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CLASS 12

Chemistry

Sample Paper 4 - Questions

33 questions | 70 marks | 2026-27

Time: 3 hours. Answer all questions and subparts unless a choice is stated. Marks are shown on the right. Write answers on separate sheets. Independently prepared practice paper.

Section A - Objective questions

1. Which concept is illustrated in this example? Variable oxidation states can arise from accessible d and s electron energies. **1**

(A) Colligative property
(B) Electrode potential
(C) Peptide bond
(D) Transition element

2. Which statement correctly describes Nucleophilic substitution? **1**

(A) A nucleophile replaces a leaving group in a suitable substrate.
(B) For a reversible electrochemical cell, Gibbs energy change equals negative charge transfer times emf.
(C) An element has an incomplete d subshell in its atom or a common ion under the definition.
(D) The effect depends on the number of dissolved particles under the stated model.

3. Which statement correctly describes Phenol? **1**

(A) A rate-related barrier separates reactants from a suitable activated configuration.
(B) An OH group is directly attached to an aromatic ring.
(C) An element has an incomplete d subshell in its atom or a common ion under the definition.
(D) A terminal carbonyl group bears at least one hydrogen.

4. Which concept is illustrated in this example? Dilution changes a solvent's partial vapour pressure. **1**

(A) Gibbs energy and emf
(B) Raoult's law
(C) Amine
(D) Aldehyde

5. Which concept is illustrated in this example? Dissolving a nonvolatile solute can lower the freezing point. **1**

(A) First-order kinetics
(B) Coordination number
(C) Colligative property
(D) Peptide bond

6. Which concept is illustrated in this example? A positive standard cell emf corresponds to a negative standard reaction Gibbs energy change. **1**

(A) Gibbs energy and emf
(B) Lanthanide contraction
(C) Raoult's law
(D) Coordination number

7. Which statement correctly describes Lanthanide contraction? **1**

(A) An element has an incomplete d subshell in its atom or a common ion under the definition.
(B) Atomic and ionic sizes generally decrease across the lanthanide series.
(C) An amide linkage joins amino-acid residues in a peptide.
(D) The number of donor atoms directly attached to a central metal is counted.

8. Which statement correctly describes Electrode potential? **1**

(A) An electrode's reduction tendency is described relative to a reference.
(B) The number of donor atoms directly attached to a central metal is counted.
(C) An element has an incomplete d subshell in its atom or a common ion under the definition.
(D) Atomic and ionic sizes generally decrease across the lanthanide series.

9. Which statement correctly describes Aldehyde? **1**

(A) The effect depends on the number of dissolved particles under the stated model.

(B) Atomic and ionic sizes generally decrease across the lanthanide series.

(C) A terminal carbonyl group bears at least one hydrogen.

(D) An electrode's reduction tendency is described relative to a reference.

10. Which statement correctly describes Activation energy? **1**

(A) An element has an incomplete d subshell in its atom or a common ion under the definition.

(B) An amide linkage joins amino-acid residues in a peptide.

(C) Atomic and ionic sizes generally decrease across the lanthanide series.

(D) A rate-related barrier separates reactants from a suitable activated configuration.

11. Which statement correctly describes Peptide bond? **1**

(A) An amide linkage joins amino-acid residues in a peptide.

(B) A nucleophile replaces a leaving group in a suitable substrate.

(C) Atomic and ionic sizes generally decrease across the lanthanide series.

(D) An organic nitrogen base can be related to ammonia by replacement of hydrogen with carbon groups.

12. Which concept is illustrated in this example? A bidentate ligand contributes two donor atoms when both bind. **1**

(A) Mole fraction

(B) Coordination number

(C) Chelation

(D) Lanthanide contraction

13. Which concept is illustrated in this example? Component mole fractions sum to one. **1**

(A) Mole fraction

(B) Coordination number

(C) Raoult's law

(D) Gibbs energy and emf

14. Which concept is illustrated in this example? A suitable ligand attaches to a metal at two sites. 1

(A) Lanthanide contraction
(B) Mole fraction
(C) Chelation
(D) Peptide bond

15. Which concept is illustrated in this example? The half-life is independent of initial concentration in the ideal first-order model. 1

(A) Colligative property
(B) First-order kinetics
(C) Gibbs energy and emf
(D) Amine

16. Which concept is illustrated in this example? An amine reacts with a suitable acid to form an ammonium salt. 1

(A) Transition element
(B) Nucleophilic substitution
(C) Amine
(D) Coordination number

Section B - Short responses

17. The cathode reduction potential is 0.80 V and anode reduction potential is -2.7 V. Calculate cell emf. 2

18. State the meaning of Activation energy. Identify a relevant feature in this situation: Temperature changes the fraction able to react under the model. 2

19. A non-electrolyte solution has molality 2.9 mol/kg. If Kf = 2 K kg/mol and i = 1, calculate freezing-point depression. 2

20. Compare Chelation and Aldehyde. Give the meaning and an appropriate application of each. 2

21. 486 g glucose (180 g/mol) dissolves in 1 kg water. Calculate molality. 2

Section C - Short responses

22. Compare Coordination number and Peptide bond. Give the meaning and an appropriate application of each. **3**

23. A first-order reaction has half-life 2800 s. How long is required for 75 percent completion? **3**

24. Compare Electrode potential and Mole fraction. Give the meaning and an appropriate application of each. **3**

25. In $[Co(NH_3)_6]Cl_3$, determine the oxidation number of cobalt. **3**

26. Compare Amine and Chelation. Give the meaning and an appropriate application of each. **3**

27. A non-electrolyte solution has molality 3.3 mol/kg. If Kf = 2 K kg/mol and i = 1, calculate freezing-point depression. **3**

28. Compare Raoult's law and Colligative property. Give the meaning and an appropriate application of each. **3**

Section D - Case and application questions

29. Consider this situation: A haloalkane forms an alcohol under appropriate substitution conditions.

(a) Name the concept demonstrated in the case. **1**

(b) Explain the connection between the situation and that concept. **1**

(c) Distinguish that concept from Phenol, giving an appropriate feature of each. **2**

30. Consider this situation: A positive standard cell emf corresponds to a negative standard reaction Gibbs energy change.

(a) Name the concept demonstrated in the case. 1

(b) Explain the connection between the situation and that concept. 1

(c) Distinguish that concept from Raoult's law, giving an appropriate feature of each. 2

Section E - Extended responses

31. (a) Explain Mole fraction and analyse this application: Component mole fractions sum to one. 5
(b) Explain Colligative property and show how this second application fits it: Dissolving a nonvolatile solute can lower the freezing point.

32. (a) Explain Colligative property and analyse this application: Dissolving a nonvolatile solute can lower the freezing point. 5
(b) Explain Raoult's law and show how this second application fits it: Dilution changes a solvent's partial vapour pressure.

33. (a) Explain Lanthanide contraction and analyse this application: Poor shielding contributes to increasing effective nuclear attraction. 5
(b) Explain Transition element and show how this second application fits it: Variable oxidation states can arise from accessible d and s electron energies.

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