

2962

- (c) Decomposition of Ammonium Nitrite produces Nitrogen gas. Volume of N_2 collected at different intervals of time are following. 5

Time/min	10	15	20	24	∞
Volume of N_2 /ml	6.25	9.0	11.4	13.65	35.05

Prove that the reaction is first order.

6. (a) Discuss the titration curves obtained from conductometric titrations of; 5
 (i) HCl vs NaOH
 (ii) Acetic acid vs NaOH
 (b) At 25°C the molar conductivity of 0.03M AgNO_3 solution is $143.2 \text{ Scm}^2\text{mol}^{-1}$ while the transference number of NO_3^- is 0.52. Calculate the molar ionic conductivity and mobility of Ag^+ and ions NO_3^- . 5
 (c) Describe the mechanism of acid catalysed reaction in which acid form of substrate reacts with water. Discuss the cases. 5
 (i) $k_2 \gg k_{-1} [\text{A}]$ and
 (ii) $k_2 \ll k_{-1} [\text{A}]$

[This question paper contains 4 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **2962**

Unique Paper Code : 2173542003

Name of the Course : **B.Sc.(Prog.)**

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

Semester : IV/VI

Time : 2 Hours **Maximum Marks : 60**

Instructions for Candidates :

- Write your Roll No. on the top immediately on receipt of this question paper.
- Attempt any **Four** questions in all. Question No. **1** is compulsory.
- The questions should be numbered in accordance to the number in the questions paper.
- Use of Scientific Calculator is permitted.

1. Answer any five of the following. 5×3=15

- What is the difference between rate constant and rate of reaction.
- What is the difference between a reversible and an irreversible cell ? Explain with examples of both.
- Why it is not possible to determine the equivalent conductance of a weak electrolyte at infinite dilution by direct measurement using conductivity meter ?

- (d) Calculate the free energy change for the reaction of the following cell at 25°C.
 $\text{Sn} | \text{Sn}^{2+}(0.6\text{M}) || \text{Pb}^{2+}(0.3\text{M}) | \text{Pb}$
 (The standard EMF of the cell is 0.14V)
- (e) Draw labelled energy profile diagrams for endothermic and exothermic reactions using a catalyst ?
- (f) Why a first-order reaction never reaches completion ?
- 2.** (a) Define specific conductance, molar conductance and equivalent conductance. Explain why conductivity decreases while equivalent conductivity increases on dilution. 5
- (b) If the molar conductance at infinite dilution of NaCl, HCl and CH_3COONa are 126, 420, and 91 $\text{Scm}^2\text{mol}^{-1}$, respectively, calculate the molar conductance of acetic acid at infinite dilution. 5
- (c) The kinetics of enzyme catalyzed 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
- 3.** (a) How does the rate of a reaction depend on temperature ? The activation energy of a reaction is 22.5 kcalmol^{-1} . Its specific rate constant is $1.8 \times 10^{-5} \text{sec}^{-1}$. Calculate the Pre-exponential factor (A) at 40°C. 5

- (b) How do we use glass electrode for the determination of pH of a given solution ? What are advantages and disadvantages of glass electrode ? 5
- (c) For the electrochemical cell.
 $\text{Cd} | \text{CdCl}_2 \cdot 5/2\text{H}_2\text{O}(\text{aq}) || \text{AgCl}(\text{s}) / \text{Ag}$
 The EMF at 0°C and 25°C are 0.6915 V and 0.6753 V, respectively.
 The cell reaction is : $\text{Cd}(\text{s}) + 2\text{AgCl}(\text{s}) + \text{H}_2\text{O} \rightarrow \text{CdCl}_2 \cdot 5/2 \text{H}_2\text{O} (\text{sat.}) + 2\text{Ag}(\text{s})$ Calculate the ΔG° , ΔH° and ΔS° at 25°C.
- 4.** (a) What is the significance of the order of a reaction ? Show that the units of specific rate constant are different for reactions of zero, first and second order. 5
- (b) The half-life of a first order decomposition reaction at 650K is 363 min and its activation energy is 220 kJ/mol. Calculate the rate constant for this reaction at 720K. 5
- (c) The resistance of 0.5N solution of an electrolyte in a cell was found to be 45 ohms. Calculate equivalent conductance of the solution if the electrodes in the cell are 2.2 cm apart and have an area of 3.8cm^2 5
- 5.** (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
- (b) Derive expression between EMF and equilibrium constant of reversible cell. 5