

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 2 Hours

Maximum Marks: 35

General Instructions

- (i) This question paper contains **12 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 3 are very short answer questions, carrying 2 marks each.
- (iii) Section B: Questions 4 to 11 are short answer questions, carrying 3 marks each.
- (iv) Section C: Questions 12 are case-based questions, carrying 5 marks each.
- (v) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (vi) Use of calculators is not allowed.

Section A

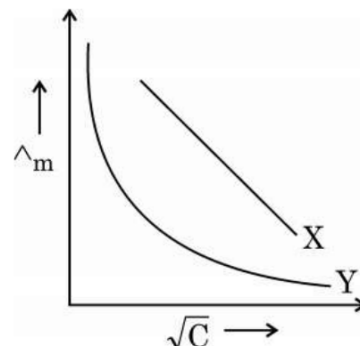
1. Arrange the following compounds as directed: (any Two)

(i) In decreasing order of basic strength in aqueous solution: $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $(\text{C}_2\text{H}_5)_3\text{N}$

(ii) In increasing order of solubility in water: $(\text{C}_2\text{H}_5)_2\text{NH}$, $\text{C}_2\text{H}_5\text{NH}_2$, $\text{C}_6\text{H}_5\text{NH}_2$

(iii) In decreasing order of their pK_b values: $\text{C}_6\text{H}_5\text{NH}_2$, $\text{C}_2\text{H}_5\text{NH}_2$, NH_3

2. In the plot of molar conductivity (Λ_m) Vs. square root of concentration ($\sqrt{C}$), following curves are obtained for two electrolytes X and Y:



Answer the following:

- (i) Predict the nature of electrolyte X and Y.
- (ii) What happens on extrapolation of Λ_m to concentration approaching zero for electrolytes X and Y?

3. What do you mean by complex reactions? Can we determine order and molecularity of a complex reaction?

Section B

4(a). Write any three differences between physisorption and chemisorption.

4(b). Define the following terms with a suitable example in each:

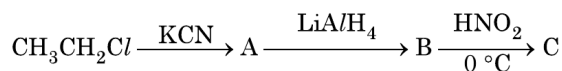
- (i) Lyophilic sol
- (ii) Macromolecular colloid
- (iii) Coagulation

5(a). Illustrate the following reactions giving suitable example in each case:

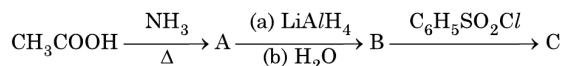
- (i) Gabriel phthalimide synthesis.
- (ii) Carbylamine reaction.
- (iii) Hoffmann bromamide degradation reaction.

5(b). Write the structures of A, B and C in the following reactions:

(i)



(ii)



6. An organic compound 'X' with the molecular formula $\text{C}_5\text{H}_{10}\text{O}$ forms 2,4-DNP derivative, does not reduce Tollens' reagent but gives positive iodoform test on heating with I_2 in the presence of NaOH . Compound 'X' gives ethanoic acid and propanoic acid on vigorous oxidation. Write the

- (i) Structure of the compound 'X'.
- (ii) Structure of the product obtained when compound 'X' reacts with 2,4-DNP reagent.
- (iii) Structures of the products obtained when compound 'X' is heated with I_2 in the presence of NaOH .

7(a). (i) On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_o < P$

(ii) Using valence bond theory, predict the hybridization and magnetic character of $[\text{Ni}(\text{CN})_4]^{2-}$. (Atomic number of Ni = 28)

(iii) Write the formula of the following complex using IUPAC norms: Dichloridobis(ethane-1,2-diamine)cobalt(III)

7(b). When a co-ordination compound $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ is mixed with AgNO_3 , 2 moles of AgCl are precipitated per mole of the compound. Write

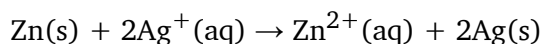
- (i) Structural formula of the complex.
- (ii) Secondary valency of 'Ni' in the complex.
- (iii) IUPAC name of the complex.

8(a). Account for the following:

- (i) Zr and Hf have almost similar atomic radii.
- (ii) Transition metals show variable oxidation states.
- (iii) Zinc has lowest enthalpy of atomisation.

8(b). Why transition metals and their compounds act as good catalysts? How is the variability in oxidation states of transition metals different from that of the non-transition metals? Illustrate with examples.

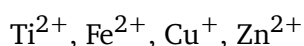
9. (a) The standard Gibbs energy ($\Delta_r G^\circ$) for the following cell reaction is -300 kJ mol^{-1} :



Calculate E°_{cell} for the reaction. (Given: $1 \text{ F} = 96500 \text{ C mol}^{-1}$)

(b) Calculate Λ°_m for MgCl_2 if λ° values for Mg^{2+} ion and Cl^- ion are $106 \text{ S cm}^2 \text{ mol}^{-1}$ and $76.3 \text{ S cm}^2 \text{ mol}^{-1}$ respectively.

10. Following ions of 3d transition series are given:



(Atomic number: Ti = 22, Fe = 26, Cu = 29, Zn = 30)

Identify the ion, which is

- (i) a strong reducing agent in aqueous solution.
- (ii) more stable than its +1 oxidation state.
- (iii) colourless in aqueous solution.

Give a suitable reason in each.

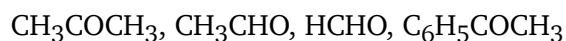
11. A first order reaction is 50% complete in 40 minutes. Calculate the time required for the completion of 90% of reaction.

[Given: $\log 2 = 0.3010$, $\log 10 = 1$]

12(a). Case Study (read the passage):

Aldehydes, ketones and carboxylic acids are some of the important classes of organic compounds containing carbonyl group. These are highly polar molecules due to higher electro-negativity of oxygen relative to carbon in the carbonyl group. Aldehydes are prepared by dehydrogenation or controlled oxidation of primary alcohols and controlled reduction of acyl halides. Ketones are prepared by oxidation of secondary alcohols and hydration of alkynes. Aldehydes and ketones undergo nucleophilic addition reactions onto the carbonyl group but carboxylic acid does not undergo nucleophilic addition reaction. The alpha (α) hydrogens of aldehydes and ketones are acidic. Therefore aldehydes and ketones having at least one α-hydrogen undergo Aldol condensation. Aldehydes are easily oxidised by mild oxidising agents such as Tollens' reagent and Fehling's reagent. Carboxylic acids are prepared by the oxidation of primary alcohols, aldehydes and by hydrolysis of nitriles. Aromatic carboxylic acids are prepared by side-chain oxidation of alkyl benzenes. Carboxylic acids are considerably more acidic than alcohols and most of simple phenols.

(a) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction:

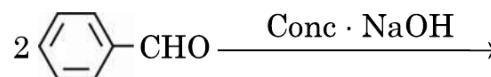


12(b). (b) Give a simple chemical test to distinguish between Ethanal and Propanone.

12(c). (c) Why carboxylic acid does not give nucleophilic addition reactions like aldehydes and ketones?

12(d). (d) (i) Why α-hydrogen of aldehydes and ketones are acidic in nature?

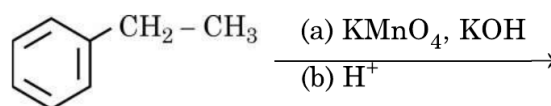
(ii) Write the products in the following:



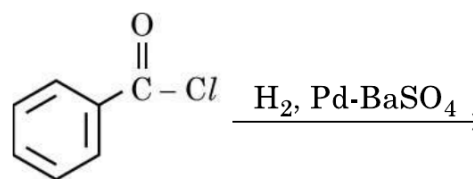
OR

Write the major products of the following reactions:

(i)



(ii)



- End of Question Paper -