ChemQuest 31

Using Moles with Formulas

Name: _____

Date: _____

Hour: _____

Information: Percent Composition

Sometimes it is needful to know the composition of a compound. For example, 39.3% of the mass of sodium chloride is due to sodium. The other 60.7% of the mass is from chlorine. So, in a 100 g sample of sodium chloride, there are 39.3 g of sodium and 60.7 g of chlorine. This type of data is known as percent composition. The percent composition tells you the percentage by mass of an element in a compound. There is a convenient formula for finding the percent composition of an element in a compound:

$$\text{percent composition of element "X"} = \frac{\text{mass of x in one mole of the compound}}{\text{mass of one mole of the compound}} \bullet 100$$

(obtained from periodic table) — numerator

(obtained from periodic table) — denominator

Let us look at how the percent composition of calcium (Ca) in calcium chloride ($CaCl_2$) was determined.

$$\text{percent composition of Ca} = \frac{\text{mass of Ca in one mole of } CaCl_2}{\text{mass of one mole of } CaCl_2} \bullet 100$$

$$\text{percent composition of Ca} = \frac{40.1\ \text{g}}{111.1\ \text{g}} \bullet 100 = 36.1\%$$

40.1 g: from periodic table for calcium

111.1 g: from periodic table for calcium + 2 chlorines; 40.1 + 2(35.5) = 111.1

As another example, consider calculating the percent composition of nitrogen in Ca_3N_2:

$$\text{percent composition of N} = \frac{28.0\ \text{g}}{148.3\ \text{g}} \bullet 100 = 18.9\%$$

2(14.0)=28.0

From periodic table for 2 nitrogen atoms: 28.0 g

148.3 g: from periodic table for 3 calcium + 2 nitrogen atoms

3(40.1) + 2(14.0) = 148.3

Critical Thinking Questions

1. Verify that in C_4H_{10} the percent composition of carbon is approximately 82.6%.

$$\frac{4(12.0)}{[4(12.0)+10(1.01)]} \bullet 100 = 82.6\%$$