

**Empirical Formula**

**Page 241, Problem 57**      **Compound contains**

Phosphorus    90.10%

Hydrogen      8.90 %

**Page 241, Problem 58**      **Compound contains**

Hydrogen      3.09%

Phosphorus    31.60%

Oxygen        65.31%

**Page 241, Problem 59**      **0.5998 g of a sample**

Carbon        0.2322 g

Hydrogen      0.05848 g

Oxygen        0.3091 g

**Page 242, Problem 60**

Barium        58.84 %

Sulfur        13.74 %

Oxygen        27.43 %

**Chapter 9, P 256**

$\text{HF} + \text{SiO}_2 \rightarrow \text{SiF}_4 + \text{H}_2\text{O}$       20 g HF requires how much  $\text{SiO}_2$

$\text{NaHCO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$       1.00 g  $\text{NaHCO}_3$  requires how much HCl

$\text{Mg}(\text{OH})_2 + 2 \text{HCl} \rightarrow 2 \text{H}_2\text{O} + \text{MgCl}_2$       1.00 g  $\text{Mg}(\text{OH})_2$  requires how much HCl – in moles

**A. Determine the Empirical Formulae:**

1. H 2.055%  
S 32.70%  
O 65.25%

2. C 59.96%  
H 13.42%  
O 26.62%

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%  
O 22.41%

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

H 6.700%

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 TO ABOVE

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%	$2.055 \text{ g} / 1.008 \text{ g/M} = 2.039 \text{ M}$	$2.039 \text{ M} / 1.020 \text{ M} = 1.999$	= 2
	S	32.70%	$32.70 \text{ g} / 32.07 \text{ g/M} = 1.020 \text{ M}$	$1.020 \text{ M} / 1.020 \text{ M} = 1$	= 1
	O	65.25%	$65.25 \text{ g} / 16.00 \text{ g/M} = 4.078 \text{ M}$	$4.078 \text{ M} / 1.020 \text{ M} = 3.998$	= 4



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



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



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



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



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



$$C_1H_2O_1 = 12.01 + 2 * 1.008 + 16.00 = 30.03 \text{ g / M}$$

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

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

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



$$C_4H_5N_2O = 4 * 12.01 + 5 * 1.008 + 2 * 14.01 + 16.00 = 90.09$$

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

$$2 * 90.09 = 192.18 \quad \mathbf{2 C_4H_5N_2O = C_8H_{10}N_4O}$$