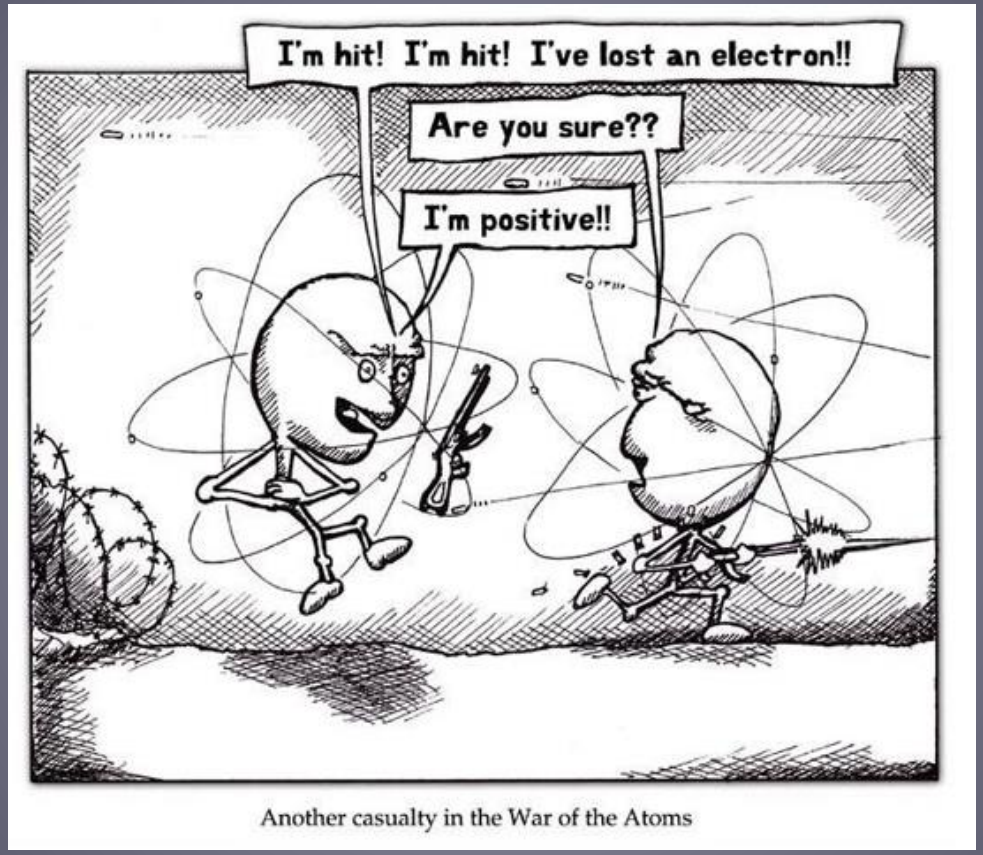
Redox Introduction



Another casualty in the War of the Atoms

http://www.linuxgrrls.org/~nick/lihr.html

Outcomes:

1-08 Define oxidation and reduction. Include: gain & loss of electrons, oxidizing and reducing agents.

1-09 Determine the oxidation numbers for atoms in compounds and ions.

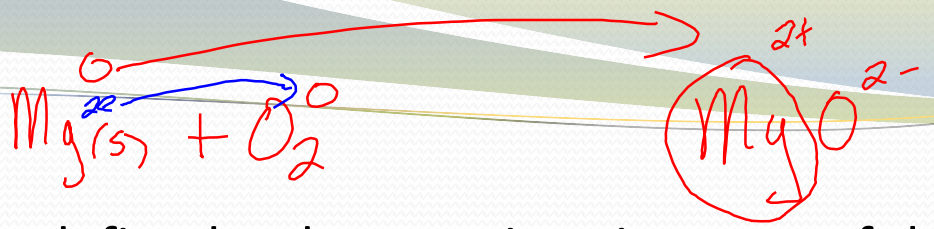
Oxidation-Reduction (Redox) Reactions:

Involve the **TRANSFER** of **ELECTRONS** from one reactant to another.

Antoinne Lavoisier:

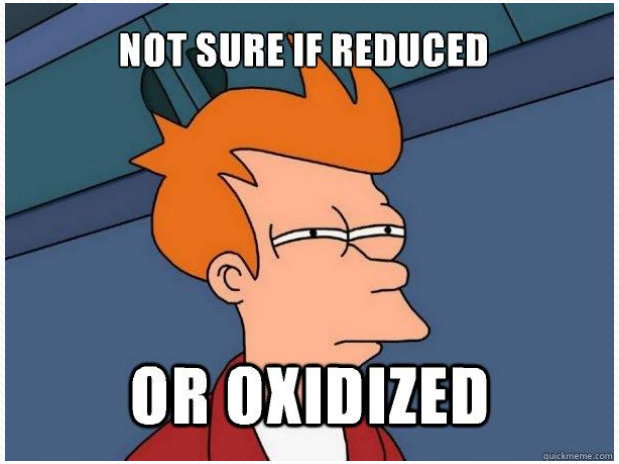
- Discovered that when substances **BURNED**, they combined with **OXYGEN**.
- **COMBUSTION** and **CORROSION** were called **OXIDATION REACTIONS**, since the substances combined with **OXYGEN** (form **OXIDES**).
- He found that **OXIDES DECREASED** in **MASS** when heated → **REDUCTION REACTION**.

Redox Today:



After the discovery of **ELECTRONS**, we defined redox reactions in terms of the **TRANSFER** of **ELECTRONS**.

- **OXIDATION** is when a substance **LOSES** electrons,
- **REDUCTION** is when a substance **GAINS** electrons:



http://www.quickmeme.com/Futurama-Fry/page/4728/

"LEO is the lion, and GER is his roar"

- **LEO** means **LOSING ELECTRONS** *is* **OXIDATION**
- **GER** means **GAINING ELECTRONS** *is* **REDUCTION**

OIL RIG

http://ch302.cm.utexas.edu/echem/redox/selector.php?name=redox

Redox Reaction Examples:

$$2Mg^{0}_{(s)} + O^{0}_{2(g)} \rightarrow 2MgO^{2+\ 2-}_{(s)}$$

- Magnesium starts as a **NEUTRAL** atom, and **LOSES TWO** electrons to become a **Mg^{2+}** ion

  → **OXIDIZED**

- Oxygen starts **NEUTRAL**, and **GAINS TWO** electrons to become **O^{2-}**

  → **REDUCED**

Redox reactions don't have to involve oxygen…

$$Mg_{(s)} + Cl_{2(g)} \rightarrow MgCl_{2(s)}$$

Oxidation Numbers:

NaCl
1+ 1-

Na_2SO_4
1+ 2-

A system chemists use to keep track of **ELECTRONS** in a reaction using the **CHARGE** an atom has when assigned a certain number of electrons (**VALENCE**).

+6 -8 = 2-
SO_4
+6 -2

Rules for Assigning Oxidation Numbers:

1. Oxidation of any **ELEMENT** (monatomic, diatomic, etc.) is always **0** (**Fe, H_2**)
2. **ALKALI** metals are all **+1** (**Na^{+1}, K^{+1}**)
3. All **ALKALINE EARTH** metals are **+2** (**Ca^{+2}**)
4. **HALOGENS** are **-1** (some exceptions)
5. **OXYGEN** is usually **-2**, exceptions are in **PEROXIDES** (**H_2O_2, Na_2O_2**) where it is **-1**.
6. **HYDROGEN** is usually **+1**, except in **METAL HYDRIDES** (**-1**) like **LiH, MgH_2** (H is more **ELECTRONEGATIVE**)
7. Oxidation numbers for **NEUTRAL** compounds must **EQUAL 0**.
8. Oxidation numbers for **POLYATOMIC IONS** must **ADD** to the **OVERALL CHARGE** of the **ION**.

Oxidation Numbers:

Assigning Oxidation Numbers:

- Assign them to **EACH ATOM**
- Assign numbers that are **KNOWN FIRST**, then calculate the rest.
- If there are no rules for a certain atom, assume the compound is **IONIC**, and use the **IONIC CHARGE**.

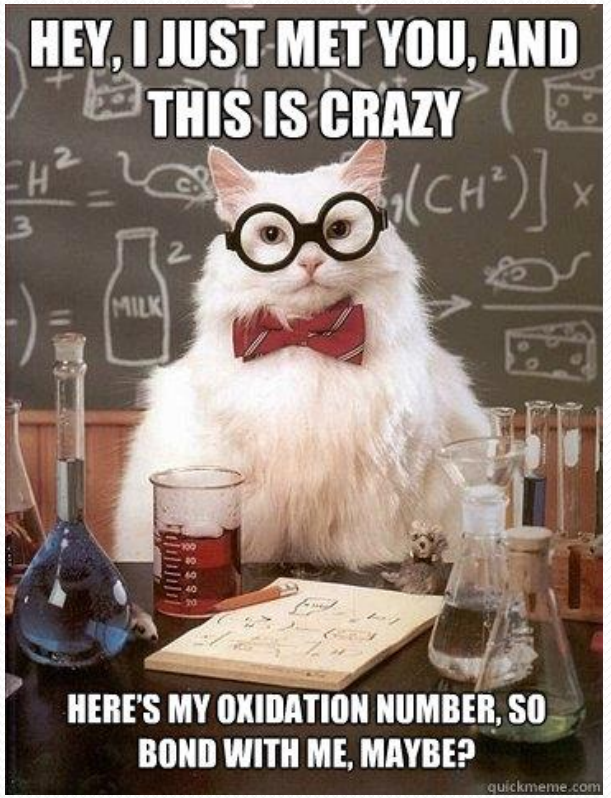
Note:

There is a difference between the **ION CHARGE** and **OXIDATION NUMBER**.

Ex) Magnesium Ion Mg^{2+}

Ion charge → **2+**

Oxidation # → **+2**



http://www.quickmeme.com/meme/3pnebu

Examples:

Assign oxidation numbers to the following compounds:

work

+1 +5 -6 = 0

HNO_3

+1 +5 -2

answer

+5 -6 = −

NO_3

+5 -2

+3 -4 = −1

NO_2

+3 -2

+2 +6 -8 = 0

K_2CrO_4

+1 +6 -2

+1 +5 -6 = 0

$AgNO_3$

+1 +5 -2

+3 -4 = -1

SO_2

+3 -2

MgO_2

+2 -1

+2 -2 = 0

BaH_2

+2 -1

+2 -2 = 0

H_2O_2

+1 -1

NaO

+1 -1

-6 +8 +6 -8 = 0

$(NH_4)_2SO_4$

-3 +1 +6 -2