

Rules for Assigning Oxidation Numbers

Chemical reactions in which electrons are transferred from one atom to another are called oxidation-reduction (or redox) reactions.

Remember that in a chemical bond electrons are shared, given, or taken. This all has to do with electronegativity.

In order to keep track of where the electrons are moving to and from, we use a bookkeeping system called "oxidation numbers". An oxidation number is the *apparent* charge of the atom in the bond. The rules follow:

Oxidation Numbers

1. Elements in their elemental, uncombined state have an oxidation number of zero.
ex: O_2 and Fe
2. The oxidation number of a monatomic ion is the same as the charge of the ion.
ex: NaCl (Na = +1, Cl = -1).
see your common ion sheet for others
3. Hydrogen will have an oxidation number of +1.
ex: HCl (H = +1, Cl = -1)
Exception: in metal hydrides, hydrogen has an oxidation number of -1.
ex: NaH (Na = +1, H = -1)

Oxidation Numbers

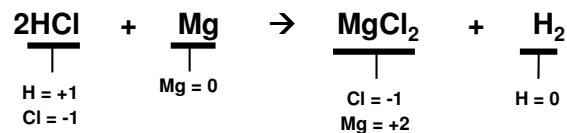
4. Oxygen has an oxidation number of -2.
ex: H_2O (H = +1, O = -2)
Exception: in peroxides oxygen has an oxidation number of -1.
ex: CaO_2 (Ca = +2, O = -1)
Exception: in OF_2 oxygen has an oxidation number of +2. Think about why this is such a unique exception.
5. Oxidation numbers must follow conservation of charge – in other words, the charges of the individual atoms must add up to the overall charge of the molecule or ion.
ex: $CaCl_2$ (Ca = +2, Cl = -1x2, total = 0)
ex: $NaNO_3$ (Na = +1, O = -2x3, N = +5, total = 0)
ex: SO_4^{2-} (O = -2x4, S = +6, total = -2)

Oil Rig

O_{xidation}
I_s
L_{oss}
R_{eduction}
I_s
G_{ain}
Of electrons



Example:



Identify how the elements' charges are changing:

Hydrogen: $+1 \rightarrow 0$ → Oxidation number is reduced → H is reduced

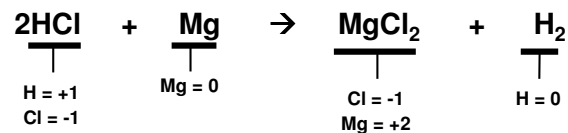
Magnesium: $0 \rightarrow +2$ → Oxidation number is increased → Mg is oxidized

What is H being reduced by? $\text{Mg} \rightarrow \text{Mg}$ is the "reducing agent"

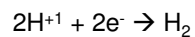
What is Mg being oxidized by? $\text{H} \rightarrow \text{H}$ is the "oxidizing agent"

Now let's write the half reactions

Example:



Hydrogen is reduced, so it will be the reduction half reaction:



Magnesium is oxidized, so it will be the oxidation half reaction:

