

SECTION 2

OBJECTIVES

- Calculate the amount in moles of a reactant or product from the amount in moles of a different reactant or product.
- Calculate the mass of a reactant or product from the amount in moles of a different reactant or product.
- Calculate the amount in moles of a reactant or product from the mass of a different reactant or product.
- Calculate the mass of a reactant or product from the mass of a different reactant or product.

Ideal Stoichiometric Calculations

The chemical equation plays a very important part in all stoichiometric calculations because the mole ratio is obtained directly from it. Solving any reaction stoichiometry problem must begin with a balanced equation.

Chemical equations help us make predictions about chemical reactions without having to run the reactions in the laboratory. The reaction stoichiometry calculations described in this chapter are theoretical. They tell us the amounts of reactants and products for a given chemical reaction under *ideal conditions*, in which all reactants are completely converted into products. However, many reactions do not proceed such that all reactants are completely converted into products. Theoretical stoichiometric calculations allow us to determine the maximum amount of product that could be obtained in a reaction but do not require that the reaction be carried out.

Solving stoichiometric problems requires practice. These problems are extensions of the composition stoichiometry problems that you solved in Chapters 3 and 7. Practice by working the sample problems in the rest of this chapter. Using a logical, systematic approach will help you successfully solve these problems.

Conversions of Quantities in Moles

In these stoichiometric problems, you are asked to calculate the amount in moles of one substance that will react with or be produced from the given amount in moles of another substance. The plan for a simple mole conversion problem is

$$\begin{array}{ccc} \text{amount of} & & \text{amount of} \\ \text{given substance (mol)} & \longrightarrow & \text{unknown substance (mol)} \end{array}$$

This plan requires one conversion factor—the stoichiometric mole ratio of the *unknown* substance to the *given* substance from the balanced equation. To solve this type of problem, simply multiply the *known* quantity by the appropriate conversion factor.

$$\text{given quantity} \times \text{conversion factor} = \text{unknown quantity}$$