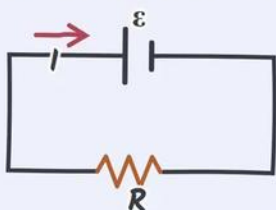




cells turn chemistry into current, and current back into chemistry

Galvanic cell vs electrolytic cell

Galvanic (voltaic) cell



the cell itself is the source: current I leaves it and runs through the outside resistance

- chemical $\rightarrow$ electrical energy, spontaneous, $\Delta G < 0$
- anode is negative, cathode is positive
- oxidation at the anode, reduction at the cathode
- electrons flow anode $\rightarrow$ cathode through the wire

Electrolytic cell

- electrical $\rightarrow$ chemical energy, non-spontaneous, driven from outside
- anode is positive, cathode is negative
- oxidation at the anode, reduction at the cathode: same rule
- external source pushes electrons into the cathode

the electrode NAMES never swap: anode is always oxidation, cathode always reduction. only the POLARITY flips between the two cell types

Cell representation notation

Daniell

cell, $\text{Zn(s)} \mid \text{Zn}^{2+}(\text{aq}) \parallel \text{Cu}^{2+}(\text{aq}) \mid \text{Cu(s)}$
standard notation

single $|$ marks a phase boundary, double $\parallel$ marks the salt bridge; anode (oxidation) is always written on the LEFT, cathode (reduction) on the RIGHT

Standard electrode potential

cell potential from the two half-cells

$$E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$$

standard hydrogen electrode, the reference

$$E^\circ_{\text{H}^+/\text{H}_2} = 0 \text{ V}$$

electrode potentials are tabulated as reduction potentials by convention; a more positive E° means a stronger oxidising agent than H^+

The electrochemical series *

- half-cells arranged in order of E° , usually most negative (top) to most positive (bottom)
- higher up (more negative E°) is a stronger reducing agent, oxidises easily
- lower down (more positive E°) is a stronger oxidising agent, reduces easily
- a half-cell with the higher E° will oxidise a half-cell with a lower E° , which predicts whether a redox reaction runs at all

galvanic runs on its own, electrolytic is forced. decide which one you're looking at first, then the polarity falls out automatically