6.1: An Introduction to Stoichiometry

Stoichiometry… what a wonderful word! It sounds so complex and so *chemical*. In fact, it's a fairly simple concept; **stoichiometry** is the relationship between the molar masses of chemical reactants and products in a given chemical reaction. In Chapter 5 we learned to balance chemical equations by inserting numerical coefficients in front of reactants or products so that there were the same number and types of atoms on each side of the equation. Thus, in the reaction between sodium metal and chlorine gas, the balanced chemical equation is:

$$2\,\mathrm{Na(s)} + \mathrm{Cl_2(g)} \rightarrow 2\,\mathrm{NaCl(s)}$$

This equation tells us that two atoms of sodium react with one molecule of chlorine gas to give two sodium chlorides. The coefficients in front of the sodium and the sodium chloride are called the **stoichiometric coefficients** for this reaction. If we were to totally react a single molecule of chlorine gas in this reaction, this stoichiometry tells us that two atoms of sodium (atomic mass 22.99) having a total mass of 45.98 amu, would react with one molecule of chlorine gas (having a mass 70.90 amu) to give two sodium chlorides (formula mass 137.94), for a total of 275.9 amu of product. Because chemists usually don't speak of chemical reactions in terms of individual atoms or molecules, it is much more common to describe the stoichiometry of a reaction in terms of grams of reactants and products, or more conveniently in terms of moles. **Molar stoichiometry** is simply the expression of the coefficients of a reaction in terms of moles of reactants and products.
