(c) Describe the mechanism of acid catalysed reaction in which acid form of substrate reacts with water. Discuss the cases : (i) $k_2 >> k_{-1}[A]$ and (ii) $k_2 << k_{-1}[A]$. (5)



[This question paper contains 8 printed pages.]

**Your Roll No.....**

**Sr. No. of Question Paper : 5854** **J**

Unique Paper Code : 2172523601

Name of the Paper : DSE – Conductance, Electrochemistry and Chemical Kinetics

Name of the Course : **B.Sc. Life Science**

Semester : VI

Duration : 2 Hours Maximum Marks : 60

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **four** questions in all, question No. **1** is compulsory.
3. The answers should be numbered in accordance to the number in the question paper.
4. Use of Scientific Calculator is permitted.

($R = 8.314\ J\ K^{-1}\ mol^{-1}$ $k = 1.38\times10^{-23}\ J\ K^{-1}$ $N_A = 6.023\times10^{23}$)

1. Answer any **Five** (3×5)

(a) Differentiate between order and molecularity of a reaction giving examples.

(b) The molar conductance of an electrolyte solution increases, whereas its specific conductance decreases with dilution. Explain.

(c) Why it is not possible to determine the equivalent conductance of a weak electrolyte at infinite dilution by direct measurement using conductivity meter?

(d) A finely powdered substance is more effective catalyst. Why?



(c) In a particular reaction the time required to complete half of the reaction was found to increase 16 times when the initial concentration of the reactant was reduced to one fourth. Determine the order of the reaction? (5)

6. (a) The kinetics of enzyme catalysed reaction is studied by Michaelis-Menton mechanism. Using the suitable approximation, relate enzyme and substrate concentration to the rate of the reaction. Also discuss how the rate of reaction varies when Michaelis-Menton constant is greater than enzyme concentration. (5)

(b) Describe characteristics of a catalyst. (5)

(b) Explain the concept of activation energy of reaction. Derive expression for its calculation from Arrhenius equation. (5)

(c) The rate constant for a second order reaction is $5.7 \times 10^{-5}$ $dm^3$ $mol^{-1}$ $s^{-1}$ at 25°C and $1.64 \times 10^{-4}$ $dm^3$ $mol^{-1}$ $s^{-1}$ at 40°C. Calculate the activation energy of the reaction. (5)

5. (a) Derive expression between EMF and equilibrium constant of reversible cell. (5)

(b) Using integrated rate expressions, derive equations for half-life of first and second order reactions. (5)



(e) Why a first order reaction never reaches completion?

(f) Draw labelled energy profile diagrams for endothermic and exothermic reaction using a catalyst.

2. (a) State Kohlrausch's law of independent migration of ions. How does it help in determination of equivalent conductance at infinite dilution of weak electrolytes? (5)

(b) If the molar conductance at infinite dilution of NaCl, HCl and $CH_3COONa$ are 126, 420, and 91 S $cm^2$ $mol^{-1}$ respectively, calculate molar conductance of acetic acid at infinite dilution.

(5)

(c) Calculate the transference numbers of $H^+$ and $Cl^-$ ions from the following data obtained from the moving boundary method using cadmium chloride as indicator electrolyte, Given:

Atomic mass of Ag = 108 g $mol^{-1}$

Concentration of HCl solution = 0.1 N

Mass of Ag deposited in the coulometer = 0.1209 g

Movement of boundary = 8.5 cm

Cross-section of the tube = 1.1 $cm^2$. (5)

3. (a) What is meant by transference number? Describe the Hittorfs method to determine experimentally the transference number of ions. (5)

(b) For the electrochemical cell :

$Cd \mid CdCl_2.5/2H_2O$ (aq) $\parallel$ AgCl(s) $\mid$ Ag



the EMF at 0°C and 25°C are 0.6915 V and 0.6753 V, respectively.

The cell reaction is: $Cd(s) + 2AgCl(s) + H_2O \rightarrow CdCl_2.5/2H_2O$ (sat.) + 2Ag(s)

Calculate $\Delta G°$, $\Delta H°$ and $\Delta S°$ at 25°C. (5)

(c) Discuss the titration curves obtained from conductometric titrations of

(i) HCl vs. NaOH solution

(ii) Formic acid vs. NaOH solution (5)

4. (a) State the principle underlying the potentiometric titrations. What are the advantages of potentiometric titrations over volumetric titrations? Explain the potentiometric titration curve involving an acid and a base. (5)