



( 2 )

- (f) Write the condition for the spontaneity of a reaction.
- (g) Mention a direct and indirect method for the determination of transport number.
- (h) At 2000K,  $\Delta G^0 = 22000 - 2.5 \times T$ . Calculate  $K_p$  at the temperature.

**Group - B**

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

- 2. (a) Difference between molar volume and partial molar volume.
- (b) Discuss the effect of temperature on chemical potential. (2½×2)=5
- 3. (a) State Le Chatelier principle and discuss its thermodynamic basis. Using this principle, explain why we observe a lowering vapour pressure when a non-volatile solute is added to it.
- (b) In the reaction,  $N_2 + 3H_2 = 2NH_3$ , initially 0.80 moles of  $NH_3$ , 0.70 moles of  $H_2$  and 0.40 moles of  $N_2$  are present. At the later time t, 0.55 moles of  $H_2$  is present, Find advancement of the reaction and find the moles of  $NH_3$  and  $N_2$  present at time t. (2+3)=5

( 3 )

4. (a) A galvanic cell is not truly reversible cell –Why?  
(b) Why Voltmeter is not used for emf measurement.  
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 energy would be consumed in the process.  
(b) Calculate the Avogadro number from Faraday law of electrolysis?  
(3+2)=5
6. (a) A 4 molal  $\text{FeCl}_3$  solution is electrolyzed between platinum electrodes. After the electrolysis in cathode solution weighing 30 gm is 3.15 molal in  $\text{FeCl}_3$  and 1 molal in  $\text{FeCl}_2$ . What is the transport number of  $\text{Fe}^{+3}$  and  $\text{Cl}^-$  ions.  
(b) Discuss the origin of electrode potential. (3+2)=5
7. (a) Write a short note on Glass electrode.  
(b) Draw the potentiometric titration curve (E vs V) for the titration of a weak acid by strong base. Explain how you would get pKa of acid from the plot. Also explain the nature of  $\Delta E/\Delta V$  vs V curve in this case.  
(2+3)=5

( 4 )

**Group - C**

**Answer any one from the following (1×10)=10**

8. (a) For the reaction  $N_2O_4(g) = 2NO_2(g)$ , measurements of the composition of equilibrium mixture gives  $K_p = 0.144$  at  $25^\circ C$  and  $0.321$  at  $35^\circ C$ . Find  $\Delta H^0$ ,  $\Delta G^0$  and  $\Delta S^0$  at  $25^\circ C$  for the reaction. State any assumptions made.

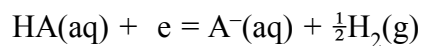
(b) Write mechanism of Galvanic cell.

(c) Express chemical potential for real system.

(4+3+3)=10

9. (a) The emf of a reaction is given by  $E = E^0 - (0.059/n) \log X$ . Explain how  $X$  and  $\log X$  will change if the overall cell reaction is multiplied by 2. Will there be any change in  $E$  value due to such an operation?

(b) The thermodynamic dissociation constant of a weak acid (HA) is  $1.0 \times 10^{-5}$  at  $25^\circ C$ . Find the standard electrode potential ( $E^0$ ) for the half cell reaction.



(c) Discuss Walden rule.

(3+3+4)=10