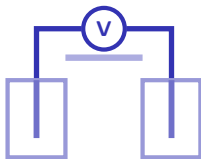


Electrochemistry

A-Level Chemistry ■ Topic 24

A-Level Chemistry



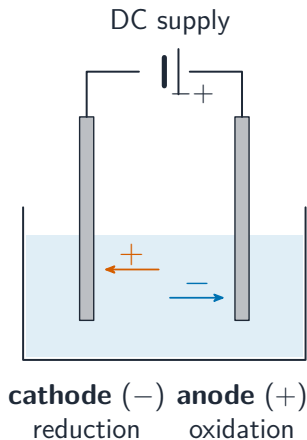
What we will cover

- 1 Electrolysis
- 2 Faraday calculations
- 3 Standard electrode potentials
- 4 Cell potentials & feasibility
- 5 The Nernst equation



electrolysis of water

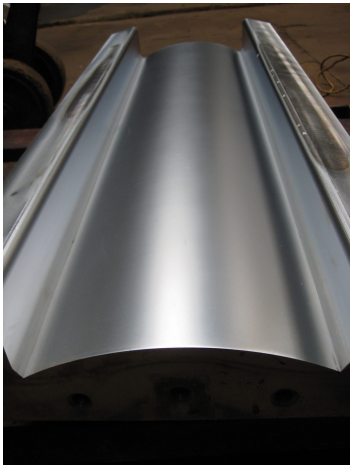
Electrolysis



Electrolysis 电解 breaks down an **electrolyte** 电解质:

- **cathode** 阴极 (-): positive ions gain e^- (reduction)
- **anode** 阳极 (+): negative ions lose e^- (oxidation)

Faraday calculations



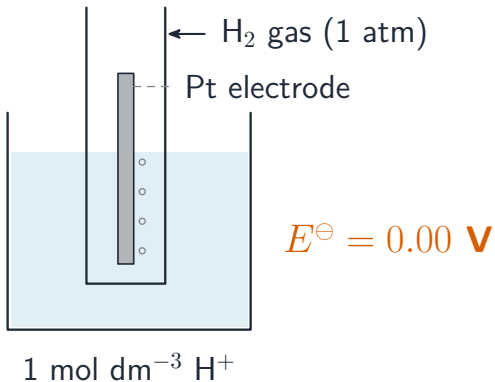
Charge $Q = It$; moles of electrons = Q/F (**Faraday constant** 法拉第常量).

2.0 A for 30 min through CuSO_4

$$Q = 3600 \text{ C}; n(\text{e}^-) = 0.0373; n(\text{Cu}) = 0.0187 \\ \Rightarrow m \approx 1.2 \text{ g}$$

Use the half-equation to find moles of product.

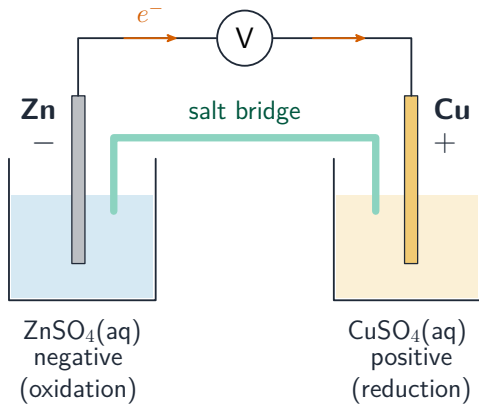
Standard electrode potentials



The **standard electrode potential** 标准电极电势 $E^{\ominus}$ shows how easily a half-cell is reduced.

It is measured against the **standard hydrogen electrode** 标准氢电极, defined as exactly 0.00 V.

Cell potentials and feasibility



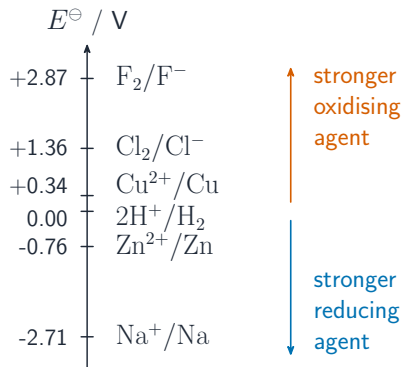
$$E_{\text{cell}}^{\ominus} = E^{\ominus}(\text{more+}) - E^{\ominus}(\text{less+}).$$

$$\text{Zn } (-0.76) \text{ \& \; Cu } (+0.34)$$

$$E_{\text{cell}}^{\ominus} = 0.34 - (-0.76) = 1.10 \text{ V}$$

A reaction is **feasible** 可行 when
 $E_{\text{cell}}^{\ominus} > 0$. ($\Delta G^{\ominus} = -nE^{\ominus}F$.)

The electrochemical series



- a more **positive** $E^\ominus \rightarrow$ a stronger **oxidising agent** 氧化剂 (easily reduced)
- a more **negative** $E^\ominus \rightarrow$ a stronger **reducing agent** 还原剂

The Nernst equation

$$E = E^{\ominus} + \frac{0.059}{z} \log \frac{[\text{oxidised}]}{[\text{reduced}]}$$

Away from standard conditions, raising the **oxidised** 氧化态 species' concentration makes E **more positive** (z = electrons in the half-equation).

Topic 24 – key takeaways

1

Electrolysis

cathode reduces; anode oxidises

2

Faraday

$$Q = It; \text{ moles of } e^- = Q/F$$

3

 $E^\ominus$

measured vs the hydrogen
electrode (0 V)

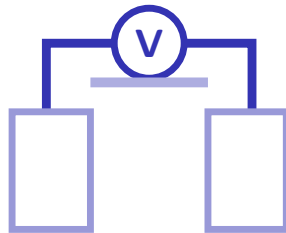
4

Cells

$$E_{\text{cell}}^\ominus > 0 \text{ means feasible}$$

Check yourself

- 1 What happens at the cathode?
- 2 What is the charge Q equal to?
- 3 What is the SHE defined as?
- 4 A cell is feasible when $E_{\text{cell}}^{\ominus}$ is what?



Answers 1. reduction (positive ions gain e^{-}) 2. It 3. 0.00 V 4. positive