Q.1. Cal $\Lambda_m^\infty(CH_3COOH)$, given limiting Λ_m^∞ of HCl, NaCl and CH_3COONa are 4.26×10^{-2}, 1.26×10^{-2} & 9.1×10^{-3} $S\,cm^2\,mol^{-1}$

Sol.
$$\Lambda_m^\infty(CH_3COOH) = \Lambda_m^\infty(CH_3COONa) + \Lambda_m^\infty(HCl) - \Lambda_m^\infty(NaCl)$$

$$= 0.91 \times 10^{-2} + 4.26 \times 10^{-2} - 1.26 \times 10^{-2}$$
$$= 10^{-2}(3.91) \Rightarrow \Lambda_m^\infty(CH_3COOH) = 3.91 \times 10^{-2}$$

Ques2. Cal λ_m^∞ of $Ba(OH)_2$ given

Electrolyte	λ_m^∞ ($S\,cm^2\,mol^{-1}$)
$BaCl_2$	280×10^{-4}
$2 \times NaCl$	126.5×10^{-4}
$2 \times NaOH$	248×10^{-4}

Sol.

$$\lambda_m^\infty Ba(OH)_2 = \lambda_m^\infty(BaCl_2) + 2\lambda_m^\infty(NaOH) - 2\lambda_m^\infty(NaCl)$$

$$= 280 \times 10^{-4} + 2 \times 248 \times 10^{-4} - 2 \times 126.5 \times 10^{-4}$$

$$= 523 \times 10^{-4}\ S\,cm^2\,mol^{-1}$$

Q.3. The conductivity of 0.01 M Solⁿ of NH_4OH is $1.15 \times 10^{-4}\ S\,cm^{-1}$. Given: $\Lambda^{\infty}_{m}(NH_4^+) = 73.6\ S\,cm^2\,mol^{-1}$

$\Lambda^{\infty}_{m}(OH^-) = 197.4$ — " —

Cal. (1) molar Conductance of NH_4OH ($\Lambda_m = ?$)

(2) $\alpha_{(NH_4OH)}$ (3) $K_{b(NH_4OH)}$

Sol. given: $M = 0.01\,M$, $K = 1.15 \times 10^{-4}\ S\,cm^{-1}$

$\Lambda^{\infty}_{m}(NH_4^+) = 73.6\ S\,cm^2\,mol^{-1}$

$\Lambda^{\infty}_{m}(OH^-) = 197.4$ — " —

(i) $\Lambda_m = \frac{K \cdot 1000}{M}$

$\Lambda_m = \frac{1.15 \times \cancel{10^{-4}} \times \cancel{10^{3}}}{\cancel{10^{-2}}}$

$\Lambda_m = 1.15 \times 10 \Rightarrow \boxed{\Lambda_m = 11.5}$

$\alpha = \frac{11.5}{271}$

$\% \alpha = \cancel{\frac{11.5}{271}} \times \cancel{100}$

$\boxed{\alpha = 4 \%}$

(2) $\alpha = \frac{\Lambda_m(NH_4OH)}{\Lambda_m^\infty(NH_4OH)}$

$\Lambda_m^\infty(NH_4OH) = \Lambda_m^\infty(NH_4^+) + \Lambda_m^\infty(OH^-)$

$73.6 + 197.4$

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(3) $k_b = \frac{C\alpha^2}{1-\alpha}$

if $\alpha << 1$ then $1-\alpha \simeq 1$

$(\alpha \leq 5\%)$

$k_b = C\alpha^2$

$k_b = 10^{-2}(0.04)^2$

$= 10^{-2} \times (4 \times 10^{-2})^2$

$$\boxed{k_b = 16 \times 10^{-6}}$$

PART-2

(CELL)

Cell :- Combination of two eleltrode.

- Galvanic Cell (Chemical energy to Electrical energy)
- Electrolytic cell (Electrical energy to Chemical energy)

Galvanic cell :-

It is based on indirect redox reaction (oxidation and reduction)

ex:- Daniel cell

$Zn_{(s)} \rightarrow Zn^{2+} + 2e^-$
e^-
Zn rod (s)
Cu rod (s)
$Cu^{2+} + 2e^- \rightarrow Cu_{(s)}$
i
(KCl + KNO_3)
Salt bridge
Cl^-
K^+
Zn^{2+}
Cu^{2+}
Cotton plucked
$ZnSO_{4(aq)}$
$CuSO_{4(aq)}$
Anode (-ve)
Cathode (+ve)