Electrochemistry

- → Electrochemical cells / Galvanic cells
- → Electrochemical series
- → Electrolytic cell
- → Conductance through solution

Two types of cells

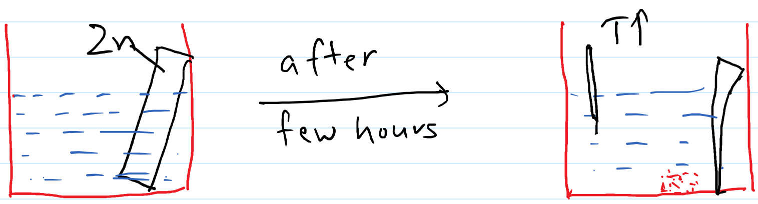
i) Electrochemical cell

Cell in which spontaneous redox reaction occurs, hence chemical energy gets converted into electrical energy is called Electrochemical cell

ii) Electrolytic cell

Cell in which non-spontaneous redox reaction is made to happen by passing electricity from external source, thus converting electrical energy to chemical energy is called electrolytic cell.

Electrochemical cell



$CuSO_4(aq)$

Observations:

i) Deposition of reddish brown ppt. (Cu)

ii) Weight of zinc rod decreases ($Zn \rightarrow Zn^{2+}$)

iii) Blue colour of solution fades ($Cu^{2+} \rightarrow Cu$)

iv) Temperature of system rises. (exothermic)

Reaction happening:

Oxidation half reaction

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

Reduction half reaction

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

Oxidation half reaction — Reduction half reaction

$Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$ — $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

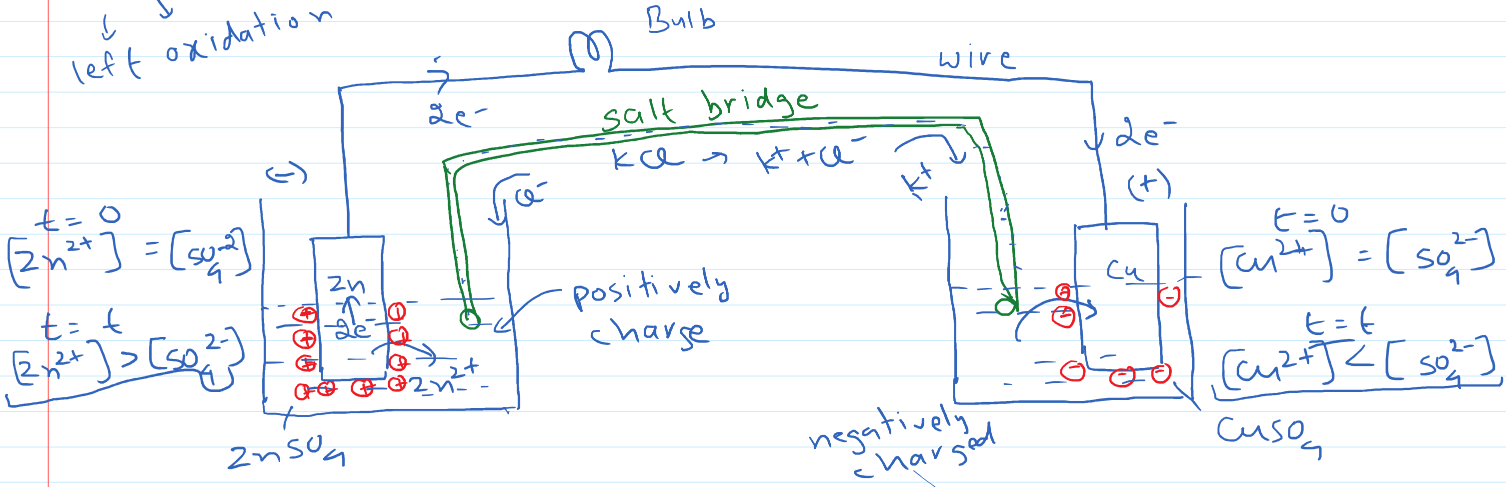
Net reaction.

$$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$$

Zinc transferred two electrons to Cu^{2+} is same container, hence chemical energy got converted into heat energy.

But we want to convert this chemical energy into electrical energy.

L O A N → anode, negative
L → left, O → oxidation



Oxidation half reaction (Anode) — Reduction half reaction (Cathode)

$Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$ — $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

Net reaction

$$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$$

(L O A N — Left oxidation anode negative)

Electrode potential

When a metal rod is dipped in aqueous solution of its ions charges develope between metal rod and solution. this leads to development of a potential difference called electrode potential

When concentration of all the species involved in a half cell reaction is unity, then electrode potential is known as standard electrode potential.

Pressure → 1bar solution → 1M

Reduction potential is taken as standard electrode potential by conversion.

$Zn \rightarrow Zn^{2+} + 2e^-$ $E^\circ_{Zn/Zn^{2+}}$ (oxidation potential)

$Cu^{2+} + 2e^- \rightarrow Cu$ $E^\circ_{Cu^{2+}/Cu}$ (reduction potential)

$Zn^{2+} + 2e^- \rightarrow Zn$ $E^\circ_{Zn^{2+}/Zn} = - E^\circ_{Zn/Zn^{2+}}$

oxidation potential = − reduction potential.