Electrochemistry B.Sc. (II) Sub
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Ex.7. The specific Conductivity of a solution Containing 1.0 g of anhydrous $BaCl_2$ in 200 cm^3 of the solution has been found to be 0.0058 $S\,cm^{-1}$. Calculate the molar and equivalent Conductivity of the Solution. Molecular Wt. of $BaCl_2$ = 208.

Sol.

Molarity of $BaCl_2 = \frac{1 \times 1000}{208 \times 200} = 0.024\,M$

Also normality of $BaCl_2 = 0.024 \times 2 = 0.048\,N$ ($\because N = M \times v.f$)

Now $\mu = K \times \frac{1000}{C_M} = \frac{0.0058 \times 1000}{0.024}$

$= 241.67\ S\,cm^2\,mol^{-1}$

Also $\lambda = K \times \frac{1000}{C_N} = \frac{0.0058 \times 1000}{0.048}$

$= 120.83\ S\,cm^2\,equiv^{-1}$

Ex.8 The resistance of a solution 'A' is 50 ohm and that of solution 'B' is 100 ohm, both solution being taken in the same conductivity cell. If equal volumes of solutions A and B are mixed, what will be the resistance of the mixture using the same cell?

Sol. Let K_1 and K_2 be the specific conductance of the solution A and B respectively and the cell constant of the cell be X.

For solution A: Sp. Conductance = Conductance × Cell Constant

$$K_1 = \frac{1}{50} \times X \text{ --- (i)}$$

For solution B: Sp. Conductance, $K_2 = \frac{1}{100} \times X$ --- (ii)

When equal volumes of A and B are mixed, both the solutions get doubly diluted, hence their individual contribution towards the Sp. Conductance of the mixture will be $\frac{K_1}{2}$ and $\frac{K_2}{2}$ respectively and the Sp. Conductance of the mixture will be $\frac{1}{2}(K_1 + K_2)$.

$\therefore$ For the mixture, $\frac{1}{2}(K_1 + K_2) = \frac{1}{R} \times X$ — (iii)

(R is the resistance of mixture)

From equation (i), (ii) and (iii); $R = 66.67$ ohm

Ex.9 The value of μ^∞ for NH_4Cl, NaOH and NaCl are 129.8, 248.1 and 126.4 $ohm^{-1}\ cm^2\ mol^{-1}$ respectively. Calculate μ^∞ for NH_4OH Solution.

Sol. $\mu^\infty_{NH_4OH} = \mu^\infty_{NH_4Cl} + \mu^\infty_{NaOH} - \mu^\infty_{NaCl}$

$= 129.8 + 248.1 - 126.4$

$\mu^\infty_{NH_4OH} = 251.5\ ohm^{-1}\ cm^2\ mol^{-1}$

Ex.10 Calculate molar Conductance for NH_4OH, given that molar Conductances for $Ba(OH)_2$, $BaCl_2$ and NH_4Cl are 523.28, 280.0 and 129.8 $ohm^{-1}\ cm^2\ mol^{-1}$ respectively.

Sol. $\mu^{\infty}_{Ba(OH)_2} = \lambda^{\infty}_{Ba^{2+}} + 2\lambda^{\infty}_{OH^-} = 523.28$ —— (i)

$\mu^{\infty}_{BaCl_2} = \lambda^{\infty}_{Ba^{2+}} + 2\lambda^{\infty}_{Cl^-} = 280.00$ —— (ii)

$\mu^{\infty}_{NH_4Cl} = \lambda^{\infty}_{NH_4^+} + \lambda^{\infty}_{Cl^-} = 129.80$ —— (iii)

$\mu^{\infty}_{NH_4OH} = \lambda^{\infty}_{NH_4} + \lambda^{\infty}_{OH^-} = ?$

Eq.(iii) + $\frac{Eq.(i)}{2} - \frac{Eq.(ii)}{2}$ will gives

$\lambda^{\infty}_{NH_4^+} + \lambda^{\infty}_{OH^-} = \lambda^{\infty}_{NH_4OH^-} = \frac{502.88}{2}$

$= 251.44 \ ohm^{-1} cm^2 mol^{-1}$