(b) The resistance of 0.5 M solution of an electrolyte in a cell was found to be 45 Ω. Calculate the molar conductance of the solution if the cell are 2.2cm apart and have an area of 3.8 cm^2.

(c) The molar ionic conductivities at infinite dilution of Na_2SO_4, K_2SO_4, KCl, HCl and HCOONa at 300K are 260, 308,150, 426, and 105 S cm^2 mol^{-1} respectively. Calculate the molar conductivity at infinite dilution for formic acid at same temperature. (5,5,5)

6. (a) Explain how the pH of a solution is determined using the hydrogen electrode?

(b) Answer whether the following reaction is possible or not under standard conditions, through appropriate calculations.

$2Fe^{3+} + Fe \leftrightharpoons 3Fe^{2+}$; given that $E^o_{Fe^{3+},Fe^{2+}/Pt} = 0.771V$ and $E^o_{Fe^{2+}/Fe} = -0.44\ V$

(c) Calculate the transport numbers of H^+ and Cl^- ions from the following data obtained by moving boundary method using $CdCl_2$ as the indicator electrolyte; concentration of HCl solution = 0.1 M, mass of Ag deposited in the coulometer = 0.120 9 g; movement of boundary = 7.50 cm and cross-sectional area of the tube = 1.24 cm^2. (5,5,5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3023 **I**

Unique Paper Code : 2174001008

Name of the Paper : Conductance and Electrochemistry

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

Semester : I/III/V

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.
3. Use of scientific calculator is allowed.

1. (a) Construct the galvanic cell for the following reaction and write the expression for cell potential:

$2Cr(s) + 3Hg_2Cl_2(s) \rightleftharpoons 2Cr^{3+}(aq) + 6\ Cl^-(aq) + 6Hg(1)$

(b) What do you mean by Liquid Junction Potential? Liquid junction potential depends on the transference number of cations and anions. Explain.

(c) State and explain Kohlrausch law of independent migration of ions with suitable example

(5, 5,5)

2. (a) Describe the moving boundary method for determining the transport number of ions.

(b) What are concentration cells. Derive the expression for potential of the following concentration cell without transference, separated by salt bridge.

H_2(g, 1 bar)/HCl(a_1)//HCl(a_2)/H_2 (g, 1bar)

(c) Derive the Nernst equation for the hydrogen-hydrogen ion half-cell. (5, 5,5)

3. (a) Draw and discuss the titration curved obtained in the conductometric titration of weak acid with strong base.

(b) Determine the E_{cell} reaction and *Ecell* of the given cell at 25°C assuming activity and 1fugacity equal

to molar concentration and pressure, resepectively.

Mg/MgI_2(0.1 mol dm^{-3})/I_2/Pt. ($E^o_{I^-/I_2}$ = 0.535 V and $E^o_{Mg^{2+}/Mg}$ = –2.363

(c) Write short note on any one

(i) Calomel electrode

(ii) Reversible and Irreversible electrode

(5,5,5)

4. (a) Explain the importance of salt bridge. Name the most commonly used electrolyte used in constructing salt bridge. Why it is chosen over other electrolytes.

(b) At 273 K, the calorimetric determination of ΔH for the reaction

$Zn(S)+2AgCl(s) \rightarrow ZnCl_2(s) + Ag(s)$,

yielded -217.78 KJ mol^{-1}, while the emf of the corresponding cell was 1.015 V.

What is the value of $\left(\frac{\partial E}{\partial T}\right)_P$ of the cell?

(c) Define the term electrolysis. State and explain Faraday's laws of electrolysis?

(5,5,5)

5. (a) What are potentiometric titrations? Discuss briefly the potentiometric titration of strong acid against strong base.

P.T.O.