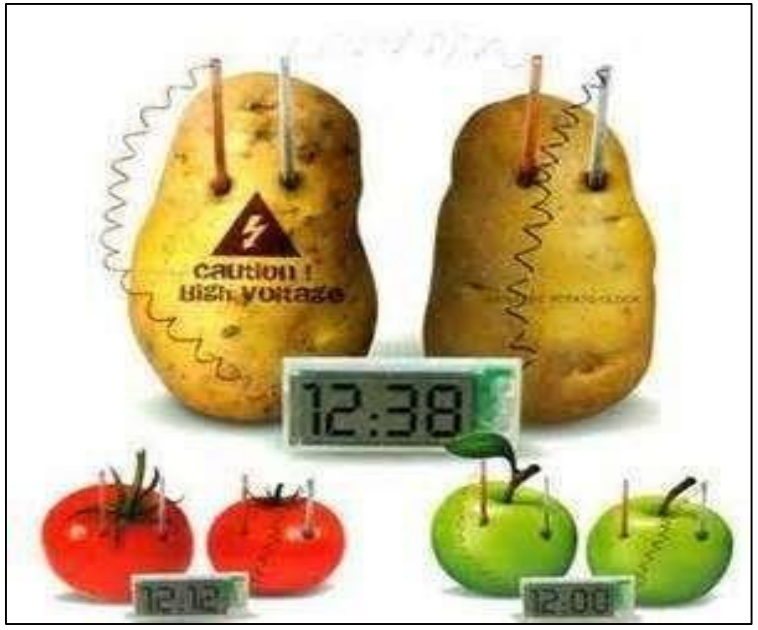
SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution
Coimbatore-35

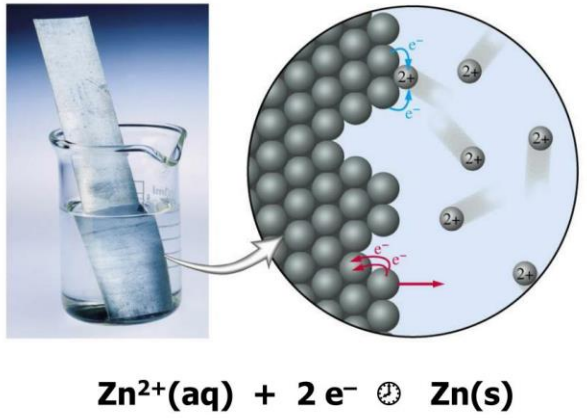
Department of Chemistry

23CHT101 – Enginerring Chemistry

UNIT 1:ELECTROCHEMISTRY



Topic 1.1- Introduction

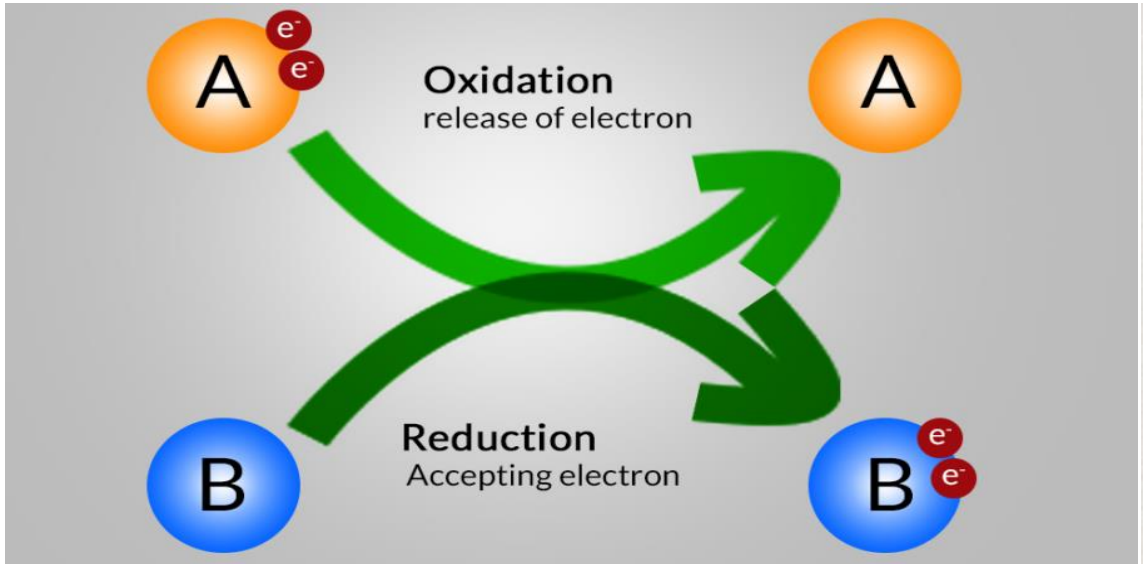


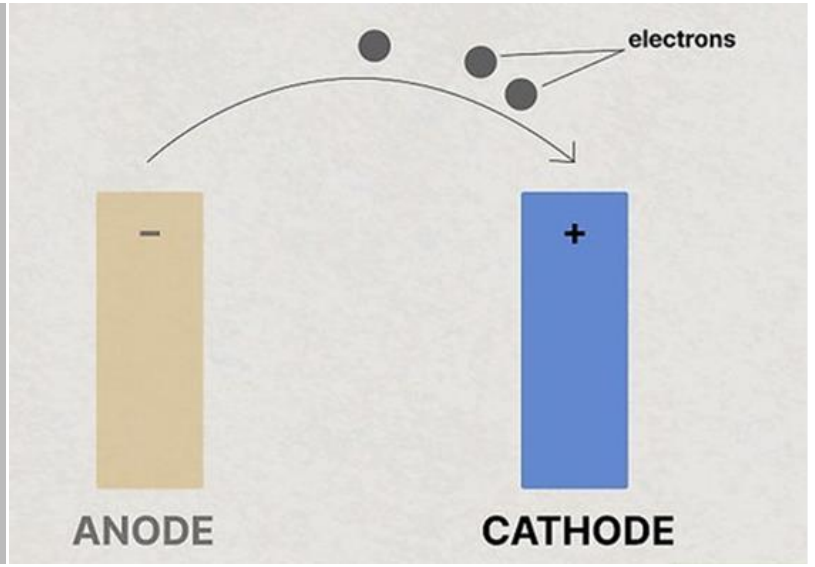
How to Recall !!

Section Title	Key Idea
Redox Reactions	Oxidation (loss of e^-) + Reduction (gain of e^-)
Electrochemical Cells	Galvanic (spontaneous) and Electrolytic (non-spontaneous)
Electrodes (Anode & Cathode)	Anode = Oxidation, Cathode = Reduction
Electrolytes	Conduct electric current in molten or aqueous solution
Standard Electrode Potential (E°)	Predicts direction of redox reactions
Electrolysis & Faraday's Laws	Electrical energy drives chemical change

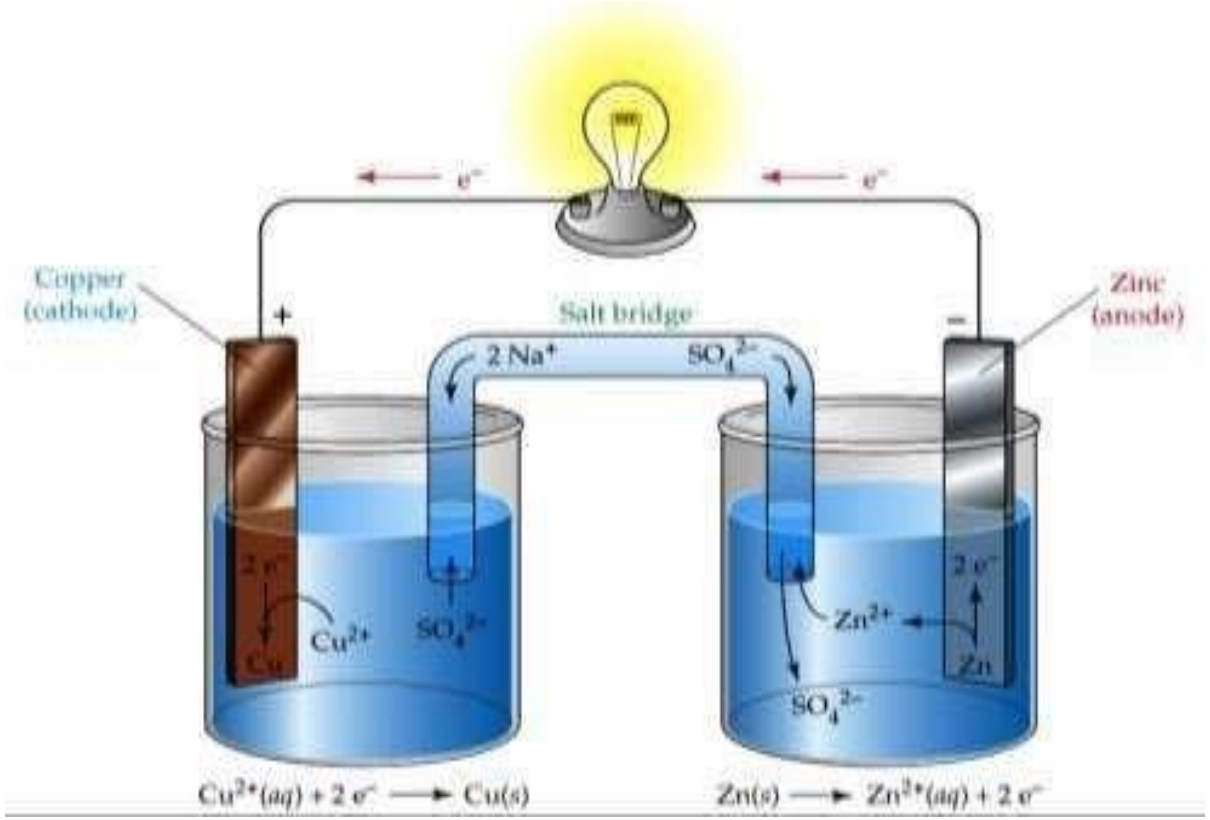
Topics for discussion

- Introduction-Electrochemical Cell- EMF – Electrode potential
- Nernst equation — problem
- Electrochemical series – significance
- Reference electrodes –SHE - Calomel electrode
- Ion selective electrode – glass electrode and pH





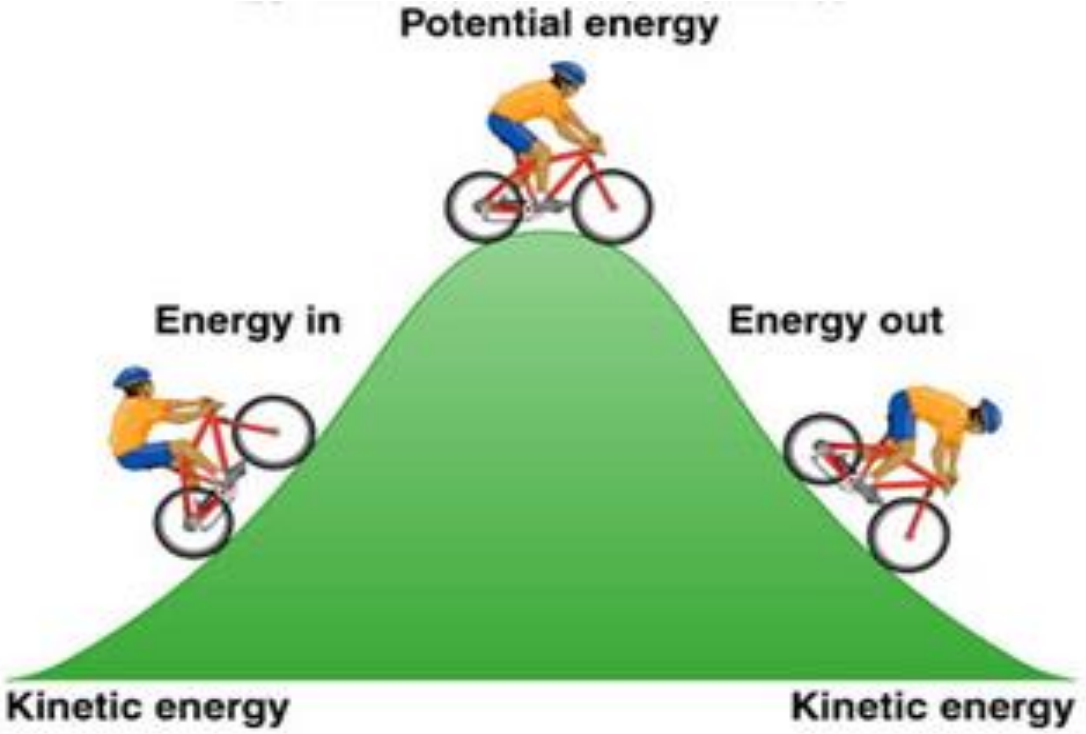
Lets explore !!

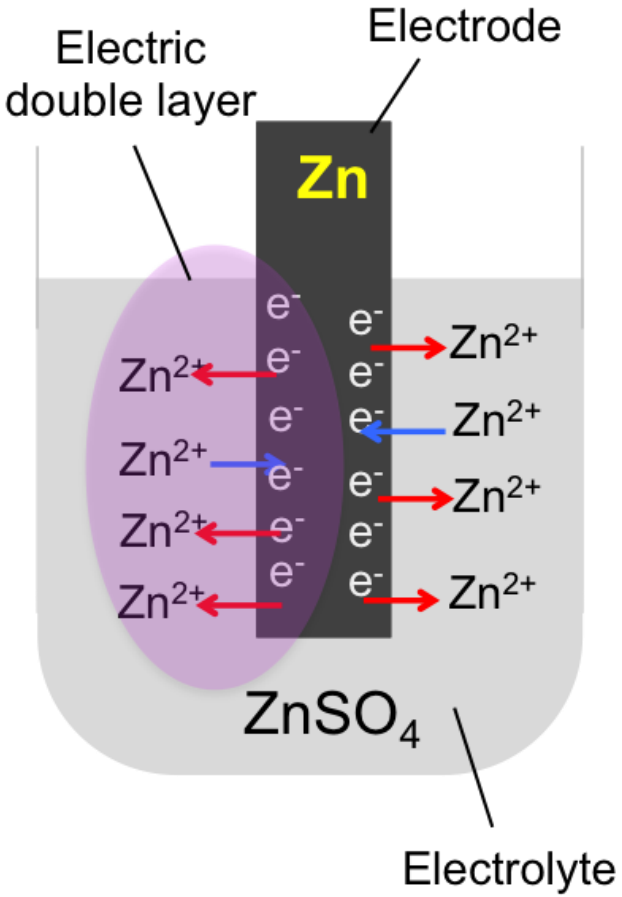


Introduction to Electrochemistry

DT-Empathize

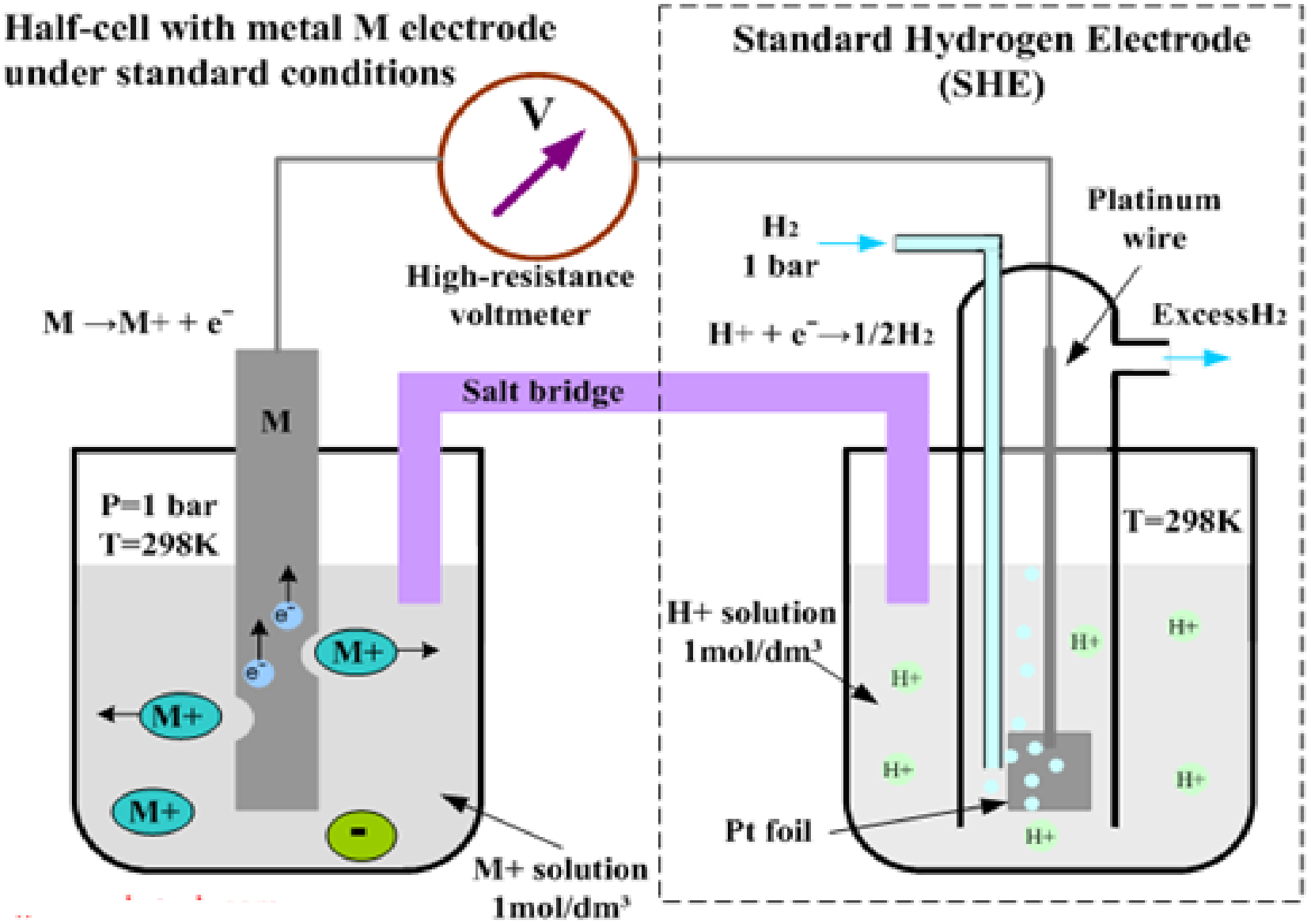
Due to the tendency of the metal atoms to lose or gain electrons.





Standard Electrode Potential (E°)

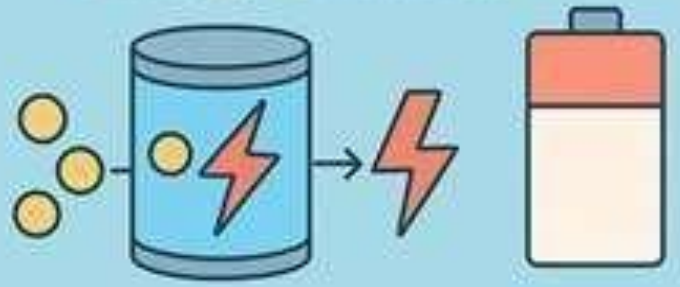
1 M concentration
1 atm pressure
25°C temperature



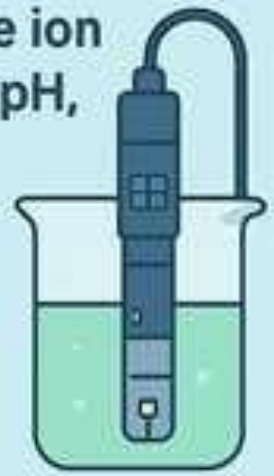
Introduction to Electrochemistry?

DT-Define

How to convert chemical energy into electrical energy efficiently



How to measure ion concentration (pH, sensors) in real systems?



How to prevent corrosion and energy loss in industries?

How to make energy systems sustainable and eco-friendly?

Introduction to Electrochemistry

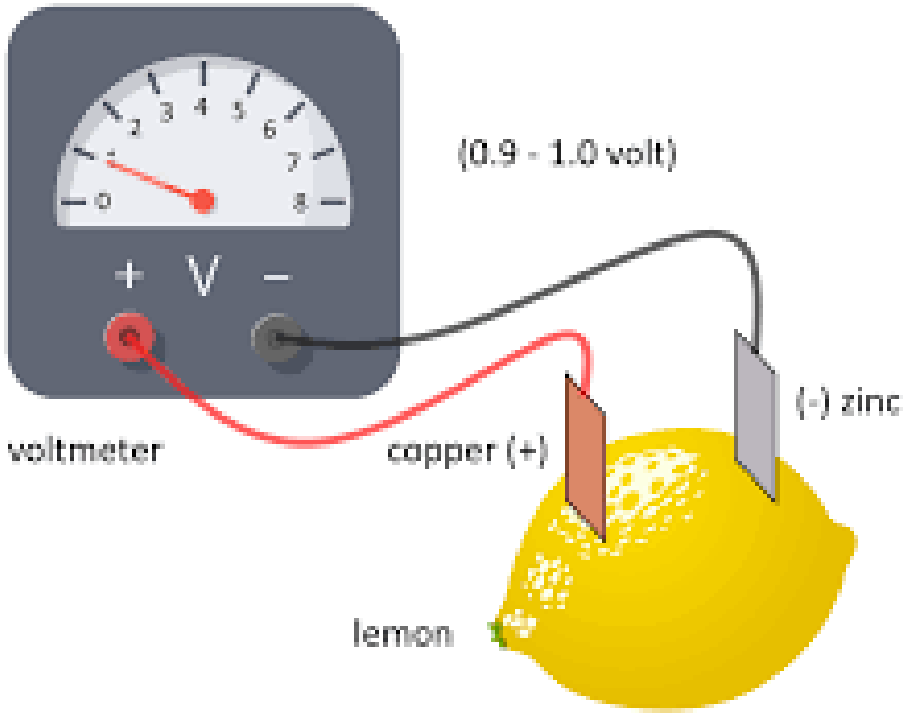
Try this Activity

- Build Your Own Mini Battery
- Corrosion Challenge
- Electrochemical Series Game

Half Reaction				Standard Potential (V)
F_2	+ $2e^-$ ⇌	$2F^-$		+2.87
Pb^{4+}	+ $2e^-$ ⇌	Pb^{2+}		+1.67
Cl_2	+ $2e^-$ ⇌	$2Cl^-$		+1.36
O_2+4H^+	+ $4e^-$ ⇌	$2H_2O$		+1.23
Ag^+	+ $1e^-$ ⇌	Ag		+0.80
Fe^{3+}	+ $1e^-$ ⇌	Fe^{2+}		+0.77
Cu^{2+}	+ $2e^-$ ⇌	Cu		+0.34
$2H^+$	+ $2e^-$ ⇌	H_2		0.00
Pb^{2+}	+ $2e^-$ ⇌	Pb		-0.13
Fe^{2+}	+ $2e^-$ ⇌	Fe		-0.44
Zn^{2+}	+ $2e^-$ ⇌	Zn		-0.76
Al^{3+}	+ $3e^-$ ⇌	Al		-1.66
Mg^{2+}	+ $2e^-$ ⇌	Mg		-2.36
Li^+	+ $1e^-$ ⇌	Li		-3.05

Stronger oxidizing agent

Stronger reducing agent



Introduction to Electrochemistry?

Current : Flow of electron

Conductor :

1. **Electronic/ Metallic Conductor:** All metals, graphite
2. **Electrolytic conductor:** Acids Bases, Salts.,

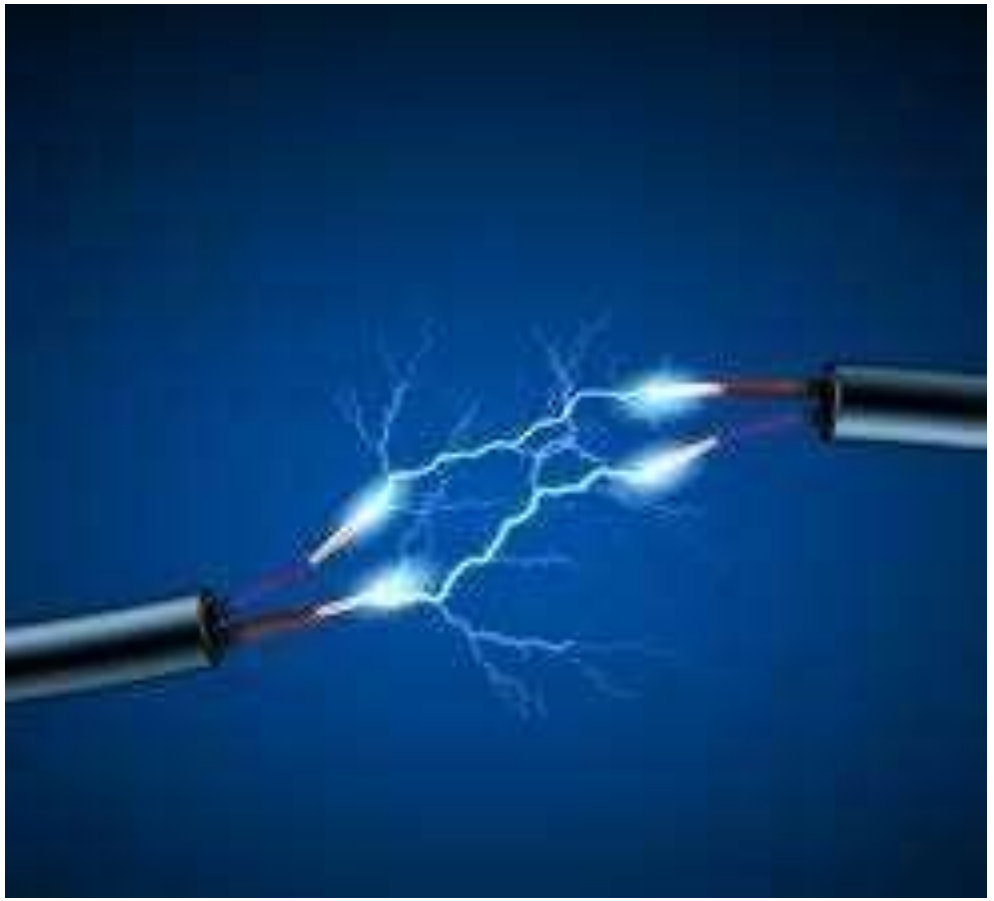
   Strong Electrolyte: Strong acid and bases

   Weak Electrolyte: Weak acid and bases

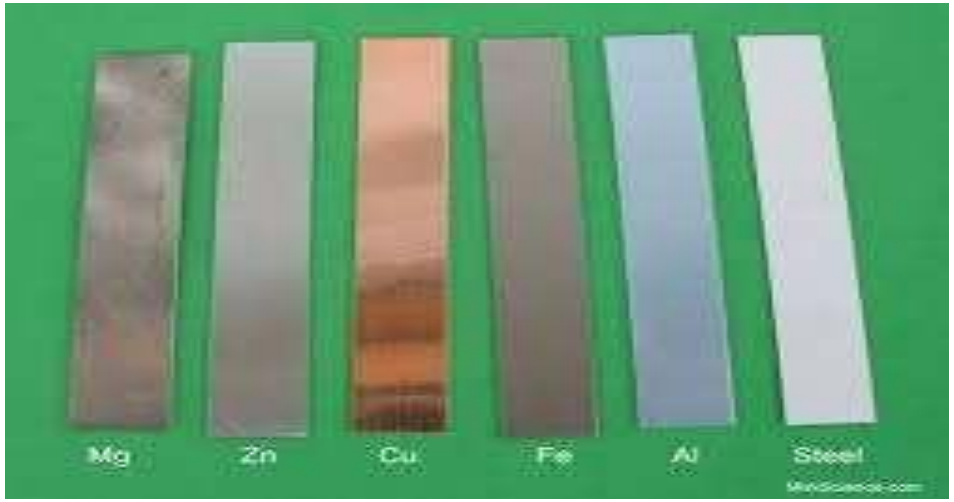
   Non Electrolyte: Not ionized at dilution. Ex -OH, Glucose.,

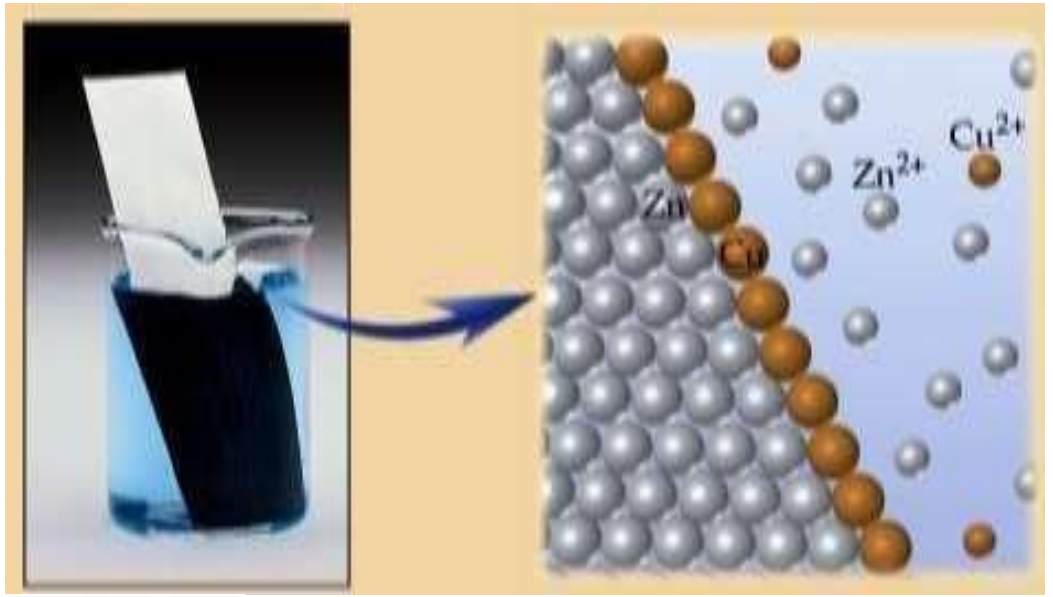
Non Conductor / insulator

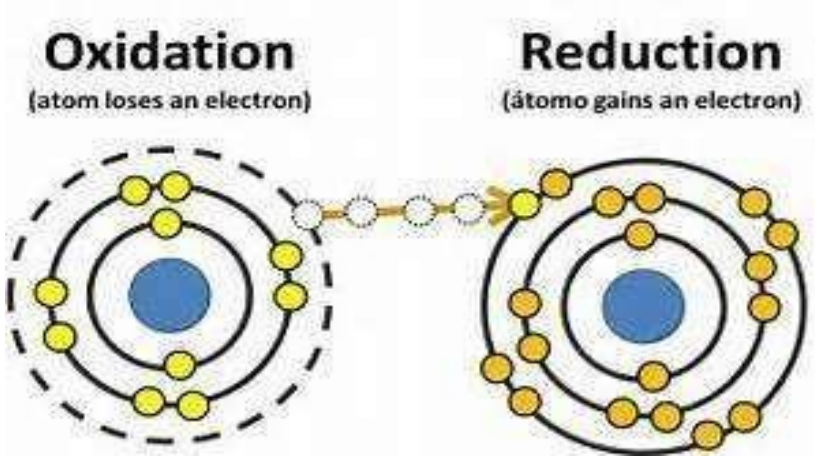
Semi Conductor: N & P Type



Introduction to Electrochemistry







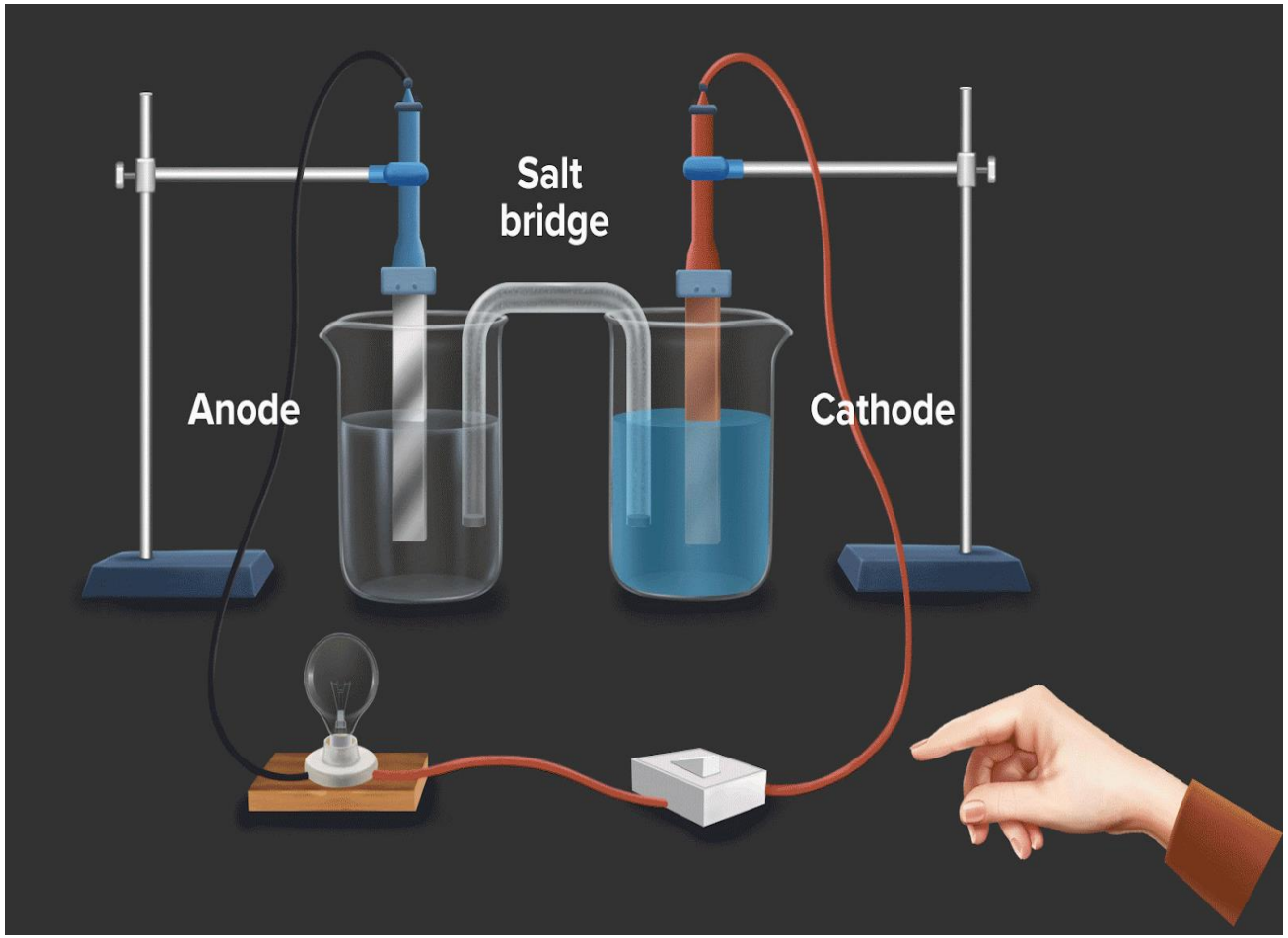
Electrochemical Cells /Galvanic Cell

- **At Anode: $Zn(s) + 2\ e^- \rightarrow Zn^{2+}(aq)$**
- **At Cathode: $Cu^{2+}(aq) + 2\ e^- \rightarrow Cu(s)$**
- **Net Reaction :**

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

Salt Bridge

❖ Saturated KCl or
NH_4NO_3 in agar- agar.



CELL REPRESENTATION

1. LHS : Anode Half-Cell
2. RHS : Cathode Half-Cell
3. Anode Half-Cell - Electrode | Anode Solution Ex. $Zn(s) \mid Zn^{2+}$ or $Zn(s)\ ;\ Zn^{2+}$
4. Cathode Half-Cell- Cathode Solution | Electrode. Ex. $Cu^{2+} \mid Cu(s)$ or $Cu^{2+}\ ;\ Cu(s)$
5. Two half cells are separated by salt bridge- $Zn(s) \mid Zn^{2+} \mid\mid Cu^{2+} \mid Cu(s)$
6. Concentration of the solution mention in the bracket $Zn(s) \mid$

$Zn^{2+}\ (1M) \mid\mid Cu^{2+}\ (1M) \mid Cu(s)$

Assessment- Quiz

1. In a galvanic cell, the chemical energy is converted into:

A) Heat energy
B) Electrical energy
C) Light energy
D) Mechanical energy

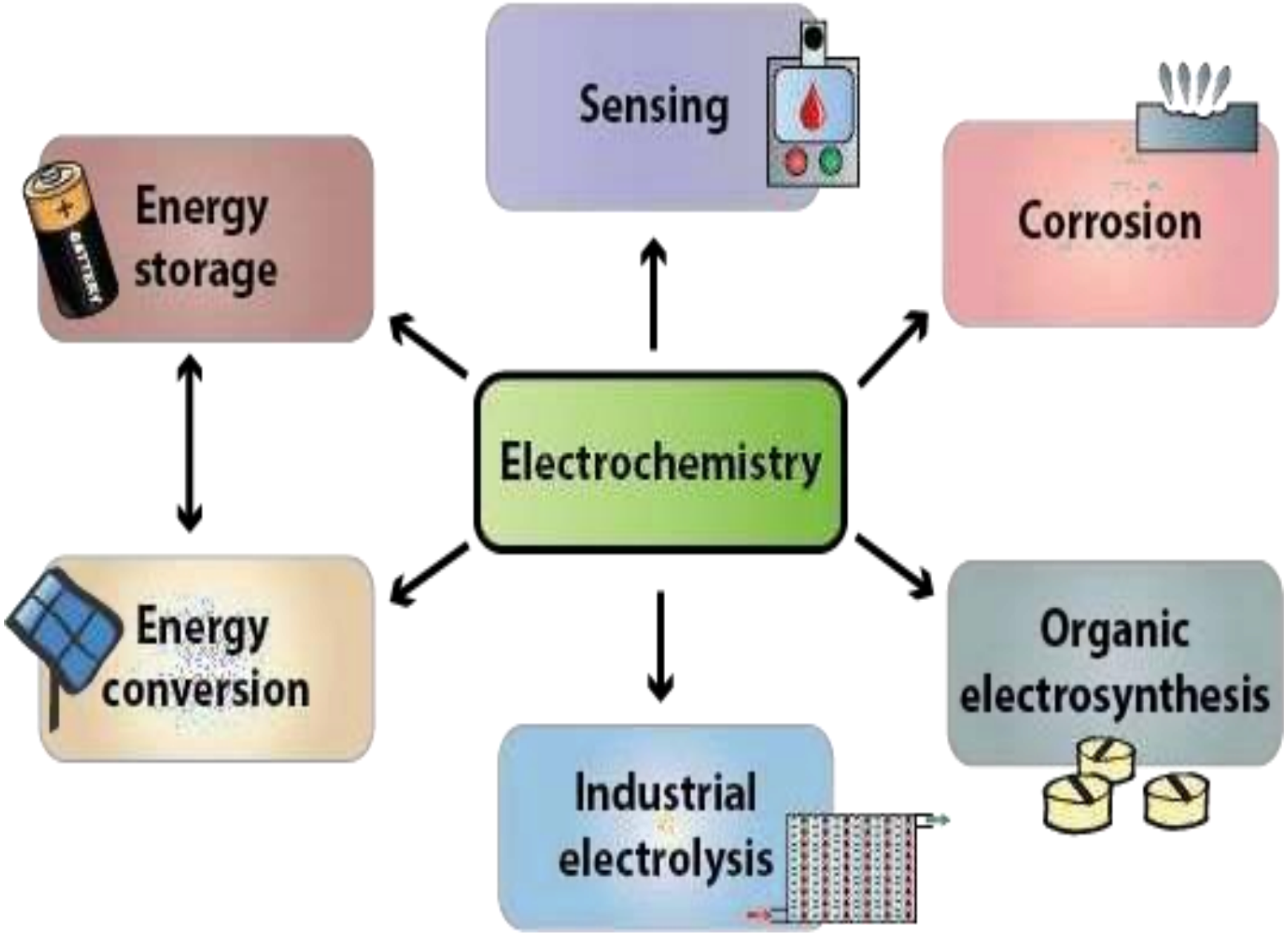
Option: B

2. Which of the following statements is true about an electrolytic cell?

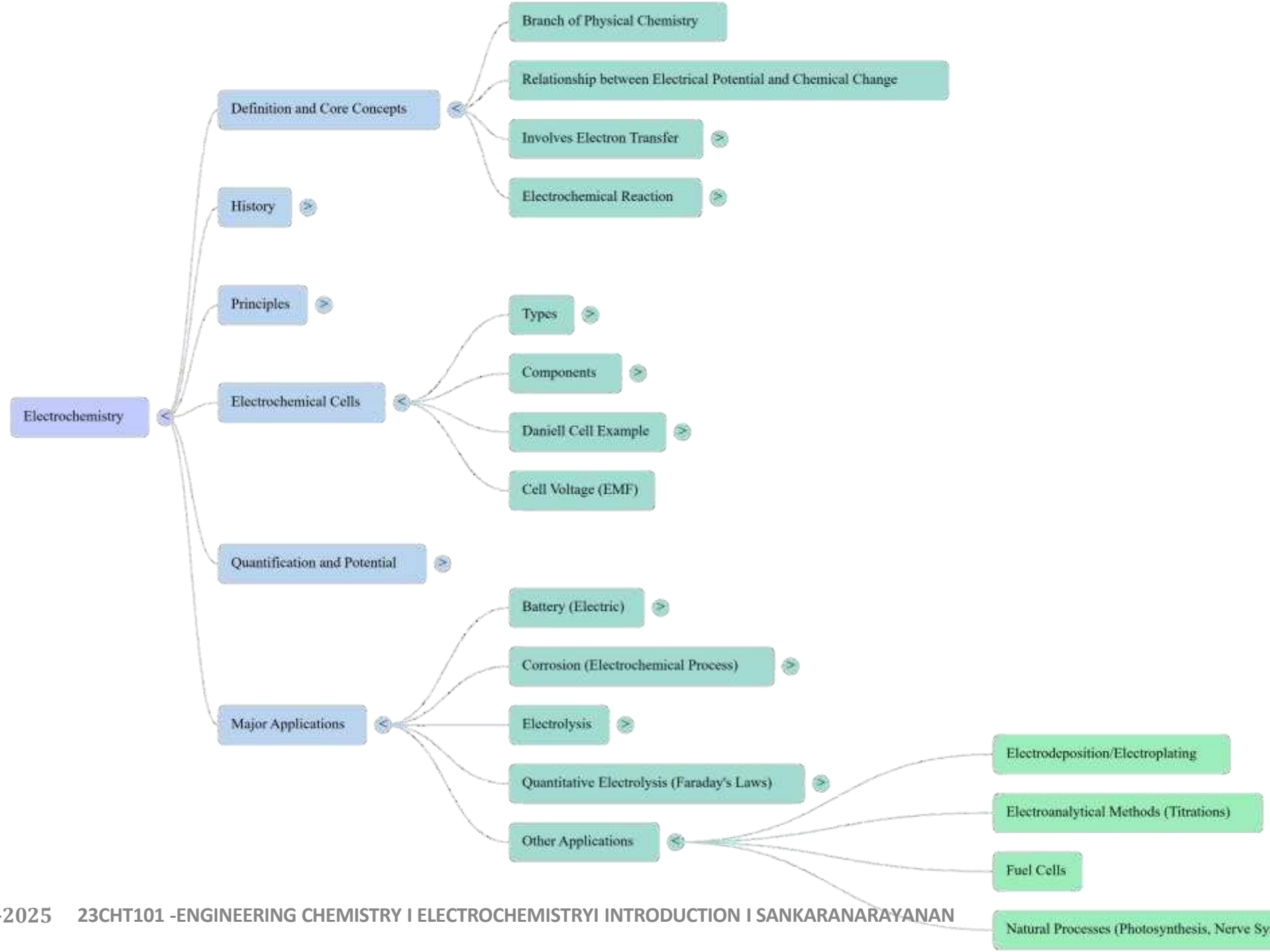
A) It converts electrical energy into chemical energy.
B) The anode is positive and the cathode is negative.
C) The reaction is spontaneous.
D) Electrons flow from cathode to anode externally.

Option: A

Application of Electrochemistry



Let's summarize



References

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