

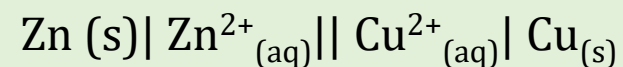
# Chemical Cell

- A chemical cell is a device that converts chemical energy into electrical energy. Most batteries are chemical cells. A chemical reaction takes place inside a chemical cell which results in the flow of electric current.

## EMF of a cell

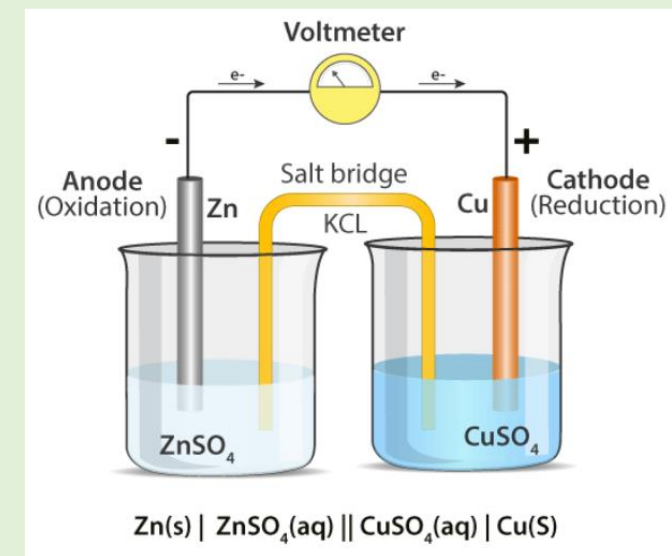
It is the potential difference across the terminals of a cell when no current is being drawn from it.

## Standard EMF of a cell ( $E^{\circ}_{\text{Cell}}$ )



$$E^{\circ}_{\text{cell}} = E^{\circ}_{\text{Cu}^{2+}/\text{Cu}} - E^{\circ}_{\text{Zn}^{2+}/\text{Zn}}$$

$$E^{\circ}_{\text{cell}} = E^{\circ}_{\text{red}} - E^{\circ}_{\text{oxid}}$$



- The potential difference across the terminals of a cell when the concentration of the species taking part in the electrode reactions is unity (1 Molar), if any gas appears in the reaction, it is said to have a pressure of 1 bar and further the reaction is carried out at 298 K is called **standard cell potential**.

That means, when the concentration of the species taking part in the cell reaction is not 1 M, then the cell potential is not equal to the standard cell potential.

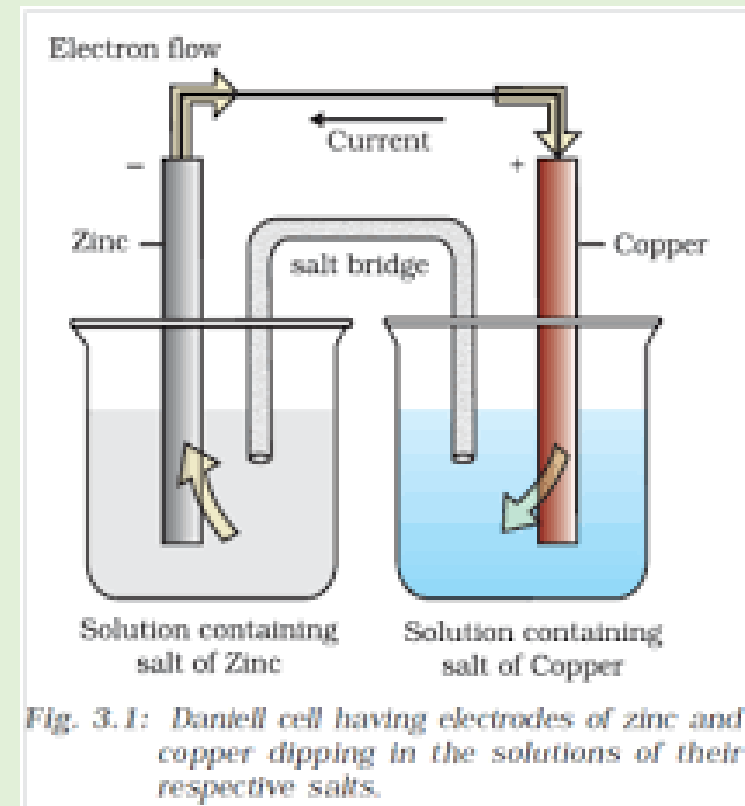
It varies with the concentration of the species as:

$$E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{RT}{nF} \ln Q$$

# Reversible and Irreversible Cells

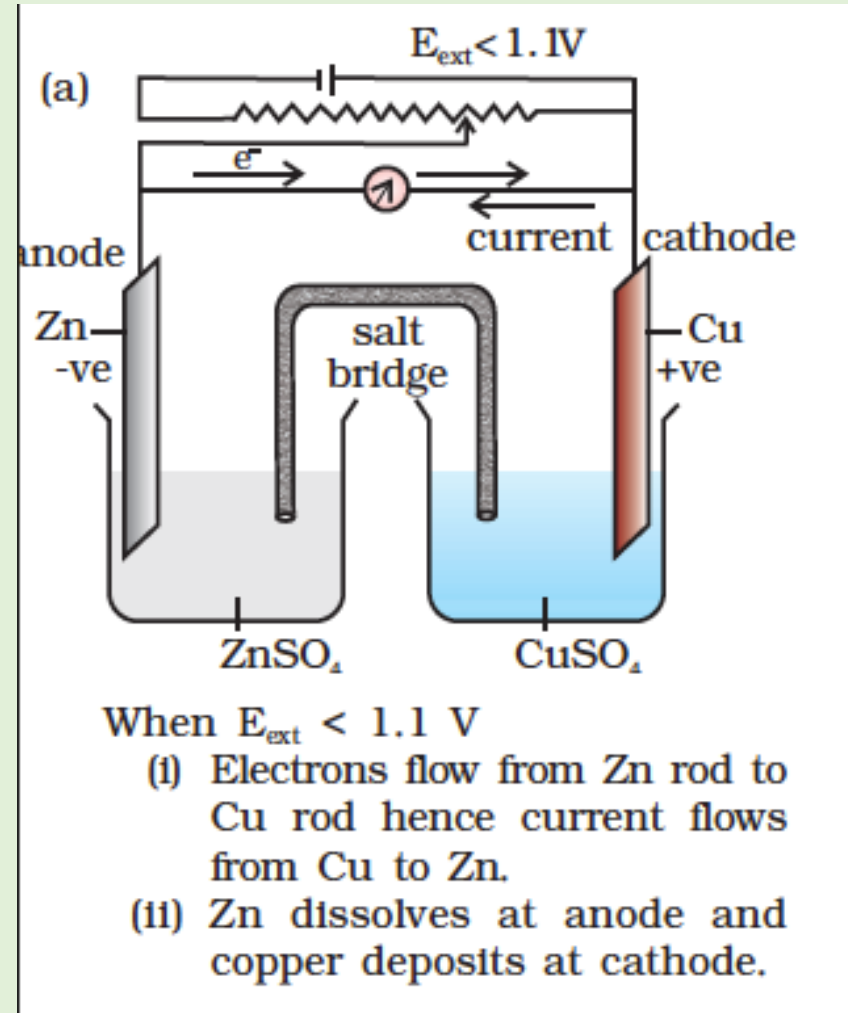
A chemical cell is said to be reversible if it follows the given conditions:

1. The chemical reaction of the cell stops when an exactly equal external emf is applied.
2. The chemical reaction of the cell is reversed and the current flows in opposite direction when the external emf is slightly higher than that of the cell. Any other cell, which does not obey the above two conditions, is termed as irreversible. Daniel cell is reversible.

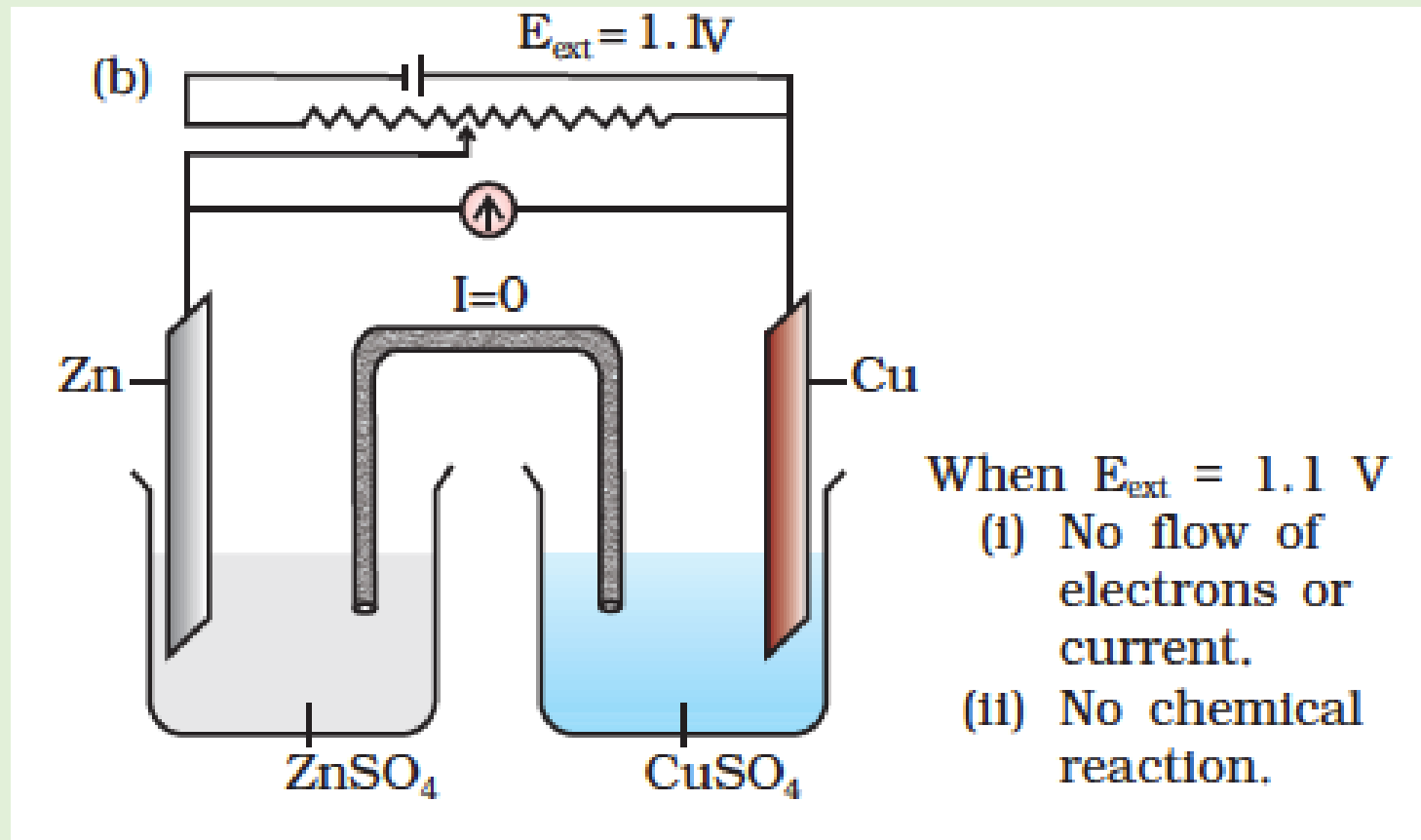


$$E^{\circ}_{\text{cell}} = 1.1 \text{ Volt}$$

- Case I, Daniel cell is connected to an external cell of emf ( $E_{\text{ext}}$ ) < 1.1 Volts



- Case I, Daniel cell is connected to an external cell of emf ( $E_{\text{ext}} = 1.1$  Volts)



- Case I, Daniel cell is connected to an external cell of emf ( $E_{\text{ext}}$ ) > 1.1 Volts.

