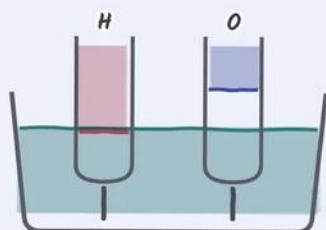


one species loses electrons, another gains them, and it happens in the same breath

Oxidation and reduction, the classical and electronic pictures

- classically: **oxidation** adds oxygen or removes hydrogen; **reduction** adds hydrogen or removes oxygen
- modern picture: **oxidation** is loss of electrons; **reduction** is gain of electrons
- the two always happen **together**: whatever loses electrons hands them straight to the gainer
- oxidised species = **reducing agent** (donates electrons); reduced species = **oxidising agent** (accepts electrons)



electrolysis of water

electrolysis of water: hydrogen collects at about twice the rate of oxygen, since water carries twice as many H atoms as O

OIL RIG

OILRIG

O	Oxidation
I	Is
L	Loss (of electrons)
R	Reduction
I	Is
G	Gain (of electrons)

electrons lost by one species always equal electrons gained by the other

Oxidation number: the bookkeeping rule

*

- oxidation number: the charge an atom would carry if every bond were fully ionic
- assigned to the more electronegative atom in each bond
- any free element has oxidation number **zero**: Na(s), O₂(g), P₄(s)
- a monatomic ion's oxidation number equals its charge: Na⁺ is +1, Cl⁻ is -1
- neutral compound: oxidation numbers sum to **zero**; polyatomic ion: sum to its charge

Fixed oxidation number rules

species	usual oxidation number	exception
Group 1 metals	+1	none
Group 2 metals	+2	none
H (bonded to non-metal)	+1	-1 in metal hydrides, e.g. NaH
O (bonded normally)	-2	-1 in peroxides (H ₂ O ₂); +2 only in OF ₂
F	-1	none, always -1

assign the fixed values first, then solve for the one unknown atom using the sum rule; that unknown is almost always what a question is actually asking for

