**Molecular Weight**

Molecular Weight = weight in atomic mass units of all the atoms in a given formula.

Symbol = was and is most commonly amu but not the most correct symbol is u.

Why do we need to know molecular weight? It is needed in order to know how many grams are in one mole of a substance.

What is a MOLE?

Mole is the standard method in chemistry for communicating how much of a substance is present. (I’ll explain more later…)

Four Steps to Calculating a substance’s molecular weight:

1. Determine how many atoms of each different element are in the formula.
2. Look up the atomic weight of each element in a periodic table
3. Multiply step one times step two for each element
4. Add the results of step three together and round off as necessary.

Practice:

KCl  
1. K = 1 Cl = 1  
2. K = 39.10 Cl = 35.45  
3. 1(39.10) + 1(35.45) =   
4. 74.55 amu represents the molecular weight of KCl

H2O2

1. H = 2 O = 2
2. H = 1.00 O = 15.99
3. 2(1) + 2(15.99) =
4. 2+32 = 34 amu

**MOLE**

The standard method in chemistry for communicating how much of a substance is present. The mole is the amount of “entities” where entities is a generic term and can used to describe atoms, molecules, ions, electrons, etc.   
In one mole of ANYTHING there are 6.022 x 1023 entities.

So… One mole of donuts contains 6.022 x 1023 donuts  
 One mole of carbon atoms contains 6.022 x 1023 of carbon atoms  
 One mole of water molecules contains 6.022 x 1023 of H2O molecules.

Avogadro’s Number  
6.022 x 1023 is such an important number that it has its own name and symbol, N. Named Avogadro’s Number in honor of Italian chemist who made critical contributions to measuring atomic weights.

So….

**Molar Mass**  
Counting atoms or molecules is very difficult since they are so small BUT you can “count” atoms or molecules by weighing large amounts of them on a balance.

When we weigh one mole of a substance on a balance, this is called “molar mass” and has the units g/mol (grams per mole).

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

How do YOU calculate molar mass? The molar mass IS the molecular weight (!) in grams (not amu’s)

So 🡪You calculate the molecular weight and stick the unit “g/mol” after the number and that is the molar mass for the substance in question.

Example:  
Al(NO3)3

(1xAl)+(3xN)+(9xO) 🡪 (1x 26.98)+(3x14.007) + (9x 16.00) = 213.00 g/mol

213 grams is the mass of one mole of aluminum nitrate

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

Practice:  
AlCl3

**Converting Moles 🡪 to Grams**

The mole is the standard measurement amount in chemistry and when substances react with one another they do so in ratios of moles. Problem is…balances give readings in grams, not moles!

So, when comparing one substance to another using moles….we have to convert moles to grams since this is the unit we measure from balances.

3 steps to converting moles of a substance to grams:

1. Determine how many moles are given in the problem
2. Calculate the molar mass of the substance
3. Multiply step one by step two.

The equation looks like this:

Grams of the substance = molar mass of the substance in grams  
moles of the substance one mole

You replace the “grams of the substance” with X because this is what you are solving for.

CONFUSED? It’s okay…..follow along with the example:

Problem: Calculate how many grams are in 0.700 moles of H2O2

1. Determine how many moles you have ---- 0.700 moles
2. Determine the molar mass of the substance ---- H2O2 has a molar mass of 34.0146 g/mol
3. Multiply the moles given by the substance’s molar mass:  
   0.700 mole x 34.0146 g/mol = 23.8 grams

The answer of 23.8 grams has been rounded to three significant figures because the 0.700 value had the least number of significant figures in the problem.

Using the equation – this problem would look like:  
 x = 34.0146 g  
 0.700 mol 1.00 mol  
(then cross multiply and divide to solve for x)

Problem #2: Convert 2.50 moles of KClO3 to grams.

**Converting Grams 🡪 to Moles**

The mole is the standard measurement of amount. However, remember that balances do NOT give readings in moles, they give readings in grams. Oh hNO!!

Steps to convert grams of a substance to moles

1. Determine how many grams are given in the problem
2. Calculate the molar mass of the substance.
3. Divide step one by step two.

Here is the equation:

Grams of the substance = molar mass of the substance in grams  
moles of the substance one mole

Where the “moles of the substance” will be the unknown (x) and what you solve for.

Practice Problem:

Convert 25.0 grams of KMnO4 to moles

1. Determine how many grams are present --- 25.0 grams
2. Determine the molar mass of the substance --- KMnO4 is 158.034 g/mol
3. Divide the grams given by the substance’s molar mass  
   25.0 g = 0.158 mol  
   158.034 g/mol

If this problem were set up like the proportion, it would look like this:

25.0 g = 158.034 g  
 x 1.00 mol

Then, you cross-multiply and divide to solve for X.

Practice Problem:

Calculate how many moles are in 17.0 grams of H2O2