Classifying Chemical Equations:

We will be looking at 6 main types of chemical reaction. You will be expected to look at a chemical reaction and determine what type of reaction it is.

1. SYNTHESIS

A synthesis reaction is one in which simple parts (often elements) join to form more complex molecules (compounds). **Usually** a synthesis reaction will begin with 2 reactants and end with 1 product. The reaction has the following BASIC FORM:

A + B → AB

\*Here if this is an ionic compound, A is representing the metal and B is representing the non-metal. The following equations could also represent a synthesis:

A+B→BA; B+A→BA; B+A→AB

2. DECOMPOSITION

A decomposition reaction is one in which a complex molecule breaks apart into simpler molecules. **Usually** a decomposition reaction will begin with 1 reactants and end with 2 product. The reaction has the following BASIC FORM:

AB → A + B

\*What other equations could represent a decomposition?

3. SINGLE REPLACEMENT

In a single replacement reaction a SINGLE part of a compound is REPLACED with another element (or polyatomic ion). **Usually** there is one single element and one compound on both the reactant and the product side of the equation. The equation will have one of 2 BASIC FORMS:

A + BC → B + AC

A + BC → C + BA

4. DOUBLE REPLACEMENT

In a double replacement reaction two compounds switch or trade their metal and non-metal parts. There are two compounds on both the reactant and the product side of the equation.

AB + CD → AD + CB

5. COMBUSTION of a HYDROCARBON

This is the easiest type of reaction to identify.

A ***hydrocarbon*** is a compound consisting of only carbon and hydrogen. There is an infinite number of possible arrangements. Examples include: CH4 (methane), C2H6 (ethane), C3H8 (propane), C4H10 (butane)…

CxHy + O2 → CO2 + H2O

Notice that this is VERY different from the above examples as all of the elements involved are known (Carbon, Hydrogen and Oxygen). Infact three of the four compounds are known (Oxygen gas, Carbon dioxide and water). The only unknowns (x,y) are the numbers of carbon atoms and hydrogen atoms in the original hydro carbon.

If any other elements are present, the combustion becomes more complex, and there can be, and usually are toxic by-products. This is why most fires produce smoke and fumes.

6. Neutralization Reaction

This is a special case of a double replacement reaction in which one of the reactants is an ***acid*** and the other is a ***base***.

An ***acid*** is any ionic compound whose metal (or cation) is hydrogen (HCl, HBr, H3N, H2S, H2SO4…). These compounds give off H+ ions (or protons) in solution.

A ***base*** is any ionic compound whose anion is the polyatomic ion hydroxide (OH-) (NaOH, Ca(OH)2, KOH, Al(OH)3…). These compounds give off the OH- ions in solution.

HnX + Y(OH)m → YX + H2O

acid base salt water

An acid plus a base yields salt and water.

Classify the following Reactions. ***When finished***, try to balance them.

1. \_\_\_\_CaCO3 🡪 \_\_\_\_\_Ca + \_\_\_\_\_CO3 Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_P4 + \_\_\_O2 🡪 \_\_\_P2O3 Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_RbNO3 +\_\_\_BeF2 🡪\_\_\_Be(NO3)2 +\_\_\_RbF Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_AgNO3 + \_\_\_Cu 🡪 \_\_\_Cu(NO3)2 + \_\_\_Ag Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. \_\_\_C3H8 + \_\_\_O2 🡪 \_\_\_CO2 + \_\_\_H2O Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. \_\_\_C5H5 + \_\_\_Fe 🡪 \_\_\_Fe(C5H5)2 Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. \_\_\_SeCl6 + \_\_\_O2 🡪 \_\_\_SeO2 + \_\_\_Cl2 Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. \_\_\_MgI2 + \_\_\_Mn(SO3)2 🡪 \_\_\_MgSO3 + \_\_\_MnI4 Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. \_\_\_O3 🡪 \_\_\_O + \_\_\_O2 Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. \_\_\_NO2 🡪 \_\_\_O2 + \_\_\_N2 Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. \_\_\_C3H5N3O9 🡪 \_\_N2 + \_\_O2 + \_\_CO2 + \_\_H2O Reaction Type \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_