2023

Physical Chemistry

B.Sc. III Semester End Examination - 2023

PAPER - CC-5T

Full Marks : 40   *Time : 2 hours*

The figures in the right-hand margin indicate marks.
Candidates are required to give their answers in their own
words as far as practicable.
Illustrate the answers wherever necessary.

Group - A

Answer any five questions :   5×2=10

1. (a) What ms the meaning of $E^\circ_{Cu+2/Cu}$=0.34V?

    (b) Calculate equilibrium constant (K_d) for the decomposition reaction water at 25°C.

    (c) How we can determine transport number of EMF measurement.

    (d) At 27°C and 1 atm pressure, NH_3 is 2.18% decomposed into $N_2(g)$ and $H_2(g)$ in accordance with the equation, $2NH_3(g)=3H_2(g) + N_2(g)$. Calculate K_p of the reaction.

Group - B

Answer any four from the following : 5×4=20

2. (a) If 50 ml HCl and 50 ml H_2O mixed then net volume of the solution will be 100 ml?

   (b) If n_1 mole hydrogen an n_2 moles nitrogen mixed. Calculate Gibbs free enerty of the system. [chemical potential and hydrogen and nitrogen are μ_1 and μ_2 respectively]

   (c) E_{cell} is an intensive or extensive property?   (2+2+1)=5

3. (a) Find out the final concentration H_2, I_2, HI after attained of equilibrium on heating a mixture of one mole H_2 and one mole I_2 at 490°C in a one litre sealed flask assuming that the equilibrium constant 45.9.

   (b) One mole of H_2 and 0.2 mole of CO_2 introduced in vaccum flask at 450°C, reacts as $H_2(g) + CO_2(g) \rightarrow H_2O(g) + CO(g)$. At equilibrium, the pressure is 0.5 atm and the amount of steam is 10 mole percent. Find the equilibrium constant at 450°C. Assuming ideal behaviour, calculate the volume of the flask. $2\frac{1}{2}×2=5$

4. (a) A galvanic cell is not truely reversible cell – Justify.

   (b) Difference between electronic conductor and ionic conductor.   (3+2)=5

5. (a) Calculate the quantity of electricity which would be required to reduce 9.84 gm nitrobenzene to aniline. If voltage across the electrolyte will be 2.4 volt, what amount of energy would be consumed in the process?

   (b) Calculate the Avogardo number from Faraday law of electrolysis?   3+2=5

6. (a) At 25°C, specific conductance of saturated solution of $SrSO_4$ and that of water used are $1.482×10^{-4}$ and $1.5×10^{-6}$ ohm^{-1} cm^{-1} respectively. Given ionic conductance of Sr^{+2} and SO_4^{2-} and 59.46 and 79.8 Ohm^{-1} cm^2 (g.equiv)$^{-1}$ respectively at this temperature. Calculate solubility in g/L. [The formula weight of $SrSO_4$ is 182]

   (b) Discuss about electrolyte concentration cell.   (3+2)=5

7. (a) Consider the metal | metal ion electrode $M(s) \rightarrow M^{+n}+ne$. If the electrode potential changes on 0.03 volts for ten-fold change in the conc. of M^{+n}, calculate the valur of n.

   (b) A Colution of Fe^{+2} is titrated potentiometrically using Ce^{+4} solution. Calculate the emf of redox electrode this formed when (i) 50% of Fe^{+2} is titrated. (ii) 90% of Fe^{+2} is titrated and (iii) 110% titration is done.
   Given $Fe^{+2} \rightarrow Fe^{+3} +e$, $E^0=-0.77V$,
   $Fe^{+2} + Ce^{+4} \rightarrow Fe^{+3} + Ce^{+3}$; $K=10^{14}$ 2+3=5

(4)

Group - C

Answer one from the following :   1×10=10

8. (a) Sketch the conductometric titration curve the titration between $AgNO_3$ vs HCl explain.

    (b) Discuss Wine effect.

    (c) The solubility product of AgBr(s) is 5×10^{-13} at 25°C. If the standard reduction potential of the half cell $E^o_{Ag/AgBr/Br} = 0.07$ V.

    What will be the standard reduction potential of $E^o_{Ag^+/Ag}$?

    (d) What is primary reference electrode.   3+3+3+1

9. (a) "If the standard Gibbs function change of a reaction is zero, the reaction is thermodynamically impossible."– State whether the statement is true or false. Justify.

    (b) Discuss the effect of viscosity on the addition of solute to a solvent.

    (c) Prove that a $(\partial A/\partial ni)_{T,V,nj} = (\partial H/\partial ni)_{S,P, nj}$

    (d) Find ΔG_{mix} and ΔV_{mix} when 1.0 mole of benzene is mixed with 2.0 moles of toluene at 20°C and 1 atm. Treat the solution as ideal. Which one is the redundant datum?   2+2+3+3=10