

Empirical Formula Calculations WS - K

Name: KEY
 Period: _____ Date: _____

Empirical Formula from MOLE RATIOS

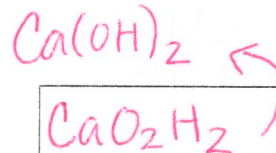
mole \rightarrow ratio

1. A compound was analyzed and found to contain 0.337 moles of calcium, 0.675 moles of oxygen, and 0.668 mole of hydrogen. What is the empirical formula of the compound?

$$\text{Ca} = \frac{0.337}{0.337} = 1$$

$$\text{H} = \frac{0.668}{0.337} = 2$$

$$\text{O} = \frac{0.675}{0.337} = 2$$



2. Determine the empirical formula for an unknown compound composed of 4.028 mol C, 8.056 mol H, and 3.336 mol O.

$$\text{C} = \frac{4.028}{3.336} = 1 \quad \text{H} = \frac{8.056}{3.336} = 2 \quad \text{O} = \frac{3.336}{3.336} = 1$$



Empirical Formula from GRAMS

grams \rightarrow mole \rightarrow ratio

3. What is the empirical formula for a compound which contains 0.0134g of iron, 0.00769g of sulfur, and 0.0115g of oxygen.

$$\text{Fe} = \frac{0.0134}{55.847} = \frac{2.399}{2.398} = 1$$

$$\text{S} = \frac{0.00769}{32.066} = \frac{2.398}{2.398} = 1$$

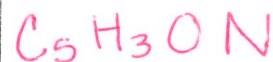
$$\text{O} = \frac{0.0115}{15.999} = \frac{7.188}{2.398} = 2.99 = 3$$



4. Barry Um has a sample of a compound which contains 97.56g of carbon, 4.878g of hydrogen, 52.03g of oxygen, and 45.53g of nitrogen. Find the empirical formula.

$$\text{C} = \frac{97.56}{12.011} = \frac{8.123}{3.251} = 2.5 \times 2 \quad \text{H} = \frac{4.878}{1.008} = \frac{4.8392}{3.251} = 1.5 \times 2 \quad \text{O} = \frac{52.03}{15.999} = \frac{3.252}{3.251} = 1 \times 2$$

$$\text{N} = \frac{45.53}{14.007} = \frac{3.251}{3.251} = 1 \times 2$$



5. An organic sample contains 145.946g carbon, 24.3243g hydrogen, and 129.7297g oxygen. What is its empirical formula?

$$\text{C} = \frac{145.946}{12.011} = \frac{12.151}{8.1086} = 1.5 \times 2$$

$$\text{H} = \frac{24.3243}{1.008} = \frac{24.131}{8.1086} = 3 \times 2$$



$$\text{O} = \frac{129.7297}{15.999} = \frac{8.1086}{8.1086} = 1 \times 2$$

Empirical Formula from PERCENTS

% → grams → moles → ratio

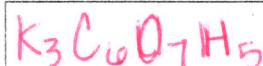
6. Determine the empirical formula for an unknown compound composed of 38.4% potassium, 36.3% oxygen, 23.7% carbon, and 1.66% hydrogen.

$$K = \frac{38.4}{39.098} = \frac{.982}{.982} = 1 \times 3$$

$$C = \frac{23.7}{12.011} = \frac{1.97}{.982} = 2 \times 3$$

$$O = \frac{36.3}{15.999} = \frac{2.27}{.982} = 2.3 \times 3$$

$$H = \frac{1.66}{1.008} = \frac{1.6}{.982} = 1.63 \times 3$$

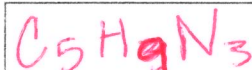


7. Determine the empirical formula for an unknown compound composed of 54.03% C, 8.16% H and 37.81% N.

$$C = \frac{54.03}{12.011} = \frac{4.49}{2.70} = 1.66 \times 3 = 4.98 = 5$$

$$N = \frac{37.81}{14.007} = \frac{2.70}{2.70} = 1 \times 3$$

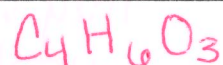
$$H = \frac{8.16}{1.008} = \frac{8.095}{2.70} = 2.99 = 3 \times 3$$



8. A compound contains only carbon, hydrogen, and oxygen. It contains 6.0% hydrogen, and equal percents of carbon and oxygen. What is the empirical formula? $94\% = 2 = 47$

$$H = \frac{6.0}{1.008} = \frac{5.95}{2.94} = 2 \times 3 = 6 \quad O = \frac{47}{15.999} = \frac{2.94}{2.94} = 1 \times 3 = 3$$

$$C = \frac{47}{12.011} = \frac{3.91}{2.94} = 1.3 \times 3 = 4$$



9. A compound has the following composition: Barium (Ba): 81.1%; Oxygen (O): 18.9%; and Hydrogen (H): 1.2%. What is the empirical formula of this compound?

a. Ba₂OH

c. BaOH₂

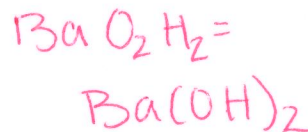
b. Ba(OH)₂

d. BaO₂H

$$Ba = \frac{81.1}{137.33} = \frac{.59}{.59} = 1$$

$$O = \frac{18.9}{15.999} = \frac{1.19}{.59} = 2$$

$$H = \frac{1.2}{1.008} = \frac{1.19}{.59} = 2$$



MOLE CONVERSIONS

10. How many moles of NH₃ are in 42.3g of NH₃?

$$\frac{42.3g}{17.031} \times \frac{1 \text{ mole}}{17.031} = 2.48$$

2.48 moles

11. How many atoms are in a 50.0g sample of barium?

$$\frac{50.0g}{137.33g} \times \frac{1 \text{ mole}}{137.33g} \times 6.02 \times 10^{23} \text{ atoms} = 2.19 \times 10^{23} \text{ atoms}$$

2.19×10^{23} atoms