**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_**

**Moles, Percent Composition, and Empirical Formulas**

Use conversion factors and show all of your work in answering the following questions.

1. Determine the molar mass of the following compounds.
	1. Na2O2 c. (NH4)2SO4

* 1. Mg(NO3)2 d. K2CO3
1. Make the following calculations for AlCl3.

a. Determine the molar mass of AlCl3.

b. Calculate the moles of 855.8 grams of AlCl3.

c. Determine the formula units of AlCl3 in 0.665 moles.

d. Determine the mass of 2.30 x 1024 formula units of AlCl3.

**Percent Composition and Empirical Formula: Definitions**

 **Percent Composition**

The **percent composition** (by mass) of an element in a compound is the mass of one element in one mole of compound divided by the molar mass of the compound, times 100.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |
| --- | --- | --- | --- |
| Percent composition of element *i* | = | mass of *i* in one mole of the compound | x 100 |
| mass of one mole of the compound |

 |

The **molecular formula** of a compound gives the exact number of atoms of each element.

The **empirical formula** of a compound describes the *relative number* of each type of atom in the compound. It is the smallest-whole-number ratio of elements (as subscripts). For example, the empirical formula of ethyne (in table above) is CH even though the molecular formula is C2H2.



Empirical Formula

CH

Answer the following questions regarding the table above, showing your work for any calculations.

1. Fill in the missing molecular formulas and % composition in Table 1.
2. Verify that the % composition given for ethyne in Table 1 is correct.
3. Is it possible, given the original data in Table 1, to determine the % composition by mass of H for

2-butene without using the given equation for percent composition? If so, how?

1. Based on the data in Table 1, is it possible to determine the *molecular* formula of a compound solely from its percent composition? Why or why not?
2. Comment on the ratio of the elements present in all the compounds with the same % composition.

6. Determine the empirical formula of each molecule in Table1. Write it to the right of the molecule in the table.

7. The molecule 2-hexene has the molecular formula C6H12. Using Table 1, instead of math, determine the percent composition of H in this molecule.

**Practice Problems**

1. Calculate the percent composition **(include each element)** for the following compounds.

* 1. Na2O2 b. Mg(ClO3)2

c. (NH4)2SO4 d. K2Cr2O7

2. Determine the percent composition of acetic acid, C2H3O2.

1. Calcium dihydrogen phosphate is an important fertilizer. What is the percent of phosphorous in Ca(H2PO4)2?
2. A 9.03 piece of Mg combines completely with 3.48 g N to form a compound. What is the percent composition of this compound?
3. For many years, chloroform (CHCl3) was used as an anesthetic in spite of the fact that it is also a toxic substance that may cause liver and kidney damage. Calculate the percent composition of CHCl3.