

immersed in solutions of Zn^{+2} ions of 0.1M and 0.01M concentrations. 3

7. (a) Show that the radius ratio value for co-ordination number 3 of a solid is 0.1. 3

(b) Define Law of Rational intercepts for a crystal. 3

(c) 2 moles of HI were heated in a sealed tube at 440 K till the equilibrium state was reached. HI was found to be 22% dissociated. Calculate the equilibrium constant for the dissociation reaction and also calculate the standard free energy change for the reaction. 4

8. (a) Define Hess's law of Heat of Summation. 3

(b) Write down the EMF expression by representing the cell for a reversible cell in which the following reaction persists.



(c) Determine the Miller indices for the plane with its intercepts along the axes are 2a, 3b and 2c respectively. 4



- (c) NO is paramagnetic and NO⁺ is diamagnetic. Using MO configuration justify.
- (d) The metal ion deficient defect MX_{1+δ} is not possible. Justify.
- (e) The rate law for the decomposition of N₂O₅ is given by {Rate = k[N₂O₅]}. Where, k = 6.2 × 10⁻⁴ sec⁻¹. Calculate the half-life and average life of the reaction.
- (f) Calculate the equilibrium K_{eq} for the following reaction at 27°C :



Where the standard emf of the cell is 1.56 V.

- (g) What is the physical significance of free energy change (ΔG) ?
- (h) Write down van't Hoff reaction isotherm giving the significance of all the terms involved there in.

- (i) What role does As₂O₃ play in the synthesis H₂SO₄ by contact process.
- (j) When NH₄Cl is heated alone in a closed vessel it is 1 component system, where as when heated either in presence of NH₃ or HCl then it is two component system. Justify your answer.

(a) Show that the variation of free energy of a system with temperature is a measure of decrease in the entropy of the system at constant pressure. 4

(b) Show that $\left(\frac{\partial V}{\partial T}\right)_P = \left(\frac{\partial S}{\partial P}\right)_T$ 3

(c) Calculate the change in entropy (ΔS) when 1 mole of water is vapourized at 100° C and 1 atmospheric pressure. The latent heat of vaporization of water is 540 cal/gm. 3



3. (a) Show that $C_p - C_v = \left[\left(\frac{\partial E}{\partial V} \right)_T + P \right] \left(\frac{\partial V}{\partial T} \right)_P$

5

(b) Derive Gibb's-Helmholtz equation 5

4. (a) Define phases, components and Degrees of Freedom. Give appropriate examples to support the definition. 6

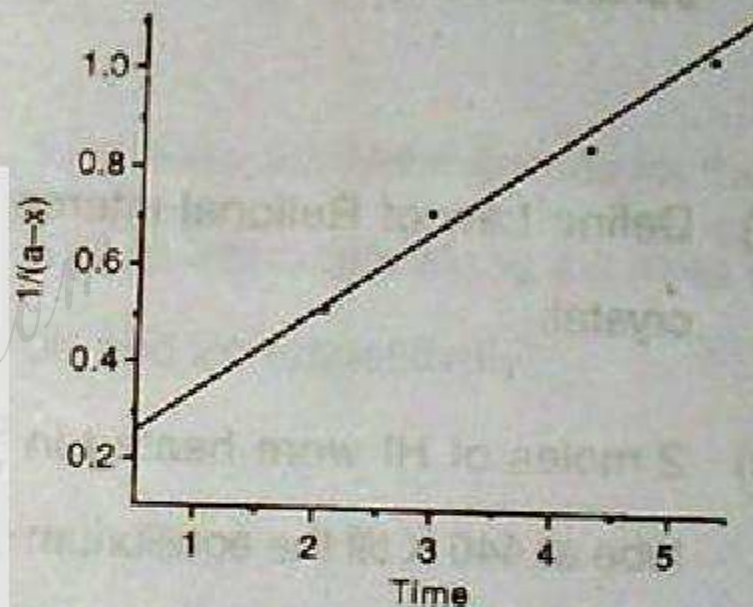
(b) Discuss the phase diagram of Cd-Bi system. 4

5. (a) The half-life of a reaction become 2.5 times if the concentration is made half. What is the order of the reaction ? 3

(b) At 300 K, a 1st order reaction is 50% completed in 20 minutes. At 350 K, the same reaction is 50% in 5 minutes. Calculate the energy of activation of the reaction. 3

(c) The plot of $1/(a-x)$ versus time for a particular reaction is given as follows :

Derive the expression for the rate constant of the reaction. 4



Discuss the working of a calculator battery giving the cell reaction involved there in.

4

(b) What are the main advantages of alkaline battery over dry battery ? 3

(c) Calculate the EMF of a concentration cell at 25°C consisting of two Zn electrodes



Total number of printed pages – 7 **B. Tech**

BSCC 2101/BS 1103

Second Semester Examination – 2009

CHEMISTRY – I

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10
- (a) State Heisenberg's uncertainty principle.
 - (b) Calculate the kinetic energy of an electron emitted from a surface of a metal, by the irradiation of light of frequency $5.5 \times 10^{17} \text{ sec}^{-1}$. The work function of the said metal is $3.62 \times 10^{-12} \text{ erg}$.

P.T.O.

