S.No.Q.P. - 13341

Name of the course : **All undergraduate courses except chemistry**

Semester : **II/IV/VI/~~VII~~**

Name of the paper : **GE: CONDUCTANCE AND ELECTROCHEMISTRY**

Unique paper code : **2174001008**

Duration : **2 hours**

Maximum marks : **60**

Instructions

1. This question paper has 6 questions. Out of these only 4 have to be attempted
2. All questions contain equal marks
3. Use of calculator is allowed
4. While answering, mention the question number properly

1.

a. Explain the terms conductance, specific conductance, equivalent conductance as applied to the solutions of the electrolytes. In which units are these expressed? How is specific conductance related to equivalent conductance?

b. What is the principle underlying conductometric titrations? Discuss the titration curves obtained in titration of:

(i) A Strong acid with Strong Base

(ii) A Strong Acid with Weak Base

c. A zinc rod is placed in 0.1 M solution of zinc sulphate at 25°C . Assuming that the salt is dissociated to the extent of 90 percent at this dilution, calculate, occurring in the zinc – silver cell at 25 °C the potential of the electrode at this temperature ($E^{\circ}\ Zn^{2+} / Zn = -0.76$ V)

(5, 5 ,5)

2.

a. The solubility product of Magnesium Hydroxide $Mg(OH)_2$ at 25 °C is 1.4×10^{-11} . Calculate the solubility of magnesium hydroxide in grams per litre? (The atomic masses are: Mg = 24 , O = 16 and H = 1)

b. What is meant by "degree of hydrolysis" and "hydrolysis constant"? Describe the various methods used for determination of degree of hydrolysis of a salt.

c. What is Ostwald's dilution law for weak electrolytes?

(5, 5, 5)

3.(a). What are concentration cells without transference? Explain with the help of an example.

(b). What is standard hydrogen electrode? How can this electrode be used to find out the pH of a solution?

(c). Calculate the free energy change, enthalpy change and entropy change at 298 K for the following cell reaction if the EMF of this cell is 0.0455 V and the temperature coefficient is 3.38×10^{-4} V/K at this temperature.

$$2Ag(s) + Hg_2Cl_2(s) \longrightarrow 2AgCl(s) + 2Hg(l)$$ (5, 5, 5)

4.(a). A resistance of 1982 Ω was observed when a conductivity cell with a cell constant of 0.3 cm^{-1} was filled with 0.01 M acetic acid solution. The conductivity water used to prepare this solution had a conductivity of 7.0×10^{-6} S cm^{-1}. Calculate the molar conductivity of 0.01 M acetic acid solution.

(b). Explain the following:

i. Ostwald dilution law
ii. Conductivity cell

(c). What are conductometric titrations? What are their advantages over conventional titrations? (5, 5, 5)

5. (a). What is a reversible cell? Explain with the help of an example. List the conditions required for thermodynamic reversibility of a cell.

(b). Calculate the equilibrium constant at 298 K for the following cell reaction:

$$2Al + 3Cu^{2+} \longrightarrow 2Al^{3+} + 3Cu$$

Given that $E^\circ (Al^{3+} | Al) = -1.66$ V and $E^\circ (Cu^{2+} | Cu) = 0.34$ V

(c). If the transport number of K^+ is 0.48 and the molar conductivity of KBr at infinite dilution is 1.52×10^{-2} S m^2 mol^{-1} then calculate the ionic mobility of K^+ at infinite solution.

(5, 5, 5)

6. Write a short note on any three of the following:

i. Conductometric titrations
ii. Concentrations cells
iii. Glass electrode
iv. Hittorf's method

(5, 5, 5)