Section 12.2 Stoichiometric Calculations

In your textbook, read about mole-to-mole conversion.

Read the following passage and then solve the problems. In the equation that follows each problem, write in the space provided the mole ratio that can be used to solve the problem. Complete the equation by writing the correct value on the line provided.

The reaction of sodium peroxide and water produces sodium hydroxide and oxygen gas. The following balanced chemical equation represents the reaction.

$$2Na_2O_2(s) + 2H_2O(l) \rightarrow 4NaOH(s) + O_2(g)$$

1. How many moles of sodium hydroxide are produced when 1.00 mol sodium peroxide reacts with water?

1.00 mol Na_2O_2 × _____ = _____ mol *NaOH*

2. How many moles of oxygen gas are produced when 0.500 mol Na_2O_2 reacts with water?

0.500 mol Na_2O_2 × _____ = _____ mol O_2

3. How many moles of sodium peroxide are needed to produce 1.00 mol sodium hydroxide?

1.00 mol NaOH × _____ = _____ mol Na_2O_2

4. How many moles of water are required to produce 2.15 mol oxygen gas in this reaction?

2.15 mol O_2 × _____ = _____ mol H_2O

5. How many moles of water are needed for 0.100 mol of sodium peroxide to react completely in this reaction?

0.100 mol Na_2O_2 × _____ = _____ mol H_2O

6. How many moles of oxygen are produced if the reaction produces 0.600 mol sodium hydroxide?

0.600 mol NaOH × _____ = _____ mol O_2

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Section 12.2 *continued*

In your textbook, read about mole-to-mass and mass-to-mass conversions.

Solving a mass-to-mass problem requires the four steps listed below. The equations in the boxes show how the four steps are used to solve an example problem. After you have studied the example, solve the problems below, using the four steps.

Example problem: How many grams of carbon dioxide are produced when 20.0 g acetylene (C_2H_2) is burned?

	Solution
Step 1 Write a balanced chemical equation for the reaction.	$2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(g)$
Step 2 Determine the number of moles of the known substance, using mass-to-mole conversion.	$20.0\ \text{g}\ C_2H_2 \times \frac{1\ \text{mol}\ C_2H_2}{26.04\ \text{g}\ C_2H_2} = 0.768\ \text{mol}\ C_2H_2$
Step 3 Determine the number of moles of the unknown substance, using mole-to-mole conversion.	$0.768\ \text{mol}\ C_2H_2 \times \frac{4\ \text{mol}\ CO_2}{2\ \text{mol}\ C_2H_2} = 1.54\ \text{mol}\ CO_2$
Step 4 Determine the mass of the unknown substance, using mole-to-mass conversion.	$1.54\ \text{mol}\ CO_2 \times \frac{44.01\ \text{g}\ CO_2}{1\ \text{mol}\ CO_2} = 67.8\ \text{g}\ CO_2$

7. In some mole-to-mass conversions, the number of moles of the known substance is given. In those conversions, which step of the above solution is not necessary? _____

8. In a blast furnace, iron and carbon monoxide are produced from the reaction of iron(III) oxide (Fe_2O_3) and carbon. How many grams of iron are formed when 150 g iron(III) oxide reacts with an excess of carbon?

9. Solid sulfur tetrafluoride (SF_4) and water react to form sulfur dioxide and an aqueous solution of hydrogen fluoride. How many grams of water are necessary for 20.0 g sulfur tetrafluoride to react completely?