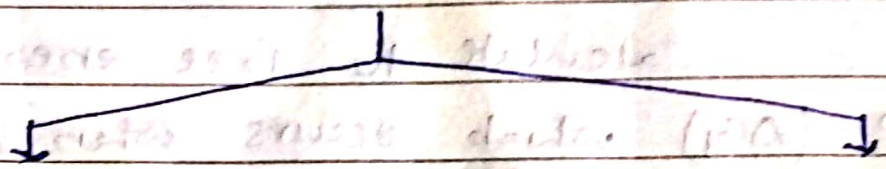
Notes Electrochemical Cell

A cell is a device which convert electrical energy in to chemical energy and vice-versa.



1). **Electrolytic cell :-** A device in which electrical energy is converted into chemical energy by passing an electric current to produce the desired chemical change is called an electrolytic cell and the process is called Electrolysis.

2). **Electrochemical cell :-**

A device which convert chemical energy in to electrical energy. It is also called galvanic cell.

Daniell cell is a well known

example of electrochemical cell.

* Electrode potential :-

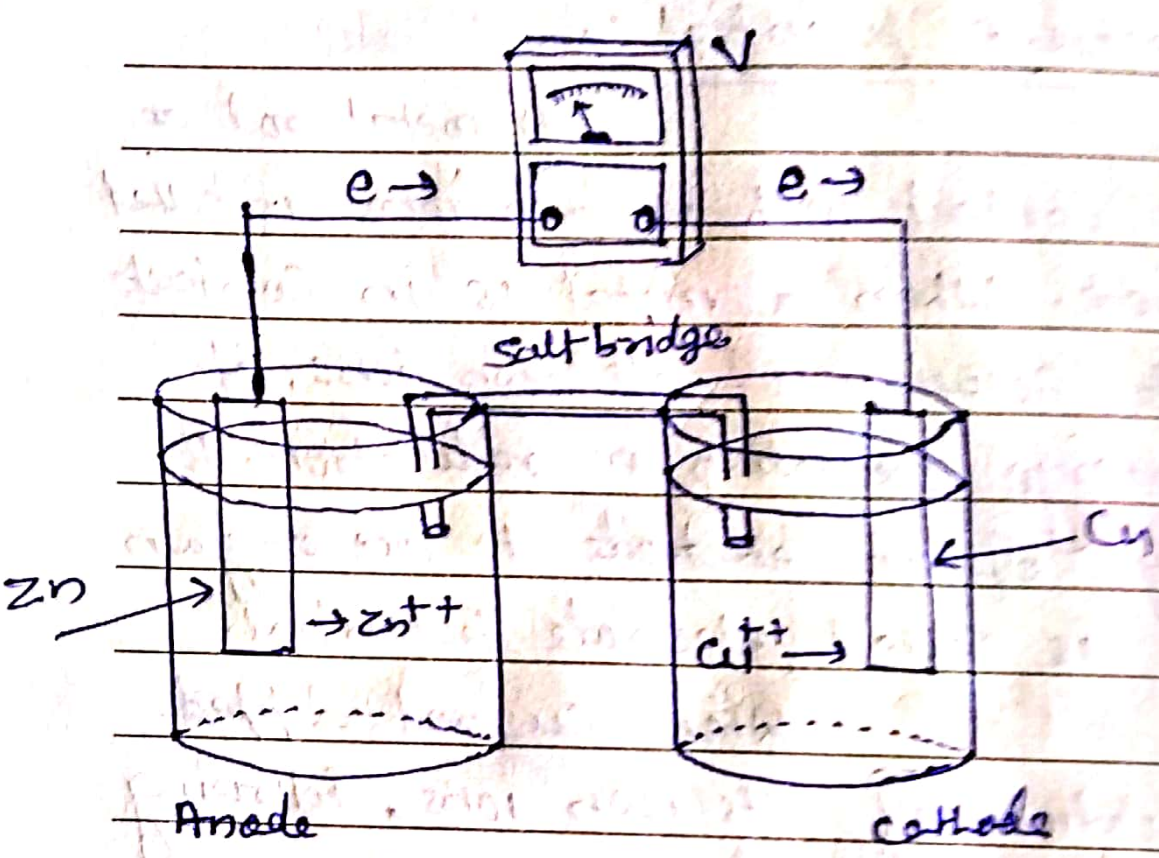
A metal rod or plate is contact with its own ions is called an electrode. When a metal is in contact with the solution of its own ions, it can undergo oxidation or reduction. The tendency of an electrode to lose or gain electrons is called electrode potential.

When Cu rod dipped in to solution of its own ions, following equilibrium exists -

$$Cu(s) \rightleftharpoons Cu^{++}(aq) + 2e^-$$

When such an equilibrium is reached, a separation of +ve and -ve charges would occurs. This separation creates a potential difference between metal rod and the solution. This potential difference is called the electrode potential.

Daniell cell :-



$Zn \rightarrow Zn^{++} + 2e^-$ oxidation

$Cu^{++} + 2e^- \rightarrow Cu$ Reduction

Function of salt bridge :-

1). It maintains the electrical neutrality of the two electrolyte solution.
2). It also completes the circuit.
3). It prevents the intermixing of the solution of both the half cells.

* Cell Potential and EMF of the cell :-

An electrochemical cell consists of two electrodes which have different electrode potential. The difference in electrode potential which causes the current to flow from the electrode at a higher potential to lower potential is known as the cell potential or emf of the cell.

This difference in potential can be measured by using a voltmetre.

When the cell potential is zero, the reaction is at equilibrium and no work is done.

* Calculation of E°_{cell} :-

$$E^\circ_{cell} = E^\circ_R - E^\circ_L$$

= (Standard reduction potential of right electrode) − (Standard reduction potential of left electrode).

Notes

for eg:-

$$Zn + CuSO_4 \longrightarrow ZnSO_4 + Cu.$$

Oxidation :-

$$Zn(s) \longrightarrow Zn^{++}_{(aq)} + 2e^-$$

Reduction :-

$$Cu^{++}_{(aq)} + 2e^- \longrightarrow Cu(s)$$

Given, $E^{\circ}_{Zn^{++}/Zn} = -0.76\,V$

$E^{\circ}_{Cu^{++}/Cu} = 0.34\,V$

Cell representation :-

$$Zn \,|\, Zn^{++} \,||\, Cu^{++} \,|\, Cu$$

(salt bridge.)

$$E^{\circ}_{cell} = E^{\circ}_{Cu^{++}/Cu} - E^{\circ}_{Zn^{++}/Zn}$$

$$= 0.34\,V - (-0.76\,V)$$

$$= 0.34\,V + 0.76\,V$$

$$E^{\circ}_{cell} = 1.10\,V.$$