Topic - Electrochemistry

The study of chemical reaction which are caused by passing electric current is known as electrochemistry.

Electrolyte - A solution in which current can pass
Ex- NaCl

Electrodes

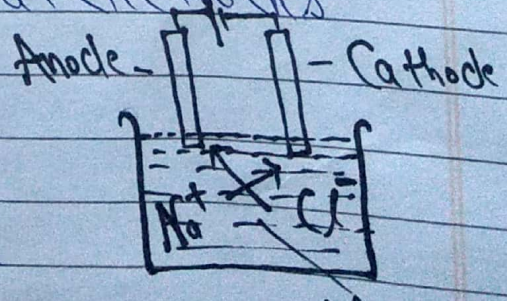
- Anode (Positive electrode)
- Cathode (Negative Electride)

Ions

- Cations (Positive ion)
- Anions (Negative ion)

Electrolysis - The decomposition of electrolyte on passing electric current is known as Electrolysis

Electrolysis of NaCl - When current is passed through molten Sodium Chloride by the help of electrodes, NaCl breaks up into Na^+ and Cl^- following reaction take place at electrodes



At Cathode $Na^+ + e^- \rightarrow Na$

At Anode $2Cl^- + 2e^- \rightarrow Cl_2$

Rxn $2NaCl \xrightarrow{\text{Current}} 2Na + Cl_2$

Faraday's law of Electrolysis - Faraday gives two laws of Electrolysis.

I^st law - According to this law in the process of electrolysis mass deposit on electrodes is directly proportional to quantity of current pass

$$m \propto q$$
$$m \propto it \quad (\because q = it)$$
$$\text{so } \boxed{m = Zit}$$

Where Z is constant known as Electro chemical equivalence. Unit of Z is gm/Coulomb

II^nd law - According to this law if same amount of current is passed through two different Sol^n then mass deposit on electrodes is directly proportional to equivalent wt

$$m \propto E$$
$$\text{OR } \frac{m}{E} = \text{Constant}$$
$$\text{so } \frac{m_1}{E_1} = \frac{m_2}{E_2}$$
$$\text{OR } \boxed{\frac{m_1}{m_2} = \frac{E_1}{E_2}}$$

Cond^n

$$F = 96500 \text{ Coulomb}$$

(Faradday)

Types of Numerical -

2016, 17

Ques 1- A current 3A passing through $AgNO_3$ solution for 20 min deposit 4 gm Silver. Calculate E.C.E of Ag.

Soln

$m = Zit$ $\qquad t = 20 \text{ min} = 20 \times 60 = 1200 \text{ sec}$

$4 = Z \times 3 \times 1200$

$Z = \frac{1}{300}$ gm/Coulomb **Ans**

Ques 2- Same amount of Current for same time through $AgNO_3$ and $CuSO_4$ solution, 0.390 gm Cu and 1.322 gm Ag collected on Electrodes. If Equivalent wt of Cu is 31.8 find Equivalent wt of Ag.

Soln

$m_{Cu} = 0.390$ gm, $m_{Ag} = 1.322$ gm

$E_{Cu} = 31.8$, $E_{Ag} = ?$

So $\frac{m_{Cu}}{m_{Ag}} = \frac{E_{Cu}}{E_{Ag}}$

$\frac{0.390}{1.322} = \frac{31.8}{E_{Ag}}$

So $E_{Ag} = \frac{31.8 \times 1322}{0.390} = 107.9$

Short Cut $\boxed{\frac{\text{mass}}{\text{atomic wt}} \times \text{Charge} = \frac{it}{96500}}$

2017-

Ques3- How much quantity of Cu will be deposit on electrode by passing 0.5 ampere current for 30 min in $CuSO_4$ Soln. (Atomic wt of Cu = 63.5)

Soln

$m = ?$, $i = 0.5\ A$, $t = 30\ min = 30 \times 60 = 1800\ sec$

$$\frac{\text{Mass}}{\text{At wt}} \times \text{Charge} = \frac{it}{96500}$$

$$\text{So } \frac{m}{63.5} \times 2 = \frac{0.5 \times 1800}{96500}$$

After Solving So $\boxed{m = 0.296\ gm}$

Ques4- 20.149m Ag is deposited on electrodes by passing 5 Ambere Current for 70 min in $AgNO_3$ Soln. find out E.C.E (Ans $Z = 0.00096$)

2018

Ques5- Same amount of Current passes for same time through $AgNO_3$ and $CuSO_4$ Soln. Eq wt of Ag is 68 and for Cu is 31.5. Calculate quantity of Cu deposited on electrode if quantity for Ag is 45gm (Ans- 13.12 gm)

Ques6- How much electric Current will be passed in KI Soln to liberate 10 gm I_2 in 1 hour. (Ans- 2.1 A)

Ques 7- A cell Consist of Zinc Sulphate Soln. How much Zinc will be deposit if 12 A current passed for 2 hours. (Ans - 29.2 gm)

Ques 8- 0.25A Current is passed for 1 hour in $CuSO_4$ Soln Calculate the amount of Cu liberated on electrode. (Ans - 0.2969)

Ques 9- If 0.5A Current passed for 30 min in a Soln of $AgNO_3$ and 1.006 gm Ag Silver is deposit on electrode. Calculate E.C.E (Z = 0.00111778 gm/Coulomb)