

Exercise 7.4a

Determining Empirical Formulas

Name: _____

Date: _____ Per: _____

Empirical formulas can be derived using the percent composition and the molar masses of the elements:

1. Assume that there is 100g of the sample present.
2. Assign mass values to each element based on its percentage.
3. Calculate the number of moles present by dividing the mass value by the molar mass of the substance.
4. Divide the each number of moles calculated by the smallest number of moles calculated, to arrive at a ratio.

Example: Find the empirical formula of a substance that is: 30.5% nitrogen and 69.5 % oxygen.

1. Assuming 100 g, there would be 30.5 g nitrogen and 69.5 g oxygen.
2. Calculate the number of moles present by dividing the mass value by the molar mass of the substance.
3. Divide the each number of moles calculated by the smallest number of moles calculated, to arrive at a ratio.

$$\frac{30.5 \text{ g N}}{14.007 \text{ g N}} = 2.18 \text{ mol N}$$

$$\frac{69.5 \text{ g O}}{15.999 \text{ g O}} = 4.34 \text{ mol O}$$

4. Divide the each number of moles calculated by the smallest number of moles calculated, to arrive at a ratio.

$$\text{N} \frac{2.18 \text{ mol N}}{2.18 \text{ mol N}} = 1 \text{ mol N/mol N}$$

$$\text{O} \frac{4.34 \text{ mol O}}{2.18 \text{ mol N}} = 2 \text{ mol O / mol N}$$



DIRECTIONS: Calculate the formulas of the compounds below based on the information given.

1. A compound is 52.7% potassium, 47.3% chlorine. What is the empirical formula?
2. A compound is 74.9% carbon, 25.1% hydrogen. What is the empirical formula?
3. A compound is known to contain the elements sodium, sulfur and oxygen. If it 36.5% sodium and 25.4% sulfur, what is its empirical formula?
4. Find the empirical formula of a compound that is 53.7% iron and 46.3% sulfur.
5. Analysis of a sample of a compound indicates that it has 1.04 g K, 0.700 g Cr, and 0.860 g O. What is its empirical formula?