Oxidation Numbers

The oxidation number of an element is the charge the element would have if it were an ion
It helps us keep track of electrons in an oxidation-reduction reaction; It may be real or make-believe

Oxidation: The process whereby the oxidation number of an element increases

- Becomes more positive
- Involves the ***loss*** of electrons
- Electrons are a **product**
- $M^{\circ} \rightarrow M^{n+} + ne^-$
- $X^- \rightarrow X^{\circ} + e^-$
- $M^{2+} \rightarrow M^{3+} + e^-$

Reduction: The process whereby the oxidation number of an element decreases

- Becomes more negative
- Involves the ***gain*** of electrons
- Electrons are a **reactant**
- $M^{n+} + ne^- \rightarrow M^{\circ}$
- $X_2 + 2e^- \rightarrow 2X^-$
- $M^{4+} + 2e^- \rightarrow M^{2+}$

oxidation – reduction reactions

- Called "**redox**" reactions for short
- **Always** occur as a pair
- One element "loses" electrons
    - Oxidation
- One element "gains" electrons
    - Reduction

Redox reaction examples:
$Zn^{\circ} + Cu^{2+} \rightarrow Zn^{2+} + Cu^{\circ}$
$2\ Cl^- + F_2^{\circ} \rightarrow 2\ F^- + Cl_2^{\circ}$

Determining oxidation numbers

1. The oxidation number of a free element is zero, regardless of it is "monatomic" or if it has a subscript
    Examples: Mg, O_2, P_4, Zn
2. The oxidation number of a "monatomic" ion is the same as the charge of the ion
    Na^+ has an ox# of +1
    S^{2-} has an ox# of -2
    Fe^{3+} has an ox# of +3
    I^- has an ox# of -1
3. The sum of all the oxidation numbers of all the elements in a substance is the same as the charge of the substance
    The ox#'s in a neutral compound must all add up to zero
    The ox#'s in a polyatomic ion must all add up to the charge of the polyatomic ion

In a compound…
4) The ox# of fluorine is -1
5) the ox# of hydrogen is +1
        except in a hydride, where it is -1
        ex: LiH, CaH_2
6) the ox# of oxygen is -2
        except in peroxides and superoxides
        ex: H_2O_2, KO_2, OF_2