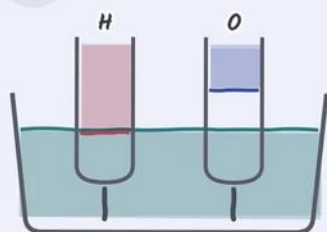


one species loses electrons, another gains them, in the same breath

Classical and electron-transfer pictures

- classically: **oxidation** adds oxygen/electronegative element or removes hydrogen/electropositive element; **reduction** is the reverse
- modern: **oxidation** is loss of electrons, **reduction** is gain; the two always happen together, never alone
- oxidant: itself gets reduced, the electron acceptor.
reductant: itself gets oxidised, the electron donor
- covalent reactions ($2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$) fit too: an electron **shift**, not a full transfer, toward the electronegative atom



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

Oxidation number: the bookkeeping rule

- oxidation number: the charge an atom would carry if every bond to it were fully ionic
- free element: always 0 (H_2 , Cl_2 , O_3 , S_8 , P_4 , Ca metal)
- monatomic ion: equals its charge (alkali +1, alkaline earth +2, Al +3)
- neutral molecule: oxidation numbers sum to 0.
polyatomic ion: sum to the net charge
- when an element appears more than once in one species, report the **average** oxidation number

Fixed oxidation number rules *

species	usual O.N.	exception
O	-2	-1 peroxide (H_2O_2); $-\frac{1}{2}$ superoxide (KO_2); +2 in OF_2
H bonded to non-metal	+1	-1 in a metal hydride, e.g. LiH , CaH_2
F	-1	none, always -1
Cl, Br, I in a halide	-1	+1 when bonded to O, e.g. Cl-O-Cl

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