NAME: _____ **CHEMISTRY** __/__/__

PART I: PERCENT COMPOSITION

When we calculate percent composition, we are determining the relative mass that each element contributes to the total mass of the compound. For example, if we calculate the gram formula mass of H_2O we will find it to be 18.0 g/mol. We arrived at this number by adding the mass of oxygen, 16.0, and the mass of two hydrogen, 2.0. Oxygen makes up 16.0 of the total 18.0 grams. Hydrogen is 2.0 of 18.0 grams. If we divide each elements total mass by the compounds total mass and multiplying this result by 100, we get a percentage. This percentage is the element's percent composition.

Example (from above):

STEP 1		**STEP 2**		**STEP 3**
H_2O:				
H: 2 x 1.01 = 2.02	→	H: 2.0 ÷ 18.0 = 0.111	→	H: 0.111 x 100 = **11.1%**
O: 1 x 16.00 = 16.00		O: 16.0 ÷ 18.0 = 0.889 (rounded)		O: 0.889 x 100 = **88.9%**
Total: 18.02 g/mol				

Example #1 Calculate the percent composition of ammonium nitrate.

Description of Action	Action
1. Write the formula for the given compound.	**1.** NH_4NO_3
2. Record the amount of each element in the compound. (Note: We have 2 total nitrogen, so we record them together.) Multiply the amount of each element by its atomic weight (measured to the tenths place). Add the results to find the gram formula mass of the compound.	**2.** N: 2 x 14.0 = **28.0** H: 4 x 1.0 = **4.0** O: 3 x 16.0 = **48.0** **80.0 g/mol**
3. Divide the total mass of each element by the gram formula mass. For these calculations your answer should have 3 places after the decimal (round if necessary).	**3.** N: 28.0 ÷ 80.0 = **0.350** H: 4.0 ÷ 80.0 = **0.050** O: 48.0 ÷ 80.0 = **0.600**
4. Multiply each result by 100. Add the % symbol to your new result. (If you were to add up your percentages the must equal 100.)	**4.** N: 0.350 x 100 = **35.0%** H: 0.050 x 100 = **5.0%** O: 0.600 x 100 = **60.0%** **100.0%**

Now you try one. Again, **write in the descriptions**. Trust me, it helps!!!
Calculate the percent composition of each element in **barium phosphate**.

Description of Action	Action
1. Write the formula for the given compound.	**1.** $Ba_3(PO_4)_2$
2. Record the amount of each element in the compound. Multiply the amount of each element by its atomic weight. Add the results to find the gram formula mass of the compound.	**2.** Ba: 3 x 137.3 = 411.9 P: 2 x 31.0 = 62.0 O: 8 x 16.0 = 128.0 **601.9 g/mol**
3. Divide the total mass of each element by the gram formula mass. For these calculations your answer should have 3 places after the decimal (round if necessary).	**3.** Ba: 411.9 ÷ 601.9 = **0.684** P: 62.0 ÷ 601.9 = **0.103** O: 128.0 ÷ 601.9 = **0.213**
4. Multiply each result by 100. Add the % symbol to your new result. (If you were to add up your percentages the must equal 100.)	**4.** Ba: 0.684 x 100 = **68.4%** P: 0.103 x 100 = **10.3%** O: 0.213 x 100 = **21.3%** **100.0%**

PART II: CALCULATING THE MASS OF EACH ELEMENT IN A COMPOUND

So far we have been dealing only with percents. In this section we will be focusing on how to determine the mass of each element in a compound. For example, how would I determine the number of grams of barium I would need to make 27.5 grams of barium chloride? Just as above, we would calculate our percent composition and then multiply our decimal value and the total amount of grams needed.

Example (from above)

STEP 1	STEP 2	STEP 3
$BaCl_2$		
Ba: 1 x 137.3 = 137.3 ⟶	Ba: 137.3 ÷ 208.3 = 0.659 ⟶	Ba: 0.659 x 27.5 = 18.1 grams
Cl: 2 x 35.5 = 71.0	Cl: 71.0 ÷ 208.3 = 0.341	Cl: 0.341 x 27.5 = 9.4 grams
Total: 208.3 g/mol		

Lets try one step by step. How many grams of iron are in 45.6 grams of ferrous bromide?

Description of Action	Action
1. Write the formula for the given compound.	**1.** $FeBr_2$
2. Record the amount of each element in the compound. Multiply the amount of each element by its atomic weight. Add the results to find the gram formula mass of the compound.	**2.** Fe: 1 x 55.8 = **55.8** Br: 2 x 79.9 = **159.8** **215.6 g/mol**
3. Divide the mass of each element by the total gram formula mass. For these calculations your answer should have 3 places after the decimal.	**3.** Fe: 55.8 ÷ 215.6 = **0.259** Br: 159.8 ÷ 215.6 = **0.741**
4. Instead of multiplying our results by 100 to find a percentage, we will multiply our result by the given mass. Our results are in grams. (Note: To check your work, add your two masses. It should equal your given mass.)	**4.** Fe: 0.259 x 45.6 = **11.8 grams** Br: 0.741 x 45.6 = **33.8 grams** **45.6 grams**

Now you try the next one. FILL IN THE DESCRIPTIONS!!!
Calculate the number of grams of gold in 89.6 grams of **aurous perchlorate**.

Description of Action	Action
1. Write the formula for the given compound.	**1.** $AuClO_4$
2. Record the amount of each element in the compound. Multiply the amount of each element by its atomic weight. Add the results to find the gram formula mass of the compound..	**2.** Au: 1 x 197.0 = 197.0 Cl: 1 x 35.5 = 35.5 O: 4 x 16.0 = 64.0 **296.5 g/mol**
3. Divide the mass of each element by the total gram formula mass. For these calculations your answer should have 3 places after the decimal.	**3.** Au: 197.0 ÷ 296.5 = **0.664** Cl: 35.5 ÷ 296.5 = **0.120** O: 64.0 ÷ 296.5 = **0.216**
4. Instead of multiplying our results by 100 to find a percentage, we will multiply our result by the given mass. Our results are in grams. (Note: To check your work, add your two masses. It should equal your given mass.)	**4.** Au: 0.664 x 89.6 = **59.5 grams** Cl: 0.120 x 89.6 = **10.8 grams** O: 0.216 x 89.6 = **19.4 grams** **89.7 grams (close enough)**

Summary for Percent Composition & Mass Composition Problems

1. Write the formula. (Do not forget to cross your charges.)
2. Calculate the gram formula mass.
3. Add all masses to get a total mass.
4. Divide each gram formula mass by the total mass.

If % Composition: 5. Multiply each result by 100.
If Mass Composition: 5. Multiply each result by the given mass.

Part I: Calculate the percent composition of all of the elements in the following compounds.

1. gold(I) iodide
AuI
Au: 60.8%
I: 39.2%

2. manganese(III) silicate
$Mn_2(SiO_3)_3$
Mn: 32.5%
Si: 24.9%
O: 42.6%

3. strontium astatide
$SrAt_2$
Sr: 17.3%
At: 82.7%

4. calcium hypochlorite
$Ca(ClO)_2$
Ca: 28.0%
Cl: 49.6%
O: 22.4%

5. radium sulfate
$RaSO_4$
Ra:70.2%
S: 10.0%
O: 19.9%

6. stannous phosphite
$Sn_3(PO_3)_2$
Sn: 69.3%
P: 12.1%
O: 18.7%

7. sodium sulfite
Na_2SO_3
Na: 36.5%
S: 25.5%
O: 38.1%

8. ammonium carbonate
$(NH_4)_2CO_3$
N: 29.2%
H: 8.3%
C: 12.5%
O: 50.0%

9. plumbic silicate
$Pb(SiO_3)_2$
Pb: 57.7%
Si: 15.6%
O: 26.7%

10. silver chlorite
$AgClO_2$
Ag: 61.5%
Cl: 20.2%
O: 18.2%

Part II: Calculate the mass of each element in the following compounds.

1. 23.85 grams of francium fluoride
FrF
Fr: 21.97 g
F: 1.88 g

2. 86.1 grams of ferrous oxide
FeO
Fe: 66.9 g
O: 19.2 g

3. 5.6 grams of mercury(II) phosphate
$Hg_3(PO_4)_2$
Hg: 4.3 g
P: 0.44 g
O: 0.91 g

4. 234.7 grams of tin(IV) nitride
Sn_3N_4
Sn: 202.8 g
N: 31.9 g

5. 39.1 grams of aluminum chloride
$AlCl_3$
Al: 7.91 g
Cl: 31.2 g

6. 38.25 grams of zinc sulfide
ZnS
Zn: 25.66 g
S: 12.59 g

7. 420.69 grams of ammonium sulfite
$(NH_4)_2SO_3$
N: 101.4 g
H: 29.0 g
S: 116.1 g
O: 173.7 g

8. 90.33 grams of magnesium telluride
MgTe
Mg: 14.5 g
Te: 75.9 g

9. 87.21 grams of beryllium phosphite
$Be_3(PO_3)_2$
Be: 12.74 g
P: 29.20 g
O: 45.36 g

10. 56.78 grams of cesium oxide
Cs_2O
Cs: 53.5 g
O: 3.2 g