Science Notebook

Glencoe Science

CHEMISTRY

MATTER AND CHANGE

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Mc Graw Hill Glencoe

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Send all inquiries to:
Glencoe/McGraw-Hill
8787 Orion Place
Columbus, OH 43240-4027

ISBN: 978-0-07-878755-3
MHID: 0-07-878755-6

Printed in the United States of America.

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To the Teacher

Dear Science Teacher,

As you begin a new school year, one of the biggest challenges you will probably encounter is getting students to read their textbooks. Informational text can overwhelm students, leaving them less likely to read and more likely to become apathetic about learning. I believe that this* Science Notebook *will help students use their textbooks more effectively as they learn about Chemistry.

Note-Taking and Student Success

There is considerable research evidence that addresses how students understand difficult concepts and content in school. Glencoe/McGraw-Hill has developed the *Science Notebook* for science students based upon that research. Evidence indicates that students need to know how to take notes, use graphic organizers, learn vocabulary, and develop their thinking skills by writing in order to achieve academic success.

The ability to take and organize notes predicts how well students will do in school. Peverly, Brobst, Graham, and Shaw (2003) showed that when students use background knowledge and take notes, they are likely to perform well on tests. Pauk (1974) observed that note-taking was a critical skill for college success. Notes serve as an external storage function (meaning on the paper) that builds comprehension and content understanding (Ganske, 1981). This *Science Notebook* is a tool that students can use to achieve this goal. I would like to share some of the features of this *Science Notebook* with you before you begin teaching.

The Cornell Note-Taking System

First, you will notice that the pages in the *Science Notebook* are arranged in two columns, which will help students organize their thinking. This two-column design is based on the **Cornell Note-Taking System**, developed at Cornell University. Faber, Morris, and Lieberman (2000) found that the Cornell Note-Taking System improves comprehension and increases test scores.

The column on the left side of the page highlights the main ideas and vocabulary of the lesson. This column will help students find information and locate the references in their textbooks quickly. Students can also use this column to sketch drawings that help them visually remember the lesson's information. In the column on the right side of the page, students will write detailed notes about the main ideas and vocabulary. The notes they take in this column will help them focus on the important information in the lesson. As students become more comfortable using the Cornell Note-Taking System, they will see that it is an important tool that helps them organize information.

The Importance of Graphic Organizers

Second, there are many graphic organizers in this *Science Notebook*. Graphic organizers allow students to see the lesson's important information in a visual format. In addition, graphic organizers help students summarize information and remember the content. I hope that you will encourage students to use the graphic organizers because they will help them understand what they are reading.

Research-Based Vocabulary Development

Third, you will notice that vocabulary is introduced and practiced throughout the *Science Notebook*. When students know the meaning of the words used to discuss information, they are able to understand that information better. Also, students are more likely to be successful in school when they have vocabulary knowledge. When researchers study successful students, they find that as students acquire vocabulary knowledge, their ability to learn improves (Martino and Hoffman, 2002). The *Science Notebook* focuses on learning words that are very specific to understanding the content of the textbook. The *Science Notebook* also highlights general academic words that students need to know so that they can understand any textbook. These vocabulary words are based on the Academic Word List (AWL) developed by Averil Coxhead. The AWL includes the most common 570 words found in academic texts, excluding the 2,000 general English words such as *the*, *in*, and *that*. Research indicates that students who master the words on Coxhead's list score significantly higher on standardized tests.

Writing Prompts and Note-Taking

Finally, there are a number of writing exercises included in this *Science Notebook*. Writing is a useful tool that helps students understand the information that is being presented. Writing helps them to assess what they have learned. You will see that many of the writing exercises require students to practice the skills of good readers. Good readers *make connections* between their lives and the text and *predict* what will happen next in the reading. They *question* the information and the author of the text, *clarify* information and ideas, and *visualize* what the text is saying. Good readers also *summarize* the information that is presented and *make inferences* or *draw conclusions* about the facts and ideas.

I wish you well as you begin another school year. This *Science Notebook* is designed to help students understand the information in your Chemistry class. The guide will be a valuable tool that will also provide students with skills that they can use throughout their lives.

I hope you have a successful school year.

Sincerely,
Douglas Fisher

References

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Note-Taking Tips

Your notes are a reminder of what you learned in class. Taking good notes can help you succeed in science. The following tips will help you take better classroom notes.

- Before class, ask what your teacher will be discussing in class. Review mentally what you already know about the concept.
- Be an active listener. Focus on what your teacher is saying. Listen for important concepts. Pay attention to words, examples, and/or diagrams you teacher emphasizes.
- Write your notes as clear and concise as possible. The following symbols and abbreviations may be helpful in your note-taking.

Word or Phrase	Symbol or Abbreviation	Word or Phrase	Symbol or Abbreviation
for example	e.g.	and	+
that is	i.e.	approximately	≈
with	w/	therefore	∴
without	w/o	versus	vs

- Use a symbol such as a star (★) or an asterisk (*) to emphasize important concepts. Place a question mark (?) next to anything that you do not understand.
- Ask questions and participate in class discussion.
- Draw and label pictures or diagrams to help clarify a concept.
- When working out an example, write what you are doing to solve the problem next to each step. Be sure to use your own words.
- Review you notes as soon as possible after class. During this time, organize and summarize new concepts and clarify misunderstandings.

Note-Taking Don'ts

- **Don't** write every word. Concentrate on the main ideas and concepts.
- **Don't** use someone else's notes as they may not make sense.
- **Don't** doodle. It distracts you from listening actively.
- **Don't** lose focus or you will become lost in your note-taking.

Name _____ Date _____

Introduction to Chemistry

Before You Read

Before you read the chapter, write down four facts you know about chemistry.

1. _____
2. _____
3. _____
4. _____

Science Journal

Write three questions about scientific methods and research.

1. _____
2. _____
3. _____

Name _____ Date _____

Introduction to Chemistry

Section 1.1 A Story of Two Substances

Main Idea **Details**

Scan *Section 1 of your text. Use the checklist below as a guide.*

- 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 ozone and chlorofluorocarbons (CFCs).

Write *four facts you discovered about ozone and chlorofluorocarbons (CFCs).*

1. _____

2. _____

3. _____

4. _____

New Vocabulary *Use your text to define each term.*

chemistry _____

substance _____

Name _____ Date _____

Section 1.1 A Story of Two Substances (continued)

Main Idea | **Details**

The Ozone Layer

Use with pages 5–7.

Explain *the ozone by completing the following paragraph.*

Overexposure to _____ causes sunburn, is harmful to _____, lowers _____, and disrupts _____. When _____ is exposed to ultraviolet radiation in the upper regions of the _____, a chemical called _____ is formed. About _____ of Earth's ozone is spread out in a layer that surrounds and _____ our planet. Ozone forms over the _____ and flows toward the _____.

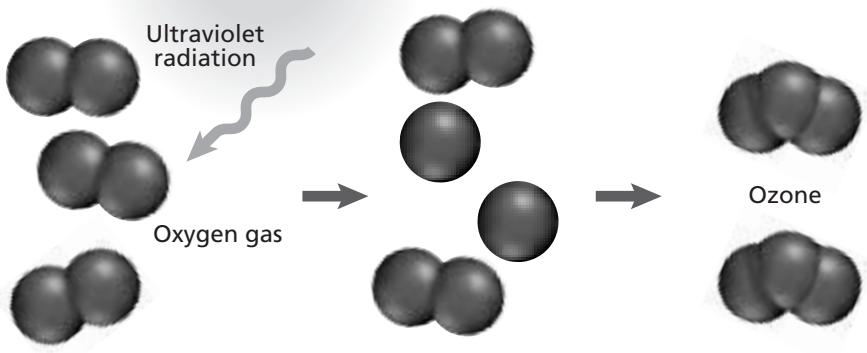
Sequence *the steps necessary for the formation of ozone.*

1. _____

2. _____

3. _____

Illustrate *the balance between oxygen gas and ozone levels in the stratosphere, using Figure 1.3 in your text as a model. Give it a title and label the parts of your model.*



Formation of ozone

Name _____ **Date** _____

Section 1.1 A Story of Two Substances (continued)

Main Idea ——— **Details** ———

Chlorofluoro-carbons

Use with pages 7–8.

Analyze *the graph in Figure 1.6. Write a brief description of the concentration of CFCs from 1977 through 1996.*

_____

_____

_____

Analyze *chlorofluorocarbons by completing the following table.*

CFCs Were First Developed Because:	Facts about CFCs	Uses of CFCs
	1. 2. 3. 4. 5.	

Real-World Connection

Infer from your reading the potential connection between CFCs and the ozone layer. Use Figure 1.5 and the table in the Section 1.1 Assessment to draw your conclusions.

_____

_____

Name _____ Date _____

Introduction to Chemistry

Section 1.2 Chemistry and Matter

Main Idea — **Details**

Skim *Section 2 of your text. Write four facts that come to mind from reading the headings, boldfaced words, and the illustration captions.*

1. _____
2. _____
3. _____
4. _____

New Vocabulary *Use your text to define each term.*

mass _____

weight _____

_____

model _____

Name _____ **Date** _____

Section 1.2 Chemistry and Matter (continued)

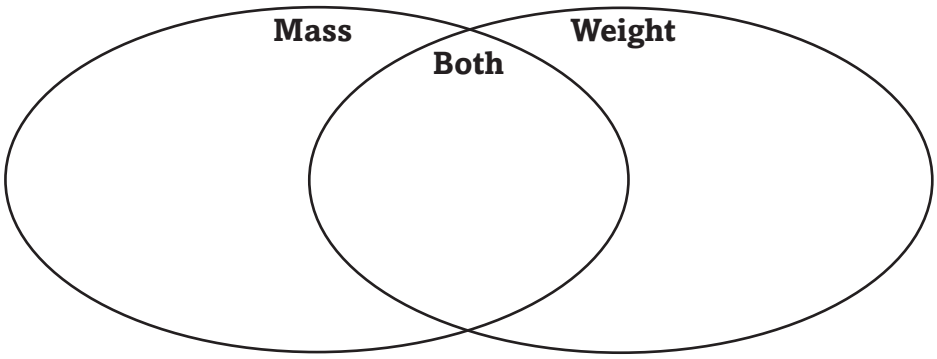
Main Idea | **Details**

Matter and its Characteristics

Use with pages 9–10.

Compare and contrast *mass and weight using the Venn diagram below.*

- does not reflect gravitational pull on matter
- a measure of the effect of gravitational pull on matter
- a measurement that reflects the amount of matter in an object



Chemistry: The Central Science

Use with page 11.

Identify *six substances mentioned in the book that are important in everyday life and are made of chemicals.*

1. _____ **4.** _____

2. _____ **5.** _____

3. _____ **6.** _____

Name _____ **Date** _____

Section 1.2 Chemistry and Matter (continued)

Main Idea **Details**

Organize *the following terms by arranging them from largest to smallest.*

macroscopic, submicroscopic, microscopic

_____

Explain *a chemical model by completing the following sentences.*

The _____, composition, and _____ of all matter can be explained on a _____ level. All that we observe depends on _____ and the _____ they undergo. _____ seeks to explain the submicroscopic events that lead to _____. One way to do this is by making a chemical model, a _____ of a _____.

Real-World Connection

Analyze the importance of chemistry in our society using the branches of chemistry as examples.

_____

_____

_____

_____

_____

Name _____ Date _____

Introduction to Chemistry

Section 1.3 Scientific Methods

Main Idea — **Details**

Skim *Section 2 of your text. Write three questions that come to mind from reading the headings, boldface terms, and illustration captions.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

scientific method _____

_____

hypothesis _____

experiment _____

control _____

conclusion _____

theory _____

scientific law _____

A Systematic Approach

Use with pages 12–15.

Compare *the terms qualitative data and quantitative data.*

_____

_____

_____

_____

Section 1.3 Scientific Methods (continued)

Main Idea **Details**

Compare *the terms independent variable and dependent variable.*

_____

_____

_____

Analyze *whether the characteristics listed below represent qualitative data, quantitative data, or both.*

Characteristic	Type of Data
the rate at which a candle burns	
a blanket with varying degrees of softness	
sand with a reddish-brown color	

Sequence *the steps of the scientific method.*

____ Plan and set up one or more experiments to test one variable at a time.

____ Gather information using both qualitative data and quantitative data.

____ Observe, record, and analyze experimental data.

____ Develop a hypothesis, or tentative explanation based on observations.

____ Develop a theory or a scientific law.

____ Compare findings to the hypothesis, and form a conclusion.

Name _____ **Date** _____

Section 1.3 Scientific Methods (continued)

Main Idea **Details**

Use with page 15.

Analyze *Figure 1.13 and the caption information on Molina and Rowland's model. Explain in words what the model visually predicts about the effect of ultraviolet radiation on CFCs.*

_____

_____

_____

_____

SYNTHESIZE

Design a simple experiment using the scientific method. Give your experiment a descriptive title. Limit the number of variables you test. Write the steps of the experiment based on the scientific method, including but not limited to hypothesis, analysis, and conclusions. Draw a simple sketch of your experiment, if appropriate, and label the independent, dependent, and control variables.

Title: _____

Steps: _____

_____

_____

_____

_____

_____

_____

_____

Independent variable(s): _____

Dependent variable(s): _____

Control variable(s): _____

Name _____ Date _____

Introduction to Chemistry

Section 1.4 Scientific Research

Main Idea — **Details**

Skim *Section 4 of your text. Write three questions that come to mind from reading the headings, boldfaced terms, and illustration captions.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

pure research _____

applied research _____

Academic Vocabulary *Define the following term.*

recover _____

Name _____ **Date** _____

Section 1.4 Scientific Research (continued)

Main Idea | **Details**

Types of Scientific Investigations

Use with pages 17–18.

Describe *scientific investigations by completing the following sentences.*

Pure research becomes _____ when scientists develop a hypothesis based on the data and try to solve a specific problem. _____ have been made when a scientist reaches a conclusion far different than anticipated. Some wonderful scientific discoveries have been made _____.

Students in the Laboratory

Use with pages 18–19.

Review *Table 1.2 in your text. Write an A if you agree with the statement. Write a D if you disagree with the statement.*

____ Return unused chemicals to the stock bottle.

____ It is not safe to wear contact lenses in the lab.

____ Only a major accident, injury, incorrect procedure, or damage to equipment needs to be reported.

____ Graduated cylinders, burettes, or pipettes should be heated with a laboratory burner.

Analyze *laboratory safety by responding to the following situations.*

1. Explain in your own words why safety goggles and a laboratory apron must be worn whenever you are in the lab.

_____

_____

2. State why bare feet or sandals are not permitted in the lab.

_____

_____

_____

Section 1.4 Scientific Research (continued)

Main Idea **Details**

3. Describe how you would explain to another student why you should not return unused chemicals to the stock bottle.

_____

_____

_____

4. Explain why is it important to keep the balance area clean.

_____

_____

_____

SYNTHESIZE

Some students are conducting an experiment that involves combining sodium and water. Too much sodium is added, which causes a fire. A student reacts by throwing water on the fire, but this only causes the fire to spread. The teacher finally puts the fire out. Based on what you now know about chemistry and lab safety, explain how this could have been avoided.

_____

_____

_____

_____

Name _____ **Date** _____

Introduction to Chemistry Chapter Wrap-Up

Now that you have read the chapter, review what you have learned. Fill in the blanks below with the correct word or phrase.

Chemistry is the study of _____.

Matter is anything that has _____ and takes up _____. Mass is _____ and differs from weight in that it does not measure the effect of _____ on matter.

The steps of the scientific process include:

_____

_____

Two types of scientific investigation are:

_____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the vocabulary words and scientific definitions.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Explain three ways you use chemistry in daily life.

1. _____

2. _____

3. _____

Name _____ Date _____

Analyzing Data

Before You Read

Review Vocabulary *Define the following terms.*

qualitative data _____

quantitative data _____

variable _____

analysis _____

Chapter 1

You and a friend are making sweetened iced tea. You both have different opinions about how much sugar to add and at what temperature is best to add the sugar. Design an experiment to find out how much sugar will dissolve at three different temperatures. In your experiment, identify the following:

Qualitative data _____

Quantitative data _____

Independent variable _____

Dependent variable _____

Name _____ Date _____

Analyzing Data

Section 2.1 Units and Measurements

Main Idea — **Details**

Skim *Section 1 of your text. Write a question you have about each of the two types of units discussed in this section.*

1. _____

2. _____

New Vocabulary *Use your text to define each term.*

base unit _____

_____

derived unit _____

density _____

Match *the SI base units below with their functions.*

second	distance
meter	temperature
kilogram	time
kelvin	mass
liter	volume

Name _____ **Date** _____

Section 2.1 Units and Measurements (continued)

Main Idea	Details
Units *Use with page 32.*	**Identify** *five items around your home that use SI units of measurement.* **1.** _____ **2.** _____ **3.** _____ **4.** _____ **5.** _____
Base Units and SI Prefixes *Use with pages 33–35.*	**Organize** *these prefixes from smallest to largest.* ____ pico ____ giga ____ micro ____ nano ____ deci ____ milli ____ kilo ____ centi ____ mega
Temperature *Use with pages 34–35.*	**Compare and contrast** *the kelvin scale and the Celsius scale.* _____ _____ _____
Derived Units *Use with pages 35–37.*	**Explain** *density by completing the following statement and equation.* Density is a _____ that _____ the _____ of an object to its _____. density = _____

Name _____ **Date** _____

Section 2.1 Units and Measurements (continued)

Main Idea | **Details**

Using Density and Volume to Find Mass

Use with Example Problem 2.1, page 38.

Solve *Read Example Problem 2.1 in your text.*

You Try It

Problem

Determine the mass of an object that, when placed in a 25-mL graduated cylinder containing 14 mL of water, causes the level of the water to rise to 19 mL. The object has a density of 3.2 g/mL.

1. Analyze the Problem

Known: _____

Unknown: _____

You know the density and the volume of an object and must determine its mass; therefore, you will calculate the answer using the density equation.

2. Solve for the Unknown

Write the density equation.

$= \_\_\_\_\_$

Rearrange the density equation to solve for mass.

_____

Substitute the known values for _____ and _____ into the equation.

_____

Multiply the values and units. The mL units will cancel out.

mass = _____ × _____ = ____

3. Evaluate the Answer

The two sides of the equation should be _____.

density = _____

_____

If you divide 16 g by 5.0 mL, you get _____

Name _____ Date _____

Analyzing Data

Section 2.2 Scientific Notation and Dimensional Analysis

Main Idea

Details

Scan *Section 2 of your text. Use the checklist below as a guide.*

- 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 scientific notation and dimensional analysis.*

1. _____

2. _____

3. _____

New Vocabulary

Use your text to define each term.

scientific notation _____

_____

dimensional analysis _____

_____

conversion factor _____

Academic Vocabulary

Define the following term.

sum _____

Section 2.2 Scientific Notation and Dimensional Analysis (continued)

Main Idea

Scientific Notation

Use with Example Problem 2.2, page 41.

Details

Solve *Read Example Problem 2.2 in your text.*

You Try It

Problem

Change the following data into scientific notation:

a. The distance between Pluto and the Sun is 5, 913, 000 km.

b. The density of nitrogen gas, a major component of Pluto's atmosphere, is .0012506 g/cm^3.

1. Analyze the Problem

Known: _____

Unknown: _____

You are given two measurements. In both cases, the answers will be factors between 1 and 10 that are multiplied by a power of ten.

2. Solve for the Unknown

Move the decimal point to produce a factor between 1 and 10. Count the number of places the decimal point moved and the direction.

The decimal point moved __ places to the ____.

The decimal point moved __ places to the _____.

Remove the extra zeros at the end or beginning of the factor.

Multiply the result by 10^n where n equals the _____ _____. When the decimal point moves to the left, n is a _____ number. When the decimal point moves to the right, n is a _____ number. Remember to add units to the answers.

a. _____

b. _____

3. Evaluate the Answer

The answers have ____ factors. The first factor is a number between _ and __. In answer a, because the distance to Pluto is a large number, 10 has a _____. In answer b, because the density of nitrogen gas is a very small number, the exponent is _____.

Section 2.2 Scientific Notation and Dimensional Analysis (continued)

Main Idea **Details**

Using Conversion Factors

Use with Example Problem 2.4, page 46.

Solve *Read Example Problem 2.4 in your text.*

You Try It

Problem

The Cassini probe heading toward Saturn will reach speeds of 5.2 kilometers per second. How many meters per minute would it travel at this speed?

1. Analyze the Problem

Known: _____

Unknown: _____

You need conversion factors that relate kilometers to meters and seconds to minutes. A conversion factor is a _____ of _____ used to express _____ in _____.

2. Solve for the Unknown

First convert kilometers to meters. Set up the conversion factor so that the kilometer units will cancel out.

$$\frac{5.2\ \text{km}}{\text{s}} \times \frac{1000\ \text{m}}{1\ \text{km}} = \frac{\quad\text{m}}{\text{s}}$$

Next convert seconds to minutes. Set up the conversion factor so that the seconds will cancel out.

$$\frac{5200\ \text{m}}{\text{s}} \times \frac{60\ \text{s}}{1\ \text{min}} = \frac{\quad\text{m}}{\text{min}}$$

3. Evaluate the Answer

To check your answer, you can do the steps in reverse order.

$$\frac{5.2\ \text{km}}{\text{s}} \times \frac{60\ \text{s}}{1\ \text{min}} = \frac{312\ \text{km}}{\text{min}} \times \frac{1000\ \text{m}}{\text{min}} = \frac{\quad\text{km}}{\text{min}}$$

Name _____ Date _____

Analyzing Data

Section 2.3 Uncertainty in Data

Main Idea — **Details**

Skim *Section 3 of your text. Focus on the headings, subheadings, boldfaced words, and main ideas. Summarize the main ideas of this section.*

_____

_____

_____

_____

New Vocabulary *Use your text to define each term.*

accuracy _____

precision _____

error _____

percent error _____

significant figure _____

Section 2.3 Uncertainty in Data (continued)

Main Idea | **Details**

Error and Percent Error

Use with pages 48–49.

Explain *percent error by completing the statement and equation below.*

Percent error is the _____ of an _____ to an _____.

Percent error = $\times$ ___

Calculating Percent Error

Use with Example Problem 2.5, page 49.

Solve *Read Example Problem 2.5 in your text.*

You Try It

Problem

Calculate the percent errors. Report your answers to two places after the decimal point. The table below summarizes Student B's data.

Trial	Density(g/cm^3)	Error(g/cm^3)
1	1.4	−0.19
2	1.68	0.09
3	1.45	−0.14

1. Analyze the Problem

Known: _____

_____

Unknown: _____

Use the accepted value for density and the errors to calculate percent error.

2. Solve for the Unknown

Substitute each error into the percent error equation.

$$\text{percent error} = \frac{\text{error}}{\text{accepted value}} \times 100$$

$$\text{percent error} = \frac{\text{error}}{1.59\ g/cm^3} \times 100 = \square$$

$$\text{percent error} = \frac{\text{error}}{1.59\ g/cm^3} \times 100 = \square$$

$$\text{percent error} = \frac{\text{error}}{1.59\ g/cm^3} \times 100 = \square$$

3. Evaluate the Answer

The percent error is greatest for trial __ which had the largest error, and smallest for trial __ which was closest to the accepted value.

Name _____ **Date** _____

Section 2.3 Uncertainty in Data (continued)

Main Idea **Details**

Significant Figures

Use with page 50.

Identify *the significant numbers below by drawing a circle around them. Use the five rules for recognizing significant digits on page 51 for reference.*

0.0___ _____ ___00

Rounding Numbers

Use with page 52.

Explain *the rules for rounding numbers by completing the following sentences. Then complete the example of each rule for rounding numbers.*

1. If the digit to the immediate right of the last significant figure is less than five, _____

3.751 _____

2. If the digit to the immediate right of the last significant figure is greater than five, _____

4.127 _____

3. If the digit to the immediate right of the last significant figure is equal to five and is followed by a nonzero digit, _____

_____

8.3253 _____

4. If the digit to the immediate right of the last significant figure is equal to five and is not followed by a nonzero digit, look at the last significant figure. _____

_____

1.4750 = ____;1.4650 = ____

Name _____ Date _____

Analyzing Data

Section 2.4 Representing Data

Main Idea

Details

Scan *Section 4 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all tables and graphs.
- Look at all pictures and read the captions.
- Think about what you already know about data analysis.

Write *facts you learned about representing data as you scanned the section.*

1. _____

2. _____

3. _____

New Vocabulary

Use your text to define the following term.

graph _____

Name _____ **Date** _____

Section 2.4 Representing Data (continued)

Main Idea

Graphing

Use with pages 55–56.

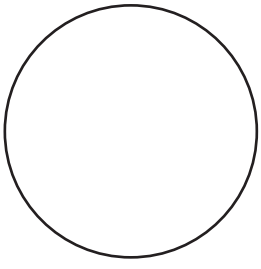
Details

Draw ***and label (a) a circle graph and (b) a bar graph using the information in the table below.***

Student Budget	
Budget items	**Percent**
Car insurance	45
Movies	6
Books	5
Clothing	30
Miscellaneous	4
Gas	10

Student Budget bar graph

Student Budget circle graph



The _____ best displays the data in the Student Budget table because _____ _____.

Name _____ **Date** _____

Section 2.4 Representing Data (continued)

Main Idea | **Details**

Line Graphs

Use with pages 56–57.

Identify *each of the following slopes.*

_____ slope

_____ slope

Analyze *whether the following sequences will likely plot as linear or nonlinear relationships.*

Sequence A:	**Sequence B:**
Result 1: 2	Result A: 31
Result 2: 4	Result B: 27
Result 3: 7	Result C: 49
Result 4: 10	Result D: 45
Answer: _____	Answer: _____

Interpreting Graphs

Use with pages 57–58.

Organize *information about interpreting graphs by completing the sentences below.*

Information on a graph typically consists of ____ types of variables: _____ variables and _____ variables.

The relationship between the variables may reflect either a _____ or a _____ slope.

When reading the graph, you use either interpolation for _____ _____ or _____ for estimated values beyond the plotted points.

Name _____ Date _____

Analyzing Data Chapter Wrap-Up

Now that you have read the chapter, review what you have learned. Write out the key equations and relationships.

density =

percent error = $\times$ 100

slope =

Conversion between temperature scales:

°C + ___ = __

K − ___ = __

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

SUMMARIZE

If you were a scientist, what precautionary guidelines would you use to ensure the accuracy of your data and to provide a clear representation of that data?

Name _____ Date _____

Matter—Properties and Changes

Before You Read

Review Vocabulary *Define the following terms.*

matter _____

significant figure _____

Chapter 2

Measure *the height and arm length for five friends or family members. In the space below, create an appropriate graph to represent the data you collected.*

Compare and contrast *circle, bar and line graphs.*

Name _____ Date _____

Matter—Properties and Changes

Section 3.1 Properties of Matter

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.

states of matter _____

vapor _____

_____

physical property _____

_____

extensive property _____

intensive property _____

chemical property _____

_____

Match *each of the following states of matter with its physical description*

solid	flows and fills the entire volume of its container
liquid	has definite shape and volume
gas	flows and has a constant volume

Academic Vocabulary

Define the following term.

resource _____

Name _____ Date _____

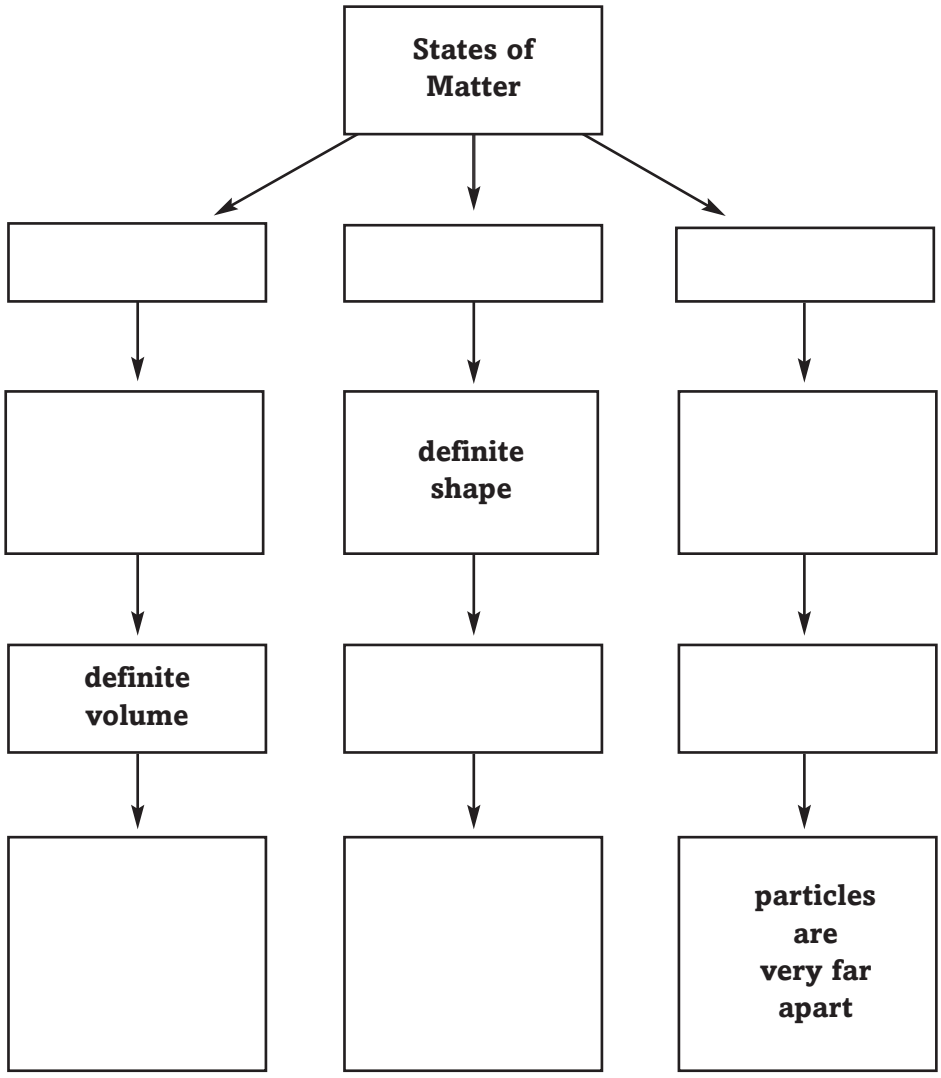
Section 3.1 Properties of Matter (continued)

Main Idea | **Details**

States of Matter

Use with pages 71–72.

Compare *the way the three common states of matter fill a container.*



Real-World Connection

Meteorologists (scientists who study weather) refer to water in the gaseous state in the atmosphere as water vapor. Explain why this term is used.

Name _____ **Date** _____

Section 3.1 Properties of Matter (continued)

Main Idea	Details
Physical and Chemical Properties of Matter *Use with pages 73–74.*	**Contrast** *intensive and extensive physical properties.* **List** *several physical properties and explain why they are used more than chemical properties in the identification of objects.*
Observing Properties of Matter *Use with pages 74–75.*	**Compare** *the properties of water at room temperature with water that has a temperature greater than 100°C.*

Name _____ Date _____

Matter—Properties and Changes

Section 3.2 Changes in Matter

Main Idea — **Details**

Scan *Section 2 of your text. Use the checklist below as a guide.*

- 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 changes in matter.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

physical change _____

phase change _____

chemical change _____

law of conservation of mass _____

_____

Name _____ Date _____

Section 3.2 Changes in Matter (continued)

Main Idea **Details**

Physical and Chemical Changes

Use with pages 76–77.

Determine *which type of change each statement represents. Use P for physical change and C for chemical change. Explain your answers.*

silver spoon tarnishes ___

Explanation: _____

crushing an aluminum can ___

Explanation: _____

freezing water ___

Explanation: _____

burning wood ___

Explanation: _____

copper turns a greenish color ___

Explanation: _____

grind coffee beans ___

Explanation: _____

Describe *how iron turns into a brownish-red powder. Name the reactants and product that are involved*

_____

_____

_____

_____

_____

Section 3.2 Changes in Matter (continued)

Main Idea — **Details**

Conservation of Mass

Use with Example Problem 3.1, page 78.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 3.1.*

Problem

The total _____ of the products must _____ the total mass of the _____. This shows the law of _____.

1. Analyze the Problem

Known: _____

_____

Unknown: _____

2. Solve for the Unknown

Write an equation showing conservation of mass of reactants and products.

mass of _____ = mass of _____ + mass of _____

Write an equation to solve for the mass of oxygen.

mass of _____ = mass of _____ − mass of _____

Substitute known values and solve.

Mass of oxygen = _____g − _____g

Mass oxygen = _____g

3. Evaluate the Answer

Write an equation that shows mass of the two products equals the mass of the reactant.

_____g mercury + _____g oxygen = _____g mercury(II) oxide

Name _____ Date _____

Matter—Properties and Changes

Section 3.3 Mixtures of Matter

Main Idea — **Details**

Scan *Section 3 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all charts and graphs.
- Look at all pictures and read the captions.

List *three facts you have learned about mixtures.*

1. _____
2. _____
3. _____

New Vocabulary *Use your text to find the correct term for each definition.*

mixture _____

_____

heterogeneous mixture _____

homogeneous mixture _____

solution _____

filtration _____

distillation _____

_____

crystallization _____

_____

sublimation _____

chromatography _____

_____

Name _____ Date _____

Section 3.3 Mixtures of Matter (continued)

Main Idea	Details
Mixtures *Use with pages 80–81.*	**Describe** *how mixtures relate to substances.* **Contrast** *heterogeneous and homogeneous mixtures.* **Describe** *what an alloy is and why alloys are used.*
Separating Mixtures *Use with pages 82–83.*	**Identify** *four techniques that take advantage of different physical properties in order to separate mixtures and describe how each is done.* Technique 1: _____ How it is done: _____ Technique 2: _____ How it is done: _____ Technique 3: _____ How it is done: _____

Name _____ **Date** _____

Section 3.3 Mixtures of Matter (continued)

Main Idea **Details**

Technique 4: _____

How it is done: _____

_____

Sequence ***the steps of separating a mixture of sand, salt, and iron filings. Identify which physical property you were using in each step.***

__ Mix the sand and salt mixture with water.

Physical property used: _____

_____

__ Boil the salt and water mixture, leaving the salt behind.

Physical property used:

_____

__ Separate the iron filings from the sand and salt by using a magnet.

Physical property used: _____

_____

__ Use filtration to separate the sand from the salt and water.

Physical property used: _____

_____

Real-World Connection

Crude oil (petroleum) is a mixture of several materials, including gasoline, kerosene, diesel fuel, and heating oil. Describe whether you think distillation or filtration would be a better method to separate the products of crude oil. Hint: each of the products listed has a different boiling point.

_____

_____

_____

Name _____ Date _____

Matter—Properties and Changes

Section 3.4 Elements and Compounds

Main Idea — **Details**

Scan *Section 4 of your text. Review the periodic table of elements. Record some observations about how the table is organized and what information you can determine just by looking at the table.*

New Vocabulary *Use your text to define each term.*

element

periodic table

compound

law of definite proportions

percent by mass

law of multiple proportions

Section 3.4 Elements and Compounds (continued)

Main Idea — **Details**

Elements and Compounds

Use with pages 84–87.

Discuss *elements and compounds by completing the following paragraph.*

There are ____ naturally occurring elements. Seventy-five percent of the universe is _____. The Earth's crust and the human body are made of different elements. But _____ is an element that is abundant in both. Most objects are made of _____ with approximately ten million known and over _____ being developed and discovered every _____.

Analyze *the concept map for matter in Figure 3.19. Write a brief description of the information the concept map is conveying.*

Describe *how the periodic table organizes elements.*

Explain *how Figure 3.18 illustrates the fact that the properties of a compound are different from the properties of its component elements.*

Name _____ Date _____

Section 3.4 Elements and Compounds (continued)

Main Idea — **Details**

Law of Definite Proportions

Use with pages 87–88.

Describe *how to do percent by mass by completing the following paragraph.*

The _____ of a compound is _____ to the _____ of the masses of the _____ that make up the compound. This demonstrates the law of _____.

Analyze *the law of definite proportions by indicating whether the following examples are for identical or different compounds.*

Description	Analysis
Compound 1 consists of 24g of Na, and 36g of Cl. Compound 2 has 36g of Na and 54g of Cl.	
Compound 3 has 10.00g of lead and 1.55g of sulfur. Compound 4 has 10.00 g of lead, 1.55g of sulfur, and 1.55g of carbon.	

Law of Multiple Proportions

Use with pages 89–90.

Describe *the law of multiple proportions by completing the following statement.*

When different _____ are formed by combining the same _____, different masses of one element combine with the same _____ of the other element in a ratio of _____.

SYNTHESIZE

Carbon combines with oxygen to form two compounds, carbon monoxide and carbon dioxide. Based on the law of multiple proportions, describe how the proportions of oxygen in the two compounds relate to each other.

Name _____ Date _____

Matter—Properties and Changes Chapter Wrap-Up

After reading this chapter, list three things you have learned about the properties and changes in matter.

1. _____

2. _____

3. _____

Review

Use this checklist to help you study.

- ☐ Use this Science Notebook to study this chapter.
- ☐ Study the vocabulary words and scientific definitions.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Explain how understanding the physical and chemical properties of matter can help find alternatives to the burning of fossil fuels, thus reducing the amount of harmful greenhouse gases released into the atmosphere.

_____

_____

_____

_____

_____

Name _____ Date _____

The Structure of the Atom

Before You Read

Review Vocabulary *Define the following terms.*

scientific law _____

_____

theory _____

_____

_____

element _____

_____

law of definite proportions _____

_____

law of multiple proportions _____

_____

_____

Describe *three things that you already know about the atom.*

1. _____

2. _____

3. _____

Name _____ Date _____

The Structure of the Atom

Section 4.1 Early Ideas About Matter

Main Idea

Details

Scan *Section 1 of your text. Use the checklist below as a guide.*

- 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.

List *three things you expect to learn about while reading the section.*

1. _____

2. _____

3. _____

New Vocabulary

Use your text to define each term.

Dalton's atomic theory

_____

_____

_____

Name _____ Date _____

Section 4.1 Early Ideas About Matter (continued)

Main Idea | **Details**

Greek Philosophers

Use with pages 102–103.

Summarize *the effect that Aristotle had on the atomic theory proposed by Democritus.*

_____

_____

_____

_____

John Dalton

Use with page 104.

List *the main points of Dalton's atomic theory.*

1. _____

_____

2. _____

_____

_____

3. _____

_____

4. _____

_____

5. _____

_____

Discuss *Dalton's ideas by completing the following paragraph.*

After years of studying _____, Dalton was able to accurately determine the _____ of the elements involved in the reactions. His conclusions resulted in the _____, which helped to explain that _____ in chemical reactions separate, _____, or _____, but are not created, _____, or _____.

Name _____ **Date** _____

Section 4.1 Early Ideas About Matter (continued)

Main Idea **Details**

Compare and contrast *the atomic theories of Democritus and Dalton. Mark an X under each name if a statement in the table applies to that person's theory.*

Statement	Democritus	Dalton
All matter is made of tiny pieces.		
Matter is made of empty space through which atoms move.		
Atoms cannot be divided.		
Atoms cannot be created.		
Atoms cannot be destroyed.		
Different atoms combine in whole-number ratios to form compounds.		
The properties of atoms vary based on shape, size, and movement.		
Different kinds of atoms come in different sizes and shapes.		

Real-World Connection

The experiments of the alchemists revealed the properties of some metals and provided the foundation for the science of chemistry. Although not successful, alchemy proved beneficial to science. Explain how this example can be applied to modern research.

_____

_____

_____

Name _____ Date _____

The Structure of the Atom

Section 4.2 Defining the Atom

Main Idea — **Details**

Scan *Section 2 of your text. Use the checklist below as a guide.*

- 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 *two facts you discovered about subatomic particles.*

1. _____

2. _____

New Vocabulary *Use your text to define each term.*

cathode ray _____

_____

electron _____

nucleus _____

_____

proton _____

_____

neutron _____

_____

The Atom

Use with pages 106–107.

Explain *an atom by completing the following statements.*

The atom is the _____

_____.

When a group of atoms _____ and act as a _____, the result is known as a _____.

Name _____ **Date** _____

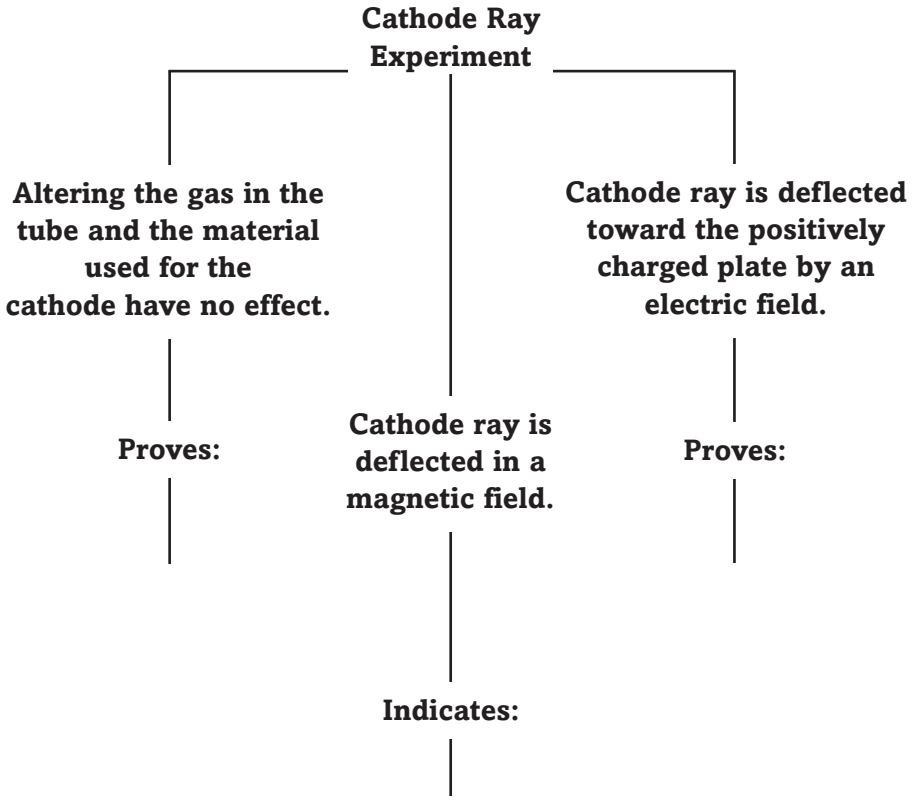
Section 4.2 Defining the Atom (continued)

Main Idea | **Details**

The Electron

Use with pages 107–110.

Summarize *the information you learned from cathode ray experiments. Use Figure 4.7 for reference.*



Identify *the major discoveries about subatomic particles made by the 19th century.*

1. _____

2. _____

3. _____

Name _____ Date _____

Section 4.2 Defining the Atom (continued)

Main Idea **Details**

The Nucleus

Use with pages 111–114.

Describe *Rutherford's model of the atom by completing the following statements.*

1. Most of an atom consists of _____ moving _____ through _____.
2. The electrons are _____ within the atom by their _____ to the positively charged _____.
3. The volume of _____ through which the electrons move is many times _____ than the volume of the _____.

Organize *the properties of subatomic particles by completing the table below. Use Table 4.3 for reference.*

	Electron	Proton	Neutron
Symbol			
Location			**in nucleus**
Relative electrical charge		**1+**	

Summarize *what you have learned about subatomic particles by completing the following paragraph.*

Atoms have a _____ shape. The _____ of an atom is made up of _____ that have a positive charge and _____ that have no _____. The nucleus makes up _____ of the mass of an atom. Most of an _____ is made up of negatively charged _____ traveling around the _____ charged nucleus. The _____ are held in place by their _____ to the positive charge of the _____. The _____ of the protons and neutrons are almost _____ to each other while the _____ of the electrons is _____.

Name _____ Date _____

The Structure of the Atom

Section 4.3 How Atoms Differ

Main Idea — **Details**

Skim *Section 3 of your text. Focus on the headings, boldfaced words, and main ideas. Then summarize the main ideas of this section.*

1. _____

2. _____

3. _____

New Vocabulary *In the left margin, write the term defined below.*

_____ *the number of protons in an atom*

_____ *atoms with the same number of protons but different numbers of neutrons*

_____ *the sum of the number of protons and neutrons in the nucleus*

_____ *1/12 the mass of a carbon-12 atom; the standard unit of measurement for the mass of atoms*

_____ *the weighted average mass of the isotopes of an element*

Academic Vocabulary *Define the following term.*

specific _____

Section 4.3 How Atoms Differ (continued)

Main Idea — **Details**

Atomic Number

Use with page 115.

Explain *how to use an atomic number to identify an element by completing the paragraph below.*

Each _____ of an element has a unique number of _____. Since the overall charge of an atom is _____ the number of _____ equals the number of _____. Atomic number = number of _____ = number of _____. If you know how many one of the three an atom contains, you also know the other _____. Once you know the _____, the _____ can be used to find the name of the _____.

Atomic Number

Use with Example Problem 4.1, page 116.

Solve *Read Example Problem 4.1 in your text.*

You Try It

Problem

Given the following information about atoms, determine the name of each atom's element and its atomic number.

a. Atom 1 has 11 protons **b. Atom 2 has 20 electrons**

1. Analyze the Problem

Apply the relationship among atomic number, number of protons, and number of electrons to determine the name and atomic number of each element.

2. Solve for the Unknown

a. Atom 1

Atomic number = number of protons = number of electrons

Atomic number = _____ = number of electrons

The element with an atomic number of 11 is _____.

b. Atom 2

Atomic number = number of protons = number of electrons

Atomic number = number of protons = _____

The element with an atomic number of _____ is _____.

3. Evaluate the Answer

The answers agree with _____ and element _____ given in the periodic table.

Name _____ Date _____

Section 4.3 How Atoms Differ (continued)

Main Idea — **Details**

Isotopes and Mass Number

Use with page 117.

Review *your understanding of isotopes and mass number by completing the following paragraph.*

Isotopes are elements with _____ but with _____. The number of neutrons can be determined by _____ the atomic number from the _____. The mass number is _____ _____.

Use Atomic Number and Mass Number

Use with Example Problem 4.2, page 118.

Solve *Read Example Problem 4.2 in your text.*

You Try It

Problem

You are given two samples of carbon. The first sample, carbon-12, has a mass number of 12, the second sample, carbon-13, has a mass number of 13. Both samples have an atomic number of 6. Determine the number of protons, electrons, and neutrons in each sample.

1. Analyze the Problem

Known:

Carbon-12	**Carbon-13**
Mass number is _____	Mass number is _____
Atomic number is _____	Atomic number is _____

Unknown:

The number of protons, electrons, and neutrons in each sample.

2. Solve for the Unknown

Number of protons = number of electrons = atomic number = ____

Number of neutrons = mass number − atomic number

The number of neutrons for carbon-12 = 12 − 6 = ____

The number of neutrons for carbon-13 = 13 − 6 = ____

3. Evaluate the Answer

The number of neutrons does equal the _____ minus the _____, or the number of protons.

Name _____ Date _____

Section 4.3 How Atoms Differ (continued)

Main Idea | **Details**

Mass of Atoms

Use with pages 119–120.

Explain *why the mass number for chlorine is more than 35. Use Figure 4.17 for reference.*

_____

_____

_____

Calculate Atomic Mass

Use with Example Problem 4.3, page 121.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 4.3.*

Isotope Abundance for Element X

Isotope	Mass (amu)	Percent abundance
^{6}X	6.015	7.59%
^{7}X	7.016	92.41%

Problem

Given the _____ in the table in the left margin, _____ the _____ of unknown element X. Then, _____ the unknown _____, which is used _____ to treat some _____.

1. Analyze the problem

Known:

For isotope ^{6}X:

mass = _____

abundance = _____

For isotope ^{7}X:

mass = _____

abundance = _____

Unknown:

_____ of X = ? amu

_____ of element X = ?

2. Solve for the unknown

Mass contribution = (_____)(_____)

For ^{6}X: Mass contribution = _____ = _____

For ^{7}X: Mass contribution = _____ = _____

Sum the mass contributions to find the atomic mass.

_____ of X = _____ = _____

Use the _____ to identify the element.

The element with an atomic mass of 6.939 amu is _____.

3. Evaluate the answer

The number of neutrons does equal the _____ minus the _____, or number of _____.

Name _____ Date _____

The Stucture of the Atom

Section 4.4 Unstable Nuclei and Radioactive Decay

Main Idea — **Details**

Skim *Section 4 of your text. Write two questions that come to mind from reading the headings, and the captions.*

1. _____

2. _____

New Vocabulary *Use your text to define each term.*

radioactivity _____

radiation _____

nuclear reaction _____

_____

radioactive decay _____

_____

alpha radiation _____

alpha particle _____

_____

nuclear equation _____

_____

beta radiation _____

beta particle _____

gamma ray _____

_____

Name _____ **Date** _____

Section 4.4 Unstable Nuclei and Radioactive Decay (continued)

Main Idea **Details**

Radioactivity

Use with pages 122–124.

Explain *radioactivity by completing the paragraph below.*

In chemical reactions, atoms may be _____, but their _____ do not change. The rearrangement _____ only the _____ of the atoms, not the _____. _____ are different. In nuclear reactions, _____ gain stability by emitting _____. As a result of _____ in the nuclei, the atoms' _____ change. _____ will continue emitting _____, in a process called _____, until stable nuclei, often of a _____, are formed.

Sequence *the steps of a nuclear reaction.*

_____ A stable, nonradioactive atom is formed.

_____ Radiation is emitted.

_____ The process of radioactive decay continues until the nucleus is stable.

_____ An atom has an unstable nucleus.

Distinguish *between alpha, beta, and gamma radiation by completing the table below.*

Radiation Type			
	Alpha	**Beta**	**Gamma**
Symbol	$^{4}_{2}\mathrm{He}$		
Mass (amu)		1/1840	
Charge			0

Discuss *why some elements are radioactive while most elements are not.*

_____

_____

_____

Name _____ Date _____

The Structure of the Atom Chapter Wrap-Up

Now that you have read the chapter, review what you have learned. List three important things you learned about the structure of an atom.

_____

_____

_____

_____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Radioactive materials are used in power plants and for medical uses. Some people object to the widespread use of nuclear reactors and radioactive materials. Discuss how what you've learned in this chapter affects your view on the use of radioactive materials.

_____

_____

_____

_____

_____

Name _____ Date _____

Electrons in Atoms

Before You Read

Chapter 4

Review *the structure of the atom by completing the following table.*

Part of the Atom	Description
proton	
	centrally located part of the atom that contains protons and neutrons
electron	
	subatomic particle with no charge found in the _____

Draw *a typical atom and label the structures.*

Identify *three facts about electrons.*

Example: Electrons are a part of the structure of an atom.

1. _____

2. _____

3. _____

_____

Name _____ Date _____

Electrons in Atoms

Section 5.1 Light and Quantized Energy

Main Idea — **Details**

Scan *Section 1 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all tables and graphs.
- Look at all pictures and read the captions.

Write three facts you discovered about light.

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

electromagnetic radiation _____

wavelength _____

frequency _____

amplitude _____

electromagnetic spectrum _____

quantum _____

Planck's constant _____

photoelectric effect _____

_____

photon _____

atomic emission spectrum _____

Name _____ Date _____

Section 5.1 Light and Quantized Energy (continued)

Main Idea | **Details**

The Atom and Unanswered Questions

Use with page 136.

List *the three reasons scientists found Rutherford's nuclear atomic model to be fundamentally incomplete.*

1. _____

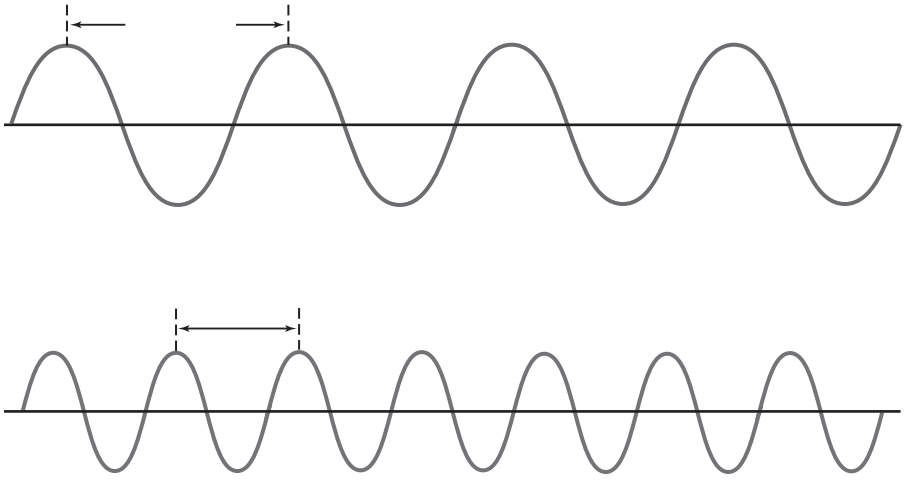
2. _____

3. _____

Wave Nature of Light

Use with pages 137–140.

Explain *the relationship shown by the figure below. Use the following terms: wavelength, frequency, amplitude, and speed.*



Section 5.1 Light and Quantized Energy (continued)

Main Idea **Details**

Calculating Wavelength of an EM Wave

Use with Example Problem 5.1, page 140.

Solve *Read Example Problem 5.1 in your text.*

You Try It

Problem

Radio waves are used to transmit information on various channels. What is the wavelength of a radio wave having the frequency of 5.40×10^{10} Hz?

1. Analyze the Problem

Known: $v =$ _____ and $c =$ _____

Unknown: $\lambda =$ _____

You know that because radio waves are part of the electromagnetic spectrum, their speed, frequency, and wavelength are related by the formula $c = \lambda v$.

2. Solve for the Unknown

Solve the equation relating the speed, frequency, and wavelength of an electromagnetic wave for wavelength (λ).

If $c = \lambda v$, then $\lambda =$ _____

Substitute c and the frequency of the radio wave, v, into the equation. Note that hertz is equivalent to 1/s or s^{-1}.

$\lambda =$

Divide the values to determine wavelength, λ, and cancel units as required.

$\lambda =$

3. Evaluate the Answer

The answer is correctly expressed in a unit of _____.

Both of the known values in the problem are expressed with ____ significant figures, so the answer must have ____ significant figures.

Name _____ Date _____

Section 5.1 Light and Quantized Energy (continued)

Main Idea | **Details**

Particle Nature of Light

Use with pages 141–143.

Identify *two facts the wave model of light failed to explain.*

1. _____

2. _____

Describe *Planck's quantum concept by completing the following statement.*

The quantum concept concludes that matter can gain or lose _____ only in small, specific amounts called _____. A quantum is the minimum amount of energy that can be _____ or _____ by an atom.

Atomic Emission Spectra

Use with pages 144–145.

Compare and contrast *Einstein's equation with Planck's equation by completing the following sentence.*

Planck's equation, _____, demonstrates mathematically that the energy of a quantum is related to the _____ of the emitted radiation. Einstein went further by explaining that, in addition to its wavelike characteristics, a beam of light can be thought of as a stream of _____ called _____.

Contrast *the continuous electromagnetic spectra and the atomic emission spectra.*

Name _____ Date _____

Electrons in Atoms

Section 5.2 Quantum Theory and the Atom

Main Idea — **Details**

Skim *Section 2 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.*

ground state _____

quantum number _____

de Broglie equation _____

_____

Heisenberg uncertainty principle _____

_____

quantum mechanical model of the atom _____

atom orbital _____

principal quantum number _____

principal energy level _____

energy sublevel _____

Section 5.2 Quantum Theory and the Atom (continued)

Main Idea — **Details**

Bohr Model of the Atom

Use with pages 146–148.

Classify *the characteristics of each series in hydrogen's line spectrum. Include the following information.*

1. Beginning orbit(s)/ending orbit
2. Description of the spectral lines

Balmer	Paschen	Lyman
1.	1.	1.
2.	2.	2.

The Quantum Mechanical Model of the Atom

Use with pages 149–150

Sequence *de Broglie's process in developing his equation by completing the flow chart below.*

Whole _____ of _____ are allowed in a circular orbit of fixed _____.

→ **Light has both _____ and _____ characteristics.**

→ **Can particles of matter, including electrons, behave like _____?**

→ **If an electron has _____ and is restricted to circular orbits of fixed radius, the _____ is allowed only certain possible wavelengths, _____, and _____.**

Name _____ Date _____

Section 5.2 Quantum Theory and the Atom (continued)

Main Idea — **Details**

The Heisenberg Uncertainty Principle

Use with pages 151–152.

Discuss *how Heisenberg's principle influenced Schrödinger to develop his wave equation.*

_____

_____

_____

_____

_____

Hydrogen's Atomic Orbitals

Use with page 153.

Identify *four facts about atomic orbitals by completing the following statements.*

1. _____ indicate the relative sizes and energies of atomic orbitals.

2. The atom's major energy levels are called _____.

3. Principal energy levels contain _____.

4. The number of _____ in a principal energy level _____ as *n* increases.

SUMMARIZE **Compare and contrast the Bohr and quantum mechanical models of the atom.**

_____

_____

_____

_____

_____

_____

Name _____ Date _____

Electrons in Atoms

Section 5.3 Electron Configuration

Main Idea — **Details**

Skim *Section 3 of your text. Focus on the headings, subheadings, boldfaced words, and figure captions. Summarize the main ideas of this section.*

New Vocabulary *Use your text to define each term.*

electron configuration

aufbau principle

Pauli exclusion principle

Hund's rule

valence electron

electron-dot structure

Name _____ **Date** _____

Section 5.3 Electron Configurations (continued)

Main Idea | **Details**

Ground-State Electron Configurations

Use with page 156.

Organize *information about electron configurations by completing the following outline.*

Electron configuration is _____.

I. Ground–state electron configurations

A. Three rules define how electrons can be arranged in an atom's orbitals:

1. _____

2. _____

3. _____

Orbital Diagrams and Electron Configuration Notation

Use with page 158.

B. The _____ methods for representing an atom's electron configuration

1. Orbital diagrams

a. An empty box represents an _____.

b. A box containing a single up arrow represents an orbital with _____.

c. A box containing both up and down arrows represents a _____.

d. Each box is labeled with the _____ and _____ associated with the orbital.

2. _____

a. This method designates the _____ and _____ associated with each of the atom's orbitals, and includes a _____ _____.

Valence Electrons

Use with page 161.

C. Only valence electrons _____ _____.

1. Electron-dot structures consist of the _____, which represents the _____ _____, surrounded by dots representing the _____.

Section 5.3 Electron Configurations *(continued)*

Main Idea **Details**

Electron-Dot Structures

Use with Example Problem 5.3, page 162.

Solve *Read Example Problem 5.3 in your text.*

You Try It

Problem

Ruthenium (Ru) is commonly used in the manufacture of platinum alloys. What is the ground-state electron configuration for an atom of ruthenium?

1. Analyze the Problem

Known: _____

Unknown: _____

Determine the number of additional electrons a ruthenium atom has compared to the nearest preceding noble gas, and then write out ruthenium's electron configuration.

2. Solve for the Unknown

From the periodic table, ruthenium's atomic number is determined to be ☐. Thus a ruthenium atom contains ☐ electrons. The noble gas preceding ruthenium is krypton (Kr), which has an atomic number of 36. Represent ruthenium's first 36 electrons using the chemical symbol for krypton written inside brackets.

_____

The first 36 electrons have filled out the 1s, 2s, 2p, 3s, 3p, 4s, 3d and 4p sublevels. The remaining ☐ electrons of ruthenium's configuration need to be written out. Thus, the remaining ☐ electrons fill the _____ orbitals.

Using the maximum number of electrons that can fill each orbital, write out the electron configuration. _____

3. Evaluate the Answer

All ☐ electrons in a ruthenium atom have been accounted for. The correct preceding noble gas _____ has been used in the notation, and the order of orbital filling for the _____ is correct.

Name _____ Date _____

Electrons in Atoms Chapter Wrap-Up

Now that you have read the chapter, review what you have learned. Write out the key equations and relationships.

_____

_____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions for vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Explain how advances in our understanding of the atom influence our daily lives.

_____

_____

_____

_____

_____

Name _____ Date _____

The Periodic Table and Periodic Law

Before You Read

Review Vocabulary **Define** *the following terms.*

atom _____

_____

electron configuration _____

valence electrons _____

electron-dot structure _____

_____

_____

Chapter 4

Distinguish *between the subatomic particles in terms of relative charge.*

Subatomic Particle	Electrical Charge
_____	_____
_____	_____
_____	_____

Describe *how the subatomic particles are arranged.*

_____

_____

Name _____ Date _____

The Periodic Table and Periodic Law

Section 6.1 Development of the Modern Periodic Table

Main Idea — **Details**

Skim *Section 1 of your text. Look at the headings, boldfaced words, figures and captions. Write two facts you discovered about the periodic table.*

1. _____

2. _____

New Vocabulary *Use your text to define each term.*

periodic law _____

group _____

period _____

representative element _____

transition element _____

metal _____

alkali metal _____

alkaline earth metal _____

transition metal _____

inner transition metal _____

nonmetal _____

halogen _____

noble gas _____

metalloid _____

Name _____ **Date** _____

Section 6.1 Development of the Modern Periodic Table (continued)

Main Idea — **Details**

Development of the Periodic Table

Use with pages 174–176.

Sequence *the events that helped develop the periodic table.*

1. In the 1790's, _____.
2. In 1864, _____ and saw the properties of elements _____.
3. In 1869, _____ _____. He left blank spaces _____.
4. In 1913, _____ _____. He arranged elements by _____.

The Modern Periodic Table

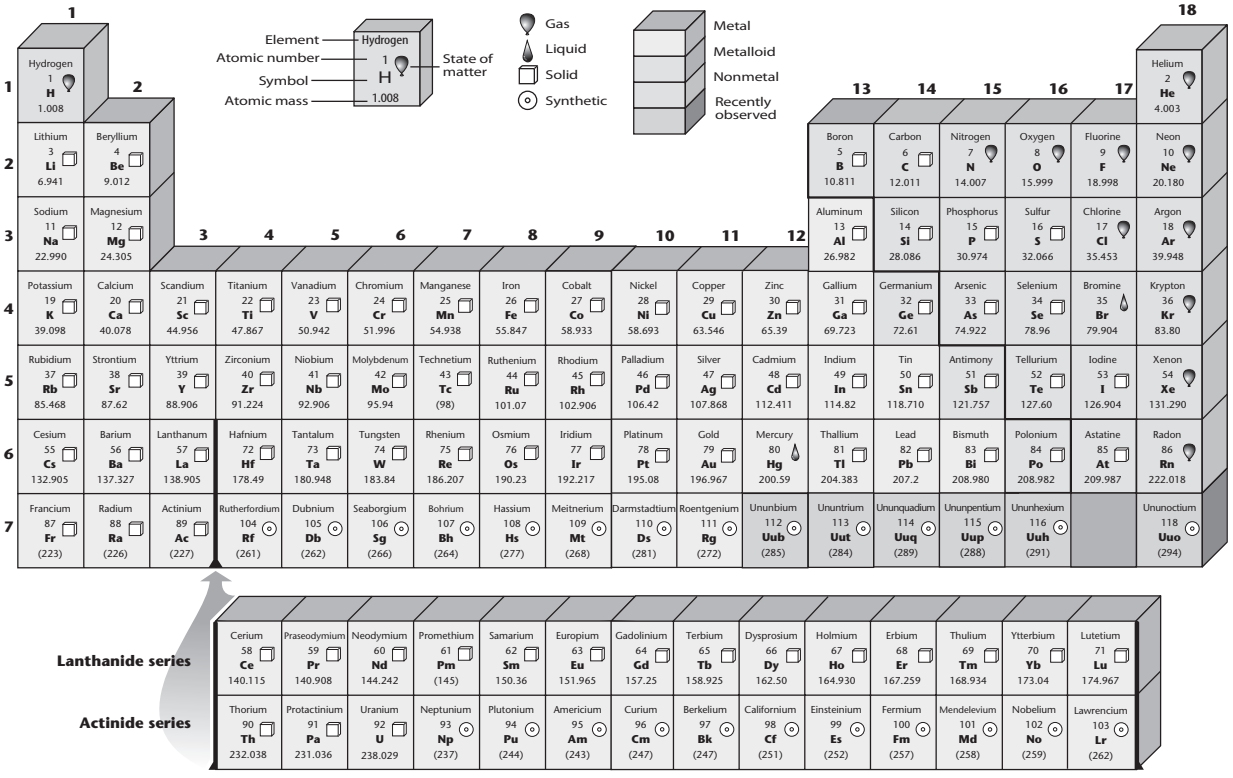
Use with pages 177–180.

Determine *where you can find each of the following groups of elements on the periodic table below:*

alkali metals
alkaline earth metals
inner transition metals
nonmetals
representative elements
transition elements
halogens
transition metals
noble gases

Hint: colored pencils might be helpful. Be sure to include a legend.

PERIODIC TABLE OF THE ELEMENTS

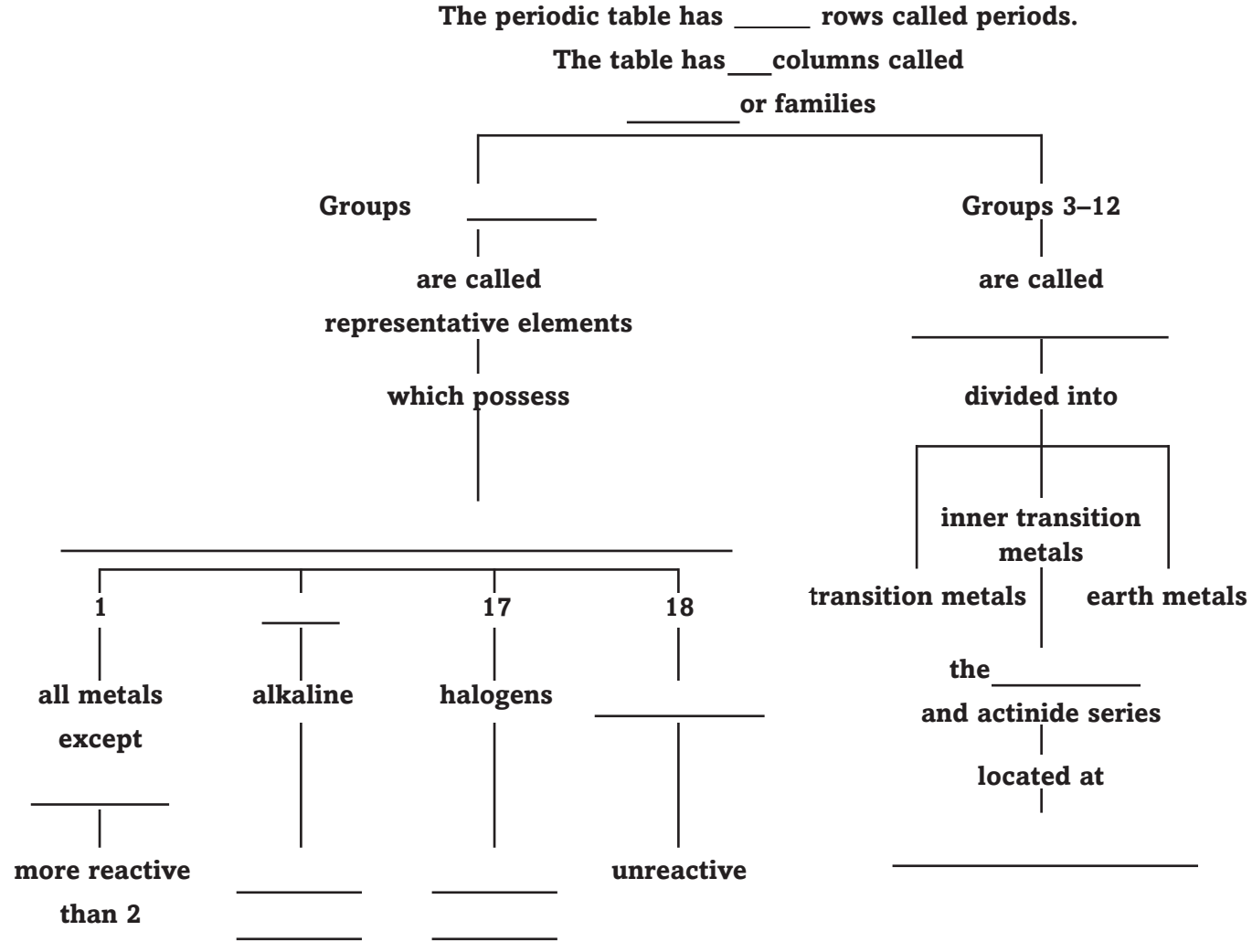


Name _____ **Date** _____

Section 6.1 Development of the Modern Periodic Table (continued)

Main Idea **Details**

Organize *information about the periodic table by completing the concept map below.*



Name _____ Date _____

Section 6.1 Development of the Modern Periodic Table (continued)

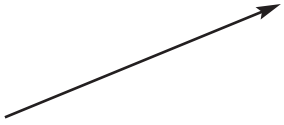
Main Idea — **Details**

Identify *the information that is given on a typical box from the periodic table.*

1. _____
2. _____
3. _____
4. _____
5. _____

Match *the box color on the periodic table in Figure 6.5 with the class of element the box describes.*

blue	nonmetal
green	recently discovered
yellow	metalloid
gray	metal



Real-World Connection

Describe how knowledge of the periodic table would be important in three different careers, based on what you've read.

_____

_____

_____

_____

_____

_____

Name _____ Date _____

The Periodic Table and Periodic Law

Section 6.2 Classification of the Elements

Main Idea **Details**

Scan *Section 2 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all tables.
- Look at all pictures and read the captions.
- Think about what you already know about the shapes and arrangements of atoms in covalent compounds.

Write *three facts that you discovered about the relationship between electrons and an element's location on the periodic table.*

1. _____

2. _____

3. _____

Academic Vocabulary

Define the following terms.

structure _____

Section 6.2 Classification of the Elements (continued)

Main Idea

Organizing the Elements by Electron Configuration

Use with pages 182–183.

Details

Organize *information about electron configurations by completing the outline below.*

I. Electrons

A. Valence electrons

1. electrons in _____

2. atoms in the _____ have _____ _____.

B. Valence electrons and period

1. The _____ of an element's valence electrons indicates _____.

a. Elements with valence electrons in energy level 2 are found in _____.

b. Elements with _____ are found in the fourth period.

C. Valence electrons and group number

1. Representative elements.

a. All elements in group 1 have _____.

b. All elements in group 2 have _____.

c. Group 13 elements have _____, group 14 elements have _____, and so on.

2. Helium, in group 18, is an _____.

Describe *the relationship between the number of valence electrons and the chemical properties of atoms.*

_____

_____

_____

Section 6.2 Classification of the Elements (continued)

Main Idea — **Details**

The s-, p-, d-, and f-Block Elements

Use with pages 183–185.

Distinguish *between s-, p-, d-, and f-block elements by completing the table below.*

	Periodic Table Groups	Orbitals	Type of Occupied Element
s-block			representative elements
p-block		p	
d-block	3 through 12		
f-block			

Electron Configuration and the Periodic Table

Use with Example Problem 6.1, page 186.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 6.1.*

Problem

Without using the periodic table, determine the group, period, and block in which strontium is located on the periodic table.

1. Analyze the problem

Known: _____ Unknown: _____

Use the electron configuration of strontium to determine its place.

2. Solve for the unknown

Group: Strontium has a valence configuration of ___. All group ___ elements have the ___ configuration.

Period: The ___ in $5s^2$ indicates that strontium is in _____.

Block: The ___ indicates that strontium's valence electrons _____. Therefore, strontium is in the _____.

3. Evaluate the answer

The relationships among _____ and _____ have been correctly applied.

Name _____ Date _____

The Periodic Table and Periodic Law

Section 6.3 Periodic Trends

Main Idea — **Details**

Scan *Section 3 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all tables.
- Look at all pictures and read the captions.

Write *three facts that you discovered about periodic trends.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

ion _____

ionization energy _____

octet rule _____

_____

electronegativity _____

Name _____ **Date** _____

Section 6.3 Periodic Trends (continued)

Main Idea | **Details**

Atomic Radius

Use with pages 187–188.

Describe *how atomic size is defined.*

_____

_____

_____

Analyze *any trends that you observe in Figure 6.11 and how the trends relate to atomic mass.*

_____

_____

_____

Interpret Trends in Atomic Radii

Use with Example Problem 6.2, page 189.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 6.2.*

Problem

Which has the largest atomic radius: carbon (C), fluorine (F), beryllium (Be), or lithium (Li)? Explain your answer in terms of trends in atomic radii.

1. **Analyze the problem**

   Known: periodic table information for four elements

   Unknown: which of the four has the _____

2. **Solve for the unknown**

   Use the _____ to determine if the elements are in the same group or period. All four elements are in _____.

   Order the elements from _____ across the period.

   _____

   Determine the largest based on trends of _____.

   _____

3. **Evaluate the answer**

   The _____ in atomic radii have been correctly applied.

Name _____ Date _____

Section 6.3 Periodic Trends (continued)

Main Idea — **Details**

Ionic Radius

Use with pages 189–190.

Describe *atomic size and ionic change by completing the table below.*

Ionic Change	Ion Charge	Size of Atom
atom electrons	becomes positive	
atom gains electrons	becomes	increases

Identify *two reasons why the relative size of an atom becomes smaller due to the loss of electrons:*

1. _____

2. _____

_____

Explain *why atoms increase in size when the atom gains electrons.*

_____

_____

Ionization Energy

Use with pages 191–193.

Describe *ionization energy trends on the periodic table by completing the paragraphs below.*

Ionization energies generally _____ as you move left-to-right across a _____. Increased nuclear charge leads to an _____ on valance electrons. Ionization energy generally _____ when you move down a _____. Less energy is required to remove _____ because they are _____ from the nucleus.

The octet rule states that atoms tend to gain, lose, or share _____ in order to acquire a full set of _____. First period elements are the _____ to this rule.

Electronegativity

Use with page 194.

Predict *what part of the periodic table has the greatest electronegativity. Use Figure 6.18 for reference.*

_____

Name _____ Date _____

The Periodic Table and Periodic Law Chapter Wrap-Up

Now that you have read the chapter, review what you have learned. List three facts about the periodic table and periodic law.

_____

_____

_____

_____

_____

_____

Review

Use this check list to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions and vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Explain how an understanding of the periodic table can help you gain confidence in studying chemistry.

_____

_____

_____

_____

_____

Name _____ Date _____

Ionic Compounds and Metals

Before You Read

Review Vocabulary *Define the following terms.*

ion _____

ionization energy _____

_____

_____

noble gas _____

valance electron _____

_____

Chapter 5

Create *electron-dot diagrams for the following elements.*

aluminum _____

calcium: _____

arsenic: _____

tellurium: _____

xenon: _____

Name _____ Date _____

Ionic Compounds and Metals

Section 7.1 Ion Formation

Main Idea — **Details**

Skim *Section 1 of your text. Read the title and subheads. List three concepts that you think will be discussed in this section.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

chemical bond _____

cation _____

_____

anion _____

_____

Section 7.1 Ion Formation (continued)

Main Idea

Valence Electrons and Chemical Bonds

Use with pages 206–209.

Details

Organize *information about forming chemical bonds by completing the concept map below.*

As the number of _____ in an atom increases,

- **_____, or the atom's ability to attract electrons, _____.**
  - **Electron affinity is smallest for _____, which in general have eight _____ in their outermost s and p orbitals.**
- **reactivity _____.**
- **_____, which is the energy needed to remove electrons from the outer orbitals, _____.**

Write *the electron configuration of the most likely ion and the charge that is lost or gained by each of the following atoms. Indicate what the overall charge of the ion is, and whether it is a cation or an anion.*

Cs: $[Xe]6s^1$ _____

O: $[He]2s^22p^4$ _____

Ga: $[Ar]4s^23d^{10}4p^1$ _____

Br: $[Ar]4s^23d^{10}4p^5$ _____

Ag: $[Kr]5s^14d^{10}$ _____

Sc: $[Ar]4s^23d^1$ _____

Name _____ **Date** _____

Section 7.1 Ion Formation (continued)

Main Idea **Details**

Sequence *the first group of elements in order of increasing ionization energy. Sequence the second group of elements in order of increasing electron affinity.*

First Group		Second Group	
____	$K \rightarrow K^{+}$	____	$P \rightarrow P^{3-}$
____	$Ne \rightarrow Ne^{+}$	____	$O \rightarrow O^{2-}$
____	$P \rightarrow P^{5+}$	____	$Xe \rightarrow Xe^{-}$
____	$Fe \rightarrow Fe^{2+}$	____	$S \rightarrow S^{2-}$
____	$Rb \rightarrow Rb^{+}$	____	$I \rightarrow I^{-}$
____	$Mg \rightarrow Mg^{2+}$	____	$F \rightarrow F^{-}$

Identify *the following ions.*

Ag^{+} _____

Li^{+} _____

Br^{-} _____

Ca^{2+} _____

S^{2-} _____

B^{3+} _____

As^{3-} _____

H^{-} _____

Cd^{2+} _____

Se^{2-} _____

Name _____ Date _____

Ionic Compounds and Metals

Section 7.2 Ionic Bonds and Ionic Compounds

Main Idea — **Details**

Skim *Section 2 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.*

ionic bond _____

ionic compound _____

crystal lattice _____

electrolyte _____

lattice energy _____

Section 7.2 Ionic Bonds and Ionic Compounds (continued)

Main Idea **Details**

Formation of an Ionic Bond

Use with pages 210–212.

Solve *Read pages 211–213 in your text.*

You Try It

Problem

Describe the formation of an ionic compound from the elements boron and selenium.

1. Analyze the Problem

Known: the electron configurations of the given elements

Unknown: the number of valence electrons for each neutral atom

2. Solve for the Unknown

Determine how many electrons need to be removed from boron and how many electrons need to be added to selenium to form noble gas configurations.

Determine how many boron atoms and how many selenium atoms must be present for the total number of electrons exchanged between the two elements to be equal.

3. Evaluate the Answer

The overall charge on one unit of this compound is zero.

☐ boron ions (3+/boron ion) + ☐ selenide ions (☐/selenide ion) = ☐ (3+) + ☐ (☐) = 0

Name _____ Date _____

Section 7.2 Ionic Bonds and Ionic Compounds (continued)

Main Idea

Properties of Ionic Compounds

Use with pages 212–217.

Details

Analyze *the relationship between the lattice energy of an ionic compound and the force of attraction.*

Describe *the relationship between the size of the ions in a compound and the compound's lattice energy.*

Explain *the relationship between lattice energy and the charge of the ion.*

Organize *the following ionic compounds from those with the least negative lattice energy to those with the most negative lattice energy.*

_____ LiCl

_____ BeS

_____ LiBr

_____ BeO

_____ $BeCl_2$

_____ RbBr

_____ CsI

_____ $SrCl_2$

_____ CsBr

Name _____ Date _____

Ionic Compounds and Metals

Section 7.3 Names and Formulas for Ionic Compounds

Main Idea — **Details**

Scan *Section 3 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all tables and diagrams.
- Look at all figures and read the captions.
- Study the example problems and note what they are intended to solve.
- Think about what you already know about the formation, formulas, and naming of ions and ionic compounds.

Write *three facts that you discovered about the names and formulas of ionic compounds.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

formula unit _____

monatomic ion _____

oxidation number _____

polyatomic ion _____

oxyanion _____

_____

Academic Vocabulary *Define the following term.*

transfer _____

Section 7.3 Names and Formulas for Ionic Compounds (continued)

Main Idea **Details**

Formula for an Ionic Compound

Use with Example Problem 7.1, page 220.

Solve *Read Example Problem 7.1 in your text.*

You Try It

Problem

Calcium can form a cation with a 2+ charge. Write the formula for the ionic compound formed from calcium ion and Chlorine.

1. Analyze the Problem

Known: the ionic forms of the component elements _____ and _____

Unknown: _____

2. Solve for the Unknown

The smallest number that is divisible by both ionic charges is _____, so the compound contains _____ calcium ion(s) and _____ sulfide ion(s). The formula for the ionic compound formed is _____.

3. Evaluate the Answer

The overall charge on one formula unit of this compound is zero.

☐ Ca ion(s) (2+/Ca ion) + ☐ Cl ions (1− /Cl ion) = 0

Formula for a Polyatomic Ionic Compound

Use with Example Problem 7.3, page 222.

Solve *Read Example Problem 7.3 in your text.*

You Try It

Problem

Write the formula for the ionic compound formed from the calcium ion and the bromate ion.

1. Analyze the Problem

Known: the ionic forms of the component elements _____ and _____

Unknown: _____

Section 7.3 Names and Formulas for Ionic Compounds (continued)

Main Idea

Details

2. Solve for the Unknown

The smallest number that is divisible by both ionic charges is _____, so _____ bromate ions combine with _____ calcium ion. The formula for the ionic compound formed is to form _____.

3. Evaluate the Answer

The overall charge on one formula unit of this compound is zero.

1 Ca ion (2+/Ca ion) + ☐ BrO_3 ions (1−/BrO_3 ion) = 0

Names for Ions and Ionic Compounds

Use with pages 222–224.

Classify *the ions listed below as monatomic or polyatomic cations or anions. If the ion is a polyatomic anion, indicate whether it is an oxyanion.*

CN^- _____

MnO_4^- _____

Ba^{2+} _____

$Fe(CN)_6^{4-}$ _____

NH_4^+ _____

N^{3-} _____

Hg_2^{2+} _____

$S_2O_3^{2-}$ _____

O^{2-} _____

Identify *the ionic compounds listed below.*

CaO _____

$KMnO_4$ _____

$Sr(IO_3)_2$ _____

NH_4OH _____

Fe_2S_3 _____

$Sn(NO_3)_4$ _____

$Pb_3(PO_4)_2$ _____

Hg_2SO_4 _____

$PtCl_4$ _____

Name _____ Date _____

Ionic Compounds and Metals

Section 7.4 Metallic Bonds and the Properties of Metals

Main Idea — **Details**

Skim *Section 4 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.

electron sea model _____

delocalized electrons _____

metallic bond _____

alloy _____

Name _____ **Date** _____

Section 7.4 Metallic Bonds and the Properties of Metals (continued)

Main Idea **Details**

Metallic Bonds

Use with pages 225–226.

Summarize ***how the electron sea model accounts for the malleability, high thermal conductivity, and high electrical conductivity of metals.***

_____

_____

_____

_____

_____

Explain ***the properties of metals by completing the following sentences.***

The _____ of transition metals increases as the number of delocalized electrons _____.

Because the _____ in metals are strongly attracted to the delocalized electrons in the metal, they are not easily _____ from the metal, causing the metal to be very _____.

Alkali metals are _____ than transition metals because they have only _____ per atom.

The _____ of metals vary greatly. The melting points are not as extreme as the _____. It does not take an extreme amount of energy for _____ to be able to move past each other. However, during _____, atoms must be separated from a group of _____, which requires a lot of _____.

Light absorbed and released by the _____ in a metal accounts for the _____ of the metal.

Name _____ Date _____

Section 7.4 Metallic Bonds and the Properties of Metals (continued)

Main Idea **Details**

Metal Alloys

Use with pages 227–228.

Match ***the alloy composition given in the first column with the common name of the alloy in the second column and the alloy's uses in the third column. Draw lines between the appropriate items. Use Table 7.13 as a reference.***

45% Cu, 15% Ag, 42% Au	cast iron	tableware, jewelry
75% Fe, 17% Cr, 8% Ni	10-carat gold	dental fillings
97 % Fe, 3% C	sterling silver	casting
92.5% Ag, 7.5% Cu	dental amalgam	medals, bells
80% Cu, 15% Zn, 5% Sn	brass	instruments, sinks
85% Cu, 15% Zn	bronze	jewelry
50% Hg, 35% Ag, 15% Sn	stainless steel	hardware, lighting

Contrast ***a substitutional alloy with an interstitial alloy. Give an example of each.***

Name _____ Date _____

Ionic Compounds and Metals Chapter Wrap-Up

Review

Now that you have read the chapter, review what you have learned. List three important facts about ionic compounds.

1. _____

2. _____

3. _____

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter, and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

SUMMARIZE

Explain how the atomic properties of an element determine what sort of ion it will form, and what properties a resulting ionic compound will have.

Name _____ Date _____

Covalent Bonding

Before You Read

Review Vocabulary **Define** *the following terms.*

ionic bond _____

_____

octet rule _____

_____

Chapter 4 **Describe** *the structure of an atom.*

_____

_____

_____

Chapter 6 **Explain** *the following concepts: periodic trends and periodic properties of elements.*

_____

_____

_____

_____

Chapter 8 **Identify** *the ions, along with their charges, in the following ionic compounds.*

Li_2S _____

$KMnO_4$ _____

Al_2O_3 _____

Name _____ Date _____

Covalent Bonding

Section 8.1 The Covalent Bond

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.*

covalent bond _____

molecule _____

Lewis structure _____

_____

sigma bond _____

_____

pi bond _____

endothermic reaction _____

_____

exothermic reaction _____

_____

Academic Vocabulary *Define the following term.*

overlap _____

Section 8.1 The Covalent Bond (continued)

Main Idea — **Details**

Why do atoms bond?

Use with page 240.

Explain *the octet rule by completing the following sentences.*

The _____ rule states that _____

_____

_____. Although exceptions exist, the rule provides a useful framework for understanding _____.

What is a covalent bond?

Use with page 241.

Complete *the following sentences using words or phrases from your text.*

The force between two atoms is the result of _____ repulsion, nucleus-nucleus _____, and nucleus-electron _____. At the point of _____, the _____ forces balance the _____ forces. The most stable arrangement of atoms exists at the point of _____, when the atoms bond covalently and a _____ forms.

Single Covalent Bonds Lewis Structure of a Molecule

Use with Example Problem 8.1, page 244.

Solve *Read Example Problem 8.1 in your text.*

You Try It

Problem

Draw the Lewis structure for hydrochloric acid, HCl.

1. **Analyze the Problem**

   Write the electron-dot structures of each of the two component atoms.

   Known: $H\cdot, \cdot\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}:$

   Unknown: _____ of HCl

   Hydrogen, H, has only one valence electron. Chlorine, Cl, has seven valence electrons. Cl needs one electron to complete its octet.

2. **Solve for the Unknown**

   Draw the electron-dot structure for each of the component atoms. Then show the sharing of the pairs of electrons.

   $H\cdot \quad + \quad \cdot\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}: \quad \rightarrow \quad H{-}\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}:$

   _____ _____ _____

   _____ _____ _____

Name _____ Date _____

Section 8.1 The Covalent Bond (continued)

Main Idea **Details**

3. Evaluate the Answer

Each atom in the molecule has achieved a _____ configuration and thus is _____.

Multiple Covalent Bonds

Use with pages 245–246.

Identify *each bond between the component atoms as sigma bonds (single bonds), one sigma bond and one pi bond (double bonds), or one sigma bond and two pi bonds (triple bonds).*

H−C≡C−H _____

H−C=O
    |
    H _____

The Strength of Covalent Bonds

Use with pages 246–247.

Explain *the factors that control the strength of covalent bonds.*

Define *bond dissociation energy.*

Real-World Connection

Explain how understanding covalent bonding and the chemistry of compounds might help scientists increase food supplies.

Name _____ Date _____

The Covalent Bond

Section 8.2 Naming Molecules

Main Idea — **Details**

Scan *Section 2 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all tables and graphs.
- Read all formulas.
- Look at all figures and read the captions.
- Think about what you already know about the naming of molecules.

Write *three facts you discovered about the names and formulas of covalent molecules.*

1. _____

2. _____

3. _____

New Vocabulary

Use your text to define the following term.

oxyacid _____

Section 8.2 Naming Molecules (continued)

Main Idea

Naming Binary Molecular Compounds

Use with Example Problem 8.2, page 249.

Details

Identify *the prefixes for these three binary molecular compounds.*

Ge_3N_2 _____-germanium _____-nitride

C_2Cl_4 _____-carbon _____-chloride

B_6Si _____-boron silicide

Solve ***Read Example Problem 8.2 in your text.***

You Try It

Problem

Name the compound N_2O_3.

1. Analyze the Problem

Known: _____

Unknown: _____

The formula reveals the elements present and the number of atoms for each element. Only two elements are present, and both are nonmetals, so the compound can be named according to the rules for binary molecular compounds.

2. Solve for the Unknown

The first element present in the compound is ___, _____. The second element is ___, _____. The root of this name is ____, so the second part of the name is _____. From the formula, two _____ atoms and three _____ atoms make up a molecule of the compound. The prefix for two is ____ and prefix for three is ____. The complete name for the compound is _____.

3. Evaluate the Answer

The name _____ shows that a molecule of the compound contains _____ atoms and _____ atoms, which agrees with the chemical formula for the compound, N_2O_3.

Name _____ Date _____

Section 8.2 Naming Molecules (continued)

Main Idea — **Details**

Naming Acids

Use with page 250.

Match *the chemical formulas listed below with the correct acids.*

HF	sulfurous acid
HIO_4	hydrofluoric acid
H_2SO_3	phosphoric acid
H_3PO_4	hypochlorous acid
$HC_2H_3O_2$	periodic acid
H_2CO_3	permanganic acid
HClO	acetic acid
$HMnO_4$	carbonic acid

Writing Formulas from Names

Use with pages 251–252.

Write *the chemical formula for the molecular compound names given below. Use the flow chart in Figure 8.12 to help you determine the correct formulas.*

_____ dicarbon tetrabromide

_____ arsenic pentafluoride

_____ perchloric acid

_____ tetrasulfur tetranitride

_____ arsenic acid

_____ hydrocyanic acid

SYNTHESIZE

Create questions and answers about naming molecules for your own original quiz game. Include topics such as: prefixes and number of atoms; formulas, common names, and molecular names for covalent binary compounds; and formulas, common names, and molecular names for binary acids and oxyacids.

Name _____ Date _____

Covalent Bonding

Section 8.3 Molecular Structures

Main Idea — **Details**

Skim *Section 3 of your text. Write three questions that come to mind from reading the headings, illustration captions, and topics for the example problems.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

structural formula _____

_____

resonance _____

_____

coordinate covalent bond _____

_____

_____

Name _____ Date _____

Section 8.3 Molecular Structures (continued)

Main Idea — **Details**

Structural Formulas

Use with pages 253–254.

List *the steps that should be used to determine Lewis structures.*

1. _____
2. _____
3. _____
4. _____

Lewis Structure for a Covalent Compound with Multiple Bonds

Use with Example Problem 8.4, page 256.

Solve *Read Example Problem 8.4 in your text.*

You Try It

Problem

Draw the Lewis structure for FCHO.

1. Analyze the Problem

Known: the compound formula: _____

Unknown: _____

Carbon has less attraction for shared electrons, so it is the central atom.

2. Solve for the Unknown

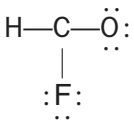
Find the total number of valence electrons and the number of bonding pairs.

☐ valence electrons/C atom + ☐ valence electrons/F atom + 1 valence electron/H atom + ☐ valence electrons/O atom = ☐ valence electrons

☐ available valence electrons/(2 electrons/pair) = ☐ available pairs

Main Idea — Details

Draw single bonds, which represent _____ each, from the carbon atom to each terminal atom, and place electron pairs around the _____ and _____ atoms to give them stable _____.



_____ available pairs – _____ pairs used = 0

Carbon does not have an octet, so one of the lone pairs on the _____ atom must be used to form a _____ bond.

_____

3. Evaluate the Answer

Both carbon and _____ now have an octet, which satisfies the octet rule.

Lewis Structure for a Polyatomic Ion

Use with Example Problem 8.5, page 257.

Solve *Read Example Problem 8.5 in your text.*

You Try It

Problem

Draw the Lewis structure for the permanganate ion (MnO_4^-).

1. Analyze the Problem

Known: the compound formula: _____

Unknown: _____

Manganese has less attraction for shared electrons, so it is the central atom.

2. Solve for the Unknown

Find the total number of valence electrons and the number of bonding pairs.

1 Mn atom × (☐ valence electrons/Mn atom) + ☐ O atoms × (6 valence electrons/O atom + ☐ electron(s) from the negative charge = ☐ valence electrons

Section 8.3 Molecular Structures (continued)

Main Idea — **Details**

☐ available valence electrons/(2 electrons/pair) = ☐ available pairs + 1 electron

Draw single bonds, which represent an _____, from the Mn atom to each O atom, and place electron pairs around the O atoms to give them stable _____.

☐ available pairs − ☐ pairs used = 0

No electron pairs remain available for the Mn atom, so the Lewis structure for the permanganate ion is:

3. Evaluate the Answer

All atoms now have an octet, and the group of atoms has a net charge of ____.

Resonance Structures

Use with page 258.

Explain ***resonance structures by completing the following sentences.***

Each actual molecule or ion that undergoes _____ behaves as if it has only ____ structure. Experimentally measured bond lengths show that the bonds are _____ to each other.

Exceptions to the Octet Rule

Use with pages 258–259.

List ***three reasons for exceptions to the octet rule.***

1. _____

_____

2. _____

_____

3. _____

_____

Name _____ Date _____

Covalent Bonding

Section 8.4 Molecular Shapes

Main Idea **Details**

Scan *Section 4 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all tables.
- Look at all pictures and read the captions.
- Think about what you already know about the shapes and arrangements of atoms in covalent compounds.

Write *three facts you discovered about the shapes covalent compounds take.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

VSEPR model _____

hybridization _____

Name _____ Date _____

Section 8.4 Molecular Shapes (continued)

Main Idea **Details**

VSEPR Model

Use with pages 261–263.

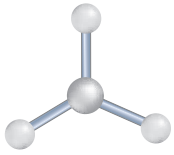
Match *the molecular shapes listed below with their corresponding bond angles.*

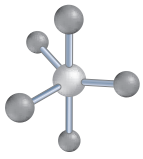
trigonal planar	180°
trigonal pyramidal	120°
bent	109.5°
linear	107.3°
octahedral	104.5°
tetrahedral	90° (out of plane); 120° (in plane)
trigonal bipyramidal	90°

Hybridization

Use with pages 262–263.

Label *the hybrid orbitals in the figures below as sp, sp^2, sp^3 sp^3d, or sp^3d_2.*





Name _____ Date _____

Section 8.4 Molecular Shapes (continued)

Main Idea | **Details**

Find the Shape of a Molecule

Use with Example Problem 8.7, page 264.

Solve *Read Example Problem 8.7 in your text.*

You Try It

Problem

What is the shape of a SbI_5 molecule? Determine the bond angles, and identify the type of hybrid orbitals that form the molecule's bonds.

1. Analyze the Problem

Known: the compound formula: _____

Unknown: _____

_____

The molecule contains one central antimony atom bonded to _____ iodine atoms.

2. Solve for the Unknown

Find the number of valence electrons and the number of electron pairs.

1 Sb atom × (☐ valence electrons/Sb atom) + ☐ I atoms × (☐ valence electrons/I atom) = ☐ valence electrons

Three electron pairs exist on each iodine atom. This leaves ☐ available valence electrons for bonding. ☐ available valence electrons/(2 electrons/pair) = ☐ available pairs

Draw the molecule's Lewis structure. From this Lewis structure, determine the molecular shape.

Lewis structure Molecular shape

The molecule's shape is _____, with a bond angle of _____ in the horizontal plane, and a bond angle of ____ between the vertical and horizontal bonds. The bonds are made up of _____ hybrid orbitals.

3. Evaluate the Answer

Each iodine atom has an octet. The antimony atom has ____ electrons, which is allowed when a *d* orbital is hybridized.

Name _____ Date _____

Covalent Bonding

Section 8.5 Electronegativity and Polarity

Main Idea — **Details**

Scan *Section 5 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all tables and charts.
- Look at all pictures and read the captions.
- Think about what you already know about the strengths and distribution of charge in covalent bonds.

Write *three facts you discovered about electrognegativity.*

1. _____

2. _____

3. _____

New Vocabulary

polar covalent bond

Use your text to define the following term.

_____

_____

Name _____ Date _____

Section 8.5 Electronegativity and Polarity (continued)

Main Idea | **Details**

Electron Affinity, Electronegativity, and Bond Character

Use with pages 265–266.

Sequence *the following elements from the least electronegative to the most electronegative. Use Figure 8.20 for reference.*

____ Au

____ Y

____ Ba

____ P

____ H

____ Te

____ O

____ I

____ Co

Polar Covalent Bonds

Use with pages 267–268.

Draw *the Lewis structure for each of the molecular compounds listed below. Analyze the symmetry of the structure to determine whether or not the compound is polar covalent or nonpolar covalent.*

N_2 _____ _____

CO_2 _____ _____

CH_3Cl _____

_____

Name _____ Date _____

Section 8.5 Electronegativity and Polarity (continued)

Main Idea **Details**

Properties of Covalent Compounds

Use with pages 269–270.

Determine *whether each of the properties listed below is characteristic of ionic compounds, covalent compounds, nonpolar covalent compounds, or polar covalent compounds.*

low melting point _____

very soft solid _____

high boiling point _____

weak interaction between formula units _____

solubility in oil _____

very hard solid _____

high melting point _____

solubility in water _____

easily vaporized _____

strong interaction between formula units _____

Covalent Network Solids

Use with page 270.

Describe *what the network solid for quartz (SiO_2) molecules is like, and how it has a tetrahedral structure similar to diamond structure.*

Name _____ **Date** _____

Covalent Bonding Chapter Wrap-Up

After reading this chapter, list three key facts about covalent bonding.

1. _____

2. _____

3. _____

Review

Use this checklist to help you study.

- ☐ Use this Science Notebook to study this chapter.
- ☐ Study the vocabulary words and scientific definitions.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Explain how covalent bonds in carbon account for the vast number of carbon compounds, including those responsible for living organisms.

Name _____ Date _____

Chemical Reactions

Before You Read

Review Vocabulary *Define the following terms.*

ionic compound

molecular compound

Chapter 7

Explain *how to write formulas for ionic compounds.*

Write *the formula for the following ionic compound.*

aluminum carbonate

Chapter 8

Explain *how to write formulas for molecular compounds.*

Write *the formula for the following molecular compound.*

sulfuric acid

Name _____ Date _____

Chemical Reactions

Section 9.1 Reactions and Equations

Main Idea — **Details**

Scan *Section 1 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all charts and graphs.
- Look at all pictures and read the captions.

Write *three facts about chemical reactions.*

1. _____
2. _____
3. _____

New Vocabulary *In the left column, write the terms defined below.*

_____	*a rearrangement of the atoms in one or more substances to form different substances*
_____	*the starting substances of a chemical reaction*
_____	*the substances formed during a chemical reaction*
_____	*a statement that uses chemical formulas to show the identities and relative amounts of the substances involved in a chemical reaction*
_____	*number written in front of a reactant or product that is used to balance chemical equations*

Academic Vocabulary *Define the following term.*

formula _____

_____

Name _____ Date _____

Section 9.1 Reactions and Equations (continued)

Main Idea — Details

Evidence of a Chemical Reaction

Use with page 282.

Identify *three examples of chemical reactions you have seen, heard, or smelled in the last 24 hours. Think about activities at home, at school, or outside. Include any evidence you had that a chemical reaction was occurring.*

Reaction	Evidence
1.	
2.	
3.	

Representing Chemical Reactions

Use with pages 283–285.

Organize *types of equations that can express a chemical reaction. In the second column, list the elements (words, coefficients, etc.) that are used to create each equation. In the third column, rank each equation from 1 to 3, giving a 3 to the equation that provides the most information, and a 1 to the equation that provides the least information.*

Type	Elements	Ranking
Word equations		
Chemical equations		
Skeleton equations		

Label *the chemical state each symbol below identifies in a chemical equation.*

(s) _____

(g) _____

(aq) _____

(l) _____

Name _____ Date _____

Section 9.1 Reactions and Equations (continued)

Main Idea **Details**

Balancing Chemical Equations

Use with pages 285–287.

Solve *Read Example Problem 9.1 in your text.*

You Try It

Problem

Balance the chemical equation for the reaction in which fluorine reacts with water to produce hydrofluoric acid and oxygen.

1. Analyze the problem

Known: _____

Unknown: _____

2. Solve for the Unknown

Use the space below to write the skeleton equation:

_____

Count the atoms of each element in the reactants.

____ F, ____ H, ____ O

Count the atoms of each element in the products.

____ F, ____ H, ____ O

Insert the coefficient ____ in front of ____ to balance the oxygen atoms.

Insert the coefficient ____ in front of ____ to balance the _____ .

Insert the coefficient ____ in front of ____ to balance the _____ .

Write the equation after adding the coefficients.

_____

Check that the coefficients are at their lowest possible ratio. The ratio of the coefficients is _____.

Write the number of atoms in the balanced equation below:

Reactants: _____

Products: _____

3. Evaluate the Answer

The _____ of each element is _____ on both sides of the equation. The _____ are written to the _____ _____ ratio.

Name _____ Date _____

Chemical Reactions

Section 9.2 Classifying Chemical Reactions

Main Idea

Details

Scan *Section 2 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all charts and graphs.
- Look at all pictures and read the captions.
- Think about what you already know about chemical reactions.

Write *three facts you discovered about classifying chemical reactions.*

1. _____

2. _____

3. _____

New Vocabulary

Use your text to define of each term.

synthesis reaction _____

_____

combustion reaction _____

_____

decomposition reaction _____

_____

single-replacement reaction _____

_____

double-replacement reaction _____

_____

precipitate _____

Name _____ **Date** _____

Section 9.2 Classifying Chemical Reactions (continued)

Main Idea — **Details**

Complete *the following diagrams illustrating each classification of chemical reaction. The first one has been completed for you.*

Synthesis Reactions

Use with page 289.

Synthesis reaction

Substance
Substance → New compound

A + B → _____

Combustion Reactions

Use with pages 290–291.

Combustion reactions

Metal, nonmetal, or compound substance → _____

Decomposition Reactions

Use with page 292.

Decomposition reactions

Compound → Element or
Element or

AB → _____

Replacement Reactions

Use with pages 293–296.

Single-replacement reactions

_____
Compound → Metal or nonmetal

A + BX → _____

Double-replacement reactions

_____
Compound with anion → _____

AX + BY → _____

Name _____ **Date** _____

Section 9.2 Classifying Chemical Reactions (continued)

Main Idea **Details**

Use with pages 289–297.

Organize *types of chemical reactions. The first column in the chart below lists some possible products in a chemical reaction. In the second column, write the type of chemical reaction that is likely to generate each product.*

Products	Possible Chemical Reaction
two different compounds, one of which is often a solid, a gas, or water	
oxide of the metal or a nonmetal or two or more oxides	
two or more elements or compounds	
a new compound and a replaced metal or nonmetal	
one compound	

ANALOGY

Consider the list of metals and halogens and their relative reactivity in Figure 9.13. Using your own experiences, identify people or things that could be ranked according to how they react in a certain situation.

1. (Example) Rank baseball bats by how likely they are to break.

2. _____

3. _____

4. _____

Name _____ Date _____

Chemical Reactions

Section 9.3 Reactions in Aqueous Solutions

Main Idea | **Details**

Consider *the title and first paragraph in Section 3. Based on what you read, what do you expect to learn in this chapter?*

_____

_____

_____

New Vocabulary *In the left column, write the terms defined below.*

_____ *the most plentiful substance in a solution*

_____ *substances dissolved in a solution*

_____ *equations that include only particles that participate in a reaction*

_____ *ion that does not participate in a reaction*

_____ *ionic equation that shows all the particles in a solution as they realistically exist*

_____ *a solution in which the most plentiful substance is water*

Name _____ Date _____

Section 9.3 Reactions in Aqueous Solutions (continued)

Main Idea — **Details**

Aqueous Solutions

Use with pages 299–300.

Connect *English words to their Latin roots. The term* aqueous *comes from the Latin word for water,* aqua. *Use a dictionary to find three words that also come from* aqua, *and list them in the box below together with a brief definition that explains their connection to water.*

Word	Definition

Types of Reactions in Aqueous Solutions

Use with pages 300–301.

Compare *a complete ionic equation and a chemical equation.*

Draw *a circle around the spectator ions in the following equation.*

$2A^+(aq) + 2B^-(aq) + C^+(aq) + 2D^-(aq) \longrightarrow 2A^+(aq) + 2D^-(aq) + 2BC$

Identify *whether each of the equations below is a complete ionic equation or a net ionic equation.*

$A^+(aq) + B^-(aq) + C^+(aq) + D^-(aq) \longrightarrow AD + B^-(aq) + C^+(aq)$

$E^+(aq) + F^-(aq) \longrightarrow EF$

$G^+(aq) + HI^-(aq) \longrightarrow GI + H(g)$

Name _____ Date _____

Section 9.3 Reactions in Aqueous Solutions (continued)

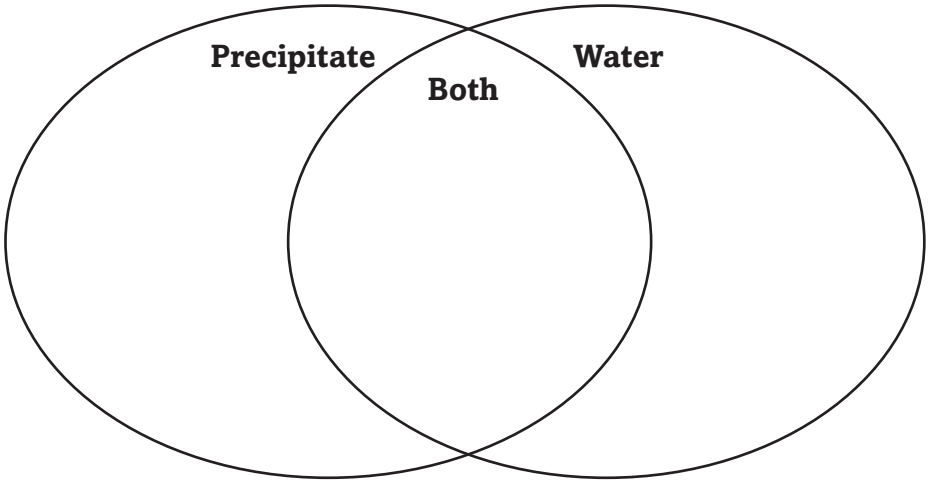
Main Idea **Details**

Reactions That Form Water

Use with page 303.

Compare *reactions in aqueous solution that form a precipitate and reactions that form water. Put each of the following characteristics in the corresponding category.*

- can be described with ionic equations
- generates a solid product
- double-replacement reaction
- has no observable evidence



Reactions That Form Gases

Use with page 305.

Identify *three commonly produced gases in reactions in aqueous solutions.*

_____

_____

_____

State *the evidence that would indicate that carbon dioxide gas is escaping from the solution containing sodium hydrogen carbonate shown in Figure 9.19.*

_____

List *the two reactions that occur when any acidic solution is mixed with sodium hydrogen carbonate.*

_____

_____

Name _____ **Date** _____

Tie-It-All-Together

SYNTHESIZE

Sequence *the steps in writing an overall equation.*

1. _____

2. _____

3. _____

4. _____

What if *ten years from now, you are a chemist working for a government agency that investigates chemical reactions. Read each of the case studies below, and in the space provided, list the type of chemical reaction that you think is involved and any products or effects that you would expect to discover during or after the chemical reaction.*

1. Owners of an industrial plant plan to mix oxygen with existing chemical substances in order to create a new product.

Type of Reaction	Product or Effect

2. Two vats of chemicals have spilled into a river and created a gelatinous ooze.

Type of Reaction	Product or Effect

Name _____ Date _____

Chemical Reactions Chapter Wrap-Up

Now that you have read the chapter, review what you have learned. List three facts you have learned about chemical reactions and the equations that describe them.

_____

_____

_____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter, and review the charts, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

SYNTHESIZE

Imagine you were asked to give an expert opinion on a magazine article before it is published. The article is on how to make your own household cleansers. You can tell that the author got the ingredients right, and she has amounts in the correct proportion. However, it looks to you like the author mixed up the order in which ingredients should be combined. How would you explain to the author why that matters?

_____

_____

_____

_____

Name _____ Date _____

The Mole

Before You Read

Review Vocabulary *Define the following terms.*

atomic mass _____

atomic mass unit (amu) _____

Chapter 2

Write *the following in scientific notation*

0.00582 _____

24, 367 _____

400 _____

Circle *the significant figures in the numbers below.*

75,600,000

0.00033

3.140

Name _____ Date _____

The Mole

Section 10.1 Measuring Matter

Main Idea — **Details**

Scan *Section 1, 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 questions that come to mind from your reading.

1. _____

2. _____

3. _____

New Vocabulary

Use your text to define each term.

mole _____

Avogadro's number _____

_____

Counting Particles

Use with page 320.

List *three common counting units and their values.*

1. _____

2. _____

3. _____

Name _____ Date _____

Section 10.1 Measuring Matter (continued)

Main Idea | **Details**

Use with pages 320–321.

Describe *why chemists needed to invent a new counting unit.*

_____

_____

List *three forms of substances that can be measured using moles.*

1. _____
2. _____
3. _____

Converting Between Moles and Particles

Use with pages 322–323.

Analyze *the usefulness of a conversion factor.*

_____

_____

_____

Write *the equation for finding the number of representative particles in a number of moles.*

Explain *how you would find the number of moles that are represented by a certain number of representative particles.*

Name _____ **Date** _____

Section 10.1 Measuring Matter (continued)

Main Idea | **Details**

Converting Particles to Moles

Use with Example Problem 10.1, page 324.

Summarize *Fill in the blanks to help you take notes as you read Example Problem 10.1.*

Problem

Convert 4.50×10^{24} atoms of Zn to find the number of mol of Zn.

1. Analyze the Problem

Known: number of atoms = _____

1 mole Zn = _____ atoms of Zn

Unknown: mole Zn = _____

2. Solve for the Unknown

the number of atoms × conversion factor = number of moles

_____ atoms Zn ×

= number of moles

= _____

3. Evaluate the Answer

The answer has _____ significant digits and is less than _____.

REAL-WORLD CONNECTION

Suppose you were given each of the following tasks. Analyze which task(s) the mole would be an effective unit for counting. Explain your answer.

A. Counting the atoms in a single grain of salt.

B. Counting the grains of salt in a very large mine.

C. Counting the grains of salt in the world.

Name _____ Date _____

The Mole

Section 10.2 Mass and the Mole

Main Idea **Details**

Scan *Section 2, using the checklist below as a guide.*

- 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.

List four things you expect to learn from the chapter.

1. _____

2. _____

_____

3. _____

_____

4. _____

_____

New Vocabulary

molar mass

Use your text to define this term.

_____

Name _____ Date _____

Section 10.2 Mass and the Mole (continued)

Main Idea | **Details**

The Mass of a Mole

Use with pages 325–326.

Analyze *molar mass by completing the following statements.*

The mass of one mole of carbon-12 atoms is ____ grams.

The mass of one mole of hydrogen is ____ gram and is _____ the mass of one mole of _____.

The mass of one mole of helium-4 is _____ the mass of one mole of _____ and is equal to ____ grams.

One mole of manganese is equal to _____ atoms of Mn.

Using Molar Mass

Use with pages 327–331.

Organize *the following equations by drawing a line from type of conversion to the correct equation.*

mole to mass

$$\text{mass} \times \frac{1 \text{ mole}}{\text{number of grams}}$$

mass to mole

$$\text{mass} \times \frac{1 \text{ mole}}{\text{number of grams}},$$

$$\text{moles} \times \frac{6.02 \times 10^{23}}{1 \text{ mole}}$$

mass to atoms

$$\text{number of moles} \times \frac{\text{number of grams}}{1 \text{ mole}}$$

atoms to mass

$$\text{atoms} \times \frac{1 \text{ mole}}{6.02 \times 10^{23}},$$

$$\text{moles} \times \frac{\text{number of grams}}{1 \text{ mole}}$$

Section 10.2 Mass and the Mole (continued)

Main Idea | **Details**

Using Molar Mass

Mass to Atoms Conversion

Use with Example Problem 10.4, page 330.

Solve *Read Example Problem 10.4.*

You Try It

Problem

Determine how many atoms are in 10 g of pure copper (Cu).

1. Analyze the Problem

Known: mass = _____

Unknown: molar mass

number of atoms

2. Solve for the Unknown

Use the periodic table to find the atomic mass of copper and convert it to g/mol.

_____

Complete the conversion equations.

mass Cu x conversion factor = moles Cu

_____ × _____ g Cu = _____ moles Cu

moles Cu × conversion factor = atoms Cu

_____ mol Cu × _____

atoms Cu

3. Evaluate the Answer

Restate the answer with correct significant digits.

_____

Name _____ Date _____

The Mole

Section 10.3 Moles of Compounds

Main Idea — **Details**

Skim *Section 3 of your text. Write three questions that come to mind from your reading.*

1. _____

2. _____

3. _____

Chemical Formulas and the Mole

Use with pages 333–334.

Describe *the relationship between the mole information of a substance and its chemical formula.*

_____

_____

_____

Mole Relationships from a Chemical Formula

Use with Example Problem 10.6, page 334.

Summarize *Fill in the blanks to help you take notes as you read Problem 10.6.*

Problem

Determine the number of moles of Al^{3+} ions in 1.25 moles of Al_2O_3.

1. Analyze the Problem

Known: number of moles of alumina = _____

Unknown: number of moles = _____

2. Solve for the Unknown

Write the conversion factor: ☐ mol Al^{3+} ions/☐ mol Al_2O_3

Multiply the known number of moles by the conversion factor.

☐ mol Al_2O_3 × ☐ mol Al^{3+} ions/☐ mol Al_2O_3

= ☐ mol Al^{3+} ions

3. Evaluate the Answer

Restate the answer with correct significant digits:

_____

Name _____ Date _____

Section 10.3 Moles of Compounds (continued)

Main Idea — **Details**

The Molar Mass of Compounds

Use with page 335.

Describe *the molar mass of a compound.*

Investigate *the process of finding molar mass by completing the table below.*

Number of Moles	Molar Mass	=	Number of Grams
mol K	g K/1 mol K	=	g
mol Cr	g Cr/1 mol Cr	=	g
mol O	g O/1 mol O	=	g
molar mass of K_2CrO_4		=	g

Converting Moles of a Compound to Mass

Use with page 336.

Analyze *the process of converting moles of a compound to molar mass by completing the table below. Refer to Example Problem 10.7.*

Number of Moles	Molar Mass	=	Number of Grams
2 × 3 mol C	g C/1 mol C	=	g
2 × 5 mol H	g H/1 mol H	=	g
1 mol S	g S/1 mol S	=	g
molar mass of $(C_3H_5)_2S$		=	g

Name _____ **Date** _____

Section 10.3 Moles of Compounds (continued)

Main Idea **Details**

Converting the Mass of a Compound to Moles

Use with page 337.

Investigate *the process of converting the mass of a compound to moles by completing the following.*

Number of Moles	Molar Mass	=	Number of Grams
1 mol Ca	g Ca/1 mol Ca	=	g
2 × 1 mol O	g O/1 mol O	=	g
2 × 1 mol H	g H/1 mol H	=	g
molar mass of $Ca(OH)_2$		=	g

Conversion factor: _____ g of $Ca(OH)_2$/1 mol $Ca(OH)_2$

g $Ca(OH)_2$ x conversion factor = mol $Ca(OH)_2$

_____ × _____ /_____ = ___ mol $Ca(OH)_2$

Converting the Mass of a Compound to Number of Particles

Use with page 338.

Explain *the steps in converting the mass of a compound to number of particles.*

1. Determine the _____.
2. Multiply by the _____ of the molar mass to convert to _____.
3. Multiply by _____ to calculate the number of _____.
4. Use the ratios from the _____ to calculate the number of ____.
5. Calculate the _____ per formula unit.

Name _____ Date _____

The Mole

Section 10.4 Empirical and Molecular Formulas

Main Idea — **Details**

Skim *Section 4 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.*

percent composition _____

empirical formula _____

molecular formula _____

_____

Name _____ Date _____

Section 10.4 Empirical and Molecular Formulas (continued)

Main Idea	Details
Percent Composition *Use with pages 341–342.*	**Write** *the equation for determining the percent by mass for any element in a compound.* **Describe** *the general equation for calculating the percent by mass of any element in a compound.*
Empirical Formula *Use with page 344.*	**Explain** *empirical formula by completing the following statements.* To determine the empirical _____ for a compound, you must first determine the smallest _____ of the moles of the elements in the compound. This ratio provides the _____ in the empirical formula. If the empirical formula differs from the molecular formula, the molecular formula will be a _____ multiple of the empirical formula. The data used to determine the chemical formula may be in the form of _____ or it may be the actual masses. When the percent composition is given, you can assume that the total mass of the compound is 100.0 g to simplify calculations. The _____ of elements in a compound must be _____ to whole numbers to be used as _____ in the chemical formula.

Section 10.4 Empirical and Molecular Formulas (continued)

Main Idea | **Details**

Molecular Formula

Use with pages 346–349.

Explain *how a molecular formula distinguishes two distinct substances sharing the same empirical formula.*

_____

_____

Investigate *molecular formulas by completing the steps below. Refer to Example Problem 10.12 in your text.*
empirical formula = $C_2H_3O_2$
molar mass = 118.1 g/mol

Identify the molar mass of the compound.

Moles of Element	Mass of Element/ 1 Mol of Element	=	Mass of Element
2 mol C	g C/mol C	=	g C
3 mol H	g H/mol H	=	g H
2 mol O	g O/mol O mol C/mol	=	g O
empirical molar mass of $C_2H_3O_2$		=	g

Divide the molar mass of the substance by the molar mass of the compound to determine **n**.

$$n = \frac{\text{molar mass of substance}}{\text{molar mass of compound}} = \qquad = \boxed{}$$

Multiply the subscripts in the empirical formula by **n**. *Write the molecular formula.*

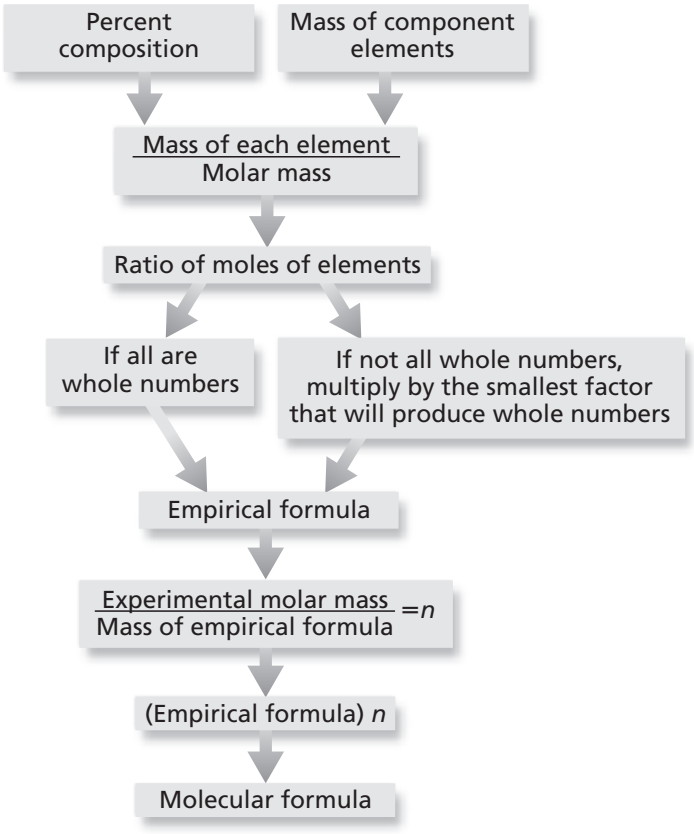
_____

Name _____ **Date** _____

Section 10.4 Empirical and Molecular Formulas (continued)

Main Idea **Details**

Examine *the flow chart below. Write the steps in determining empirical and molecular formulas from percent composition or mass data next to the relevant boxes in the flow chart.*



Name _____ Date _____

The Mole

Section 10.5 Formulas of Hydrates

Main Idea — **Details**

Skim *Section 5 of your text. Write three questions that come to mind from reading the headings and the illustration captions.*

1. _____

2. _____

3. _____

New Vocabulary

hydrate

Use your text to define the following term.

_____

_____

Naming Hydrates

Use with page 351.

Explain *how hydrates are named by completing the table below.*

Prefix	Molecules of Water
mono-	1
	2
	3
	4
	5
	6
	7
	8
nona-	9
	10

Name _____ Date _____

Section 10.5 Formulas of Hydrates (continued)

Main Idea | **Details**

Analyzing a Hydrate

Use with page 352.

Describe *an anyhydrate.*

_____

_____

Determining the Formula of a Hydrate

Use with Example Problem 10.14, page 353.

Solve *Read Example Problem 10.14 in your text.*

You Try It

Problem

A 5.00 g sample of barium chloride hydrate was heated in a crucible. After the experiment, the mass of the solid weighed 4.26 g. Determine the number of moles of water that must be attached to $BaCl_2$.

1. Analyze the Problem

Known: mass of hydrated compound = ____ g $BaCl_2 \cdot x\ H_2O$

mass of anhydrous compound = ____ g $BaCl_2$

molar mass of H_2O = _____ g/mol

molar mass of $BaCl_2$ = 208.23 g/mol

Unknown: formula for hydrate
name of hydrate

Name _____ Date _____

Section 10.5 Formulas of Hydrates (continued)

Main Idea **Details**

2. Solve for the Unknown

Subtract the mass of the anhydrous compound from the hydrated compound.

_____

Calculate the number of moles of H_2O and anhydrous $BaCl_2$ using the conversion factor that relates moles and mass based on the molar mass.

4.26 g $BaCl_2$ x = _____

0.84 g H_2O x = _____

Determine the value of x.

$$x = \frac{\text{moles } H_2O}{\text{moles } BaCl_2} = \quad = \_\_\_\_$$

3. Evaluate the Answer

The ratio of H_2O to $BaCl_2$ is _____ so the formula for the hydrate is _____, and the name of the hydrate is _____ _____.

REAL-WORLD CONNECTION **Explain why hydrates are useful in storage and shipping.**

_____

_____

_____

Name _____ Date _____

The Mole Chapter Wrap-Up

Now that you have read the chapter, review what you have learned and list three things you have learned about moles.

1. _____

2. _____

_____

3. _____

_____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

SUMMARIZE

Summarize the important conversions you have learned in this chapter.

_____

_____

_____

Name _____ Date _____

Stoichiometry

Before You Read

Review Vocabulary *Define the following terms.*

mole _____

_____

molar mass _____

conversion factor _____

dimensional analysis _____

_____

law of conservation of mass _____

_____

Chapter 9

Balance *the following equation.*

$$\square\ Mg\ (s) + \square\ AlCl_3\ (aq) \rightarrow \square\ Al\ (s) + \square\ MgCl_2\ (aq)$$

Chapter 10

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	

Name _____ Date _____

Stoichiometry

Section 11.1 Defining Stoichiometry

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.

derive

_____

Particle and Mole Relationships

Use with page 368.

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

_____

_____

_____

_____

_____

Name _____ **Date** _____

Section 11.1 Defining Stoichiometry (continued)

Main Idea | **Details**

Interpreting Chemical Equations

Use with Example Problem 11.1, page 370.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 11.1.*

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.

$$\text{moles of reactant} \times \frac{\text{grams of reactant}}{\text{1 mole of reactant}} = \text{grams of } \_\_\_\_\_$$

$$\text{moles of product} \times \frac{\text{grams of reactant}}{\text{1 mole of reactant}} = \text{grams of } \_\_\_\_\_$$

Add the masses of the reactants.

$$\square \text{ g } C_3H_8 + \square \text{ g } O_2 = \square \text{ g reactants}$$

Add the masses of the products.

$$\square \text{ g } CO_2 + \square \text{ g } H_2O = \square \text{ g products}$$

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 ☐ significant figures. Your answer must have ☐ significant figures.

Name _____ **Date** _____

Section 11.1 Defining Stoichiometry (continued)

Main Idea **Details**

Mole ratios

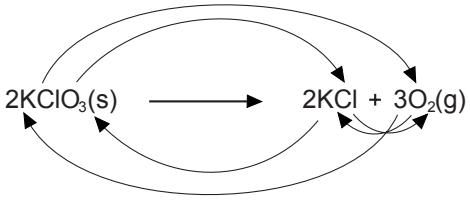
Use with pages 371–372.

Examine ***Relationships between coefficients can be used to write conversion factors called _____.***

Example

Given the equation $2KClO_3(s) \longrightarrow 2KCl(s) + 3O_2(g)$

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.***

$$C_2H_4(g) + 3O_2(g) \longrightarrow 2CO_2(g) + 2H_2O(l)$$

Write ***the mole ratios for the above equation.***

Name _____ Date _____

Stoichiometry

Section 11.2 Stoichiometric Calculations

Main Idea **Details**

Using Stoichiometry

Use with page 373.

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. _____

Identify *the tools needed for stoichiometric calculations.*

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

Name _____ Date _____

Section 11.2 Stoichiometric Calculations (continued)

Main Idea | **Details**

Mole-to-Mass Stoichiometry

Use with Example Problem 11.3, page 376.

Solve *Read Example Problem 11.3 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.

$\square$ Fe(s) + $\square$ Cl_2(g) = $\square$ $FeCl_3$(s)

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 11.2 Stoichiometric Calculations (continued)

Main Idea **Details**

Mole-to-Mole Stoichiometry

Use with Example Problem 11.2, page 375.

Solve *Read Example Problem 11.2 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.

$$\square\ Al(s) + \square\ O_2(g) = \square\ Al_2O_3(s)$$

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.

$$\square \text{ moles of Al} \times \frac{\square \text{ moles of } Al_2O_3}{\square \text{ moles of Al}} = \square \text{ moles of } Al_2O_3$$

3. Evaluate the Answer

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

Section 11.2 Stoichiometric Calculations (continued)

Main Idea **Details**

Mass-to-Mass Stoichiometry

Use with Example Problem 11.4, page 377.

Solve *Read Example Problem 11.4 in your text.*

You Try It

Problem

Determine the mass of ammonia (NH_3) produced when 3.75 g of nitrogen gas (N_2) react with hydrogen gas (H_2).

1. Analyze the Problem

Known: _____

Unknown: _____

You are given the mass of the reactant, N_2, and must determine the mass of the product NH_3. Do a mass-to-mass conversion.

2. Solve for the Unknown

Write the balanced chemical equation for the reaction.

$\square\ N_2(g) + \square\ H_2(g) = \square\ NH_3(g)$

Convert grams of $N_2(g)$ to moles of $N_2(g)$ using the inverse of molar mass as the conversion factor.

$$\square\ \text{g } N_2(g) \times \frac{1\ \text{mol } N_2}{\square\ \text{g } N_2} = \square\ \text{mol } N_2$$

List the mole ratios for this equation.

Multiply moles of N_2 by the mole ratio that relates N_2 to NH_3.

$$\square\ \text{mol } N_2 \times \frac{\square\ \text{mol } NH_3}{\square\ \text{mol } N_2} = \square\ \text{mol } NH_3$$

Multiply moles of NH_3 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 $\square$ significant figures, so the mass of NH_3 must have $\square$ significant figures.

Name _____ **Date** _____

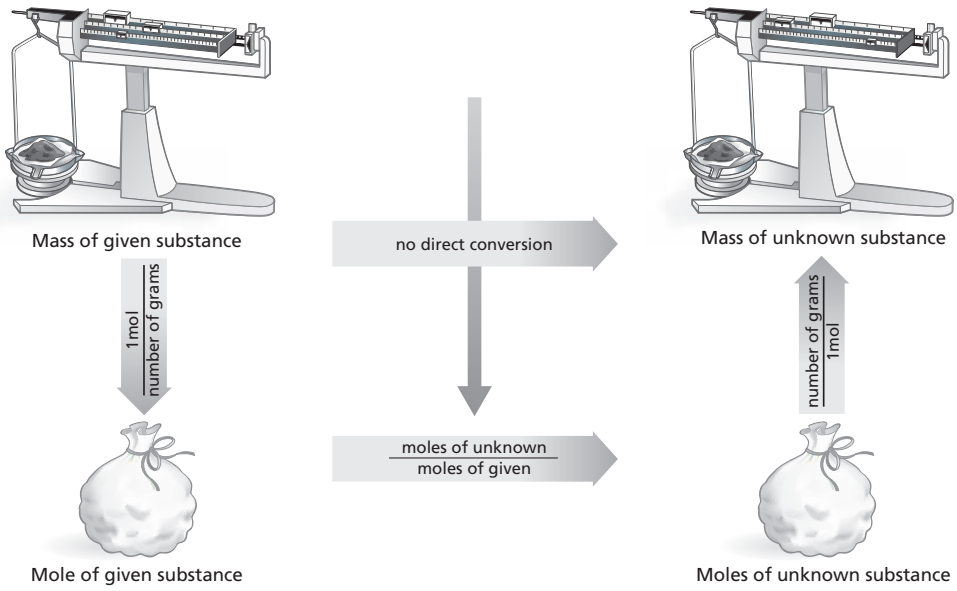
Section 11.2 Stoichiometric Calculations (continued)

Main Idea | **Details**

Stoichiometric Problem Solving

Use with page 374.

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.

Name _____ Date _____

Stoichiometry

Section 11.3 Limiting Reactants

Main Idea

Details

Scan *Section 3 of your text. Use the checklist below as a guide.*

- 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 limiting reactants.

Write three facts you discovered about limiting reactants.

1. _____

2. _____

3. _____

New Vocabulary

Use your text to define each term.

limiting reactant _____

_____

excess reactant _____

Name _____ Date _____

Section 11.3 Limiting Reactants (continued)

Main Idea — **Details**

Why do Reactions Stop?

Use with pages 379–380.

What if *you have six slices of bread, three tomato slices, and two cheese slices. How many tomato-cheese sandwiches can you make? Which ingredient(s) limit the number of sandwiches you can make?*

_____

Calculating the Product When a Reactant is Limiting

Use with pages 380–381.

Organize *information about limiting reactants.*

I. _____

A. Limiting reactant

1. _____

2. _____

B. _____

II. Calculating the product when a reactant is limited

A. _____

1. convert the masses to moles

2. multiply each mass by the inverse of the molar mass

B. _____

C. _____

_____

D. Determine the amount of product that can be made with the moles of the limiting reactant.

Determining the Limiting Reactant

Use with Example Problem 11.5, page 382.

Solve *Read Example Problem 11.5 in your text.*

You Try It

Problem

If 100.0 g of sulfur reacts with 50.0 g of chlorine, what mass of disulfur dichloride is produced?

1. Analyze the Problem

Known: _____

Unknown: _____

2. Solve for the Unknown

Write the balanced chemical equation.

Section 11.3 Limiting Reactants (continued)

Main Idea **Details**

List the mole ratios for this equation.

Multiply each mass by the inverse of molar mass.

Calculate the actual ratio of available moles.

Determine the limiting reactant.

_____

_____

Multiply the number of moles of the limiting reactant by the mole ratio of the product to the limiting reactant.

Multiply moles of the product by the molar mass.

Multiply moles of the excess reactant by the molar mass.

Subtract the mass of the excess reactant needed from the mass available.

3. Evaluate the Answer

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

Name _____ Date _____

Stoichiometry

Section 11.4 Percent Yield

Main Idea — **Details**

Skim *Section 4 of your text. Focus on the headings, subheadings, and boldfaced words. Summarize the main ideas of this section.*

_____

_____

_____

New Vocabulary

In the left margin, write the terms defined below.

_____ *the ratio of actual yield to theoretical yield (from stoichiometric calculations) expressed as a percent*

_____ *in a chemical reaction, the maximum amount of product that can be produced from a given amount of reactant*

_____ *the amount of product actually produced when a chemical reaction is carried out in an experiment*

How much product?

Use with pages 385–386.

Write *the formula for percent yield.*

$$\frac{\text{\_\_\_\_\_ (from an experiment)}}{\text{\_\_\_\_\_ (from stoichiometric calculations)}} \times \text{\_\_\_} = \text{percent yield}$$

Section 11.4 Percent Yield (continued)

Main Idea **Details**

Percent Yield

Use with page 386.

Solve *Read Example Problem 11.6 in your text.*

You Try It

Problem

When 100.0 kg sand (SiO_2) are processed with carbon, CO and 51.4 kg SiC are recovered. What is the percent yield of SiC?

1. Analyze the Problem

Known: _____

Unknown: _____

2. Solve for the Unknown

Write the balanced chemical equation.

_____ $\longrightarrow$ _____

Determine the mole ratio that relates ____ to ___.

Convert kg to g.

100 kg SiO_2 = _____ g, 51.4 kg SiC = _____ g

Convert mass to moles using the inverse of molar mass.

Use the appropriate mole ratio to convert mol SiO_2 to mol SiC.

Calculate the theoretical yield. Multiply mol SiC by the molar mass.

Divide the actual yield by the theoretical yield and multiply by 100.

3. Evaluate the Answer

The quantities have ☐ significant figures, so the percent yield must have ☐ significant figures.

Name _____ Date _____

Stoichiometry

Stoichiometry and the Stock Market

SYNTHESIZE

In the left margin, write the stoichiometry concepts that parallel the daily activities of a Wall Street professional.

_____ **1.** A stock analyst keeps a close eye on the earnings of corporations. She has determined how much each company should accomplish.

_____ **2.** The same analyst tracks whether companies meet expectations or fall short.

_____ **3.** A grain trader wants to be sure to have 100,000 bushels in reserve for the winter selling season. He places an order for 120,000 bushels because he knows spoilage may damage a percentage of the crop.

_____ **4.** A livestock futures trader knows that one cattle car holds 10 steers averaging 1200 lbs. each. He wants to bid on an identical car full of sheep, which average about 200 lbs. each. He needs to know how many sheep are on the car.

_____ **5.** A stockbroker learns that a medical supply company has acquired several tons of a rare silver compound that will allow it to make superior dental equipment. The question is whether the company will have enough of the product to meet the demands of the marketplace.

Name _____ Date _____

Stoichiometry Chapter Wrap-Up

Now that you have read the chapter, review what you have learned. Write the key equations and relationships.

_____

_____

_____

_____

Review

Use this checklist to help you study.

- ☐ Use this Science Notebook to study this chapter.
- ☐ Study the vocabulary words and scientific definitions.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter, reviewing the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Explain how stoichiometry is important to air bags and your safety.

_____

_____

_____

_____

Name _____ Date _____

States of Matter

Before You Read

Review Vocabulary *Define the following terms.*

gas

physical property

Chapter 2

Calculate *the density of a sample with a mass of 22.5 g and a volume of 5.0 cm^3. Use the equation: density = mass/volume.*

Chapter 3

Describe *the two essential characteristics that determine the chemical and physical properties of matter.*

Compare and contrast *the chemical and physical properties of gases.*

Name _____ Date _____

States of Matter

Section 12.1 Gases

Main Idea — **Details**

Scan *Section 1, using the checklist below as a guide.*

- 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.

New Vocabulary *Use your text to define each term.*

kinetic-molecular theory _____

elastic collision _____

temperature _____

diffusion _____

_____

Graham's law of effusion _____

_____

pressure _____

barometer _____

pascal _____

atmosphere _____

Dalton's law of partial pressures _____

_____

Section 12.1 Gases (continued)

Main Idea — **Details**

The Kinetic-Molecular Theory

Use with pages 402–403.

Distinguish *between the three main physical properties of gas particles by completing the passages below.*

1. Size is very _____. It is assumed that there are ___ significant _____ or _____ forces among gas particles.
2. Motion is _____ moving in a _____ pattern. It is assumed that gas particles move in a _____ path until they _____.
3. Energy is _____. It is assumed that _____ and _____ impact the _____ level of a gas _____.

Describe *kinetic energy in equation form by completing the table below.*

$KE = 1/2mv^2$	Variable	Definition
KE		
m		
v		

Explaining the Behavior of Gases

Use with pages 403–405.

Describe *the following concepts as they relate to the behaviors of gases by completing the passages below.*

low density—Gases have low density (_____ per _____) in comparison to _____. The difference in density is partly due to the mass of the _____ and also because there is a great deal of _____ between gas particles.

compression and expansion—The large amount of _____ between gas particles allows them to be _____, or pushed, into a _____ volume. Once the pressure is _____, the particles _____ to the original _____.

diffusion and effusion—Because there are no _____ forces of _____ between gas particles, gases _____ past one another. This _____ motion allows gases to mix until they are _____. The movement of _____ past one another is called _____. The process of allowing a gas to escape from a more concentrated container is called _____.

Section 12.1 Gases (continued)

Main Idea — **Details**

Gas Pressure

Use with pages 408–410.

Write *Graham's law of effusion as a proportional statement.*

_____

Write *the proportional statement based on Graham's law of effusion that allows you to compare the diffusion rate of two different gases.*

Describe *pressure as it relates to the behaviors of gases.*

_____

_____

_____

Distinguish *between a barometer and a manometer.*

_____

_____

Explore *the relationship between different units of pressure by filling in the table below.*

Unit Name (unit symbol)	Conversion Ratio: 1 atm = _____	Conversion Ratio: 1 kPa = _____
kilopascal ( )		
millimeters of mercury ( )		
torr		
pounds per square inch (or)		
atmosphere ( )		

Name _____ Date _____

States of Matter

Section 12.2 Forces of Attraction

Main Idea — **Details**

Skim *Section 2 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.*

dispersion forces _____

dipole-dipole force _____

hydrogen bond _____

Academic Vocabulary *Define the following term.*

orient _____

Name _____ Date _____

Section 12.2 Forces of Attraction (continued)

Main Idea **Details**

Intermolecular Forces

Use with pages 411–414.

Describe *the difference between an intramolecular and an intermolecular force.*

_____

_____

_____

Compare and contrast *intramolecular forces by completing the table below.*

Force	Basis of Attraction	Example
Ionic		
Covalent		
Metallic		

Compare *intermolecular forces by completing the table below.*

Force	Basis of Attraction	Example
Dispersion		
Dipole-dipole		
Hydrogen bond		

Name _____ Date _____

States of Matter

Section 12.3 Liquids and Solids

Main Idea — **Details**

Scan *Section 3, using the checklist below as a guide.*

- 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.

New Vocabulary *Use your text to define each term.*

viscosity _____

surface tension _____

surfactant _____

_____

crystalline solid _____

_____

unit cell _____

_____

allotrope _____

amorphous solid _____

Section 12.3 Liquids and Solids (continued)

Main Idea **Details**

Liquids

Use with pages 415–419.

Compare and contrast *the following paired concepts as they relate to the properties of liquids by completing the following statements.*

Density and compression: A liquid can take the _____ _____, but its volume is _____. The density of a liquid is _____ than the density of the same substance as a ____. Liquids cannot usually be _____ except under _____ pressure.

Fluidity and viscosity: Fluidity is the ability to ____. Liquids flow through each other but at a _____ than _____ do. Viscosity is the measure of the _____ of a liquid to ____. The stronger _____ slow down the ability to flow, which _____ resistance (viscosity).

Viscosity and temperature: Temperature affects the _____ of a _____. Viscosity _____ with temperature.

Analyze *the relationship between viscosity, temperature, and change in kinetic energy by completing the table.*

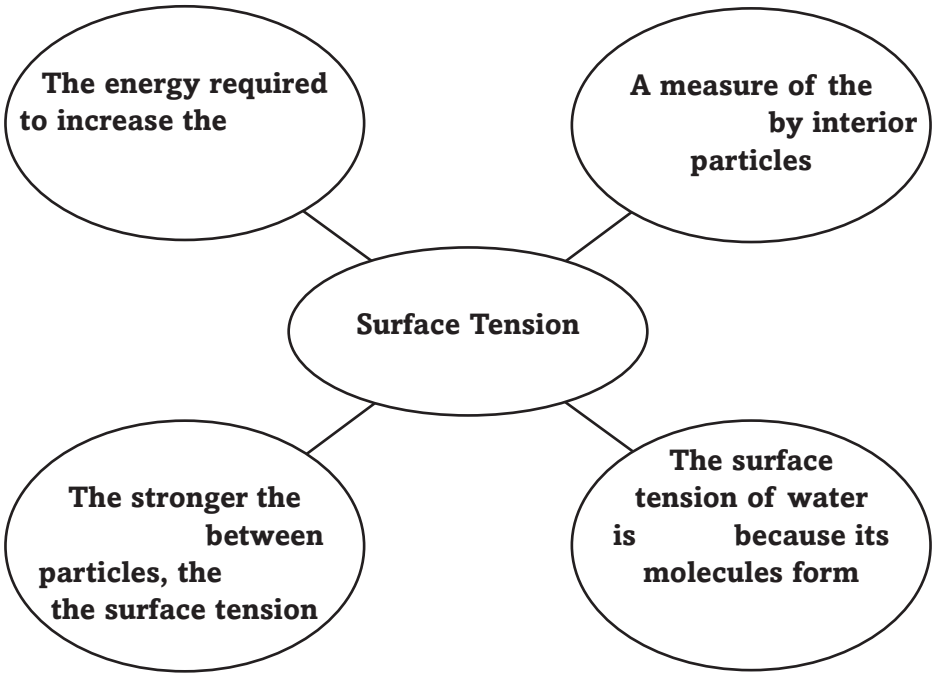
Temperature	Δ KE	Viscosity	Effect in Liquid
increases			flows faster
decreases		increases	
stays the same	no change		

Name _____ **Date** _____

Section 12.3 Liquids and Solids (continued)

Main Idea **Details**

Explain *surface tension by completing the web diagram below.*



Use with page 419.

Describe *the following concepts as they relate to the properties of liquids by completing the following passages.*

Capillary action is _____

_____

Cohesion is _____

Adhesion is _____

Name _____ **Date** _____

Section 12.3 Liquids and Solids (continued)

Main Idea | **Details**

Solids

Use with pages 420–424.

Contrast ***the density of solids and liquids by completing the following paragraph.***

In general, the _____ in a solid are more _____—that is, more dense—than those in a _____. When liquid and solid states of the same substance exist at the same time, the _____ usually _____ in the _____. One familiar exception is _____. When water is in its solid state as ice, it _____, such as _____ or a(n) _____. This is because there is _____ space between the _____ in ice than in liquid water.

Use with page 422.

Compare ***the different types of crystalline solids by completing the following table.***

Type	Unit Particles	Characteristics	Examples
Atomic			
Molecular			
Covalent network			
Ionic			
Metallic			

Name _____ Date _____

States of Matter

Section 12.4 Phase Changes

Main Idea — **Details**

Skim *Section 4 of your text. Write a brief summary of the main topics covered.*

New Vocabulary *Use your text to define each term.*

vapor pressure

boiling point

condensation

deposition

phase diagram

Compare and contrast *the following terms using your text as a guide.*

melting point, freezing point, and triple point

vaporization and evaporation

Name _____ **Date** _____

Section 12.4 Phase Changes (continued)

Main Idea | **Details**

Phase Changes That Require Energy

Use with page 425.

Classify *the types of phase changes by completing the table below. Use Figure 12.23 in your text for reference.*

Phase Transition	Type of Transition
gas to solid	
solid to liquid	
liquid to gas	
liquid to solid	
	condensation
solid to gas	

Use with pages 425–428.

Describe *the phase changes that require energy by completing the following outline.*

I. Melting

A. Heat energy disrupts _____.

B. The amount of energy required depends on _____ _____.

C. The melting point is the temperature at which _____ _____.

D. The melting point of _____ may be unspecified.

II. Vaporization

A. In liquid water, some particles have more _____.

B. Particles that escape from liquid enter the _____.

C. When vaporization occurs only at a surface it is called _____.

D. The pressure exerted by a vapor over liquid is called _____ _____.

E. The temperature at which vapor pressure equals atmospheric pressure is called the _____.

III. Sublimation

A. Many solids can become gases without _____ _____.

B. Some solids sublime at _____.

C. The process of _____ is an example of sublimation.

Name _____ **Date** _____

Section 12.4 Phase Changes (continued)

Main Idea **Details**

Phase Changes That Release Energy

Use with pages 428–429.

Organize *the phase changes that release energy. Identify the phase, describe the process, and identify the reverse process by completing the table below.*

Phase Change	Process Description	Reverse Process
condensation		vaporization
	process in which a liquid becomes a solid	
deposition		sublimation

Phase Diagrams

Use with pages 429–430.

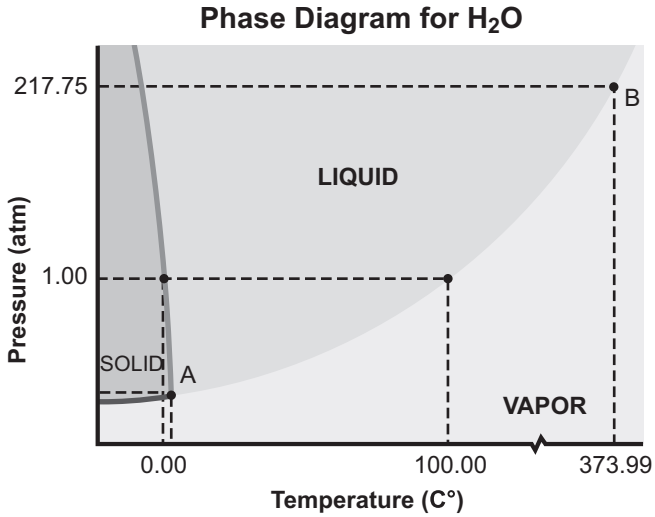
Explain *how the critical point affects water.*

_____

_____

_____

Identify *normal freezing point, normal boiling point, critical point, and triple point in the phase diagram for H_2O below. Use Figure 12.30 in your text for reference.*



Name _____ **Date** _____

States of Matter Chapter Wrap-Up

After reading this chapter, list three key equations and relationships.

1. _____

2. _____

3. _____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

You see examples of phase changes every day. Use your text to identify which phase change each of the following transitions demonstrates. The first one has been done for you.

frost forms on a windowpane	deposition
ice becomes water	_____
steam rises from a cup of coffee	_____
a water pipe bursts on a very cold day	_____
drops of water cover the mirror after a shower	_____
snow melts without leaving a puddle	_____

Name _____ Date _____

Gases

Before You Read

Review Vocabulary **Define** *the following terms.*

density _____

stoichiometry _____

_____

kinetic-molecular theory _____

_____

Chapter 9 **Balance** *the following equation.*

___Fe + ___H_2SO_4 ⟶ $Fe_2(SO_4)_3$ + ___H_2

Chapter 11 **Show** *the mole ratios for the following reaction.*

$N_2 + 3H_2 \longrightarrow 2NH_3$

a. mole ratio of N to H_2

b. mole ratio of NH_3 to H_2

Chapter 12 **Explain** *how gas particles exert pressure.*

_____

_____

Name _____ Date _____

Gases

Section 13.1 The Gas Laws

Main Idea — **Details**

Scan *Section 1 of your text. Use the checklist below as a guide.*

- 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 the gas laws.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

Boyle's law _____

_____

absolute zero _____

Charles's law _____

_____

Gay-Lussac's law _____

_____

combined gas law _____

_____

Section 13.1 The Gas Laws (continued)

Main Idea | **Details**

Boyle's Law

Use with page 443.

Solve *Read Example Problem 13.1 in your text.*

You Try It

Problem

Helium gas in a balloon is compressed from 4.0 L to 2.5 L at constant temperature. The gas's pressure at 4.0 L is 210 kPa. Determine the pressure at 2.5 L.

1. Analyze the Problem

Known:

V_1 = _____

V_2 = _____

P_1 = _____

Unknown:

P_2 _____

Use the equation for Boyle's law to solve for P_2.

2. Solve for the Unknown

Write the equation for Boyle's law: _____

To solve for P_2, divide both sides by V_2. P_2 =

Substitute the known values. P_2 =

Solve for P_2. P_2 = _____

3. Evaluate the Answer

When the volume is _____, the pressure is _____.

The answer is in ____, a unit of pressure.

Main Idea — Details

Charles's Law

Use with Example Problem 13.2, page 446.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 13.2.*

Problem

A gas sample at 40.0°C occupies a volume of 2.32 L. Assuming the pressure is constant, if the temperature is raised to 75.0°C, what will the volume be?

1. Analyze the Problem

Known: Unknown:

T_1 = _____

V_1 = _____ V_2 = ___

T_2 = _____

Use Charles's law and the known values for T_1, V_1, and T_2 to solve for V_2.

2. Solve for the Unknown

Convert the T_1 and T_2 Celsius temperatures to kelvin:

$T_1 = 273 + 40.0°C =$ ___ K $T_2 = 273 + 75.0°C =$ ___ K

Write the equation for Charles's law:

$$=$$

To solve for V_2, multiply both sides by T_2:

$$V_2 =$$

Substitute known values:

$$V_2 =$$

Solve for V_2.

V_2 = _____

3. Evaluate the Answer

When temperature in kelvin increases by a small amount, the volume _____ by a small amount. The answer is in _____, a unit for volume.

Main Idea — Details

Gay-Lussac's Law

Use with Example Problem 13.3, page 448.

Solve *Read Example Problem 13.3 in your text.*

You Try It

Problem

The pressure of a gas stored in a refrigerated container is 4.0 atm at 22.0°C. Determine the gas pressure in the tank if the temperature is lowered to 0.0°C.

1. Analyze the Problem

Known: Unknown:

$P_1 = 4.0$ atm $P_2 = ?$ ___

$T_1 =$ _____

$T_2 =$ _____

Use Gay-Lussac's law and the known values for T_1,V_1, and T_2 to solve for V_2.

2. Solve for the Unknown

Convert the T_1 and T_2 Celsius figures to kelvin.

$T_1 =$ ___ + 22.0°C = ___ K

$T_2 = 273 +$ ___ °C = ___ K

Write the equation for Gay-Lussac's law.

To solve for P_2, multiply both sides by T_2.

$$P_2 =$$

Substitute known values.

$$P_2 =$$

Solve for P_2.

$P_2 = 3.7$ atm

3. Evaluate the Answer

The temperature _____ and the pressure _____.

Name _____ Date _____

Section 13.1 The Gas Laws (continued)

Main Idea — **Details**

The Combined Gas Law

Use with page 449.

Describe *the combined gas law.*

_____

_____

Write *the combined gas law equation.*

=

Pressure is inversely proportional to _____ and directly proportional to _____. Volume also is _____ to temperature.

Use with Example Problem 13.4, page 450.

Solve *Read Example Problem 14.4 in your text.*

You Try It

Problem

A gas at 100.0 kPa and 30.0°C has an initial volume of 1.00 L. Determine the temperature that could support the gas at 200.0 kPa and a volume of 0.50 L.

1. Analyze the Problem

Known:

P_1 = _____

P_2 = _____

T_1 = _____

V_1 = _____

V_2 = _____

Unknown:

T_2 = ? °C

Remember that volume increases as temperature increases, and volume is inversely proportional to pressure.

2. Solve for the Unknown

Convert the T_1 Celsius temperature to kelvin.

T_1 = ___ + 30.0°C = ___ K

Section 13.1 The Gas Laws (continued)

Main Idea **Details**

Write the combined gas law equation.

To solve for T_2, multiply both sides of the equation by T_2.

$$\frac{\qquad}{T_1} = P_2\ V_2$$

Multiply both sides of the equation by T_1.

$$T_2\ P_1\ V_1\ = \_\_\_\_\_$$

Divide both sides of the equation by $P_1\ V_1$.

$$T_2 =$$

Substitute known values.

$$T_2 = \frac{\qquad\qquad\qquad\qquad}{100.0\ \text{kPa} \times 1.00\ \text{L}}$$

Solve for T_2.

$$T_2 = 303\ \text{K} - 273\ \text{K} = 30.0°\text{C}$$

3. Evaluate the Answer

As pressure _____ and volume _____ in proportional amounts, the temperature remained constant.

Name _____ Date _____

Gases

Section 13.2 The Ideal Gas Law

Main Idea — **Details**

Skim *Section 2 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.*

Avogadro's principle _____

_____

molar volume _____

ideal gas constant (R) _____

_____

ideal gas law _____

_____

Section 13.2 The Ideal Gas Law (continued)

Main Idea — **Details**

Avogadro's Principle

Use with pages 452–453.

Explain *Avogadro's principle by completing the paragraph below.*

Avogadro's principle states that _____

_____.

The _____ volume for a gas is the volume that one mole occupies at _____ of pressure and a temperature of _____.

Convert the following volumes of a gas at STP to moles by using 22.4 L/mol as the conversion factor.

$$2.50\ \text{L} \times \frac{1\ \text{mol}}{22.4\ \text{L}} = \_\_\_\_\_$$

$$7.34\ \text{L} \times \frac{1\ \text{mol}}{22.4\ \text{L}} = \_\_\_\_\_$$

$$4.7\ \text{L} \times \frac{1\ \text{mol}}{22.4\ \text{L}} = \_\_\_\_\_$$

Name _____ **Date** _____

Section 13.2 The Ideal Gas Law (continued)

Main Idea | **Details**

The Ideal Gas Law

Use with pages 454–455.

Analyze *the ideal gas law.*

The equation is written ___ = ____

P represents _____

V represents _____

n represents the number of _____ of gas present

R represents the _____

___ represents temperature

The ideal gas law states that _____

_____

_____. The value of R depends on the units used for _____.

Describe *the properties of an ideal gas.*

_____

_____

Describe *the properties of a real gas.*

_____

_____

Section 13.2 The Ideal Gas Law (continued)

Main Idea | **Details**

The Ideal Gas Law

Use with Example Problem 13.6, page 455.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 13.6.*

Problem

Calculate the number of moles of a gas contained in a 3.0-L vessel at 3.00×10^2 K with a pressure of 1.50 atm.

1. Analyze the Problem

Known: Unknown:

$V =$ _____ $n =$? mol

$T =$ _____

$P =$ _____

R =

Use the known values to find the value of n.

2. Solve for the Unknown

Write the ideal gas law equation.

_____

To solve for n, divide both sides by RT.

$n =$

Substitute known values into the equation.

$n =$

Solve for n.

$n =$

$n =$ _____

3. Evaluate the Answer

The answer agrees with the prediction that the number of moles will be _____ one mole. The unit in the answer is the _____ .

Name _____ Date _____

Gases

Section 13.3 Gas Stoichiometry

Main Idea **Details**

Scan *Section 3 of your text. Use the checklist below as a guide.*

- 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 gas stoichiometry.*

1. _____

2. _____

3. _____

Academic Vocabulary *Define the following terms.*

ratio _____

Name _____ Date _____

Section 13.3 Gas Stoichiometry (continued)

Main Idea | **Details**

Stoichiometry and Volume–Volume Problems

Use with page 460.

Indicate *the moles and volume for the reaction below. Use Figure 13.10 as a reference.*

$2C_4H_{10}(g) + 13O_2(g) \longrightarrow 8CO_2(g) + 10H_2O(g)$

___ moles ___ moles ___ moles ___ moles

___ volumes ___ volumes ___ volumes ___ volumes

The coefficients in the balanced equation represent _____ amounts and relative _____.

Volume–Volume Problems

Use with Example Problem 13.7, page 461.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 13.7.*

Problem

Determine the volume of oxygen gas needed for the complete combustion of 4.00 L of propane gas (C_3H_8).

1. Analyze the Problem

Known: Unknown:

V of C_3H_8 = _____ V of O_2 = ? L

Use the known volume of 4.00 L to find the volume needed for the combustion.

2. Solve for the Unknown

Write the balanced equation for the combustion of C_3H_8.

_____

Write the volume ratio.

Multiply the known volume of propane by the volume ratio to find the volume of O_2.

3. Evaluate the Answer

The coefficients of the reactants show that the quantity of _____ consumed is greater than the amount of propane. The unit of the answer is the ____ , a unit of volume.

Name _____ **Date** _____

Gases Chapter Wrap-Up

After reading the chapter, review what you have learned. Match each of the gas laws with its equation.

____ Ideal gas law	**1.** $\frac{V_1}{T_1} = \frac{V_2}{T_2}$
____ Gay-Lussac's law	**2.** $P_1V_1 = P_2V_2$
____ Charles's law	**3.** $\frac{P_1}{T_1} = \frac{P_2}{T_2}$
____ Combined gas law	**4.** $PV = n\mathrm{R}T$
____ Boyle's law	**5.** $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the vocabulary words and scientific definitions.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Explain why the volume of a balloon increases as you blow into it instead of bursting immediately from the added pressure.

Name _____ Date _____

Mixtures and Solutions

Before You Read

Review Vocabulary *Define the following terms.*

alloy _____

_____

solution _____

Chapter 3

Compare and contrast *a homogeneous mixture with a heterogeneous mixture.*

_____

_____

_____

Chapter 8

Explain *why water is a polar molecule. Include a labeled drawing of a water molecule in your answer.*

_____

_____

_____

Chapter 10

Describe *the relationship between moles and molar mass.*

_____

_____

_____

Name _____ Date _____

Mixtures and Solutions

Section 14.1 Types of Mixtures

Main Idea — **Details**

Scan *Section 1 of your text, using the checklist below as a guide.*

- 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 solutions.

Identify *the unifying theme of this section.*

_____

New Vocabulary *Use your text to define each term.*

suspension _____

colloid _____

_____

Brownian motion _____

_____

Tyndall effect _____

Compare and contrast *soluble and insoluble substances.*

_____

_____

Compare and contrast *miscible and immiscible liquids.*

_____

_____

Name _____ Date _____

Section 14.1 Types of Mixtures (continued)

Main Idea	Details
Suspensions *Use with page 476.*	**List** *three properties of a suspension.* 1. _____ 2. _____ 3. _____ **State** *three examples of suspensions.* 1. _____ 2. _____ 3. _____
Colloids *Use with pages 477–479.*	**Identify** *four properties of a colloid.* 1. _____ 2. _____ 3. _____ 4. _____

Name _____ Date _____

Section 14.1 Types of Mixtures (continued)

Main Idea **Details**

Explain *why particles in Brownian motion do not settle out.*

Identify *each of the following mixtures as a suspension, dilute colloid, or concentrated colloid. Base your answers on the property described.*

Property	Type of Solution
cloudy mixture with particles that move erratically	
large particles with thixotropic behavior	
clear mixture with particles that scatter light	

Real-World Connection

Describe the properties of fog in terms of being a mixture and why those properties make driving through fog so dangerous.

Name _____ Date _____

Mixtures and Solutions

Section 14.2 Solution Concentration

Main Idea — **Details**

Scan *Section 2 of your text, using the checklist below as a guide.*

- 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 solutions.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define these terms.*

concentration _____

molarity _____

molality _____

mole fraction _____

Academic Vocabulary *Define the following term.*

concentrated _____

Name _____ Date _____

Section 14.2 Solution Concentration (continued)

Main Idea | **Details**

Expressing Concentration

Use with pages 480–481.

Analyze *the similarities in all of the concentration ratios shown in Table 14.3 in your text.*

_____

_____

_____

Write *the equation for determining percent by mass.*

Percent by mass =

Calculate Percent by Mass

Use with Example Problem 14.1, page 481.

Summarize *Fill in the blanks to help you take notes as you read Example Problem 14.1.*

Problem

Determine the percent by mass of 3.6 g NaCl in 100.0 g H_2O.

1. Analyze the Problem

List the knowns and unknowns.

Known:	Unknown:
mass of solute = _____	percent by mass = ?
mass of solvent = _____	

2. Solve for the Unknown

Find the mass of the solution.

mass of solution = grams of solute + grams of solvent

mass of solution = 3.6 g + _____ = _____

Substitute the known values into the percent by mass equation.

percent by mass =

3. Evaluate the Answer

The answer should be a small percent, to match the small quantity of _____. The mass of sodium chloride was given in two significant figures, therefore, the answer should have ____ significant figures.

Name _____ **Date** _____

Section 14.2 Solution Concentration (continued)

Main Idea **Details**

Molarity

Use with pages 482–485.

Describe *how to calculate the molarity of a solution by completing the following statements.*

To calculate the _____ of a solution, you must know the amount of dissolved _____ and the volume of _____. The following equation is used: molarity (M) = _____ of solute/liters of _____.

Explain *why you may need less than one liter of water to prepare a molar solution of one liter.*

_____

Write *the expression that describes the relationship between a stock solution and a dilute solution.*

_____

M_1 = _____

V_1 = _____

M_2 = _____

V_2 = _____

Name _____ Date _____

Section 14.2 Solution Concentration (continued)

Main Idea | **Details**

Molality and Mole Fraction

Use with pages 487–488.

Explain *how the volume and mass of a solution change with temperature.*

The volume may _____ when heated or _____ when cooled.

The mass of the solution _____ change.

Write *the mole fraction equations for a solvent (X_A) and a solute (X_B) below.*

$X_A =$ $X_B =$

Evaluate *the mole fraction for the values given in problem 14.4 on page 487 of your text. The number of moles for 100 g H_2O is given.*

$n_A = 5.55$ mol H_2O $n_B =$ _____ mol NaCl

$X_{H_2O} =$ = _____

$X_{NaCL} =$ = _____

$X_{H_2O} + X_{NaCl} = 1.000$

_____ + _____ = 1.000

Real-World Connection

Describe how the mole fractions for a solution are similar to the pieces of a pie.

Name _____ Date _____

Mixtures and Solutions

Section 14.3 Factors Affecting Solvation

Main Idea — **Details**

Skim *Section 3 of your text. List three main ideas of the section.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

solvation _____

heat of solution _____

supersaturated solution _____

_____

Henry's law _____

_____

Compare and contrast *saturated solutions and unsaturated solutions.*

_____

_____

_____

Name _____ Date _____

Section 14.3 Factors Affecting Solvation (continued)

Main Idea **Details**

The Solvation Process

Use with pages 489–492.

Describe *solutions by completing the following statements.*

A solution may exist in gas, solid, or liquid form, depending on the state of its _____. Some combinations of substances easily form _____ and others do not. A substance that does not _____ in a solvent is _____ in that solvent.

Write *the general rule to determine if solvation will occur.*

_____

List *three factors that must be known about component substances to determine if solvation will occur.*

1. _____
2. _____
3. _____

Sequence *the steps required for a sodium chloride crystal to dissolve in water.*

____ The charged ends of water molecules attract the positive Na ions and the negative Cl ions.

____ The ions from the crystal break away from the surface.

____ Water molecules collide with the surface of the crystal.

____ NaCl crystals are placed in water.

____ Solvation continues until the entire crystal has dissolved.

____ The attraction between the dipoles and the ions are stronger than the attractions among the ions in the crystal.

Name _____ Date _____

Section 14.3 Factors Affecting Solvation (continued)

Main Idea — **Details**

Factors That Affect Solvation

Use with page 492.

Organize *the following table on factors that can increase the rate of solvation by increasing the number of collisions.*

Factor	Increase Collisions By
agitating the mixture	
breaking particles into smaller pieces	
increasing temperature of the solvent	

Solubility

Use with pages 493–496.

Explain *how solubility is expressed in units of measurement.*

_____

Review *Table 14.4 in your text to determine the solubility of the following compounds in water.*

$Ca(OH)_2$ at 20°C _____

KCl at 60°C _____

Describe *each of these solubility states.*

State	Description
continuing solvation	
dynamic equilibrium	
saturated solution	
unsaturated solution	

Name _____ **Date** _____

Section 14.3 Factors Affecting Solvation (continued)

Main Idea | **Details**

Describe *how solubility changes with temperature for most substances.*

_____

Explain *why some gases are less soluble as temperature increases.*

_____

_____

Describe *the relationship between solubility and pressure.*

_____

Write *the equation for Henry's law.*

Henry's Law

Use with Example Problem 14.5, page 497.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 14.5.*

Problem

Find how much of a gas will dissolve in 1.0 L of water at 1.0 atm, if 0.85 g of that gas will dissolve in 1.0 L of water at 4.0 atm and temperature does not change.

1. Analyze the Problem

List the knowns and unknowns.

Known: Unknown:

S_1 = _____

P_1 = _____ S_2 = _____

P_2 = _____

2. Solve for the Unknown

Rearrange Henry's Law to solve for S_2.

S_2 = _____

Substitute known values and solve.

S_2 = _____ $\frac{(1.0\ \text{atm})}{\_\_\_\_\_}$ = _____

3. Evaluate the Answer

The solubility _____ as expected due to the _____ in pressure.

Name _____ Date _____

Mixtures and Solutions

Section 14.4 Colligative Properties of Solutions

Main Idea

Details

Scan *Section 4 of your text, using the checklist below as a guide.*

- 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 solutions.

Write two questions that you would want answers to based on your reading.

1. _____

2. _____

New Vocabulary

Use your text to define each term.

colligative property _____

vapor pressure lowering _____

boiling point elevation _____

freezing point depression _____

osmosis _____

osmotic pressure _____

Name _____ Date _____

Section 14.4 Colligative Properties of Solutions (continued)

Main Idea	Details
Electrolytes and Colligative Properties *Use with pages 498–499.*	**Compare and contrast** *electrolytes and nonelectrolytes.* Substances like sodium chloride that _____ in water and conduct an _____ are called _____. Substances like sucrose that dissolve in water but do not _____ and do not conduct an electric current are called _____.
Vapor Pressure Lowering *Use with page 499.*	**Summarize** *why vapor pressure lowering is a colligative property. Include an explanation of vapor pressure.*
Boiling Point Elevation *Use with page 500.*	**Explain** *boiling point elevation by completing the following statements.* A liquid boils when its _____ equals _____. Adding a nonvolatile solute lowers the solvent's _____ pressure. More _____ energy must be added to reach the solvent's _____. The greater the number of _____ particles in the solution, the greater the _____ elevation.

Name _____ Date _____

Section 14.4 Colligative Properties of Solutions (continued)

Main Idea	Details

Freezing Point Depression

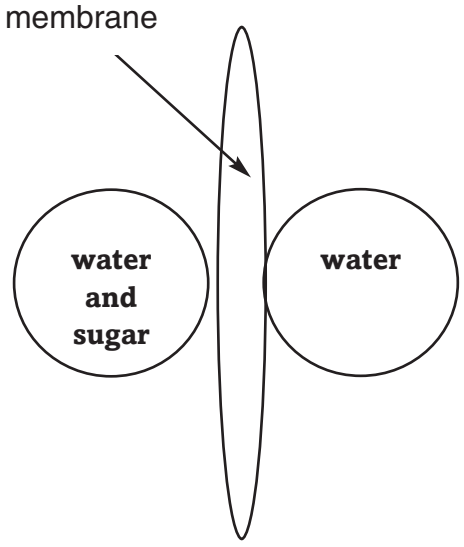
Use with pages 501–502.

Describe *why the freezing point changes when a solute is added to a solution.*

Osmotic Pressure

Use with page 504.

Evaluate *the diagram of a semipermeable membrane separating a sucrose-water solution on one side and water on the other side. Draw an arrow to show in which direction more water will flow and circle the side which has the greater osmotic pressure.*



Name _____ Date _____

Mixtures and Solutions Chapter Wrap-Up

Now that you have read the chapter, review what you have learned and write the key equations and relationships.

_____

_____

_____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Identify four ways in which an understanding of the properties of solutions and heterogenous mixtures can be applied to your own life.

1. _____

2. _____

3. _____

4. _____

Name _____ Date _____

Energy and Chemical Change

Before You Read

Review Vocabulary *Define the following terms.*

chemical equation _____

_____

mole _____

_____

_____

Chapter 10

Describe *the equation you would use to convert mass in grams to moles.*

Chapter 12

Identify *the three characteristics of particles about which the kinetic-molecular theory makes assumptions.*

1. _____

2. _____

3. _____

Write the equation that represents the kinetic energy of a particle.

_____

Name _____ Date _____

Energy and Chemical Change

Section 15.1 Energy

Main Idea — **Details**

Skim *Section 1 of your text. Write two facts you discovered about energy.*

1. _____

_____

2. _____

_____

New Vocabulary *Use your text to define each term.*

energy _____

law of conservation of energy _____

_____

chemical potential energy _____

heat _____

_____

calorie _____

_____

joule _____

specific heat _____

_____

Name _____ Date _____

Section 15.1 Energy (continued)

Main Idea — **Details**

The Nature of Energy

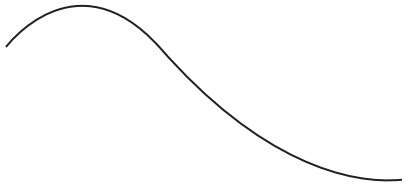
Use with pages 516–518.

Compare and contrast *kinetic energy with potential energy.*

_____

_____

On the curve below that represents the skier on a ski slope on page 516, label the place of greatest kinetic energy A, least kinetic energy B, greatest potential energy C, and least potential energy D.



Describe *the skier above as a function of the law of conservation of energy.*

_____

_____

_____

Explain *chemical potential energy.*

Chemical _____ energy of a substance is a result of the arrangement of its _____ and the strength of the _____ joining the atoms. During some _____ reactions, such as burning ____, much of the potential energy may be released as ____. Some of the energy may be converted to work, which is a form of _____ energy.

Specific Heat

Use with pages 519–520.

Identify *each symbol in the equation for specific heat.*

$q = c \times m \times \Delta T$

____ represents heat absorbed or released

____ represents the specific heat of the substance

____ represents mass of a sample in grams

____ represents a change in temperature

Name _____ **Date** _____

Section 15.1 Energy (continued)

Main Idea **Details**

Calculate Specific Heat

Use with Example Problem 15.2, page 521.

Summarize. *Fill in the blanks to help you take notes while you read Example Problem 15.2.*

Problem

The temperature of a sample of iron with a mass of 10.0 g changed from 50.4°C to 25.0°C with the release of 114 J heat. Determine the specific heat of iron.

1. Analyze the Problem

Known:

energy released = _____

ΔT = _____

mass of iron = _____

Unknown:

specific heat of iron = ?

2. Solve for the Unknown

Write the equation for heat absorption.

q = _____

Solve for c.

q = c =

c =

3. Evaluate the Answer

If the values used in the calculations have _____ significant figures, the answer must also have _____ significant figures. The calculated value matches the value for iron in Table 15.2.

Real-World Connection

Describe two potential problems with the use of the Sun as a source of everyday energy.

1. _____

2. _____

Name _____ Date _____

Energy and Chemical Change

Section 15.2 Heat

Main Idea — **Details**

Skim *Section 2 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.*

calorimeter _____

thermochemistry _____

system _____

surroundings _____

universe _____

enthalpy _____

enthalpy (heat) of reaction _____

Name _____ Date _____

Section 15.2 Heat (continued)

Main Idea — **Details**

Calorimetry

Use with page 523.

Describe *how a calorimeter measures heat.*

_____

_____

_____

Using Specific Heat

Use with Example Problem 15.3, page 525.

Summarize. *Fill in the blanks to help you take notes while you read Example Problem 15.3.*

Problem

Determine the specific heat of a piece of metal with a mass of 4.68 g that _____ 256 J of heat when its temperature increases by 182°C, and explain if the metal could be an _____.

1. Analyze the problem

Known: mass of metal = _____

quantity of heat absorbed = _____

_____ = 182°C

Unknown: specific heat, c = ? J/(g · °C)

2. Solve for the Unknown

Write the equation for absorption of heat.

q = _____

Solve for c by dividing both sides of the equation by $m \times \Delta T$.

c =

Section 15.2 Heat (continued)

Main Idea **Details**

Substitute the known values into the equation.

$c =$ $= \_\_\_\_\_$

Table 15.2 indicates the metal could be _____.

3. Evaluate the Answer

The quantities used in the calculation have _____ significant figures, and the answer is correctly stated with _____ significant figures. The calculation yielded the _____ unit, and the calculated _____ is the same as that for _____.

Chemical Energy and the Universe

Use with pages 525–528.

Compare and contrast *exothermic and endothermic reactions.*

_____

_____

Write *the symbol for enthalpy (heat) of reaction.*

_____

Explain *why chemists prefer to measure change in heat energy, rather than the total amount of heat energy present.*

_____

_____

_____

_____

Name _____ Date _____

Energy and Chemical Change

Section 15.3 Thermochemical Equations

Main Idea — **Details**

Skim *Section 3. Focus on the subheadings, boldfaced words, and the main ideas. In the space below, summarize the main idea of this section.*

_____

_____

_____

New Vocabulary *Use your text to define each term.*

thermochemical equation _____

_____

_____

enthalpy (heat) of combustion _____

molar enthalpy (heat) of vaporization _____

molar enthalpy (heat) of fusion _____

Name _____ Date _____

Section 15.3 Thermochemical Equations (continued)

Main Idea | **Details**

Writing Thermochemical Equations

Use with page 529.

Identify *which of the reactions below is endothermic, and explain how you know.*

1. $4Fe(s) + 3O_2(g) \longrightarrow 2Fe_2O_3(s)$ $\Delta H = -1625$ kJ
2. $NH_4NO_3(s) \longrightarrow NH_4^+(aq) + NO_3^-(aq)$ $\Delta H = 27$ kJ

Identify *which of the reactions below is exothermic, and explain how you know.*

1. $4Fe(s) + 3O_2(g) \longrightarrow 2Fe_2O_3(s)$ $\Delta H = -1625$ kJ
2. $NH_4NO_3(s) \longrightarrow NH_4^+(aq) + NO_3^-(aq)$ $\Delta H = 27$kJ

Changes of State

Use with pages 530–531.

Name *the common states of matter.*

Name _____ Date _____

Section 15.3 Thermochemical Equations (continued)

Main Idea **Details**

Explain *changes in physical states by completing the sentences below.*

During vaporization, a _____ becomes a _____.

Energy must be _____ by the liquid.

During condensation, a _____ becomes a _____.

Energy is _____ by the gas.

During fusion of ice, a _____ becomes a _____.

Energy is _____ by the solid.

Identify *what the following equations represent.*

$\Delta H_{vap} = -\Delta H_{cond}$

_____

_____

$\Delta H_{fus} = -\Delta H_{solid}$

_____

_____

REAL-WORLD CONNECTION **Explain why a farmer would spray his orange trees with water when he knows the overnight temperature will be below 30°C.**

_____

_____

_____

Name _____ Date _____

Energy and Chemical Change

Section 15.4 Calculating Enthalpy Change

Main Idea — **Details**

Scan *Section 4 of your text. Use the checklist below to preview the section.*

- 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 energy and chemical change.

Write three statements about calculating enthalpy change based on your reading.

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

Hess's law

_____

_____

_____

_____

standard enthalpy (heat) of formation

_____

_____

_____

Name _____ Date _____

Section 15.4 Calculating Enthalpy Change (continued)

Main Idea | **Details**

Hess's Law

Use with pages 534–536.

Describe *Hess's law by completing the following statement.*

_____ is used to determine the _____ of a system by imagining that each reaction is part of a _____, each of which has a known ΔH.

Examine *Figure 15.13. Read the caption and follow the arrows. Then apply Hess's law to fill in the blanks below.*

ΔH for reaction **c** _____

ΔH for reaction **d** _____

sum of ΔH for reactions **c** and **d** _____

In other words, the _____ for the conversion of S and O_2 to SO_3 is _____ .

Standard Enthalpy (Heat) of Formation

Use with pages 537–538.

Explain *standard enthalpy of elements and compounds by completing the following statements.*

An element's _____ is the normal _____ state at one _____ pressure and _____. For example, the standard state for iron is _____, for mercury is _____, and for oxygen is ___ . Free elements such as these are assigned a ΔH_f^0, or _____ _____, of exactly _____. The ΔH_f^0 of many _____ has been measured _____ . For example, the standard enthalpies of formation for the following compounds are:

$NO_2(g)$ ____

$SO_3(g)$ _____

$SF_6(g)$ _____

Name _____ Date _____

Section 15.4 Calculating Enthalpy Change (continued)

Main Idea — **Details**

The Summation Equation

Use with page 546.

Write *the formula that sums up the procedure for combining standard heats of formation equations to produce the desired equation and its* ΔH^0_{rxn}.

This equation says to _____ the ____ of heats of _____ of the _____ from the sum of the _____ of formation of the _____.

Enthalpy Change from Standard Enthalpies of Formation

Use with Example Problem 15.6, page 540.

Summarize. *Fill in the blanks to help you take notes as you work through Example Problem 15.6.*

Problem

Calculate ΔH^0_{rxn} for the combustion of methane.
$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$

1. **Analyze the Problem**
   Use the formula $\Delta H^0_{rxn} = \Sigma \Delta H^0_f$ (products) $- \Sigma \Delta H^0_f$ (reactants) with data from Table R-11.

   Known:

   $\Delta H^0_f(CO_2) =$ _____

   $\Delta H^0_f(H_2O) =$ _____

   $\Delta H^0_f(CH_4) =$ _____

   $\Delta H^0_f(O_2) =$ _____

   Unknown:

   $\Delta H^0_{rxn} = ?$ kJ

Name _____ **Date** _____

Section 15.4 Calculating Enthalpy Change (continued)

Main Idea

Details

2. Solve for the Unknown

Use the formula $\Delta H^{O}_{rxn} = \Sigma \Delta H^{O}_{f}$ (products) $- \Sigma \Delta H^{O}_{f}$ (reactants)

Substitute values in the formula

ΔH^{O}_{rxn} = _____

ΔH^{O}_{rxn} = _____ = _____

3. Evaluate the Answer

All values are _____ to the stated place. The calculated value matches that in Table R-11.

Real-World Connection

Your family needs to choose a system to heat the new home you are building. From what you have learned so far, write down four questions you will use to evaluate the systems available.

1. _____

2. _____

3. _____

4. _____

Name _____ Date _____

Energy and Chemical Change

Section 15.5 Reaction Spontaneity

Main Idea — **Details**

Scan *Section 5, using the checklist below as a guide.*

- 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 energy and chemical change.

State *the main concepts of this section.*

_____

_____

_____

_____

New Vocabulary *Use your text to define each term.*

spontaneous process _____

entropy _____

_____

_____

second law of thermodynamics _____

_____

free energy _____

Academic Vocabulary *Define the following term.*

demonstrate _____

Name _____ **Date** _____

Section 15.5 Reaction Spontaneity (continued)

Main Idea | **Details**

Spontaneous Processes

Use with pages 542–545.

Compare and contrast *spontaneous processes and non-spontaneous processes.*

_____

_____

_____

_____

_____

Identify *the parts of the entropy equation.*

$\Delta S_{system} = S_{products} - S_{reactants}$

ΔS represents _____.

S represents _____.

List *five reactions or processes in which it is possible to predict change in entropy. For each process, indicate whether entropy will increase or decrease.*

1. _____

2. _____

3. _____

_____

4. _____

5. _____

Section 15.5 Reaction Spontaneity (continued)

Main Idea

Entropy, the Universe, and Free Energy

Use with pages 546–548.

Details

Write *the equation for the standard free energy change under standard conditions.*

_____

Predict *whether entropy increases or decreases for the reaction below and explain your reasoning.*

$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

_____

_____

Describe *free energy changes by writing the word positive or negative in the appropriate blank.*

If the sign of the free energy change is _____, the reaction is spontaneous.

If the sign of the free energy system is _____, the reaction is non-spontaneous.

Explain *how* ΔH^0_{system} *and* ΔS^0_{system} *affect reaction spontaneity by completing the following table.*

How ΔH^0_{system} and ΔS^0_{system} Affect Reaction Spontaneity		
	$-\Delta H^0_{system}$	$+\Delta H^0_{system}$
$+\Delta S^0_{system}$		
$-\Delta S^0_{system}$		

Name _____ Date _____

Energy and Chemical Change Chapter Wrap-Up

Now that you have read the chapter, review what you have learned and write three key equations or relationships.

1. _____

2. _____

_____

3. _____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter, reviewing the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Chapter Assessment at the end of the chapter.

Real-World Connection

Explain why the energy that comes from chemical reactions is critical for almost every phase of your daily life.

_____

_____

_____

_____

Name _____ Date _____

Reaction Rates

Before You Read

Review Vocabulary *Define the following terms.*

Boyle's law _____

_____

Charles's law _____

_____

Gay-Lussac's law _____

_____

molarity _____

_____

Chapter 9

Balance *the following equation.*

$\square\ C_8H_{18}(l) + \square\ O_2(g) \rightarrow \square\ CO_2(g) + \square\ H_2O(l)$

Name _____ Date _____

Reaction Rates

Section 16.1 A Model for Reaction Rates

Main Idea — **Details**

Skim *Section 1 of your text. Preview headings, photos, captions, boldfaced words, problems, and graphs. Write three questions that come to mind.*

1. _____
2. _____
3. _____

New Vocabulary *Use your text to define each term.*

reaction rate _____

collision theory _____

activated complex _____

activation energy _____

Academic Vocabulary *Define the following term.*

investigate _____

Name _____ Date _____

Section 16.1 A Model for Reaction Rates (continued)

Main Idea **Details**

Expressing Reaction Rates

Use with page 560.

Identify *what each phrase or symbol represents in this equation.*

$$\text{Average rate} = \frac{\Delta\text{quantity}}{\Delta t}$$

Average rate = the average is used because the rate changes over time

Δ = _____

t = _____

Calculate Average Reaction Rates

Use with Example Problem 16.1, page 562.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 16.1.*

Problem

Calculate the average reaction rate of the chemical reaction using the _____ of butyl chloride in _____.

1. Analyze the Problem

Known: Unknown:

_____ _____

_____

$[C_4H_9Cl]$ at $t_1 = 0.220M$

_____

2. Solve for the Unknown

Write the equation.

Average reaction rate =

Insert known quantities.

Solve for the average rate = $\dfrac{\text{_____}}{4.00\text{ s} - 0.00\text{ s}}$

= _____

Average reaction rate = _____

3. Evaluate the Answer

The answer is correctly expressed in _____ significant figures.

Name _____ Date _____

Section 16.1 A Model for Reaction Rates (continued)

Main Idea | **Details**

Collision Theory

Use with pages 563–564.

Describe *how each of the items below affects a reaction.*

collision theory

_____

orientation and the activated complex

_____

_____

activation energy and reaction

_____

_____

_____

Analyze *Figure 16.4. Use colored pencils to draw similar molecules colliding. Be sure to include incorrect orientation, correct orientation, and correct orientation with insufficient energy. Develop a key for your drawings.*

Use with page 565.

Explain *activation energy by completing the following paragraph.*

Some reactions have enough _____ to overcome the _____ _____ of the reaction in order to form products. These are called _____. After the _____ is formed, _____ is released. In other reactions the reactants must absorb energy to overcome the _____ of the reaction. These reactions are called _____.

Real-World Connection

Describe how the collision theory would apply to a demolition derby.

_____

_____

Name _____ Date _____

Reaction Rates

Section 16.2 Factors Affecting Reaction Rates

Main Idea — **Details**

Scan *Section 2, using the checklist below as a guide.*

- 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 topic.

Write three facts you discovered about reaction rates.

1. _____
2. _____
3. _____

New Vocabulary *Use your text to define each term.*

catalyst _____

_____

inhibitor _____

heterogeneous catalyst _____

_____

homogeneous catalyst _____

_____

The Nature of Reactants

Use with page 568.

Explain *how reactants influence the rate at which a chemical reaction occurs by completing the following statement.*

As the reactant increases, the _____ increases.

Name _____ **Date** _____

Section 16.2 Factors Affecting Reaction Rates (continued)

Main Idea

Use with pages 568–573.

Details

Explain ***the effect each of the following has on the rate of a reaction.***

reactivity of reactants

_____

concentration

_____

surface area

_____

temperature

_____

catalyst

_____

inhibitors

_____

Real-World Connection

Compare and contrast the rate at which a sugar cube in cold water and granulated sugar in warm water would dissolve. Include how surface area and the temperature of the water might affect the rate at which each dissolves. Create a statement about which would dissolve faster.

_____

_____

_____

_____

Name _____ Date _____

Reaction Rates

Section 16.3 Reaction Rate Laws

Main Idea — **Details**

Skim *Section 3 of your text. Choose a photograph from this section. Write a question based on what you see and read.*

_____

_____

New Vocabulary *Use your text to define each term.*

rate law _____

_____

specific rate constant _____

_____

reaction order _____

_____

method of initial rates _____

_____

Name _____ **Date** _____

Section 16.3 Reaction Rate Laws (continued)

Main Idea | **Details**

Writing Reaction Rate Laws

Use with pages 574–576.

Explain *what each symbol represents in the following equation.*

Rate = k[A]

k = _____

_____

[A] = _____

Analyze *the rate law reaction for the decomposition of hydrogen peroxide.*

$2H_2O_2 \longrightarrow 2H_2O + O_2$

rate law equation: rate = k[A], where [A] = _____

insert the reactant: rate = _____

Express *the rate law reaction for this chemical reaction.*

chemical equation: $2NO(g) + 2H_2(g) \longrightarrow N_2(g) + 2H_2O(g)$

rate law equation: rate = _____ , where [A] represents the reactant ____ and [B] represents the reactant ____

insert the reactants: rate = _____

Name _____ Date _____

Section 16.3 Reaction Rate Laws (continued)

Main Idea | **Details**

Determining Reaction Order

Use with page 576.

Relate *how the reaction rate varies with:*

concentration

_____

_____

the overall reaction order

_____

_____

Explain *reaction order by completing the following sentences.*

One of the means of determining reaction order is by comparing _____ of a reaction with varying _____. This is known as the method of _____. This method requires experimentation with differing _____ of the reactants and comparing the _____ of the reaction at each quantity. While the rate law for a reaction can tell you the reaction rate, the rate constant *k*, and the _____, actual _____ and _____ of a complex reaction can be determined only through experimentation.

Real-World Connection

Consider whether an average of a student's grades on all chemistry tests is or is not a better way of determining a final grade as compared to using just one test score. Explain which is better and why.

_____

_____

Name _____ Date _____

Reaction Rates

Section 16.4 Instantaneous Reaction Rates and Reaction Mechanisms

Main Idea — **Details**

Skim *Section 4 of your text. Preview the headings, photos, captions, boldfaced words, problems, and graphs. Write three questions that come to mind.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

instantaneous rate _____

_____

complex reaction _____

reaction mechanism _____

_____

intermediate _____

_____

rate-determining step _____

Name _____ Date _____

Section 16.4 Instantaneous Reaction Rates and Reaction Mechanisms (continued)

Main Idea — **Details**

Calculate Instantaneous Reaction Rates

Use with Example Problem 16.2, page 579.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 16.2.*

Problem

Calculate the instantaneous rate for this reaction, given the quantities for NO and H_2.

$$2NO(g) + H_2(g) \longrightarrow N_2O(g) + H_2O(g)$$

1. Analyze the Problem

Known:

quantity of [NO] = 0.00200*M*

quantity of [H_2] = _____

k = _____

Unknown:

rate = ? mol/(L · s)

2. Solve for the Unknown

Insert the known quantities into the rate law equation.

rate = _____

rate = _____

rate = _____

3. Evaluate the Answer

Are your units correct? Is your magnitude reasonable?

Reaction Mechanisms

Use with pages 580–582.

Compare *the reaction mechanism using the terms complex, intermediate, and rate-determining step to the process of building a car. Show that you understand the vocabulary.*

Name _____ Date _____

Reaction Rates Chapter Wrap-Up

Now that you have read the chapter, list three facts you learned about reaction rates:

1. _____

2. _____

3. _____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Chapter Assessment at the end of the chapter.

Real-World Connection

Suppose you obtain a part-time job working for a lawn care business. Your new boss wants you to help her choose the right fertilizer for most of the lawns you will see. Use the terms from this chapter to explain to your boss what she should look for in a fertilizer.

_____

_____

_____

Name _____ Date _____

Chemical Equilibrium

Before You Read

Review Vocabulary *Define the following terms.*

chemical equation _____

reaction rate _____

rate law _____

Chapter 9

Balance *the chemical equation below.*

$NO(g) + H_2(g) \longrightarrow N_2O(g) + H_2O(g)$

Chapter 16

Write *the rate law for the reaction below.*

$H_2(g) + I_2(g) \longrightarrow 2\ HI(g)$

Rate = _____

Name _____ Date _____

Chemical Equilibrium

Section 17.1 A State of Dynamic Balance

Main Idea — **Details**

Skim *Section 1 of your text. Write a statement that describes the nature of equilibrium from your reading of the headings, boldface terms, and illustration captions.*

New Vocabulary *Use your text to define each term.*

reversible reaction

chemical equilibrium

law of chemical equilibrium

equilibrium constant

homogeneous equilibrium

heterogeneous equilibrium

Name _____ Date _____

Section 17.1 A State of Dynamic Balance (continued)

Main Idea — **Details**

What is equilibrium?

Use with pages 594–598.

Explain *reversible reactions by inserting the words left and right in the following statements.*

The reactants for the forward reaction are on the _____. The products are on the _____. The reactants for the reverse reaction are on the _____. The products are on the _____.

List *the reactants and products of the following reversible reaction.*

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

	Reactants	Products
Forward reaction		
Reverse reaction		

Complete *the following statement.*

The state in which forward and reverse reactions balance each other because they take place at equal rates is called _____ _____. Although a chemical reaction may be in equilibrium, the _____ and _____ may continually be _____ because chemical equilibrium is a dynamic process.

Equilibrium Expressions and Constants

Use with pages 599–604.

Identify *the parts of the equilibrium constant expression.*

$$K_{eq} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

K_{eq} = _____

[C][D] = _____

[A][B] = _____

a, b, c, and d = _____

Name _____ **Date** _____

Section 17.1 A State of Dynamic Balance (continued)

Main Idea **Details**

Write *the equilibrium constant expression for the following balanced chemical equation.*

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

$K_{eq} =$ _____

_____

Compare and contrast *homogeneous equilibrium and heterogeneous equilibrium by completing the following sentences.*

Homogeneous equilibrium occurs when _____ and _____ of a reaction are in the _____ physical state. Heterogeneous equilibrium occurs when _____ and _____ of a reaction are in more than ____ physical state. Equilibrium depends on the _____ in the system.

Write *the equilibrium expression for this reaction.*

$I_2(s) \rightleftharpoons I_2(g)$

_____

Real-World Connection

Discuss why sodium hydrogen carbonate is valuable in baking.

_____

_____

_____

Name _____ **Date** _____

Section 17.1 A State of Dynamic Balance (continued)

Main Idea **Details**

The Value of Equilibrium Constants

Use with Example Problem 17.3, page 605.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 17.3.*

Problem

Calculate the value of K_{eq} for the equilibrium constant expression.

$$K_{eq} = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

1. Analyze the Problem

List the knowns and unknowns.

Known: the equilibrium constant expression:

_____

Known: the concentration of each reactant and product:

$[NH_3]$ = _____

$[N_2]$ = _____

$[H_2]$ = _____

Unknown: the value of the equilbrium constant

2. Solve for the Unknown

Substitute the _____ into the equilibrium _____ and calculate its value.

$$K_{eq} = \frac{\text{_____}}{[0.533]} = \text{_____}$$

3. Evaluate the Answer

The given concentrations have ____ significant figures, therefore the answer must have ____ significant figures.

Name _____ Date _____

Chemical Equilibrium

Section 17.2 Factors Affecting Chemical Equilibrium

Main Idea

Details

Scan *Section 2 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all tables and graphs.
- Look at all figures and read the captions.
- Think about what you already know about chemical equilibrium.

Write *four facts you discovered about chemical equilibrium.*

1. _____

2. _____

3. _____

4. _____

New Vocabulary

Use your text to define the following term.

Le Châtelier's principle

_____

_____

Name _____ Date _____

Section 17.2 Factors Affecting Chemical Equilibrium (continued)

Main Idea | **Details**

Applying Le Châtelier's Principle

Use with pages 607–610.

Determine *how each of the following changes affects a system in equilibrium. Write a sentence that includes the term(s) in parentheses.*

changes in concentration (collisions)

_____

_____

changes in volume (pressure, products)

_____

_____

changes in temperature (endothermic, exothermic)

_____

_____

_____

REAL-WORLD CONNECTION **Describe how your body would relieve the stress placed on it by climbing to a high altitude.**

_____

_____

_____

Name _____ Date _____

Chemical Equilibrium

Section 17.3 Using Equilibrium Constants

Main Idea

Details

Scan *Section 3 of your text. Use the checklist below as a guide.*

- Read all section heads.
- Read all boldfaced words.
- Read all the tables and graphs.
- Look at all pictures and read the captions.
- Think about what you already know about equilibrium constants.

Write *three facts you discovered about using equilibrium constants.*

1. _____

2. _____

3. _____

New Vocabulary

Use your text to define each term.

solubility product constant _____

_____

common ion _____

common ion effect _____

_____

Name _____ Date _____

Section 17.3 Using Equilibrium Constants (continued)

Main Idea **Details**

Calculating Equilibrium Concentrations

Use with Example Problem 17.4, page 613.

Summarize *Fill in the blanks to help you take notes while you read example Problem 17.4.*

Problem

At 1405 K, hydrogen sulfide _____ to form _____ and a diatomic _____ molecule, S_2. The _____ for the reaction is 2.27×10^{-3}.

$$2H_2S(g) \rightleftharpoons 2H_2(g) + S_2(g)$$

What is the concentration of $H_2(g)$ if $[S_2] = 0.0540$ mol/L and $[H_2S] = 0.184$ mol/L?

1. Analyze the Problem

List the knowns and unknowns.

Known:

K_{eq} = _____

$[S_2]$ = _____

$[H_2S]$ = _____

Unknown:

$[H_2]$ = _____

2. Solve for the Unknown

Write the equilibrium constant expression.

K_{eq} =

_____

Substitute known quantities.

_____

Solve for the unknown.

_____

_____

3. Evaluate the Answer

The number of significant figures in the data is _____. Therefore, the number of significant figures in the answer must be _____.

Name _____ Date _____

Section 17.3 Using Equilibrium Constants (continued)

Main Idea | **Details**

The Solubility Product Constant

Use with pages 614–619.

Describe *solubility equilibrium.*

_____

_____

Identify *the part of the equation that shows equilibrium and circle it.*

$$BaSO_4(s) \rightleftharpoons Ba^{2+}(aq) + SO_4^{2-}(aq)$$

Explain *solubility by completing the following statements.*

_____ is the amount of a substance that will _____ in a given volume of _____.

K_{sp} represents the _____.

K_{sp} is the _____ of the concentration _____ each raised to the power equal to the _____ of the ion in the _____.

K_{sp} depends only on the _____ of the ____ in a saturated _____.

Explain *why it benefits doctors to understand solubility.*

_____

Calculating Molar Solubility

Use with Example Problem 17.5, page 616.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 17.5.*

Problem

Calculate the solubility in mol/L of copper(II) carbonate ($CuCO_3$) at 298 K.

1. **Analyze the Problem**
   List the knowns and unknowns.

   Known: Unknown:

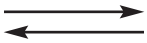
   K_{sp} ($CuCO_3$) = _____ solubility ($CuCO_3$) = _____

Section 17.3 Using Equilibrium Constants (continued)

Main Idea **Details**

2. Solve for the Unknown

Write the balanced chemical equation.



_____

Write the solubility constant expression (remember only the ions are used).

_____

$s = [Cu^{2+}] =$ _____

Substitute s for $[Cu^{2}+]$ and _____

_____

_____

3. Evaluate the Answer

K_{sp} has ___ significant figures so the answer must be expressed with ___ significant figures.

Describe *conditions in which precipitates are likely to form.*

1. _____

2. _____

3. _____

_____

The Common Ion Effect

Use with pages 620–621.

Discuss *the common ion effect by completing the following paragraph.*

An ion that is common to two or more ionic compounds is known as a _____. The lowering of the solubility of a substance by the presence of a common ion is called the _____.

Name _____ **Date** _____

Chemical Equilibrium Chapter Wrap-Up

Now that you have read the chapter, review what you have learned.

Describe *chemical equilibrium.*

_____

_____

_____

Explain *Le Châtelier's principle.*

_____

_____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the vocabulary words and scientific definitions.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Describe several uses of solubility in your home.

_____

_____

_____

Name _____ Date _____

Acids and Bases

Before You Read

Review Vocabulary *Define the following term.*

chemical equilibrium _____

_____

Chapter 9

Write *the equation for hydrogen chloride dissolving in water to form hydrogen ions and chloride ions.*

_____

Explain *what type of compound hydrogen chloride is since it produces hydrogen ions in aqueous solution.*

_____

Chapter 16

Identify *five factors that influence reaction rate.*

1. _____
2. _____
3. _____
4. _____
5. _____

Name _____ Date _____

Acids and Bases

Section 18.1 Introduction to Acids and Bases

Main Idea — **Details**

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

1. _____

2. _____

New Vocabulary *Use your text to define each term.*

acidic solution _____

basic solution _____

Arrhenius model _____

Brønsted-Lowry model _____

conjugate acid _____

conjugate base _____

conjugate acid-base pair _____

amphoteric _____

Lewis model _____

Name _____ Date _____

Section 18.1 Introduction to Acids and Bases (continued)

Main Idea — Details

Properties of Acids and Bases

Use with pages 634–636.

Compare and contrast *the properties of an acid and a base by placing an X in the Acid column if the property applies to an acid and in the Base column if the property applies to a base.*

Acid	Properties	Base
	tastes sour	
	tastes bitter	
	feels slippery	
	affects color	
	reacts with metal	
	conducts electricity	
	has more hydrogen ions than hydroxide ions	
	has more hydroxide ions than hydrogen ions	

Write *the chemical equation for the self-ionization of water.*

The Arrhenius and Brønsted-Lowry Models

Use with pages 637–639.

Analyze *why the Arrhenius model of acids and bases does NOT include ammonia (NH_3) in solution as a base.*

_____

_____

_____

Identify *which of the following statements describes the Arrhenius model and which describes the Brønsted-Lowry model by filling in the blanks.*

The _____ model is based on the dissociation of compounds, while the _____ model is based on the donation and acceptance of hydrogen ions. Conjugate acid-base pairs are a component of the _____ model and are NOT a component of the _____ model.

Name _____ Date _____

Section 18.1 Introduction to Acids and Bases (continued)

Main Idea | **Details**

Monoprotic and Polyprotic Acids

Use with pages 640–641.

Describe *what happens in the forward and reverse reactions when ammonia is dissolved in water. Identify the conjugate acid, the conjugate base, and the two conjugate acid-base pairs.*

Explain *what a polyprotic acid is.*

Sequence *the following equations in the steps of the ionization of phosphoric acid in the correct order.*

____ $HPO_4^{2-}(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + PO_4^{3-}(aq)$

____ $H_3PO_4(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + H_2PO_4^{2-}(aq)$

____ $H_2PO_4^-(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + HPO_4^-(aq)$

The Lewis Model

Use with pages 641–643.

Define and give examples of an anhydride, distinguishing between those that produce an acid and those that produce a base.

Name _____ Date _____

Acids and Bases

Section 18.2 Strengths of Acids and Bases

Main Idea — **Details**

Skim *Section 2 of your text. Focus on the headings, subheadings, boldfaced words, and the main ideas. Write three questions about strengths of acids and basis based on what you have read.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

strong acid _____

weak acid _____

acid ionization constant _____

_____

strong base _____

weak base _____

_____

base ionization constant _____

_____

Section 18.2 Strengths of Acids and Bases (continued)

Main Idea **Details**

Strengths of Acids

Use with pages 644–647.

Explain *why all acids are not equal in strength.*

_____

_____

Identify *the acids in the following table as strong or weak.*

Acid	Strong or Weak	Acid	Strong or Weak
acetic		hydroiodic	
carbonic		hydrosulfuric	
		hypochlorous	
hydrochloric		nitric	
hydrofluoric		sulfuric	

Describe *the difference in conductivity between strong and weak acids.*

_____

_____

_____

_____

Analyze *equilibrium constant expressions by completing the following statements.*

The concentration of liquid water in the denominator of an equilibrium constant expression is considered to be _____ in dilute aqueous solutions. Therefore, liquid water can be _____ K_{eq} to give a new equilibrium constant, K_a. For weak acids, the equilibrium _____ of the _____ in the numerator tends to be small compared to the equilibrium _____ of the _____ in the denominator. The weakest acids have the _____ K_a values because their solutions have the highest concentrations of _____ acid molecules.

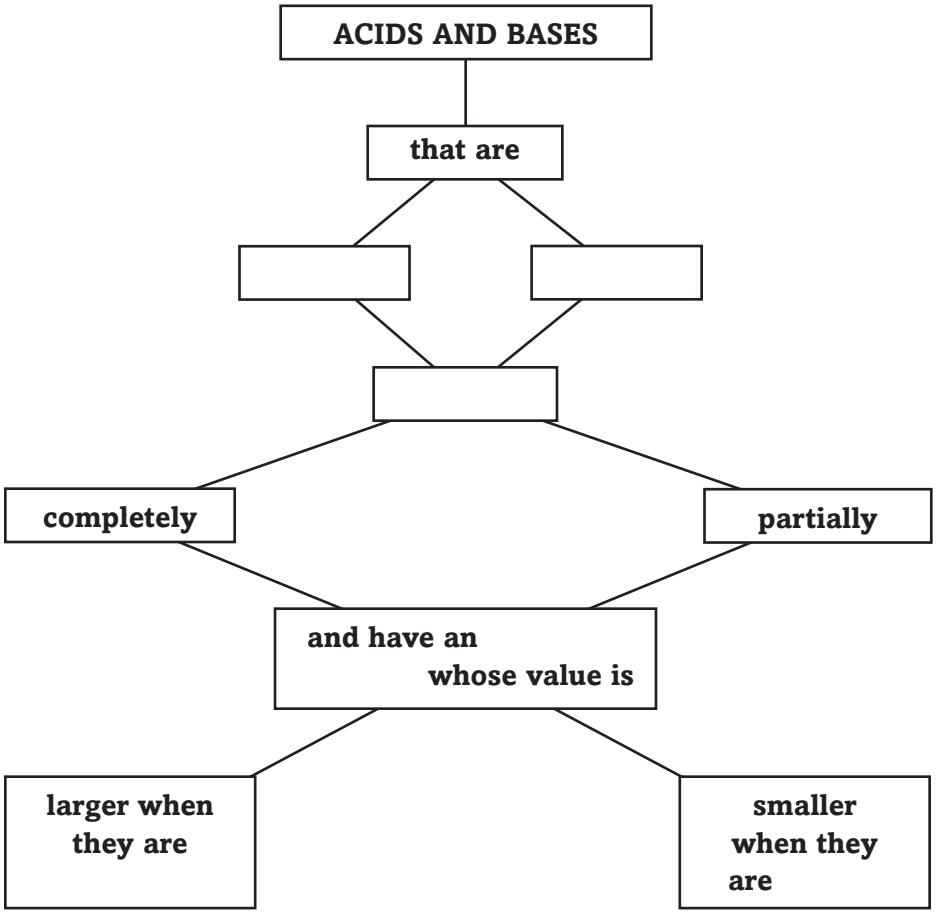
Section 18.2 Strengths of Acids and Bases (continued)

Main Idea **Details**

Strengths of Bases

Use with pages 648 and 649.

Compare and contrast *the strengths of acids and bases by completing this concept map using the terms ionize, ionization constant, strong, stronger, weak, and weaker.*



Describe *the differences between the strength and the concentration of acids and bases by completing the following statements.*

The number of the acid or base molecules dissolved is described by the terms _____ and _____. The degree to which an acid or base separates into ions is described by the terms _____ and _____. A strong acid can be a _____ solution and a _____ acid can be a concentrated solution.

Name _____ Date _____

Acids and Bases

Section 18.3 Hydrogen Ions and pH

Main Idea — **Details**

Scan *Section 3 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all formulas.
- Look at all figures and read the captions.
- Think about what you already know about alcohols, ethers, and amines.

Write *three facts you discovered about pH as you scanned the section.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define the following terms.*

ion product constant for water _____

_____

pH _____

pOH _____

Name _____ Date _____

Section 18.3 Hydrogen Ions and pH (continued)

Main Idea **Details**

Ion Product Constant for Water

Use with pages 650–651.

Describe *how the ion product constant for water is derived from the self-ionization equation.*

$H_2O(l) \leftrightharpoons$ _____

K_{eq} = _____

$K_{eq}[H_2O]$ = _____

$K_w = [H^+][OH^-]$ = _____

Calculate $[H^+]$ and $[OH^-]$ Using K_w

Use with Example Problem 18.1, page 651.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 18.1.*

Problem

Calculate $[OH^-]$ using _____ and the concentration of _____, and determine if the solution is acidic, basic, or neutral.

Step 1: Analyze the Problem

Known: Unknown:

$[H^+]$ = _____ $[OH^-]$ = ? mol/L

K_w = _____

Write what you can predict about $[OH^-]$:

_____

Step 2: Solve for the Unknown

Write the ion product constant expression

K_w = _____

Solve for $[OH^-]$ by _____.

$[OH^-]$ = _____

$[OH^-]$ = _____

Since $[H^+] > [OH^-]$, _____.

Section 18.3 Hydrogen Ions and pH (continued)

Main Idea

Details

Step 3: Evaluate the Answer

The answer is correctly stated with ____ significant figures because $[H^+]$ and $[OH^-]$ each have two. The hydroxide ion concentration _____ the prediction.

pH and pOH

Use with pages 652–658.

Compare and contrast *pH and pOH by completing the following table.*

Solution Type	Scale Measure	Relationship (Equation)
acid	pH	
base		
acid and base		

Analyze *the process of calculating pH and pOH from the hydroxide concentration.*

Describe *the process of calculating the hydrogen ion and hydroxide ion concentrations from pH.*

Describe *the process of calculating* K_a *from pH for a 0.100M weak acid.*

Name _____ Date _____

Acids and Bases

Section 18.4 Neutralization

Main Idea — **Details**

Skim *Section 4 of your text. Focus on the headings, subheadings, boldfaced words, and the main ideas. Write three questions about strengths of acids and basis based on what you have read.*

1. _____

2. _____

3. _____

New Vocabulary *Define the following terms.*

neutralization reaction _____

salt _____

titration _____

titrant _____

equivalence point _____

acid-base indicator _____

end point _____

salt hydrolysis _____

buffer _____

buffer capacity _____

Section 18.4 Neutralization (continued)

Main Idea **Details**

Reactions Between Acids and Bases

Use with pages 659–664.

Write *the full equation of the neutralization reaction for magnesium hydroxide and hydrochloric acid.*

_____

Draw *the titration curve for 50.0 mL 0.100M HCl titrated with 0.100M NaOH. Label the pH and volume vectors, as well as the equivalence point.*

Describe *the indicator that matches each of the following pH levels. Use Figure 18.24 as a guide.*

pH	Indicator
7.2	
4.2	
1.8	
1–12	

Explain *the process for calculating the molarity of an unknown HCOOH solution by completing the equations below.*

Balanced equation:

$HCOOH(aq) + NaOH(aq) \longrightarrow HCOONa(aq) + H_2O(l)$

18.28 mL NaOH × _____ = _____ L NaOH

0.01828 L NaOH × _____

= _____ mol NaOH

1.828×10^{-3} mol NaOH × _____

= _____ mol HCOOH

1.828×10^{-3} mol HCOOH / _____

= _____ *M* HCOOH

Section 18.4 Neutralization (continued)

Main Idea — **Details**

Salt Hydrolysis

Use with page 665.

Describe *salt hydrolysis by completing the following statements.*

Some aqueous salt solutions are neutral, some are basic, and some are _____. The reason for this is a process known as _____. In this process, the anions of the dissociated salt donate _____ to water. Salts that will hydrolyze have a weak acid and a _____ or a strong acid and a _____. A salt formed from a strong acid and a weak base will form an _____. A salt formed from a strong base and a weak acid will form a _____. Salts formed from weak acids and bases or from strong acids and bases will not hydrolyze and form _____.

Buffered Solutions

Use with pages 666–667.

Explain *how a buffer works by completing the table below.*

The equation at equilibrium	**$HF(aq) \rightleftharpoons H^+(aq) + F^-(aq)$**	
Δ Condition	**Equilibrium Shift**	**The Process**
add acid	left	The H^+ ions react with F^- ions to form
add base	right	The OH^- ions react with H^+ ions to form water. This decreases the concentration of the H^+ ions so that
A greater _____ the solution leads to a		of the buffering molecules and ions in _____ of the solution.
A buffer has _____ or a base with its		of an acid and its _____

Name _____ Date _____

Acids and Bases Chapter Wrap-Up

Now that you have read the chapter, review what you have learned; write out three key equations and relationships.

1. _____

_____

2. _____

3. _____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Suppose you are on the bench for your school's soccer team when one of the players comes out of the game with a cramp. A teammate suggests that she start breathing into a paper bag to recover sooner. Explain whether or not this is good advice.

_____

_____

_____

Name _____ Date _____

Redox Reactions

Before You Read

Review Vocabulary *Define the following terms.*

electronegativity _____

_____

chemical reactions _____

_____

Chapter 7 **Compare and contrast** *monatomic ions and polyatomic ions.*

_____

_____

_____

Chapter 9 **List** *five types of chemical reactions.*

1. _____
2. _____
3. _____
4. _____
5. _____

Name _____ Date _____

Redox Reactions

Section 19.1 Oxidation and Reduction

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.

oxidation-reduction reaction _____

redox reaction _____

oxidation _____

reduction _____

oxidizing agent _____

reducing agent _____

Electron Transfer and Redox Reactions

Use with pages 680–682.

Describe *redox reactions by completing the statement below. Use Figure 19.1 in your text as reference.*

A redox reaction consists of two complimentary processes. Oxidation results in a _____ and an increased _____. Reduction results in a _____ and a _____ oxidation number.

Name _____ Date _____

Section 19.1 Oxidation and Reduction (continued)

Main Idea — **Details**

Oxidizing and Reducing Agents

Use with page 683.

Compare and contrast *an oxidizing agent and a reducing agent.*

_____

_____

_____

_____

_____

Identify Oxidation–Reduction Reactions

Use with Example Problem 19.1, page 685.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 19.1.*

Problem

Write the equation for the redox reaction:

Identify what is _____ and what is _____ in the redox reaction of aluminum and iron. Identify the _____ and the _____.

1. Analyze the Problem

Known: _____

Unknown: _____

2. Solve for the Unknown

Al becomes Al^{3+} and _____ electrons.

Fe^{3+} becomes Fe and gains _____ electrons.

3. Evaluate the Answer

Aluminum _____ electrons and is _____.

It is the _____ agent. Iron _____ electrons and is _____. It is the _____ agent.

Name _____ **Date** _____

Section 19.1 Oxidation and Reduction (continued)

Main Idea **Details**

Determining Oxidation Numbers

Use with page 686.

Describe *the rules for determining oxidation numbers by completing these statements.*

1. The oxidation number of an uncombined atom is _____.
2. The oxidation number of a monatomic ion is equal to _____.
3. The oxidation number of the more electronegative atom in a molecule or a complex ion is the same as _____ _____.
4. The oxidation number of fluorine, the most electronegative element, when it is bonded to another element is ____.
5. The oxidation number of oxygen in compounds is ____, except in peroxides where it is ____. The oxidation number of oxygen when it bonds to fluorine is _____.
6. The oxidation number of hydrogen in most of its compounds is ____.
7. The oxidation numbers of the metal atom in the compounds formed by the metals of groups 1 and 2 and aluminum in group 13 are _____, respectively. These oxidation numbers are equal to _____.
8. The sum of the oxidation numbers in a neutral compound is _____.
9. The sum of the oxidation numbers of the atoms in a polyatomic ion is equal to _____.

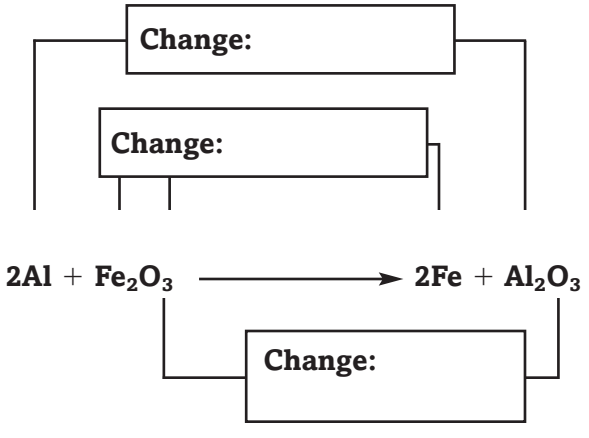
Oxidation Numbers in Redox Reactions

Use with page 688.

Describe *the redox reaction for the equation listed below. Use the example on page 688 of your text to complete the table, then label the oxidation numbers of the elements in the equation and indicate the change in each.*

$2Al + Fe_2O_3 \longrightarrow 2Fe + Al_2O_3$

Element	Oxidation Number	Rule
Al		
Fe in Fe_2O_3		
O in Fe_2O_3		
Fe		
Al in Al_2O_3		
O in Al_2O_3		



Name _____ Date _____

Redox Reactions

Section 19.2 Balancing Redox Equations

Main Idea — **Details**

Scan *Section 2 of your text, using the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all formulas.
- Look at all figures and read the captions.
- Think about what you already know about redox reactions.

Write *three facts you discovered about balancing redox reactions.*

1. _____
2. _____
3. _____

New Vocabulary *Use your text to define this term.*

oxidation-number method _____

species _____

half-reaction _____

The Oxidation-Number Method

Use with page 689.

Sequence *the steps for balancing redox reactions by the oxidation-number method.*

____ Identify the atoms that are oxidized and the atoms that are reduced.

____ Assign oxidation numbers to all atoms in the equation.

____ Make the change in oxidation numbers equal in magnitude by adjusting coefficients in the equation.

____ If necessary, use the conventional method to balance the remainder of the equation.

____ Determine the change in oxidation number for the atoms that are oxidized and for the atoms that are reduced.

Name _____ Date _____

Section 19.2 Balancing Redox Equations (continued)

Main Idea **Details**

The Oxidation-Number Method

Use with Example Problem 19.3, page 690.

Summarize *Fill in the blanks to help you take notes while you read Example Problem 19.3.*

Problem

Balance the _____ equation for the _____ that produces _____.

$Cu + HNO_3 \longrightarrow Cu(NO_3)_2 + NO_2 + H_2O$

1. Analyze the Problem

Known:

The formulas for the reactants and _____; the rules for determining _____; and the fact that the increase in the oxidation number of the _____ must equal the _____ of the reduced atoms.

Unknown: _____

2. Solve for the Unknown

Step 1 Assign oxidation numbers to all the atoms in the equation.

_____

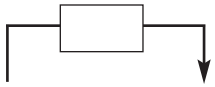
$Cu + H\ N\ O_3 \longrightarrow Cu(N\ O_3)_2 + N\ \ O_2 + H_2\ O$

Step 2 Identify which atoms are oxidized (using black arrows) and which are reduced (using red arrows).

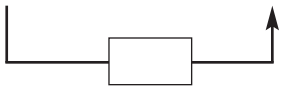
_____

$Cu + H\,N\,O_3 \longrightarrow Cu\ (NO_3)_2 + N\ \ O_2 + H_2\ O$

Step 3 Determine the change in oxidation number for the atoms that are oxidized and for the atoms that are reduced. Complete the following tables.



$Cu + HNO_3 \longrightarrow Cu(NO_3)_2 + NO_2 + H_2O$



Step 4 To make the net changes in oxidation number have the same magnitude, HNO_3 on the left and NO_2 on the right must be multiplied by ____.

Section 19.2 Balancing Redox Equations (continued)

Main Idea — **Details**

Step 5 Increase the coefficient of HNO_3 from 2 to ____ to balance the nitrogen atoms in the products. Add a coefficient of ____ to H_2O to balance the number of hydrogen atoms on the left.

3. Evaluate the Answer

The number of atoms of each element is _____ on both sides of the equation. No subscripts have been _____.

Balancing Net Ionic Redox Equations

Use with page 691.

Describe *how the form of the balanced equation for the oxidation of copper by nitric acid, below:*

$Cu(s) + 4HNO_3(aq) \longrightarrow Cu(NO_3)_2(aq) + 2NO_2(g) + 2H_2O(l)$

is changed when rewritten as:

$Cu(s) + 4H^+(aq) + 4NO_3^-(aq) \longrightarrow Cu^{2+}(aq) + 2NO_3^-(aq) + 2NO_2(g) + 2H_2O(l)$

Balance a Net Ionic Redox Equation

Use with Example Problem 19.4, page 692.

Solve *Read Example Problem 19.4 in your text.*

You Try It

• Problem

Balance the net ionic redox equation for the reaction between the perchlorate ion and the iodide ion in acid solution.

$ClO_3^-(aq) + I^-(aq) \longrightarrow Cl^-(aq) + I_2(s)$ (in acid solution)

1. Analyze the Problem

Known: _____

_____

Unknown: _____

Section 19.2 Balancing Redox Equations (continued)

Main Idea **Details**

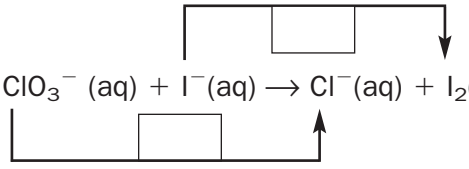
2. Solve for the Unknown

Step 1 Assign oxidation numbers to all the atoms in the equation.

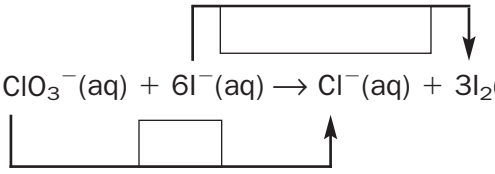
$ClO_3^-(aq) + I^-(aq) \longrightarrow Cl^-(aq) + I_2(s)$ (in acid solution)

Step 2 Identify which atoms are oxidized (using black arrows) and which are reduced (using red arrows).

Step 3 Determine the change in oxidation number for the atoms that are oxidized and for the atoms that are reduced. Complete the following tables.



Step 4 To make the net changes in oxidation number have the same magnitude, place the appropriate coefficients in front of the formulas in the equation.



Step 5 Write an equation that adds enough hydrogen ions and water molecules to balance the oxygen atoms on both sides.

_____

3. Evaluate the Answer

The number of atoms of each element is _____ on both sides of the equation. The net charge on the right _____ the net charge on the left. No subscripts have been _____.

Name _____ Date _____

Section 19.2 Balancing Redox Equations (continued)

Main Idea **Details**

Balancing Redox Equations Using Half-Reactions

Use with pages 693–694.

Identify *the number of species in each reaction. Then, show the oxidation half-reaction and the reduction half-reaction for each equation.*

Reaction	No. of Species	Half-Reaction	
		Oxidation	Reduction
$4Fe + 3O_2 \longrightarrow 2Fe_2O_3$			
$4Fe + 3Cl_2 \longrightarrow 2Fe_2Cl_3$			

Sequence *the steps for balancing by half-reactions.*

____ Adjust the coefficients so that the number of electrons lost in oxidation equals the number of electrons gained in reduction.

____ Write the net ionic equation for the reaction, omitting spectator ions.

____ Add the balanced half-reactions and return spectator ions.

____ Write the oxidation and reduction half-reactions for the net ionic equation.

____ Balance the atoms and charges in each half-reaction.

Name _____ Date _____

Section 19.2 Balancing Redox Reactions (continued)

Main Idea

Balance a Redox Equation by Using Half-Reactions

Use with Example Problem 19.5, page 695.

Details

Summarize *Fill in the blanks to help you take notes while you read Example Problem 19.5.*

Problem

Balance the redox equation for the _____ of permanganate and sulfur dioxide when sulfur dioxide ____ is bubbled into an _____ solution of _____.

$KMnO_4(aq) + SO_2(g) \longrightarrow MnSO_4(aq) + K_2SO_4(aq)$

1. Analyze the problem

Known: _____

_____

Unknown: _____

_____

2. Solve for the Unknown

Step 1: Write the net ionic equation for the reaction:

_____

Step 2: Using rule number 5, the oxidation number for Mn in MnO_4^- is ____. Using rule number 2, the oxidation number for Mn^{2+} is ____. The reduction half-reaction is _____.

Step 3(a): Balance the atoms and charges in the half-reaction.

_____.

Section 19.2 Balancing Redox Reactions (continued)

Main Idea **Details**

Step 3(b): The _____ ions are readily available and can be used to balance the charge in half-reactions in acid solutions. The number of H+ ions added to the right side of the oxidation half-reaction is _____. The number of H+ ions added to the left side of the reduction half-reaction is _____.

Write the oxidation half-reaction: _____.

Write the reduction half-reaction: _____.

Step 4: The number of electrons lost in oxidation is _____. The number of electrons gained in reduction is _____. The least common multiple of these numbers is _____. To balance the half-reactions, the atoms in the oxidation half-reaction must be multiplied by _____ and the atoms in the reduction half-reaction must be multiplied by _____. The oxidation half-reaction is now

_____

The reduction half-reaction is now

_____

Step 5 After adding the balanced half-reactions, write the redox reaction equation:

_____

Cancel or reduce like terms on both sides of the equation, then write the simplified equation:

_____

Return spectator ions _____ and restore the state descriptions.

_____

3. Evaluate the Answer

The number of _____ for each element is _____ on both sides of the equation and none of the subscripts have been changed.

Name _____ Date _____

Redox Reactions Chapter Wrap-Up

After reading this chapter, summarize the processes that occur in a redox reaction.

_____

_____

_____

_____

_____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Photosynthesis is an example of a series of naturally occurring redox reactions. In this context, discuss the importance of redox reactions to life on Earth.

_____

_____

_____

_____

Name _____ Date _____

Electrochemistry

Before You Read

Review Vocabulary *Define the following terms.*

energy _____

chemical potential energy _____

spontaneous process _____

_____

oxidation _____

reduction _____

half-reaction _____

_____

_____

_____

Chapter 9

Identify *three types of reactions.*

1. _____
2. _____
3. _____

Organize *the following elements from least active to most active. Refer to the activity series in Figure 9.13.*

aluminum, copper, calcium, gold, rubidium, iron, lead, potassium

_____

Name _____ Date _____

Electrochemistry

Section 20.1 Voltaic Cells

Main Idea — **Details**

Skim *Section 1 of your text. Focus on the headings, subheadings, boldfaced words, and the main ideas. Summarize three main ideas of this section.*

1. _____

2. _____

3. _____

New Vocabulary

Use your text to define each term.

salt bridge _____

electrochemical cell _____

_____

voltaic cell _____

_____

half-cell _____

_____

anode _____

cathode _____

reduction potential _____

standard hydrogen electrode _____

_____

Academic Vocabulary

Define the following term.

correspond _____

Name _____ Date _____

Section 20.1 Voltaic Cells (continued)

Main Idea — **Details**

Redox in Electrochemistry

Use with pages 708–709.

Explain *the branch of chemistry called electrochemistry.*

_____

_____

Write *the half-reactions of copper and zinc.*

_____ (reduction half-reaction: electrons _____)

_____ (oxidation half-reaction: electrons ___)

Explain *how an electrochemical cell uses a redox reaction.*

_____

_____

Chemistry of Voltaic Cells

Use with page 710.

Complete *each of the following statements.*

1. The electrode where oxidation takes place is called the _____.

2. The electrode where reduction takes place is called the _____.

3. An object's potential energy is _____.

4. In electrochemistry, _____ is a measure of the amount of _____ that can be generated from a _____ to do work.

Sequence *the steps of the electrochemical process that occur in a zinc-copper voltaic cell. The first one has been done for you.*

____ To complete the circuit, both positive and negative ions move through the salt bridge. The two half-reactions can be summed to show the overall cell reaction.

____ The electrons flow from the zinc strip and pass through the external circuit to the copper strip.

1 Electrons are produced in the oxidation half-cell according to this half-reaction: $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$.

____ Electrons enter the reduction half-cell where the following half-reaction occurs: $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$.

Name _____ Date _____

Section 20.1 Voltaic Cells (continued)

Main Idea | **Details**

Calculating Electrochemical Cell Potential

Use with pages 711–712.

Describe *reduction potential in relation to an electrode.*

Analyze *Table 20.1. Some of the E^0 (V)s are positive, some are negative. Explain the difference.*

Write *the abbreviated E^0 and half-reaction for each of the following:*

Element	Half-Reaction	E^0 (V)
Li		
Au		
$PbSO_4$		
Na		

Calculate a Cell Potential

Use with Example Problem 20.1, page 715.

Summarize *Fill the blanks to help you take notes while you read Example Problem 20.1.*

Problem

Calculate the overall cell reaction and the standard potential for the half-cells of a voltaic cell.

$I_2(s) + 2e^- \rightarrow 2I^-(aq)$

$Fe^{2+}(aq) + 2e^- \rightarrow Fe\ (s)$

1. **Analyze the Problem.**
   List the known and the unknown.
   Known: Standard reduction potentials for the half-cells
   Unknown: _____

Section 20.1 Voltaic Cells (continued)

Main Idea — **Details**

2. Solve for the unknown.

Find the standard reduction potentials for half-reactions.

$E^0_{I_2|I^-}$ = _____

$E^0_{Fe^{2+}|Fe}$ = _____

Rewrite the half−reactions in the correct direction.

reduction half−cell reaction: _____

oxidation half−cell reaction: _____

overall cell reaction: _____ $I_2(s) + Fe(s) \rightarrow Fe^{2+}(aq) + 2I^-(aq)$

Balance the reaction if necessary:

_____

Calculate cell standard potential:

$E^0_{cell} = E^0_{reduction} - E^0_{oxidation}$

$E^0_{cell} = +0.536\ V -$ _____

$E^0_{cell} = +$ _____

Write the reaction using cell notation:

_____

3. Evaluate the answer.

The answer seems reasonable given the _____ of the _____ that comprise it.

Using Standard Reduction Potentials

Use with page 716.

Write ***the steps for the process of predicting whether any proposed redox reaction will occur spontaneously.***

1. _____

2. _____

3. _____

_____

4. _____

5. _____

Name _____ Date _____

Electrochemistry

Section 20.2 Batteries

Main Idea — **Details**

Skim *Section 2 of your text. Write three questions that come to mind after reading the headings and the illustration captions.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

battery _____

dry cell _____

primary battery _____

secondary battery _____

fuel cell _____

corrosion _____

galvanization _____

Name _____ Date _____

Section 20.2 Batteries (continued)

Main Idea | **Details**

Dry Cells

Use with pages 718–720.

Write *the oxidation half-reaction for the dry cell of the most commonly used voltaic cell.*

_____

List *the paste and cathode type for each of the following batteries. So-called dry cell batteries contain different moist pastes in which the cathode half-reaction takes place.*

Zinc-carbon battery

Paste _____

Cathode type _____

Alkaline battery

Paste _____

Cathode type _____

Mercury battery

Paste _____

Cathode type _____

Compare and contrast *primary and secondary batteries.*

_____

_____

_____

_____

Explain *how NiCad batteries, often found in cordless tools and phones, are recharged.*

_____

_____

_____

Name _____ Date _____

Section 20.2 Batteries (continued)

Main Idea	Details

Lead-Acid Storage Battery

Use with pages 720–721.

Explain *how the following overall reaction of lead-acid batteries is different from traditional redox reactions.*

$Pb(s) + PbO_2(s) + 4H^+(aq) + 2SO_4^{2-}(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$

_____

_____

_____

_____

Lithium Batteries

Use with pages 721–722.

List *two reasons that scientists and engineers have focused a lot of attention on the element lithium to make batteries.*

1. _____

2. _____

Describe *two applications of lightweight lithium batteries.*

_____

_____

Fuel Cells

Use with pages 722–723.

Explain *the makeup of a fuel cell by completing the following paragraph and accompanying reactions.*

In a fuel cell, each electrode _____

that allows contact between the _____

_____. The walls of the chamber also contain _____,

such as powdered platinum or palladium, which _____.

oxidation half-reaction: _____

reduction half-reaction: _____

overall cell reaction: _____

The overall cell reaction is the same as the equation for the _____

_____.

List *three reasons why PEMs are used instead of a liquid electrode.*

1. _____

2. _____

3. _____

Name _____ Date _____

Section 20.2 Batteries (continued)

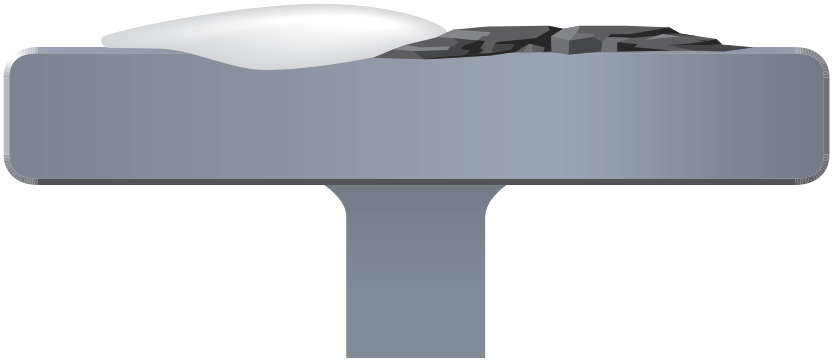
Main Idea | **Details**

Corrosion

Use with pages 724–727.

Compare *rusting of metal to redox reactions in voltaic cells.*

Draw *and label the parts of the corrosion reaction in Figure 20.15. Be sure to identify the anode and cathode.*



Explain *why rusting is a slow process. List a way that it might be sped up in certain areas.*

Explain *the two ways galvanizing helps prevent corrosion.*

1. _____

2. _____

Name _____ Date _____

Electrochemistry

Section 20.3 Electrolysis

Main Idea — **Details**

Scan *Section 3 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all formulas.
- Look at all figures and read the captions.
- Think about what you already know about electrolysis.

Write *three facts you discovered about electrolysis as you scanned the section.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

electrolysis _____

electrolytic cell _____

Name _____ Date _____

Section 20.3 Electrolysis (continued)

Main Idea	Details
Reversing Redox Reactions *Use with page 728.*	**Describe** *how it is possible to reverse a spontaneous redox reaction in an electrochemical cell.*
Applications of Electrolysis *Use with pages 729–732.*	**Compare** *the reactions involved in sodium chloride to those in the electrolysis of brine.* **Explain** *the importance of electrolysis in the purification of metals.*

Name _____ **Date** _____

Electrochemistry Chapter Wrap-Up

After reading this chapter, list three important facts you have learned about electrochemistry.

1. _____

_____

2. _____

_____

3. _____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Describe how electrochemistry is involved in producing energy in batteries.

_____

_____

_____

Name _____ Date _____

Hydrocarbons

Before You Read

Review Vocabulary **Define** *each term.*

covalent bond

Lewis structure

Chapter 8

Draw *the Lewis structure for* NH_3.

Chapter 12

Compare and contrast *melting and boiling.*

Name _____ Date _____

Hydrocarbons

Section 21.1 Introduction to Hydrocarbons

Main Idea — **Details**

Scan *Section 1 of your text. Use the checklist below as a guide.*

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

Write *three facts you discovered about hydrocarbons.*

1. _____

2. _____

_____

3. _____

New Vocabulary *Use your text to define each term.*

organic compound _____

_____

hydrocarbon _____

_____

saturated hydrocarbon _____

unsaturated hydrocarbon _____

_____

fractional distillation _____

cracking _____

_____

Name _____ Date _____

Section 21.1 Introduction to Hydrocarbons (continued)

Main Idea — Details

Organic Compounds

Use with pages 744–745.

Explain *the evolution of the contemporary understanding of the term organic compound.*

In the early nineteenth century, chemists referred to the variety of carbon compounds produced by living things as organic compounds.

↓

↓

Today the term organic compound is applied to all carbon-containing compounds with the primary exceptions of carbon oxides, carbides, and carbonates, which are considered inorganic.

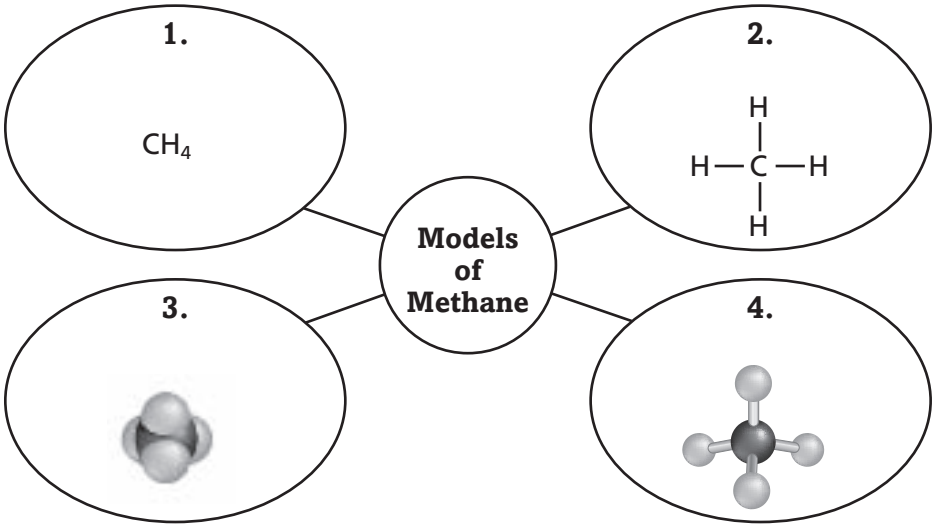
Explain *why many compounds contain carbon by completing the following statements.*

Carbon's _____ allows it to make four covalent bonds. In organic compounds, carbon atoms bond to _____ or other elements near carbon on the periodic table. Carbon atoms also bond to _____ and can form long _____.

Hydrocarbons

Use with pages 745–746.

Label *the web below with the correct name for each model of methane.*



Name _____ Date _____

Section 21.1 Introduction to Hydrocarbons (continued)

Main Idea — **Details**

Multiple Carbon-Carbon Bonds

Use with page 746.

Organize *the outline below.*

I. Ways that carbon atoms bond to each other

A. _____

1. share _____

2. also called _____

B. _____

1. share _____

2. also called _____

C. _____

1. share _____

2. also called _____

Draw *models of each carbon-carbon bond and label them appropriately. Use the illustrations on page 710 of your text as a guide.*

Single Covalent Bond	Double Covalent Bond	Triple Covalent Bond

Name _____ Date _____

Section 21.1 Introduction to Hydrocarbons (continued)

Main Idea — **Details**

Refining Hydrocarbons

Use with pages 747–748.

Identify *natural sources of hydrocarbons by completing the following statements.*

The main natural source of hydrocarbons is _____, a complex mixture containing more than a thousand _____. Petroleum is more useful to humans when _____ _____, called _____. Separation is carried out by _____ _____, a process called fractional distillation.

Sequence *the process of fractional distillation.*

____ Vapors travel up through the column.

____ Temperature is controlled to remain near 400° at the bottom of the fractionating tower.

____ Hydrocarbons with fewer carbon atoms remain in the vapor phase until they reach regions of cooler temperatures farther up the column.

____ Hydrocarbons with more carbon atoms condense closer to the bottom or the tower and are drawn off.

____ Petroleum boils and gradually moves toward the top.

Match the names of these two processes with their definitions.

1. fractional distillation **2.** cracking

_____ is done to break the larger molecules of petroleum components into smaller molecules.

_____ separates petroleum into simpler components.

Rating Gasoline

Use with pages 748–749.

Explain *why branched-chain alkanes make better gasolines than straight-chain hydrocarbons.*

_____

_____

_____

_____

Name _____ Date _____

Hydrocarbons

Section 21.2 Alkanes

Main Idea — **Details**

Skim *Section 2 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.*

alkane _____

homologous series _____

parent chain _____

substituent group _____

_____

cyclic hydrocarbon _____

cycloalkane _____

_____

Academic Vocabulary *Define the following terms.*

substitute _____

Name _____ Date _____

Section 21.2 Alkanes

Main Idea **Details**

Straight-Chain Alkanes

Use with pages 750–751.

Compare and contrast *the models in the table below.*

Type of Model	Description of Model
1. Molecular formula	
2. Structural formula	
3. Space-filling model	
4. Ball-and-stick model	

Describe ***straight-chain alkanes by completing the following sentences.***

The first four compounds in the straight-chain series of alkanes are _____. The names of all alkanes end in _____. Because the first four alkanes were named before there was a complete understanding of alkane structures, their names do not have _____ as do the alkanes with _____ in a chain. Chemists use _____ _____ to save space.

Explain ***the structural formula of the following hydrocarbons. The first has been done for you.***

1. Methane is formed from one atom of carbon and four atoms of hydrogen.
2. Butane is formed _____.
3. Octane is formed _____ _____.
4. Decane is formed _____ _____.

Analyze ***how the function of a homologous series is evidenced in the condensed structural formula of nonane.***

_____

_____

_____

Name _____ Date _____

Section 21.2 Alkanes (continued)

Main Idea — **Details**

Branched-Chain Alkanes

Use with page 752.

Compare *three characteristics of butane and isobutane.*

Naming Branched-Chain Alkanes

Use with page 753.

Describe *naming branched-chain alkanes.*

A straight-chain and a branched-chain alkane can have the same molecular formula.

PRINCIPLE

Therefore, the name of an organic compound also must describe

NAMING PROCESS

Branched-chain alkanes are viewed as consisting of a

NAMING, PART 1

The longest continuous chain of carbon atoms is called .

NAMING, PART 2

All side branches are called because they appear to substitute for a hydrogen atom in the straight chain.

NAMING, PART 3

Each alkane-based substituent group branching from the parent chain is named

Name _____ Date _____

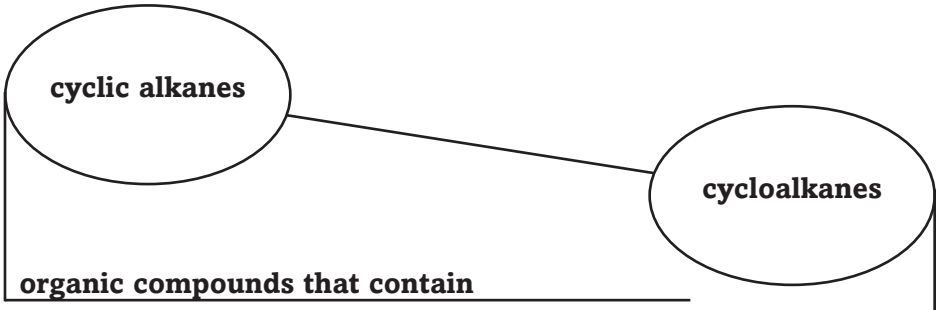
Section 21.2 Alkanes (continued)

Main Idea — **Details**

Cycloalkanes

Use with pages 755–756.

Organize *the concept web below.*



organic compounds that contain _____

the prefix *cyclo-* indicates a _____

possible to have three, four, five, six, or even more _____

represented by condensed, skeletal, _____

can have _____ **groups**

Properties of Alkanes

Use with pages 757–758.

Classify *the properties of alkanes into categories.*

General Properties (3)	Physical Properties (4)	Chemical Properties (2)

Name _____ Date _____

Hydrocarbons

Section 21.3 Alkenes and Alkynes

Main Idea — **Details**

Scan *Section 3 of your text. Focus on the headings, subheadings, boldfaced words, and the main ideas. Set the book aside and, in the space below, summarize the main ideas of this section.*

_____

_____

_____

_____

_____

New Vocabulary *Use your text to define each term.*

alkene _____

_____

alkyne _____

_____

Name _____ Date _____

Section 21.3 Alkenes and Alkynes (continued)

Main Idea — **Details**

Alkenes

Use with pages 759–760.

Identify *five facts about alkenes as discussed in your text.*

1. _____

_____

2. _____

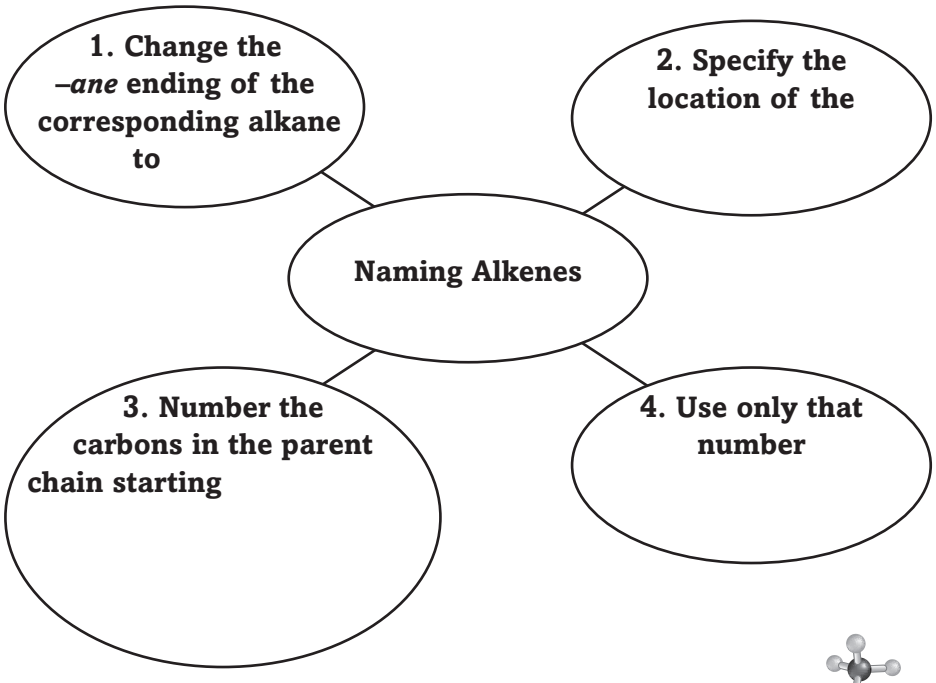
3. _____

_____

4. _____

5. _____

Sequence *the factors involved in naming an alkene with four or more carbons in the chain using the web below and number the steps.*



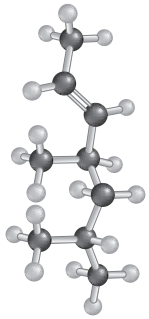
Naming Branched-Chain Alkenes

Use with Example Problem 21.3, page 761.

Summarize *Use the following to help you take notes as you read Example Problem 21.3 in your text.*

Problem

Name the following alkene.



Name _____ Date _____

Section 21.3 Alkenes and Alkynes (continued)

Main Idea | **Details**

1. **Analyze the Problem**
   You are given a branch-chained alkene that contains one double bond and two alkyl groups. Follow the IUPAC rules to name the organic compound.

2. **Solve for the Unknown**
   a. The longest continuous carbon chain that includes the double bond contains _____ carbons. The _____ alkane is heptane, but the name is changed to _____ because a double bond is present.

   b. and **c.** Number the chain to give the lowest number to the double bond and name each substituent.

   d. Determine how many of each substituent is present, and assign the correct prefix to represent that number. Then, include the position numbers to get the complete prefix.

   e. The names of substituents _____ _____.

   f. Apply the complete prefix to the name of the parent alkene chain. Use commas to separate numbers and hyphens between numbers and words. Write the name _____.

3. **Evaluate the Answer**
   The longest carbon chain includes the _____, and the position of the double bond has the _____. Correct prefixes and alkyl-group names _____.

Alkynes

Use with pages 762–764.

Compare and contrast *alkenes and alkynes.*

_____

_____

Name _____ Date _____

Hydrocarbons

Section 21.4 Hydrocarbon Isomers

Main Idea — **Details**

Skim *Section 4 of your text. Write two questions that come to mind from reading the headings and the illustration captions.*

1. _____

2. _____

New Vocabulary *Use your text to define each term.*

isomer _____

structural isomer _____

stereoisomer _____

geometric isomer _____

chirality _____

asymmetric carbon _____

optical isomer _____

optical rotation _____

Name _____ **Date** _____

Section 21.4 Hydrocarbon Isomers (continued)

Main Idea — **Details**

Structural Isomers

Use with page 765.

Organize *the outline below.*

I. _____:Two or more compounds that have the same molecular formula but different molecular structures.

A. Two types of isomers

1. Structural isomers

a. _____

b. _____

_____

i. Examples include _____

_____

Stereoisomers

Use with page 766.

2. Stereoisomers

a. _____

_____

i. _____

ii. _____

_____

b. _____

i. Result from different arrangements of groups around a double bond

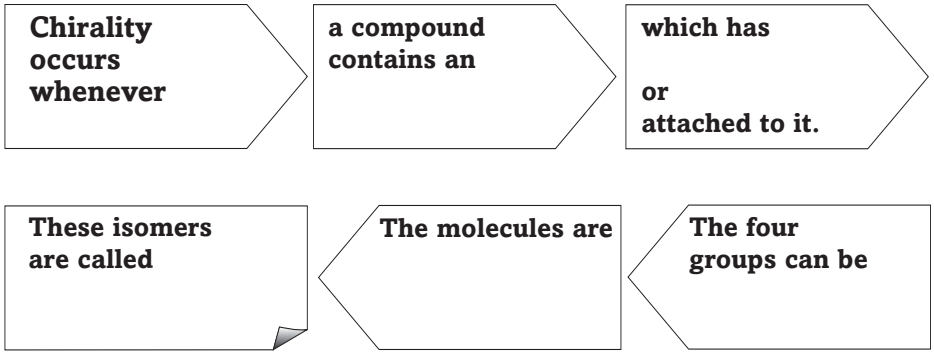
1. Possible _____ with *trans*-fatty acids.

2. The _____ seem not to be as harmful.

Chiralty

Use with page 767.

Describe *chirality by completing the flow chart below.*



Name _____ Date _____

Section 21.4 Hydrocarbon Isomers (continued)

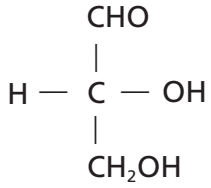
Main Idea **Details**

Optical Isomers

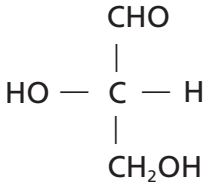
Use with pages 768–769.

Identify *the types of isomers shown below. Which pair are optical isomers?*

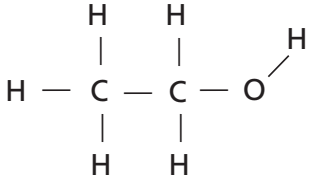
D-glyceraldehyde



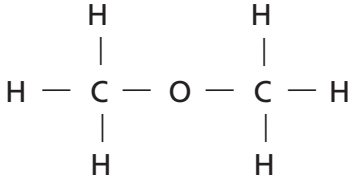
L-glyceraldehyde



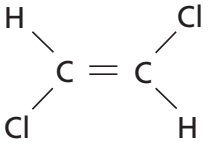
ethanol



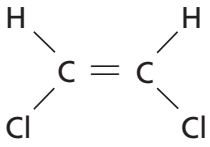
methoxymethane



***trans*-1,2-dichloroethene**



***cis*-1,2-dichloroethene**



COMPARE Explain what a pair of shoes and crystals of the organic compound tartaric acid have in common.

Name _____ Date _____

Hydrocarbons

Section 21.5 Aromatic Hydrocarbons

Main Idea — **Details**

Skim *Section 5 of your text. Focus on the headings, subheadings, boldfaced words, and the main ideas. Summarize the main ideas of this section.*

_____

_____

_____

_____

_____

New Vocabulary *Use your text to define each term.*

aromatic compound _____

aliphatic compound _____

Name _____ **Date** _____

Section 21.5 Aromatic Hydrocarbons (continued)

Main Idea — **Details**

Aromatic Compounds

Use with pages 771–772.

Classify *the properties of aromatic and aliphatic compounds.*

	Structural Characteristics	Reactivity
Aromatic Compounds		
Aliphatic Compounds		

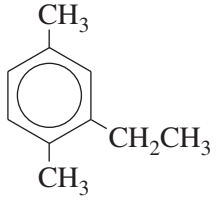
Model *Draw a model of a fused ring system.*

Explain *how substituted benzene rings are numbered.*

_____

_____

Number *the substituted benzene ring in the structure below, then name the structure.*



Name _____ **Date** _____

Hydrocarbons Chapter Wrap-Up

Now that you have read the chapter, review what you have learned; list the types of models used to represent chemical compounds and name the different categories of hydrocarbons.

Hydrocarbons: **Models:**

Alkanes

_____ _____

_____ _____

_____ _____

Alkenes

_____

Alkynes

Isomers

_____ _____

_____ _____

Aromatic _____ Aliphatic _____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

SUMMARIZE

Explain how hydrocarbons have contributed to space exploration.

_____

_____

_____

Name _____ Date _____

Substituted Hydrocarbons and Their Reactions

Before You Read

Review Vocabulary *Define the following terms.*

periodic table _____

compound _____

halogens _____

chemical bond _____

catalyst _____

Chapter 21

Compare and contrast *stereoisomers with structural isomers.*

_____

Name _____ Date _____

Substituted Hydrocarbons and Their Reactions

Section 22.1 Alkyl Halides and Aryl Halides

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.*

functional group _____

_____

halocarbon _____

alkyl halide _____

_____

aryl halide _____

_____

substitution reaction _____

_____

halogenation _____

_____

Section 22.1 Alkyl Halides and Aryl Halides (continued)

Main Idea — **Details**

Functional Groups

Use with pages 786–787.

Describe *how a functional group can be helpful in determining how a molecule reacts.*

_____

_____

_____

_____

Identify *the meaning of each of the following symbols for functional groups.*

* represents _____

R and R′ represents _____

_____

Organize *information about organic compounds and their functional groups by completing the table below.*

Compound Type	General Formula	Functional Group
Halocarbon		Halogen
	R-OH	
		Ether
	R-NH2	
Aldehyde		
		Carbonyl
		Carbonyl
		Ester
		Amido

Name _____ Date _____

Section 22.1 Alkyl Halides and Aryl Halides (continued)

Main Idea	Details
Organic Compounds Containing Halogens *Use with pages 787–788.*	**Compare and contrast** *alkyl halides and aryl halides.* _____ _____ _____
Naming Halocarbons *Use with page 788.*	**Describe** *how to name halocarbons by completing the following paragraph.* Organic molecules containing functional groups are given IUPAC names based on their _____. For the alkyl halides, a prefix indicates which _____ is present. The prefixes are formed by _____.
Properties and Uses of Halocarbons *Use with page 789.*	**Examine** *Table 22.2 on page 789. Write three observations you make regarding the compounds listed in the table.* **1.** _____ **2.** _____ **3.** _____
Substitution Reactions *Use with page 790.*	**Sequence** *the steps needed to add Cl_2 to ethane to create chloroethane. Use the reaction from the bottom of page 741 in your text as a reference.* **1.** _____ **2.** _____ **3.** _____ **4.** _____ **Create** *another substitution reaction using Br2 and methane. Label molecules in each part of the reaction.* _____ _____

Name _____ Date _____

Substituted Hydrocarbons and Their Reactions

Section 22.2 Alcohols, Ethers, and Amines

Main Idea — **Details**

Scan *Section 2 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all formulas.
- Look at all figures and read the captions.
- Think about what you already know about alcohols, ethers, and amines.

Write *three facts you discovered about alcohols as you scanned the section.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

hydroxyl group _____

alcohol _____

_____

denatured alcohol _____

_____

Define the following terms and write the general formula for each term.

ether _____

_____

amine _____

_____

Academic Vocabulary *Define the following term.*

bond _____

Name _____ Date _____

Section 22.2 Alcohols, Ethers, and Amines (continued)

Main Idea | **Details**

Alcohols

Use with pages 792–793.

Describe *alcohol by completing the following sentence.*

Because they readily form hydrogen bonds, alcohols have _____ boiling points and _____ water solubility than other organic compounds.

Write *the general formula for alcohol:*

_____

Draw *structures for the following molecules.*

1-butanol

2-butanol

Ethers

Use with page 794.

Describe *ethers by completing the following sentence.*

Ethers are similar to _____ as they are compounds in which oxygen is bonded to _____. Ethers are different from alcohols because the oxygen atom bonds with ____ carbon atoms. Ethers are much less _____ in water than alcohol because they have no _____ to donate to a hydrogen bond.

Section 22.2 Alcohols, Ethers, and Amines (continued)

Main Idea | **Details**

Write *the general formula for ethers:*

_____

Draw *a structure for the following molecule.*

ethyl ether

Amines

Use with page 795.

Complete *the following sentence.*

Amines contain _____ atoms bonded to carbon atoms in _____ chains or _____ rings. Amines are responsible for many of the _____ associated with decay.

Write *the general formula for amines:*

_____

Draw *a structure for the following molecule.*

ethylamine

Name _____ Date _____

Substituted Hydrocarbons and Their Reactions

Section 22.3 Carbonyl Compounds

Main Idea — **Details**

Skim *Section 3 of your text. Write two questions that come to mind from reading the headings and the illustration captions.*

1. _____

2. _____

New Vocabulary *Use your text to define each term.*

ketone _____

_____

carboxylic acid _____

carboxyl group _____

ester _____

_____

amide _____

_____

Define the following terms and write the general formula of each.

carbonyl group _____

_____

aldehyde _____

_____

_____

condensation reaction _____

_____

_____

Name _____ Date _____

Section 22.3 Carbonyl Compounds (continued)

Main Idea — **Details**

Organic Compounds Containing the Carbonyl Group

Use with pages 796–800.

Identify *five important classes of organic compounds containing or made from carbonyl compounds:*

a. _____

b. _____

c. _____

d. _____

e. _____

Describe *the common structure of aldehydes and ketones.*

_____

_____

_____

Carboxylic Acids

Use with page 798.

Draw *a molecule of a carboxylic acid.*

Organic Compounds Derived From Carboxylic Acids

Use with pages 799–800.

Describe *organic compounds that are derived from carboxylic acids by completing the following paragraph.*

Several classes of organic compound have structures in which the _____ of a carboxylic acid is replaced by _____ or _____. The two most common types are _____.

Name _____ Date _____

Section 22.3 Carbonyl Compounds (continued)

Main Idea — **Details**

Condensation Reactions

Use with page 801.

Sequence *the steps for a condensation reaction.*

____ A small molecule, such as water, is lost.

____ Two organic molecules combine.

____ A more complex molecule is formed.

Complete *the following condensation reaction.*

RCOOH + R′OH → _____

Summarize

Identify *the functional group that corresponds to each of the following:*

a. *-ine* at the end of each halogen name to *–o* _____

b. adding *–amine* as the suffix _____

c. *-ane* of the parent alkane to *–ol* _____

d. replacing *–e* ending with *–amide* _____

e. *–e* at the end of the name to *–al* _____

f. *–ane* of the parent alkane to *–anolic acid* _____

g. *-ic acid* ending replaced by *–ate* _____

h. *–e* end of the alkane replaced by *–one* _____

Name _____ Date _____

Substituted Hydrocarbons and Their Reactions

Section 22.4 Other Reactions of Organic Compounds

Main Idea — **Details**

Scan *Section 4 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all formulas.
- Look at all figures and read the captions.

Write *three facts you discovered about organic reactions.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

elimination reaction _____

dehydrogenation reaction _____

dehydration reaction _____

addition reaction _____

hydration reaction _____

hydrogenation reaction _____

Name _____ **Date** _____

Section 22.4 Other Reactions of Organic Compounds (continued)

Main Idea

Classifying Reactions of Organic Substances

Use with pages 802–805.

Details

List *what needs to happen for chemical reactions of organic substances to occur. Include when and why a catalyst might be needed.*

1. _____
2. _____
3. _____

Review *the section and give an example formula for each of the following reaction types.*

addition reaction

hydration reaction

dehydrogenation reaction

dehydration reaction

hydrogenation reaction

elimination reaction

Name _____ Date _____

Section 22.4 Other Reactions of Organic Compounds (continued)

Main Idea | **Details**

Oxidation-Reduction Reactions

Use with Pages 806–807

Describe *oxidation-reduction reactions by completing the following statements.*

Many _____ compounds can be converted to other compounds by _____ and _____ reactions. _____ is the loss of _____. A substance is oxidized when it gains _____ or loses _____. Reduction is the _____ of electrons. A substance is reduced when it loses _____ or gains _____.

Predicting Products of Organic Reactions

Use with Pages 807–808.

Write *the generic equation representing an addition reaction between an alkene and an alkyl halide.*

Substitute *the structure for cyclopentene and the formula for hydrogen bromide. From the equation, you can see that:*

A _____ and a _____ add across the _____ to form an _____ .

Draw *the formula for the likely product.*

Name _____ Date _____

Substituted Hydrocarbons and Their Reactions

Section 22.5 Polymers

Main Idea — **Details**

Scan *Section 5 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Read all tables and formulas.
- Look at all figures and read the captions.

Write *three facts you discovered about polymers.*

1. _____
2. _____
3. _____

New Vocabulary *Use your text to define each term.*

polymer _____

monomer _____

polymerization reaction _____

addition polymerization _____

_____

condensation polymerization _____

_____

thermoplastic _____

_____

thermosetting _____

_____

Name _____ Date _____

Section 22.5 Polymers (continued)

Main Idea **Details**

The Age of Polymers

Use with page 809.

Identify *three common polymers described in the text. Include their uses.*

1. _____

2. _____

3. _____

Reactions Used to Make Polymers

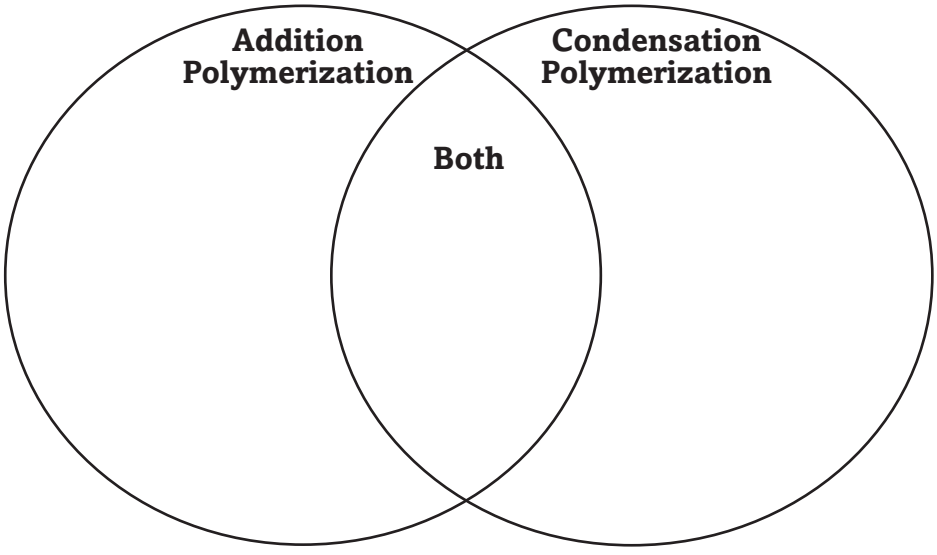
Use with page 810–811.

Identify *the monomers or polymers.*

Monomer (s)	Polymer (s)
Ethylene	
	Nylon 6.6
Urethane	

Compare and contrast *condensation polymerization with addition polymerization by placing the terms below into the Venn diagram.*

- all atoms present in final product
- small by-product, usually water
- involves the bonding of monomers



Name _____ Date _____

Section 22.5 Polymers (continued)

Main Idea — **Details**

Common Polymers

Use with page 812.

Identify *the common polymer. Use Table 22.4 in your text as a reference.*

Use	Polymers
Foam furniture cushions	
A planter	
Nonstick cookware	
Food wrap	
Windows	
Clothing	
Carpet	
Water pipes	
Beverage containers	

Properties and Recycling of Polymers

Use with pages 813–814.

Identify *four reasons that many different polymers are widely used in manufacturing.*

1. _____

2. _____

3. _____

4. _____

Describe *the melting characteristics of thermoplastic polymers and thermosetting polymers.*

Thermoplastic polymers _____

_____.

Thermosetting polymers _____

_____.

Name _____ **Date** _____

Section 22.5 Polymers (continued)

Main Idea **Details**

Discuss *recycling by completing the following paragraph.*

Americans are not efficient at recycling their plastics. Currently, only _____ of plastic waste is recycled. This low rate of _____ _____ is due in part to the _____. Plastics must be _____ according to _____, which is _____ and _____. The plastic industry has _____ that indicate the _____ of each plastic product to make the process easier on individuals.

Describe *what the code of recycling polymers does. Give an example of the code from the textbook.*

_____

_____

_____

Real-World Connection

Describe some common polymers that you use every day.

_____

_____

_____

_____

_____

Name _____ **Date** _____

Substituted Hydrocarbons and Their Reactions Chapter Wrap-Up

After reading this chapter, list three things you have learned about substituted hydrocarbons and their reactions.

1. _____

2. _____

3. _____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Examine the picture of spooled threads on page 736. Explain how monomers might be a part of the process that produces these spooled polymer threads.

_____

_____

_____

Name _____ Date _____

The Chemistry of Life

Before You Read

Review Vocabulary *Define the following terms.*

hydrogen bond _____

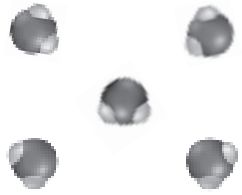
isomers _____

functional group _____

polymers _____

Chapter 12

Illustrate *the hydrogen bonding between water molecules.*



Chapter 22

Illustrate *the molecules for flouroethane and 1,2 difluoropronane.*

Name _____ Date _____

The Chemistry of Life

Section 23.1 Proteins

Main Idea **Details**

Skim *Section 1 of your text. Focus on the headings, subheadings, boldfaced words, and the main ideas. Summarize three main ideas of this section.*

_____

_____

_____

New Vocabulary *Use your text to define each term.*

protein _____

amino acid _____

_____

peptide bond _____

peptide _____

denaturation _____

_____

enzyme _____

substrate _____

active site _____

Section 23.1 Proteins (continued)

Main Idea | **Details**

Protein Structure

Use with pages 826–829.

Draw *and label a general amino acid with a variable side chain, an amino group, and a carboxyl group.*

Describe *the structure of a dipeptide and its functional units.*

Rewrite *each of the following statements, making each true.*

To function properly, each protein must be flat.

_____

_____

A dipeptide consists of an amino acid with two side chains.

_____

_____

Complete *the following paragraph statements about peptide bonds.*

When a peptide bond is formed, _____ is released in the process.

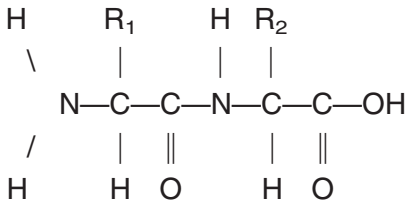
This type of reaction is known as a _____ reaction.

Name _____ Date _____

Section 23.1 Proteins (continued)

Main Idea — **Details**

Identify *the peptide bond between the following amino acids.*



Explain *why Gly-Phe is a different molecule than the Phe-Gly.*

_____

_____

Describe *three changes in environment that will uncoil or otherwise denature a protein.*

1. _____

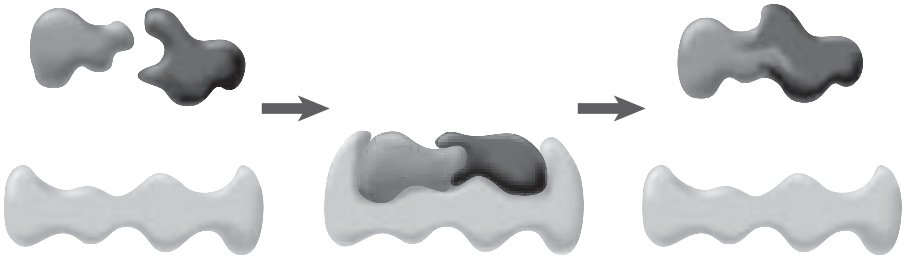
2. _____

3. _____

The Many Functions of Proteins

Use with pages 829–831.

Draw *an enzyme/substrate complex with the enzyme and substrates labeled.*



Name _____ **Date** _____

Section 23.1 Proteins (continued)

Main Idea **Details**

Describe *how the following functions affect living organisms by giving an example from your text.*

Enzymes: _____

Transport proteins: _____

Structural proteins: _____

Hormones: _____

Review *the statements below and revise to make them correct.*

1. Substrates bind to an enzyme site.

2. An active site changes shape a great deal to accommodate the substrate.

3. An enzyme-substrate complex changes the enzyme, and it becomes part of the new molecule.

Name _____ Date _____

The Chemistry of Life

Section 23.2 Carbohydrates

Main Idea — **Details**

Scan *Section 2 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Look at all figures and read the captions.
- Think about what you already know about carbohydrates.

Write *three facts you discovered about carbohydrates as you scanned the section.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

carbohydrate _____

_____

monosaccharide _____

disaccharide _____

polysaccharide _____

_____

Name _____ Date _____

Section 23.2 Carbohydrates (continued)

Main Idea — **Details**

Kinds of Carbohydrates

Use with pages 832–834.

Draw *the cyclic and open-chain structures of the monosaccharide glucose.*

Explain *how the monosaccharides glucose and galactose differ. Discuss why they would not react the same way in nature.*

Describe *the structure and composition of the following types of carbohydrates by completing this table.*

Carbohydrate	Example	Structure and composition
starch		
cellulose		
glycogen		
glucose		

Name _____ Date _____

The Chemistry of Life

Section 23.3 Lipids

Main Idea **Details**

Scan *Section 3 of your text. Use the checklist below as a guide.*

- Read all section titles.
- Read all boldfaced words.
- Look at all figures and read the captions.
- Think about what you already know about lipids.

Write *three facts you discovered about lipids as you scanned the section.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

lipid _____

fatty acid _____

triglyceride _____

saponification _____

_____

phospholipid _____

_____

wax _____

steroid _____

Name _____ **Date** _____

Section 23.3 Lipids (continued)

Main Idea | **Details**

What is a lipid?

Use with pages 835–839.

Describe *how a lipid differs from a protein or carbohydrate.*

Compare and contrast *saturated and unsaturated fatty acids. Give an example of each.*

Explain *the reactions that form triglycerides. Give the type of reaction as well as the substrates.*

Name _____ **Date** _____

Section 23.3 Lipids (continued)

Main Idea **Details**

Describe *how waxes are made and what their specific properties include.*

_____

_____

_____

Describe *a lipid that is not composed of fatty acid chains. Give an example.*

_____

_____

_____

SYNTHESIZE

List the important functions for each of the following types of lipids.

triglyceride _____

phospholipid _____

waxes _____

steroids _____

_____

Name _____ Date _____

The Chemistry of Life

Section 23.4 Nucleic Acids

Main Idea — **Details**

Skim *Section 4 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.*

nucleic acid _____

nucleotide _____

Name _____ Date _____

Section 23.4 Nucleic Acids (continued)

Main Idea | **Details**

Structure of Nucleic Acids

Use with page 840.

Draw *a diagram of a nucleotide. Label all of the parts: sugar, phosphate group, and nitrogen-containing base.*

DNA: The Double Helix

Use with pages 841–842.

Write *a statement that differentiates between nucleotides and nucleic acids.*

_____

Sequence *the events of DNA replication. The first one has been done for you.*

____ Hydrogen bonds form between new nitrogen bases and the existing strand.

____ Two nucleotide strands unzip.

____ Nitrogen bases pair adenine with thymine, cytosine with guanine.

__1__ An enzyme breaks the hydrogen bonds between the nitrogen bases.

____ The nucleotide strands separate to expose the nitrogen bases.

____ Free nucleotides are delivered by enzymes from the surrounding environment.

Predict *the complimentary base pairing given the following strand of nucleotides.*

A T C T A T C G G A T A T C T G

_____

Name _____ Date _____

Section 23.4 Nucleic Acids (continued)

Main Idea **Details**

RNA

Use with page 843.

Identify *differences in DNA and RNA.*

	DNA	RNA
Sugar		
Nitrogen Bases		
Function		
Form of strand		

State *whether you would find each of the following in DNA, RNA, both, or neither. Explain your answer.*

A-A	
A-T	
C-G	
G-A	
A-U	
U-A	

Real-World Connection

Suppose you are an assistant to a forensic scientist who has found an unknown sample of DNA at a crime scene. Upon analysis, he finds it contains 22% thymine molecules. A DNA sample that contains 40% guanine is obtained from a suspect who is brought in. You ask for the suspect's release. Explain your reasoning based on the bonding patterns of DNA nucleotides.

Name _____ Date _____

The Chemistry of Life

Section 23.5 Metabolism

Main Idea — **Details**

Skim *Section 5 of your text. Focus on the headings, subheadings, boldfaced words, and the main ideas. List three main ideas of this section.*

1. _____
2. _____
3. _____

New Vocabulary *Use your text to define each term.*

metabolism _____

catabolism _____

_____

anabolism _____

_____

ATP _____

_____

photosynthesis _____

_____

cellular respiration _____

_____

fermentation _____

Academic Vocabulary *Define the following term.*

conceptualize _____

Name _____ Date _____

Section 23.5 Metabolism (continued)

Main Idea	Details
Anabolism and Catabolism *Use with pages 844–845.*	**Explain** *the relationship between metabolism, catabolism, and anabolism.* **Explain** *how ATP is able to store and release energy in the cells of organisms.*
Photosynthesis *Use with page 846.*	**Write** *the reaction of photosynthesis. Label the individual molecules.* **Identify** *the redox process that occurs during photosynthesis.*

Name _____ Date _____

Section 23.5 Metabolism (continued)

Main Idea

Cellular Respiration

Use with page 846.

Details

Write *the reaction of cellular respiration. Be sure to label the individual molecules.*

Identify *the redox process that occurs during cellular respiration.*

Summarize *the relationship between photosynthesis and cellular respiration.*

Name _____ Date _____

Section 23.5 Metabolism (continued)

Main Idea | **Details**

Fermentation

Use with pages 847–848.

Compare and contrast *alcoholic fermentation and lactic acid fermentation.*

REAL-WORLD CONNECTION

Explain why the redox processes that occur during photosynthesis are vital to life.

Name _____ Date _____

The Chemistry of Life Chapter Wrap-Up

Now that you have read the chapter, review what you have learned. Write out the major concepts from the chapter.

_____

_____

_____

_____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Explain why someone with a liver disorder might be advised to avoid overexertion.

_____

_____

_____

_____

_____

Name _____ Date _____

Nuclear Chemistry

Before You Read

Review Vocabulary *Define the following terms.*

isotopes _____

_____

nuclear reaction _____

electron _____

Chapter 4

Use your text to review the following concepts which will help you understand this chapter.

List *the three kinds of subatomic particles discussed in Chapter 4.*

1. _____
2. _____
3. _____

Draw and label *a nuclear model of the atom. Use Figure 4.14 as a reference.*

_____

_____

Identify *the primary factor in determining an atom's stability.*

_____

Name _____ Date _____

Nuclear Chemistry

Section 24.1 Nuclear Radiation

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.*

radioisotope _____

X ray _____

penetrating power _____

Name _____ Date _____

Section 24.1 Nuclear Radiation (continued)

Main Idea — **Details**

Comparison of Chemical and Nuclear Reactions

Use with page 860.

Contrast *chemical and nuclear reactions.*

Chemical Reactions	Nuclear Reactions
bonds are and formed	nuclei emit
atoms are , though they may be rearranged	are converted into atoms of another element
reaction rate by pressure, temperature, concentration, and catalyst	reaction rate by pressure, temperature, concentration, or catalyst
involve only valence	may involve protons,
energy changes	energy changes

The Discovery of Radioactivity

Use with pages 860–861.

Summarize *the discovery of radioactivity. Review the dates on the timeline below. Use your text to fill in the important achievements in radioactive research on those dates.*

1895 Roentgen _____

_____

1895 Becquerel _____

_____

1898 The Curies _____

_____

1903 The Curies and Becquerel _____

1911 Marie Curie _____

Name _____ **Date** _____

Section 24.1 Nuclear Radiation (continued)

Main Idea **Details**

Types of Radiation

Use with pages 861–864.

Identify *the common type of radiation signified by each symbol.*

α _____

β _____

γ _____

Differentiate *between each of the subatomic radiation particles mentioned in the chapter.*

Radiation Type	Charge	Mass	Relative Penetrating Power
Alpha			
Beta			
Gamma			

Describe *what happens when a radioactive nucleus emits an alpha particle.*

_____

_____

Describe *beta particles by completing the following statements.*

A beta particle is a very fast-moving _____. To represent its insignificant mass, beta particles have a superscript of _____. A subscript of –1 denotes the _____ charge of beta particles. Beta particles have greater _____ than alpha particles.

Describe *what the subscript and superscript of zero tell you about gamma particles.*

_____

_____

Name _____ Date _____

Nuclear Chemistry

Section 24.2 Radioactive Decay

Main Idea — **Details**

Scan *Section 2, using the checklist below as a guide.*

- Read all section titles and boldfaced words.
- Study all tables, graphs, and figures.

Write *two facts you discovered about transmutation.*

1. _____

2. _____

New Vocabulary *Use your text to define each term.*

transmutation _____

nucleon _____

strong nuclear force _____

_____

band of stability _____

positron emission _____

_____

positron _____

electron capture _____

_____

radioactive decay series _____

_____

half-life _____

_____

radiochemical dating _____

_____

Name _____ Date _____

Main Idea

Nuclear Stability

Use with pages 865–866.

Types of Radioactive Decay

Use with pages 866–868.

Details

Section 24.2 Radioactive Decay (continued)

Contrast *the properties of isotopes by imagining two eggs as models. One isotope would be created using hard-boiled eggs as building blocks, the other using raw eggs as building blocks. Explain which model would be more stable, and which would be more typical of known isotopes.*

_____

_____

_____

Summarize *how the strong nuclear force helps to keep protons in a nucleus.*

_____

_____

Describe *the neutron-to-proton (n/p) ratio in nuclear stability.*

The number of protons compared to the number of _____ in a ratio identifies the nuclear ratio. To some degree, the _____ of a nucleus can be correlated with its _____ ratio. As atomic number _____, more _____ are needed to balance the _____ forces. Plotting the number of neutrons versus the number of _____ for all stable nuclei illustrates the _____.

Analyze *the relative stability of radioisotopes. Use Figure 25.8 as a guide.*

1. a radioisotope with too many neutrons relative to its protons

_____

2. a radioactive isotope _____

3. a nucleus with more than 83 protons _____

4. a nucleus with a high atomic number and a neutron-to-proton ratio of 1:5:1. _____

Name _____ Date _____

Section 24.2 Radioactive Decay (continued)

Main Idea | **Details**

Writing and Balancing Nuclear Equations

Use with page 869.

Compare ***positron emission with electron capture.***

Positron emission is _____ that involves the emission of a _____ (particle with the same mass as an electron but opposite charge) from a nucleus. During this process, a _____ in the nucleus is converted into a neutron and a positron, and then the _____ is emitted.

Electron capture is _____ that decreases the number of _____ in unstable nuclei lying below the _____. This occurs when the nucleus of an atom draws in a surrounding _____, usually from the lowest energy level. The captured electron combines with a _____ to form a _____.

Contrast ***balanced chemical equations with balanced nuclear equations.***

Balanced chemical equations conserve _____ _____.

Balanced nuclear equations conserve _____ _____.

Balancing a Nuclear Equation

Use with Example Problem 24.1, page 869.

Solve ***Read Example Problem 24.1 in your text.***

You Try It

Problem

Write a balanced nuclear equation for the alpha decay of uranium-238 ($^{238}_{92}U$).

1. Analyze the Problem

Known: _____

decay type: _____

Unknown: _____

Section 24.2 Radioactive Decay (continued)

Main Idea **Details**

2. Solve for the Unknown

Using each particle's mass number, make sure the mass number is conserved on each side of the reaction arrow.

Mass number: 238 = X + ___ X = 238 − 4

Mass number of X = ____

Using each particle's atomic number, make sure the atomic number is conserved on each side of the reaction arrow.

Atomic number: 92 = _____ X = 92 − ____

Atomic number of X = ____

Use the periodic table to identify the unknown element.

_____

Write the balanced nuclear equation.

_____

Radioactive Series

Use with page 870.

Describe ***a radioactive decay series by completing the following paragraph.***

A radioactive decay series is a series of _____ that begins with a(n) _____ nucleus and ends in the formation of a stable _____. Both alpha decay and _____ are involved in the process.

Name _____ Date _____

Section 24.2 Radioactive Decay (continued)

Main Idea | **Details**

Radioactive Decay Rates

Use with pages 870–871.

Describe *how Ernest Rutherford's early experiments in inducing nuclear reactions led to modern particle accelerators.*

Rutherford discovered that particles must move at extremely _____ _____ to overcome electrostatic _____ and affect a target nucleus. Scientists have built on this to develop methods to accelerate particles to extreme speed using _____ and _____ fields. Particle accelerators use conventional and _____ magnets to force particles to move at high speeds.

Explain *why some naturally occurring radioactive substances still remain on Earth.*

_____

REAL-WORLD CONNECTION

Suppose you want to join an after-school club. Two clubs interest you. In the photography club, there are a lot of members, but only a few who are truly interested (or proactive) about the topic. Most members just seem to have joined to be involved in an activity (or are neutral). The chemistry club, on the other hand, has fewer members, but there seems to be an equal number of truly interested (proactive) students as there are students without a lot of interest (neutrals). If human interactions followed the same laws as radioisotopes, explain which group would be more stable over the school year.

_____

_____

_____

_____

Name _____ Date _____

Section 24.2 Radioactive Decay (continued)

Main Idea — **Details**

Calculating the Amount of Remaining Isotope

Use with Example Problem 24.2, page 872.

Solve *Read Example Problem 24.2 in your text.*

You Try It

Problem

Determine the amount of an original sample of 2.0 grams of thorium-234 after 49 days. The half-life of thorium-234 is 24.5 days.

1. Analyze the Problem

Known:

Initial amount = _____

Elapsed time (t) = _____

Half-life (T) = _____

Unknown:

Amount remaining = ? g

2. Solve for the Unknown

Number of half-lives (n) = Elapsed time/Half-life

n = 49/24.5 = _____

Amount remaining = _____

Amount remaining = _____

Amount remaining = _____

Amount remaining = _____

3. Evaluate the Answer

After 49 days, _____ half-lives of thorium-234 have elapsed. The number of half-lives is equivalent to (1/2)(1/2) or _____. The answer, _____ is equal to _____ the original quantity.

Radiochemical Dating

Use with pages 873–874.

Write *the balanced nuclear equation for carbon dating.*

_____

Name _____ Date _____

Nuclear Chemistry

Section 24.3 Nuclear Reactions

Main Idea — **Details**

Skim *Section 3 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.

induced transmutation _____

transuranium elements _____

mass defect _____

nuclear fission _____

critical mass _____

breeder reactor _____

nuclear fusion _____

thermonuclear reaction _____

Academic Vocabulary

Define the following term.

generate _____

Name _____ **Date** _____

Section 24.3 Nuclear Reactions (continued)

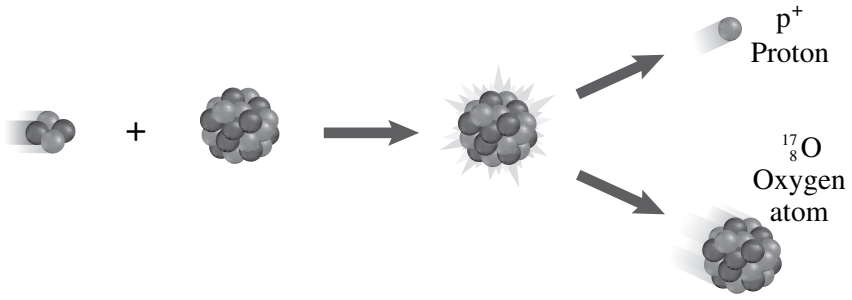
Main Idea

Induced Transmutation

Use with pages 875–876.

Details

Sequence the steps in Rutherford's induced transformation of nitrogen-14 into oxygen.



$^{4}_{2}$ He bombarding alpha particle

+

and →

p+ proton

Name _____ **Date** _____

Section 24.3 Nuclear Reactions (continued)

Main Idea	Details
Nuclear Reactions and Energy *Use with pages 877–878.*	**Write** *Einstein's equation. Be sure to include the measurement units.* **Identify** *the three things you need to know to calculate mass defects.* **a.** _____ **b.** _____ **c.** _____
Nuclear Fission *Use with pages 878–880.*	**Organize** *the steps in a nuclear fission reaction involving uranium.* **1.** A neutron _____ **2.** The uranium _____ **3.** The nucleus _____ **Explain** *why a fissionable material must have sufficient mass before a sustained reaction can take place.* **Explain** *why a fissionable material must not have an excess of mass.*

Name _____ **Date** _____

Section 24.3 Nuclear Reactions (continued)

Main Idea | **Details**

Nuclear Reactors

Use with pages 880–882.

Describe ***how a nuclear reactor creates energy. Include how the environment is protected from nuclear waste.***

Nuclear fission produces _____.

A common fuel is _____

_____. A neutron-emitting source _____ and control rods absorb virtually all of the _____ produced in the reaction. Heat from a reaction is used to power _____ which produce electrical power.

Nuclear Fusion

Use with pages 883–884.

Describe ***nuclear fusion by completing the following paragraph.***

Nuclear fusion is the combining of atomic _____. Nuclear fusion reactions are capable of _____. The most common fusion reaction is the _____. Because of the energy requirements, fusion reactions are also known as _____.

Explain ***why fusion reaction is not yet a practical source of everyday energy.***

_____

_____

_____

_____

_____

Real-World Connection

Create a metaphor from everyday life that will show the difference between nuclear fission and nuclear fusion.

Nuclear fusion requires _____

Nuclear fusion requires _____

Fusion is like: _____

Fusion is like: _____

_____

Name _____ Date _____

Nuclear Chemistry

Section 24.4 Applications and Effects of Nuclear Reactions

Main Idea — **Details**

Scan *Section 4, using the checklist below as a guide.*

- 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 radioactive decay.

Write *three questions you have about nuclear radiation.*

1. _____

2. _____

3. _____

New Vocabulary *Use your text to define each term.*

ionizing radiation _____

radiotracer _____

_____

Name _____ Date _____

Section 24.4 Applications and Effects of Nuclear Reactions (continued)

Main Idea	Details

Detecting Radioactivity

Use with pages 885–886.

List *and describe three methods of detecting radiation.*

1. _____

2. _____

3. _____

Uses of Radiation

Use with pages 886–888.

Describe *how a radiotracer works.*

A radiotracer is a _____ that emits _____ and is used to signal the presence of _____ or specific substance. The fact that all of an element's isotopes have the same _____ makes the use of radioisotopes possible.

Discuss *a common radiotracer that is used in medicine.*

Iodine-131 is commonly used to detect _____ associated with the _____. A doctor will give the patient a drink containing a small amount of iodine-131. The iodine-containing _____ is then used to monitor the function of the thyroid gland.

Name _____ Date _____

Section 24.4 Applications and Effects of Nuclear Reactions (continued)

Main Idea | **Details**

Biological Effects of Radiation

Use with pages 888–890.

Identify *three factors that affect the possible damage to the body caused by ionizing radiation discussed in the textbook.*

1. _____

2. _____

3. _____

Discuss *genetic and somatic damage caused by ionizing radiation.*

Somatic damage affects _____

_____

Genetic damage can affect _____

_____

_____

_____

REAL-WORLD CONNECTION **Create a warning label that will identify the dangers of a radioactive material to users.**

_____

_____

_____

Name _____ **Date** _____

Nuclear Chemistry Chapter Wrap-Up

After reading this chapter, list three important facts you have learned about nuclear chemistry.

1. _____
2. _____
3. _____

Review

Use this checklist to help you study.

- ☐ Study your Science Notebook for this chapter.
- ☐ Study the definitions of vocabulary words.
- ☐ Review daily homework assignments.
- ☐ Reread the chapter and review the tables, graphs, and illustrations.
- ☐ Review the Section Assessment questions at the end of each section.
- ☐ Look over the Study Guide at the end of the chapter.

Real-World Connection

Imagine you are watching a program on radiation with a friend. Your friend is afraid of all radiation. Explain to your friend some of the common useful applications of radiation.

_____

_____

_____

_____