[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2917 **L**

Unique Paper Code : 2172523601

Name of the Paper : DSC: Conductance, Electrochemistry & Chemical Kinetics

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

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 any four questions. Q. No. **1** is compulsory,
3. Each question carries equal marks.
4. Use of Scientific Calculator is permitted.

   ($F = 96500\ C\ mol^{-1}$, $R = 8.314\ J\ K^{1}\ mol^{1}$)

1. Answer any **five**. Each carries equal marks. (3×5)

   (a) Equivalent conductance increases while conductivity decreases with dilution of solution of electrolyte. Explain.

   (b) Transport number of Cl^- ion in aqueous solution of HCl is 0.16 and it is 0.62 in aqueous solution of NaCl. Explain.

   (c) Ionic Molar Conductivity at infinite dilution increases as Li^+, Na^+, K^+, Rb^+. Explain.

   (d) Explain the terms specificity and selectivity in catalysis with examples.

   (e) The first order reaction never achieves completion. Explain.

   (f) If we double all the coefficients in a cell reaction, the charge number 'n' is doubled and the emf is unchanged. Explain.

P.T.O.

2. (a) Draw and discuss the titration curves obtained during the conductometric titration of :

(i) An aqueous solution of CH_3COOH with aqueous solution of NaOH.

(ii) An aqueous solution of HCl with aqueous solution of NH_4OH. (5)

(b) A cell contains 0.10 mol dm^{-3} aqueous KCl, which at that concentration has a molar conductivity of 129 $ohm^{-1}cm^2mol^{-1}$. The measured resistance was 28.44 ohm, When the same cell was filled with 0.05 mol dm^{-3} NaOH aqueous solution the resistance was 31.6 ohm. Find the molar conductivity of aqueous NaOH at that concentration. (5)

(c) Define Ionic Mobility. What is its unit? Write the relation between transference number and ionic mobility. (5)

3. (a) Derive the expression for the determination of the pH of the solution using glass electrode. Mention two advantages of glass electrode. (5)

(b) The emf of the cell

$Ag \mid AgCl\ (s) \mid KCl_{(soln)} \mid Hg_2Cl_2(s) \mid Hg$

is 0.0455 V at 298 K and the temperature coefficient is 3.38×10^{-4} V K^{-1}. The cell reaction is

$Hg_2Cl_2(s) + 2Ag\ (s) \rightarrow 2Hg(l) + 2AgCl\ (s)$

Calculate ΔG, ΔH and ΔS at 298K. (5)

(c) Explain the potentiometric titration curves Mohr salt and $K_2Cr_2O_7$. Discuss the redox pairs involved in the reaction

(i) Before equivalence point

(ii) After equivalence point (5)

4. (a) What are the advantages of using salt bridge in electrochemical cells? KCl and NH_4NO_3 are frequently used to prepare salt bridge. Explain. (5)

(b) Given that

$$E^\circ_{cu2+|Cu} = 0.337V \text{ and } E^\circ_{Cr3+|Cr} = -0.774V$$

Write the cell representation of the following chemical reaction. Determine, whether the given reaction proceeds in forward or backward direction at 25°C.

$$2Cr + 3Cu^{2+} \rightarrow 2Cr^{3+} + 3Cu$$ (5)

(c) Write short notes on :

(i) Daniel cell

(ii) Electrochemical series (2.5×2)

5. (a) Write the integrated rate equation for a first-order reaction.

For a reaction A → Products, the following data is given :

[A] (mol L^{-1})	Rate (mol L^{-1} s^{-1})
0.10	2.0×10^{-3}
0.20	4.0×10^{-3}
0.40	8.0×10^{-3}

(i) Determine the order of reaction. (ii) Calculate the rate constant. (5)

(b) Derive the expression for its half-life of a second order reaction. A second-order reaction has a rate constant $k=3.3\times10^{-2}$ dm^3 mol^{-1} s^{-1}. If the initial concentration of the reactant is 0.05 mol dm^{-3} calculate its half-life. (5)

(c) Explain the Lineweaver-Burk plot ($1/r \sim 1/[S]$) used in enzyme catalysis kinetics. How are r_{max} and K_m determined from the slope and intercept of this plot? (5)

6. (a) Derive the expression for rate of a reaction involving specific acid catalysis. (5)

(b) Using l angmuir adsorption theory, show that a uni-molecular surface reaction follows first order kinetics at low pressures and zeroth law kinetics at high pressures. Support the answer with appropriate expressions and a suitable diagram. (5)

(c) Define Activation Energy. How does a catalyst change the activation energy (represented on a potential energy diagram)? The rate constants of a reaction at 300 K and 350 K are $2.5 \times 10^{-3}\ s^{-1}$ and $5.0 \times 10^{-3}\ s^{-1}$ respectively. Calculate the activation energy of the reaction. (5)