



PERCENT COMPOSITION, EMPIRICAL FORMULA, & MOLECULAR FORMULA

1. For the following experimental percent composition, find the empirical formula of the compound:

a) 14.1% carbon, 2.4% hydrogen, and 83.5% chlorine.

b) 43.7% phosphorous and 56.3% oxygen

c) 26.58% potassium, 35.35% chromium, and 38.07% oxygen

d) 56.8% carbon, 5.3% hydrogen, and 37.9% oxygen

2. What is the empirical formula of a compound composed of 16.39% magnesium, 18.88% nitrogen, and 64.73% oxygen? Write the formula in a meaningful way.

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Answers

1. For the following experimental percent composition, find the empirical formula of the compound:

a) 14.1% carbon, 2.4% hydrogen, and 83.5% chlorine.

$$\text{Moles of C} = 14.1 \text{ g}/12.01 \text{ g/mol} = 1.17 \text{ mol}/1.17 \text{ mol} = 1$$

$$\text{Moles of H} = 2.4 \text{ g}/1.01 \text{ g/mol} = 2.38 \text{ mol}/1.17 \text{ mol} = 2$$

$$\text{Moles of Cl} = 83.5 \text{ g}/35.5 \text{ g/mol} = 2.36 \text{ mol}/1.17 \text{ mol} = 2$$

Empirical formula = CH_2Cl_2

b) 43.7% phosphorous and 56.3% oxygen

$$\text{Moles of P} = 43.7 \text{ g}/30.974 \text{ g/mol} = 1.41 \text{ mol}/1.41 \text{ mol} = 1 \times 2 = 2$$

$$\text{Moles of O} = 56.3 \text{ g}/16.00 \text{ g/mol} = 3.52 \text{ mol}/1.41 \text{ mol} = 2.5 \times 2 = 5$$

Empirical formula = P_2O_5

c) 26.58% potassium, 35.35% chromium, and 38.07% oxygen

$$\text{Mass of K} = 26.58 \text{ g}/39.1 \text{ g/mol} = 0.68 \text{ mol}/0.68 \text{ mol} = 1 \times 2 = 2$$

$$\text{Mass of Cr} = 35.35 \text{ g}/52 \text{ g/mol} = 0.68 \text{ mol}/0.68 \text{ mol} = 1 \times 2 = 2$$

$$\text{Mass of O} = 38.07 \text{ g}/16.00 \text{ g/mol} = 2.38 \text{ mol}/0.68 \text{ mol} = 3.5 \times 2 = 7$$

Empirical formula = $\text{K}_2\text{Cr}_2\text{O}_7$

d) 56.8% carbon, 5.3% hydrogen, and 37.9% oxygen

$$\text{Moles of C} = 56.8 \text{ g}/12.01 \text{ g/mol} = 4.73 \text{ mol}/2.37 \text{ mol} = 2 \times 5 = 10$$

$$\text{Moles of H} = 5.3 \text{ g}/1.01 \text{ g/mol} = 5.26 \text{ mol}/2.37 \text{ mol} = 2.2 \times 5 = 11$$

$$\text{Moles of O} = 37.9 \text{ g}/16.00 \text{ g/mol} = 2.37 \text{ mol}/2.37 \text{ mol} = 1 \times 5 = 5$$

Empirical formula = $\text{C}_{10}\text{H}_{11}\text{O}_5$

2. What is the empirical formula of a compound composed of 16.39% magnesium, 18.88% nitrogen, and 64.73% oxygen? Write the formula in a meaningful way.

$$\text{Moles of Mg} = 16.39 \text{ g}/24.31 \text{ g/mol} = 0.674 \text{ mol}/0.674 \text{ mol} = 1$$

$$\text{Moles of N} = 18.88 \text{ g}/14.01 \text{ g/mol} = 1.35 \text{ mol}/0.674 \text{ mol} = 2$$

$$\text{Moles of O} = 64.73 \text{ g}/16.00 \text{ g/mol} = 4.05 \text{ mol}/0.674 \text{ mol} = 6$$

Empirical formula
= $\text{MgN}_2\text{O}_6 = \text{Mg}(\text{NO}_3)_2$

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