Percent composition:

For those of you keeping track at home, this is chapter 7 section 3 in your book. The equation in the book is:

$$\frac{\text{total mass of the element}}{\text{molar mass}} \times 100 = \text{percent mass of the element}$$

This looks somewhat different than the equation I gave you in class, but don't let that throw you off. Here is the equation I have you in class:

$$\frac{(\text{molar mass of element}) \times (\text{\# of moles of element})}{\text{molar mass of compound}} \times 100 = \text{percent mass of the element}$$

By this point in the semester, you should be able to recognize that (molar mass of element) x (# of moles of element) = total mass of the element; so these two equations are exactly the same. So how does this work?

Examples:

a) What is the percent composition of manganese in strontium permanganate?
First you need a formula (better know your nomenclature). → $Sr(MnO_4)_2$
Next, what element is the question asking about, and how many moles of that element are in the compound? → Mn is the element and there are 2 moles of Mn in one mole of $Sr(MnO_4)_2$
Now plug all of this into the equation (I am going to use the equation I gave you, but either will work).

$$\frac{(54.9380) \times (2)}{325.49} \times 100 = \mathbf{33.757\%}$$

So, manganese makes up 33.75% of strontium permanganate. For sig. figs., the 2 and the 100 are infinite, so in this case 325.49 limits, but that could change depending on how many sig. figs. you use for the molar mass.

b) What is the percent composition of each element in aluminum biphosphate?
Again, you need to know the formula: $Al_2(HPO_4)_3$ = 341.9011 g/mol

$$\mathbf{Al} = \frac{26.9815 \times 2}{341.9011} \times 100 = \mathbf{15.7832\%} \qquad \mathbf{H} = \frac{1.00797 \times 3}{341.9011} \times 100 = \mathbf{0.884440\%}$$

$$\mathbf{P} = \frac{26.9815 \times 3}{341.9011} \times 100 = \mathbf{27.1779\%} \qquad \mathbf{O} = \frac{15.9994 \times 12}{341.9011} \times 100 = \mathbf{56.1545\%}$$

Here is some practice for you; Find the percent composition of each element in each of the following:

1) oxalic acid
2) $C_{23}H_{40}N_7O_{17}P_3S$
3) mercury (I) chloride
4) ammonium dichromate
5) iron (III) peroxide

Here are a few other things to think about. You should be able to look at two compounds and be able to tell which one has a higher percent of a certain element. What does that mean? Well, hopefully if I have you the following pair of compounds, you can tell just by looking which one has a higher percentage of oxygen: titanium (II) oxide and titanium (IV) oxide. Take a guess and then do the math and see if you were correct.

BONUS!! A question from a previous semesters' exam to try:

1) Hemoglobin is 0.342 % Fe by mass, and each hemoglobin molecule contains four iron atoms. Calculate the molar mass of hemoglobin.