Electrochemistry B.Sc. (II) Sub
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Ex.1. How many moles of electrons are needed for the reduction of 20mL of 0.5M solution of $KMnO_4$ in acid medium?

Sol. Moles of $KMnO_4 = M \quad V(L) = 0.5 \quad 20 \quad 10^{-3} = 10^{-2}$

[$\because Mn^{7+} + 5e^- \rightarrow Mn^{2+}$]

$\therefore$ 1 mol $KMnO_4$ required $= 5$ mol e^-

$\therefore$ 10^{-2} mol $KMnO_4$ required $= 5 \quad 10^{-2}$ mol e^-

Ex.2 An aqueous solution of NaCl is electrolysed with inert electrodes. Write the equations for the reactions taking Place at Cathode and anode. What happens if $NaNO_{3(aq.)}$ is used instead of NaCl?

Sol. For $NaCl_{(aq.)}$ anode : $2Cl^- \rightarrow Cl_2 + 2e^-$

Cathode : $2H^+ + 2e^- \rightarrow H_2$

For $NaNO_{3(aq)}$ anode : $2OH^- \longrightarrow H_2O + 1/2 O_2 + 2e$

Cathode : $2H^+ + 2e^- \longrightarrow H_2$

Ex.3 On electrolysing $CuSO_4$ Solution in presence of Pt, the Solution becomes Colourless, blue Colour of Solution disappears. why ?

Sol. At Cathode : $Cu^{2+} + 2e^- \longrightarrow Cu$

At anode : $2OH^- \longrightarrow H_2O + 1/2 O_2 + 2e$

Cu^{2+} ions are reduced and blue Colour is due to Cu^{2+}.

Ex.4 Colour of KI Solution Containing Starch turns blue when Cl_2 Water is added. Explain.

Sol. Chlorine placed below iodine in electrochemical series having more reduction potential and thus shows reduction whereas I^- undergoes oxidation. The I_2 So formed get Absorbed in starch to give blue Colour.

$$2I^- \longrightarrow I_2 + 2e^-$$

$$Cl_2 + 2e^- \longrightarrow 2Cl^-$$

$$Cl_2 + 2I \longrightarrow I_2 + 2Cl^-$$

Ex.5 The resistance of a 0.01 N solution of an electrolyte was found 210 ohm at 298 K using a Conductivity Cell with a Cell Constant of $0.88\ cm^{-1}$. Calculate specific Conductance and equivalent Conductance of solution.

Sol. Given for 0.01 N Solution.

$$R = 210 \text{ ohm}$$

$$\frac{l}{A} = 0.88\ Cm^{-1}$$

Specific Conductance

$$\therefore \quad K = \frac{1}{R} \times \frac{l}{A}$$

$$K = \frac{1}{210} \quad 0.88 = 4.19 \quad 10^{-3} \text{ mhocm}^{-1}$$

$$\lambda_{eq} = \frac{K \times 1000}{N}$$

$$\lambda_{eq} = \frac{4.19 \times 10^{-3} \times 1000}{0.01}$$

$$\lambda_{eq.} = 419 \text{ mho } cm^2 \text{ } eq^{-1}.$$

Ex.6 The conductivity of pure water in a conductivity cell with electrodes of cross-sectional area 4 cm^2 placed at a distance 2 cm apart is 8×10^{-7} S cm^{-1}. Calculate:

(a) the resistance of water.

(b) the current that would flow through the cell under the applied potential difference of 1 Volt.

Sol. Cell Constant $= \frac{l}{A} = \frac{2}{4} = \frac{1}{2} cm^{-1}$

(a) Also $K = \frac{1}{R} \times \frac{l}{A}$

$$R = \frac{1}{K} \times \frac{l}{A} = \frac{1}{8 \times 10^{-7}} \times \frac{1}{2} = 6.25 \times 10^5 \text{ ohm}$$

(b) From Ohm's law, $\frac{V}{I} = R$ $\therefore I = \frac{1}{6.25 \times 10^5} = 1.6 \times 10^{-6}$ ampere