BALANCING

$3MgCl_2 + 2Na_3PO_4 \longrightarrow Mg_3(PO_4)_2 + 6NaCl$ ✓

$2C_2H_2 + \frac{5}{2}O_2 \longrightarrow 2CO_2 + 2H_2O$

5 → 2 = 5

4 + 1 = 5

$2C_2H_2 + 5O_2 \longrightarrow 4CO_2 + 2H_2O$ ✓

To get one oxygen atom from O2, you need HALF (1/2) of an O2. So to get FIVE oxygen atoms, you need 5/2 O2. To get rid of the 5/2, multiply EVERY coefficient by 2. That will give us the smallest whole number ratio!

$H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$ ✓

4 H, 6 O

~~2 H~~, 4 H, 6 O ✓

IDENTIFYING REACTIONS

You may see one or more of these signs when a chemical reaction occurs

1. - A change in temperature that can't be explained in another way.
2. - Emission of light that can't be explained in another way
3. - The formation of a solid - or PRECIPITATION - in a previously liquid solution. (Not a simple phase change!) or gas formation.
4. - Color change (not simply lightening of color caused by diluting a solution!)

CLASSIFYING REACTIONS

- It's simpler to talk about different reactions if we can classify them into a small number of classes.

- We will discuss five classes of chemical reaction. (You mey learn additional ways to classsify reactions in more advanced chemistry courses!)

1 COMBINATION REACTIONS

- Reactions that involve two or more simple substances COMBINING to form a SINGLE product

- Often involve large energy changes. Sometimes violent!

- Form: $A + B + \ldots \longrightarrow C$

Example:

$$2\,Al(s) + 3\,Br_2(l) \longrightarrow 2\,AlBr_3(s)$$

CLASSIFYING REACTIONS

2 DECOMPOSITION REACTIONS

- Reactions where a SINGLE REACTANT breaks apart into several products

- Form: $A \longrightarrow B + C + \ldots$

Example:

$$2\,H_2O_2(\ell) \longrightarrow 2\,H_2O(\ell) + O_2(g)$$

* This reaction is NOT a combustion reaction, even though O_2 is involved!

* Combustion reactions CONSUME O_2, while this reaction PRODUCES O_2

CLASSIFYING REACTIONS

3 COMBUSTION REACTIONS

- Reactions of substances with MOLECULAR OXYGEN (O_2) to form OXIDES.

- Combustion forms an OXIDE of EACH ELEMENT in the burned substance!

- Form: $AB + O_2 \longrightarrow AO + BO$

Oxide: a compound containing OXYGEN and one other element!

* Combustion of hydrocarbons makes carbon dioxide and water, if enough oxygen is present. In low-oxygen environments, carbon monoxide is made instead!

Examples:

Oxides!

$$C_3H_8(g) + 5O_2(g) \longrightarrow 4H_2O(g) + 3CO_2(g)$$

$$2Mg(s) + O_2(g) \longrightarrow 2MgO(s)$$

This reaction can also be called a combination!
Two reactants form a single product.

CLASSIFYING REACTIONS

4 SINGLE REPLACEMENT REACTIONS

- Reactions where one element REPLACES another element in a compound.

- Can be predicted via an ACTIVITY SERIES (more on that later!)

- Form: $A + BC \longrightarrow AC + B$

"A" and "B" are elements., often metals.

- Easy to spot, since there is an element "by itself" on each side of the equation.

Examples:

$$Cu(s) + 2AgNO_3(aq) \longrightarrow Cu(NO_3)_2(aq) + 2Ag(s)$$

$$Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2(g)$$

CLASSIFYING REACTIONS

5 DOUBLE REPLACEMENT REACTIONS

- Also called "exchange" reactions

- The ions in two ionic compounds (one compound may also be an acid) EXCHANGE PARTNERS, forming two new compounds.

- Form: $AB + CD \longrightarrow AD + CB$

"A" and "C" are CATIONS
"B" and "D" are ANIONS

- Can be predicted based on the characteristics of the potential products (More on that later!)

- Occur in AQUEOUS SOLUTION

Examples:

Precipitation!

$$3MgCl_2(aq) + 2Na_3PO_4(aq) \longrightarrow Mg_3(PO_4)_2(s) + 6NaCl(aq)$$

$$AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$$