

CHEMISTRY

(Paper – XV : Physical Chemistry – B)

Time Allowed : 3 hours

Maximum marks : 22

Note : Attempt five questions in all, one question from each Section and the compulsory question. Compulsory question carries 6 marks and other questions carry 4 marks each.

SECTION – A

- (a) Draw labelled phase diagram of Mg-Zn system. Indicate clearly the eutectic points and congruent melting point on the diagram.

(b) What is meant by upper critical solution temperature ? Illustrate phenol-H₂O system. 2,2
- (a) State Nernst distribution law. Derive the modified expression if the solute undergoes dissociation in one of the solvents with degree of dissociation equal of α .

(b) Discuss the application of distribution law to Parke's process for desilverisation of lead. 3,1

SECTION – B

- (a) How can the Kohlrausch's law be applied to determine ?

 - Ionic product of water
 - Solubility of a sparingly soluble salt

(b) During the eletrolysis of a solution of Potassium Chloride between platinum electrodes, the fall in concentration of Chloride ions in the anode chamber is 0.0137 g and 0.00857 g of silver was deposited in a silver coulometer connected in series with cell. What are the transport numbers of the Potassium ion and the chloride ion ? 2,2
- (a) State and explain Ostwald's dilution law. What are its limitations ?

(b) 0.5 N solution of salt placed between two platinum electrodes. 2.0 cm apart and of area of cross-section 4.0 cm² has a resistance of 25 ohms. Calculate the equivalent conductance of the solution. 2,2

SECTION – C

- (a) A zinc rod is dipped in 0.1 μ solution of ZnSO₄ at 25°C. The salt is 95% dissociated at this dilution. Calculate the electrode potential.

Given that $E^\circ_{Zn^{2+}/Zn} = -0.76 V$.

(b) Discuss the main applications of the electrochemical series. 2,2
- (a) Why calomel electrode is preferred over hydrogen electrode as a reference electrode ? Give the reactions occurring on the calomel electrode.

(b) Derive Nernst equation for measuring EMF of a cell. 2,2

SECTION – D

7. (a) Calculate the EMF of the following concentration cell at 25°C :
 $\text{Cd}/\text{CdSO}_4 (m = 0.01, r = 0.383) \parallel \text{CdSO}_4 (m = 1.00, r = 0.042)/\text{Cd}$
- (b) What is the principle of Potentiometric Titrations ? Also give advantages of these titrations. 2,2
8. (a) Calculate the free energy change of the given cell at 298 K :
 $\text{Sn}/\text{Sn}^{2+} (a = 0.6) \parallel \text{Pb}^{2+} (a = 0.3)/\text{Pb}$
Standard EMF of the cell is 0.014 V.
- (b) Define hydrogen over voltage. What are the factors which influence it ? Explain any two applications of it. 2,2

SECTION – E

(Compulsory Questions)

9. (a) What is meant by triple point of water ?
- (b) How does specific conductance vary with dilution ?
- (c) Write Debye-Huckel Onsager equation in terms of dielectric constant (D) and Coeff. of viscosity (η) of the medium at temp T.
- (d) What is liquid junction potential ? How can you minimize it ?
- (e) Why anode is referred as oxidation electrode while cathode as reduction electrode in an electrolytic cell ?
- (f) Give one example each of concentration cell without transference and concentration cell with transference. 1×6=6