Extra Practice - Percent Composition and Molecular Formula Worksheet

1. What's the empirical formula of a molecule containing 65.5% carbon, 5.5% hydrogen, and 29.0% oxygen?

C - 5.458 mol = 3
H = 5.5 = 3
O = 1.81 = 1

C_3H_3O

2. If the molar mass of the compound in problem 1 is 110 grams/mole, what's the molecular formula?

$\frac{110}{(36+3+16)} = 2 \times C_3H_3O$

$C_6H_6O_2$

3. What's the empirical formula of a molecule containing 18.7% lithium, 16.3% carbon, and 65.0% oxygen?

Li 2.69 ≈ 2
C 1.358 ≈ 1
O 4.0625 ≈ 3

Li_2CO_3

4. If the molar mass of the compound in problem 3 is 73.8 grams/mole, what's the molecular formula?

$\frac{73.8}{73.8} = 1$ Li_2CO_3

Write the molecular formulas of the following compounds:

5. A compound with an empirical formula of C_2OH_4 and a molar mass of 88 grams per mole.

44 88/44 = 2

$C_4O_2H_8$

6. A compound with an empirical formula of C_4H_4O and a molar mass of 136 grams per mole.

68 136/68 = 2

$C_8H_8O_2$

7. A compound with an empirical formula of CFBrO and a molar mass of 254.7 grams per mole.

8. A compound with an empirical formula of C_2H_8N and a molar mass of 46 grams per mole.

46 46/46 = 1

C_2H_8N

Answer the following questions:

9. The percentage composition of acetic acid is found to be 39.9% C, 6.7% H, and 53.4% O. Determine the empirical formula of acetic acid.

$39.9/12 = 3.325 \approx 1$
$6.7/1 = 6.7 \approx 2$
$53.4/16 = 3.3375 \approx 1$

CH_2O

10. The molar mass for question #9 was determined by experiment to be 60.0 g/mol. What is the molecular formula?

$\frac{60}{(12+2+16)} = 2$ $C_2H_4O_2$

~~11.~~ SKIP Aniline, a starting material for urethane plastic foams, consists of C, H, and N. Combustion of such compounds yields CO_2, H_2O, and N_2 as products. If the combustion of 9.71 g of aniline yields 6.63 g H_2O and 1.46 g N_2, what is its empirical formula?

~~12.~~ The molar mass of aniline is 93 g/mol. What is its molecular formula?

13. Calculate the mass percent of carbon, nitrogen and oxygen in acetamide, C_2H_5NO.

$C = \frac{24}{59} = 40.7\%$ $N = \frac{14}{59} = 23.7\%$ $O = \frac{16}{59} = 27.1$

$H = 8.47\%$

14. A 50.51 g sample of a compound made from phosphorus and chlorine is decomposed. Analysis of the products showed that 11.39 g of phosphorus atoms were produced. What is the empirical formula of the compound?

$11.39/30.974 = 0.3677/0.3677 = 1$

$39.12/35.45 = 1.10/0.3677 = 3$ PCl_3

15. When 2.50 g of an oxide of mercury, (Hg_xO_y) is decomposed into the elements by heating, 2.405 g of mercury are produced. Calculate the empirical formula.

$0.23760/0.23760 = 1$

$\frac{2.405}{2.50} = 96.2\%$ $Hg/200.59 = 0.4796/0.23760 = 2$ Hg_2O

16. The compound benzamide has the following percent composition. What is the empirical formula?

$C = \frac{69.40\%}{12} \approx 5.783 \approx 7$ $H = \frac{5.825\%}{1} \approx 5.825 \approx 7$ $O = \frac{13.21\%}{16} \approx 0.8256 \approx 1$ $N = \frac{11.57\%}{14} = 0.8264 = 1$

C_7H_7ON

17. A component of protein called serine has an approximate molar mass of 100 g/mole. If the percent composition is as follows, what is the empirical and molecular formula of serine?

$C = \frac{34.95\%}{12} \approx 2.9125 \approx 3$ $H = \frac{6.844\%}{1} \approx 6.844 \approx 7$ $O = \frac{46.56\%}{16} \approx 2.91 \approx 3$ $N = \frac{13.59\%}{14} = 0.9707 = 1$

$C_3H_7O_3N$