

Being an Synthetic Organic Chemist, I spent the past weeks synthesizing several compounds and here's the analysis:

A. Determine the Empirical Formulae:

1. H 2.055% S 32.70%

2. C 59.96% H 13.42%

3. A 3.450 g of a sample of nitrogen reacts with 1.970 g of Oxygen.

4. An organic chemical gives the following analysis:
5.667 g Carbon 0.3165 g Hydrogen 5.566 g Chlorine

5. Cu 66.75% P 10.84%

6. A compound containing only Carbon, Hydrogen and Oxygen gives the following analysis:
C 40.00% H 6.700%⁹⁹⁵

The Molar Mass is between 115 and 125 g/mole. What is the Empirical and Molecular formulae.

7. An organic compound containing only C, H, N and O has the following analysis
C 49.47% H 5.191% N 28.86%

The approximate molar mass is 194. What is the Empirical and Molecular formulae.

ANSWERS

1. H 2.055% 2.055 g / 1.008 g/M = 2.039 M 2.039 M / 1.020 M = 1.999 = 2
 S 32.70% 32.70 g / 32.07 g/M = 1.020 M 1.020 M / 1.020 M = 1 = 1
 O 65.25% 65.25 g / 16.00 g/M = 4.078 M 4.078 M / 1.020 M = 3.998 = 4



2. C 59.96% 59.96 g / 12.01 g/M = 4.993 M 4.993 M / 1.664 M = 3.001 = 3
 H 13.42% 13.42 g / 1.008 g/M = 13.31 M 13.31 M / 1.664 M = 7.999 = 8
 O 26.62% 26.62 g / 16.00 g/M = 1.664 M 1.664 M / 1.664 M = 1 = 1



3. A 3.450 g of a sample of nitrogen reacts with 1.970 g of Oxygen.
 3.450 g N 3.450 g / 14.01 g/M = 0.2463 M 0.2463 M / 0.1231 M = 2.001
 1.970 g O 1.970 g / 16.00 g/M = 0.1231 M 0.1231 M / 0.1231 M = 1



4. An organic chemical gives the following analysis:
 5.667 g Carbon 5.667 g / 12.01 g/M = 0.4719 M 0.4719 M / 0.1570 M = 3.006
 0.3165 g Hydrogen 0.3165 g / 1.008 g/M = 0.3140 M 0.3140 M / 0.1570 M = 2
 5.566 g Chlorine 5.566 g / 35.45 g/M = 0.1570 M 0.1570 M / 0.1570 M = 1



5. Cu 66.75% 66.75 g / 63.55 g/M = 1.050 M 1.050 M / 0.3500 M = 3
 P 10.84% 10.84 g / 30.97 g/M = 0.3500 M 0.3500 M / 0.3500 M = 1
 O 22.41% 22.41 g / 16.00 g/M = 1.401 M 1.401 M / 0.3500 M = 4.003



6. A compound containing only Carbon, Hydrogen and Oxygen gives the following analysis:

C	40.00%	40.00 g / 12.01 g/M = 3.331 M	3.331 M / 3.331 M = 1
H	6.700%	6.700 g / 1.008 g/M = 6.647 M	6.647 M / 3.331 M = 1.995
O	100 % - 40.00% - 6.700% = 59.33 % O	53.30 g / 16.00 g/M = 3.331 M	3.331 M / 3.331 M = 1

C₁H₂O

$$\text{C}_1\text{H}_2\text{O}_1 = 12.01 + 2 * 1.008 + 16.00 = 30.03 \text{ g / M}$$

The Molar Mass is between 115 and 125 g/mole. What is the Empirical and Molecular formulae.

$$2 * 30.03 = 30.06 \quad 3 * 30.03 = 90.09 \quad \underline{4 * 30.03 = 120.12} \quad \mathbf{4 * C_1H_2O_1 = C_4H_8O_4}$$

7. An organic compound containing only C, H, N and O has the following analysis

C	49.47%	49.47 g / 12.01 g/M = 4.119 M	4.119 M / 1.03 M = 3.999
H	5.191%	5.191 g / 1.008 g/M = 5.149 M	5.149 M / 1.03 M = 4.999
N	28.86%	28.86 g / 14.01 g/M = 2.060 M	2.060 M / 1.03 M = 2
O	100% - 49.47% - 5.191% - 28.86% = 16.48% O	16.48 g / 16.00 g/M = 1.03 M	1.03 M / 1.03 M = 1

C₄H₅N₂O

$$\text{C}_4\text{H}_5\text{N}_2\text{O} = 4 * 12.01 + 5 * 1.008 + 2 * 14.01 + 16.00 = 90.09$$

The approximate molar mass is 194. What is the Empirical and Molecular formulae.

$$2 * 90.09 = 180.18 \quad \mathbf{2 C_4H_5N_2O = C_8H_{10}N_4O}$$