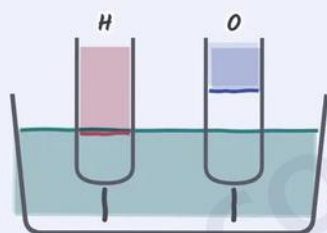


cells, the Nernst equation, and conductance that runs the other way

The two kinds of cell, and the one rule that never changes

- oxidation is always at the anode and reduction always at the cathode, in both kinds of cell, and that is the only thing you never have to think about
- galvanic (voltaic) cell: a spontaneous redox reaction produces electricity, the anode is NEGATIVE and the cathode POSITIVE
- electrolytic cell: electricity forces a non spontaneous reaction, the anode is POSITIVE and the cathode NEGATIVE
- the sign flips because in a galvanic cell the electrode makes the electrons, while in an electrolytic cell the supply pushes them
- electrons travel through the WIRE and ions through the solution; the salt bridge carries ions to keep both half cells neutral, and without it the cell stops within seconds



two electrodes in an electrolyte with the external circuit closed: the electrons move in the wire and the ions in the solution

Cell notation, written the way it is marked

*

- the anode goes on the left and the cathode on the right, which is alphabetical and easy to keep straight
- a single vertical line is a phase boundary and a double line is the salt bridge: $\text{Zn} | \text{Zn}^{2+}(1\text{ M}) || \text{Cu}^{2+}(1\text{ M}) | \text{Cu}$
- $E_{\text{cell}} = E_{\text{cathode}} \text{ minus } E_{\text{anode}}$, both taken as REDUCTION potentials, and this subtraction is where most sign errors live
- a positive E_{cell} means the reaction as written is spontaneous, which is the same statement as a negative ΔG

The standard hydrogen electrode, and the series it defines

- no single electrode potential can be measured alone, so one is DEFINED as zero: the standard hydrogen electrode, hydrogen gas at 1 bar over a platinum electrode in 1 M H^+ at 298 K
- every other potential is measured against it, and the list of them in order is the electrochemical series
- more positive means more easily reduced, so fluorine at the top is the strongest oxidising agent and lithium at the bottom the strongest reducing agent
- a metal with a NEGATIVE standard reduction potential displaces hydrogen from an acid; one with a positive value does not, which is why copper does not dissolve in hydrochloric acid

