**Balancing Chemical Equations**

An equation is balanced when there are an equal number of atoms on each side of the equation.

*Why?   CONSERVATION* OF MASS

Matter is neither created nor destroyed!

Example of a balance equation:   2H2 + O2  → 2H2O

Notice here are two types of numbers in this equation

1. Subscripts:  example - O2

The subscript is the number after an atom and can NEVER be changed when balancing equations.

2. Coefficients:  example 2H

A coefficient is the number in front of the atom or compound that can be changed to balance the equation.

If there is no coefficient assume the number 1.  There is one molecule or mole of O2 in the above equation.  For that same oxygen gas(O2) there are 2 atoms of O .

In order to calculate the numbers of atoms multiply the subscript by the coefficient for each atom in the molecule.

For  example: to calculate the atoms in H2O on the product side in the above equation we must multiply the coefficient by the subscript.



 When we do this we get we get  4 H atoms and 2 O atoms. This equals the 4H atoms and 2O atoms on the reactant side.

2Ca(NO3)2

The one above is more complicated.  Remember to multiply the coefficient by the subscript of each atom.  If there is no subscript it is assumed 1. If there are brackets the subscript is for every atom within the bracket.

So, in the above compound with a subscript of 2, there are 2 Ca atoms. 4 N atoms (2 atoms due to the subscript outside the brackets times the coefficient of 2) and 12 O atoms (6 due to the subscript in and out of the brackets times the coefficient of 2).

Steps to Balance Equations

1. If the equation is not written for you, write the reactants on the left followed by the products on the right.

2.  Use a chart to help balance the equation. Write each atom on each side with the number of atoms next to it.  One side is for the reactants; the other side is for the products. Keep the atoms in the same order on the reactant and product side.

**ZnCl2 + (NH4)2S → ZnS + NH4Cl**

|  |  |
| --- | --- |
| Zn   1Cl    2N     2H8S     1 | Zn  1Cl   1  N    1H 4S   1 |

3. Balance one atom at a time.  Change your numbers in the chart for every atom that may have changed.  Here I started with Cl.  I have 2 Cl on the reactant side, so I need 2 Cl on the product side. This changed H and N so I have to change this in my inventory for each atom before moving on.

**ZnCl2 + (NH4)2S → ZnS + 2NH4Cl**

|  |  |
| --- | --- |
| Zn   1Cl    2N     2H8  S     1 | Zn  1Cl   ~~1~~   2N    ~~1~~   2H ~~4~~   8S     1 |

6. Now we are balanced.  We have equal number of atoms on the reactant side and product side of the equation.

**2ZnCl2 + (NH4)2S → ZnS + 2NH4Cl**

8. Finally make sure the coefficients are in the **lowest whole number ratio**.

The above coefficients are 2, 1, 1, 2 this is the lowest whole number ratio for each coefficient.

Super fun!!  Now go and practice.