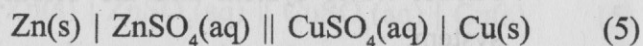


(c) Explain the significance of the Clausius-Clapeyron equation for solid-vapour equilibria using a phase diagram of the water system. (5)

7. (a) Describe the steam-distillation process principle and theory. If a mixture of water and aniline boils at 98.5°C at 760 mm pressure, provided the vapor pressure of water at this temperature is 717 mm, find the composition of distillate. (5)

(b) How a cell stops working if the cell is expressed as below :



(c) Derive the expression for entropy change with EMF of a cell using the relation of free energy change. (5)

7/12/M

December 2023

B.Sc. (Chemistry) - III SEMESTER

Physical Chemistry-III (BCH-303)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.
2. Answer any four questions from Part-B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.

PART-A

1. (a) Derive the expression of the phase rule for non-reactive system. (1.5)
- (b) Describe the phase rule for a reactive system with a suitable example. (1.5)
- (c) Sketch a triangular plot for the $\text{H}_2\text{O}-\text{CHCl}_3-\text{CH}_3\text{COOH}$ system and explain its characteristics. (1.5)
- (d) Write a short note on precipitation titration and explain with one suitable example. (1.5)

- (e) Differentiate primary and secondary batteries with a minimum of three parameters. (1.5)
- (f) Describe the half-cell reaction for Cu-I and Cu-II and what will be the standard oxidation potential? (1.5)
- (g) What is the physical significance of the Gibbs-Duhem-Margules equation? (1.5)
- (h) Predict the feasibility of the reaction of 1 N sulphuric acid with Copper, and Lead. (1.5)
- (i) Discuss the desilverization of lead on the basis of the phase diagram. (1.5)
- (j) Differentiate Physical adsorption and chemisorption. (1.5)

PART-B

2. (a) What are the applications of a phase diagram? How are bivariant, univariant, and non-variant systems represented in the phase diagram? (5)
- (b) Draw a labelled phase diagram of S system and describe in detail the interpretation of the transition curve of S_R and the melting curve of S_M . (5)
- (c) Explain concentration cells with two suitable examples. (5)
3. (a) Why 3-dimensional diagrams are required for studying two-component systems? How is the problem simplified? (5)

- (b) If the distribution coefficient of benzoic acid between water and benzene is 0.304 at 20°C, calculate the number of moles of benzoic acid which may be extracted from 100 ml of 0.2 molar aqueous solution by 10 ml of benzene. (5)
- (c) Write a short note on 'Eutectic Point'. (5)

4. (a) What is the Critical Solution Temperature? Sketch phase diagram for partially miscible liquids such Phenol-Water system and the Triethylamine-Water system. (2+3+3)
- (b) Define Liquid junction potential. Derive an expression for liquid junction potential. (7)
5. (a) Derive an expression for Langmuir adsorption isotherm. (7)
- (b) Differentiate solid-liquid equilibria with congruent and incongruent melting points with suitable examples. Sketch a Phase diagram for a system representing an incongruent melting point. (4+4)
6. (a) Describe the working of quinhydrone electrode. (5)
- (b) Calculate the mean ionic activity coefficient of 0.1 mol Kg^{-1} HCl at 25°C, given that EMF of the cell
- $$\text{H}_2(1 \text{ atm}) \mid \text{HCl(a)}, \text{AgCl(s)} \mid \text{Ag}$$
- is 0.03524 V at 25°C and the standard electrode potential of Ag-AgCl is 0.2224 V at 25°C. (5)