3-CH_2-CH=CH_2$ (A) + $CH_3-CH=CH-CH_3$ (B)? Give a suitable reason for your answer.

Q79. CBSE 2025 · 1 mark Haloarenes are less reactive towards nucleophilic substitution reactions.

Q80. CBSE 2025 · 3 marks Write any two differences between SN_1 and SN_2 reactions. Which of the following compounds would undergo SN_1 reaction faster and why? (choice between two structural compounds)

Q81. CBSE 2025 · 3 marks Write any two differences between SN_1 and SN_2 reactions. Which of the following compounds would undergo SN_1 reaction faster and why? CH_2Cl-Cl or CH_2Cl-Cl (with benzene ring)

Q82. CBSE 2025 · 3 marks A compound (A) with molecular formula C_4H_9I which is a primary alkyl halide, reacts with alcoholic KOH to give compound (B). Compound (B) reacts with HI to give (C) which is an isomer of (A). When (A) reacts with Na metal in the presence of dry ether, it gives a compound (D), C_8H_{18} , which is different from the compound formed when n-butyl iodide reacts with sodium. Write the structures of (A), (B), (C) and (D). Write the chemical equation when compound (A) is reacted with alcoholic KOH.

Q83. CBSE 2024 · 3 marks (a) Which of the following is an allylic halide? (i) $CH_3-CH=CH-Br$ (ii) $CH_2=CH-CH(Br)-CH_3$. (b) Out of chlorobenzene and 2,4,6-trinitrochlorobenzene, which is more reactive towards nucleophilic substitution and why? (c) Which isomer of C_4H_9Cl has the lowest boiling point?

Q84. CBSE 2024 · 3 marks Give reasons for the following: (a) Chlorine is ortho/para directing in electrophilic aromatic substitution reactions, though chlorine is an electron withdrawing group. (b) Racemic mixture is optically inactive. (c) Allyl chloride is hydrolysed more readily than n-propyl chloride.

Q85. CBSE 2024 · 3 marks (a) What type of nucleophilic substitution (SN_1 or SN_2) occurs in the hydrolysis of 2-Bromobutane to form (-)-Butan-2-ol? Give reason. (b) What happens when chlorobenzene and methyl chloride are treated with sodium metal in dry ether?



Q86. CBSE 2024 · 3 marks What type of nucleophilic substitution (SN1 or SN2) occurs in the hydrolysis of 2-Bromobutane to form ()-Butan-2-ol? Give reason. OR What happens when chlorobenzene and methyl chloride are treated with sodium metal in dry ether?

Q87. CBSE 2024 · 3 marks What type of nucleophilic substitution (SN1 or SN2) occurs in the hydrolysis of 2-Bromobutane to form ()-Butan-2-ol? Give reason.

Q88. CBSE 2023 · 3 marks Write main product formed when: (a) Methyl chloride is treated with NaI/Acetone. (b) 2,4,6-trinitrochlorobenzene is subjected to hydrolysis. (c) n-Butyl chloride is treated with alcoholic KOH.

Q89. CBSE 2023 · 3 marks Answer any 3 of the following: (a) Which isomer of C₅H₁₀ gives a single monochloro compound C₅H₉Cl in bright sunlight? (b) Arrange the following compounds in increasing order of reactivity towards SN2 reaction: 2-Bromopentane, 1-Bromopentane, 2-Bromo-2-methylbutane

Q90. CBSE 2023 · 3 marks Account for the following: (a) Benzyl chloride is highly reactive towards SN1 reaction. (b) ()-Butan-2-ol is optically inactive, though it contains a chiral carbon atom. (c) Chloroform is stored in closed dark coloured bottles.

LONG ANSWER (3)

Q91. CBSE 2026 · 5 marks (i) How will you bring about the following conversions: (I) Bromobenzene to 1-phenylethanol (II) Benzene to m-nitroacetophenone (ii) An organic compound with the molecular formula C₈H₈O forms 2,4-DNP derivative, reduces Tollens' reagent and undergoes Cannizzaro reaction. On vigorous oxidation with acidic or alkaline KMnO₄ it gives Benzene-1,2-dicarboxylic acid. Identify the compound and write the products when it undergoes Cannizzaro reaction. (iii) Arrange the following compounds in increasing order of their acid strength: C₆H₅COOH, O₂N-CH₂-COOH, CF₃-COOH, HCOOH

Q92. CBSE 2026 · 5 marks (a) (i) Which of the following is more reactive towards SN1 reaction: 2-Bromo-2-methylbutane or 1-Bromopentane. (II) What type of halide is present in the following compound: CH₃-CH(CH₃)-C(=CH₂)-Cl. (III) Why is chloroform stored in dark coloured bottles? (ii) Define the following terms: (I) Ambident Nucleophiles (II) Racemic mixture

Q93. CBSE 2026 · 5 marks (a) (i) Which of the following is more reactive towards SN1 reaction: 2-Bromo-2-methylbutane or 1-Bromopentane (II) What type of halide is present in the following compound: CH₃-CH(CH₃)-C(Cl)=CH₂ (III) Why is chloroform stored in dark coloured bottles? (ii) Define the following terms: (I) Ambident Nucleophiles (II) Racemic mixture

CASE-BASED (3)

CASE STUDY · CBSE 2023

The polarity of C-X bond of alkyl halides is responsible for their nucleophilic substitution, elimination and their reaction with metal atoms to form organometallic compounds. Alkyl halides are prepared by the free radical halogenation of alkanes, addition of halogen acids to alkenes, replacement of OH group of alcohols with halogens using phosphorus halides, thionyl chloride or halogen acids. Aryl halides are prepared by electrophilic substitution of arenes. Nucleophilic substitution reactions are categorised into SN1 and SN2 on the basis of their kinetic properties. Chirality has a profound role in understanding the SN1 and SN2 mechanism.

Q94. CBSE 2023 · 1 mark What happens when bromobenzene is treated with Mg in the presence of dry ether?

CASE STUDY · CBSE 2023

Nucleophilic Substitution reaction of haloalkane can be conducted according to both SN1 and SN2 mechanisms. SN1 is a two step reaction while SN2 is a single step reaction. For any haloalkane which mechanism is followed depends on factors such as structure of haloalkane, properties of leaving group, nucleophilic reagent and solvent. Influences of solvent polarity: In SN1 reaction, the polarity of the system increases from the reactant to the transition state, because a polar solvent has a greater effect on the transition state than the reactant, thereby reducing activation energy and accelerating the reaction. In SN2 reaction, the polarity of the system generally does not change from the reactant to the transition state and only charge dispersion occurs. At this time, polar solvent has a great stabilizing effect on Nu than the transition state, thereby increasing activation energy and slow down the reaction rate. For example, the decomposition rate (SN1) of tertiary chlorobutane at 25 °C in water (dielectric constant 79) is 300000 times faster than in ethanol (dielectric constant 24). The reaction rate (SN2) of 2-Bromopropane and NaOH in ethanol containing 40% water is twice slower than in absolute ethanol. Hence the level of solvent polarity has influence on both SN1 and SN2 reaction, but with different results. Generally speaking weak polar solvent is favourable for SN2 reaction, while strong polar solvent is favourable for SN1. Generally speaking the substitution reaction of tertiary haloalkane is based on SN1 mechanism in solvents with a strong polarity (for example ethanol containing water).

Q95. CBSE 2023 · 4 marks (a) Why racemisation occurs in SN1?

Q96. CBSE 2023 · 1 mark (a) Why does racemisation occur in SN1?

7 Alcohols, Phenols and Ethers

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (69)

Q1. CBSE 2026 · 1 mark Propan-2-ol on oxidation with CrO₃ gives :
(a) Propanal (b) Propanoic acid (c) Propene
(d) Propanone



Q2. CBSE 2026 · 1 mark Assertion (A) : p-nitrophenol is less acidic than phenol. Reason (R) : Nitro group is an electron-withdrawing group, which stabilises the phenoxide ion.

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

Q3. CBSE 2026 · 1 mark Aspirin is obtained by acetylation of

- (a) Phenol (b) Salicylaldehyde (c) 2-Hydroxybenzoic acid
- (d) Benzoic acid

Q4. CBSE 2026 · 1 mark At low temperature, phenol reacts with dil. HNO_3 to yield

- (a) 2, 4, 6-Trinitrophenol (b) o-Nitrophenol only
- (c) p-Nitrophenol only (d) ortho-and para-nitrophenol

Q5. CBSE 2026 · 1 mark Assertion (A): The presence of $-\text{OH}$ group in phenols directs the incoming group to meta position in the ring. Reason (R): $-\text{OH}$ group in phenols activates the aromatic ring towards electrophilic substitution reaction.

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

Q6. CBSE 2026 · 1 mark Assertion (A): The presence of $-\text{OH}$ group in phenols directs the incoming group to ortho and para positions. Reason (R): $-\text{OH}$ group in phenols activates the aromatic ring towards electrophilic substitution reaction.

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

Q7. CBSE 2026 · 1 mark Which of the following is 'not' true about enantiomers ?

- (a) They have the same chemical reactivity.
- (b) They have the same specific rotation.
- (c) They have the same melting or boiling point.
- (d) They have the same refractive index.

Q8. CBSE 2026 · 1 mark At low temperature, phenol on reaction with Br_2 in CS_2 gives

- (a) 2, 4, 6-Tribromophenol
- (b) a mixture of ortho-and para-bromophenol
- (c) ortho-bromophenol only (d) para-bromophenol only

Q9. CBSE 2026 · 1 mark Assertion (A) : The presence of $-\text{OH}$ group in phenols directs the incoming group at ortho- and para-positions. Reason (R) : $-\text{OH}$ group in phenols deactivates the aromatic ring.

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

Q10. CBSE 2026 · 1 mark Which of the following molecules is chiral in nature?

- (a) Propan-2-ol (b) Butan-2-ol (c) 1-Bromobutane
- (d) 2-Bromopropane

Q11. CBSE 2026 · 1 mark Identify the correct increasing order of boiling points of the given compounds:

- (a) Propan-1-ol < butan-1-ol < butan-2-ol < pentan-1-ol
- (b) Pentan-1-ol < butan-1-ol < butan-2-ol < Propan-1-ol
- (c) Propan-1-ol < butan-2-ol < butan-1-ol < pentan-1-ol
- (d) Butan-1-ol < Butan-2-ol < Propan-1-ol < Pentan-1-ol

Q12. CBSE 2026 · 1 mark The intermediate formed during the slowest step involved in the dehydration of alcohol is:

- (a) protonated alcohol (b) carbanion (c) free radical
- (d) carbocation

Q13. CBSE 2026 · 1 mark Assertion (A): Phenol is less acidic than 4-methylphenol. Reason (R): The presence of an electron releasing group in phenol makes it less acidic.

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

Q14. CBSE 2026 · 1 mark The dehydration of 1° , 2° and 3° alcohols follows the order :

- (a) $2^\circ > 1^\circ > 3^\circ$ (b) $3^\circ > 2^\circ > 1^\circ$ (c) $1^\circ > 2^\circ > 3^\circ$
- (d) $1^\circ > 3^\circ > 2^\circ$

Q15. CBSE 2026 · 1 mark Assertion (A): Phenol is more acidic than 4-methylphenol. Reason (R): The presence of an electron releasing group in phenol makes it more acidic.

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



Q16. CBSE 2026 · 1 mark Assertion (A): Ethers have lower boiling points than the boiling points of alcohols. Reason (R): This is due to the presence of hydrogen bonding in alcohols.

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

Q17. CBSE 2026 · 1 mark Lucas reagent produces cloudiness immediately with:

- (a) 2-methyl-1-propanol (b) Butan-2-ol
- (c) 2-methyl-2-propanol (d) Butan-1-ol

Q18. CBSE 2026 · 1 mark Assertion (A): Alcohols act as Bronsted bases as well as Bronsted acids. Reason (R): It is due to the presence of unshared electron pairs on oxygen atom and presence of polar O-H bond.

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

Q19. CBSE 2026 · 1 mark Williamson synthesis is an example of :

- (a) Nucleophilic addition reaction
- (b) Electrophilic substitution reaction
- (c) Nucleophilic substitution reaction
- (d) Electrophilic addition reaction

Q20. CBSE 2026 · 1 mark Assertion (A): Alcohols act as Bronsted bases as well as Bronsted acids. Reason (R): Alcohols react as both nucleophiles and electrophiles.

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

Q21. CBSE 2026 · 1 mark Assertion (A): $(\text{CH}_3)_3\text{C}-\text{O}-\text{CH}_3$ gives $(\text{CH}_3)_3\text{C}-\text{I}$ and CH_3OH on reaction with HI. Reason (R): The reaction occurs by SN_1 mechanism.

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

Q22. CBSE 2026 · 1 mark Primary, secondary and tertiary alcohols can be distinguished by :

- (a) Lucas test (b) Fehling's test (c) Tollens' test
- (d) Hinsberg's test

Q23. CBSE 2026 · 1 mark Assertion (A) : p-nitrophenol is more acidic than phenol. Reason (R) : Nitro group is an electron-withdrawing group, it stabilises phenoxide ion by dispersal of negative charge.

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

Q24. CBSE 2025 · 1 mark The compound which undergoes dehydration most easily is

- (a) 2-Methylpropan-2-ol (b) Ethanol
- (c) 2-Methylbutan-2-ol (d) Propan-1-ol

Q25. CBSE 2025 · 1 mark Alkenes are formed by heating alcohols with conc. H_2SO_4 . The first step in the reaction is:

- (a) formation of carbocation (b) formation of ester
- (c) protonation of alcohol molecule (d) elimination of water

Q26. CBSE 2025 · 1 mark $\text{CH}_3\text{CH}_2\text{OH}$ can be converted to CH_3CHO by :

- (a) catalytic hydrogenation (b) treatment with LiAlH_4
- (c) treatment with PCC (d) treatment with KMnO_4

Q27. CBSE 2025 · 1 mark Williamson synthesis of preparing unsymmetrical ether is :

- (a) SN_1 reaction (b) SN_2 reaction
- (c) Electrophilic addition reaction (d) Elimination reaction

Q28. CBSE 2025 · 1 mark Assertion (A) : Phenol is strongly acidic as compared to ethanol. Reason (R) : Phenoxide ion is more stable than ethoxide ion.

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

Q29. CBSE 2025 · 1 mark Which by-product is obtained in the manufacture of phenol from cumene?

- (a) Acetaldehyde (b) Acetone (c) Anisole (d) o-Cresol

Q30. CBSE 2025 · 1 mark Assertion (A): Phenol is less acidic than alcohol. Reason (R): Phenoxide ion is more stable than alkoxide ion.

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

Q31. CBSE 2025 · 1 mark During dehydration of alcohol to alkene by heating with conc. H_2SO_4 , the initiation step is:

- (a) Formation of an ester (b) Formation of carbocation
- (c) Protonation of alcohol (d) Elimination of water



Q32. CBSE 2025 · 1 mark Assertion (A): The bond angle C – O – C in ethers is slightly greater than tetrahedral angle. Reason (R): This is because of the repulsive interaction between the two bulky alkyl groups.

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

Q33. CBSE 2025 · 1 mark The reaction $R-OH + Na \rightarrow RO^-Na^+ + \frac{1}{2}H_2$ (g) suggests that alcohols are :

- (a) Acidic (b) Basic (c) Neutral (d) Amphoteric

Q34. CBSE 2025 · 1 mark At low temperature, phenol reacts with Br_2 in CS_2 to form :

- (a) 2,4,6-tribromophenol (b) p-bromophenol
- (c) o-and p-bromophenol (d) 2,4-dibromophenol

Q35. CBSE 2025 · 1 mark Assertion (A): A mixture of o-nitrophenol and p-nitrophenol can be separated by steam distillation. Reason (R): o-nitrophenol is steam volatile due to intermolecular hydrogen bonding.

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

Q36. CBSE 2025 · 1 mark In the reaction $R-OH + HCl \rightarrow (2ZnCl)RCl + H_2O$, what is the correct order of reactivity of alcohols ?

- (a) $1 < 2 < 3$ (b) $2 < 1 < 3$ (c) $3 > 1 < 2$ (d) $1 > 2 > 3$

Q37. CBSE 2025 · 1 mark Phenol reacts with Bromine (Br_2) water to form :

- (a) 2,4-dibromophenol (b) 2-bromophenol
- (c) 2,4,6-tribromophenol (d) 4-bromophenol

Q38. CBSE 2025 · 1 mark Assertion (A): A mixture of o-nitrophenol and p-nitrophenol can be separated by steam distillation. Reason (R): o-nitrophenol is steam volatile due to intramolecular hydrogen bonding.

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

Q39. CBSE 2025 · 1 mark The reaction $OH^- + NaOH(aq) \rightarrow O^{2-}Na^+ + \frac{1}{2}H_2$ (g) suggests that phenol is:

- (a) Basic (b) Neutral (c) Acidic (d) Amphoteric

Q40. CBSE 2025 · 1 mark Phenol reacts with conc. HNO_3 to form:

- (a) Salicylic acid (b) Picric acid (c) Benzoic acid
- (d) Phthalic acid

Q41. CBSE 2025 · 1 mark Assertion (A): A mixture of o-nitrophenol and p-nitrophenol can be separated by fractional distillation. Reason (R): o-nitrophenol is steam volatile due to intramolecular hydrogen bonding.

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

Q42. CBSE 2024 · 1 mark The reaction of an alkyl halide with sodium alkoxide forming ether is known as:

- (a) Wurtz reaction (b) Reimer-Tiemann reaction
- (c) Williamson synthesis (d) Kolbe reaction

Q43. CBSE 2024 · 1 mark Decarboxylation of sodium benzoate on heating with soda lime gives:

- (a) benzene (b) benzoic acid (c) benzaldehyde
- (d) toluene

Q44. CBSE 2024 · 1 mark Dehydration of tertiary alcohols with Cu at 573 K gives:

- (a) Alkyne (b) Alkene (c) Aldehyde (d) Ketone

Q45. CBSE 2024 · 1 mark Phenol on reaction with aqueous bromine at room temperature gives:

- (a) 2-bromophenol (b) 3-bromophenol
- (c) 4-bromophenol (d) 2,4,6-tribromophenol

Q46. CBSE 2024 · 1 mark Phenol does not undergo nucleophilic substitution reaction easily due to:

- (a) Partial double bond character of C-OH bond
- (b) Partial double bond character of C-C bond
- (c) Acidic nature of phenol (d) Instability of phenoxide ion

Q47. CBSE 2024 · 1 mark Ethanol on heating with conc. H_2SO_4 at 413 K gives:

- (a) $C_2H_5OSO_3H$ (b) $C_2H_5-O-CH_3$ (c) $C_2H_5-O-C_2H_5$
- (d) $CH_2=CH_2$

Q48. CBSE 2024 · 1 mark Phenol is less acidic than:

- (a) ethanol (b) o-nitrophenol (c) o-methoxyphenol
- (d) o-methylphenol

Q49. CBSE 2024 · 1 mark $(CH_3)_3C-O-CH_3$ reacts with HI to give:

- (a) $(CH_3)_3C-I + CH_3OH$ (b) $(CH_3)_3C-I + CH_3-I$
- (c) $(CH_3)_3C-OH + CH_3-I$ (d) $(CH_3)_3C-OH + CH_3OH$

Q50. CBSE 2024 · 1 mark $(CH_3)_2CH-O-CH_3$ reacts with HI to give:

- (a) $(CH_3)_2CH-OH + CH_3-OH$ (b) $(CH_3)_2CH-OH + CH_3-I$
- (c) $(CH_3)_2CH-I + CH_3-OH$ (d) $(CH_3)_2CH-I + CH_3-I$

Q51. CBSE 2024 · 1 mark A compound (X) with the molecular formula C_3H_8O can be oxidized by strong oxidizing agents to another compound (Y) whose molecular formula is $C_3H_6O_2$. The compound (X) is:

- (a) $CH_3-CH_2-O-CH_3$ (b) $CH_3-CH(OH)-CH_3$
- (c) $CH_3-CH_2-CH_2-OH$ (d) None of the above



Q52. CBSE 2024 · 1 mark Which one of the following compounds has the lowest pKa value ?

- (a) p-Cresol (b) p-Nitrophenol (c) m-Nitrophenol
(d) 2,4,6-Trinitrophenol

Q53. CBSE 2024 · 1 mark Assertion (A): The boiling point of ethanol is higher than that of dimethyl ether. Reason (R): Ethanol molecules are associated through hydrogen bonding whereas in dimethyl ether, it is not possible.

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

Q54. CBSE 2024 · 1 mark Which one of the following compounds has the highest pKa value?

- (a) p-Nitrophenol (b) m-Nitrophenol (c) p-Cresol
(d) 2,4,6-Trinitrophenol

Q55. CBSE 2024 · 1 mark $C_6H_5OCH_3$ when treated with HI gives:

- (a) $C_6H_5I + CH_3OH$ (b) $C_6H_5OH + CH_3I$
(c) $C_6H_5OH + CH_3OH$ (d) $C_6H_5I + CH_3I$

Q56. CBSE 2024 · 1 mark Assertion (A): The boiling point of ethanol is higher than that of dimethyl ether. Reason (R): Dimethyl ether molecules are associated through hydrogen bonding.

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

Q57. CBSE 2024 · 1 mark CH_3-O-CH_3 when treated with excess HI gives:

- (a) $CH_3OH + CH_3I$ (b) $2CH_3OH$ (c) $2CH_3I$ (d) $CH_3I + CH_4$

Q58. CBSE 2024 · 1 mark Assertion (A): Phenol on reaction with aqueous NaOH gives sodium phenoxide. Reason (R): This reaction supports the acidic nature of phenol.

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

Q59. CBSE 2024 · 1 mark Assertion (A): Boiling point of butan-1-ol is higher than that of butan-1-amine. Reason (R): Being more polar, butan-1-ol forms stronger intermolecular hydrogen bonds as compared to butan-1-amine.

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

Q60. CBSE 2023 · 1 mark Assertion (A): NH_2 group is o- and p-directing in electrophilic substitution reactions. Reason (R): Aniline cannot undergo Friedel-Crafts reaction. Select the correct answer.

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

Q61. CBSE 2023 · 1 mark Assertion (A): Acetylation of aniline gives a monosubstituted product. Reason (R): Activating effect of $NHCOCH_3$ group is more than that of amino group. Select the correct answer.

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

Q62. CBSE 2023 · 1 mark In the reaction $R-OH + HCl \rightarrow R-Cl + H_2O$ (with $ZnCl_2$), what is the correct order of reactivity of alcohol?

- (a) $1 < 2 < 3$ (b) $1 > 3 > 2$ (c) $1 > 2 > 3$ (d) $3 > 1 > 2$

Q63. CBSE 2023 · 1 mark Which of the following reactions are feasible ?

- (a) $CH_3CH_2Br + Na + O-C(CH_3)_3 \rightarrow CH_3CH_2-O-C(CH_3)_3$
(b) $(CH_3)_3C-Cl + Na + O-CH_2CH_3 \rightarrow (CH_3)_3C-O-CH_2CH_3$
(c) Both (a) and (b) (d) Neither (a) nor (b)

Q64. CBSE 2023 · 1 mark Aspirin is obtained by the acetylation of which of the following compounds?

- (a) Salicylaldehyde (b) Salicylic acid (c) Acetyl salicylic acid
(d) Phenol

Q65. CBSE 2023 · 1 mark Sodium phenoxide when heated with CO_2 under pressure, followed by acidification, yields:

- (a) Sodium benzoate (b) Salicylic acid (c) Salicylaldehyde
(d) Benzoic acid

Q66. CBSE 2023 · 1 mark For the conversion of propene into 1-propanol, which of the following reagents and conditions should be used?

- (a) Conc. H_2SO_4 ; H_2O and heat (b) B_2H_6 ; H_2O_2/OH^-
(c) Dilute H_2SO_4 (d) H_2O/H^+

Q67. CBSE 2023 · 1 mark When diethyl ether is heated with excess of HI, it produces:

- (a) ethanol (b) iodoform (c) methyl iodide
(d) ethyl iodide

Q68. CBSE 2023 · 1 mark Which of the following alkenes on acid catalysed hydration gives a tertiary alcohol?

- (a) 2-Butene (b) 2-Methylpropene (c) Propene
(d) 1-Butene



Q69. CBSE 2023 · 1 mark Which of the following alcohols will not undergo oxidation?

- (a) Butanol (b) Butan-2-ol (c) 2-Methylbutan-2-ol
(d) 3-Methylbutan-2-ol

VERY SHORT ANSWER (18)

Q70. CBSE 2026 · 2 marks (a) Write the major product in the following reaction: (benzene) + $\text{CH}_3 - \text{Cl}$ Na dry ether ? (b) What happens when 2-Bromobutane is made to react with alcoholic potassium hydroxide?

Q71. CBSE 2025 · 2 marks Explain the mechanism of acid catalysed hydration of ethene.

Q72. CBSE 2025 · 2 marks Write the mechanism of dehydration of ethyl alcohol with conc. H_2SO_4 at 413 K.

Q73. CBSE 2025 · 2 marks Write the mechanism of dehydration of ethyl alcohol with conc. H_2SO_4 at 443 K.

Q74. CBSE 2024 · 2 marks (b) What type of deviation is shown by ethanol and acetone mixture ? Give reason. What type of azeotropic mixture is formed by that deviation ?

Q75. CBSE 2023 · 2 marks Account for the following: (i) Phenol is a stronger acid than an alcohol. (ii) The boiling point of alcohols decreases with increase in branching of alkyl chain.

Q76. CBSE 2023 · 2 marks (a) Predict the products of the following reactions: (i) $\text{CH}_3\text{CH}_2\text{OH} \rightarrow (\text{K}, 573\text{K})$ (ii) $\text{C}_6\text{H}_5\text{OH} \rightarrow (\text{aq. Br}_2)$ OR (b) Give reasons for the following: (i) p-nitrophenol is more acidic than p-methylphenol. (ii) $(\text{CH}_3)_3\text{C} - \text{Br}$ on reaction with NaOCH_3 gives alkene as the main product and not an ether.

Q77. CBSE 2023 · 2 marks (a) Account for the following: (i) Phenol is a stronger acid than an alcohol. (ii) The boiling point of alcohols decreases with increase in branching of alkyl chain. OR (b) (i) Write the mechanism of the following reaction: $\text{CH}_3\text{CH}_2\text{OH} \rightarrow (\text{K}, 443\text{K}) \text{CH}=\text{CH}_2 + \text{H}_2\text{O}$ (ii) Write the equation involved in Reimer-Tiemann reaction.

Q78. CBSE 2023 · 2 marks Write the chemical equation involved in the following reactions: (a) Reimer-Tiemann reaction (b) Acetylation of Salicylic acid

Q79. CBSE 2023 · 2 marks Write the chemical equation involved in the following: (a) Kolbe's reaction (b) Williamson synthesis

Q80. CBSE 2023 · 2 marks Give the structures and IUPAC name of the products expected from the following reactions: (b) Reaction of phenol with $\text{Br}_2(\text{aq})$.

Q81. CBSE 2023 · 2 marks Write the mechanism of the following reaction: $\text{CH}_2 = \text{CH}_2 + \text{H}_2\text{O} \rightarrow (\text{H}^+) \text{CH}_3\text{CH}_2\text{OH}$

Q82. CBSE 2023 · 2 marks Write the mechanism of acid dehydration of ethanol to yield ethene.

Q83. CBSE 2023 · 2 marks Why is boiling point of o-dichlorobenzene higher than p-dichlorobenzene but melting point of para isomer is higher than ortho isomer?

Q84. CBSE 2023 · 2 marks (b) (i) Complete the reaction with the main product formed: $\text{CH}_3\text{CH}_2\text{OH}$ (ii) Convert Bromoethane to Propanamine.

Q85. CBSE 2023 · 2 marks (a) For the pair phenol and cyclohexanol: Why is phenol more acidic than cyclohexanol?

Q86. CBSE 2023 · 2 marks (a) Write equations for: Oxidation of chloroform by air and light

Q87. CBSE 2023 · 2 marks For the pair phenol and cyclohexanol, answer the following: (a) Why is phenol more acidic than cyclohexanol? (b) Give one chemical test to distinguish between the two.

SHORT ANSWER (23)

Q88. CBSE 2026 · 3 marks Write the reaction involved in the following: (a) Reimer-Tiemann reaction (b) Kolbe's reaction (c) Friedal-Crafts acylation of anisole

Q89. CBSE 2026 · 3 marks Give reasons for the following: (a) Although chlorine is an electron-withdrawing group, yet it is ortho-, para-directing in electrophilic aromatic substitution reactions. (b) Aryl halides cannot be prepared by reacting phenol with concentrated halogen acids or phosphorus halides. (c) Chloroform is stored in closed dark coloured bottles.

Q90. CBSE 2026 · 3 marks How will you obtain the following from benzene diazonium chloride ? Write chemical equations involved: (a) Phenol (b) Iodobenzene (c) p-Aminoazobenzene

Q91. CBSE 2025 · 3 marks (a) Can sodium ethoxide and t-butyl chloride be used for the preparation of t-butyl ethyl ether? Give suitable explanation. Justify your answer by suggesting the appropriate starting material required for preparation of t-butyl ethyl ether. (b) Give the IUPAC name of above mentioned ether.

Q92. CBSE 2025 · 3 marks (a) Can sodium methoxide and t-butyl bromide be used for the preparation of t-butyl methyl ether. Give suitable reason. Justify your answer by suggesting the appropriate starting material if required for the preparation of t-butyl methyl ether. (b) Give the IUPAC name of above mentioned ether.

Q93. CBSE 2025 · 3 marks (a) Can sodium propoxide and t-butyl chloride be used for the preparation of t-butyl propyl ether? Give suitable explanation. Justify your answer by suggesting the appropriate starting material required for the preparation of t-butyl propyl ether. (b) Give the IUPAC name of the above mentioned ether.

Q94. CBSE 2025 · 3 marks (a) Arrange the following compounds in the increasing order of their acidic strength: 3,5-dinitrophenol, 4-methylphenol, phenol, 2,4,6-trinitrophenol. (b) What happens when: (i) Phenol is distilled with Zn dust? (ii) Anisole is treated with HBr? (write equations)

Q95. CBSE 2025 · 3 marks Write the chemical equation for Williamson's synthesis. Give a method to separate o-nitrophenol and p-nitrophenol. Explain the principle involved.

Q96. CBSE 2025 · 2 marks Write the chemical equation for the following: (i) Preparation of phenol from cumene (ii) Nitration of anisole



Q97. CBSE 2024 · 3 marks Compound (A) ($C_6H_{12}O_2$) on reduction with $LiAlH_4$ gives two compounds (B) and (C). The compound (B) on oxidation with PCC gives compound (D) which upon treatment with dilute NaOH and subsequent heating gives compound (E). Compound (E) on catalytic hydrogenation gives compound (C). The compound (D) is oxidized further to give compound (F) which is found to be a monobasic acid (Molecular weight = 60). Identify the compounds (A), (B), (C), (D), (E) and (F).

Q98. CBSE 2024 · 3 marks Give the equations of reactions for the preparation of (any three): (a) Phenol from chlorobenzene (b) Salicylaldehyde from phenol (c) 2-Methoxyacetophenone from anisole (d) Picric acid from phenol

Q99. CBSE 2024 · 3 marks Give reasons for the following: (a) Chlorine is ortho/para directing in electrophilic aromatic substitution reactions, though chlorine is an electron withdrawing group. (b) Racemic mixture is optically inactive. (c) Allyl chloride is hydrolysed more readily than n-propyl chloride.

Q100. CBSE 2024 · 3 marks (a) Write the equations of the reactions involved in the following: (i) Reimer-Tiemann reaction (ii) Kolbe reaction (b) Name the reagent used in the bromination of phenol to form 2,4,6-Tribromophenol.

Q101. CBSE 2024 · 3 marks Write the reactions involved in the following: (i) Reimer-Tiemann reaction (ii) Kolbe reaction OR Name the reagent used in the bromination of phenol to form 2,4,6-Tribromophenol.

Q102. CBSE 2023 · 3 marks How do you convert the following: (Any three) (a) Phenol to picric acid (b) Propanone to 2-Methylpropan-2-ol (c) Phenol to anisole (d) Propene to Propan-1-ol

Q103. CBSE 2023 · 3 marks How do you convert the following: (Any three): (a) Phenol to 2-Hydroxybenzaldehyde (b) Anisole to 2-Methoxyacetophenone (c) Propene to Propan-2-ol (d) Ethanol to Ethanal

Q104. CBSE 2023 · 3 marks Write the mechanism of the following reaction: $2CH_3CH_2OH + H^+/413K \rightarrow CH_3-CH_2-O-CH_2-CH_3 + H_2O$

Q105. CBSE 2023 · 3 marks Write the mechanism of the following reaction: $2CH_3CH_2OH \xrightarrow{(H^+, 413 K)} CH_3-CH_2-O-CH_2-CH_3 + H_2O$. Why ortho-nitrophenol is steam volatile while para-nitrophenol is not?

Q106. CBSE 2023 · 3 marks (a) (i) Write the mechanism of the following reaction: $2CH_3CH_2OH \xrightarrow{H^+, 413 K} CH_3-CH_2-O-CH_2-CH_3 + H_2O$ (ii) Why ortho-nitrophenol is steam volatile while para-nitrophenol is not? OR (b) What happens when (i) Anisole is treated with CH_3Cl /anhydrous $AlCl_3$? (ii) Phenol is oxidised with $Na_2Cr_2O_7/H^+$? (iii) $(CH_3)_3C-OH$ is heated with $Cu/573 K$? Write chemical equation in support of your answer.

Q107. CBSE 2023 · 3 marks (a) Write the mechanism of the following reaction: $CH_3-CH_2-OH \xrightarrow{(K, 443H)} CH_2=CH_2 + H_2O$ (b) Write the equation of the reaction for the preparation of phenol from cumene.

Q108. CBSE 2023 · 3 marks Write the mechanism of the following reaction: $CH_3-CH_2-OH \xrightarrow{(K, 443^\circ C)} CH_2=CH_2 + H_2O$

Q109. CBSE 2023 · 3 marks (a) (i) Why is the C – O bond length in phenols less than that in methanol? (ii) Arrange the following in order of increasing boiling point: Ethoxyethane, Butanal, Butanol, n-butane (iii) How can phenol be prepared from anisole? Give reaction.

Q110. CBSE 2023 · 3 marks (a)(i) Why is the C – O bond length in phenols less than that in methanol?

LONG ANSWER (2)

Q111. CBSE 2026 · 5 marks (b) (v) Draw the structure of 'X' in the following reaction: $C_6H_5CH_2CH(OH)CH_3 + CrO_3 \rightarrow 'X'$

Q112. CBSE 2026 · 5 marks An organic compound 'A', with molecular formula C_2H_6O reacts with active metals such as sodium to give compound 'B' and hydrogen gas. 'A' on treatment with iodine and sodium hydroxide gives 'C' and in presence of H_2SO_4 at 413 K gives 'D' ($C_4H_{10}O$). 'D' on reaction with excess of HI gives 'E'. Identify 'A', 'B', 'C', 'D' and 'E' and write all the reactions involved.

CASE-BASED (6)

CASE STUDY · CBSE 2026

The boiling points of alcohols and phenols increase with increase in the number of carbon atoms due to increase in van der Waals forces. The – OH group in alcohols and phenols is involved in intermolecular hydrogen bonding, due to which their boiling points are higher than those of ethers, haloalkanes and haloarenes of comparable molecular masses. Alcohols and phenols are acidic in nature. Electron-withdrawing groups in phenol increase its acidic strength, while electron-releasing groups decrease it. The presence of – OH group in phenols activates the aromatic ring towards electrophilic substitution and directs the incoming group to the ortho and para positions due to resonance effect. The Reimer-Tiemann reaction of phenol yields salicylaldehyde, whereas Kolbe's reaction of phenol yields salicylic acid. Aspirin is formed by the acetylation of salicylic acid.

Q113. CBSE 2026 · 4 marks (i) Write the name of the major product(s) formed in: (I) Reimer-Tiemann reaction (II) Kolbe's reaction (ii) Name the method by which aspirin is formed from salicylic acid.

CASE STUDY · CBSE 2026

Like NH_3 , nitrogen atom of amine is trivalent and carries an unshared pair of electrons. Nitrogen orbitals in amines are therefore sp^3 hybridised and the geometry of amines is pyramidal. Lower aliphatic amines are soluble in water due to the formation of hydrogen bond with water molecules. The solubility decreases as the molar mass of amines increases due to increase in size of hydrophobic part. Higher amines are insoluble in water. However amines are less soluble in water than alcohols because of low electronegativity of nitrogen as compared to oxygen. Boiling points of isomeric amines follow the order $1^\circ > 2^\circ > 3^\circ$. It is due to the fact the amines are held together due to hydrogen bonding. Extent of hydrogen bonding is more in primary amines than in secondary amines as two hydrogen atoms are available for hydrogen bond



formation. Tertiary amines do not show hydrogen bonding because of the absence of hydrogen atom attached to nitrogen. Amines can be prepared from, nitro compounds, nitriles, amides etc.

Q114. CBSE 2026 · 1 mark Out of Butan-1-amine and Butan-1-ol, which is more soluble in water?

CASE STUDY · CBSE 2026

Alcohols have higher boiling points than other compounds, namely hydrocarbons, ethers and haloalkanes of comparable molecular masses. On oxidation, primary alcohols yield aldehydes with mild oxidizing agents and carboxylic acids with strong oxidizing agents. Secondary alcohols yield ketones on oxidation while tertiary alcohols are resistant to oxidation. Ethers may be prepared by dehydration of alcohols and Williamson synthesis. The C – O bond in ethers can be cleaved by hydrogen halides. The presence of – OH group in phenols activates the aromatic ring towards electrophilic substitution and directs the incoming group to ortho and para positions due to resonance effect. In presence of NaOH, phenol generates phenoxide ion which is even more reactive than phenol. Thus, in alkaline medium, phenol undergoes Kolbe's reaction.

Q115. CBSE 2026 · 4 marks Name the reagents used in the following reactions: (i) Oxidation of a primary alcohol to aldehyde (ii) Oxidation of a primary alcohol to carboxylic acid

CASE STUDY · CBSE 2026

Alcohols and Phenols are acidic in nature. Electron withdrawing groups in phenol increase its acidic strength and electron releasing groups decrease it. Alcohols undergo nucleophilic substitution with hydrogen halides to yield alkyl halides. Dehydration of alcohols gives alkenes. On oxidation, primary alcohols yield aldehydes with mild oxidising agents and carboxylic acids with strong oxidising agents, while secondary alcohols yield ketones. Tertiary alcohols are resistant to oxidation. The presence of –OH group in phenols activates the aromatic ring towards electrophilic substitution and directs the incoming group to ortho and para positions due to resonance effect.

Q116. CBSE 2026 · 4 marks (a) Write the mechanism of acid dehydration of ethanol to yield ethene.

CASE STUDY · CBSE 2026

Ethers are prepared by the dehydration of alcohols in presence of protic acids at 413 K. Symmetrical and unsymmetrical ethers can also be prepared by Williamson synthesis. This reaction involves SN2 attack of an alkoxide ion on primary alkyl halide. If a tertiary alkyl halide is used, elimination reaction occurs and an alkene is formed, no ether is formed. C – O bond in ethers are cleaved under drastic conditions with excess of HI. When unsymmetrical ethers react with HI, the alkyl halide is formed from smaller alkyl group. If one of the alkyl group is tertiary, the alkyl halide is formed from the tertiary alkyl group because tertiary alkyl carbocation is more stable than the primary carbocation. Cleavage of alkyl aryl ethers takes place at the alkyl-oxygen bond due to more stable aryl-oxygen bond. The order of reactivity of hydrogen halides is $\text{HI} > \text{HBr} > \text{HCl}$. Aromatic ethers undergo electrophilic substitution reactions. The alkoxy group attached to the aromatic ring activates the ring towards electrophilic substitution and directs the incoming group to ortho- and para-positions.

Q117. CBSE 2026 · 4 marks (a) Complete the following equations: (i) $\text{CH}_3\text{Cl} + \text{S} + \text{AlCl}_3 (\text{anhyd.}) \rightarrow ?$ (ii) Anisole + Conc. ($\text{HNO}_3 + \text{H}_2\text{SO}_4$) $\rightarrow ?$

CASE STUDY · CBSE 2025

Alcohols undergo a number of reactions involving the cleavage of C – OH bond. However, phenols do not undergo reactions involving the cleavage of C – OH bond. Alcohols are weaker acids than water. Alcohols react with halogen acids to form the corresponding haloalkanes. Phenols are stronger acids than alcohols. A characteristic feature of phenols is that they undergo electrophilic substitution reactions such as halogenation, nitration, etc. Since – OH group is a strong activating group, phenol gives trisubstituted products during halogenation, nitration, etc.

Q118. CBSE 2025 · 4 marks (a) What happens when phenol is treated with the following ? (i) Br_2 water (ii) Conc. HNO_3

8 Aldehydes, Ketones and Carboxylic Acids

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (32)

Q1. CBSE 2026 · 1 mark Which of the following is 'not' true about enantiomers?

- (a) They have the same chemical reactivity.
- (b) They have the same specific rotation.
- (c) They have the same melting or boiling point.
- (d) They have the same refractive index.

Q2. CBSE 2026 · 1 mark Identify 'X' in the following reaction : $\text{CH}_3 - \text{CO} - \text{CH}_2 - \text{COO} - \text{CH}_3 + \text{NaBH}_4 \rightarrow \text{'X'}$

- (a) $\text{CH}_3 - \text{CHOH} - \text{CH}_2 - \text{COO} - \text{CH}_3$
- (b) $\text{CH}_3 - \text{CO} - \text{CH}_2 - \text{CH}_2 - \text{OH}$
- (c) $\text{CH}_3 - \text{CHOH} - \text{CH}_2 - \text{CH}_2 - \text{OH}$
- (d) $\text{CH}_3 - \text{CHOH} - \text{CH}_2 - \text{COOH}$

Q3. CBSE 2026 · 1 mark Which of the reactions is used in the conversion of a ketone into hydrocarbon ?

- (a) Reimer-Tiemann reaction (b) Wolff-Kishner reduction
- (c) Aldol condensation (d) Stephen reaction



Q4. CBSE 2026 · 1 mark Assertion (A) : All aliphatic aldehydes give a positive Fehling's test. Reason (R) : Aliphatic aldehydes are reduced by Fehling's reagent.

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

Q5. CBSE 2025 · 1 mark $\text{CH}_3\text{CH}_2\text{OH}$ can be converted to CH_3CHO by:

- (a) catalytic hydrogenation (b) treatment with LiAlH_4
(c) treatment with PCC (d) treatment with KMnO_4

Q6. CBSE 2025 · 1 mark Which of the following aldehydes will undergo Cannizzaro reaction?

- (a) $\text{CH}_3 - \text{CH} - \text{CHO}$ with CH_3 group (b) $(\text{CH}_3)_3\text{C} - \text{CHO}$
(c) $\text{CH}_3 - \text{CH}_2 - \text{CHO}$
(d) $\text{CH}_3 - \text{CH} - \text{CH} - \text{CHO}$ with two CH_3 groups

Q7. CBSE 2025 · 1 mark $\text{CH}_3\text{CH}_2\text{CHO}$ and $\text{CH}_3\text{CH}_2\text{COOH}$ can be distinguished by:

- (a) Sodium bicarbonate test (b) Hinsberg test
(c) Iodoform test (d) Lucas test

Q8. CBSE 2025 · 1 mark Assertion (A): The solubility of aldehydes and ketones in water decreases with increase in size of the alkyl group. Reason (R): Aldehydes and ketones have dipole-dipole interaction.

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

Q9. CBSE 2024 · 1 mark The formation of cyanohydrin from an aldehyde is an example of:

- (a) nucleophilic addition (b) electrophilic addition
(c) nucleophilic substitution (d) electrophilic substitution

Q10. CBSE 2024 · 1 mark The product formed as a result of reaction of CH_3MgBr and CO_2 followed by hydrolysis is:

- (a) CH_3CHO (b) CH_3COCH_3 (c) HCOOH (d) CH_3COOH

Q11. CBSE 2024 · 1 mark The IUPAC name of the compound with structure showing 3-oxobutanal is:

- (a) 1-oxobutanal-3-one (b) 1-oxobutanal (c) 3-oxobutanal
(d) 3-oxobutanone

Q12. CBSE 2024 · 1 mark Assertion (A): The pK_a of $\text{O}_2\text{N}-\text{CH}_2-\text{COOH}$ is lower than that of CH_3-COOH . Reason (R): NO_2 group shows electron withdrawing effect which increases the acidic character of $\text{O}_2\text{N}-\text{CH}_2-\text{COOH}$.

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

Q13. CBSE 2024 · 1 mark Which of the following is the strongest acid?

- (a) $\text{p-Cl-C}_6\text{H}_4\text{COOH}$ (b) $\text{p-OH-C}_6\text{H}_4\text{COOH}$ (c) $\text{C}_6\text{H}_5\text{COOH}$
(d) $\text{p-NO}_2-\text{C}_6\text{H}_4\text{COOH}$

Q14. CBSE 2024 · 1 mark Which of the following has the highest boiling point?

- (a) CH_3CHO (b) CH_3COCl (c) CH_3COCH_3 (d) CH_3COOH

Q15. CBSE 2024 · 1 mark The suitable Grignard reagent used for the synthesis of $\text{CH}_3-\text{CH}(\text{CH}_3)-\text{CH}_2-\text{OH}$ with methanal is:

- (a) $(\text{CH}_3)_2\text{CH}-\text{CH}_2\text{MgBr} / \text{H}_2\text{O}$ (b) $\text{CH}_3\text{MgBr} / \text{H}_2\text{O}$
(c) $(\text{CH}_3)_2\text{CHMgBr} / \text{H}_2\text{O}$ (d) $\text{CH}_3\text{CH}_2\text{CH}_2\text{MgBr} / \text{H}_2\text{O}$

Q16. CBSE 2024 · 1 mark Assertion (A): Fluoroacetic acid is stronger acid than chloroacetic acid. Reason (R): This is due to greater electron withdrawing nature of F than Cl.

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

Q17. CBSE 2024 · 1 mark Aspirin is formed by the acetylation of:

- (a) Benzoic acid (b) Phenol (c) Salicylic acid
(d) Phthalic acid

Q18. CBSE 2023 · 1 mark Which of the following is most reactive in nucleophilic addition reactions?

- (a) HCHO (b) CH_3CHO (c) CH_3COCH_3 (d) $\text{CH}_3\text{COC}_2\text{H}_5$

Q19. CBSE 2023 · 1 mark Which of the following does not give aldol condensation reaction?

- (a) CH_3-CHO (b) (b) (c) (c) (d) CH_3COCH_3

Q20. CBSE 2023 · 1 mark Aldehydes and ketones react with hydroxylamine to form

- (a) hydrazones (b) cyanohydrins (c) semicarbazones
(d) Oxime

Q21. CBSE 2023 · 1 mark The reagent that can be used to distinguish acetophenone and benzophenone is

- (a) 2, 4-dinitrophenyl hydrazine (b) aqueous NaHSO_3
(c) Fehling solution (d) I_2 and NaOH



Q22. CBSE 2023 · 1 mark Which of the following compounds will undergo self-condensation in the presence of dilute NaOH solution?

- (a) $\text{C}_6\text{H}_5\text{CHO}$ (b) $\text{CH}_3\text{CH}_2\text{CHO}$ (c) $(\text{CH}_3)_3\text{C}-\text{CHO}$
(d) $\text{H}-\text{CHO}$

Q23. CBSE 2023 · 1 mark The reactivities of the carbonyl compounds HCHO (I), CH_3CHO (II) and CH_3COCH_3 (III) towards nucleophilic addition reaction decreases in the order:

- (a) $\text{III} > \text{II} > \text{I}$ (b) $\text{I} > \text{II} > \text{III}$ (c) $\text{II} > \text{III} > \text{I}$ (d) $\text{I} > \text{III} > \text{II}$

Q24. CBSE 2023 · 1 mark A compound (A) with molecular formula $\text{C}_5\text{H}_{10}\text{O}$, forms a compound on reduction gives n-pentane. The compound (A) is:

- (a) Pentan-3-one (b) Pentanal (c) Pentanol
(d) Pentan-2-one

Q25. CBSE 2023 · 1 mark Which of the following reagents would one choose to transform CH_3COCl into acetone?

- (a) $(\text{CH}_3)_2\text{Cd}$ (b) CH_3MgBr (c) CH_3Cl (d) $(\text{CH}_3\text{O})_2\text{Mg}$

Q26. CBSE 2023 · 1 mark $\text{C}_6\text{H}_5\text{CHO} + \text{CH}_3\text{COCH}_3 \rightarrow (\text{OH})\text{C}_6\text{H}_5\text{CH} = \text{CH}-\text{COCH}_3$. This reaction is known as:

- (a) Aldol condensation (b) Cross-Aldol condensation
(c) Cannizzaro reaction (d) Friedel-Crafts reaction

Q27. CBSE 2023 · 1 mark This reaction is known as:

- (a) Cannizzaro reaction (b) Etard reaction
(c) Rosenmund reduction (d) Aldol condensation

Q28. CBSE 2023 · 1 mark Which one of the following has lowest pK_a value?

- (a) $\text{CH}_3 - \text{COOH}$ (b) $\text{O}_2\text{N} - \text{CH}_2 - \text{COOH}$
(c) $\text{Cl} - \text{CH}_2 - \text{COOH}$ (d) HCOOH

Q29. CBSE 2023 · 1 mark Assertion (A): Acetic acid but not formic acid can be halogenated in presence of red P and Cl_2 . Reason (R): Acetic acid is a weaker acid than formic acid.

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

Q30. CBSE 2023 · 1 mark Assertion (A): Bromination of benzoic acid gives m-bromobenzoic acid. Reason (R): Carboxyl group increases the electron density at the meta position.

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

Q31. CBSE 2023 · 1 mark Which of the following would not be a good choice for reducing nitrobenzene to aniline?

- (a) LiAlH_4 (b) H_2/Ni (c) Fe and HCl (d) Sn and HCl

Q32. CBSE 2023 · 1 mark Assertion (A): The final product in Aldol condensation is always α - β -unsaturated carbonyl compound. Reason (R): α - β -unsaturated carbonyl compounds are stabilised due to conjugation.

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

VERY SHORT ANSWER (19)

Q33. CBSE 2025 · 2 marks (a) How can acetaldehyde be prepared from acetyl chloride?

Q34. CBSE 2025 · 2 marks Give a simple chemical test to distinguish between 3-pentanone and 2-pentanone, and write an equation for Clemmensen reduction.

Q35. CBSE 2025 · 1 mark Carboxylic acid is more acidic than phenol. Give reason.

Q36. CBSE 2024 · 2 marks Write the chemical equation when: (a) Butan-2-one is treated with $\text{Zn}(\text{Hg})$ and conc. HCl. (b) Two molecules of benzaldehyde are treated with conc. NaOH.

Q37. CBSE 2024 · 2 marks Write the chemical equations when: (a) Pentan-3-one is treated with $\text{H}_2\text{N}-\text{NH}_2$ followed by heating with KOH in high boiling solvent such as ethylene glycol. (b) Two molecules of $(\text{CH}_3)_3\text{C}-\text{CHO}$ are treated with conc. NaOH.

Q38. CBSE 2024 · 2 marks Write the chemical equations when: (a) Ethanal is treated with 2,4-dinitrophenylhydrazine? (b) Propanone is treated with $\text{Zn}(\text{Hg})$ and conc. HCl?

Q39. CBSE 2024 · 2 marks Complete and balance the following chemical equations: (a) KMnO_4 heat (b) $\text{MnO}_2 + 2\text{C}_2\text{O}_4 + 16\text{H}^+$

Q40. CBSE 2023 · 2 marks Write the structures and IUPAC names of the products expected from the following reactions: (a) Reaction of methanal with $(\text{CH}_3)_2\text{CHMgBr}$ followed by hydrolysis. (b) Reaction of phenol with conc. HNO_3 .

Q41. CBSE 2023 · 2 marks Give reasons for the following: (a) Carboxylic carbon is less electrophilic than Carbonyl carbon of aldehydes and ketones. (b) Propanal is more reactive than Propanone towards addition of HCN.

Q42. CBSE 2023 · 2 marks Give the structures and IUPAC name of the products expected from the following reactions: (a) Reaction of methanal with $\text{C}_6\text{H}_5-\text{CH}_2-\text{MgBr}$ followed by hydrolysis.

Q43. CBSE 2023 · 2 marks Give reasons: (a) Formic acid is a stronger acid than acetic acid.

Q44. CBSE 2023 · 2 marks Write the products of the following reactions: (i) Reaction with concentrated NaOH. (ii) Reaction with $\text{H}_2\text{N}-\text{NH}-\text{CO}-\text{NH}_2$

Q45. CBSE 2023 · 2 marks Write the products of the following reactions: (i) Benzaldehyde + Concentrated NaOH (ii) Acetophenone + $\text{H}_2\text{N}-\text{NH}-\text{CO}-\text{NH}_2$

Q46. CBSE 2022 · 2 marks Predict the products formed when $\text{CH}_3\text{CH}_2\text{CHO}$ reacts with the following reagents : (Any two) (i) PhMgBr and then H_3O^+ (ii) LiAlH_4 (iii) HCN



Q47. CBSE 2022 · 2 marks Predict the products formed when CH_3CHO reacts with the following reagents: (Any two) (i) CH_3MgBr and then H_3O^+ (ii) Zn(Hg)/Conc. HCl (iii) Tollens reagent

Q48. CBSE 2022 · 2 marks Arrange the following compounds in the increasing order of their property indicated: (Any two) (i) Acetaldehyde, Benzaldehyde, Acetophenone, Acetone (Reactivity towards HCN) (ii) $(\text{CH}_3)_2\text{CHCOOH}$, $\text{CH}_3\text{CH}_2\text{CH(Br)COOH}$, $\text{CH}_3\text{CH(Br)CH}_2\text{COOH}$ (Acidic strength) (iii) $\text{CH}_3\text{CH}_2\text{OH}$, CH_3CHO , CH_3COOH (Boiling point)

Q49. CBSE 2022 · 2 marks Write reasons for the following statements: (i) Benzoic acid does not undergo Friedel-Crafts reaction. (ii) Oxidation of aldehydes is easier than that of ketones.

Q50. CBSE 2022 · 2 marks Give reasons for the following statements (Any two): (i) Benzaldehyde is less reactive than propanal in nucleophilic addition reactions. (ii) Carboxylic acids do not give reactions of carbonyl group. (iii) 4-nitrobenzoic acid is a stronger acid than benzoic acid.

Q51. CBSE 2022 · 2 marks (i) $(\text{CH}_3)_3\text{C-CHO}$ does not undergo aldol condensation. Why? (ii) Distinguish between Acetophenone and Benzophenone with the help of a chemical test.

SHORT ANSWER (34)

Q52. CBSE 2026 · 3 marks How do you convert the following ? (a) Propanone to Propan-2-ol (b) Ethanal to Ethane (c) Sodium benzoate to Benzene

Q53. CBSE 2026 · 3 marks Give reasons for the following: (a) Carboxylic acids have higher boiling point than alcohols of comparable molecular masses. (b) Alpha (α) hydrogens of aldehydes and ketones are acidic in nature. (c) Nucleophilic addition of ammonia and its derivatives does not occur with carbonyl group in strongly acidic medium.

Q54. CBSE 2026 · 3 marks Write the reaction involved in (a) Rosenmund's reduction (b) Cannizzaro's reaction (c) Hell – Volhard – Zelinsky reaction

Q55. CBSE 2026 · 3 marks An organic compound (A) with molecular formula $\text{C}_3\text{H}_5\text{N}$ on reaction with $\text{C}_6\text{H}_5\text{MgBr}$ followed by hydrolysis, gives a compound (B). Compound (B) forms an orange-red precipitate with 2,4-DNP reagent and does not give iodoform test. It neither reduces Tollens' or Fehling's reagent nor does it decolourise bromine water. On drastic oxidation with chromic acid it gives a carboxylic acid (C) having molecular formula $\text{C}_7\text{H}_6\text{O}_2$. Identify the compounds (A), (B) and (C). Write the reactions of compound (A) with $\text{C}_6\text{H}_5\text{MgBr}$ followed by hydrolysis to give compound (B).

Q56. CBSE 2026 · 3 marks Write the structures of A, B and C in the following reactions:

Q57. CBSE 2026 · 3 marks What happens when: (a) Propanenitrile is treated with phenyl magnesium bromide followed by hydrolysis? (b) p-fluorotoluene is treated with CrO_3 in the presence of acetic anhydride followed by hydrolysis with aqueous acid. (c) Phthalic acid is treated with NH_3 followed by heating? Write chemical reactions in support of your answer.

Q58. CBSE 2026 · 3 marks How do you convert the following ? (a) Acetophenone to Benzoic acid (b) Acetonitrile to Acetone (c) Benzoic acid to Benzene

Q59. CBSE 2026 · 3 marks How do you convert the following? (a) Toluene to Benzaldehyde (b) Benzoyl chloride to Acetophenone (c) Bromobenzene to Benzoic acid

Q60. CBSE 2026 · 3 marks How do you convert the following? (a) Benzene to m-Nitroacetophenone (b) Bromobenzene to 1-Phenylethanol (c) But-3-en-2-one to Prop-2-en-1-oic acid

Q61. CBSE 2026 · 3 marks (a) (i) Arrange the following compounds in increasing order of their acidic strengths: $\text{CH}_3\text{CH(Br)CH}_2\text{COOH}$, $\text{CH}_3\text{CH(CH}_3\text{)COOH}$, $\text{CH}_3\text{CH}_2\text{CH(Br)COOH}$ (ii) Why is CH_3CHO more reactive than acetone towards reaction with HCN ? (iii) Complete the equation: $\text{CH}_3\text{CH=O} + \text{NH}_2\text{NH}_2 \rightarrow ?$

Q62. CBSE 2025 · 3 marks What happens when (a) Ethanal is treated with CH_3MgBr followed by hydrolysis ? (b) Phenol is treated with Zinc dust ? (c) Anisole is treated with HI ?

Q63. CBSE 2025 · 3 marks Explain the following reactions : (a) Rosenmund's Reduction (b) Cannizzaro's reaction (c) Hell-Volhard Zelinsky reaction

Q64. CBSE 2025 · 3 marks An aromatic compound 'A' with molecular formula $\text{C}_8\text{H}_8\text{O}$ gives positive 2,4-DNP test. It gives yellow precipitate of compound 'B' on treatment with sodium hypoiodite. Compound 'A' does not react with Tollen's or Fehling's reagent; on drastic oxidation with KMnO_4 it forms a carboxylic acid 'C'. Elucidate the structures of A, B and C. Also give their IUPAC names.

Q65. CBSE 2025 · 3 marks A compound 'A' with molecular formula $\text{C}_4\text{H}_8\text{O}$ gives positive 2,4-DNP test. It gives yellow precipitate of compound 'B' on treatment with sodium hypoiodite. Compound 'A' does not react with Tollen's or Fehling's reagent; on drastic oxidation with KMnO_4 , it forms a carboxylic acid 'C'. Elucidate the structures of 'A', 'B' and 'C'. Also give their IUPAC names.

Q66. CBSE 2025 · 3 marks An organic compound 'A' (molecular formula $\text{C}_8\text{H}_8\text{O}$) gives 2,4-DNP test. It does not give Tollen's test, but gives a yellow precipitate 'B' with NaOH and I_2 . On drastic oxidation, it gives a carboxylic acid 'C' with formula $\text{C}_7\text{H}_6\text{O}_2$. Identify 'A', 'B', 'C' and write the reactions involved.

Q67. CBSE 2025 · 1 mark Write the products formed in the following reaction: $\text{CH}_3\text{CHO} + \text{NH}_2\text{CONHNH}_2 \rightarrow$

Q68. CBSE 2025 · 3 marks A compound (A) with molecular formula $\text{C}_4\text{H}_5\text{N}$ on reduction with DIBAL-H followed by hydrolysis, gives a compound (B). Compound (B) gives positive Tollens' test but does not give iodoform test. Compound (B) can also be obtained when ethanal is treated with dilute NaOH followed by heating. Identify (A) and (B). Write the reactions of (A) with DIBAL-H followed by hydrolysis.

Q69. CBSE 2025 · 3 marks Write structure of the products of the following reactions: (a) $\text{MgBr} + \text{HCHO}$ followed by $\text{H}^+/\text{H}_2\text{O}$. (b) An aromatic compound + conc. HNO_3 . (c) An organic compound + HI followed by OCH_3 .



Q70. CBSE 2025 · 3 marks Give reasons for the following: (a) Benzoic acid does not undergo Friedel-Crafts reaction. (b) HCHO is more reactive than CH₃CHO towards addition of HCN. (c) Vinyl group directly attached with carboxylic acid should decrease the acidity of corresponding carboxylic acid due to resonance, but on the contrary it increases the acidity.

Q71. CBSE 2025 · 3 marks Write structure of the products of the following reactions : (a) $3\text{-OCH}_3\text{-C}_6\text{H}_4\text{-CHO} + \text{HI} \rightarrow$ (b) $\text{C}_6\text{H}_5\text{-OH} + \text{conc. HNO}_3 \rightarrow$ (c) $\text{C}_6\text{H}_5\text{-MgBr} + \text{HCHO} \rightarrow$ (followed by $\text{H}^+/\text{H}_2\text{O}$)

Q72. CBSE 2024 · 3 marks Compound (A) ($\text{C}_6\text{H}_{12}\text{O}_2$) on reduction with LiAlH_4 gives two compounds (B) and (C). The compound (B) on oxidation with PCC gives compound (D) which upon treatment with dilute NaOH and subsequent heating gives compound (E). Compound (E) on catalytic hydrogenation gives compound (C). The compound (D) is oxidized further to give compound (F) which is found to be a monobasic acid (Molecular weight = 60). Identify the compounds (A), (B), (C), (D), (E) and (F).

Q73. CBSE 2024 · 3 marks Write the reaction involved in the following: (a) Wolff-Kishner reduction (b) Decarboxylation reaction (c) Cannizzaro reaction

Q74. CBSE 2024 · 3 marks How will you bring about the following conversions ? (any three) (a) Benzoic acid to Benzaldehyde (b) Ethanal to Propanone (c) Acetophenone to Benzoic acid (d) Bromobenzene to 1-Phenylethanol

Q75. CBSE 2024 · 3 marks Give the structures of A, B and C in the following reactions:

Q76. CBSE 2023 · 3 marks Explain why: (i) Carboxyl group in benzoic acid is meta directing. (ii) Sodium bisulphite is used for the purification of aldehydes and ketones. (iii) Carboxylic acids do not give characteristic reactions of carbonyl group.

Q77. CBSE 2023 · 3 marks Complete the following reactions:

Q78. CBSE 2023 · 3 marks (a) Explain why: (i) Carboxyl group in benzoic acid is meta directing. (ii) Sodium bisulphite is used for the purification of aldehydes and ketones. (iii) Carboxylic acids do not give characteristic reactions of carbonyl group. OR (b) A compound with molecular formula $\text{C}_3\text{H}_8\text{O}$ on reaction with Cu at 573 K gives a compound B. B gives positive Fehling test and also reacts with iodine and NaOH solution. B does not give iodoform test but C precipitates. Identify A to D.

Q79. CBSE 2023 · 3 marks (a) Explain why: (i) Carboxyl group in benzoic acid is meta directing. (ii) Sodium bisulphite is used for the purification of aldehydes and ketones. (iii) Carboxylic acids do not give characteristic reactions of carbonyl group. OR (b) Give chemical equation for the following reactions: (i) Propanone is treated with dil. $\text{Ba}(\text{OH})_2$. (ii) Acetophenone is treated with $\text{Zn}(\text{Hg})/\text{Conc. HCl}$. (iii) Benzoyl chloride is hydrogenated in presence of Pd-BaSO_4 .

Q80. CBSE 2023 · 3 marks Write the equation of the reaction for the preparation of phenol from cumene.

Q81. CBSE 2022 · 2 marks How will you carry out the following conversions (Any two): (i) Propanal to Propane (ii) Ethanal to But-2-enal (iii) Ethanoic acid to ethanamide

Q82. CBSE 2022 · 3 marks Write the equation involved in the following reactions: (i) Rosenmund reduction (ii) Etard reaction (iii) Stephen reaction

Q83. CBSE 2022 · 3 marks Write the equations involved in the following reactions : (i) Cannizzaro reaction (ii) Aldol condensation (iii) Hell-Volhard-Zelinsky reaction

Q84. CBSE 2022 · 3 marks Arrange the following compounds in increasing order of their reactivity towards HCN: CH_3CHO , $\text{CH}_3\text{CH}_2\text{CHO}$, $\text{CH}_3\text{-C(=O)-CH}_2\text{-CH}_3$, $\text{CH}_3\text{-C(=O)-CH}_3$

Q85. CBSE 2022 · 3 marks A compound gives yellow precipitate with Iodoform reaction and reacts with HCN to form a compound. On hydrolysis, products A and B are identified. Write equations for the reactions involved.

LONG ANSWER (24)

Q86. CBSE 2026 · 5 marks Give reasons for the following : (i) Oxidation of propanal is easier than propanone. (ii) There are two $-\text{NH}_2$ groups in semicarbazide. However, only one $-\text{NH}_2$ groups is involved in the formation of semicarbazones. (iii) HCHO does not undergo aldol condensation reaction. (iv) Boiling points of carboxylic acids are higher than those of alcohols of comparable molecular masses. (v) Aldehydes are more reactive towards nucleophilic addition reactions than ketones.

Q87. CBSE 2026 · 5 marks An organic compound (X) has the molecular formula $\text{C}_5\text{H}_{10}\text{O}$. Draw structures for (X) if it: (I) does not give Tollen's test but gives a positive iodoform test. (II) does not give Tollen's test and iodoform test but undergoes Aldol condensation. (III) undergoes Cannizzaro's reaction.

Q88. CBSE 2026 · 5 marks (a) (i) An organic compound (X) has the molecular formula $\text{C}_5\text{H}_{10}\text{O}$. Draw structures for (X) if it: (I) does not give Tollen's test but gives a positive iodoform test. (II) does not give Tollen's test and iodoform test but undergoes Aldol condensation. (III) undergoes Cannizzaro's reaction. (ii) Show how each of the following compounds can be converted to benzoic acid: (I) Acetophenone (II) Ethyl benzene

Q89. CBSE 2026 · 5 marks How will you convert the following: (i) Propanone to Propene (ii) Benzoic acid to Benzaldehyde (iii) Benzene to m-Nitroacetophenone. Arrange the following compounds in increasing order of their reactivity towards HCN. Identify the compounds, which would undergo Aldol condensation.

Q90. CBSE 2026 · 5 marks (a) How will you convert the following : (i) Propanone to Propene (ii) Benzoic acid to Benzaldehyde (iii) Benzene to m-Nitroacetophenone (b) (i) Arrange the following compounds in increasing order of their reactivity towards HCN : $\text{CH}_3\text{CH}_2\text{C}=\text{O}$, $(\text{CH}_3)_3\text{C}(\text{CH}_3)_3\text{C}=\text{O}$, $\text{CH}_3\text{HC}=\text{O}$ (ii) Identify the compounds, which would undergo Aldol condensation : HCHO, $\text{C}_6\text{H}_5\text{CHO}$, CH_3CHO

Q91. CBSE 2026 · 5 marks (a) How will you convert the following: (i) Propanone to Propene (ii) Benzoic acid to Benzaldehyde (iii) Benzene to m-Nitroacetophenone (b) (i) Arrange the following compounds in increasing order of their reactivity towards HCN: $(\text{CH}_3)_2\text{C}=\text{O}$, $[(\text{CH}_3)_3\text{C}]_2\text{C}=\text{O}$, $\text{CH}_3\text{CH}_2\text{CHO}$ (ii) Identify the compounds, which would undergo Aldol condensation: HCHO, $\text{C}_6\text{H}_5\text{CHO}$, CH_3CHO , $(\text{CH}_3)_3\text{CCHO}$



Q92. CBSE 2026 · 5 marks Write the product(s) when: (I) One mol of ethanal is treated with 1 mol of CH_3OH in the presence of dry HCl gas. (II) Benzaldehyde is treated with conc. NaOH . (III) Ethanoic acid is heated in the presence of P_2O_5 . Write a simple chemical test to distinguish between Ethanal and Propanal. Write the name of the reagent to transform Allyl alcohol to Propenal.

Q93. CBSE 2026 · 5 marks (a) (i) Write the product(s) when: (I) One mol of ethanal is treated with 1 mol of CH_3OH in the presence of dry HCl gas. (II) Benzaldehyde is treated with conc. NaOH . (III) Ethanoic acid is heated in the presence of P_2O_5 .

Q94. CBSE 2026 · 5 marks (a) Write the product(s) when: (I) One mol of ethanal is treated with 1 mol of CH_3OH in the presence of dry HCl gas. (II) Benzaldehyde is treated with conc. NaOH . (III) Ethanoic acid is heated in the presence of P_2O_5 . (ii) Write a simple chemical test to distinguish between Ethanal and Propanal. (iii) Write the name of the reagent to transform Allyl alcohol to Propenal.

Q95. CBSE 2026 · 5 marks (a)(i) How will you bring about the following conversions: (I) Bromobenzene to 1-phenylethanol (II) Benzene to m-nitroacetophenone (ii) An organic compound with the molecular formula $\text{C}_8\text{H}_8\text{O}$ forms 2,4-DNP derivative, reduces Tollens' reagent and undergoes Cannizzaro reaction. On vigorous oxidation with acidic or alkaline KMnO_4 it gives Benzene-1,2-dicarboxylic acid. Identify the compound and write the products when it undergoes Cannizzaro reaction. (iii) Arrange the following compounds in increasing order of their acid strength: $\text{C}_6\text{H}_5\text{COOH}$, $\text{O}_2\text{N}-\text{CH}_2-\text{COOH}$, CF_3-COOH , HCOOH

Q96. CBSE 2025 · 5 marks (A) (a) 'A' and 'B' are two functional isomers of compound $\text{C}_4\text{H}_8\text{O}$. On heating with NaOH and I_2 , isomer 'B' forms yellow precipitate of iodoform whereas isomer 'A' does not form any precipitate. (i) Identify 'A' and 'B'. (ii) What happens when isomer 'A' is treated with $\text{Zn}(\text{Hg})$ in the presence of Conc. HCl ? (iii) Write the reaction of isomer 'B' with NaOH and I_2 . (b) Arrange the following in the increasing order of their property as indicated: (i) Ethanol, Ethanoic acid, Ethanal (boiling point). (ii) Ethanal, Methanal, acetone (reactivity towards addition of HCN).

Q97. CBSE 2025 · 5 marks (a) (i) Identify A, B and C in the following reactions: (with structural formulas shown) (ii) Give reasons for the following: (I) Carboxylic acids do not give the characteristic reactions of carbonyl group. (II) Ethanoic acid is a stronger acid than ethanol.

Q98. CBSE 2025 · 5 marks Identify A, B and C in the following reactions: $\text{CH}_3\text{COO}^- + \text{CrO}_3$ (with $\text{K}_2\text{Cr}_2\text{O}_7$, H^+ , heat, 273 K, 28 bar) $\rightarrow \text{A} + 3\text{H}_2\text{O} \rightarrow \text{B} \rightarrow \text{C}$

Q99. CBSE 2025 · 5 marks An organic compound (X) having molecular formula $\text{C}_5\text{H}_{10}\text{O}$ can show various properties depending on its structures. Draw each of the structures if it: (I) shows Cannizzaro reaction. (II) reduces Tollens' reagent and has a chiral carbon. (III) gives positive iodoform test. Write the reaction involved in the following: (I) Clemmensen reduction (II) Etard reaction

Q100. CBSE 2025 · 1 mark An organic compound (X) having molecular formula $\text{C}_5\text{H}_{10}\text{O}$ can show various properties depending on its structures. Draw each of the structures if it shows Cannizzaro reaction.

Q101. CBSE 2025 · 5 marks (a) (i) An organic compound (X) having molecular formula $\text{C}_5\text{H}_{10}\text{O}$ can show various properties depending on its structures. Draw each of the structures if it: (I) shows Cannizzaro reaction. (II) reduces Tollens' reagent and has a chiral carbon. (III) gives positive iodoform test. (ii) Write the reaction involved in the following: (I) Clemmensen reduction (II) Etard reaction

Q102. CBSE 2024 · 5 marks Write the major product(s) in the following reactions:

Q103. CBSE 2023 · 5 marks (a) (i) Carry out the following conversions: (1) Ethanal to But-2-en-1-al (2) Propanoic acid to 2-chloropropanoic acid (ii) An alkene with molecular formula C_5H_{10} on ozonolysis gives compounds A and B. Compound A gives positive Fehling test and also reacts with iodine and NaOH solution. Compound B gives Fehling test but forms iodoform on reaction with I_2 and NaOH solution. Identify A, B and the original alkene.

Q104. CBSE 2023 · 5 marks (a) (i) Carry out the following conversions: (1) Ethanal to But-2-en-1-al (2) Propanoic acid to 2-chloropropanoic acid (ii) An alkene with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds. A gives positive Fehling test and also reacts with iodine and NaOH . B does not give Fehling test but forms an iodoform precipitate. Identify A, B and the alkene. OR (b) (i) Distinguish with a suitable chemical test: (1) $\text{CH}_3\text{COCH}_2\text{CH}_3$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ (2) Ethanal and Ethanoic acid (ii) Write the structure of oxime of acetone. (iii) Identify A to D: $\text{CH}_3\text{COOH} \rightarrow (\text{PCl}_5)$ A $\rightarrow (4\text{BaSO}_4, \text{Pd}/\text{H}_2)$ B $\rightarrow (\text{MgBr}/\text{ether})$ C $\rightarrow (\text{LiAlH}_4)$ D

Q105. CBSE 2023 · 5 marks (a) (i) Carry out the following conversions: (1) Ethanal to But-2-en-1-al (2) Propanoic acid to 2-chloropropanoic acid (ii) An alkene with molecular formula C_5H_{10} on ozonolysis gives positive Fehling test and also reacts with iodine and NaOH forms iodoform. Identify the compounds. OR (b) (i) Distinguish with a suitable chemical test: (1) $\text{CH}_3\text{COCH}_2\text{CH}_3$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ (2) Ethanal and Ethanoic acid (ii) Write the structure of oxime of acetone. (iii) Identify A to D: $\text{CH}_3\text{COOH} \rightarrow (\text{PCl}_5)$ A $\rightarrow (\text{BaSO}_4/\text{Pd}/\text{H}_2)$ B $\rightarrow (\text{MgBr}/\text{CH}_3\text{I})$ C $\rightarrow (\text{LiAlH}_4)$ D (then H_3O^+)

Q106. CBSE 2023 · 5 marks (a) (i) An organic compound (X) having molecular formula $\text{C}_5\text{H}_{10}\text{O}$ can show various properties depending on its structures. Draw each of the structures if it (1) gives positive iodoform test. (2) shows Cannizzaro reaction. (3) reduces Tollens reagent and has a chiral carbon. (ii) Write the reaction involved in the following: (1) Wolff-Kishner reduction (2) Hell-Volhard-Zelinsky reaction

Q107. CBSE 2023 · 5 marks An organic compound (X) having molecular formula $\text{C}_5\text{H}_{10}\text{O}$ can show various properties depending on its structures. Draw each of the structures if it (1) gives positive iodoform test (2) shows Cannizzaro reaction (3) has a chiral carbon.

Q108. CBSE 2023 · 5 marks (a) Draw structure of the 2,4-dinitrophenylhydrazone of benzaldehyde.



Q109. CBSE 2023 · 5 marks (a) (i) Write the reaction involved in Cannizzaro's reaction. (ii) Why are the boiling point of aldehydes and ketones lower than that of corresponding carboxylic acids? (iii) An organic compound 'A' with molecular formula $C_5H_8O_2$ is reduced to n-pentane with hydrazine followed by heating with NaOH and Glycol. 'A' forms a dioxime with hydroxylamine and gives a positive Iodoform and Tollen's test. Identify 'A' and give its reaction for Iodoform and Tollen's test.

CASE-BASED (1)

CASE STUDY · CBSE 2023

The carbon–oxygen double bond is polarised in aldehydes and ketones due to higher electronegativity of oxygen relative to carbon. Therefore they undergo nucleophilic addition reactions with a number of nucleophiles such as HCN, $NaHSO_3$, alcohols, ammonia derivatives and Grignard reagents. Aldehydes are easily oxidised by mild oxidising agents as compared to ketones. The carbonyl group of carboxylic acid does not give reactions of aldehydes and ketones. Carboxylic acids are considerably more acidic than alcohols and most of simple phenols.

Q110. CBSE 2023 · 1 mark Write the name of the product when an aldehyde reacts with excess alcohol in presence of dry HCl.

9 Amines

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (79)

Q1. CBSE 2026 · 1 mark The reaction of ammonia with a large excess of ethyl chloride will give mainly :

- (a) Ethylamine (b) Tetraethylammonium chloride
(c) Triethylamine (d) Diethylamine

Q2. CBSE 2026 · 1 mark Acetamide reacts with Br_2 and aqueous KOH to form :

- (a) Ethanamine (b) Ammonia (c) Methanamine
(d) Ethanenitrile

Q3. CBSE 2026 · 1 mark Assertion (A) : Boiling point of propylamine is higher than that of trimethylamine. Reason (R) : In propylamine, intermolecular hydrogen bonding occurs, whereas trimethylamine does not undergo intermolecular hydrogen bonding.

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

Q4. CBSE 2026 · 1 mark Aniline on direct nitration yields

- (a) 51%-ortho, 47%-para, 2%-meta derivatives
(b) 51%-meta, 47%-ortho, 2%-para derivatives
(c) 51%-para, 47%-meta, 2%-ortho derivatives
(d) 51%-ortho, 47%-meta, 2%-para derivatives

Q5. CBSE 2026 · 1 mark Benzene diazonium chloride on reaction with phenol in weakly basic medium gives

- (a) Azobenzene (b) Benzene (c) Chlorobenzene
(d) p-hydroxyazobenzene

Q6. CBSE 2026 · 1 mark $CH_3 - NH_2$ on reaction with $(CH_3CO)_2O$ gives

- (a) CH_3CONH_2 (b) $CH_3COONHCH_3$
(c) $CH_3 - NH - CO - CH_3$ (d) $CH_3 - CO - CH_2 - NH_2$

Q7. CBSE 2026 · 1 mark Identify the compound produced by the reduction of Ethanenitrile with Lithium aluminium hydride:

- (a) Ethylamine (b) Ethanal (c) Propylamine
(d) Methylamine

Q8. CBSE 2026 · 1 mark Assertion (A): Aromatic primary amines can be prepared by Gabriel Phthalimide synthesis. Reason (R): Aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide.

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

Q9. CBSE 2026 · 1 mark Which of the following reagent is used to distinguish between $(C_2H_5)_2NH$ and $(C_2H_5)_3N$?

- (a) $CHCl_3 + KOH$ (b) $C_6H_5SO_2Cl$ (c) Conc. HCl + ZnCl₂
(d) NaOH + I₂

Q10. CBSE 2026 · 1 mark Assertion (A): Aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis. Reason (R): Gabriel phthalimide synthesis is used for the preparation of primary aliphatic amines.

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

Q11. CBSE 2026 · 1 mark Which reagent is used to distinguish between $C_2H_5NH_2$ and $(C_2H_5)_2NH$?

- (a) $KMnO_4$ (b) $CHCl_3 + KOH$ (ethanolic) (c) NaOH + I₂
(d) Neutral $FeCl_3$

Q12. CBSE 2026 · 1 mark Assertion (A): Aromatic primary amines can easily be prepared by Gabriel phthalimide synthesis. Reason (R): Gabriel phthalimide synthesis is used to prepare only aliphatic primary amines.

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



Q13. CBSE 2026 · 1 mark Which reagent is used to distinguish between primary, secondary and tertiary amines ?

- (a) $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$ (b) $\text{C}_6\text{H}_5\text{COCl}$ (c) $\text{CHCl}_3 + \text{ethanolic KOH}$
(d) $\text{NaOH} + \text{I}_2$

Q14. CBSE 2026 · 1 mark The correct order of decreasing basic strength in aqueous solution of the following is :

- (a) $(\text{C}_2\text{H}_5)_3\text{N} > \text{C}_2\text{H}_5\text{NH}_2 > (\text{C}_2\text{H}_5)_2\text{NH}$
(b) $(\text{C}_2\text{H}_5)_2\text{NH} > \text{C}_2\text{H}_5\text{NH}_2 > (\text{C}_2\text{H}_5)_3\text{N}$
(c) $\text{C}_2\text{H}_5\text{NH}_2 > (\text{C}_2\text{H}_5)_2\text{NH} > (\text{C}_2\text{H}_5)_3\text{N}$
(d) $(\text{C}_2\text{H}_5)_2\text{NH} > (\text{C}_2\text{H}_5)_3\text{N} > \text{C}_2\text{H}_5\text{NH}_2$

Q15. CBSE 2026 · 1 mark Assertion (A): Monobromination of aniline can be conveniently done by protecting the amino group by acetylation. Reason (R): Acetylation increases the activation effect of the amino group.

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

Q16. CBSE 2026 · 1 mark The correct order of decreasing basicities of $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$ and $(\text{C}_2\text{H}_5)_3\text{N}$ in aqueous solution is:

- (a) $(\text{C}_2\text{H}_5)_3\text{N} > (\text{C}_2\text{H}_5)_2\text{NH} > \text{C}_2\text{H}_5\text{NH}_2$
(b) $(\text{C}_2\text{H}_5)_2\text{NH} > \text{C}_2\text{H}_5\text{NH}_2 > (\text{C}_2\text{H}_5)_3\text{N}$
(c) $\text{C}_2\text{H}_5\text{NH}_2 > (\text{C}_2\text{H}_5)_2\text{NH} > (\text{C}_2\text{H}_5)_3\text{N}$
(d) $(\text{C}_2\text{H}_5)_2\text{NH} > (\text{C}_2\text{H}_5)_3\text{N} > \text{C}_2\text{H}_5\text{NH}_2$

Q17. CBSE 2026 · 1 mark In the reaction of NaOBr with amide, the carbonyl carbon is lost as:

- (a) HCO_3^- (b) CO_3^{2-} (c) CO_2 (d) CO

Q18. CBSE 2026 · 1 mark Assertion (A): Diazonium salts of aromatic amines are more stable than those of aliphatic amines. Reason (R): Diazonium salts of aliphatic amines undergo resonance.

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

Q19. CBSE 2026 · 1 mark The correct order of decreasing basic strength of $\text{CH}_3 - \text{NH}_2$, $(\text{CH}_3)_2\text{NH}$ and $(\text{CH}_3)_3\text{N}$ in aqueous solution is :

- (a) $(\text{CH}_3)_3\text{N} > (\text{CH}_3)_2\text{NH} > \text{CH}_3 - \text{NH}_2$
(b) $\text{CH}_3 - \text{NH}_2 > (\text{CH}_3)_2\text{NH} > (\text{CH}_3)_3\text{N}$
(c) $(\text{CH}_3)_2\text{NH} > \text{CH}_3 - \text{NH}_2 > (\text{CH}_3)_3\text{N}$
(d) $(\text{CH}_3)_2\text{NH} > (\text{CH}_3)_3\text{N} > \text{CH}_3 - \text{NH}_2$

Q20. CBSE 2026 · 1 mark Which of the following reagent is used to convert benzene diazonium chloride to benzene ?

- (a) H_2O (b) LiAlH_4 (c) $\text{C}_2\text{H}_5\text{OH}$ (d) CuCN

Q21. CBSE 2026 · 1 mark Assertion (A): Diazonium salts of aromatic amines are more stable than those of aliphatic amines. Reason (R): Diazonium salts of aromatic amines undergo resonance.

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

Q22. CBSE 2026 · 1 mark The correct order of decreasing order of pK_b values is:

- (a) $\text{C}_6\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{NHCH}_3 > \text{C}_2\text{H}_5\text{NH}_2$
(b) $\text{C}_2\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{NHCH}_3$
(c) $\text{C}_6\text{H}_5\text{NH}_2 > \text{C}_2\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{NHCH}_3$
(d) $\text{C}_6\text{H}_5\text{NHCH}_3 > \text{C}_6\text{H}_5\text{NH}_2 > \text{C}_2\text{H}_5\text{NH}_2$

Q23. CBSE 2026 · 1 mark Assertion (A): Diazonium salts of aromatic amines are less stable than those of aliphatic amines. Reason (R): Diazonium salts of aromatic amines undergo resonance.

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

Q24. CBSE 2026 · 1 mark Which of the following reagents are used to prepare primary amines by Hoffmann bromamide degradation reaction ? (i) $\text{R}-\text{CO}-\text{NH}_2$ (ii) NaOH (iii) Br_2 (iv) CHCl_3

- (a) (i), (ii) and (iv) (b) (i) and (iii) (c) (i), (ii) and (iii)
(d) (i), (iii) and (iv)

Q25. CBSE 2026 · 1 mark The major product of carbylamine reaction is :

- (a) Carboxylic acid (b) Aldehyde (c) Cyanide
(d) Isocyanide

Q26. CBSE 2026 · 1 mark The correct formula of Hinsberg's reagent is :

- (a) $\text{C}_6\text{H}_5\text{COCl}$ (b) $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$ (c) $\text{C}_6\text{H}_5\text{CONHCH}_3$
(d) $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$

Q27. CBSE 2026 · 1 mark Consider the following compounds : $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$, NH_3 , $\text{C}_6\text{H}_5\text{NH}_2$. The correct increasing order of the above compounds on the basis of their basic strength is :

- (a) $\text{C}_6\text{H}_5\text{NH}_2 < \text{NH}_3 < \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 < \text{C}_2\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_2\text{NH}$
(b) $\text{NH}_3 < \text{C}_6\text{H}_5\text{NH}_2 < \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 < \text{C}_2\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_2\text{NH}$
(c) $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 < (\text{C}_2\text{H}_5)_2\text{NH} < \text{NH}_3 < \text{C}_6\text{H}_5\text{NH}_2 < \text{C}_2\text{H}_5\text{NH}_2$
(d) $\text{C}_2\text{H}_5\text{NH}_2 < \text{C}_6\text{H}_5\text{NH}_2 < \text{NH}_3 < \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 < (\text{C}_2\text{H}_5)_2\text{NH}$

Q28. CBSE 2025 · 1 mark The Gabriel Phthalimide Synthesis is used for the preparation of

- (a) Secondary amines (b) Primary aromatic amines
(c) Tertiary amines (d) Primary aliphatic amines



Q29. CBSE 2025 · 1 mark Hoffmann Bromamide degradation reaction is given by:

- (a) ArNO_2 (b) ArNH_2 (c) ArCONH_2 (d) ArCH_2NH_2

Q30. CBSE 2025 · 1 mark Assertion (A): Acetanilide is less basic than aniline. Reason (R): Acetylation of aniline results in decrease of electron density on nitrogen.

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

Q31. CBSE 2025 · 1 mark Assertion (A): Acetanilide is more basic than aniline. Reason (R): Acetylation of aniline results in decrease of electron density on nitrogen.

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

Q32. CBSE 2025 · 1 mark The IUPAC name for $\text{CH}_3 - \text{CH}_2 - \text{N}(\text{CH}_3) - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$ is:

- (a) N-methylpentan-2-amine
(b) N-ethyl-N-methylpropan-1-amine
(c) N,N-diethylpropan-1-amine
(d) N,N-dimethylpropan-1-amine

Q33. CBSE 2025 · 1 mark In the Hinsberg's method for separation of primary, secondary and tertiary amines, the reagent used is :

- (a) Nitrous acid (b) $\text{CHCl}_3 + \text{aq. NaOH}$
(c) Benzene sulfonyl chloride (d) $\text{HCl} / \text{ZnCl}_2$

Q34. CBSE 2025 · 1 mark Which one of the following amines gives an alcohol on reaction with HNO_2 ?

- (a) Aniline (b) $\text{C}_2\text{H}_5\text{NH}_2$ (c) $(\text{C}_2\text{H}_5)_2\text{NH}$ (d) $(\text{C}_2\text{H}_5)_3\text{N}$

Q35. CBSE 2025 · 1 mark Assertion(A): Boiling point of $(\text{CH}_3)_3\text{N}$ is higher than that of $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$. Reason (R) : Hydrogen bonding is more extensive in $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$.

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

Q36. CBSE 2025 · 1 mark The reagent that can be used to convert benzenediazonium chloride to benzene is:

- (a) Cu/HCl (b) H_2O (c) $\text{CH}_3\text{CH}_2\text{OH}$ (d) CuCN

Q37. CBSE 2025 · 1 mark The gas evolved when methylamine reacts with HNO_2 is:

- (a) NO (b) N_2 (c) NH_3 (d) NO_2

Q38. CBSE 2025 · 1 mark Assertion (A): Boiling point of $(\text{C}_2\text{H}_5)_2\text{NH}$ is lower than that of $n\text{-C}_4\text{H}_9\text{NH}_2$. Reason (R): Hydrogen bonding is much more extensive in $n\text{-C}_4\text{H}_9\text{NH}_2$ as compared to $(\text{C}_2\text{H}_5)_2\text{NH}$.

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

Q39. CBSE 2025 · 1 mark The reagent that can be used to convert benzenediazonium chloride to benzonitrile is:

- (a) Cu/HCl (b) CH_3CN (c) CuCN (d) AgCN

Q40. CBSE 2025 · 1 mark The strongest base in aqueous solution among the following amines is:

- (a) $(\text{C}_2\text{H}_5)_2\text{NH}$ (b) $(\text{C}_2\text{H}_5)_3\text{N}$ (c) $\text{C}_2\text{H}_5\text{NH}_2$ (d) $\text{C}_6\text{H}_5\text{NH}_2$

Q41. CBSE 2025 · 1 mark Assertion (A): Boiling point of $(\text{C}_2\text{H}_5)_2\text{NH}$ is lower than that of $n\text{-C}_4\text{H}_9\text{NH}_2$. Reason (R): Hydrogen bonding is much more extensive in $(\text{C}_2\text{H}_5)_2\text{NH}$ as compared to $n\text{-C}_4\text{H}_9\text{NH}_2$.

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

Q42. CBSE 2025 · 1 mark When alkyl iodide is treated with large excess of ammonia, the major product obtained is :

- (a) Tertiary amine (b) Quaternary ammonium salt
(c) Secondary amine (d) Primary amine

Q43. CBSE 2025 · 1 mark An amine 'X' reacts with Hinsberg reagent and the product obtained is soluble in alkali. The amine 'X' is :

- (a) $\text{CH}_3 - \text{NH}_2$ (b) $(\text{CH}_3)_2\text{NH}$ (c) $(\text{CH}_3)_3\text{N}$ (d) $\text{C}_6\text{H}_5\text{NH}_2$

Q44. CBSE 2025 · 1 mark When excess of alkyl iodide is treated with ammonia, the product obtained is :

- (a) Primary amine (b) Secondary amine (c) Tertiary amine
(d) A mixture of amines

Q45. CBSE 2025 · 1 mark An amine 'X' reacts with Hinsberg reagent and the product obtained is insoluble in alkali. The amine 'X' is :

- (a) $(\text{CH}_3)_2 - \text{NH}$ (b) $(\text{CH}_3)_3\text{N}$ (c) $\text{CH}_3 - \text{CH}_2 - \text{NH}_2$
(d) $\text{C}_6\text{H}_5\text{NH}_2$

Q46. CBSE 2025 · 1 mark Anilinium hydrogen sulphate on heating at 453 – 473 K produces which of the following as a major product?

- (a) 2-aminobenzene sulphonic acid
(b) benzene sulphonic acid (c) 2-aminobenzoic acid
(d) sulphanilic acid

Q47. CBSE 2025 · 1 mark Which of the following amines does not give foul smell of isocyanide on heating with chloroform and ethanolic KOH ?

- (a) $\text{CH}_3 - \text{CH}_2 - \text{NH}_2$ (b) $(\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2)_2\text{NH}$
(c) $(\text{CH}_3 - \text{CH}_2)_3\text{N}$ (d) NH_2



Q48. CBSE 2024 · 1 mark Assertion (A): Aniline is a stronger base than ammonia. Reason (R): The unshared electron pair on nitrogen atom in aniline becomes less available for protonation due to resonance.

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

Q49. CBSE 2024 · 1 mark Assertion (A): p-nitroaniline is a weaker base than p-toluidine. Reason (R): The electron donating NO₂ group in p-nitroaniline makes it a weaker base.

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

Q50. CBSE 2024 · 1 mark Assertion (A): Aliphatic primary amines can be prepared by Gabriel phthalimide synthesis. Reason (R): Alkyl halides undergo nucleophilic substitution with anion formed by phthalimide.

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

Q51. CBSE 2024 · 1 mark Assertion (A): Diazonium salts of aromatic amines are more stable than those of aliphatic amines. Reason (R): Diazonium salts of aliphatic amines show resonance.

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

Q52. CBSE 2024 · 1 mark Assertion (A): Aromatic primary amines can be prepared by Gabriel phthalimide synthesis. Reason (R): Alkyl halide undergoes nucleophilic substitution with anion formed by phthalimide.

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

Q53. CBSE 2024 · 1 mark Assertion (A): Diazonium salts of aliphatic amines are more stable than those of aromatic amines. Reason (R): Diazonium salts of aromatic amines show resonance.

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

Q54. CBSE 2024 · 1 mark Assertion (A): Acetanilide is less basic than aniline. Reason (R): Acetylation of aniline results in decrease of electron density on nitrogen in acetanilide.

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

Q55. CBSE 2024 · 1 mark Butanenitrile may be prepared by heating:

- (a) propyl chloride with KCN (b) butyl chloride with KCN
- (c) propyl alcohol with KCN (d) butyl alcohol with KCN

Q56. CBSE 2024 · 1 mark Assertion (A): Aniline is a weaker base than cyclohexylamine. Reason (R): Aniline is resonance stabilized. Select the correct answer.

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

Q57. CBSE 2024 · 1 mark Assertion (A): Ammonolysis of alkyl halides involves reaction between alkyl halide and ethanolic solution of ammonia. Reason (R): Ammonolysis of alkyl halides mainly produces secondary amines. Select the correct answer.

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

Q58. CBSE 2024 · 1 mark Assertion (A): Aniline does not undergo Friedel-Crafts reaction. Reason (R): Friedel-Crafts reaction is a nucleophilic substitution reaction. Select the correct answer.

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



Q59. CBSE 2024 · 1 mark Which of the following compounds on treatment with benzene sulphonyl chloride forms an alkali-soluble precipitate?

- (a) CH_3CONH_2 (b) $(\text{CH}_3)_3\text{N}$ (c) $(\text{CH}_3)_2\text{NH}$
(d) $\text{CH}_3\text{CH}_2\text{NH}_2$

Q60. CBSE 2024 · 1 mark The order of increasing basicities of CH_3NH_2 (I), $(\text{CH}_3)_2\text{NH}$ (II), $(\text{CH}_3)_3\text{N}$ (III) and $\text{C}_6\text{H}_5\text{NH}_2$ (IV) in aqueous media is:

- (a) $\text{IV} < \text{III} < \text{I} < \text{II}$ (b) $\text{II} < \text{I} < \text{IV} < \text{III}$ (c) $\text{I} < \text{II} < \text{III} < \text{IV}$
(d) $\text{II} < \text{III} < \text{I} < \text{IV}$

Q61. CBSE 2024 · 1 mark Assertion (A): Aniline does not undergo Friedel-Crafts reaction. Reason (R): Friedel-Crafts reaction is an electrophilic substitution reaction.

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

Q62. CBSE 2024 · 1 mark Which of the following compounds on treatment with benzene sulphonyl chloride forms product insoluble in alkali?

- (a) $(\text{CH}_3)_3\text{N}$ (b) $(\text{CH}_3)_2\text{NH}$ (c) $\text{CH}_3\text{CH}_2\text{NH}_2$ (d) $\text{C}_6\text{H}_5\text{NH}_2$

Q63. CBSE 2024 · 1 mark Which of the following amines gives carbylamine reaction?

- (a) $\text{C}_2\text{H}_5\text{NH}_2$ (b) $(\text{C}_2\text{H}_5)_2\text{NH}$ (c) $(\text{C}_2\text{H}_5)_3\text{N}$ (d) None

Q64. CBSE 2024 · 1 mark Assertion (A): Aniline undergoes Friedel-Crafts reaction. Reason (R): Aniline forms salt with AlCl_3 , the Lewis acid in Friedel-Crafts reaction.

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

Q65. CBSE 2024 · 1 mark Aniline on reaction with Bromine water gives:

- (a) o-bromoaniline (b) 2,4,6-tribromoaniline
(c) m-bromoaniline (d) p-bromoaniline

Q66. CBSE 2023 · 1 mark CH_3CONH_2 on reaction with NaOH and Br_2 in alcoholic medium gives:

- (a) CH_3COONa (b) CH_3NH_2 (c) $\text{CH}_3\text{CH}_2\text{Br}$
(d) $\text{CH}_3\text{CH}_2\text{NH}_2$

Q67. CBSE 2023 · 1 mark Which of the following is least basic?

- (a) $(\text{CH}_3)_2\text{NH}$ (b) NH_3 (c) $\text{C}_6\text{H}_5\text{NH}_2$ (d) $(\text{CH}_3)_3\text{N}$

Q68. CBSE 2023 · 1 mark Assertion (A): $(\text{C}_2\text{H}_5)_2\text{NH}$ is more basic than $(\text{C}_2\text{H}_5)_3\text{N}$ in aqueous solution. Reason (R): In $(\text{C}_2\text{H}_5)_2\text{NH}$, there is more steric hindrance and +I effect than $(\text{C}_2\text{H}_5)_3\text{N}$.

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

Q69. CBSE 2023 · 1 mark Assertion (A): Acetylation of aniline gives a monosubstituted product. Reason (R): Activating effect of $-\text{NHCOCH}_3$ group is more than that of amino group.

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

Q70. CBSE 2023 · 1 mark Assertion (A): Ammonolysis of alkyl halides is not a suitable method for the preparation of pure primary amines. Reason (R): Ammonolysis of alkyl halides yields mainly secondary amines.

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

Q71. CBSE 2023 · 1 mark Among the following, which is the strongest base?

- (a) (a) (b) (b) (c) (c) (d) (d)

Q72. CBSE 2023 · 1 mark When Benzene diazonium chloride reacts with phenol, it forms a dye. This reaction is called

- (a) Diazotisation reaction (b) Condensation reaction
(c) Coupling reaction (d) Acetylation reaction

Q73. CBSE 2023 · 1 mark The reaction of ammonia with a large excess of methyl chloride will yield mainly:

- (a) methylamine (b) dimethylamine
(c) tetramethylammonium chloride (d) trimethylamine

Q74. CBSE 2023 · 1 mark The reduction of ethanenitrile with sodium and alcohol gives:

- (a) 1-aminopropane (b) 1-aminoethane (c) Ethanoic acid
(d) Ethanamide

Q75. CBSE 2023 · 1 mark The action of nitrous acid on ethylamine gives mainly:

- (a) ethyl nitrite (b) ethyl alcohol (c) nitroethane
(d) ethane



Q76. CBSE 2023 · 1 mark Assertion (A): Monobromination of aniline can be conveniently done by protecting the amino group by acetylation. Reason (R): Acetylation decreases the activating effect of the amino group.

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

Q77. CBSE 2023 · 1 mark Amides can be converted into amines by the reaction named

- (a) Hoffmann degradation (b) Ammonolysis
 (c) Carbylamine (d) Diazotisation

Q78. CBSE 2023 · 1 mark Which of the following would not be a good choice for reducing nitrobenzene to aniline?

- (a) LiAlH_4 (b) H_2/Ni (c) Fe and HCl (d) Sn and HCl

Q79. CBSE 2023 · 1 mark In the reaction $\text{C}_6\text{H}_5\text{NH}_2 + \text{CHCl}_3 + 3 \text{KOH} \rightarrow \text{A} + 3\text{B} + 3\text{C}$ the product A is

- (a) $\text{C}_6\text{H}_5\text{NC}$ (b) $\text{C}_6\text{H}_5\text{CN}$ (c) $\text{C}_6\text{H}_5\text{Cl}$ (d) $\text{C}_6\text{H}_5\text{NHCH}_3$

VERY SHORT ANSWER (7)

Q80. CBSE 2025 · 2 marks (a) How do you convert the following? (i) Ethanenitrile to Ethanamine (ii) Benzenediazonium chloride to benzonitrile OR (b) (i) Write a simple chemical test to distinguish between ethanamine and dimethylamine. (ii) What happens when CH_3CONH_2 is heated with Br_2 and an aqueous solution of NaOH ?

Q81. CBSE 2023 · 2 marks Explain briefly: (a) Carbylamine reaction (b) Gabriel phthalimide synthesis

Q82. CBSE 2023 · 2 marks (a) $\text{CH}_3-\text{CH}-\text{CH}_3 \xrightarrow{(\text{PCl}_5)} \text{A} \xrightarrow{(\text{AgCN})}$ compound with useful applications | OH (b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} + \text{KOH} \rightarrow (\text{ethanol}) \text{B} \rightarrow (\text{HBr}) \text{C}$ Identify A, B and C in the above reactions.

Q83. CBSE 2023 · 2 marks Write the chemical equation involved in the following reactions: (a) Carbylamine reaction (b) Gabriel phthalimide synthesis

Q84. CBSE 2023 · 2 marks Write the chemical equation involved in the following reactions: (a) Carbylamine reaction

Q85. CBSE 2023 · 2 marks (a) (i) Draw the zwitter ion structure for sulphanilic acid. (ii) How can the activating effect of $-\text{NH}_2$ group in aniline be controlled?

Q86. CBSE 2023 · 2 marks (a)(i) Draw the zwitter ion structure for sulphanilic acid.

SHORT ANSWER (18)

Q87. CBSE 2026 · 3 marks Explain the following: (a) Carbylamine reaction (b) Hoffmann's bromamide degradation reaction (c) Diazotisation reaction

Q88. CBSE 2026 · 3 marks How will you obtain the following from benzenediazonium chloride? Give chemical equations involved: (a) Chlorobenzene (b) Benzene (c) Benzonitrile

Q89. CBSE 2026 · 3 marks How will you obtain the following from aniline? Write the chemical equations involved: (a) Sulphanilic acid (b) 2,4,6-Tribromoaniline (c) Acetanilide

Q90. CBSE 2025 · 3 marks Give reactions for the following: (i) Aniline does not undergo Friedel-Crafts reaction. (ii) $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in an aqueous solution. (iii) Ethyl amine is soluble in water whereas aniline is insoluble.

Q91. CBSE 2025 · 3 marks Arrange the following compounds as asked: (a) in decreasing order of pK_b values: $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $\text{C}_6\text{H}_5\text{NHCH}_3$, $\text{C}_6\text{H}_5\text{NH}_2$ (b) in increasing order of boiling point: $\text{C}_2\text{H}_5\text{OH}$, $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{CH}_3)_2\text{NH}$ (c) in increasing order of solubility in water: $\text{C}_6\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $\text{C}_2\text{H}_5\text{NH}_2$

Q92. CBSE 2025 · 3 marks Arrange the following compounds as asked: (a) in increasing order of pK_b values: $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $\text{C}_6\text{H}_5\text{NHCH}_3$, $\text{C}_6\text{H}_5\text{NH}_2$. (b) in decreasing order of boiling point: $\text{C}_2\text{H}_5\text{OH}$, $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{CH}_3)_2\text{NH}$. (c) in decreasing order of solubility in water: $\text{C}_6\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $\text{C}_2\text{H}_5\text{NH}_2$.

Q93. CBSE 2025 · 3 marks Identify P, Q and R in the following reaction sequence: $\text{P} + \text{NH}_3 \rightarrow \text{CH}_3\text{COO}^- \text{NH}_4^+ + \text{Q} \rightarrow \text{R} + \text{PCl}_5$

Q94. CBSE 2025 · 3 marks How will you obtain the following from aniline? Give chemical equations only. (a) Sulphanilic acid (b) Phenylisocyanide (c) Acetanilide

Q95. CBSE 2025 · 3 marks How can you obtain the following from aniline? Give only chemical equation. (a) p-nitroaniline (b) Chlorobenzene (c) Phenol

Q96. CBSE 2025 · 3 marks How can you obtain the following? (a) Aniline from ammonium benzoate (b) Benzene diazonium chloride from nitrobenzene (c) 2,4,6-tribromoaniline from aniline

Q97. CBSE 2024 · 3 marks Write the structures of A, B and C in the following reactions: (a) $\text{CH}_3-\text{CH}_2-\text{Br} \xrightarrow{(\text{KCN})} \text{hydrolysis} \rightarrow \text{A} \xrightarrow{(\text{NaOH})} \text{B} + \text{Br}^- \rightarrow \text{C}$ (b) $\text{C}_6\text{H}_5-\text{NH}_2 + \text{Fe}/\text{HCl} \rightarrow \text{A} \xrightarrow{(2\text{NaNO}_2 + \text{HCl})} \text{B} \xrightarrow{(\text{C}_2\text{H}_5\text{OH})} \text{C}$

Q98. CBSE 2024 · 3 marks Write the structures of A, B and C in the following reactions: (a) $\text{CH}_3-\text{CH}_2-\text{Br} \xrightarrow{(\text{KCN})} \text{partial hydrolysis} \rightarrow \text{A} \xrightarrow{(2 \text{NaOH})} \text{B} + \text{Br}^- \rightarrow \text{C}$

Q99. CBSE 2023 · 3 marks Write the structures of A, B and C in the following reactions: (i) $\text{C}_6\text{H}_5\text{NH}_2 + \text{CO} + \text{COCl}_2 \rightarrow \text{A} + \text{NaOH} \rightarrow \text{B} + \text{Br}_2 \rightarrow \text{C} + \text{HCl} + \text{NaNO}_2 \rightarrow \text{product}$

Q100. CBSE 2023 · 3 marks (a) Illustrate Sandmeyer's reaction with an equation.

Q101. CBSE 2023 · 3 marks (a) Illustrate Sandmeyer's reaction with an equation. (b) Explain, why $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in aqueous solution.

Q102. CBSE 2022 · 3 marks (i) Why is oxidation of propanal easier than propanone? (ii) How can you distinguish between Acetophenone and Benzophenone? (iii) Draw the structure of 2,4-Dinitrophenylhydrazone of Propanone

Q103. CBSE 2022 · 3 marks Write reasons for the following: (i) Ethylamine is soluble in water whereas aniline is insoluble. (ii) Amino group is o- and p-directing in aromatic electrophilic substitution reactions, but aniline on nitration gives a substantial amount of m-nitroaniline. (iii) Amines behave as nucleophiles.



Q104. CBSE 2022 - 3 marks (a) Write equations involved in the following reactions: (i) Ethanamine reacts with acetyl chloride. (ii) Aniline reacts with bromine water at room temperature. (iii) Aniline reacts with chloroform and ethanolic potassium hydroxide.

LONG ANSWER (6)

Q105. CBSE 2025 - 5 marks (a)(i) In a chemistry practical class, the teacher gave his students an amine 'X' having molecular formula C_2H_7N , and asked the students to identify the type of amine. One of the students, Neeta, observed that it reacts with $C_6H_5SO_2Cl$, to give a compound which dissolves in NaOH solution. Can you help Neeta to identify the compound 'X'?

Q106. CBSE 2025 - 5 marks In a chemistry practical class, the teacher gave his students an amine 'X' having molecular formula C_2H_7N , and asked the students to identify the type of amine. One of the students, Neeta, observed that it reacts with $C_6H_5SO_2Cl$, to give a compound which dissolves in NaOH solution. Can you help Neeta to identify the compound 'X'? Arrange the following in the increasing order of their pK_b value in aqueous phase: $C_6H_5NH_2$, $(CH_3)_2NH$, NH_3 , CH_3NH_2 , $(CH_3)_3N$. Aniline on nitration gives considerable amount of meta product along with ortho and para products. Why? Convert aniline to: (I) p-bromoaniline, (II) phenol

Q107. CBSE 2024 - 5 marks (a) N,N-diethyl-benzenesulphonamide is insoluble in alkali. Give reason.

Q108. CBSE 2023 - 5 marks Give reasons: (i) Aniline on nitration gives good amount of m-nitroaniline, though $-NH_2$ group is o/p directing in electrophilic substitution reactions. (ii) $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution. (iii) Ammonolysis of alkyl halides is not a good method to prepare pure primary amines. (iv) Write the reaction involved in the following: (a) Carbyl amine test (b) Gabriel phthalimide synthesis

Q109. CBSE 2023 - 5 marks Give reasons: (i) Aniline on nitration gives good amount of m-nitroaniline, though $-NH_2$ group is o/p directing in electrophilic substitution reactions. (ii) $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution. (iii) Ammonolysis of alkyl halides is not a good method to prepare pure primary amines. Write the reaction involved in the following: (i) Carbyl amine test (ii) Gabriel phthalimide synthesis

Q110. CBSE 2023 - 5 marks (I) Give reasons: (i) Aniline on nitration gives good amount of m-nitroaniline, though $-NH_2$ group is o/p directing in electrophilic substitution reactions. (ii) $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution. (iii) Ammonolysis of alkyl halides is not a good method to prepare pure primary amines. (II) Write the reaction involved in the following: (i) Carbyl amine test (ii) Gabriel phthalimide synthesis

CASE-BASED (6)

CASE STUDY - CBSE 2026

The reaction of amines with mineral acids to form ammonium salts shows that these are basic in nature. Aliphatic amines are stronger bases than ammonia whereas aromatic amines are weaker bases than ammonia. Aliphatic and aromatic primary and secondary amines react with acid chlorides, anhydrides and esters by nucleophilic substitution reaction. The main problem

encountered during electrophilic substitution reactions of aromatic amines is that of their high reactivity. Substitution tends to occur at ortho-and para-positions. Hinsberg reagent is used for the identification and distinction between primary, secondary and tertiary amines. Aryldiazonium salts, usually obtained from arylamines, undergo replacement of the diazonium group with a variety of nucleophiles to provide advantageous methods for producing aryl halides, cyanides, phenols and arenes.

Q111. CBSE 2026 - 4 marks Why $CH_3 - NH_2$ is a stronger base than $(CH_3)_3N$ in aqueous solution?

Q112. CBSE 2026 - 4 marks (a) (i) Why is $CH_3 - NH_2$ a stronger base than $(CH_3)_3N$ in aqueous solution? (2 marks) (ii) Write structural formulae of the compound A and B: $CH_3CONH_2 \rightarrow (NaOBr) A \rightarrow (C_6H_5COCl \text{ Base}) B$

CASE STUDY - CBSE 2026

Like NH_3 , nitrogen atom of amine is trivalent and carries an unshared pair of electrons. Nitrogen orbitals in amines are therefore sp^3 hybridised and the geometry of amines is pyramidal. Lower aliphatic amines are soluble in water due to the formation of hydrogen bond with water molecules. The solubility decreases as the molar mass of amines increases due to increase in size of hydrophobic part. Higher amines are insoluble in water. However amines are less soluble in water than alcohols because of low electronegativity of nitrogen as compared to oxygen. Boiling points of isomeric amines follow the order $1^\circ > 2^\circ > 3^\circ$. It is due to the fact the amines are held together due to hydrogen bonding. Extent of hydrogen bonding is more in primary amines than in secondary amines as two hydrogen atoms are available for hydrogen bond formation. Tertiary amines do not show hydrogen bonding because of the absence of hydrogen atom attached to nitrogen. Amines can be prepared from, nitro compounds, nitriles, amides etc.

Q113. CBSE 2026 - 4 marks (a) Complete the following equations: (i) CH_3CONH_2 (i) $LiAlH_4$ (ii) H_2O (ii) $(NO_2 - \text{benzene}) Fe + HCl$

CASE STUDY - CBSE 2025

Amines are usually formed from amides, imides, halides, nitro compounds, etc. They exhibit hydrogen bonding which influences their physical properties. In alkyl amines, a combination of electron releasing, steric and H-bonding factors influence the stability of the substituted ammonium cations in protic polar solvents and thus affect the basic nature of amines. Alkyl amines are found to be stronger bases than ammonia. Amines being basic in nature, react with acids to form salts. Aryldiazonium salts, undergo replacement of the diazonium group with a variety of nucleophiles to produce aryl halides, cyanides, phenols and arenes.

Q114. CBSE 2025 - 2 marks How can you convert the following? (i) Ethanoic acid to methanamine (ii) Propanenitrile to 1-aminopropane



CASE STUDY · CBSE 2023

Amines are usually formed from nitro compounds, halides, amides, imides, etc. They exhibit hydrogen bonding which influences their physical properties. In alkyl amines, a combination of electron releasing, steric and hydrogen bonding factors influence the stability of the substituted ammonium cations in protic polar solvents and thus affect the basic nature of amines. In aromatic amines, electron releasing and withdrawing groups, respectively increase and decrease their basic character. Influence of the number of hydrogen atoms at nitrogen atom on the type of reactions and nature of products is responsible for identification and distinction between primary, secondary and tertiary amines. Presence of amino group in aromatic ring enhances reactivity of the aromatic amines. Aryl diazonium salts provide advantageous methods for producing aryl halides, cyanides, phenols and arenes by reductive removal of the diazo group.

Q115. CBSE 2023 · 4 marks (i) Arrange the following in the increasing order of their pK_b values in aqueous solution: $C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$

CASE STUDY · CBSE 2022

Amines constitute an important class of organic compounds derived by replacing one or more hydrogen atoms of ammonia molecule by alkyl/aryl groups. Amines are usually formed from nitro compounds, halides, amides, etc. They exhibit hydrogen bonding which influences their physical properties. Alkyl amines are found to be stronger bases than ammonia. In aromatic amines, electron releasing and withdrawing groups, respectively increase and decrease their basic character. Reactions of amines are governed by availability of the unshared pair of electrons on nitrogen. Influence of the number of hydrogen atoms at nitrogen atom on the type of reactions and nature of products is responsible for identification and distinction between primary, secondary and tertiary amines. Reactivity of aromatic amines can be controlled by acylation process.

Q116. CBSE 2022 · 1 mark Why does aniline not give Friedel-Crafts reaction?

10 Biomolecules

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (59)

Q1. CBSE 2026 · 1 mark Vitamin B12 is a complex compound of :

- (a) Fe^{2+} (b) Mg^{2+} (c) Co^{3+} (d) Cu^{2+}

Q2. CBSE 2026 · 1 mark In the ring structure of fructose, the anomeric carbon is :

- (a) C2 (b) C3 (c) C4 (d) C1

Q3. CBSE 2026 · 1 mark The deficiency of which of the following vitamins causes increased fragility of red blood cells and muscular weakness:

- (a) Vitamin A (b) Vitamin K (c) Vitamin E (d) Vitamin D

Q4. CBSE 2026 · 1 mark Assertion (A): The pentaacetate of glucose does not react with H_2N-OH . Reason (R): It indicates the presence of free $-CHO$ group in glucose.

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

Q5. CBSE 2026 · 1 mark An example of non-reducing sugar is

- (a) Glucose (b) Sucrose (c) Lactose (d) Maltose

Q6. CBSE 2026 · 1 mark Assertion (A): The two strands of DNA are complementary to each other. Reason (R): The hydrogen bonds are formed between specific pairs of bases.

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

Q7. CBSE 2026 · 1 mark Assertion (A) : The pentaacetate of glucose does not react with H_2N-OH . Reason (R) : It indicates the absence of free $-CHO$ group in glucose.

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

Q8. CBSE 2026 · 1 mark The base which is present in DNA but not in RNA is:

- (a) Guanine (b) Cytosine (c) Thymine (d) Adenine

Q9. CBSE 2026 · 1 mark Proteins are polymers of α -amino acids which are joined to each other by:

- (a) Covalent Bond (b) Peptide Bond (c) Glycosidic Bond
 (d) Coordinate Bond

Q10. CBSE 2026 · 1 mark Which of the following reactions is not explained by the open chain structure of glucose?

- (a) Glucose on prolonged heating with HI forms n-hexane.
 (b) Glucose reacts with hydroxylamine to form an oxime.
 (c) Glucose gets oxidized to gluconic acid on reaction with bromine water.
 (d) Glucose exists in two different crystalline forms, α and β .



Q11. CBSE 2026 · 1 mark Assertion (A): Glucose gets oxidized to six carbon gluconic acid on reaction with bromine water. Reason (R): The carbonyl group is absent in the open chain structure of glucose.

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

Q12. CBSE 2026 · 1 mark Nucleic acids are polymers of:

- (a) amino acids (b) nucleosides (c) nucleotides
- (d) pentose sugar

Q13. CBSE 2026 · 1 mark Which of the following is a water-soluble vitamin ?

- (a) Vitamin K (b) Vitamin A (c) Vitamin B (d) Vitamin D

Q14. CBSE 2026 · 1 mark Each polypeptide in a protein has amino acids linked with each other in a specific sequence and it is this sequence of amino acids that is said to be:

- (a) primary structure of proteins
- (b) secondary structure of proteins
- (c) tertiary structure of proteins
- (d) quaternary structure of proteins

Q15. CBSE 2026 · 1 mark Identify the polysaccharide among the following :

- (a) Fructose (b) Maltose (c) Glucose (d) Cellulose

Q16. CBSE 2026 · 1 mark The polypeptide chain in a protein has amino acids linked with each other in a specific sequence. This specific sequence of amino acids is called :

- (a) Primary structure of protein
- (b) Secondary structure of protein
- (c) Tertiary structure of protein
- (d) Quaternary structure of protein

Q17. CBSE 2026 · 1 mark Assertion (A) : D (+) – Glucose is dextrorotatory in nature. Reason (R) : (+) represents dextrorotatory nature and D represents the configuration.

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

Q18. CBSE 2025 · 1 mark Which of the following is a polysaccharide ?

- (a) Maltose (b) Glucose (c) Cellulose (d) Sucrose

Q19. CBSE 2025 · 1 mark Pyranose ring of glucose is formed due to the reaction between :

- (a) C1 and C3 (b) C1 and C5 (c) C1 and C4 (d) C1 and C2

Q20. CBSE 2025 · 1 mark Furanose ring of fructose is formed due to reaction between:

- (a) C1 and C5 (b) C2 and C5 (c) C1 and C4 (d) C1 and C2

Q21. CBSE 2025 · 1 mark α -D-glucose and β -D-glucose differ from each other with respect to the:

- (a) size of the hemiacetal ring
- (b) configuration at the C2 carbon
- (c) number of – OH groups
- (d) configuration at the C1 carbon

Q22. CBSE 2025 · 1 mark α -helix structure refers to :

- (a) primary structure of protein
- (b) secondary structure of protein
- (c) tertiary structure of protein
- (d) quaternary structure of protein

Q23. CBSE 2025 · 1 mark Assertion (A): Vitamin K can be stored in our body. Reason (R): Vitamin K is a water soluble vitamin.

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

Q24. CBSE 2025 · 1 mark 'Scurvy' is caused due to the deficiency of :

- (a) Vitamin A (b) Vitamin B2 (c) Vitamin C (d) Vitamin D

Q25. CBSE 2025 · 1 mark Assertion (A): Maltose is a reducing sugar. Reason (R): One of the two glucose units can open to expose free aldehydic group in solution.

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

Q26. CBSE 2025 · 1 mark Deficiency of vitamin B1 causes the disease:

- (a) Convulsions (b) Beri-Beri
- (c) Fissuring at corners of mouth and lips (Cheilosis)
- (d) Muscular weakness

Q27. CBSE 2025 · 1 mark Assertion (A): Vitamin C cannot be stored in our body. Reason (R): Vitamin C is water soluble and excreted in urine.

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

Q28. CBSE 2024 · 1 mark Two among the three components of DNA are D-2-deoxyribose and a heterocyclic base. The third component is:

- (a) Adenine (b) Phosphoric acid (c) Sulphuric acid
- (d) Uracil



Q29. CBSE 2024 · 1 mark Nucleotides are composed of a:

- (a) pentose sugar and phosphoric acid
- (b) nitrogenous base, pentose sugar and phosphoric acid
- (c) nitrogenous base and phosphoric acid
- (d) pentose sugar and nitrogenous base

Q30. CBSE 2024 · 1 mark The specific sequence in which amino acids are arranged in a protein is called:

- (a) Secondary structure
- (b) Primary structure
- (c) Tertiary structure
- (d) Quaternary structure

Q31. CBSE 2024 · 1 mark Maltose is made up of:

- (a) glucose and fructose
- (b) glucose and galactose
- (c) glucose and glucose
- (d) glucose and ribose

Q32. CBSE 2024 · 1 mark All proteins on hydrolysis give:

- (a) Enzymes
- (b) α -amino acids
- (c) Glucose
- (d) Polypeptides

Q33. CBSE 2024 · 1 mark Assertion (A): Uracil base is present in DNA. Reason (R): DNA undergoes self-replication.

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

Q34. CBSE 2024 · 1 mark Assertion (A): Uracil base is present in RNA. Reason (R): RNA undergoes self-replication.

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

Q35. CBSE 2024 · 1 mark Assertion (A): Vitamin C cannot be stored in our body. Reason (R): Vitamin C is water soluble and readily excreted in urine. Select the correct answer.

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

Q36. CBSE 2024 · 1 mark The vitamin which plays an important role in coagulating blood is :

- (a) Vitamin A
- (b) Vitamin E
- (c) Vitamin D
- (d) Vitamin K

Q37. CBSE 2023 · 1 mark The glycosidic linkage involved in linking the glucose units in amylase part of starch is:

- (a) C1 - C6 α linkage
- (b) C1 - C6 β linkage
- (c) C1 - C4 α linkage
- (d) C1 - C4 β linkage

Q38. CBSE 2023 · 1 mark An α -helix is a structural feature of:

- (a) Sucrose
- (b) Starch
- (c) Polypeptides
- (d) Nucleotides

Q39. CBSE 2023 · 1 mark Which of the following is a non-reducing sugar?

- (a) Sucrose
- (b) Maltose
- (c) Glucose
- (d) Lactose

Q40. CBSE 2023 · 1 mark Proteins are polymers of

- (a) Nucleic acids
- (b) Amino acids
- (c) Monosaccharides
- (d) Amines

Q41. CBSE 2023 · 1 mark When D-glucose reacts with HI, it forms

- (a) Gluconic acid
- (b) n-hexane
- (c) Saccharic acid
- (d) Iodohehexane

Q42. CBSE 2023 · 1 mark Which of the following is not true about enantiomers?

- (a) They have the same density.
- (b) They have the same melting or boiling point.
- (c) They have the same specific rotation.
- (d) They have the same chemical reactivity.

Q43. CBSE 2023 · 1 mark On hydrolysis, which of the following carbohydrates gives only glucose?

- (a) Starch
- (b) Fructose
- (c) Lactose
- (d) Sucrose

Q44. CBSE 2023 · 1 mark Which of the following vitamins is water soluble?

- (a) Vitamin A
- (b) Vitamin D
- (c) Vitamin E
- (d) Vitamin C

Q45. CBSE 2023 · 1 mark Helical structure of proteins is stabilized by:

- (a) ionic bond
- (b) covalent bond
- (c) hydrogen bond
- (d) Van der Waals forces

Q46. CBSE 2023 · 1 mark A vitamin which plays a vital role in the clotting of blood is:

- (a) Vitamin A
- (b) Vitamin K
- (c) Vitamin D
- (d) Vitamin B

Q47. CBSE 2023 · 1 mark In the ring structure of glucose, the anomeric carbon is:

- (a) C-2
- (b) C-3
- (c) C-4
- (d) C-1

Q48. CBSE 2023 · 1 mark Deficiency of Vitamin B causes:

- (a) rickets
- (b) muscular weakness
- (c) scurvy
- (d) beri-beri

Q49. CBSE 2023 · 1 mark Deficiency of which of the following vitamins causes Pernicious anaemia?

- (a) Vitamin B1
- (b) Vitamin B2
- (c) Vitamin B6
- (d) Vitamin B12

Q50. CBSE 2023 · 1 mark On hydrolysis, which of the following carbohydrates gives glucose and fructose?

- (a) Sucrose
- (b) Starch
- (c) Lactose
- (d) Maltose

Q51. CBSE 2023 · 1 mark The deficiency of which of the following vitamins causes Scurvy?

- (a) Vitamin A
- (b) Vitamin B6
- (c) Vitamin C
- (d) Vitamin B12

Q52. CBSE 2023 · 1 mark On hydrolysis, which of the following carbohydrates gives glucose and galactose?

- (a) Sucrose
- (b) Lactose
- (c) Maltose
- (d) Cellulose



Q53. CBSE 2023 · 1 mark The deficiency of which of the following vitamin causes rickets?

- (a) Vitamin A (b) Vitamin D (c) Vitamin B (d) Vitamin C

Q54. CBSE 2023 · 1 mark Hydrolysis of sucrose is called

- (a) inversion (b) hydration (c) esterification
(d) saponification

Q55. CBSE 2023 · 1 mark Assertion (A): Proteins are polymers of α -amino acids connected by a peptide bond. Reason (R): A tetrapeptide contains 4 amino acids linked by 4 peptide bonds.

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

Q56. CBSE 2023 · 1 mark Which of the following statements is not true about glucose?

- (a) It is an aldohexose
(b) On heating with HI it forms n-hexane
(c) It is present in pyranose form (d) It gives 2, 4 DNP test

Q57. CBSE 2023 · 1 mark Assertion (A): Vitamin C cannot be stored in our body. Reason (R): Vitamin C is fat soluble and is excreted from the body in urine.

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

Q58. CBSE 2023 · 1 mark β -pleated sheet structure in proteins refers to

- (a) primary structure (b) secondary structure
(c) tertiary structure (d) quaternary structure

Q59. CBSE 2023 · 1 mark Assertion (A): The backbone of DNA and RNA molecules is a chain consisting of heterocyclic base, pentose sugar and phosphate group. Reason (R): Nucleotides and nucleosides mainly differ from each other in presence of phosphate group.

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

VERY SHORT ANSWER (40)

Q60. CBSE 2026 · 2 marks What are essential amino acids? How do you explain the amphoteric behaviour of amino acids?

Q61. CBSE 2026 · 2 marks Differentiate between the following: (i) Peptide linkage and Glycosidic linkage (ii) Essential amino acids and Non-essential amino acids

Q62. CBSE 2026 · 2 marks Differentiate between the following: (i) Acidic amino acids and basic amino acids (ii) Nucleotide and Nucleoside

Q63. CBSE 2026 · 2 marks Differentiate between the following: (i) Fibrous protein and Globular protein (ii) Peptide linkage and Phosphodiester linkage

Q64. CBSE 2026 · 2 marks How do you explain the following? (a) Presence of a straight chain in glucose (b) Presence of five – OH groups in glucose which are attached to different carbon atoms

Q65. CBSE 2026 · 2 marks How do you explain the following? (a) Presence of a carbonyl group in glucose (b) Presence of five – OH groups in glucose

Q66. CBSE 2026 · 2 marks How do you explain the following? (a) Presence of an aldehyde group in glucose (b) Presence of a primary alcoholic group in glucose

Q67. CBSE 2026 · 2 marks What are the hydrolysis products of the following? (a) Lactose (b) DNA containing Thymine

Q68. CBSE 2026 · 2 marks Name the sugar present in sugarcane. What are the hydrolysis products of this sugar? Is this sugar a reducing sugar?

Q69. CBSE 2026 · 2 marks What is the effect of denaturation on the structure of proteins? What are the common types of secondary structures of proteins?

Q70. CBSE 2026 · 2 marks (a) What are the products obtained on hydrolysis of sucrose? (b) What are essential amino acids?

Q71. CBSE 2026 · 2 marks (a) Write any two fat soluble vitamins. (b) How will you confirm the presence of five – OH groups in a glucose molecule, which are attached to different carbon atoms?

Q72. CBSE 2026 · 2 marks (a) Write the hydrolysis products of lactose. (b) What are non-essential amino acids?

Q73. CBSE 2026 · 2 marks (a) Name two water-soluble vitamins. (b) How will you prove the absence of free –CHO group in the cyclic structure of glucose molecule?

Q74. CBSE 2026 · 2 marks (a) Name the disease caused by the deficiency of Vitamin A. (b) How will you confirm the presence of carbonyl group as an aldehydic group in glucose?

Q75. CBSE 2025 · 2 marks What is the effect of denaturation on the structures of protein? Give one example each of fibrous protein and globular protein.

Q76. CBSE 2025 · 2 marks What is meant by essential amino acids? Why are amino acids amphoteric in nature?

Q77. CBSE 2025 · 2 marks How do you explain the following? (a) Presence of an aldehydic group in glucose. (b) Presence of five – OH groups in glucose.

Q78. CBSE 2025 · 2 marks The two strands in DNA are not identical but complementary. Explain. What products would be formed when DNA is hydrolysed?

Q79. CBSE 2025 · 2 marks Write two differences between Amylose and Amylopectin components of starch.



Q80. CBSE 2024 · 2 marks What happens when D-glucose is treated with the following reagents? (a) HI (b) Conc. HNO_3

Q81. CBSE 2024 · 2 marks What happens when D-glucose is treated with the following reagents? (a) Br_2 water (b) HCN

Q82. CBSE 2024 · 2 marks What happens when D-glucose is treated with the following reagents? (a) $\text{H}_2\text{N}-\text{OH}$ (b) $(\text{CH}_3\text{CO})_2\text{O}$

Q83. CBSE 2024 · 2 marks Define the following terms: (a) Denaturation of protein (b) Invert sugar

Q84. CBSE 2024 · 2 marks Define the following terms: (a) Essential amino acids (b) Nucleotide

Q85. CBSE 2024 · 2 marks Define the following terms: (a) Peptide linkage (b) Essential amino acids

Q86. CBSE 2024 · 2 marks Give reaction of glucose with the following: (a) HCN

Q87. CBSE 2024 · 2 marks Write the reactions of glucose with: (a) $\text{H}_2\text{N}-\text{OH}$ (b) Br_2 water

Q88. CBSE 2024 · 2 marks Write the reactions of glucose with: (a) HI (b) $(\text{CH}_3\text{CO})_2\text{O}$

Q89. CBSE 2023 · 2 marks Answer the following: (a) Write chemical reaction to show that open structure of D-glucose contains the straight chain. (b) What type of linkage is responsible for the formation of protein?

Q90. CBSE 2023 · 2 marks Define denaturation of protein. What is the effect of denaturation on the structure of protein?

Q91. CBSE 2023 · 2 marks (a) Write chemical reaction to show that open structure of D-glucose contains the straight chain. (b) What type of linkage is responsible for the formation of protein?

Q92. CBSE 2023 · 2 marks Write two differences between DNA and RNA.

Q93. CBSE 2023 · 2 marks What is the difference between a nucleoside and nucleotide ?

Q94. CBSE 2023 · 2 marks What are nucleic acids? Why two strands in DNA are not identical but are complementary?

Q95. CBSE 2023 · 2 marks (a) (i) How are carbohydrates stored in animal body? Mention any one organ where they are present. (ii) What is the basic structural difference between starch and cellulose?

Q96. CBSE 2023 · 2 marks How are carbohydrates stored in animal body? Mention any one organ where they are present.

Q97. CBSE 2023 · 2 marks Give the reaction of glucose with hydrogen cyanide. Presence of which group is confirmed by this reaction?

Q98. CBSE 2023 · 2 marks Give the reaction of glucose with acetic anhydride. Presence of which group is confirmed by this reaction?

Q99. CBSE 2023 · 2 marks Give the reaction of heating glucose with hydroxylamine. Presence of which group is confirmed by this reaction?

SHORT ANSWER (18)

Q100. CBSE 2026 · 3 marks Write the reactions of D-Glucose with the following: (a) HI (b) Br_2 water (c) Conc. HNO_3

Q101. CBSE 2026 · 3 marks Define the following terms: (a) Anomers (b) Invert sugar (c) Glycosidic linkage

Q102. CBSE 2026 · 3 marks How do you explain the presence of following in open structure of glucose ? (a) all the six carbon atoms are in a straight chain. (b) five $-\text{OH}$ groups which are attached to different carbon atoms. (c) an aldehyde group.

Q103. CBSE 2026 · 3 marks Define the following term: (a) Reducing sugar (b) Differentiate between the following: (i) Fibrous proteins and globular proteins (ii) Nucleotide and nucleoside

Q104. CBSE 2026 · 3 marks (a) Define the following terms : (i) Denaturation as related to proteins (ii) Oligosaccharides (b) On the basis of structure differentiate between Amylose and Amylopectin.

Q105. CBSE 2026 · 3 marks (a) Define the following terms: (i) Invert Sugar (ii) Polysaccharides (b) On the basis of structure differentiate between fibrous and globular proteins.

Q106. CBSE 2025 · 3 marks (a) Name the type of linkage responsible for the formation of proteins from α -amino acids. (b) Write any two differences between DNA and RNA.

Q107. CBSE 2025 · 3 marks Name the vitamin whose deficiency causes pernicious anaemia. Write any two differences between globular and fibrous proteins.

Q108. CBSE 2025 · 1 mark Name the vitamin which is responsible for coagulation of blood.

Q109. CBSE 2025 · 3 marks Write the reaction of D-Glucose with the following: (a) HCN (b) Br_2 water (c) $(\text{CH}_3\text{CO})_2\text{O}$

Q110. CBSE 2025 · 3 marks Differentiate between : (a) Essential amino acids and Non-essential amino acids (b) Peptide linkage and Glycosidic linkage (c) Fibrous protein and Globular protein

Q111. CBSE 2024 · 3 marks Answer the following (any three): (a) What is peptide linkage? (b) What type of bonds hold a DNA double helix together? (c) Which one of the following is a polysaccharide? Sucrose, Glucose, Starch, Fructose (d) Give one example each for water-soluble vitamins and fat-soluble vitamins.

Q112. CBSE 2023 · 3 marks (a) What are the hydrolysis products of (i) Lactose, (ii) Maltose? (b) Give the basic structural difference between starch and cellulose.

Q113. CBSE 2023 · 3 marks (a) Write the product when D-glucose reacts with conc. HNO_3 . (b) Amino acids show amphoteric behaviour. Why? (c) Write one difference between α -helix and β -pleated structure of protein.

Q114. CBSE 2023 · 3 marks Write the structure of product when D-Glucose reacts with the following: (any three) (a) HI (b) Conc. HNO_3 (c) Br_2 water (d) HCN

Q115. CBSE 2023 · 3 marks Write the structure of product when D-Glucose reacts with the following: (any three) (a) HI



Q116. CBSE 2023 · 3 marks Give reasons for any 3 of the following observations: (a) Penta-acetate of glucose does not react with hydroxylamine. (b) Amino acids behave like salts. (c) Water soluble vitamins must be taken regularly in diet. (d) The two strands in DNA are complimentary to each other.

Q117. CBSE 2022 · 3 marks A compound on reduction gives 2-propanol. Iodoform reaction to give yellow precipitate and reacts with HCN to form 2-hydroxy-3-methylpropanoic acid. Identify the compound and write the equations for the reactions involved.

CASE-BASED (12)

CASE STUDY · CBSE 2026

Carbohydrates are optically active polyhydroxy aldehydes or ketones or molecules that provide such units on hydrolysis. They are broadly classified into three groups : monosaccharides, oligosaccharides and polysaccharides. Monosaccharide units are held together by glycosidic linkages to form disaccharides or polysaccharides. Starch and cellulose are polysaccharides. Starch is a polymer of α -glucose and consists of two components : Amylose and Amylopectin. Amylose is water soluble, having 15 – 20% of starch, whereas Amylopectin is insoluble in water, having 80 – 85% starch. Chemically, amylose is a long unbranched chain of α -glucose units held together by C1 – C4 glycosidic linkage. Amylopectin is a branched chain of α -glucose units held together by C1 – C4 and C1 – C6 glycosidic linkages.

Q118. CBSE 2026 · 4 marks Write two differences between Amylose and Amylopectin.

CASE STUDY · CBSE 2026

Living systems are made up of various complex biomolecules like carbohydrates, proteins, nucleic acids, lipids, etc. Proteins and carbohydrates are essential constituents of our food. In addition, some simple molecules like vitamins and mineral salts also play an important role in the functions of organisms. All proteins are polymers of α -amino acids. Proteins can be classified into two types on the basis of their molecular shape — Fibrous and Globular proteins. Vitamins are accessory food factors required in the diet. They are classified as fat-soluble and water-soluble. Deficiency of vitamins leads to many diseases. Nucleic acids are the polymers of nucleotides which in turn consist of a base, a pentose sugar and phosphate moiety. There are two types of nucleic acids — DNA and RNA. Nucleic acids are responsible for the transfer of characters from parents to offsprings.

Q119. CBSE 2026 · 4 marks Write the name of basic building units of proteins and nucleic acids. How can you differentiate between Fibrous and Globular proteins on the basis of their structures?

CASE STUDY · CBSE 2026

Carbohydrates are optically active polyhydroxy aldehydes or ketones or the compounds which produce such units on

hydrolysis. They have been broadly classified into three groups — monosaccharides, oligosaccharides and polysaccharides. The carbohydrates may also be classified as either reducing or non-reducing sugars. An important monosaccharide glucose is an aldohexose and is correctly named as D(+)-glucose. It was assigned the open structure on the basis of its reactions with HI, NH_2OH , Br_2 water, $(\text{CH}_3\text{CO})_2\text{O}$ and nitric acid. Despite having the $-\text{CHO}$ group, glucose does not give Schiff's test and hydrogen sulphite addition product with NaHSO_3 . It was found that glucose forms a six-membered ring in which one of the $-\text{OH}$ groups add to the $-\text{CHO}$ group and form a cyclic hemiacetal structure.

Q120. CBSE 2026 · 2 marks (a) How do you explain the following? (i) Presence of a carbonyl group in glucose (ii) Presence of five $-\text{OH}$ groups in glucose which are attached to different carbon atoms.

CASE STUDY · CBSE 2025

Carbohydrates are optically active polyhydroxy aldehydes or ketones or molecules which provide such units on hydrolysis. They are broadly classified into three groups – monosaccharides, oligosaccharides and polysaccharides. Monosaccharides are held together by glycosidic linkage to form disaccharides like sucrose, maltose. Another biomolecule : proteins are polymers of α -amino acids which are linked by peptide bonds. On the basis of number of amino group and carboxyl group, amino acids are classified as acidic, basic or neutral amino acids. Amino acids are amphoteric in nature.

Q121. CBSE 2025 · 4 marks (a) What is difference between glycosidic linkage and peptide linkage ? The pentacetate of glucose does not react with Hydroxyl amine. What does it indicate ?

CASE STUDY · CBSE 2025

Ribose and 2-deoxyribose have an important role in biology. Among the most important derivatives are those with phosphate groups attached at the 5 position. Mono-, di- and tri-phosphate forms are important, as well as 3-5 cyclic monophosphates. Purines and pyrimidines form an important class of compounds with ribose and deoxyribose. When these purine and pyrimidine derivatives are coupled to a ribose sugar, they are called nucleosides.

Q122. CBSE 2025 · 2 marks (a) What products would be formed when DNA is hydrolysed? How is DNA different from RNA with reference to a structure?

Q123. CBSE 2025 · 2 marks What products would be formed when DNA is hydrolysed? How is DNA different from RNA with reference to structure?

CASE STUDY · CBSE 2025

Carbohydrates are polyhydroxy aldehydes or ketones that represent enormous structural diversity in terms of the arrangement of atoms in space, resulting in hundreds of



stereoisomers. Although the chemical properties of most stereoisomers may not be very different, their metabolic rate and utilization in biological systems is significantly different and known to influence the overall carbohydrate metabolism. Structural variants, which arise due to a different arrangement of atoms in three-dimensional space are known as stereoisomers. The number of stereoisomers can be theoretically estimated by using the formula 2^n , where 'n' is the number of stereocenters or asymmetric (chiral) carbon atoms in a molecule. Out of these stereoisomers, there are some structures, which are mirror images of each other, and they are referred to as enantiomers.

Q124. CBSE 2025 · 4 marks (a) Give chemical reactions to show the presence of an aldehydic group and straight chain in glucose.

CASE STUDY · CBSE 2025

The α -amino acids are the building blocks of proteins. All α -amino acids exist as zwitter ion due to which they show amphoteric behaviour. All amino acids are joined through peptide bond. Proteins are broadly classified as globular proteins and fibrous proteins. Globular proteins are water soluble, whereas fibrous proteins are not. The complete structure of protein is discussed at four different levels i.e. primary, secondary, tertiary and quaternary structures. Protein loses its biological activity in denatured form.

Q125. CBSE 2025 · 4 marks (a) Define the following: (i) Peptide linkage (ii) Denatured protein

CASE STUDY · CBSE 2024

Carbohydrates are essential for life in both plants and animals. Carbohydrates are used as storage molecules as starch in plants and glycogen in animals. Chemically they are polyhydroxy aldehydes or ketones. On the basis of their behaviour on hydrolysis, carbohydrates are classified as monosaccharides, oligosaccharides and polysaccharides. All monosaccharides like glucose is aldohexose and its molecular formula was found to be $C_6H_{12}O_6$. After reacting with different reagents like HI, H_2N-OH , Bromine water, $(CH_3CO)_2O$, etc. its structure was found to contain one aldehyde group, one primary alcoholic group, (CH_2OH) and four secondary alcoholic groups $(CHOH)$. Despite having the aldehyde group, glucose does not give some of the reactions of aldehyde group like Schiff addition. This explains the existence of glucose in two cyclic hemiacetal forms which differ only in the configuration of the hydroxyl group at C1.

Q126. CBSE 2024 · 4 marks (a) What are reducing sugars?

CASE STUDY · CBSE 2024

Proteins are the most abundant biomolecules of the living system. Proteins are the polymers of about twenty different α -amino acids which are linked by peptide bonds. Ten amino acids are called essential amino acids. In zwitter ionic form, amino acids show amphoteric behaviour as they react both with acids and bases. On the basis of their molecular shape, proteins are classified into two types: Fibrous and Globular proteins. Structure and shape of proteins can be studied at four different levels i.e., primary, secondary, tertiary and quaternary, each level being more complex than the previous one. The secondary or tertiary structure of proteins get disturbed on change of pH or temperature and they are not able to perform their functions. This is called denaturation of proteins.

Q127. CBSE 2024 · 4 marks (a) What are essential amino acids ?

CASE STUDY · CBSE 2023

Carbohydrates are optically active polyhydroxy aldehydes and ketones. They are also called saccharides. All those carbohydrates which reduce Fehling's solution and Tollen's reagent are referred to as reducing sugars. Glucose, the most important source of energy for mammals, is obtained by the hydrolysis of starch. Vitamins are accessory food factors required in the diet. Proteins are the polymers of α -amino acids and perform various structural and dynamic functions in the organisms. Deficiency of vitamins leads to many diseases.

Q128. CBSE 2023 · 1 mark The penta-acetate of glucose does not react with Hydroxylamine. What does it indicate?

CASE STUDY · CBSE 2023

Living systems are made up of various complex biomolecules like carbohydrates, proteins, nucleic acids, lipids, etc. Carbohydrates are optically active polyhydroxy aldehydes or ketones or molecules which provide such units on hydrolysis. They are broadly classified into three groups — monosaccharides, oligosaccharides and polysaccharides. Monosaccharides are held together by glycosidic linkages to form disaccharides like sucrose, maltose or polysaccharides like starch and cellulose. Another biomolecule: proteins are polymers of α -amino acids which are linked by peptide bonds. Ten amino acids are called essential amino acids. Structure and shape of proteins can be studied at four different levels i.e. primary, secondary, tertiary and quaternary, each level being more complex than the previous one.

Q129. CBSE 2023 · 4 marks (i) What is the difference between a glycosidic linkage and peptide linkage?

