Chemistry CP

Name:

Determining Empirical Formula

Section:

Percentage composition data allow you to calculate the *simplest* ratio among the elements of a compound. A formula that represents this simplest ratio is called an **empirical formula**. For example, ammonium nitrite has the true formula NH_4NO_2 and consists of ammonium, NH_4^+, and nitrite, NO_2^-, ions in a 1:1 ratio. Using data from elemental analysis, a chemist would calculate the empirical formula to be NH_2O because this formula represents the *simplest* ratio of elements.

If you are given the percent composition of a compound, you can determine its formula. To do this:

1. Assume that you have a 100 gram sample, and the % of each element becomes the grams of that element in the sample.
2. Find the number of moles of each element present.
3. Find the smallest whole number ratio between the moles of the elements present, and use these numbers as the subscripts in the formula.

The true formula is some whole number multiple, n, of the empirical formula; n can be determined by finding the ratio of the empirical formula gfm and the true gfm.

1. What is the formula of a compound which has the following percent composition: 27.06% sodium, 16.47 % nitrogen, and 56.47% oxygen?

2. What is the empirical formula of a compound made up of 27.3% carbon and 72.7% oxygen?

3. A compound contains 40.27% potassium, 26.78% chromium, and 32.96% oxygen. Calculate the empirical formula of this compound.

4. A sample of a compound shows that it contains 1.620 grams of iron and 0.697 grams of oxygen. Find the empirical formula of the compound.

5. A 2.1640 gram sample of a compound is found to contain 0.7033 grams of iron, 0.6548 grams of chromium, and 0.8059 grams of oxygen. Use this information to find the empirical formula of the compound.

6. A compound is 85.62% carbon and 14.38% hydrogen. The gram formula mass of the compound is 56 g/mol. Find the empirical formula and the molecular (true) formula for the compound.

7. A 3.5471 gram sample of a compound contains 0.1153 gram of hydrogen, 1.6018 grams of nitrogen, and 1.8300 grams of oxygen. The gfm of the compound is known to be 62.0 g/mol. Find the empirical and molecular (true) formulas of the compound.