**The Mole & Molar Mass**

The mole is the standard method in chemistry for communicating how much of a substance is present.

Here is how the International Union of Pure and Applied Chemistry (IUPAC) defines "mole:"

The mole is the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon-12. When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.

This is the fundamental definition of what one mole is. One mole contains as many entities as there are in 12 grams of carbon-12 (or 0.012 kilogram).

In one mole, there are 6.022 x 1023 atoms. Here's another way: there are 6.022 x 1023 atoms of carbon in 12 grams of carbon-12.

Let's say that real clearly: one mole of ANYTHING contains 6.022 x 1023 entities.

The word "entities" is simply a generic word. For example, if we were discussing atoms, then we would use "atoms" and if molecules were the subject of discussion, the word entities would be replaced in actual use by "molecules."

Avogadro's Number has been very carefully measured in a number of ways over many decades. The symbol for mole is "mol."

Here it is again: one mole of ANY specified entity contains 6.022 x 1023 of that entity. For example:

* One mole of donuts contains 6.022 x 1023 donuts
* One mole of H2O contains 6.022 x 1023 molecules
* One mole of nails contains 6.022 x 1023 nails
* One mole of Fe contains 6.022 x 1023 atoms
* One mole of dogs contains 6.022 x 1023 dogs
* One mole of electrons contains 6.022 x 1023 electrons

Get the idea?

6.022 x 1023 is so important in chemistry that it has a name. It is called Avogadro's Number and has the symbol N. It is so named in honor of Amedeo Avogadro, an Italian chemist, who, in 1811, made a critical contribution (recognized only in 1860 after his death) which helped greatly with the measurement of atomic weights.

Please note that counting atoms or molecules is very difficult since they are so small. However, we can "count" atoms or molecules by weighing large amounts of them on a balance.

When we mass one mole of a substance on a balance, this is called a "molar mass" and has the units g/mol (grams per mole). This idea is very critical because it is used all the time.

* A molar mass is the weight in grams of one mole.
* One mole contains 6.022 x 1023 entities.

Therefore, a molar mass is the mass in grams of 6.022 x 1023 entities.

OK. How does one calculate a molar mass? Get ready, because you already know how to calculate a molar mass.

All you need to do is calculate the molecular weight from the periodic table and stick the unit "g/mol" after the number and that is the molar mass for the substance in question.

Calculate the molar mass of Al(NO3)3

(1 x 26.98) + (3 x 14.007) + (9 x 16.00) = 213.00 g/mol

213.00 grams is the mass of one mole of aluminum nitrate.

213.00 grams of aluminum nitrate contains 6.022 x 1023 entities of Al(NO3)3