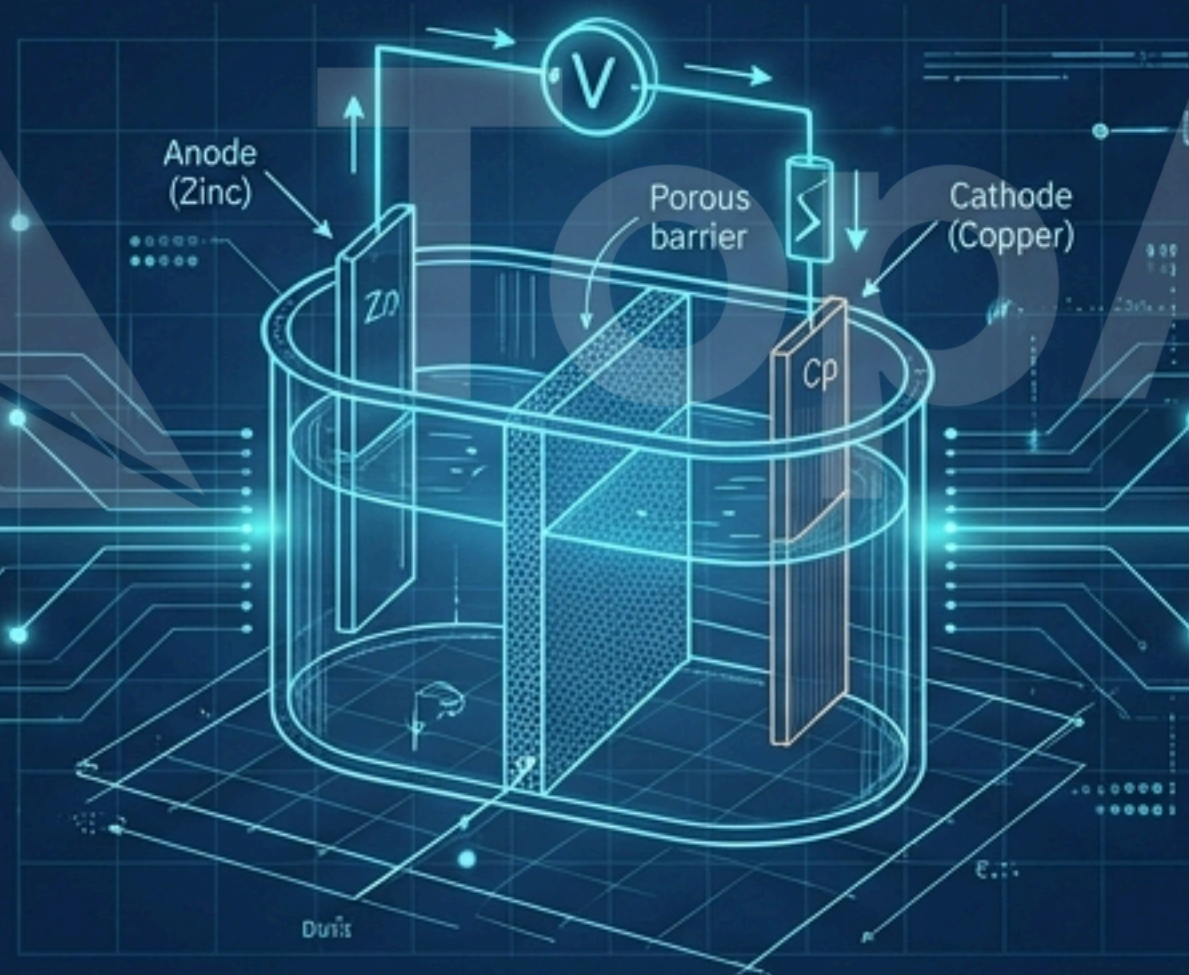


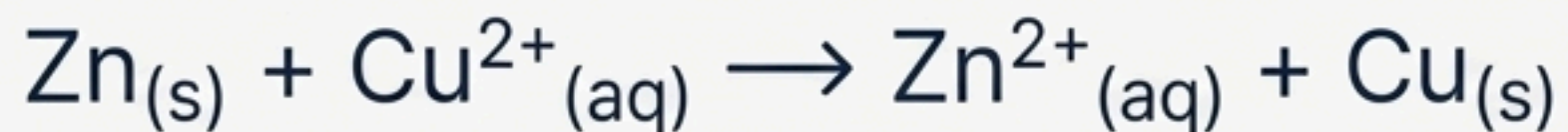
## Chapter 7: Redox Reactions

# How Redox Becomes Electricity

## The Engineering of the Daniell Cell



# The Direct Transfer Problem



## Macroscopic View



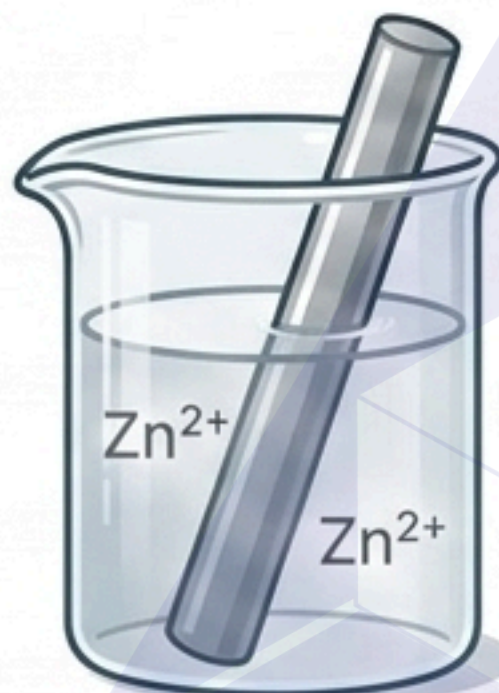
## Microscopic View



**The Wasted Energy.** When Zn and  $\text{Cu}^{2+}$  react in the same beaker, electrons transfer directly. The chemical energy is released primarily as heat, not usable electrical work.

# Separating the Half-Reactions

To harvest the electrons, we must isolate the oxidation from the reduction.



$\text{Zn}^{2+}/\text{Zn}$  Couple



$\text{Cu}^{2+}/\text{Cu}$  Couple

By separating the reactants, we force the electrons to travel an indirect path to reach the  $\text{Cu}^{2+}$  ions.



# You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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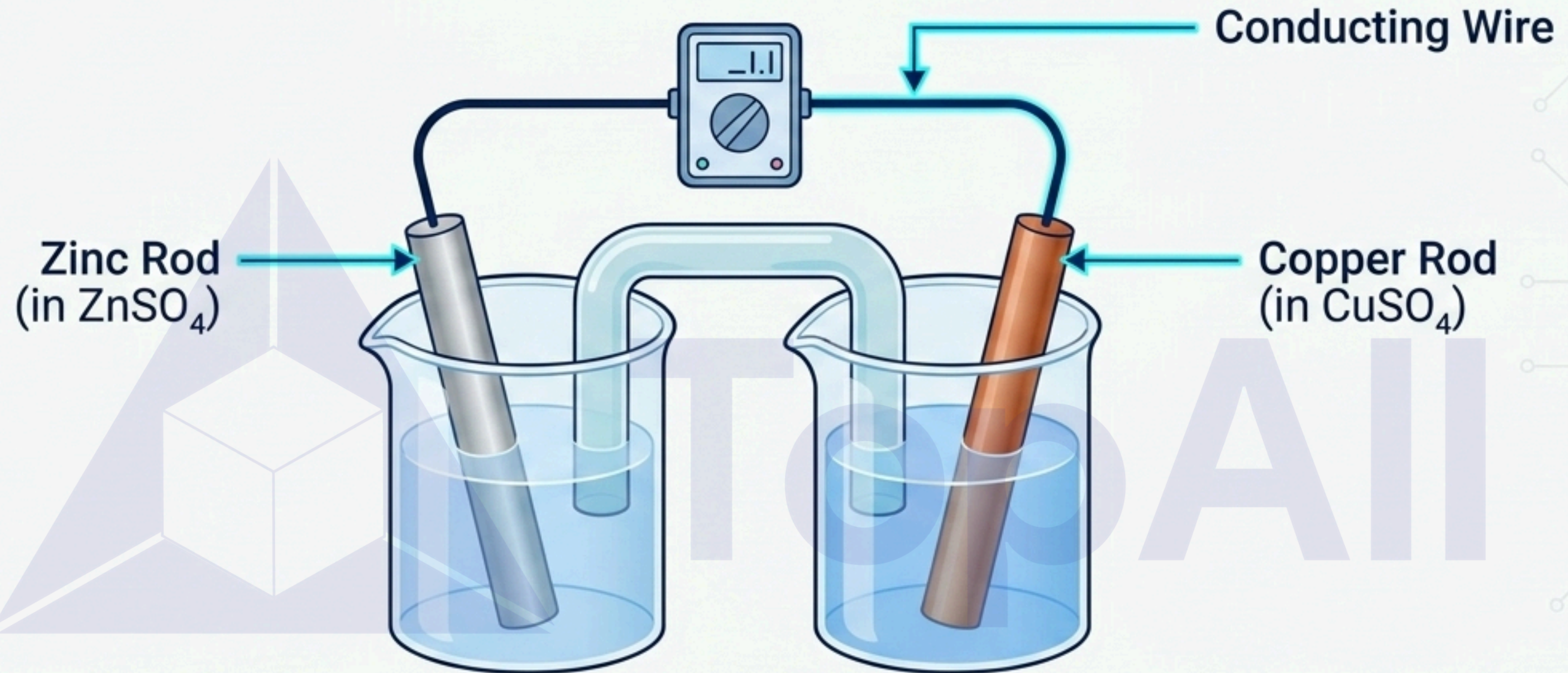
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# The Daniell Cell Architecture



## The Salt Bridge

A U-tube (typically containing  $\text{KCl}$  or  $\text{NH}_4\text{NO}_3$  in agar-agar jelly). It completes the inner electrical circuit and maintains electrical neutrality in both half-cells without allowing the solutions to mix.

# Defining the Electrodes

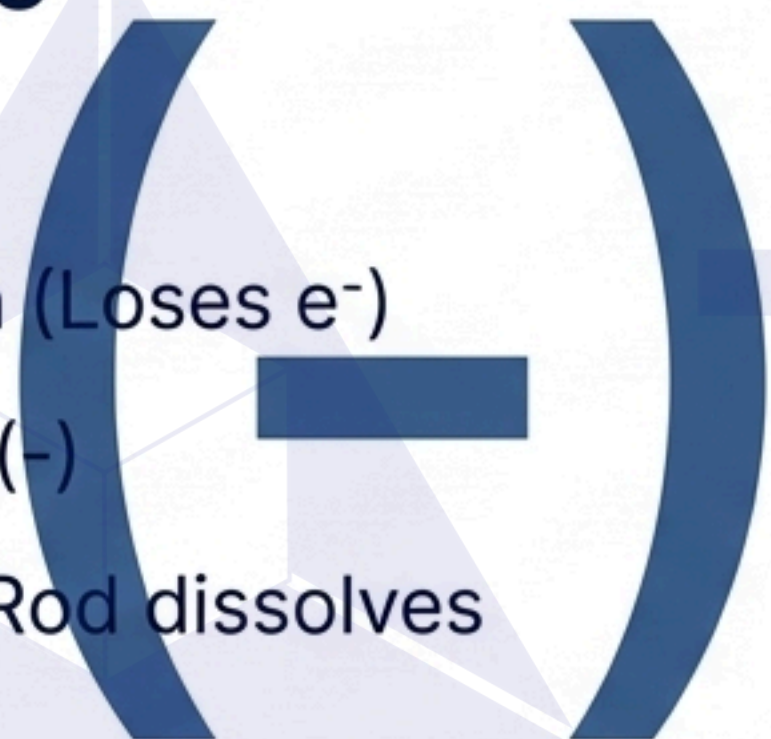
## Zinc Electrode

**Name:** Anode

**Process:** Oxidation (Loses  $e^-$ )

**Polarity:** Negative (-)

**Physical Change:** Rod dissolves  
(mass decreases)



## Copper Electrode

**Name:** Cathode

**Process:** Reduction (Gains  $e^-$ )

**Polarity:** Positive (+)

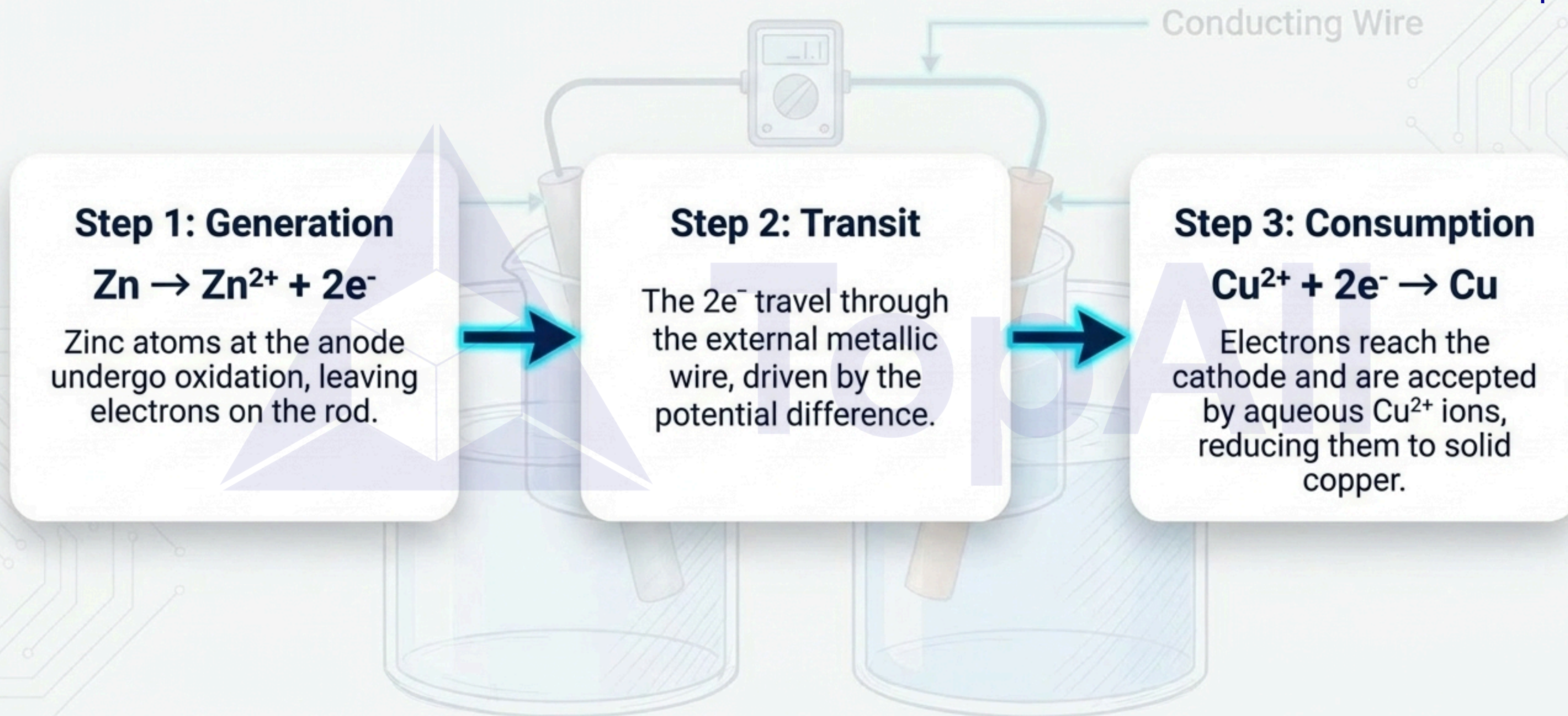
**Physical Change:** Copper deposits  
(mass increases)



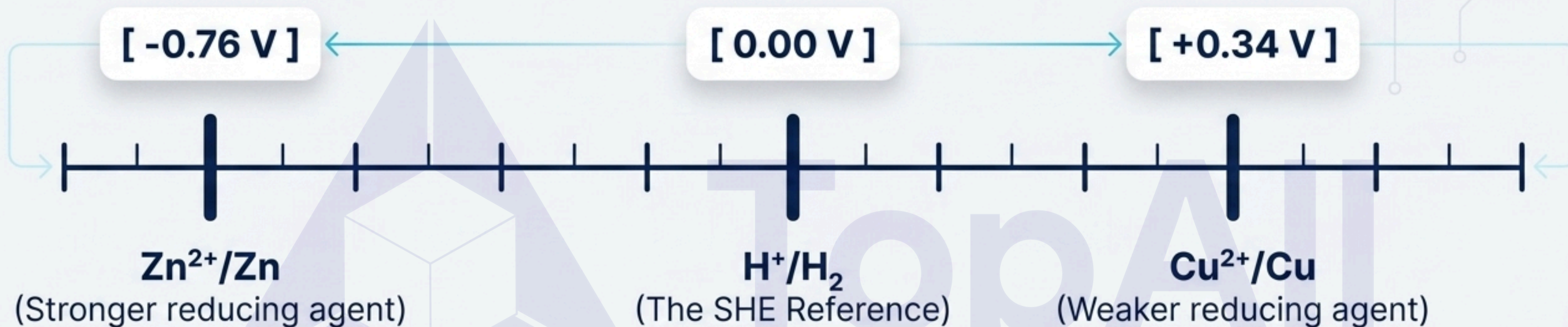
## Formula Bank

**Mnemonic: L-O-A-N** Left | Oxidation | Anode | Negative

# Tracing the Electron Flow



# Standard Electrode Potential ( $E^\circ$ )



## Key Takeaway

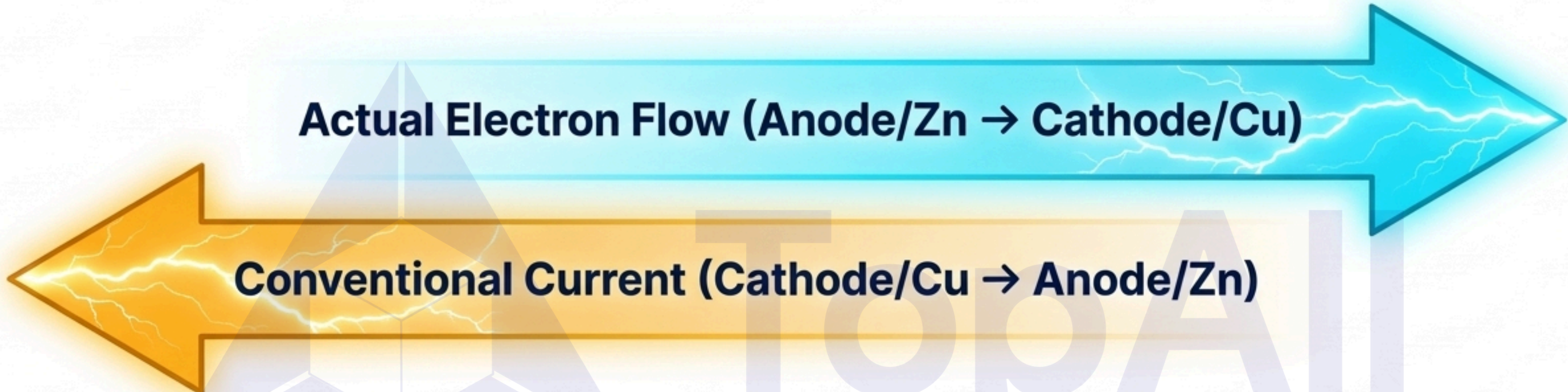
A negative  $E^\circ$  indicates the couple is a stronger reducing agent than Hydrogen.

A positive  $E^\circ$  indicates a weaker reducing agent.

## Exam Snapshot

Standard Conditions ( $E^\circ$ ):  
Concentration = 1 M,  
Pressure = 1 atm,  
Temperature = 298 K.

# Physics vs. Chemistry: The Direction Trap



**Actual Electron Flow (Anode/Zn → Cathode/Cu)**

**Conventional Current (Cathode/Cu → Anode/Zn)**

## JEE Trap Alert

⚠ **High Yield Pitfall:** Examiners frequently test this specific inversion. Remember that by historical convention, electrical current is defined as the flow of positive charge. Therefore, conventional current always flows in the exact opposite direction of electron travel in a Galvanic cell.



# You've Learned the Theory.

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