Problem Type 3: *Given* is a mass in grams and *unknown* is an amount in moles.

When you are given the mass of one substance and asked to calculate the amount in moles of another substance in the chemical reaction, the general plan is

$$\underset{\text{(g)}}{\text{mass of } \textit{given} \text{ substance}} \longrightarrow \underset{\text{(mol)}}{\text{amount of } \textit{given} \text{ substance}} \longrightarrow \underset{\text{(mol)}}{\text{amount of } \textit{unknown} \text{ substance}}$$

Problem Type 4: *Given* is a mass in grams and *unknown* is a mass in grams.

When you are given the mass of one substance and asked to calculate the mass of another substance in the chemical reaction, the general plan is

$$\underset{\text{(g)}}{\text{mass of } \textit{given} \text{ substance}} \longrightarrow \underset{\text{(mol)}}{\text{amount of } \textit{given} \text{ substance}} \longrightarrow \underset{\text{(mol)}}{\text{amount of } \textit{unknown} \text{ substance}} \longrightarrow \underset{\text{(g)}}{\text{mass of } \textit{unknown} \text{ substance}}$$

Mole Ratio

Solving any reaction stoichiometry problem requires the use of a mole ratio to convert from moles or grams of one substance in a reaction to moles or grams of another substance. *A* **mole ratio** *is a conversion factor that relates the amounts in moles of any two substances involved in a chemical reaction.* This information is obtained directly from the balanced chemical equation. Consider, for example, the chemical equation for the electrolysis of melted aluminum oxide to produce aluminum and oxygen.

$$2Al_2O_3(l) \longrightarrow 4Al(s) + 3O_2(g)$$

Recall from Chapter 8 that the coefficients in a chemical equation satisfy the law of conservation of matter and represent the relative amounts in moles of reactants and products. Therefore, 2 mol of aluminum oxide decompose to produce 4 mol of aluminum and 3 mol of oxygen gas. These relationships can be expressed in the following mole ratios.

$$\frac{2 \text{ mol } Al_2O_3}{4 \text{ mol Al}} \quad \text{or} \quad \frac{4 \text{ mol Al}}{2 \text{ mol } Al_2O_3}$$

$$\frac{2 \text{ mol } Al_2O_3}{3 \text{ mol } O_2} \quad \text{or} \quad \frac{3 \text{ mol } O_2}{2 \text{ mol } Al_2O_3}$$

$$\frac{4 \text{ mol Al}}{3 \text{ mol } O_2} \quad \text{or} \quad \frac{3 \text{ mol } O_2}{4 \text{ mol Al}}$$

For the decomposition of aluminum oxide, the appropriate mole ratio would be used as a conversion factor to convert a given amount in moles of one substance to the corresponding amount in moles of another

CAREERS in Chemistry

Chemical Technician

Chemical technicians are highly skilled scientific professionals who bring valuable skills to the development of new products, the processing of materials, the management of hazardous waste, regulatory compliance, and many other aspects of getting products and services to the consumer. Chemical technicians must have a solid background in applied chemistry and mathematics and be highly skilled in laboratory methods. Earning an associate's degree in applied science or chemical technology is one good way to prepare for this career. Many chemical technicians have a bachelor's degree in chemical technology, chemistry, or other sciences.