

key

EMPIRICAL AND MOLECULAR FORMULA WORKSHEET

1. An oxide of chromium is found to have the following % composition: 68.4 % Cr and 31.6 % O. Determine this compound's empirical formula.

$$\begin{array}{l} \text{Cr} \quad \frac{68.4\text{g}}{52\text{g}} \times \frac{1\text{mol}}{1} = \frac{1.315}{1.315} = 1 \\ \text{O} \quad \frac{31.6\text{g}}{16\text{g}} \times \frac{1\text{mol}}{1} = \frac{1.975}{1.315} = 1.5 \end{array}$$

$\text{Cr}_1\text{O}_{1.5}$
 Cr_2O_3

2. The percent composition of a compound was found to be 63.5 % silver, 8.2 % nitrogen, and 28.3 % oxygen. Determine the compound's empirical formula.

$$\begin{array}{l} \text{Ag} \quad \frac{63.5\text{g}}{107.87} \times \frac{1\text{mol}}{1} = \frac{0.589}{0.585} = 1 \\ \text{N} \quad \frac{8.2\text{g}}{14.01} \times \frac{1\text{mol}}{1} = \frac{0.585}{0.585} = 1 \\ \text{O} \quad \frac{28.3\text{g}}{16\text{g}} \times \frac{1\text{mol}}{1} = \frac{1.769}{0.585} = 3 \end{array}$$

AgNO_3

3. A 170.00 g sample of an unidentified compound contains 29.84 g sodium, 67.49 g chromium, and 72.67 g oxygen. What is the compound's empirical formula?

$$\begin{array}{l} \text{Na:} \quad \frac{29.84}{170.00} = \frac{17.55}{22.99} \times \frac{1}{1} = \frac{0.76}{0.76} = 1 \\ \text{Cr} \quad \frac{67.49}{170.00} = \frac{39.7}{52} \times \frac{1}{1} = \frac{0.76}{0.76} = 1 \\ \text{O} \quad \frac{72.67}{170.00} = \frac{42.7}{16} \times \frac{1}{1} = \frac{2.7}{0.76} = 3.5 \end{array}$$

$\text{NaCrO}_{3.5}$
 $\text{Na}_2\text{Cr}_2\text{O}_7$

4. A 60.00 g sample of tetraethyl lead, a gasoline additive, is found to contain 38.43 g lead, 17.83 g carbon, and 3.74 g hydrogen. Find its empirical formula.

$$\begin{array}{l} \text{Pb} \quad \frac{38.43}{60.00} = \frac{64.05}{207.2} \times \frac{1}{1} = \frac{0.3}{0.3} = 1 \\ \text{C} \quad \frac{17.83}{60.00} = \frac{29.72}{12.01} \times \frac{1\text{mol}}{1} = \frac{2.47}{0.3} = 8.2 \\ \text{H} \quad \frac{3.74}{60.00} = \frac{6.23}{1.01} \times \frac{1\text{mol}}{1} = \frac{6.17}{0.3} = 21 \end{array}$$

$\text{PbC}_8\text{H}_{21}$

5. A compound containing 5.9265 % H and 94.0735 % O has a molar mass of 34.01468 g/mol. Determine the empirical and molecular formula of this compound.

$$\begin{array}{l} \text{H} \quad \frac{5.9265\text{g}}{1.01\text{g}} \times \frac{1\text{mol}}{1} = \frac{5.87}{5.87} \\ \text{O} \quad \frac{94.075\text{g}}{16.00\text{g}} \times \frac{1\text{mol}}{1} = \frac{5.88}{5.87} \end{array}$$

E: HO
M: H₂O₂

EFM = 17.01
 $\frac{34}{17.01} = 2$