CHEMISTRY (BSC -105)

CHAPTER 5: FREE ENERGY CHANGE IN CHEMICAL EQUILIBRIA

Q1: Draw well labeled phase diagram of water system. Discuss its main features.

Ans: Do it yourself (from given Notes)

Q2: Draw a well labeled phase diagram of lead-silver system. Discuss the importance of various curves and eutectic point.

Ans: Do it yourself (from given Notes)

Q3: Discuss the desilverization of lead.

Ans: Do it yourself (from given Notes)

- **Q4:** Draw well labeled phase diagram of KI-Water system. Discuss its main features.
- Ans: Do it yourself (from given Notes)
- **Q5:** Draw a well labeled phase diagram of water system and explain the effect of change in pressure on melting curve.

Ans: Do it yourself (from given Notes)

Q6: Calculate the cell e.m.f. and the value of free energy change for the cell reaction at 25°C for the cell:

 $Zn(s) | Zn^{2+}(0.0004 \text{ M}) | | Cd^{2+}(0.2 \text{ M}) | Cd(s)$

E° values at 25°C: $Zn^{2+} | Zn = -0.763 V$; $Cd^{2+} | Cd = -0.403 V$

DOMS Page No. Date Sulution: Gall is your musicine interior Zn(s) 1 Zn2+ (0.0004 m) 11 Cd2+ (0.2m) 1 Cd (s) $Z_{n(s)} + Cd^{2+} \rightarrow Z_{n}^{2+} + Cd_{(s)}$ $E_{Cell}^{\circ} = E_{Cell}^{\circ} Cell + E_{Cell}^{\circ} + Z_{h}^{\circ}$ = - 0.403 - (-0.763) 7 0.36V Acc to Nermost En $= E - 0.059 \ leg [Zn^{2+7}]$ Ē 21 Soubarry philid. [a^{2+]} = 0.36 - 0.059 - lug 0.0004 $\dot{E} = 0.36 - 0.059 (-2.6990)$ = 0.44V 6100 = - nfe SG = -2×96500×0.44 = -84.92 KJ

Q7: Calculate the solubility of AgCl in water if its solubility product is 1.6×10^{-10} at 298 K.

DOMS Page No. Date Slability equilibrium may be shown as! 7. Selution $H_g Ce_{cs} \rightleftharpoons H_g^+ + Ce_{cas}$ Let the sububility of Tice in water be x mile per litre. 0.403 = 1-Sp [Ag+] [Co] x.x =1-x20.0 - 1 Belubility product is 1.6 x10-10 But 0 x^2 10 0 1.6 ×10 = = J 1.6×1010 x = 1.26 × 105 mald Ritne 96500 × 6.44

Q8: Write down the cell reaction and calculate the value of free energy change

the following cell at 298 *K*: $Zn(s) | Zn^{2+}(0.1 M) || Cu^{2+}(0.175 M) | Cu(s)$ Given $E^{\circ}(Zn^{2+}|Zn) = -0.76 V$ and $E^{\circ}(Cu^{2+}|Cu) = 0.34 V$

DOMS Page No. Date Zncs) -> Zne+ + 2e-3. Solution Cu2+ + 20 Cures) -> ". Overall orean is Znes) + Cu2+ -> Zn2+ + Cues Acc. to Nennet 27, Ecol Ecel 0.059 Puc 2 But Ecal = $E^{\circ}(Cu^{+}|Cu)$ (Zn2+ (Zn) 5 X08 51 1. -0.34 - (-0.76) --= CIIV Su Ecen 0.059 0.1 0.17.5 = 1.107 V Eceli 0.... FIFECal 10,01 SG = -213.68 KJ

Q9: The solubility product of lead bromide $(PbBr_2)$ is 8×10^{-5} at 298 K. If the salt is 80% dissociated in saturated solution, calculate the solubility of salt.

DOMS Page No. Date 9. Sulution PbB 312 (6) = Pb²⁺(99) + 2Bn Let solubility of PBBnz is & mule L-1 $k_{SP} = [PB^{+}] [B_{T}]^{2}$ $8 \times 16^5 = 2 \cdot (2x)^2$ 23 23 PC= 8×155. 4 $\alpha = 2.714 \times 16^2 \text{ mod } 1^{-1}$ Selubility of PBBn if it is 80% dissociated 2.714 × 152 80 1.00 22 = 2.192 × 10 mil L Mol. wt of PBBnz = 367 : Selubility : C/ Pb By = 367×2:192×10? (1) × 0022P = 58.04 g2⁻¹

Q10: Calculate the solubility of AgCl(s) in (i) pure water and (ii) a solution of

0.1 M *NaCl* at 25 °C. [K_{sp} (*AgCl*) =
$$2.8 \times 10^{-10}$$
]

DOMS Page No. Date 1 ig+ + ce zi ant 10 Solution 1) Agel 2 Let $[Ag^{\dagger}] = x$, ce7 = x[Ag+] [Ce] KSp x.x -4 1 0 10 62 CC 2.8×1010 1.673 X 105 mil L -'- 2 = a dam ii) Selebility in O.I.M. Nacl Let selubility of Age be x in T $P_{\overline{z}} = 2c, \quad [C_{\overline{z}}] = 0.1 + z = 0.1$ - 0-05.91 Ksp = [Agt] [CE] (20-7 very less) 2.8×10" = X×0.1 2.8×1010 G.1 20 = 2.8×109 ml 2 - - - 0.1.9015 V V 81.0- = 115.3

Q11: Zinc rod is dipped in 0.1 *M* solution of $ZnSO_4$. The salt is 95% dissociated at this dilution at 298 *K*. Calculate the electrode potential of given that $E^{\circ} (Zn^{2+}/Zn) = -0.76 V$.

DOMS Page No. Date 1 11900 ==> 1)at + 00 11 Selution Rag is (1 mile Date) Zn^{2+} + 2e -7 Zn es Charl = x Conc. of ZnSq. = 0.1M -Dissociation is = 95% 2.6×161 0.1 × 95 15.00 = 0.095M Acc. to Nornst : Envite a stalidade (11 Ecell = Ecell . = 2.3.3 RT [22] nP 2410 =1 50 E cell - 0-0591 lug [Zn2] $= E_{(Z_n^{3+}/Z_n)}^{\circ} + \frac{0.0591}{2} lg(0.095)$ -0.76 + 0.0295 (-1.0223) Ecen = -0.76 - 0.03015 Ecell = - 0.79015V Ecen = -0.79 V