

Stoichiometry

Before You Read

Review Vocabulary

Define the following terms.

mole

molar mass

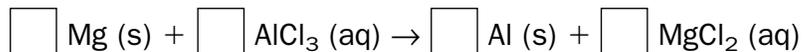
conversion factor

dimensional analysis

*law of conservation
of mass*

Chapter 10

Balance the following equation.

**Chapter 11**

Use the periodic table in the back of your text to complete the chart.

Pure Substance	Molar Mass
Carbon	12.011
	22.990
	15.999
Sodium carbonate	

Stoichiometry

Section 12.1 What is Stoichiometry?



Chemistry 3.a, 3.b, 3.d; I&E 1.d

Main Idea

Details

Skim Section 1 of your text. Write three questions that come to mind from reading the headings and the illustration captions.

1. _____
2. _____
3. _____

New Vocabulary

Use your text to define each term.

stoichiometry

mole ratio

Academic Vocabulary

Define the following term.

qualitative

Mole-Mass Relationships in Chemical Reactions

Use with page 354.

Explain the importance of the law of conservation of mass in chemical reactions.

Section 12.1 What is Stoichiometry? (continued)

Main Idea

Details

**Interpreting
Chemical
Equations**

Use with Example
Problem 12-1, page 354.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 12-1.*

Problem

Interpret the equation in terms of _____,
and _____. Show that the law of conservation of mass is _____.

1. Analyze the Problem

Known: _____



Unknown: _____

2. Solve for the Unknown

The coefficients indicate the number of _____.

The coefficients indicate the number of _____.

Use the space below to calculate the mass of each reactant and each product. Multiply the number of moles by the conversion factor, molar mass.

$$\text{moles of reactant} \times \frac{\text{grams of reactant}}{1 \text{ mole of reactant}} = \text{grams of } \underline{\hspace{2cm}}$$

$$\text{moles of product} \times \frac{\text{grams of reactant}}{1 \text{ mole of reactant}} = \text{grams of } \underline{\hspace{2cm}}$$

Add the masses of the reactants.

$$\boxed{\hspace{1cm}} \text{ g C}_3\text{H}_8 + \boxed{\hspace{1cm}} \text{ g 5O}_2 = \boxed{\hspace{1cm}} \text{ g reactants}$$

Add the masses of the products.

$$\boxed{\hspace{1cm}} \text{ g CO}_2 + \boxed{\hspace{1cm}} \text{ g H}_2\text{O} = \boxed{\hspace{1cm}} \text{ g products}$$

Determine if the _____ is observed. Does the mass of the reactants equal the mass of the products? ____.

3. Evaluate the Answer

Each product or reactant has $\boxed{\hspace{1cm}}$ significant figures. Your answer must have $\boxed{\hspace{1cm}}$ significant figures.

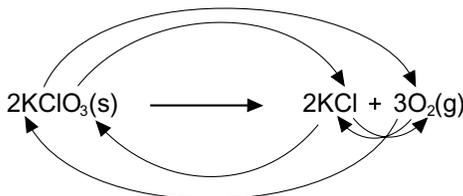
Section 12.1 What is Stoichiometry? (continued)

Main Idea

Details

Mole ratios*Use with page 356.***Examine** Relationships between coefficients can be used to write conversion factors called _____.**Example**Given the equation $2\text{KClO}_3(\text{s}) \longrightarrow 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$

Each substance forms a _____ with the other substances in the reaction.

**Write** the mole ratios that define the mole relationships in this equation. (Hint: Relate each reactant and each product to each of the other substances.)**You Try It****Draw** arrows with colored pencils that show the relationships of the substances in this equation.**Write** the mole ratios for the above equation.

Stoichiometry

Section 12.2 Stoichiometric Calculations



Chemistry 3.e

Main Idea

Details

Scan Section 2, using the checklist below to preview your text.

- Read all section titles.
- Read all boldfaced words.
- Read all tables and graphs.
- Look at all pictures and read the captions.
- Think about what you already know about this subject.

Write three facts you discovered about stoichiometric calculations.

1. _____
2. _____
3. _____

Academic Vocabulary

Define the following terms.

convert

process

significant

Using Stoichiometry

Use with page 358.

Identify the tools needed for stoichiometric calculations.

All stoichiometric calculations start with _____ based on a _____ . Finally, _____ are required.

Section 12.2 Stoichiometric Calculations (continued)

Main Idea

**Stoichiometric
Mole-to-Mole
Conversion**

Use with Example
Problem 12-2, page 359.

Details

Solve Read Example Problem 12-2 in your text.

You Try It**Problem**

How many moles of aluminum oxide (Al_2O_3) are produced when 4.0 moles of aluminum (Al) are combined with oxygen gas (O_2)?

1. Analyze the Problem

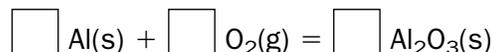
Known: _____

Unknown: _____

Both the known and the unknown are in moles, therefore, you will do a mole-to-mole conversion.

2. Solve for the Unknown

Write the balanced chemical equation. Label the known and unknown.



List the mole ratios for this equation. (Hint: Draw arrows that show the relationships of the substances in this equation.)

Circle the mole ratio that relates mol Al to mol of Al_2O_3 .

Multiply the known number of moles Al by the mole ratio to find the moles of unknown Al_2O_3 .

$$\square \text{ moles of Al} \times \frac{\square \text{ moles of Al}_2\text{O}_3}{\square \text{ moles of Al}} = \square \text{ moles of Al}_2\text{O}_3$$

3. Evaluate the Answer

The given number of moles has \square significant figures. Therefore, the answer must have \square significant figures.

Section 12.2 Stoichiometric Calculations (continued)

Main Idea

**Stoichiometric
Mole-to-Mass
Conversion**

Use with Example
Problem 12-3, page 360.

Details

Solve Read Example Problem 12-3 in your text.

You Try It**Problem**

How many grams of solid iron (III) chloride (FeCl_3) are produced when 2.00 moles of solid iron (Fe) are combined with chlorine gas (Cl_2)?

1. Analyze the Problem

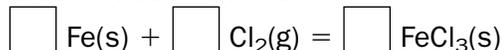
Known: _____

Unknown: _____

You are given the moles of the reactant, Fe, and must determine the mass of the product, FeCl_3 , therefore, you will do a mole to mass conversion.

2. Solve for the Unknown

Write the balanced chemical equation. Identify the known and unknown substances.



List the mole ratios for this equation. (Hint: Draw arrows that show the relationships of the substances in this equation.)

Circle the mole ratio that relates moles of Fe to FeCl_3 .

Multiply the number of moles of Fe by the mole ratio.

$$\square \text{ mol Fe} \times \frac{\square \text{ mol FeCl}_3}{\square \text{ mol Fe}} = \square \text{ mol FeCl}_3$$

Multiply the moles of FeCl_3 by the molar mass of FeCl_3 .

$$\square \text{ mol FeCl}_3 \times \frac{\square \text{ g FeCl}_3}{1 \text{ mol FeCl}_3} = \square \text{ g FeCl}_3$$

3. Evaluate the Answer

The given number of moles has \square digits, so the mass of FeCl_3 must have \square digits.

Section 12.2 Stoichiometric Calculations (continued)

Main Idea

**Stoichiometric
Mass-to-Mass
Conversion**

Use with Example
Problem 124, page 361.

Details

Solve Read Example Problem 12-4 in your text.

You Try It**Problem**

Determine the mass of ammonia (NH₃) produced when 3.75 g of nitrogen gas (N₂) react with hydrogen gas (H₂).

1. Analyze the Problem

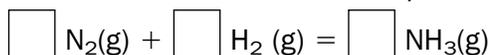
Known: _____

Unknown: _____

You are given the mass of the reactant, N₂, and must determine the mass of the product NH₃. Do a mass-to-mass conversion.

2. Solve for the Unknown

Write the balanced chemical equation for the reaction.



Convert grams of N₂(g) to moles of N₂(g) using the inverse of molar mass as the conversion factor.

$$\square \text{ g N}_2(\text{g}) \times \frac{1 \text{ mol N}_2}{\square \text{ g N}_2} = \square \text{ mol N}_2$$

List the mole ratios for this equation.

Multiply moles of N₂ by the mole ratio that relates N₂ to NH₃.

$$\square \text{ mol N}_2 \times \frac{\square \text{ mol NH}_3}{\square \text{ mol N}_2} = \square \text{ mol NH}_3$$

Multiply moles of NH₃ by the molar mass.

$$\square \text{ mol NH}_3 \times \frac{\square \text{ g NH}_3}{1 \text{ mol NH}_3} = \square \text{ g NH}_3$$

3. Evaluate the Answer

The given mass has significant figures, so the mass of NH₃ must have significant figures.

Section 12.2 Stoichiometric Calculations (continued)

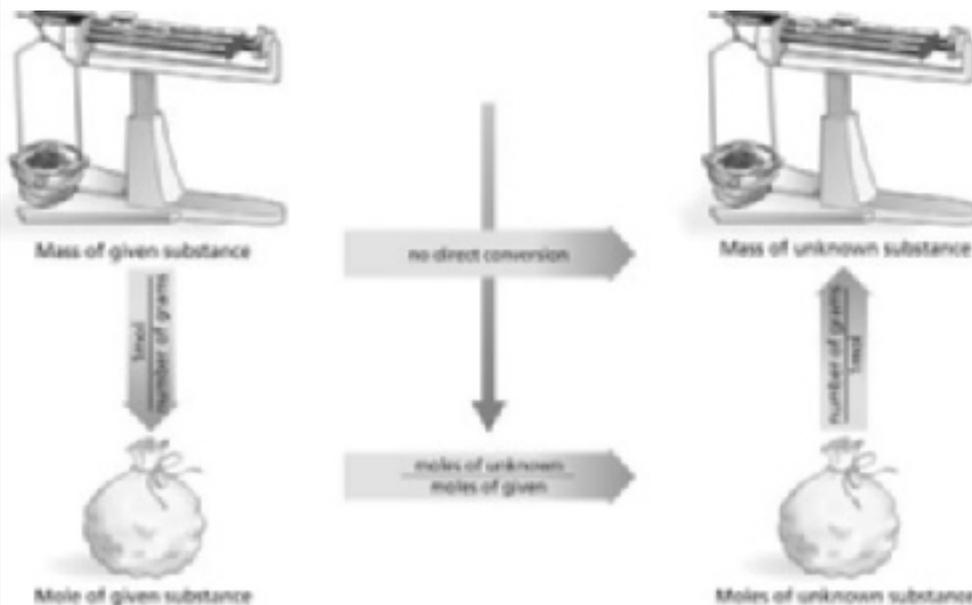
Main Idea

Details

Steps in Stoichiometric Calculations

Use with page 363.

Sequence *the steps needed to convert from the balanced equation to the mass of the unknown.*



Identify *the steps in stoichiometric calculations by completing the summary below.*

1. _____ . Interpret the equation in terms of _____ .
2. _____ . Use the _____ as the conversion factor.
3. _____ Use the appropriate mole ratio from the _____ as the conversion factor.
4. _____ Use _____ as the conversion factor.