

General Instructions

- (i) This question paper contains 26 questions. All questions are compulsory.
- (ii) It comprises 6 single-correct multiple-choice questions.
- (iii) Attempt every question; detailed solutions are provided in the companion solutions booklet.

1. Read the following assertion and reason and choose the correct alternative.

Assertion: Osmotic pressure is a colligative property.

Reason: Osmotic pressure is directly proportional to molarity at a given temperature.

- (A) Both assertion and reason are true and the reason is the correct explanation of assertion.
- (B) Both assertion and reason are true but the reason is not the correct explanation of assertion.
- (C) Assertion is correct but reason is wrong.
- (D) Assertion is wrong but reason is correct.

2. Which of the following ions forms coloured solution?

- (A) Ti^{4+}
- (B) Fe^{3+}
- (C) Zn^{2+}
- (D) Cu^{+}

3. Which type of isomerism exists between the complexes

$[\text{CoBr}(\text{NH}_3)_5]\text{SO}_4$ and $[\text{CoSO}_4(\text{NH}_3)_5]\text{Br}$?

- (A) Linkage isomerism
 - (B) Solvate isomerism
 - (C) Ionisation isomerism
 - (D) Coordination isomerism
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4. The reagent which does NOT react with both acetone and benzaldehyde is

- (A) Sodium hydrogen sulphite
 - (B) Benedict's reagent
 - (C) Grignard reagent
 - (D) Phenyl hydrazine
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5. When aniline is heated with CHCl_3 in the presence of KOH , the product formed is

- (A) Phenyl isothiocyanate
 - (B) Phenyl isocyanide
 - (C) Phenyl cyanide
 - (D) Phenol
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6. $\alpha\text{-D}(+)\text{glucose}$ and $\beta\text{-D}(+)\text{glucose}$ are

- (A) Geometrical isomers
 - (B) Epimers
 - (C) Enantiomers
 - (D) Anomers
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7. Aqueous solution of sodium chloride boils at higher temperature than water, but it freezes at lower temperature than water. Explain with reason.

8. Mention the different steps for the preparation of potassium dichromate from iron chromite ore and draw the structure of dichromate ion.

9. Write IUPAC names of the following coordination compounds:

- (i) $[\text{PtCl}_2(\text{en})_2](\text{NO}_3)_2$
 - (ii) $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$
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10. Explain the mechanism of bimolecular nucleophilic substitution ($\text{S}_{\text{N}}2$) reaction of alkyl halide.

11. Define molality and molarity.

12. Explain why phenol is more acidic than ethyl alcohol.

13. Write the chemical equations when an aldehyde reacts with the following: (i) Tollen's reagent (ii) Fehling's reagent. (1 + 1 = 2)

14. Write a short note on the structure of nucleic acid. (2)

15. (i) Explain Henry's law. (ii) 200 ml of an aqueous solution of a protein contains 1.26 g of protein. The osmotic pressure of such a solution at 300 K is found to be 2.57×10^{-3} bar. Calculate the molar mass of the protein. (1 + 2 = 3)

16. Describe the charging and discharging mechanism of lead storage battery with the help of chemical reactions. (1 + 1 = 2)

17. Derive the integrated rate equation for first order reaction. Show that half life period for this reaction does not depend on initial concentration of the reactants. (2 + 1 = 3)

18. Compare the lanthanoid and actinoid elements with reference to the following: (i) Atomic and ionic sizes (ii) Oxidation state. (1 + 1 = 2)

19. (i) Define molar conductance of the solution of an electrolyte and discuss its change with the concentration.

(ii) Calculate the electromotive force (EMF) of the following cell:



(Given: $E_{\text{cell}}^{\circ} = 1.05\text{ V}$, $\log_{10} 2 = 0.3010$)

20. A first order reaction takes 10 min for 20% decomposition. Calculate the time taken for the reaction to go to 80% decomposition. (Given, $\log_{10} 2 = 0.3010$)

21. (i) Discuss the violet colour of the complex $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ on the basis of crystal field theory.

(ii) Explain with reason that $[\text{NiCl}_4]^{2-}$ is paramagnetic while $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic.

22. Explain the following in relation to proteins:

(i) Peptide bond

(ii) Denaturation

23. Write short notes on the following: (i) Coupling reaction (ii) Sandmeyer reaction (iii) Friedel-Craft reaction. ($2 + 1\frac{1}{2} + 1\frac{1}{2} = 5$)

OR

Write chemical equations for obtaining the following from benzene diazonium chloride: (i) Phenyl cyanide (ii) Bromobenzene (iii)

Nitrobenzene (iv) p-hydroxyazobenzene (v) p-Aminoazobenzene.

($1 + 1 + 1 + 1 + 1 = 5$)

24. (i) Explain the mechanism of the formation of ethanol by acid catalyzed hydration of ethene. (ii) Explain hydroboration-oxidation reaction with an example. ($2\frac{1}{2} + 2\frac{1}{2} = 5$)

OR

What happens when? (Write chemical equations only) (i) Ethyl bromide reacts with sodium ethoxide. (ii) Phenol is heated with conc. HNO_3 in the presence of conc. H_2SO_4 . (iii) Methoxybenzene is heated with acetyl chloride in the presence of anhydrous AlCl_3 . (iv) Phenol reacts with chloroform in the presence of aqueous NaOH . (v) Ethyl methyl ether is heated with conc. HI . ($1 + 1 + 1 + 1 + 1 = 5$)

25. (a) Write short notes on the following: (i) Cannizzaro's reaction (ii) Aldol condensation (iii) Gattermann-Koch reaction. ($2 + 1\frac{1}{2} + 1\frac{1}{2} = 5$)

OR

How will you obtain (write chemical equations only): (i) Benzaldehyde from Toluene (ii) Benzamide from Benzoic acid (iii) Phthalimide from Phthalic acid (iv) m-nitrobenzaldehyde from Benzaldehyde (v) Benzaldehyde from Benzene. ($1 + 1 + 1 + 1 + 1 = 5$)

26. (b) (i) Describe any one method for the identification of primary, secondary and tertiary amines. Also write the chemical reactions. (ii) Write a short note on Gabriel Phthalimide Synthesis. ($3 + 2 = 5$)

OR

How will you obtain (write chemical equations only): (i) Benzene diazonium chloride from Aniline (ii) Methylamine from Acetamide (iii) Aniline from Nitrobenzene. ($2 + 1\frac{1}{2} + 1\frac{1}{2} = 5$)