

EMPIRICAL FORMULA Worksheet

1. A compound contains 36.5% Na, 25.4% S, and 38.1% O. Find its empirical formula.
2. Find the empirical formula of a compound consisting of 53.7% iron and 46.3% sulfur
3. Analysis of a compound's sample indicates that it has 1.04 g K, 0.70 g Cr, and 0.86 g O. What is its empirical formula?
4. An acid commonly used in the automotive industry is shown to be 31.6% phosphorous, 3.1% hydrogen, and 63.5% oxygen. Determine the empirical formula of this acid.
5. A compound is 24.7% Calcium, 1.2% Hydrogen, 14.8% Carbon, and 59.3% Oxygen. Write the empirical formula.

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Answers

1. A compound contains 36.5% Na, 25.4% S, and 38.1% O. Find its empirical formula.

$$\text{Na: } 36.5 \text{ g} / 23 \text{ g mol}^{-1} = 1.59 \text{ mol} / 0.79 \text{ mol} \rightarrow 2$$

$$\text{S: } 25.4 \text{ g} / 32 \text{ g mol}^{-1} = 0.79 \text{ mol} / 0.79 \text{ mol} \rightarrow 1$$

$$\text{O: } 38.1 \text{ g} / 16 \text{ g mol}^{-1} = 2.38 \text{ mol} / 0.79 \text{ mol} \rightarrow 3$$

The empirical formula is Na_2SO_3

2. Find the empirical formula of a compound consisting of 53.7% iron and 46.3% sulfur

$$\text{Fe: } 53.7 \text{ g} / 56 \text{ g mol}^{-1} = 0.959 \text{ mol} / 0.959 \text{ mol} \rightarrow 1 \times 2 = 2$$

$$\text{S: } 46.3 \text{ g} / 32 \text{ g mol}^{-1} = 1.45 \text{ mol} / 0.959 \text{ mol} \rightarrow 1.5 \times 2 = 3$$

The empirical formula is Fe_2S_3

3. Analysis of a compound's sample indicates that it has 1.04 g K, 0.70 g Cr, and 0.86 g O. What is its empirical formula?

$$\text{K: } 1.04 \text{ g} / 39 \text{ g mol}^{-1} = 0.027 \text{ mol} / 0.0135 \text{ mol} \rightarrow 2$$

$$\text{Cr: } 0.70 \text{ g} / 52 \text{ g mol}^{-1} = 0.0135 \text{ mol} / 0.0135 \text{ mol} \rightarrow 1$$

$$\text{O: } 0.86 \text{ g} / 16 \text{ g mol}^{-1} = 0.054 \text{ mol} / 0.0135 \text{ mol} \rightarrow 4$$

The empirical formula is K_2CrO_4

4. An acid commonly used in the automotive industry is shown to be 31.6% phosphorous, 3.1% hydrogen, and 63.5% oxygen. Determine the empirical formula of this acid.

$$\text{P: } 31.6 \text{ g} / 30.97 \text{ g mol}^{-1} = 1.02 \text{ mol} / 1.02 \text{ mol} \rightarrow 1$$

$$\text{H: } 3.1 \text{ g} / 1.01 \text{ g mol}^{-1} = 3.01 \text{ mol} / 1.02 \text{ mol} \rightarrow 3$$

$$\text{O: } 63.5 \text{ g} / 16 \text{ g mol}^{-1} = 4.08 \text{ mol} / 1.02 \text{ mol} \rightarrow 4$$

The empirical formula is H_3PO_4

5. A compound is 24.7% Calcium, 1.2% Hydrogen, 14.8% Carbon, and 59.3% Oxygen. Write the empirical formula.

$$\text{Ca: } 24.7 \text{ g} / 40.08 \text{ g mol}^{-1} = 0.614 \text{ mol} / 0.614 \text{ mol} \rightarrow 1$$

$$\text{H: } 1.2 \text{ g} / 1.01 \text{ g mol}^{-1} = 1.188 \text{ mol} / 0.614 \text{ mol} \rightarrow 2$$

$$\text{C: } 14.8 \text{ g} / 12.01 \text{ g mol}^{-1} = 1.232 \text{ mol} / 0.614 \text{ mol} \rightarrow 2$$

$$\text{O: } 59.3 \text{ g} / 16 \text{ g mol}^{-1} = 3.706 \text{ mol} / 0.614 \text{ mol} \rightarrow 6$$

The empirical formula is $\text{Ca}(\text{HCO}_3)_2$