

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 in the increasing order of their property indicated: (Any two)

(i) Acetaldehyde, Benzaldehyde, Acetophenone, Acetone (Reactivity towards HCN)

(ii) $(\text{CH}_3)_2\text{CHCOOH}$, $\text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{COOH}$, $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{COOH}$ (Acidic strength)

(iii) $\text{CH}_3\text{CH}_2\text{OH}$, CH_3CHO , CH_3COOH (Boiling point)

2. In a plot of Λ_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.

3. 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.

Section B

4. (a) 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.

OR

(b) How will you carry out the following conversions:

(i) Nitrobenzene to Aniline

(ii) Ethanamide to Methanamine

(iii) Ethanenitrile to Ethanamine

5. (a) (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 $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ in solution.

OR

(b) (i) Calculate the spin only magnetic moment of the complex $[\text{CoF}_6]^{3-}$. (Atomic no. of Co = 27)

(ii) Write the IUPAC name of the given complex: $[\text{CrCl}_2(\text{H}_2\text{O})_4]\text{Cl}$

(iii) Which out of the two complexes is more stable and why? $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$

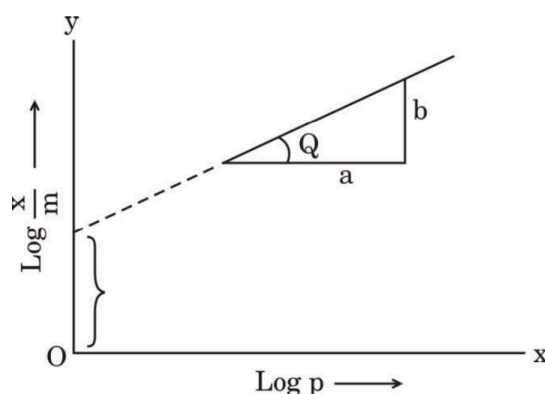
6. (i) Which ion amongst the following is colourless and why? Ti^{4+} , Cr^{3+} , V^{3+} (Atomic number of Ti = 22, Cr = 24, V = 23)

(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.

7. A compound 'A' ($\text{C}_3\text{H}_6\text{O}$) on oxidation gives 'B' ($\text{C}_3\text{H}_4\text{O}_2$). 'A' undergoes Iodoform reaction to give yellow precipitate and reacts with HCN to form the compound 'C'. 'C' on hydrolysis gives 2-hydroxypropanoic acid. Identify the compounds 'A', 'B' and 'C'. Write down equations for the reactions involved.

8. Observe the given figure and answer the following questions:



(i) Write the expression for adsorption of gases on solids in the form of an equation.

(ii) What is the slope of the graph?

(iii) What does the intercept of the line represent?

9. (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.

OR

(b) (i) Write the IUPAC name for the following organic compound: $(\text{CH}_3\text{CH}_2)_2\text{NCH}_3$

(ii) Write the equations for the following:

(I) Gabriel phthalimide synthesis

(II) Hoffmann bromamide degradation

10. Write the Nernst equation and calculate emf of the following cell at 298 K:



Given: $E^\circ_{\text{Cr}^{3+}/\text{Cr}} = -0.75 \text{ V}$, $E^\circ_{\text{Fe}^{2+}/\text{Fe}} = -0.45 \text{ V}$
($\log 10 = 1$)

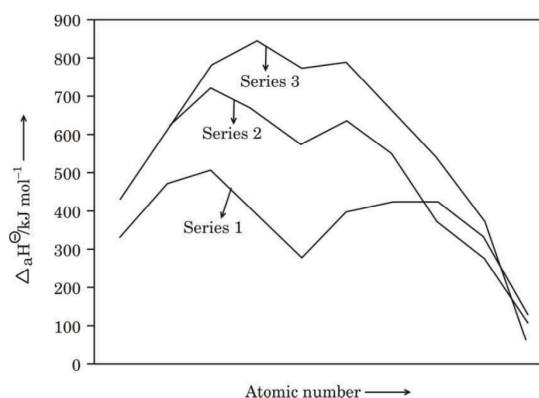
11. (a) (i) Silver atom has completely filled d-orbitals in its ground state, it is still considered to be a transition element. Justify the statement.

(ii) Why are $E^\circ_{\text{M}^{2+}/\text{M}}$ values of Mn and Zn more negative than expected?

(iii) Why do transition metals form alloys?

OR

(b) Answer the following questions on the basis of the figure given below:



(i) Which element in 3d series has lowest enthalpy of atomisation?

(ii) Why do metals of the second and third series have greater enthalpies of atomisation?

(iii) Why are enthalpies of atomisation of transition metals quite high?

12. Read the passage given below and answer the questions that follow:

The rate law for a chemical reaction relates the reaction rate with the concentrations or partial pressures of the reactants. For a general reaction $aA + bB \rightarrow C$ with no intermediate steps in its reaction mechanism, meaning that it is an elementary reaction, the rate law is given by $r = k[A]^x[B]^y$, where $[A]$ and $[B]$ 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 .

(i) Calculate the overall order of a reaction which has the following rate expression: $\text{Rate} = k[A]^{1/2}[B]^{3/2}$

(ii) What is the effect of temperature on rate of reaction?

(iii) What is meant by rate of a reaction?

(iv) (a) A first order reaction takes 77.78 minutes for 50% completion. Calculate the time required for 30% completion of this reaction. ($\log 10 = 1$, $\log 7 = 0.8450$)

OR

(b) A first order reaction has a rate constant 1×10^{-3} per sec. How long will 5 g of this reactant take to reduce to 3 g? ($\log 3 = 0.4771$; $\log 5 = 0.6990$)

- End of Question Paper -