

Electrochemistry B.Sc. (II) Sub

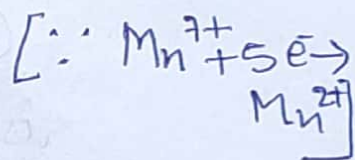
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Ex. 1. How many moles of electrons are needed for the reduction of 20 ml of 0.5 M solution of  $\text{KMnO}_4$  in acid medium?

Sol. Moles of  $\text{KMnO}_4 = M \times V(L) = 0.5 \times 20 \times 10^{-3} = 10^{-2}$



$\therefore 1 \text{ mol } \text{KMnO}_4 \text{ required} = 5 \text{ mole } e^-$

$\therefore 10^{-2} \text{ mol } \text{KMnO}_4 \text{ required} = 5 \times 10^{-2} \text{ mole } e^-$

Ex. 2 An aqueous solution of  $\text{NaCl}$  is electrolysed with inert electrodes. Write the equations for the reactions taking place at cathode and anode. What happens if  $\text{NaNO}_3(\text{aq})$  is used instead of  $\text{NaCl}$ ?

Sol. For  $\text{NaCl}(\text{aq})$  anode :  $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2e^-$

Cathode :  $2\text{H}^+ + 2e^- \rightarrow \text{H}_2$

For  $\text{NaNO}_3(\text{aq})$  anode :  $2\text{OH}^- \longrightarrow \text{H}_2\text{O} + \frac{1}{2}\text{O}_2 + 2\text{e}^-$

Cathode :  $2\text{H}^+ + 2\text{e}^- \longrightarrow \text{H}_2$

Ex. 3 On electrolysis of  $\text{CuSO}_4$  solution in presence of Pt, the solution becomes colourless, blue colour of solution disappears. Why?

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

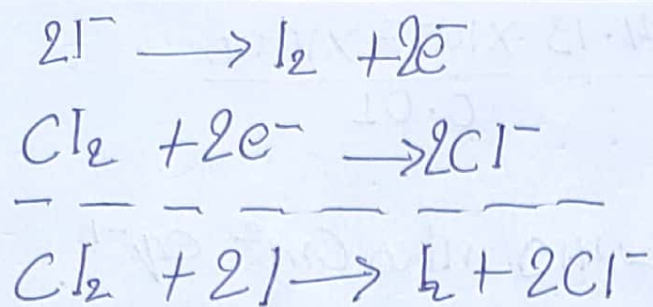
At anode :  $2\text{OH}^- \longrightarrow \text{H}_2\text{O} + \frac{1}{2}\text{O}_2 + 2\text{e}^-$

$\text{Cu}^{2+}$  ions are reduced and blue colour is due to  $\text{Cu}^{2+}$ .

Ex. 4 Colour of KI solution containing starch turns blue when  $\text{Cl}_2$  water is added. Explain.

Sol. Chlorine placed below iodine in electrochemical series having more reduction potential and thus shows reduction whereas  $\text{I}^-$  undergoes oxidation. The  $\text{I}_2$  so formed get absorbed in starch to give blue colour.





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  $0.88 \text{ cm}^{-1}$ . Calculate specific conductance and equivalent conductance of solution.

Sol. Given for 0.01 N solution.

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

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

Specific Conductance

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

$$K = \frac{1}{210} \times 0.88 = 4.19 \times 10^{-3} \text{ mho cm}^{-1}$$

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

$$\lambda_{eq} = \frac{4.13 \times 10^{-3} \times 10000}{0.01}$$

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

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

(a) the resistance of water.

(b) the current that would flow through the cell under the applied potential difference of  $1 \text{ Volt}$ .

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

(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,  $\frac{V}{I} = R \therefore I = \frac{1}{6.25 \times 10^5} = 1.6 \times 10^{-6} \text{ ampere}$