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Electrochemistry

1. What do you mean by electrochemical cell? What are the diff. betn a Galvanic cell & Electrolytic cell?

=> An Electrochemical cell is a device in which chemical energy is converted into electrical energy or electrical energy is converted into chemical energy.

Galvanic cell	Electrolysis cell
i) In this cell, chemical energy is converted into electrical energy	i) In this cell, electrical energy is converted into chemical energy
ii) The reaction is spontaneous	ii) The reaction is non-spontaneous
iii) Anode is negative part of cell. Cathode is positive part of cell.	iii) Anode is positive part of cell. Cathode is negative part of cell.
iv) Respective electrodes are dipped in their respective salt soln eg: battery in vehicle	iv) Both electrodes are dipped in some electrolytic soln eg:- electrolysis.

2. What do you understand about single electrode potential? Explain how you would measure the standard electrode potential of Zn electrode.

=> The potential which a developed due to the separation of charge is solid - liquid interface is called single electrode potential.

We measure the standard electrode potential of the Zn electrode by constructing a galvanic cell with standard hydrogen electrode (SHE) as shown:-

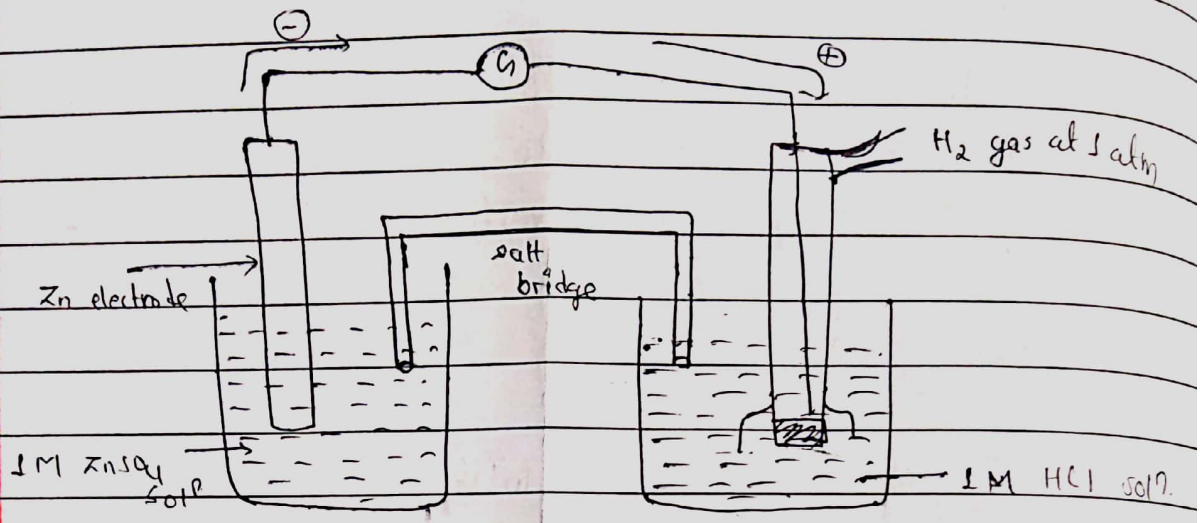

fig:- Measurement of standard electrode potential of Zn-electrode

An electrode containing Zn-rod dipped in 1M sol^n of $ZnSO_4$ is combined with standard hydrogen electrode. The flow of electrons takes place from zinc electrode to hydrogen electrode. So Zn act as anode & H_2 electrode act as cathode. The cell is represented by.

$$^{\ominus}Zn(s) \mid Zn^{++}(aq.\ 1M) \parallel 2H^{+}(aq.\ 1M) \mid H_2(g, 1\ atm)$$

The cell reaction are.

At anode

$Zn \longrightarrow Zn^{++} + 2e^{\ominus}$ $\quad E_A = ?$

At cathode

$2H^{+} + 2e^{-} \longrightarrow H_2$ $\quad E_c = 0.0V$

Net rxn :- $Zn + 2H^{+} \longrightarrow Zn^{++} + H_2(\uparrow)$.

Thus we can write

$$E^\circ_{cell} = E^\circ_A + E^\circ_c$$

$$0.76 = E_{Zn|Zn^{++}} + E^\circ_{Pt|H_2}$$

$$E^\circ_{Zn|Zn^{++}} = 0.76$$

Std. Electrode potential of Zn electrode is 0.76 volt.

Q.3 Define electrode potential & standard electrode potential. What is a normal hydrogen electrode? Why is it used as a reference electrode?

⇒ The potential developed due to the separation of charge in solid, liquid interface when metal is dipped in its ionic soln is electrode potential.

When electrode potential is measured at standard condn (i.e. temp = 25°c) concentration of electrolyte = 1M & if gaseous electrode its pressure = 1 atm), it is called standard electrode potential.

Normal hydrogen electrode is a reference electrode which consists of platinum (Pt) wire sealed in a glass tube & platinum foil attached to it which is dipped into an acid soln containing H^+ ions at 1M with pure H_2 gas at 1 atm pressure at 25°c.

It is used as a reference electrode because electrode potential of normal hydrogen electrode is 0V at 25°c. Thus, when used to form galvanic cell with other electrodes, we can make the ~~cat~~ electrode potential of other electrode.

4) Write the cell notation & cell reaction of Daniell cell.

=> Galvanic cell consisting of Zn-Cu electrodes is Daniell cell. The cell notation is

$\ominus Zn(s) | Zn^{++}(aq.1M) || Cu^{++}(aq.1M) | Cu(s) \oplus$

The cell reaction is as follows.

At cathode

$Cu^{++} + 2e^- \longrightarrow Cu$

At anode

$Zn \longrightarrow Zn^{++} + 2e^-$

Net cell rxn : $Zn + Cu^{++} \longrightarrow Zn^{++} + Cu$.