Determining 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 with 53.7% iron and 46.3% sulfur.

3. Analysis of a compound 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.

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Answers

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

$36.5\ g\ Na \left(\frac{1\ mol\ Na}{23\ g\ Na} \right) = 1.59\ mol\ Na \div 0.79\ mol \rightarrow 2$

$25.4\ g\ S \left(\frac{25.4\ g\ S}{32\ g\ S} \right) = 0.79\ mol\ S \div 0.79\ mol \rightarrow 1$

$38.1\ g\ O \left(\frac{1\ mol\ O}{16\ g\ O} \right) = 2.38\ mol\ O \div 0.79\ mol \rightarrow 3$

The empirical formula is Na_2SO_3.

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

$53.7\ g\ Fe \left(\frac{1\ mol\ Fe}{56\ g\ Fe} \right) = 0.959\ mol\ Fe \div 0.959\ mol \rightarrow 1 \times 2 = 2$

$46.3\ g\ S \left(\frac{1\ mol\ S}{32\ g\ S} \right) = 1.45\ mol\ S \div 0.959\ mol \rightarrow 1.51 \times 2 = 3$

The empirical formula is Fe_2S_3.

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

$1.04\ g\ K \left(\frac{1\ mol\ K}{39\ g\ K} \right) = 0.027\ mol\ K \div 0.0135\ mol \rightarrow 2$

$0.70\ g\ Cr \left(\frac{1\ mol\ Cr}{52\ g\ S} \right) = 0.0135\ mol\ Cr \div 0.0135\ mol \rightarrow 1$

$0.86\ g\ O \left(\frac{1\ mol\ O}{16\ g\ O} \right) = 0.054\ mol\ O \div 0.0135\ mol \rightarrow 4$

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.

$31.6\ g\ P \left(\frac{1\ mol\ P}{31\ g\ P} \right) = 1.02\ mol\ P \div 1.02\ mol \rightarrow 1$

$3.1\ g\ H \left(\frac{1\ mol\ H}{1\ g\ H} \right) = 3.1\ mol\ H \div 1.02\ mol \rightarrow 3$

$65.3\ g\ O \left(\frac{1\ mol\ O}{16\ g\ O} \right) = 4.08\ mol\ O \div 1.02\ mol \rightarrow 4$

The empirical formula is H_3PO_4