

Empirical Formula Calculations WS – L

Name: Key
 Period: _____ Date: _____

- The formula that shows the simplest whole-number ratio of the atom in a molecule is the empirical formula.
- The mole ratio of carbon to hydrogen in a compound is 1:4. What is the empirical formula of the compound?
 CH_4
- What is the average atomic mass of copper? 63.546
- What is the empirical formula for the $\text{C}_4\text{H}_{12}\text{N}_6\text{O}_2$? $\text{C}_2\text{H}_6\text{N}_3\text{O}$

Empirical Formula from MOLE RATIOS

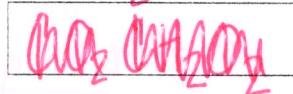
mole \rightarrow ratio

- 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?

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

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

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

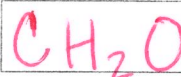


- Determine the empirical formula for an unknown compound composed of 4.028 mol C, 8.056 mol H, and 3.336 mol O.

$$\text{C} - \frac{4.028}{3.336} = 1.2 = 1$$

$$\text{H} - \frac{8.056}{3.336} = 2.414 = 2$$

$$\text{O} - \frac{3.336}{3.336} = 1$$



Empirical Formula from GRAMS

g \rightarrow mole \rightarrow ratio

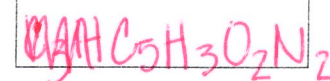
- Barry Um has a sample of a compound which contains 97.56g of carbon, 4.878g of hydrogen, 52.03g of oxygen, and 45.53g of nitrogen. Find the empirical formula.

$$\text{C} = \frac{97.56\text{g}}{12.011\text{g}} = 8.123 = \frac{8.123}{3.251} = 2.5 (2)$$

$$\text{N} = \frac{45.53\text{g}}{14.007\text{g}} = 3.251 = \frac{3.251}{3.251} = 1 (2)$$

$$\text{H} = \frac{4.878\text{g}}{1.008\text{g}} = 4.8392 = \frac{4.8392}{3.251} = 1.5 (2)$$

$$\text{O} = \frac{52.03\text{g}}{15.999\text{g}} = 3.252 = \frac{3.252}{3.251} = 1 (2)$$

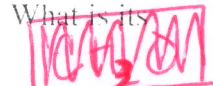
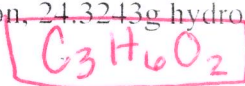


- An organic sample contains 145.946g carbon, 24.3243g hydrogen, and 129.7297g oxygen. What is its empirical formula?

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

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

$$\text{O} = \frac{129.7297}{15.999} = 8.108 = 1 \times 2$$



Empirical Formula from PERCENTS

% \rightarrow g \rightarrow moles \rightarrow ratio

5. Determine the empirical formula for an unknown compound composed of 2.04% potassium, 32.65% sulfur, and 65.3% oxygen.

2.04g

32.65g

$$K \rightarrow \frac{2.04g}{39.098g} = \frac{65.3g}{65.3g} = 1$$

$$S \rightarrow \frac{32.65g}{32.066g} = \frac{1}{0.052} = 19$$

$$O = \frac{65.3}{15.999g} = 4.081 / 0.052 = 78.48 = 79$$

$KS_{19}O_{79}$

6. Determine the empirical formula for an unknown compound which contains 67.1% zinc and the rest is oxygen?

$$\text{Zinc} = \frac{67.1g}{65.39g} = 1$$

$$\text{Oxygen} = 100 - 67.1 = 32.9g \\ \frac{32.9g}{15.999g} = 2$$

ZnO_2

MOLE CONVERSIONS

7. How many moles of NH_3 are in 42.3g of NH_3 ?

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

2.48 moles

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

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

2.19×10^{23}