About the Consultant

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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. These tips will help you take better notes.

- Be an active listener. Listen for important concepts. Pay attention to words, examples, and/or diagrams your teacher emphasizes.

- Write your notes as clear and concise as possible. The following symbols and abbreviations may be helpful in your note-taking.

<table>
<thead>
<tr>
<th>Word or Phrase</th>
<th>Symbol or Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>for example</td>
<td>e.g.</td>
</tr>
<tr>
<td>such as</td>
<td>i.e.</td>
</tr>
<tr>
<td>with</td>
<td>w/</td>
</tr>
<tr>
<td>without</td>
<td>w/o</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Word or Phrase</th>
<th>Symbol or Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>and</td>
<td>+</td>
</tr>
<tr>
<td>approximately</td>
<td>≈</td>
</tr>
<tr>
<td>therefore</td>
<td>∴</td>
</tr>
<tr>
<td>versus</td>
<td>vs</td>
</tr>
</tbody>
</table>

- Use a symbol such as a star (★) or an asterisk (*) to emphasizing 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.

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.
Oceans

Before You Read
Before you read the chapter, respond to these statements.
1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Oceans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean water is always the same temperature all over the world.</td>
<td>O</td>
</tr>
<tr>
<td>Global winds cause density currents to move the ocean water.</td>
<td>O</td>
</tr>
<tr>
<td>The Moon's gravity and rotation affect the tides.</td>
<td>O</td>
</tr>
<tr>
<td>Wave erosion affects marine life in coastal regions.</td>
<td>O</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal
Write three questions that you would ask a scientist studying ocean life.

Anticipation Guide/KWL charts
Think about what you already know before beginning a lesson and identify what you would like to learn from reading.

Language-based Activities
Activities cover the content in your science book including vocabulary, writing, note-taking, and problem solving.

Vocabulary Development
Vocabulary words help you to better understand your science lessons. Learning the Academic Words can help you score higher on standardized tests.

Using Your Science Notebook

This note-taking guide is designed to help you succeed in learning science content. Each chapter includes:

- **Main Idea**: Outline the section on dissolved gases.
  1. The three most important gases are
   - Oxygen gas
     1. Surface layer gets oxygen from atmosphere and photosynthesis
     2. Just below 200 m
     3. Very little oxygen
   - Carbon dioxide gas
     1. Absorbed directly from atmosphere
     2. Given off by organisms during respiration
     3. Reacts with water molecules to form carbonic acid
   - Nitrogen gas
     1. More in ocean than any other gas
     2. Some bacteria combine nitrogen with oxygen to form nitrates that are
       a. Important nutrients for plants
       b. Important building blocks for plant & animal tissue

- **Details**: Section 1 Ocean Water

  - Scuba divers don't need the pressurized suits that deep-sea divers do. Hypothesize why deep-sea divers must use special equipment.

  - **Vocabulary**: Use your book or a dictionary to define:
    - **atmosphere**: Earth's air, which is made of a thin layer of gases, solids, and liquids; forms a protective layer around the planet and is divided into five distinct layers.
    - **salinity**: A measure of dissolved solids, or salts, in seawater.
    - **photosynthesis**: The process in which organisms use sunlight, water, and carbon dioxide to make food and oxygen.
    - **thermocline**: A layer of ocean water that begins at a depth of about 200 m and becomes progressively colder with increasing depth.
    - **accumulate**: To increase gradually in quantity or number; to gather or pile up.

  - **Review (Vocabulary)**: Use your book to define the following terms.
    - **oxygen**: A gas that is essential for the survival of most organisms.
    - **carbon dioxide**: A gas that is produced by the respiration of all organisms.
    - **nitrogen**: A gas that is essential for the survival of most organisms.

  - **New Academic Vocabulary**
    - **accumulate**: Use your book or a dictionary to define accumulate.
Chapter Wrap-Up
This brings the information together for you. Revisiting what you thought at the beginning of the chapter provides another opportunity for you to discuss what you have learned.

Note-taking Based on the Cornell Two-Column Format
Practice effective note-taking through the use of graphic organizers, outlines, and written summaries.

Review Checklist
This list helps you assess what you have learned and prepare for your chapter tests.

Graphic Organizers
A variety of visual organizers help you to analyze and summarize information and remember content.
# The Nature of Science

## Before You Read

*Before you read the chapter, respond to these statements.*

1. Write an **A** if you agree with the statement.
2. Write a **D** if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>The Nature of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• A scientific theory will always be true.</td>
</tr>
<tr>
<td></td>
<td>• A scientific experiment is valid as long as you don’t vary more than two factors.</td>
</tr>
<tr>
<td></td>
<td>• By choosing an appropriate unit of measurement, you can avoid working with large-digit numbers and with many decimal places.</td>
</tr>
<tr>
<td></td>
<td>• Any type of graph is appropriate for displaying any type of information.</td>
</tr>
</tbody>
</table>

## Construct the Foldable as directed at the beginning of this chapter.

---

## Science Journal

List possible reasons that scientists study space.

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 

---

*The Nature of Science* 1
Skim the headings and bold words in this section. Write four steps scientists might take to solve a problem.

Define investigation to show its scientific meaning.

Read the definitions below, then write the key term on the blank in the left column.

- variable whose value changes according to the changes in other variables
- the standard by which test results can be compared
- a quantity that can have more than a single value
- the application of science to help people
- a factor that does not change when other variables change
- represents an idea, event, or object to help people better understand it
- the variable you change to see how it will affect the dependent variable
- occurs when expectations change how experimental results are viewed

Use a dictionary to define survey.
Section 1 The Methods of Science (continued)

Main Idea

What is science?

I found this information on page __________.

Scientific Methods

I found this information on page __________.

Visualizing with Models

I found this information on page __________.

Details

Summarize three types of investigations scientists perform to learn new information about the natural world.

1. ________________________________________________________________

2. ________________________________________________________________

3. ________________________________________________________________

Sequence the common steps found in scientific methods in the correct order. The first step has been completed for you.

1. State the problem

2. ________________________

3. ________________________

4. ________________________

5. ________________________

6. ________________________

Organize the advantages and disadvantages of a pilot flying a real airplane and flying a simulator.

<table>
<thead>
<tr>
<th></th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real airplane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulator</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 1 The Methods of Science (continued)

**Main Idea**

Scientific Theories and Laws

I found this information on page __________.

**Details**

Distinguish *between a scientific theory and a scientific law.*

________________________________________________________

________________________________________________________

________________________________________________________

The Limitations of Science

I found this information on page __________.

Complete *the paragraph about the* limitations of science.

Science _______ explain or solve everything. A scientist has to make sure his or her guesses can be _______ and _______.

Science cannot answer questions about _______ and _______.

For example, a _______ of people’s opinions about such questions would not prove that the opinions are true for everyone.

Using Science—Technology

I found this information on page __________.

Create *your own real-world example of how the application of a scientific discovery has helped create a new technology.*

________________________________________________________

________________________________________________________

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CONNECT IT

Summarize the steps a scientist might take to determine if a new drug works in cancer patients.

________________________________________________________

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________________________________________________________
The Nature of Science
Section 2 Standards of Measurement

**Skim** the headings in Section 2. Write three questions that come to mind about measurement.

1. __________________________________________
2. __________________________________________
3. __________________________________________

**Define** measurement to show its scientific meaning.

**New Vocabulary**

Define ratio to show its scientific meaning. Then use it in a sentence as a noun.

**Academic Vocabulary**

Review Vocabulary

**Academic Vocabulary**

The Nature of Science

5
**Main Idea**

**Units and Standards**
* I found this information on page ___________.

**Measurement Systems**
* I found this information on page ___________.

**Details**

**Summarize** *in your own words why measurement standards are necessary.*

**Complete** *the table of SI base units used to measure various quantities.*

<table>
<thead>
<tr>
<th>Quantity Measured</th>
<th>Unit</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>s</td>
<td></td>
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<td>kilogram</td>
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<td>candela</td>
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<tr>
<td>mole</td>
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<td>A</td>
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</tr>
</tbody>
</table>

**Create** *an example of a real-world object that could be appropriately measured using each SI unit.*

meter  __________________________________________

kilometer  ________________________________________

millimeter  _______________________________________

micrometer  _______________________________________

**Organize** *the steps for finding the volume of a rectangular solid by listing them below.*

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Main Idea

Measuring Matter

I found this information on page __________.

Measuring Time and Temperature

I found this information on page __________.

Details

Predict two pairs of objects that have about the same size but different masses.

Complete the table below. Place an X in the appropriate box to indicate the type of each measurement unit.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>SI Unit</th>
<th>Derived Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>gram per centimeter cubed (g/cm³)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>decimeter (dm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>liter (L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>meter cubed (m³)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kilogram (kg)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Model three thermometers, a Fahrenheit scale, a Kelvin scale, and a Celsius scale. Label each to include the boiling and freezing points of water.

SYNTHESIZE IT

Compare the advantages and disadvantages of converting our system of measurement in the United States from the English system to the International System of units.

Name ___________________________ Date ________________

Section 2 Standards of Measurement (continued)

The Nature of Science 7
Scan the headings, figures, and captions in Section 3 of your text. Write three questions that came to mind as you scanned this section.

1. 
2. 
3. 

Define *data* to show its scientific meaning.

Use your book to define *graph* to show its scientific meaning.

Use a dictionary to define the word *detect*.

Distinguish between the three types of graphs described in this section. Draw and label a simple example of each graph.
Section 3 Communicating with Graphs (continued)

**Main Idea**

**A Visual Display**

I found this information on page __________.

**Details**

**Summarize** four reasons scientists graph the results of their experiments.

**Line Graphs**

I found this information on page __________.

**Evaluate** the effectiveness of two fertilizers on plant growth by plotting the following data on a line graph. Be sure to label each axis.

<table>
<thead>
<tr>
<th>Week</th>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 cm</td>
<td>2 cm</td>
</tr>
<tr>
<td>2</td>
<td>7 cm</td>
<td>9 cm</td>
</tr>
<tr>
<td>3</td>
<td>15 cm</td>
<td>19 cm</td>
</tr>
<tr>
<td>4</td>
<td>20 cm</td>
<td>24 cm</td>
</tr>
</tbody>
</table>

**Bar Graphs**

I found this information on page __________.

**Identify** the features of the bar graph in your book titled "Classroom Size (January 20, 2004)" by completing the table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>x-axis</td>
<td>maximum bar height</td>
<td>y-axis</td>
<td>minimum bar height</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>horizontal</td>
<td>maximum class size</td>
<td>vertical scale</td>
<td>minimum class size</td>
</tr>
<tr>
<td>scale</td>
<td>27</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

The Nature of Science 9
Section 3 Communicating with Graphs (continued)

Main Idea

Circle Graphs
I found this information on page ____________.

Details

Complete the steps you would use to create a circle graph. The first step and an example has been completed for you.

<table>
<thead>
<tr>
<th>Instructions for Creating a Section of a Circle Graph</th>
<th>Example: 11/27</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Find the total number of what you are analyzing.</td>
<td>27</td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
</tbody>
</table>

Analyze the circle graph of Heating Fuel Usage in your book to complete the table. Round each answer to the nearest whole number.

<table>
<thead>
<tr>
<th>Heating Fuel</th>
<th>Percent of whole</th>
<th>Calculation</th>
<th>Angle of Slice</th>
<th># of Buildings Represented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam</td>
<td>25</td>
<td></td>
<td>90°</td>
<td>18</td>
</tr>
<tr>
<td>Coal</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Summarize It

Describe when you would use each type of graph (line graph, bar graph, and circle graph) to show information.
Engage your imagination and sharpen your writing skills to produce a draft of an article for a science magazine. You have recently conducted a scientific experiment, and you want to report the results to your colleagues. Use the outline below to help you organize your draft. Provide as much detail as possible, and include units of measurement with all of your data.

1. Identify the problem that interested you in this experiment.

2. Summarize your background information.

3. State your hypothesis.

4. Describe your experiment.

5. Present and analyze your data. Include a graphical display.

6. Draw a conclusion.
The Nature of Science  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>The Nature of Science</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A scientific theory will always be true.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>• A scientific experiment is valid as long as you don’t vary more than two factors.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>• By choosing an appropriate unit of measurement, you can avoid working with large-digit numbers with many decimal places.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>• Any type of graph is appropriate for displaying any type of information.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

Summarize It

After reading this chapter, describe the general method and two important tools that scientists use when studying the natural world.
Motion

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Distance and displacement are the same thing.</td>
<td></td>
</tr>
<tr>
<td>• Velocity and speed are the same thing.</td>
<td></td>
</tr>
<tr>
<td>• Whenever an object accelerates, its speed increases.</td>
<td></td>
</tr>
<tr>
<td>• It takes force to change an object’s direction of motion.</td>
<td></td>
</tr>
<tr>
<td>• Objects in motion tend to slow down and come to rest unless acted on by outside forces.</td>
<td></td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Write a paragraph describing three rides in an amusement park and how rides cause you to move.
Motion
Section 1 Describing Motion

Skim  Section 1 of the chapter. Read the headings and illustration captions. Write three questions that come to mind.

1. __________________________________________
2. __________________________________________
3. __________________________________________

Review Vocabulary

Analyze why the word instantaneous, as used in the book, does not mean “sudden.”

Instantaneous

New Vocabulary

Use your book to place each term in the appropriate location in the table below.

<table>
<thead>
<tr>
<th>distance</th>
<th>displacement</th>
<th>speed</th>
<th>velocity</th>
<th>Average Speed</th>
<th>Instaneous Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Does not involve direction</td>
<td>Involves direction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Units do not involve time</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Units involve time</td>
<td></td>
</tr>
</tbody>
</table>

Contrast the average speed and the instantaneous speed of a runner in a race.

Academic Vocabulary

Use a dictionary to define constant to its scientific meaning.

Name ___________________________  Date ________________
Main Idea

Motion
I found this information on page ___________.

Details

Draw a winding path that covers a distance of 70 miles and finishes with a displacement 20 miles southwest of the starting point. Label your diagram with the distance and direction traveled.

Speed
I found this information on page ___________.

Analyze the formula for speed by looking at the diagram and filling in the prompts.

Put your finger over the $s$ on the diagram. Now write the formula for speed.

Put your finger over the $d$ on the diagram. Write the calculation to find distance if you know speed and time.

Prove to yourself that these formulas are correct by checking the units.

\[
\text{speed (units of } \text{ or } \text{)} = \frac{\text{distance (units of } \text{ or } \text{)}}{\text{time (units of } \text{ or } \text{)}}
\]

\[
\text{distance (units of } \text{)} = \text{speed (units of } \text{)} \times \text{time (units of } \text{)}
\]

Note that the units always turn out the same on both sides of the equation.
Main Idea

Graphing Motion
I found this information on page __________.

Details

Create a graph to show the progress of a runner who runs a 1-kilometer race in 3 minutes. The runner gets off to a fast start, runs the middle of the race at a more moderate pace, and then sprints to the finish.

Graphing Checklist:
- title
- scale on x axis
- units on x axis
- label on x axis
- scale on y axis
- units on y axis
- label on y axis

Critique the phrase “airspeed velocity of a swallow”.

Model a swallow in flight.
- Use an arrow to show the swallow’s velocity.
- Label the arrow to indicate the swallow’s speed.

Analyzing It
Analyze the following statement. “A boat traveled at 10 km/h for one hour, then at 13 km/h for two hours, and finally at 11 km/h for another hour. The average speed over the whole trip was 15 km/h.” Support your analysis with a calculation.

Name ___________________________ Date ___________

Section 1 Describing Motion (continued)
Scan Use the checklist below to preview Section 2 of your book.

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

Define speed in a sentence to show its scientific meaning.

Use your book to define the word acceleration.

Analyze why we say an object is accelerating, when we usually mean that it is speeding up. An object that is slowing down also is accelerating.

The words positive and negative are a natural pair. Explain how no number can be both positive and negative. Can any number be neither positive nor negative?
Main Idea

Acceleration, Speed, and Velocity

I found this information on page __________.

Details

Draw a closed racecourse with parts labeled A, B, C, and D, where the following occurs: [Hint: the path crosses itself once.]

A. The car is speeding up while traveling in a straight line.
B. The car is curving left at constant speed.
C. The car is traveling in a straight line at a constant speed.
D. The car is curving right while slowing down.

I found this information on page __________.

Synthesize

Create a graph titled “Speed Changing Over Time” to show the acceleration of the car traveling around your course (above). Place the labels A, B, C, and D along the horizontal axis to represent the time when the car travels each part of the course.

• Draw a line on the graph to show how the speed of the car changes with time.

• Label each of the four parts of the graph with either a plus sign, a minus sign, or a zero to indicate where the car’s acceleration is positive, negative, or zero.

• Describe the relationship between speed and acceleration as shown in your graph.

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Analyze why the SI unit of acceleration is m/s².

Compare the results of applying the acceleration equation in the following two cases: (1) an object that goes from 0 to 10 m/s in 4 s, and (2) then goes from 10 m/s to 30 m/s in 8 s.

(1) \[ a = \frac{(v_f - v_i)}{t} \]

= \[ \text{________} \] = \[ \text{________} \]

(2) \[ a = \frac{(v_f - v_i)}{t} \]

= \[ \text{________} \] = \[ \text{________} \]

Predict the acceleration of a roller coaster that goes from 0 to 190 km/h in 4 s. Express your answer in km/s². Round to three decimal places.

SYNTHESIZE IT

Distinguish between average acceleration and instantaneous acceleration. Be sure to explain how the acceleration equation calculates average acceleration, instantaneous acceleration, or both.
Predict  Read the title of Section 3. List three things that might be discussed in this section.

1. __________________________________________
2. __________________________________________
3. __________________________________________

Review Vocabulary  Define  scientific law in a sentence to show its scientific meaning.

scientific law

New Vocabulary  Use your book or dictionary to define the following terms.

force

net force

balanced forces

inertia

Academic Vocabulary  Use a dictionary to define survive.

survive
Main Idea

What is force?
I found this information on page __________.

Inertia and Mass
I found this information on page __________.

Details

Model an apple hanging from a tree and a falling apple. Include arrows with labels to show all forces acting on the apples.

Hanging Apple

Falling Apple

Analyze the forces acting on the apple in each drawing and how they combine to form the net force.

Model a rock being thrown at a wall and a car crashing into the wall.

Predict which object will do more damage, and support your answer by using the concept of inertia.

Analyze the forces on a hockey puck sinking through water. Draw a force diagram for the puck in the water.
Inertia and Mass
I found this information on page ________.

An object moving at constant velocity ________________________.

If an object is at rest, it stays at rest unless ________________________.

Analyze the effects on a passenger riding in a car traveling at 50 km/h that collides head-on with a solid object.

<table>
<thead>
<tr>
<th>Without Restraints</th>
<th>With Safety Belts and Air Bags</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Summarize Newton’s first law of motion. The first part of each sentence is given.

An object moving at constant velocity ________________________.

If an object is at rest, it stays at rest unless ________________________.

Summarize the relationship between a moving object’s mass, its inertia, and the forces acting on it.

______________________________
______________________________
______________________________
______________________________
______________________________
______________________________
Analyze the motion of a water balloon you toss at a partner during a contest. You launch the balloon in a steep arc, it reaches the top of its flight, and then it falls back to Earth, landing with a splat in your partner’s hands.

1. Draw the balloon’s path and include arrows showing the forces acting on the balloon at several points along the path.

2. Describe the forces acting on the balloon. Identify the effects they have on the balloon’s horizontal speed and vertical speed during its flight.

3. Discuss techniques for catching the balloon that your partner might use to avoid breaking it.
Motion  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Motion</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Distance and displacement are the same thing.</td>
<td></td>
</tr>
<tr>
<td>• Velocity and speed are the same thing.</td>
<td></td>
</tr>
<tr>
<td>• Whenever an object accelerates, its speed direction increases.</td>
<td></td>
</tr>
<tr>
<td>• It takes force to change an object’s direction of motion.</td>
<td></td>
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<tr>
<td>• Objects in motion tend to slow down and come to rest unless acted on by outside forces.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

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☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

Summarize It

After reading this chapter, list three things you have learned about motion.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

24  Motion
Before You Read

Before you read the chapter, use the “What I know” column to list three things you know about forces. Then list three questions you have about forces in the “What I want to find out” column.

<table>
<thead>
<tr>
<th>K</th>
<th>What I know</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>What I want to find out</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Explain which would be a safer car—a car with a front end that crumples in a crash or one with a front end that doesn’t crumple.
Objectives Read the section objectives. Then write three questions that come to mind from reading these statements.

1. _____________________________
2. _____________________________
3. _____________________________

Explain how the idea of a sum is important for thinking about net force.

net force

Read the definitions below, then write the key term for each one in the left column.

the force that opposes the sliding motion of two surfaces that are touching each other

the force that opposes the motion of two surfaces sliding past each other

a friction-like force that opposes the motion of objects that move through the air

the frictional force that prevents two surfaces from sliding past each other

“The acceleration of an object is in the same direction as the net force on the object, and the acceleration can be calculated from the equation $a = \frac{F_{\text{net}}}{m}$.”

Use a dictionary to define the term period.
Section 1 Newton’s Second Law (continued)

Main Idea

**Force, Mass, and Acceleration**

I found this information on page __________.

Details

Complete the concept map with the 3 physical properties of an object that are related by Newton’s second law of motion.

**Newton’s Second Law**

I found this information on page __________.

I found this information on page __________.

Summarize Newton’s second law of motion in your own words.

Organize the 3 variables related by Newton’s second law in the table. Show equations to find each variable if you know the values of the other two variables.

<table>
<thead>
<tr>
<th>Newton’s Second Law of Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unknown</strong></td>
</tr>
<tr>
<td>Acceleration</td>
</tr>
<tr>
<td>Net force</td>
</tr>
<tr>
<td>Mass</td>
</tr>
</tbody>
</table>
Section 1 Newton’s Second Law (continued)

Main Idea

Friction
I found this information on page __________.

Air Resistance
I found this information on page __________.

Details

Complete the concept map, using the information in your book.

Contrast the terminal velocity of a parachutist with an open chute to the terminal velocity of the same parachutist with a closed chute.

SYNTHESIZE IT

Since rolling is a type of motion, and static means “not moving,” it doesn’t seem that rolling friction could be a type of static friction—and yet it is. Explain why this is so, using the example of a tire rolling down a road. Describe what happens when the tire skids.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Suppose an object’s acceleration is negative. Use the formula for acceleration to explain what this implies about the initial and final velocities.

**acceleration**

**gravity**

**weight**

**centripetal acceleration**

**centripetal force**

**range**

*Scan* Use the checklist below to preview Section 2 of your book.
- Read all section titles.
- Read all bold words.
- Read all equations.
- Look at all the pictures and read their captions.
- Mentally review what you already know, or have heard, about gravity.

Use a dictionary or your book to define the following key terms.

Use a dictionary to define range. Then use it in a scientific sentence.
Section 2 Gravity (continued)

Main Idea

What is gravity?
I found this information on page __________.

Details

Predict why Earth’s ocean tides are influenced more by the Moon than by the Sun, even though the Sun is much bigger than the Moon.

Summarize the law of universal gravitation in a complete sentence.

Analyze the formula \( W = mg \) to explain how an object’s weight can change even when its mass remains constant.

I found this information on page __________.
Section 2 Gravity (continued)

Main Idea

Weightlessness and Free Fall

I found this information on page __________.

Details

Distinguish between an object that is truly weightless and an object that is weightless because it is in free fall.

---

Projectile Motion

I found this information on page __________.

Model a ball thrown horizontally. Sketch the path of the ball and draw arrows showing its horizontal and vertical velocity at three points along the path. Vary the length of your arrows to show the magnitude of the velocities.

---

Centripetal Force

I found this information on page __________.

Create a top view of an object moving in a circle at constant speed, such as a ball on a string. Show at least two positions of the object. At each position, draw an arrow for the object’s velocity and another arrow for the centripetal acceleration of the object.

---

SUMMARIZE IT

The force of gravity between two objects is \( F = G \frac{m_1 m_2}{d^2} \), and the force of gravity between Earth and object of mass \( m \) on Earth’s surface is \( F = mg \). Use \( F = F \) to make an equation for \( g \) in terms of the variables of the universal gravitation equation. [Hint: the distance between Earth and an object on its surface is measured from the object to Earth’s center.]
Forces
Section 3 The Third Law of Motion

**Skim** through Section 3 of your book. Write three questions that come to mind from reading the headings and the illustration captions.

1. 
2. 
3. 

**Review Vocabulary**

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>speed</td>
<td></td>
</tr>
<tr>
<td>velocity</td>
<td></td>
</tr>
</tbody>
</table>

**New Vocabulary**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newton’s third law of motion</td>
<td></td>
</tr>
</tbody>
</table>

State Newton’s third law of motion as found in your book.

Use the word momentum in a sentence to show its scientific meaning.

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>momentum</td>
<td></td>
</tr>
</tbody>
</table>

**Academic Vocabulary**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>initial</td>
<td></td>
</tr>
</tbody>
</table>

Use a dictionary to define initial. Then use it as an adjective in a sentence to show its scientific meaning.
**Main Idea**

**Newton’s Third Law**

I found this information on page __________.

I found this information on page __________.

**Details**

**Summarize** Newton’s third law of motion in your own words.

**Predict** the corresponding reaction for each action.

<table>
<thead>
<tr>
<th>Action</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A high-jumper lands on a mat.</td>
<td></td>
</tr>
<tr>
<td>A fisherman tosses an anchor away from his boat.</td>
<td></td>
</tr>
<tr>
<td>An airplane’s jet engine pushes air toward the back of the airplane.</td>
<td></td>
</tr>
</tbody>
</table>

**Analyze** the motion of a child on a swing. The child swings forward, then back. Explain why the backward swing is not an example of reaction in the sense of Newton’s third law.

I found this information on page __________.
Analyze the property of momentum in words and with an equation. Include units and identify all variables.

Words

Equation

Predict why momentum is a property of moving objects, but not of stationary objects.

Create an example of a situation in which momentum is conserved. Explain how the law of conservation of momentum applies to your example.

CONNECT IT Use what you know about force and momentum to explain why a baseball player's position determines the amount of padding in the baseball glove.
Tie It Together

Forces

Combine some of what you have learned about forces in this chapter into a picture of a wooden block sliding across a table. Use arrows to show the following:

- As the block slides, friction with the table slows the block down.
- Gravity pulls the block downward.
- The force of gravity is balanced by an upward force exerted by the table on the block.

Suppose the block has a mass of 0.2 kg. Use \( W = mg \), with \( g = 9.8 \text{ m/s}^2 \), to calculate the weight of the block.

The block continues to slide until it strikes a second block. Draw this event below. Use arrows to show the following:

- During the collision, the first block exerts a force on second block which causes the second block to move.
- The second block exerts an equal and opposite reaction force on the first block, slowing it down.
Forces Chapter Wrap-Up

In the left column, copy the questions you listed in the Chapter Preview. In the right column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I wanted to find out</td>
<td>What I learned</td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT

After reading this chapter, list three things you have learned about forces.

___________________________

___________________________

___________________________

Forces
Energy

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• The total amount of energy in the universe never changes.</td>
</tr>
<tr>
<td></td>
<td>• Any two objects on the same shelf of a cupboard have the same potential energy.</td>
</tr>
<tr>
<td></td>
<td>• Energy is lost when an object is motionless.</td>
</tr>
<tr>
<td></td>
<td>• A light bulb transforms electrical energy into light and thermal energy.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Which takes more energy: walking up stairs or taking an escalator? Explain your reasoning.

---

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**Energy**

Section 1 The Nature of Energy

**Scan** Section 1 to find at least four forms of energy.

<table>
<thead>
<tr>
<th>Form of Energy</th>
<th>Key Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>the energy a moving object has because of its motion</td>
<td>kinetic energy</td>
</tr>
<tr>
<td>the SI unit of energy</td>
<td>joule</td>
</tr>
<tr>
<td>stored energy due to position</td>
<td>potential energy</td>
</tr>
<tr>
<td>energy stored by something that can stretch or compress</td>
<td>elastic energy</td>
</tr>
<tr>
<td>energy stored in chemical bonds</td>
<td>chemical energy</td>
</tr>
<tr>
<td>energy stored by objects due to their position above Earth’s surface</td>
<td>gravitational potential energy</td>
</tr>
</tbody>
</table>

**Review Vocabulary**

Use your book to review the definition of gravity.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>gravity</td>
<td>the force with which objects of mass attract each other</td>
</tr>
</tbody>
</table>

**New Vocabulary**

Read the definitions below, then write the key term for each one in the left column.

<table>
<thead>
<tr>
<th>Definition</th>
<th>Key Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>the energy a moving object has because of its motion</td>
<td>kinetic energy</td>
</tr>
<tr>
<td>the SI unit of energy</td>
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<tr>
<td>stored energy due to position</td>
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</tr>
<tr>
<td>energy stored by something that can stretch or compress</td>
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<tr>
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</tr>
<tr>
<td>energy stored by objects due to their position above Earth’s surface</td>
<td>gravitational potential energy</td>
</tr>
</tbody>
</table>

**Academic Vocabulary**

Use a dictionary to define analogy.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>analogy</td>
<td>a statement or example that compares one thing with another in a similar way</td>
</tr>
</tbody>
</table>
Main Idea

What is energy?
I found this information on page _________.

Details

Identify at least eight familiar items that consume energy. Group items by the form of energy they use.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Electrical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Create an analogy to show how energy is like water.

Complete the formula for the kinetic energy equation of a moving object. Use mass (kg), speed (m/s), and kinetic energy (joules) in your equation.

Word equation:

\[ \text{Kinetic Energy} = \left( \frac{1}{2} \right) \text{mass} \times \left( \text{speed} \right)^2 \]

Symbol equation:
**Main Idea**

**Potential Energy**

**Details**

Analyze the types of potential energy being used by an athlete competing in each of these athletic events.

- archery
- sprinting
- platform diving

Complete the concept map by entering each term or phrase in the appropriate location.

- chemical
- energy
- gravitational
- mgh
- potential energy
- \( \frac{1}{2} \text{ mass } \times \text{ velocity}^2 \)

**ANALYZE IT**

Make an analogy comparing energy and money.

<table>
<thead>
<tr>
<th>KE =</th>
<th>GPE =</th>
</tr>
</thead>
</table>
Predict the title of Section 2 in your book. List three things you think might be discussed in this section.

1. 
2. 
3. 

Define friction in a sentence that shows its scientific meaning.

friction

Use your book to define the following key terms.

mechanical energy

law of conservation of energy

Find convert in a dictionary, and then use it as a verb in a scientific sentence.

convert
Main Idea
Changing Forms of Energy
I found this information on page __________.

Details
Sequence the four energy transformations, such as those related to fossil fuels.
1. ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
2. ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
3. ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
4. ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________

Create a drawing of an apple falling from a tree. Label where:
- kinetic energy is low and gravitational potential energy is high
- kinetic energy is high and gravitational potential energy is low
- kinetic energy is about equal to gravitational potential energy

Predict the energy transformations when a fast-moving roller coaster finishes its ride and comes to a stop. Give three possibilities.
1. ____________________________________________
   ____________________________________________
   ____________________________________________
2. ____________________________________________
   ____________________________________________
   ____________________________________________
3. ____________________________________________
   ____________________________________________
   ____________________________________________
Section 2 Energy (continued)

Main Idea

The Law of Conservation of Energy

Create two examples of changes that might be brought about by thermal energy produced through friction when two materials rub together. Remember, energy is defined as the ability to cause change.

Compare and contrast nuclear fission and nuclear fusion. Complete the Venn diagram with at least six facts.

The Human Body-Balancing the Energy Equation

Analyse information in your book to explain why athletes need to monitor their intake of chemical potential energy.

Connect It

Describe an experience where it would have been helpful for you or someone you know to know how energy can change form.
Energy Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Energy</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>The total amount of energy in the universe never changes.</td>
<td></td>
</tr>
<tr>
<td>Any two objects on the same shelf of a cupboard have the same potential energy.</td>
<td></td>
</tr>
<tr>
<td>Energy is lost when an object is motionless.</td>
<td></td>
</tr>
<tr>
<td>A lightbulb transforms electrical energy into light and thermal energy.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

- Review the information you included in your Foldable.
- Study your Science Notebook on this chapter.
- Study the definitions of vocabulary words.
- Review daily homework assignments.
- Re-read the chapter and review the charts, graphs, and illustrations.
- Review the Self Check at the end of each section.
- Look over the Chapter Review at the end of the chapter.

Summarize It

After reading this chapter, summarize in your own words what energy is and what the law of conservation of energy means.
Work and Machines

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Work and Machines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holding a heavy object motionless involves a lot of work.</td>
<td></td>
</tr>
<tr>
<td>Machines are tools for making work easier.</td>
<td></td>
</tr>
<tr>
<td>A machine is a device that creates energy.</td>
<td></td>
</tr>
<tr>
<td>A baseball bat can be considered a machine.</td>
<td></td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Diagram a bicycle and identify the parts you think are simple machines.
Work and Machines
Section 1 Work

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

1. ______________________________________________________________________
2. ______________________________________________________________________
3. ______________________________________________________________________

**Define** the word energy in a sentence to show its scientific meaning.

energy

________________________________________________________________________

**New Vocabulary**

Use your book or a dictionary to define the terms work and power.

work

________________________________________________________________________

power

________________________________________________________________________

Sometimes the word power means ability to do something. Explain why this is not how the word is used in physical science.

________________________________________________________________________

________________________________________________________________________

**Academic Vocabulary**

Use a dictionary to define the term transfer.

transfer

________________________________________________________________________
Main Idea

What is work?
I found this information on page _________.

Details

Create three sketches showing the following situations involving work.

A force is doing work.

A force is not doing work because there is no motion.

A force is not doing work because the force does not point in the direction of motion.

Work and Energy

I found this information on page _________.

Complete the concept map relating work and energy.

is the ability to do

is the transfer of

Complete the equation for the calculation of work when force and distance are known. Copy the example from your book including units.

Work (in joules) = ________________________

\[ W = \text{force} \times \text{distance} \]

Describe the relationship between joules, meters, and newtons.
Analyze the meaning of the equation \( P = \frac{W}{t} \) by completing the sentences.

To increase power, one must either do \underline{________} in \underline{________} time or \underline{________} in \underline{________} time.

To decrease power, one must either do \underline{________} in \underline{________} time or \underline{________} in \underline{________} time.

Evaluate A candle is a device that converts chemical energy into heat energy. Start by writing the power equation. Then assume the wax in your candle contains 216,000 joules of energy, and it takes 3 hours for all of the wax to be consumed. Then calculate the candle’s power output, and compare it to that of a 60-watt light bulb.

\[
\text{Power (in watts)} = \frac{216,000}{3}
\]

CONNECT IT A child sits at the top of a slide at a playground. He wiggles forward slightly, and then slides all the way down with no further effort. Explain the source of the force acting on the child, and how you would calculate the work being done.
Read the section What You’ll Learn statements. Then write three questions that come to mind from reviewing these statements.

1. 
2. 
3. 

Define the word force in a sentence that shows its scientific meaning.

force

Read through the section to find a key term to match each definition below.

output force
input force
machine
efficiency
mechanical advantage

Look up the words per and cent in a dictionary. Then explain why 68 percent is the same as 68/100.

percent
Summarize the three different ways machines make work easier. Give an example of each, and explain why the work is easier.

1. 

2. 

3. 

Create a diagram of a machine. Show the input force and the output force.

Analyze the input work and output work of your machine.
Main Idea

**Mechanical Advantage, Efficiency**

I found this information on page __________.

---

Details

**Organize** your knowledge of the mechanical advantage and the efficiency of a machine. Complete the table of definitions.

<table>
<thead>
<tr>
<th></th>
<th>Mechanical Advantage</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define in Words</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Life Notes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Predict** what happens to the mechanical advantage of a machine if friction is reduced through the use of oil or some other means.

I found this information on page __________.

---

**ANALYZE IT**

Suppose that someone claims to have invented a machine with an efficiency greater than 100%. Explain what would have to be true for the person's claim to be correct.

I found this information on page __________.

---

*Copyright © McGraw-Hill Companies, Inc.*
Predict Read the title of Section 3. List three things that might be discussed in this section.

1. __________________________
2. __________________________
3. __________________________

Use the meaning of the word compound to predict the meaning of compound machine.

compound

Read the definitions below, then write the key term for each one in the left column.

- a bar that turns or pivots around a fixed point
- a sloping surface that reduces the amount of force needed to do work
- an inclined plane wrapped in a spiral
- an inclined plane with one or two sloping sides that moves through an object
- a grooved wheel with a rope, chain, or cable running around it
- a shaft or axle attached to a larger wheel so that they rotate together
- a machine that does work with a single movement of the machine
- a machine that consists of several simple machines working together

Use a dictionary to define reverse as a verb.
Main Idea

Types of Simple Machines

I found this information on page _________.

Levers

I found this information on page _________.

Pulleys

I found this information on page _________.

Details

Identify two types of simple machines and two examples of each.

Organize information about levers.

<table>
<thead>
<tr>
<th>Class</th>
<th>Force Closest to Fulcrum</th>
<th>Direction of Output Force</th>
<th>Is the IMA greater than 1?</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Compare the three types of pulleys that can be used to lift an object. Sketch a diagram of the input and output force for each pulley type.

<table>
<thead>
<tr>
<th>Pulley Type</th>
<th>Direction of Output Force</th>
<th>Input Force Needed</th>
<th>Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Movable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block and Tackle</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Distinguish between the two ways to use a wheel and axle. Explain how the forces differ when (1) the input force turns the wheel, and (2) the input force turns the axle.

Summarize the factors that increase the ideal mechanical advantage of each of the following machines.

Inclined plane
Screw
Wedge

Create a compound machine, showing the input force and the final output force. Include at least one lever, one pulley, one wheel and axle, one inclined plane, one screw, and one wedge.

SYNTHESIZE IT
A student states, “A lever whose ideal mechanical advantage (IMA) is less than 1 can still be a useful machine.” Analyze this statement. State whether you agree or disagree and why.
Tie It Together

Work and Machines

Combine what you have learned about work and machines in this chapter into an analysis of the ideal machine pictured below.

Complete the table, assuming that the output force is located at point B.

<table>
<thead>
<tr>
<th>$F_{in}$</th>
<th>$W_{in}$</th>
<th>IMA</th>
<th>$F_{out}$</th>
<th>$W_{out}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 newtons</td>
<td>3 joules</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 joules</td>
<td></td>
<td>21 newtons</td>
<td></td>
</tr>
<tr>
<td>36 newtons</td>
<td></td>
<td></td>
<td></td>
<td>4 joules</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18 newtons</td>
<td>2.5 joules</td>
</tr>
</tbody>
</table>

Complete the table, assuming the output force is located at point C.

<table>
<thead>
<tr>
<th>$F_{in}$</th>
<th>$W_{in}$</th>
<th>IMA</th>
<th>$F_{out}$</th>
<th>$W_{out}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 newtons</td>
<td></td>
<td></td>
<td></td>
<td>7 joules</td>
</tr>
<tr>
<td></td>
<td>1.5 joules</td>
<td></td>
<td>10 newtons</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 joules</td>
<td></td>
<td>6 newtons</td>
<td></td>
</tr>
<tr>
<td>21 newtons</td>
<td></td>
<td></td>
<td></td>
<td>11 joules</td>
</tr>
</tbody>
</table>

Predict what happens to the Ideal Mechanical Advantage of any machine if the input force and the output force trade places. (In the above diagram, imagine the input force at C and the output force at A.)
Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Work and Machines</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Holding a heavy object motionless involves a lot of work.</td>
<td></td>
</tr>
<tr>
<td>• Machines are tools for making work easier.</td>
<td></td>
</tr>
<tr>
<td>• A machine is a device that creates energy.</td>
<td></td>
</tr>
<tr>
<td>• A baseball bat can be considered a machine.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review
Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT
After reading this chapter, list three things you have learned about work and machines.

______________________________________________________________

______________________________________________________________

______________________________________________________________
Before You Read

Before you read the chapter, use the “What I Know” column to list three things you know about heat and thermal energy. Then list three questions you have about thermal energy in the “What I Want to Find Out” column.

<table>
<thead>
<tr>
<th>K</th>
<th>What I know</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>W</th>
<th>What I want to find out</th>
</tr>
</thead>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Describe things you do to make yourself feel warmer and cooler.

_________________________________________________

_________________________________________________

_________________________________________________

_________________________________________________

_________________________________________________
Read the section objectives. Write three questions that come to mind.

1. 
2. 
3. 

Define kinetic energy by using it in a sentence.

*kinetic energy* 

Use your book or a dictionary to define the following key terms.

*temperature* 

*thermal energy* 

*heat* 

*specific heat* 

Look up the word random in a dictionary. Then use the definition to describe the phrase random motion.

*random* 

Section 1 Temperature and Heat (continued)

Main Idea

Temperature
I found this information on page __________.

Thermal Energy
I found this information on page __________.

Heat
I found this information on page __________.

Specific Heat
I found this information on page __________.

Details

Compare the motion of hot atoms or molecules to cold atoms or molecules.

Analyze how each of the three actions in the table increases the kinetic, potential, or total thermal energy of a substance.

<table>
<thead>
<tr>
<th>Actions that Increase Thermal Energy</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>raise the temperature of the object</td>
<td></td>
</tr>
<tr>
<td>pull atoms or molecules that attract one another farther apart</td>
<td></td>
</tr>
<tr>
<td>add mass to the object, without changing its temperature</td>
<td></td>
</tr>
</tbody>
</table>

Model the flow of heat from a hot object to a cold one. Show the heat flow and some particles in the hot and cold objects.

Compare and contrast what happens in a metal to what happens to a mass of water when each is heated.
**Main Idea**

I found this information on page __________.

**Details**

**Evaluate** the amount of energy lost from a 0.5 kg glass casserole dish when it is placed in water. The dish’s temperature changes from 110˚C to 50˚C.

**Hints:** 1. Start by writing the equation for the change in thermal energy of an object.
   2. Find the specific heat for glass in the table in your book.

**Sequence** steps to use a calorimeter to find the specific heat of a material. Include steps for measurement and steps for calculation.

1. __________________________________________
2. __________________________________________
3. __________________________________________

**CONNECT IT**

Describe some processes in nature or daily life that depend on the high specific heat of water.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Thermal Energy
Section 2 Transferring Thermal Energy

**Skim** Section 2 of your text. Read the headings and the illustration captions. Write four questions that come to mind.

1. 
2. 
3. 
4. 

**Review Vocabulary**

**Define** density in a sentence that shows its scientific meaning.

density

**New Vocabulary**

Use your book or a dictionary to define the following key terms.

- conduction
- convection
- radiation
- insulator

**Academic Vocabulary**

Use a dictionary to define the word adapt.

adapt
Complete the table with what you have learned about the different ways thermal energy can be transferred.

<table>
<thead>
<tr>
<th>Description</th>
<th>Sketch</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Conduction**
I found this information on page ________.

**Convection**
I found this information on page ________.

**Radiation**
I found this information on page ________.
Organize the heat-controlling features of some animals in the following table. Write the feature and describe its role in helping the animal control heat.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Feature</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antarctic fur seal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emperor penguin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desert spiny lizard</td>
<td>scaly skin</td>
<td>reflects Sun's rays</td>
</tr>
</tbody>
</table>

Analyze how the vacuum between the inner and outer walls of a thermos bottle limits heat loss through conduction and convection.

List the methods you use to control the flow of heat to and from your body. Explain the purpose of each method.
Predict Read the title of Section 3. List three things that might be discussed in this section.

1. 
2. 
3. 

Review Vocabulary Define the word work in a sentence to reflect its scientific meaning.

work

New Vocabulary Read the definitions below, then write the key term for each one in the left column.

a device that converts heat into work

the study of the relationship among thermal energy, heat, and work

a heating system that absorbs radiant energy from the Sun

impossible for heat to flow from a cool object to a warmer object unless work is done

a heat engine that burns fuel in internal chambers

the increase in thermal energy of a system equals the work done on the system plus the heat transferred to the system

Academic Vocabulary Use a dictionary to define the word cycle.

cycle
**Main Idea**

**Heating Systems**

* I found this information on page __________.

**Details**

**Compare and contrast** forced-air, radiator-based, *and* electric heating systems for buildings.

<table>
<thead>
<tr>
<th>System Type</th>
<th>Heat Source</th>
<th>How Heat is Transported</th>
<th>How Heat Spreads</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Solar Heating**

* I found this information on page __________.

**Sequence** *how solar collectors work.*

1. ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________

2. ____________________________________________

3. ____________________________________________

4. ____________________________________________

**Thermodynamics**

* I found this information on page __________.

**Complete** the equation which defines the first law of thermodynamics.

\[
\text{Increase in } \quad \frac{\text{of system}}{} \quad = \quad \frac{\text{on system}}{} \quad + \quad \frac{\text{to system}}{} 
\]

**Contrast** the characteristics of an open system and a closed system.

______________________________
______________________________
______________________________
______________________________
### Main Idea

**Converting Heat to Work**

I found this information on page _________.

### Sequence

**Sequence** the four strokes of a standard automobile engine in their functional order. Fill in the other columns to describe what happens during each stroke.

<table>
<thead>
<tr>
<th>Name of Stroke</th>
<th>Which valves are open?</th>
<th>What are gases doing?</th>
<th>Piston movement (up/down)</th>
<th>Power generated? (yes/no)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Heat Movers

I found this information on page _________.

### Summarize

**Summarize** the steps a refrigerator takes to transfer heat by filling in the blanks with words from the word bank. Some words may be used more than once.

- Liquid coolant changes into a _________. In doing so, it becomes _________.
- Cold gas absorbs ________ from refrigerator interior, and the gas becomes _________.
- Gas releases _______ to the room, and the gas becomes _______. The gas turns into a _________.
- The compressor does _______ compressing the gas, which becomes even _________.

### Analyze It

A refrigerator is a device that causes heat to flow from a cool object (such as a pitcher of water) to a warm object (the air in the kitchen). Explain why this does not violate the second law of thermodynamics.
Tie It Together

Thermal Energy

Use your knowledge of thermal energy to create an imaginative thermal energy conservation poster. Include conservation ideas for home, work and school. Use bubble captions to describe how thermal energy is conserved for each conservation method.
Thermal Energy  Chapter Wrap-Up

In the left column, copy the questions you listed in the Chapter Preview.
In the right column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I wanted to find out</td>
<td>What I learned</td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

Summarize It

After reading this chapter, list three things you have learned about thermal energy.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Electricity

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Work and Machines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Electrical forces act at a distance.</td>
</tr>
<tr>
<td></td>
<td>• Electric charges can be created and destroyed.</td>
</tr>
<tr>
<td></td>
<td>• All circuits contain electrical resistance.</td>
</tr>
<tr>
<td></td>
<td>• Electricity can flow only through an open circuit.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

List five devices that use electrical energy. Write the forms of energy into which electrical energy is converted by each device.

1. 
2. 
3. 
4. 
5. 
Electricity
Section 1 Electric Charge

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

1. ______________________________________
2. ______________________________________
3. ______________________________________

Review Vocabulary
atom
Describe the structure of an atom.

New Vocabulary
Read the definitions below. Write the key term that matches each definition in the left column.

a material in which electrons are able to move easily
electrons on a neutral object are moved by a charged object
the buildup of electric charge on an object
a material in which electrons are not able to move easily
the process of transferring charge by touching or rubbing
charge can be transferred, but not created or destroyed

Academic Vocabulary
create
Use a dictionary to define the term create.
**Main Idea**

**Positive and Negative Charge**

**Details**

Model charges and electric fields of two items that have just been removed from a clothes dryer.

<table>
<thead>
<tr>
<th>Location of Force</th>
<th>Force</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within an atom</td>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td>Between atoms</td>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td>Between objects</td>
<td>Gravity</td>
<td></td>
</tr>
<tr>
<td>Between objects</td>
<td>Electricity</td>
<td></td>
</tr>
</tbody>
</table>

Compare the force of electricity to the force of gravity. Provide examples to complete the table.

Classify five conductors and five insulators in the correct space below.
Section 1 Electric Charge (continued)

Main Idea

Charging Objects
I found this information on page ___.

Details

Describe the charging that occurs in each event.
1. Lightning strikes a lightning rod on a tall building.

2. The lightning rod moves excess charges to Earth’s surface.

Detecting Electric Charge
I found this information on page ___.

Sequence the events that occur when an electroscope is used to detect a charge on an object.

1. A negatively (or positively) charged object touches the knob at the top of beaker.

2. 

3. 

4. 

Connect It

Hypothesize what might happen if you use electrical appliances while standing or sitting in water.

Name ______________________ Date ____________

Electricity
Use the checklist below to preview Section 2 of your book.

- Read all section titles.
- Read all bold words.
- Read all charts and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about electricity.

Write two facts you discovered about electric currents as you scanned the section.

1. ____________________________________________
2. ____________________________________________

Use the term pressure in a scientific sentence.

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Define the following key terms.

electric current

voltage difference

Circuit

Resistance

Ohm’s law

Use a dictionary to define terminate.

__________________________________________________________________________________
### Main Idea

**Current and Voltage Difference**

Create a drawing of an electric circuit that has a battery powering a digital clock. Show the direction of electron flow, and describe the movement of the electrons in the circuit.

---

**Batteries**

Compare dry-cell batteries to wet-cell batteries. Describe the components of each type of battery. In your own words, explain how it works.

<table>
<thead>
<tr>
<th>Battery Type</th>
<th>Components</th>
<th>How It Works</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry-cell</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet-cell</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---
Main Idea

Resistance
I found this information on page __________.

Details

Summarize the source of resistance in a material.

Organize the factors that affect the electrical resistance of a material. Write each word in one of the boxes below.

hotter       cooler       longer       shorter       thicker       thinner

More Resistance       Less Resistance

The Current in a Simple Circuit
I found this information on page __________.

Define three equations that come from Ohm’s law.

<table>
<thead>
<tr>
<th>Unknown Value</th>
<th>Known Values</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>Voltage difference</td>
<td>Resistance</td>
</tr>
<tr>
<td>Resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage difference</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Synthesize It

Electricians use different thickness of copper wire when they create the electrical circuits in a home. Use your knowledge of resistance to explain why an electrician would choose a thicker wire for a circuit that will provide power to a high-current appliance.

_____________________________________________________

_____________________________________________________

_____________________________________________________

_____________________________________________________
Predict Read the title of Section 3. List three things that might be discussed in this section.

1. 
2. 
3. 

Define energy to show its scientific meaning.

energy

Review Vocabulary

New Vocabulary

Use your book or a dictionary to define the following key terms.

series circuit

parallel circuit

electrical power

Use a dictionary to define parallel. Use the term in a sentence to show its scientific meaning.

parallel
Section 3 Electrical Energy (continued)

**Main Idea**

**Series and Parallel Circuits**

*I found this information on page __________.*

**Details**

**Analyze** what happens when you turn on a hair dryer. Explain each of the following results.

- Electric charges move:

- Heat is produced:

- Air is moved:

**Household Circuits**

*I found this information on page __________.*

**Describe** the connection of three strings of patio lights. One whole string does not light, but all bulbs in the other two strings do.

- 
- 
- 

**Compare** a fuse to a circuit breaker.

<table>
<thead>
<tr>
<th>Similarities</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Electric Power

I found this information on page ___________.

Evaluate the 3 equations that come from the definition of electric power.

<table>
<thead>
<tr>
<th>Unknown Value</th>
<th>Known Values</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage difference</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Distinguish between electric power and electrical energy. Include units in your answer.

A man-hour is defined as “a unit of one hour’s work by one person”. Describe how the unit of man-hour is similar to the kilowatt hour, the unit of electrical energy. Then explain how the two units are different.

<table>
<thead>
<tr>
<th>Comparing</th>
<th>Unit of Man-Hour</th>
<th>Unit of Kilowatt Hour</th>
</tr>
</thead>
</table>

I found this information on page ___________.

Electric Energy Converted to Example of

<table>
<thead>
<tr>
<th>Electrical Energy</th>
<th>Converted to</th>
<th>Example of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical energy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tie It Together

Electricity

Use your knowledge of electricity to become an “Electrical Detective”. Draw a wiring diagram of a room in your house, and imagine that a problem has occurred. One of the appliances has suddenly stopped working, and it is your job to figure out why. Describe the steps you might take to analyze the problem and list several possible causes and solutions.
Electricity  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Work and Machines</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Electrical forces act at a distance.</td>
<td></td>
</tr>
<tr>
<td>• Electric charges can be created and destroyed.</td>
<td></td>
</tr>
<tr>
<td>• All circuits contain electrical resistance.</td>
<td></td>
</tr>
<tr>
<td>• Electricity can flow only through an open circuit.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

Summarize It

After reading this chapter, list three things you have learned that will help you make better decisions about electricity use.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Magnetism and Its Uses

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Magnetism</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• A magnetic field is weakest close to the magnet.</td>
</tr>
<tr>
<td></td>
<td>• The north pole of a compass always points to Earth’s south magnetic pole.</td>
</tr>
<tr>
<td></td>
<td>• Moving charges can create magnetic fields.</td>
</tr>
<tr>
<td></td>
<td>• Windmills change chemical energy into electrical energy.</td>
</tr>
</tbody>
</table>

FOLDABLES Study Organizer

Construct the Foldable as directed at the beginning of this chapter.

SCIENCE JOURNAL

List three things you know about magnets.

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________
Skim through Section 1 of your book. Read the headings and the illustration captions. Write three questions that come to mind.

1. 
2. 
3. 

Define electric field to show its scientific meaning.

Read the definitions below, then write the key term for each one in the left column.

- Properties and interactions of magnets
- A region where a magnet’s force is strongest
- Something that exerts a force on magnets and objects made of magnetic materials

Define region as it might be used in science.
Section 1 Magnetism (continued)

**Main Idea**

Magnets

*I found this information on page __________.*

**Details**

Organize important facts about magnets by completing the outline.

Magnets

A. Magnetic force
   1. _____________________________
   2. _____________________________
   3. _____________________________

B. Magnetic field
   1. _____________________________
   2. _____________________________
   3. _____________________________

C. Magnetic poles
   1. _____________________________
   2. _____________________________
   3. _____________________________
   4. _____________________________
      a. _____________________________
      b. _____________________________

D. Compass
   1. _____________________________
   2. _____________________________
   3. _____________________________

E. Earth as a magnet
   1. _____________________________
   2. _____________________________
   3. _____________________________
Main Idea

Magnetic Materials

Classify each metal as magnetic or nonmagnetic.

- aluminum
- cobalt
- copper
- gold
- iron
- mercury
- nickel
- silver

I found this information on page __________.

I found this information on page __________.

Details

Model a close-up of the magnetic domains of the cross sections of an iron rod in each of these situations.

- normal state
- rod is brought near magnet
- rod is heated or dropped

Identify the poles of a magnet before and after it is sliced into three pieces.

I found this information on page __________.

Outline the steps a recycling company might use to separate metallic, nonmetallic, and other recyclable materials. (Hint: Some of the materials are magnetic.)
Scan the headings, figures, and captions in Section 2 of your text. Write three questions that come to mind.

1. 
2. 
3. 

Define electric current to show its scientific meaning.

Use your book or a dictionary to define the following key terms.

- electric current
- electromagnet
- solenoid
- galvanometer
- electric motor

Use temporary in a sentence that shows its scientific meaning.

- temporary
Evaluate the magnetic fields that surround two identical pieces of wire carrying the same electric current. One wire is straight, and the other wire is coiled into a solenoid.

Sequence the steps in the explanation of how electromagnets make sound when you listen to a CD. Some terms from the word bank may be used more than once.

- amount
- current
- direction
- electromagnet
- magnetic field
- repels
- reproduces
- voltage

The CD player produces a ______.

The ______ produces an electric _________ in the electromagnet next to the speaker cone.

The CD contains information that changes the _________ of current and its _________.

The changing electric current changes the direction and strength of the _________ around the electromagnet.

The electromagnet attracts or _________ the permanent magnet.

The moving _________ vibrates the speaker cone and _________ the sound recorded on the CD.
Section 2 Electricity and Magnetism (continued)

**Main Idea**

**Electric Motors**
I found this information on page __________.

**Details**

Model and label a galvanometer and describe how it works.

Sequence the steps an electric motor uses to change electrical energy to mechanical energy. Make a sketch and label the motor.

1. _____________________
   _____________________
   _____________________
   _____________________

2. _____________________
   _____________________
   _____________________
   _____________________

3. _____________________
   _____________________
   _____________________
   _____________________

**SYNTHESIZE IT**

Describe the properties of magnets that make them useful to humans. Include an example for each property.

________________________________________________________

________________________________________________________

________________________________________________________
### Magnetism and Its Uses

**Section 3 Producing Electric Currents**

**Scan** the headings, figures, and captions in Section 3 of your book. Write three questions that come to mind.

1. 
2. 
3. 

**Review Vocabulary**

**Define** voltage difference to show its scientific meaning.

<table>
<thead>
<tr>
<th>Voltage Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>__________________</td>
</tr>
<tr>
<td>__________________</td>
</tr>
<tr>
<td>__________________</td>
</tr>
</tbody>
</table>

**New Vocabulary**

Use your book to define the following key terms.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromagnetic induction</td>
<td></td>
</tr>
<tr>
<td>Generator</td>
<td></td>
</tr>
<tr>
<td>Turbine</td>
<td></td>
</tr>
<tr>
<td>Direct current (DC)</td>
<td></td>
</tr>
<tr>
<td>Alternating current (AC)</td>
<td></td>
</tr>
<tr>
<td>Transformer</td>
<td></td>
</tr>
</tbody>
</table>

**Academic Vocabulary**

Use a dictionary to define regulate as it might be used in science.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulate</td>
<td></td>
</tr>
</tbody>
</table>
Main Idea

From Mechanical to Electrical Energy

I found this information on page \[\text{_______}.\]

Direct and Alternating Currents

I found this information on page \[\text{_______}.\]

Details

Organize the process of creating electrical energy from mechanical energy. Complete the concept map.

Predict three electrical devices in your home that will stop working in a power failure, and which devices will continue to work. Describe the two types of current used by these devices.

<table>
<thead>
<tr>
<th>Works</th>
<th>Doesn’t Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devices</td>
<td></td>
</tr>
<tr>
<td>Description of Current</td>
<td></td>
</tr>
</tbody>
</table>
Analyze why a transformer is needed to provide power to your home with the correct voltage.

Compare the two types of transformers using a Venn diagram. List at least two pieces of information in each category.

**Synthesize It**
Evaluate how the current produced from a hand-crank generator would change as the handle is rotated forward and then backward.
Tie It Together

Magnetism and Its Uses

**Plan** an expedition to find Earth’s south magnetic pole. Plan an experiment to see how near the south magnetic pole is to the geographic north pole. Don’t forget that you will require power on your trip to run various communication and scientific equipment.

Equipment list:


State your hypothesis.


Describe your experiment.


Analyze and interpret your predicted data.


Draw a top view of Earth from your hypothesis and proposed data. Include some meridians and the positions of both poles.
Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Magnetism and Its Uses</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A magnetic field is weakest close to the magnet.</td>
<td></td>
</tr>
<tr>
<td>• The north pole of a compass always points to Earth’s south magnetic pole.</td>
<td></td>
</tr>
<tr>
<td>• Moving charges can create magnetic fields.</td>
<td></td>
</tr>
<tr>
<td>• Windmills change chemical energy into electrical energy.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

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- Study the definitions of vocabulary words.
- Review daily homework assignments.
- Re-read the chapter and review the charts, graphs, and illustrations.
- Review the Self Check at the end of each section.
- Look over the Chapter Review at the end of the chapter.

Summarize It

After reading this chapter, list at least five ways magnets are used.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Energy Sources

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• According to the law of conservation of energy, energy cannot be created or destroyed.</td>
</tr>
<tr>
<td></td>
<td>• Nonrenewable resources are resources that cannot be replaced by natural processes.</td>
</tr>
<tr>
<td></td>
<td>• Nuclear power plants produce about eight percent of the energy consumed in the United States.</td>
</tr>
<tr>
<td></td>
<td>• Nuclear fusion releases energy when nuclei are split.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Describe how your day would be different if the electric power were off all day.

________________________
________________________
________________________
________________________
________________________
________________________
________________________
________________________
Energy Sources
Section 1 Fossil Fuels

Skim through Section 1 in your book. Identify three fuels made from fossil materials.

__________, _________, and _________

Define chemical potential energy.

____________________________________

____________________________________

Read the definitions below. Then write the key term for each one in the left column.

___________ fuel formed by the decay of ancient plants and animals

___________ a liquid fuel formed by decayed organisms

___________ resources that cannot be replaced by natural processes as quickly as they are used

Use a dictionary to define generate.

____________________________________

____________________________________

Analyze the Energy Usage and Sources of Energy graphs in your book to complete the statements.

More energy is used for _________ in the United States than for anything else. _________ users use 17 percent less energy than industry. Petroleum and natural gas together supply _________ of our energy needs. _________ and _________ supply only 3 percent of our energy needs. _____________ supplies 4 percent of energy needs in the United States. Almost 85 percent of the energy used comes from burning _________, _________, and _________. 
**Main Idea**

**Making Fossil Fuels**

1. Plants and animals die.
2. 
3. Organic matter is
4. 
5. Chemical reactions change matter into

**Petroleum**

I found this information on page __________.

**Details**

**Sequence** the steps involved in the formation of oil and natural gas. The first step has been done for you.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plants and animals die.</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Organic matter is</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Chemical reactions change matter into</td>
</tr>
</tbody>
</table>

**Complete** the paragraphs about fossil fuels.

Fossil fuels store potential __________________ energy in __________________. When a fossil fuel burns, a chemical reaction takes place. __________________ and __________________ in the fuel react with ________________ in the air to produce ________________, water, ___________ and light.

Chemical potential energy in fossil fuels is more ____________ than other fuels. Burning ______________ releases two to three times as much energy as burning _____________.

**Label** the fractional distillation tower with the contents of each chamber.

- crude oil
- heat
- hydrocarbons with high boiling points
- materials with low boiling points.
Use the diagram to summarize the types and uses of fossil fuels.

Complete the sentences below.
Because fossil fuels are ______________, their supply is __________. As the human population grows and __________ demands __________, reserves are __________. This means that __________, the remaining supplies is extremely important.

In addition to being limited, fossil fuels cause air __________ in the form of ______________, ______________, and ______________. Natural gas contains more ______________ and burns more cleanly than ______________. ______________ is mainly used in ______________ to ______________. When the fuel is ______________, it heats water. Chemical energy is converted to ______________. Through turning a ______________ connected to a ______________, thermal energy is further converted ______________.

When fossil fuels are converted from ______________ to other forms, the ______________ of the conversion varies greatly. Overall, it is only ______________. Much of the remaining 65 percent is ______________.

I found this information on page __________.
Scan the headings, figures, and captions in Section 2 of your book. Write three questions that come to mind.

1. 

2. 

3. 

Define nuclear fission.

Read the definitions below. Then write the key term for each one in the left column.

- system that generates electricity from controlled nuclear reactions
- any radioactive by-product of the use of radioactive materials

Using Nuclear Energy

I found this information on page .

Analyze nuclear energy use by filling in the correct numeral in the left column for each statement.

- percent of all electricity produced in the United States from power plant
- percent of energy consumed in the United States that is nuclear
- number of nuclear reactors producing electricity in the United States in 2003.
- number of nuclear power plants in the United States in 2003
Describe the four common parts of all nuclear reactors.

1. 
2. 
3. 
4. 

Sequence a uranium nuclear fission reaction by completing the flow chart below. The first step has been done for you.

1. A neutron hits the nucleus of a U-235 atom.
2. 
3. 

Model and label the control rods in a nuclear reactor. Use arrows to show how the rods would be moved to slow the reaction.

Summarize how the control rods affect the rate of reaction in the nuclear reactor.

Predict what would happen if the control rods were completely removed from a nuclear reaction.
Nuclear Power Plants

I found this information on page ____________.

A coolant is pumped through the reactor.

Complete the graphic organizer to explain how nuclear fission produces electricity.

Identify three advantages and three disadvantages of using nuclear power.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>

Compare and contrast nuclear fusion to nuclear fission.

---

SYNTHESIZE IT
Scan the headings in Section 3 of your book. Then list six sources of energy that will be discussed in the section.

1. ____________________  4. ____________________
2. ____________________  5. ____________________
3. ____________________  6. ____________________

Define radiant energy.

radiant energy

Use your book to define the following key terms.

renewable resource

photovoltaic cell

hydroelectricity

grothermal energy

biomass

Use a dictionary to define migrate.

migrate
Section 3 Renewable Energy Sources (continued)

**Main Idea**

**Energy Options**

*Summarize the need for alternative energy sources.*

- I found this information on page __________.

**Details**

**Energy from the Sun**

*I found this information on page __________.*

**Complete the statements to make them true.**

The solar energy reaching Earth is only about __________ of all solar energy.

When sunlight strikes a solar cell, __________ are given off from the system.

Conversion of solar energy to electrical energy by solar cells is only __________ percent efficient.

The most promising solar technologies focus sunlight on a tube of ____________________________.

**Energy from Water**

*I found this information on page __________.*

**Sequence the steps in the production of hydroelectric energy. The first step has been completed for you.**

- Water flows through tunnels near the base of a dam.

[Sequence steps]

---

Energy Sources 101
Complete the table comparing information about tides, wind, and geothermal energy sources.

<table>
<thead>
<tr>
<th></th>
<th>Tides</th>
<th>Wind</th>
<th>Geothermal</th>
</tr>
</thead>
<tbody>
<tr>
<td>efficiency</td>
<td>about twice as efficient as fossil fuel or nuclear plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>availability of the source</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>effect on plants and animals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pollution created</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Alternative Fuels**

Identify three other alternative fuels.

**ANALYZE IT**

Evaluate one renewable energy source that you think is promising for our future energy needs. Support your choices.
Tie It Together

Energy Sources

Create your own graphic organizer(s) similar to the ones you have seen in your Science Notebook to clearly summarize important information about each of the renewable energy sources in this section. Leave some of the information out, and have a friend try to complete your organizer.
Energy Sources  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an **A** if you agree with the statement.
2. Write a **D** if you disagree with the statement.

<table>
<thead>
<tr>
<th>Energy</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• According to the law of conservation of energy, energy cannot be created or destroyed.</td>
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<tr>
<td>• Nuclear fusion releases energy when nuclei are split.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your *Science Notebook* on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

**Summarize It**

List the three major types of energy sources discussed in this chapter. Then indicate one major disadvantage to using each source of energy.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

104  *Energy Sources*
Waves

Before You Read

Before you read the chapter, respond to these statements.
1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Waves</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Waves move only through water.</td>
</tr>
<tr>
<td></td>
<td>• Waves can bend.</td>
</tr>
<tr>
<td></td>
<td>• Waves can be different sizes and move at different speeds.</td>
</tr>
<tr>
<td></td>
<td>• When a wave moves, the substance in which it travels moves with it.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Write down three things you already know about waves, and one thing you would like to learn about waves.

[Blank lines for answers]
Waves
Section 1 The Nature of Waves

**Predict** Read the title of Section 1. List three things that might be discussed in this section.

1. 
2. 
3. 

**Define** energy to show its scientific meaning.

energy

**New Vocabulary** Use your book or a dictionary to define the following key terms.

wave

medium

transverse wave

compressional wave

**Academic Vocabulary** Use a dictionary to define transfer.

transfer
Distinguish one way in which ocean waves and waves from earthquakes are different.

Model energy transfer in waves.
• Draw a sketch of a pebble being dropped in the water and creating waves.
• Draw arrows to show the direction of the energy that is being transferred in the waves.

Analyze what happens when waves come into contact with a boat. Explain why they do not move the boat to a different position.

Complete the graphic organizer about waves.

Waves are created by

and carry
**Main Idea**

**Mechanical Waves**

Classify each type of wave, mechanical wave or not, and describe the type of medium it moves through (water, air, or none).

<table>
<thead>
<tr>
<th>Type of Wave</th>
<th>Medium</th>
<th>Is it a mechanical wave?</th>
</tr>
</thead>
<tbody>
<tr>
<td>ocean wave</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sound wave</td>
<td></td>
<td></td>
</tr>
<tr>
<td>radio wave</td>
<td></td>
<td></td>
</tr>
<tr>
<td>light wave</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Details**

**Classify** each type of wave, mechanical wave or not, and describe the type of medium it moves through (water, air, or none).

Compare and contrast the 2 types of mechanical waves.

- Draw a cross section of the ocean.
- Use arrows to show how transverse and compressional waves each move the water.

**CONNECT IT**

Design an experiment to show that water waves are both transverse waves and compressional waves. Explain how your experiment will work.
**Waves**

Section 2  Wave Properties

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

1. 
2. 
3. 

**Define** property to show its scientific meaning.

- property

**Review Vocabulary**

Read the definitions below. Then write the key term on the blank in the left column.

- the high points of a transverse wave
- the amount of time it takes one wavelength to pass a point
- the area of a compressional wave where the medium is more spread out
- the low points of a transverse wave
- a measure of the energy that a wave carries
- the number of wavelengths that pass a fixed point each second
- the distance between one point on a wave and the nearest point just like it

**New Vocabulary**

**Academic Vocabulary**

Use a dictionary to define impact.

- impact
Section 2 Wave Properties (continued)

Main Idea

The Parts of a Wave and Wavelength

I found this information on page __________.

Model two transverse waves, one with a short wavelength and one with a longer wavelength. Identify a crest, trough and wavelength for each wave.

Complete the flow chart to help you understand the relationship between frequency and wavelength.

When the frequency of a wave increases, the wavelength of the wave...

I found this information on page __________.

Model two compressional waves, one with a small wavelength and one with a larger wavelength. Identify a rarefaction and compression in each wave. Label the wavelength.

Frequency and Period

I found this information on page __________.
Main Idea

Wave Speed
I found this information on page __________.

Details

Evaluate the speed of an ocean wave that has a wavelength of 4.0 m and a frequency of 400 Hz.

\[ v = f \times \lambda \]

\[ v = ____ \times ____ \]

\[ v = ____ \text{ m/s} \]

Amplitude and Energy
I found this information on page __________.

Compare two compressional waves by drawing them. One wave should have more energy than the other. Label the energy of each wave.

I found this information on page __________.

Identify how the amplitude of a transverse wave is measured. Make a sketch to show your answer.

Connect It

Contrast the amplitude and energy of the sound waves you make when you shout across a room with the sound waves you make when you speak softly.

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Waves
Section 3 The Behavior of Waves

Scan Write three facts you discovered about the behavior of waves as you scanned the headings and illustrations.

1. 
2. 
3. 

Review Vocabulary Define angle to show its scientific meaning.

angle 

New Vocabulary Use your book to define the following terms.

refraction 

diffraction 

interference 

standing wave 

resonance
Main Idea

Reflection

I found this information on page __________.

Summarize the law of reflection by completing the sentence below.
The angle of ________ is equal to ________________.

Create a diagram showing a flashlight shining on a mirror. Label your diagram with the terms given.

- angle of incidence
- reflected beam
- angle of reflection
- the normal
- incident beam

Details

Refraction

I found this information on page __________.

Summarize why a spoon placed in a clear glass of water appears to be crooked. Make a sketch to help you explain.

Evaluate one similarity and one difference between refraction and diffraction.

<table>
<thead>
<tr>
<th>Similarity</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 3 The Behavior of Waves (continued)

**Main Idea**

**Interference**

I found this information on page __________.

**Standing Waves**

I found this information on page __________.

**Resonance**

I found this information on page __________.

**Details**

Complete the table describing the 2 types of interference.

<table>
<thead>
<tr>
<th>Interference</th>
<th>Interference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause:</td>
<td>Cause:</td>
</tr>
<tr>
<td>Result:</td>
<td>Result:</td>
</tr>
</tbody>
</table>

**Summarize** what causes a standing wave to form.

__________________________________________________________________________

__________________________________________________________________________

**Analyze** why an opera singer singing a high note into a microphone can cause a nearby glass of water to shatter.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

**SYNTHESIZE IT**

Suppose you have sunlight shining on two clear containers of water on a table. Light waves refract through one of the containers but diffract around the other container. Describe how the two containers are different.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Predict how resonance can cause earthquakes to do greater damage to some buildings than others.

Analyze If two astronauts were able to go on a space walk without wearing space suits. Explain why they would not be able to talk to one another.

Describe how you could use interference to make a wave smaller in amplitude. Give a real world example.
Waves Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Waves</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Waves only move through water.</td>
<td></td>
</tr>
<tr>
<td>• Waves can bend.</td>
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<td></td>
</tr>
<tr>
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<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review
Use this checklist to help you study.

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- Study your Science Notebook on this chapter.
- Study the definitions of vocabulary words.
- Review daily homework assignments.
- Re-read the chapter and review the charts, graphs, and illustrations.
- Review the Self Check at the end of each section.
- Look over the Chapter Review at the end of the chapter.

CONNECT IT
Give three examples of waves that affect you every day. Then describe one characteristic that is common to all three waves.

Give three examples of waves that affect you every day:
- 
- 
- 

One characteristic that is common to all three waves: 

Name ___________________________ Date _______________
Sound

Before You Read

Preview the chapter and section titles and the section headings. Complete the two columns of the table by listing at least two ideas in each column.

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What I know</strong></td>
<td><strong>What I want to find out</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Foldables Study Organizer]

Construct the Foldable as directed at the beginning of this chapter.

![Science Journal]

Write three things that you would like to learn about sound.

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Scan Use the checklist below to preview Section 1 of your book.
• Read all section titles.
• Read all bold words.
• Read all charts and graphs.
• Look at all the pictures and read their captions.
• Think about what you already know about sound.

Write three facts you discovered about the nature of sound as you scanned the section.
1. ______________________________________
2. ______________________________________
3. ______________________________________

Review Vocabulary Define vibration in a sentence that shows its scientific meaning.
vibration

New Vocabulary Define the following terms.
eardrum

cochlea

Academic Vocabulary Use a dictionary to define medium as a noun that might relate to sound.
medium
Section 1 The Nature of Sound (continued)

Main Idea

What causes sound?
I found this information on page ___________.

Details

Complete the diagram showing what vibrates to produce each sound on the right.

- music from the radio
- people speaking
- all sound

Sound Waves
I found this information on page ___________.

Sequence the steps involved in creating a sound wave from a speaker. The steps are written in scrambled order at right. Write the steps in the correct order in the boxes on the left.

1. The air molecules collide with other air molecules.
2. A speaker vibrates.
3. A sound wave forms.
4. Energy is transferred between air molecules.
5. Some energy is transferred to these air molecules.
6. The speaker collides with nearby air molecules.

Moving Through Materials
I found this information on page ___________.

Classify the words liquid, solid, and gas on the continuum below. Describe how close the molecules are to each other in each phase.

- sound travels slowest
- sound travels fastest

Sound 119
Compare the speed of the sound of a child yelling outside when it is 10° C to the speed of the sound when it is 30° C.

Create your own sketch of an ear. Label and describe what each part of the ear does to enable you to hear:
- anvil
- cochlea
- ear canal
- eardrum
- hammer
- stirrup
- outer ear
- middle ear
- inner ear

Predict how hearing would change in a person with a damaged eardrum and hypothesize why this would be.
Preview the photos and illustrations in Section 2. Read the captions. Write three things you think will be discussed in this section.

1. 
2. 
3. 

Define potential energy in a sentence that shows its scientific meaning.

potential energy

Define the following key terms.

intensity

loudness

decibel

pitch

ultrasonic

Doppler effect

Use a dictionary to define expand.

expand
Section 2 Properties of Sound (continued)

**Main Idea**

**Intensity and Loudness**
I found this information on page __________.

**Details**

Create density drawings of molecules in sound waves with a high level of intensity and a low level of intensity. Label a rarefaction and a compression.

<table>
<thead>
<tr>
<th>Low Intensity</th>
<th>High Intensity</th>
</tr>
</thead>
</table>

I found this information on page __________.

Compare the travel distance and energy of high and low intensity sound waves. Identify which wave will travel farther, and which wave will lose its energy more quickly.

I found this information on page __________.

Complete the paragraph to summarize loudness.

The perception of intensity is ________. Loud sounds come from __________ that have ____________ and _________.

When these waves reach your ear, they cause your ________ to ____________ than sound waves with _____________.

This leads to ________________ of the bones of the __________ and of the __________ in the inner ear. As a result, you hear a ______ sound.
Main Idea

Intensity and Loudness
I found this information on page ____________.

Pitch
I found this information on page ____________.

The Doppler Effect
I found this information on page ____________.

Details

Identify the following key characteristics of sound intensity.
• how sound intensity is measured _______________________
• level of sound intensity that damages human hearing
• level of the faintest sound humans can hear ______________

Organize information about sound frequencies in the table.

<table>
<thead>
<tr>
<th>Name</th>
<th>Frequencies</th>
<th>Humans can hear?</th>
<th>Use or Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrasonic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sonic</td>
<td>20 Hz-20,000 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultrasonic</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Complete the graphic organizer about the Doppler effect.

When a source of sound is moving ______________ you, compressions are ______________, so the sound has a _____ frequency and a _____ pitch.

When a source of sound is ______________ you, compressions are ______________, so the sound has a __________ frequency and a ______ pitch.

CONNECT IT
Design a simple experiment to show younger students that sound intensity decreases with distance.

Name ____________________________ Date ______________
Skim the headings, photos, illustrations, and captions in Section 3. Write three questions you have about this section.

1. ____________________________________________________________

____________________________________________________________

2. ____________________________________________________________

____________________________________________________________

3. ____________________________________________________________

____________________________________________________________

Define frequency to show its scientific meaning.

frequency

____________________________________________________________

____________________________________________________________

Read the definitions below, then write the key term for each one in the left column.

describes the differences among sounds of the same pitch and loudness

a hollow space filled with air that makes sound louder when the air inside of it vibrates

a vibration with a frequency that is a multiple of the fundamental frequency

made of sounds that are deliberately used in a regular pattern

Use a dictionary to define fundamental as an adjective.

fundamental

____________________________________________________________

____________________________________________________________
Distinguish between music and noise in your own words. Give one example of each.

Summarize the 3 things that determine the natural frequency of a guitar string.
1. 
2. 
3. 

Sequence steps in the resonance of a brass or woodwind instrument.
Section 3 Music (continued)

Main Idea

Sound Quality
I found this information on page 126.

Details

Analyze the factors that cause each musical instrument to have its own unique sound quality.

Analyse the factors that cause each musical instrument to have its own unique sound quality.

Complete the table showing the different types of musical instruments and how they produce sound.

<table>
<thead>
<tr>
<th>Type of Instrument</th>
<th>How is sound produced?</th>
<th>What is the resonator?</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brass and Woodwinds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percussion</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CONNECT IT

Design a musical instrument. Make a sketch of the instrument and describe how it produces music, how you change notes, and what the resonator is.

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________
Objectives Before you read Section 4, look at the objectives under “What You’ll Learn”. Rewrite each objective as a question.

1. 

2. 

3. 

4. 

Review Vocabulary Define echo in a sentence of your own.

echo 

New Vocabulary Define the following key terms. Then use each term in a sentence.

acoustics 

echolocation 

sonar 

Academic Vocabulary Use a dictionary to define design.

design 

Section 4 Using Sound
Summarize three characteristics of a room that can affect reverberation. List three materials or ways to reduce reverberation.

Factors that Affect Reverberation

<table>
<thead>
<tr>
<th>Material/Way</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ways to Reduce Reverberation

Model a bat using echolocation to identify an insect. Be sure to include the sound waves being sent from the bat and reflecting back to the bat from the insect.

Summarize how bats use echolocation to hunt.

Sequence the steps involved in using sonar to find the distance to an underwater object.

1. A sound pulse is emitted toward the bottom of the ocean.
2. 
3. 
4. 
5. 
Identify four uses of sonar.

Organize information about the uses of ultrasound in medicine.

Ultrasound in Medicine
I found this information on page ___________.

SYNTHESIZE IT
Think about what you have learned about how particles absorb energy from waves to predict how ultrasonic treatments are able to break up kidney stones.

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Sound  Chapter Wrap-Up

Review the ideas that you listed in the table at the beginning of the chapter. Cross out any incorrect information in the first column. Then complete the table by filling in the third column. How do your ideas about what you know now compare with those you provided at the beginning of the chapter?

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I know</td>
<td>What I want to find out</td>
<td>What I learned</td>
</tr>
</tbody>
</table>

Review

*Use this checklist to help you study.*

- Review the information you included in your Foldable.
- Study your *Science Notebook* on this chapter.
- Study the definitions of vocabulary words.
- Review daily homework assignments.
- Re-read the chapter and review the charts, graphs, and illustrations.
- Review the Self Check at the end of each section.
- Look over the Chapter Review at the end of the chapter.

**SUMMARIZE IT**

Describe three things you have learned about sound.

---

NAME __________________________ DATE _____________

130  Sound
Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Electromagnetic Waves</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Electromagnetic waves can be transmitted only through matter.</td>
</tr>
<tr>
<td></td>
<td>• Electromagnetic waves are produced by vibrating electric charges.</td>
</tr>
<tr>
<td></td>
<td>• Visible light is only a small part of the electromagnetic spectrum.</td>
</tr>
<tr>
<td></td>
<td>• Communications satellites send out microwaves.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

List six objects around you that emit light or feel warm.

List:

1. 
2. 
3. 
4. 
5. 
6. 
Scan the headings, bold words, figures, and captions in Section 1 of your book. Write four facts you learned about electromagnetic waves as you scanned the section.

1. 
2. 
3. 
4. 

Define hertz.

hertz

Read the definitions below. Then write the key term for each definition in the left column.

waves made by vibrating electric charges that can travel through space where there is no matter

energy carried by an electromagnetic wave

an electromagnetic wave that behaves like a particle whose energy depends on the frequency of waves

Use a dictionary to define enable.

enable
Compare sound and water waves with electromagnetic waves by completing the Venn diagram. Place each characteristic in the correct place in the diagram.

- carry energy from one place to another
- do not require matter to transfer energy
- must move through matter
- transfer energy between vibrating electric and magnetic fields
- transfer energy from particle to particle
- produced by vibrations

Sound and Water Waves

Electromagnetic Waves

Both

Complete the information about electric and magnetic fields.

- All electric charges are surrounded by a/an __________ field.
- All magnets are surrounded by a/an __________ field.

Sequence steps as vibrating electric and magnetic fields become a wave that travels through space.

1. The changing electric field

2. 

3. 
Section 1 What are Electromagnetic Waves? (continued)

Main Idea

Properties of Electromagnetic Waves

I found this information on page 134.

Details

Model an electromagnetic wave with a 1-m wavelength. Beneath this, create a second wave whose wavelength is shorter than the first one.

Analyze which wave above has a greater frequency.

Summarize and model waves and particles by completing the paragraph. Create a diagram of the electron wave pattern.

All __________, not only electrons, can behave like __________. When waves of particles pass through two slits, they will form __________.

Synthesize It

Predict how jewelers, detectives, antique dealers, or other scientists could use electromagnetic waves to determine the composition of unknown materials in the course of their job.
Electromagnetic Waves
Section 2 The Electromagnetic Spectrum

**Skim** Section 2 of your book. Read the headings and the illustration captions. Write two questions that come to mind.

1. ____________________________
2. ____________________________

**Define** frequency to reflect its scientific meaning.

**Use** your book to define the following key terms.

- **radio waves**
- **microwaves**
- **infrared waves**
- **visible light**
- **ultraviolet waves**
- **X rays**
- **gamma rays**

**Use a dictionary to define** internal.

**New Vocabulary**
A Range of Frequencies

Radio Waves, Infrared Waves, Ultraviolet Waves, and X Rays and Gamma Rays

Organize characteristics of electromagnetic waves of different frequencies.

<table>
<thead>
<tr>
<th>Waves with Lower Frequency Than Visible Light</th>
<th>Waves with Higher Frequency Than Visible Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>

Summarize the different types of electromagnetic waves by completing the following paragraph.

Radio waves are ________________________________ ________________________________. Radio waves that are less than 30 cm, called __________________, make it possible to __________________________. Some ____________ are used for finding the location of planes, boats, and cars by a method called _____________. Some electromagnetic waves can be dangerous. _______ have very short wavelengths. Both ______ and ____________ can kill _____________. This is useful in treating _____________, but doctors must be careful not to kill healthy cells as well. Satellites may have ________________ for helping to identify vegetation on Earth’s surface. Near the ________________ of the frequency range, __________ makes it possible for us to ________________________.

Identify the key features of some electromagnetic waves by filling in the table below.

<table>
<thead>
<tr>
<th>Wave</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>radio</td>
<td>radio waves that produce thermal energy</td>
</tr>
<tr>
<td>infrared</td>
<td>short wavelength waves that can cause sunburn</td>
</tr>
</tbody>
</table>
Compare the advantages and disadvantages to humans of ultraviolet waves by filling in the blanks in the following graphic organizer.

- Advantages
  1.
  2.

- Disadvantages
  1.
  2.

I found this information on page 137.

Analyze how chlorofluorocarbons are destroying Earth’s ozone layer and why this is a concern to scientists.

- Chlorofluorocarbons are destroying Earth’s ozone layer because...
- This is a concern to scientists because...
- Another concern is...
- Scientists are working on...

CONNECT IT

MRIs and X rays are both useful for diagnosing and treating some medical conditions. Explain why X rays are still being used even though MRIs are safer.

- X rays are still used because...
- MRIs are safer because...
- Other reasons why X rays are used:
- Other benefits of using X rays:
- Challenges with using X rays:
- How can we improve the use of X rays?
Electromagnetic Waves
Section 3 Radio Communication

Predict three topics that might be discussed in Section 3.

1. 
2. 
3. 

Review Vocabulary

Define satellite.

satellite

New Vocabulary

Use your book to define the following key terms.

carrier wave

cathode-ray tube

transceiver

Global Positioning System (GPS)

Academic Vocabulary

Use a dictionary to define transmit.

transmit
Compare AM and FM radio transmission by completing the organizer below.

**Main Idea**

**Radio Transmission**

I found this information on page ________.

**Television**

I found this information on page ________.

**Details**

**Radio Transmission**

AM radio stations broadcast information by

FM radio stations broadcast information by

**Television**

Complete the flowchart below to describe the transmission of television signals.

A television station changes sounds and images into ________ ________.

_____ part is sent by ____ waves.

Information about color and ________ is sent by ____ waves.

The _____________ (CRT) in a color TV produces _____ electron beams.

The electron beams move back and forth across your screen, striking groups of _____, _____, and _____ spots.

The three spots together can form any _____. The colors that are formed by these spots create the full-color image you see on your TV.
Organize what you have learned about telephones by completing the table below.

<table>
<thead>
<tr>
<th>Type</th>
<th>Features</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corded</td>
<td>stays in one place</td>
<td>sends/receives</td>
<td>must use in one</td>
</tr>
<tr>
<td></td>
<td></td>
<td>consistent signal</td>
<td>place</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>not linked to the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>base</td>
</tr>
<tr>
<td>Pager</td>
<td></td>
<td></td>
<td>tower needed</td>
</tr>
</tbody>
</table>

Create a sketch to show how a satellite telephone system works.
- Use arrows to show the path of the signal.
- Include the sender, a satellite, and the receiver in your sketch.

Analyze the information on the Global Positioning System. Infer why the system uses data from four different satellites when locating an object.
Tie It Together

Electromagnetic Waves

**Synthesize It**  Draw a large diagram of part of Earth and the sky above it. Add the ozone layer, and show its effect on one type of radiation. Include a few communication satellites, vehicles, and buildings. (One building should be a hospital.) Your drawing will not be to scale. Show and label the following where they may be expected: radio waves, radar, infrared waves, gamma rays, microwaves, visible light waves, UV waves, X rays.
Electromagnetic Waves Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Electromagnetic Waves</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Electromagnetic waves can be transmitted only through matter.</td>
<td></td>
</tr>
<tr>
<td>• Electromagnetic waves are produced by vibrating electric charges.</td>
<td></td>
</tr>
<tr>
<td>• Visible light is only a small part of the electromagnetic spectrum.</td>
<td></td>
</tr>
<tr>
<td>• Communications satellites send out microwaves.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

Summarize It

After reading this chapter, list three things you have learned about Electromagnetic Waves.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Light</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Only shiny materials reflect light.</td>
</tr>
<tr>
<td></td>
<td>• Mirages appear only in deserts.</td>
</tr>
<tr>
<td></td>
<td>• The rods in your eyes are useful for night vision.</td>
</tr>
<tr>
<td></td>
<td>• Fluorescent lights contain neon.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Find some other examples of living organisms that give off light.
Define visible light to show its scientific meaning.

visible light

Read the definitions below. Then write the key term for each one in the left column.

only absorbs and reflects light; no light passes through it
allows some light to pass through it
allows almost all light to pass through it
measure of how much the speed of light in the material is reduced
an image of a distant object produced by the refraction of light through air layers having different densities

Use a dictionary to define individual.
Main Idea

Light and Matter
I found this information on page __________.

Details

Summarize each term below. Then give three examples of a material that has the same light-transmitting properties.

Opaque: ____________________________
Example: __________________________

Transluscent: _______________________
Example: __________________________

Transparent: ________________________
Example: __________________________

Model a light wave that hits a plane mirror at a 25° angle and reflects. Use a protractor to accurately draw and label the angles.
- the angle of incidence
- the angle of reflection
- the normal

Contrast regular reflection and diffuse reflection. Provide two examples of each.
Section 1 The Behavior of Light (continued)

Main Idea

**Refraction of Light**

I found this information on page __________.

Details

**Analyze** a spoon resting in a glass of water. Explain how you can tell water has a larger index of refraction than air.

Evaluate how a prism separates white light by completing the statements.

A triangular prism ______ light twice—once when it _____ the prism and again when it _____ the prism and reenters the ___.

______ wavelengths of light are refracted ___ than shorter wavelengths, so ___ light is bent the least.

Because of the different amounts of ______, the different colors are ______ when they emerge from the prism.

Summarize the reflection and refraction of mirages.

SYNTHESIZE IT

Create a concept map to summarize facts and effects of reflection and refraction you learned in this chapter.
<table>
<thead>
<tr>
<th><strong>Predict</strong> Read the title of Section 2. List three topics that might be discussed in this section.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Define</strong> refraction to show its scientific meaning. Write a sentence to demonstrate the meaning.</th>
</tr>
</thead>
<tbody>
<tr>
<td>refraction</td>
</tr>
<tr>
<td>_______________________________________________</td>
</tr>
<tr>
<td>_______________________________________________</td>
</tr>
<tr>
<td>_______________________________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>New Vocabulary</strong> Use your book to define pigment. Write a sentence to demonstrate the scientific meaning.</th>
</tr>
</thead>
<tbody>
<tr>
<td>pigment</td>
</tr>
<tr>
<td>_______________________________________________</td>
</tr>
<tr>
<td>_______________________________________________</td>
</tr>
<tr>
<td>_______________________________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Academic Vocabulary</strong> Use a dictionary to define the term visible. Write a sentence to show its scientific meaning.</th>
</tr>
</thead>
<tbody>
<tr>
<td>visible</td>
</tr>
<tr>
<td>_______________________________________________</td>
</tr>
<tr>
<td>_______________________________________________</td>
</tr>
<tr>
<td>_______________________________________________</td>
</tr>
</tbody>
</table>
Main Idea

Colors

I found this information on page _________.

Complete the graphic organizer about black and white color reflection.

<table>
<thead>
<tr>
<th>A white object</th>
<th>A ________ object</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______ all _______ of light back to your eyes.</td>
<td>_______ all colors of light and reflects little or no light back to your eyes.</td>
</tr>
</tbody>
</table>

Model Figures A, B, and C represent children’s building blocks. Fill in the table below to show how each block reflects and absorbs light. Part of the table has been filled in for you.

<table>
<thead>
<tr>
<th>Color(s)</th>
<th>Block A</th>
<th>Block B</th>
<th>Block C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflected</td>
<td>orange, yellow, green, blue, indigo,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorbed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Complete the following information about filters.

A filter is a ____________________ material that transmits ____________________ but ________ all others.

The name of the color of a ________ is the color of the ________ that it ________.
Distinguish between the colors each of blocks A (red), B (orange), and C (green) would look through a red filter. Label each block according to the color that it now appears.

Organize information about how you see colors.

CONNECT IT
Describe how a rainbow would look if viewed through an indigo filter.
Skim Section 3 of your book. Read the headings and the illustration captions. Write three questions that come to mind.

1. 
2. 
3. 

Define resistance to show its scientific meaning.

resistance

Use your book to define the following key terms.

incandescent light

fluorescent light

coherent light

incoherent light

Use a dictionary to define the term intense.

intense
Distinguish between an incandescent bulb and a fluorescent bulb by placing the following characteristics with the correct bulb in the concept map.

- contains a filament
- gives off about 90 percent of its energy as heat
- contains electrodes at each end
- uses much less energy to produce the same amount of light
- emits ultraviolet radiation
- filled with a gas
- generates light by heating a piece of metal until it glows

**Main Idea**

**Incandescent Lights, and Fluorescent Lights**

I found this information on page __________.

**Details**

**Incandescent Bulb**

**Fluorescent Bulb**

**Neon Lights**

I found this information on page __________.

**Compare and contrast** fluorescent lights with neon lights.

**Similarity:**

**Difference:**

<table>
<thead>
<tr>
<th>Light</th>
<th>Incandescent Bulb</th>
<th>Fluorescent Bulb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains a filament</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Gives off about 90 percent of its energy as heat</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Contains electrodes at each end</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Uses much less energy to produce the same amount of light</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Emitted ultraviolet radiation</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Filled with a gas</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Generates light by heating a piece of metal until it glows</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Section 3 Producing Light (continued)

Main Idea

Sodium-Vapor Lights, Tungsten-Halogen Lights, and Lasers

I found this information on page __________.

Using Lasers

I found this information on page __________.

Details

Classify which type of light is being described below.

<table>
<thead>
<tr>
<th>Type of Lighting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>very bright light, long-lasting bulbs</td>
</tr>
<tr>
<td></td>
<td>focuses light on small areas, sends information in pulses</td>
</tr>
<tr>
<td></td>
<td>outdoor lighting with a yellow-orange glow</td>
</tr>
</tbody>
</table>

Model coherent and incoherent light waves by modeling them side by side with sketches.

Evaluate uses of coherent and incoherent light and explain the suitability of each type of light to its purpose.

____________________________________
____________________________________
____________________________________

Analyze three reasons lasers are useful to surgeons.

1. __________________________________
   __________________________________
   __________________________________

2. __________________________________
   __________________________________
   __________________________________

3. __________________________________
   __________________________________
   __________________________________
Scan the headings, boldfaced words, figures, and captions in Section 4 of your book. Write four facts you learned as you scanned the section.

1. 
2. 
3. 
4. 

**Define** transverse wave to show its scientific meaning.

Read the definitions below. Then write the key term for each one in the left column.

- light in which the waves vibrate in only one direction
- a technique that produces a complete three-dimensional photographic image of an object
- the behavior of light that occurs when light traveling from one medium to another is completely reflected at the boundary between them

Use a dictionary to define exhibit.
Main Idea

Polarized Light
I found this information on page ___________.

Details
Create a diagram that shows how polarized glass filters light. Be sure to include both vertically polarized and horizontally polarized light.

Holography
I found this information on page ___________.

Compare a hologram with an ordinary photo by placing the following characteristics in the correct place in the Venn diagram.

- easily copied
- records direction of light
- not easily copied
- three dimensional
- produces flat image
- two dimensional
- produces realistic image
- uses laser light
- records brightness of light
- uses visible light

Ordinary Photo

Hologram

Both
Section 4 Using Light (continued)

Main Idea

Optical Fibers

I found this information on page ________.

Optical Scanners

I found this information on page ________.

Model how light travels between mediums, then how internal reflection happens if the light is at more than the critical angle. Use the information and figure in your book to help you.

Analyze the steps in using total internal reflection to transmit light along an optical fiber.

1. 

2. 

3. 

Summarize how an optical scanner works.

Evaluate the functions that lasers, optical fibers, total internal reflection, and digital signals provide in an up-to-date telephone system.

Light 155
Light  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Light</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Only shiny materials reflect light.</td>
<td></td>
</tr>
<tr>
<td>• Mirages appear only in deserts.</td>
<td></td>
</tr>
<tr>
<td>• The rods in your eyes are useful for night vision.</td>
<td></td>
</tr>
<tr>
<td>• Fluorescent lights contain neon.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review
Use this checklist to help you study.

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☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
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☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

Summarize It  After reading this chapter, list three things you have learned about light.

________________________________________

________________________________________

________________________________________

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Mirrors and Lenses

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Mirrors and Lenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The mirror image of an object always appears to be behind the mirror.</td>
<td></td>
</tr>
<tr>
<td>• Some lenses used to magnify objects can also make them appear smaller.</td>
<td></td>
</tr>
<tr>
<td>• Eyeglass lenses that correct nearsightedness are thicker in the middle than at the edges.</td>
<td></td>
</tr>
<tr>
<td>• Big telescopes generally use mirrors instead of lenses.</td>
<td></td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Write a paragraph describing how you use mirrors everyday.

---

Name __________________ Date __________________

Mirrors and Lenses

157
Predict Read the title of Section 1. List three things that might be discussed in this section.

1. 
2. 
3. 

Define reflection by using it in a sentence.

New Vocabulary

Read the definitions below, then write the key term for each one in the left column.

an image that is not real, even though it looks real
an image where light rays converge
a flat, smooth mirror
a mirror with a surface that curves inward
a mirror with a surface that curves outward
an imaginary line perpendicular to the center of a concave mirror
the point on the optical axis through which every ray that travels to the mirror parallel to the optical axis is reflected
the distance from the center of a concave mirror to the focal point

Use a dictionary to define the term source as a noun.
Main Idea

**How do you use light to see?**
I found this information on page __________.

Details

Evaluate the idea of Superman-style X-ray vision, using the information in your book. (In the Superman movies, rays of light shot out from Superman’s eyes and he was then able to see inside objects.)

Sequence the steps in the path that light rays take when a girl sees her image in a plane mirror. The steps are written in scrambled order on the right. Rewrite them in the correct order in the boxes. Use the figure in your book to help you.

**Seeing Reflections with Plane Mirrors**
I found this information on page __________.

- The light source puts out rays of light.
- Some of the reflected light rays hit the mirror.
- The girl sees her image in the mirror.
- The light source puts out rays of light.
- Some of the reflected light rays hit the girl’s eyes.
- The light rays reflect off of the mirror in all directions.
- The light rays reflect off of the girl in all directions.
- Some of the light rays strike the girl.
Main Idea

Seeing Reflections with Plane Mirrors
I found this information on page __________.

Concave Mirrors
I found this information on page __________.

Convex Mirrors
I found this information on page __________.

Details

Distinguish between a real and a virtual image. If it helps you to explain, draw a sketch beside your sentences.

<table>
<thead>
<tr>
<th>Real</th>
<th>Virtual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Predict the distance between an object and a concave mirror for each resulting image. Each distance should be a number relative to the mirror’s focal length.

- a bright beam of light __________________
- real, upside down, and larger than object __________________
- virtual, upright, and larger than object __________________
- real, upside down, and smaller than object __________________

Analyze why the image formed by a convex mirror is always virtual.

 CONNECT IT
Earth is round, but it looks flat to someone near the ground. Use this idea to explain why the image a concave mirror forms of an object less than one focal length away is a virtual image.

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Skim through Section 2 of your book. Read the headings and the illustration captions. Write three questions that come to mind.

1. 
2. 
3. 

Define the word transparent in a scientific sentence.

transient

Use your book or a dictionary to define the following key terms.

convex lens

concave lens

cornea

retina

Use a dictionary to define the word parallel. Then explain the phrase parallel to the optical axis.

parallel
Main Idea

**What is a lens?**
I found this information on page ______.

**Convex Lenses**
I found this information on page ______.

1. distance of object from lens
2. sketch
3. real or virtual
4. reduced or enlarged
5. upright or upside down

**Concave Lenses**
I found this information on page ______.

**Define** the term lens. **Draw an example.**

**Complete** the concept map about convex lenses. **Use the figures in your book to help you. Instructions for filling in the map are in the left column.**

**Image Formed by a Convex Lens**

1. Object is ______ from lens. ______ from lens. ______ from lens.
2. Object is ______ from lens. ______ from lens. ______ from lens.
3. Object is ______ from lens. ______ from lens. ______ from lens.

**Predict** what will happen to the image produced by a concave lens as the lens gets flatter and flatter—more like a flat piece of glass.
Main Idea

**Lenses and Eyesight**

I found this information on page __________.

Details

*Sequence the steps that occur in human vision after light enters the eye through the cornea. Unscramble the steps and write them in the correct order in the boxes.*

1. The cornea bends light rays to bring them together.
2. The light goes through the pupil.
3. The optic nerve sends electrical signals to the brain.
4. The lens behind the pupil brings light rays together.
5. The light rays form an image on the retina.
6. The cornea bends light rays to bring them together.
7. The retina changes the image into electrical signals.

Vision Problems

I found this information on page __________.

Organize information on common vision problems.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Vision Good For</th>
<th>Cause</th>
<th>Image Location</th>
<th>Eyeglass Lens Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nearsighted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farsighted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astigmatism</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SYNTHESEIZE IT**

Use the idea of a virtual image to explain how glasses help nearsighted and farsighted people see clearly and in focus.
Scan: Use the checklist below to preview Section 3 of your book.

- Read all section titles.
- Read all bold words.
- Look at all the pictures and read their captions.

Write three facts you discovered about optical instruments as you scanned the section.

1. 
2. 
3. 

Define refraction. Draw a model of a refracting light ray.

refraction

refracting telescope

reflecting telescope

microscope

Compare different meanings of image in the dictionary with its scientific meaning.

image
Evaluate a telescope design that magnifies objects but does not gather more light than the naked eye.

Sequence the steps that occur in a reflecting telescope after light enters one end of the telescope. The steps are written in scrambled order at right. Write them in the correct order in the boxes.

1. The light rays start to come together.
2. The convex lens in the eyepiece magnifies the image.
3. A real image of the object forms.
4. The plane mirror reflects the light toward the eyepiece.
5. The light rays hit a plane mirror.
6. The light reflects off of a concave mirror at the other end.
7. The plane mirror reflects the light toward the eyepiece.

Summarize challenges to building a large refracting telescope to be used on Earth.

1. 
2. 
3. 
4. 

Mirrors and Lenses 165
Compare the objective lens and the eyepiece lens of a simple microscope by completing the Venn diagram with the phrases in the bank.

- convex lens
- distance from object to lens is less than one focal length
- enlarged image
- real image
- virtual image
- distance from object to lens is one – two focal lengths

Summarize the properties of a camera lens that determine the size of an image that is recorded on the film.

Identify things you could photograph with each lens type.

Regular Lens
Telephoto Lens
Wide-Angle Lens

Analyze two different designs for a telescope mirror. One design calls for the reflective coating to be on the front surface of the mirror, and the other design calls for the reflective coating to be on the back of the mirror.
Imagine that you work in the advertising department of an optical instrument company and you have to design a full page advertisement for a new optical instrument. Select one instrument from those described in this chapter. In your advertisement, include:

- a diagram of the instrument showing all lenses and mirrors
- the focal lengths of the lenses and mirrors
- arrows tracing the path of some light rays

Include as much detail as possible about the characteristics of the optical components of the instrument.
Mirrors and Lenses  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

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<thead>
<tr>
<th>Mirrors and Lenses</th>
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Review
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☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

Summarize It
After reading this chapter, list three things you have learned about mirrors and lenses.
Classification of Matter

Before You Read

Before you read the chapter, use the “What I know” column to list three things you know about how different substances are classified. Then list three questions you have about matter in the “What I want to find out” column.

<table>
<thead>
<tr>
<th>K</th>
<th>What I know</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>What I want to find out</td>
</tr>
</tbody>
</table>
Classification of Matter
Section 1 Composition of Matter

Predict Read the title of Section 1. List three things that might be discussed in this section.
1. ____________________________
2. ____________________________
3. ____________________________

Review Vocabulary Circle the phrase that comes closest to the meaning of the word property as it is used in your book.

property
- a piece of land
- something that is owned
- a quality or attribute
- a stage prop

New Vocabulary Use the terms on the left to fill in the blanks in the sentences.

colloid
- A ____________ is an ____________ if all the atoms in the substance are the same.

compound
- A ____________ is a substance in which two or more elements are combined in a fixed proportion.

element
- A ____________ contains two or more substances blended evenly throughout.

heterogeneous mixture
- A ____________ is a mixture in which different materials can easily be distinguished.

homogeneous mixture
- A ____________ is a homogeneous mixture of particles too small to see with a microscope and too small to settle.

solution
- The ____________ is observed when light passes through a ____________, which is a mixture with particles visible under a microscope but not heavy enough to settle.

substance

suspension

Tyndall effect
- A ____________ is a heterogeneous mixture containing a liquid in which you can see particles settle.
Classify *each substance as an element or a compound.*

<table>
<thead>
<tr>
<th>Elements</th>
<th>Compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Organize *information about mixtures in the outline below.*

I. Mixtures
   A. Heterogeneous mixtures
      1. 
      2. 
      3. 
      4. Examples: 
   B. Homogeneous mixtures
      1. 
      2. 
      3. 
      4. Examples: 
   C. Colloids
      1. 
      2. 
      3. 
      4. 
      5. Examples: 

Calcium chalk graphite oxygen sugar
Carbon chlorine hydrogen salt water
Carbon dioxide copper mercury sodium zinc
Section 1 Composition of Matter (continued)

I found this information on page ___________.

**Main Idea**

**Mixtures**

*Sequence the types of mixtures according to particle size.*

<table>
<thead>
<tr>
<th></th>
<th>colloids</th>
<th>solutions</th>
<th>suspensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Largest particles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smallest particles</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Details**

**Compare and contrast** colloids, solutions, and suspensions. *Write the characteristics of each in the table.*

<table>
<thead>
<tr>
<th></th>
<th>colloids</th>
<th>solutions</th>
<th>suspensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>particles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>appearance</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Predict** what an observer who looks directly into a light source through a colloid will see.

I found this information on page ___________.

**Synthesize It**

Classify each substance as a solution, a colloid, or a suspension. Write each name in one of the boxes below.

herbed salad dressing  paint  pulpy orange juice  tea  milk  perfume  smoke  vinegar

<table>
<thead>
<tr>
<th>colloids</th>
<th>suspensions</th>
<th>solutions</th>
</tr>
</thead>
</table>
Skim Section 2 of your book. Write three questions that come to mind from reading the headings and the illustration captions.

1. __________________________
2. __________________________
3. __________________________

Use the phrase state of matter in a sentence.

state of matter

Read the definitions below, then write the key term for each one in the left column.

- A characteristic that can be observed without changing the substance
- A change in size, shape, or state of matter
- A change of one substance to another
- A characteristic that indicates whether a substance can change to another substance
- The separation of substances in a mixture using evaporation
- The mass of all substances before a chemical change equals the mass of all substances after the change

Use a dictionary to define the word identify.

identify
Distinguish between the materials listed below. Describe a unique physical property for each one that is not true for the other materials in this group.

<table>
<thead>
<tr>
<th>Material</th>
<th>Unique physical property</th>
</tr>
</thead>
<tbody>
<tr>
<td>rubber</td>
<td></td>
</tr>
<tr>
<td>applesauce</td>
<td></td>
</tr>
<tr>
<td>marble</td>
<td></td>
</tr>
<tr>
<td>mercury</td>
<td></td>
</tr>
</tbody>
</table>

Describe how freezing could be used to remove sugar from a mixture of sugar and water.

Identify four properties of a substance that will never change.

Organize five kinds of physical changes and five kinds of chemical changes.
Section 2  Properties of Matter (continued)

Main Idea

Weathering—Chemical or Physical Change?

I found this information on page ___________.

The Conservation of Mass

I found this information on page ___________.

Details

Identify chemical and physical changes that occur as a car ages.

<table>
<thead>
<tr>
<th>Physical Changes</th>
<th>Chemical Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Describe how the law of conservation of mass could be useful for investigating chemical changes.

CONNECT IT

Describe some ways that industry and agriculture use physical properties to separate substances.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Classification of Matter  Chapter Wrap-Up

Review the ideas that you listed in the table at the beginning of the chapter. Cross out any incorrect information in the first column. Then complete the table by filling in the third column. How do your ideas about what you know now compare with those you provided at the beginning of the chapter?

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I know</td>
<td>What I want to find out</td>
<td>What I learned</td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

Summarize It

After reading this chapter, list three things you have learned about matter and how substances are classified.

1.

2.

3.
Solids, Liquids, and Gases

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Solids, Liquids, and Gases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Solid, liquid, and gaseous states of matter are determined only by temperature.</td>
</tr>
<tr>
<td></td>
<td>• Plasma is the most abundant state of matter in the universe.</td>
</tr>
<tr>
<td></td>
<td>• Earth's atmosphere is a fluid system.</td>
</tr>
<tr>
<td></td>
<td>• Hydraulic lifts and toothpaste tubes both apply Pascal's principle.</td>
</tr>
<tr>
<td></td>
<td>• Pressure and temperature are directly proportional properties of a gas.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Identify examples of a solid, a liquid, and a gas in your classroom.
Scan the headings, figures, and captions in Section 1 of your book. Write four facts about kinetic theory you learned.

1. ______________________________________________________________________
2. ______________________________________________________________________
3. ______________________________________________________________________
4. ______________________________________________________________________

Define **kinetic energy**.

**kinetic energy**

particles spreading throughout a given volume until evenly distributed

the temperature at which a solid begins to turn into a liquid

the temperature at which the pressure of the vapor in a liquid is equal to the external pressure acting on the surface of the liquid

an explanation of how particles in matter behave

an increase in size of a substance when temperature is increased

matter consisting of positively and negatively charged particles

the amount of energy needed for a liquid at its boiling point to become a gas

the amount of energy needed to change a substance from a solid to a liquid at its melting point

Use a dictionary to define the term **potential**.

**potential**
States of Matter

A. Solid
1. Example: ________________________________
2. Particle kinetic energy: ________________________________
3. Particle behavior: ________________________________
4. Other fact(s): ________________________________

B. Liquid
1. Example: ________________________________
2. Particle kinetic energy: ________________________________
3. Particle behavior: ________________________________
4. Other fact(s): ________________________________

C. Gas
1. Example: ________________________________
2. Particle kinetic energy: ________________________________
3. Particle behavior: ________________________________
4. Other fact(s): ________________________________

D. Plasma
1. Example: ________________________________
2. Particle kinetic energy: ________________________________
3. Particle behavior: ________________________________
4. Other fact(s): ________________________________

Complete the outline as you read about the states of matter.
Main Idea

**Thermal Expansion**

I found this information on page _____.

**Details**

**Sequence** the kinetic energy, temperature, and density of most solids, liquids, and gases. Use 1 to represent the lowest kinetic energy and 3 to represent the highest.

<table>
<thead>
<tr>
<th>Solid</th>
<th>Liquid</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinetic energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Compare** the density of water’s solid state to that of other solid materials.

I found this information on page _____.

**Solid or a Liquid?**

I found this information on page _____.

**Organize** the features and examples of other states of matter in the following table.

<table>
<thead>
<tr>
<th></th>
<th>Amorphous Solid</th>
<th>Liquid Crystal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examples</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SYNTHESIZE IT**

Refer to the graph titled “State Changes of Water” in your book. Imagine that you reverse the process to remove heat from water vapor. Describe the changes to the temperature and energy at each level (a – d) in the reverse process.

I found this information on page _____.

180  **Solids, Liquids, and Gases**
Preview Write four questions you have after reading this section.

1. 

2. 

3. 

4. 

Define the term density.

density

Use each term in a sentence that reflects the term’s scientific meaning.

buoyancy

pressure

viscosity

Use a dictionary to define the term displace.

displace
Evaluate the buoyant force on a block of iron and a block of plastic foam. Each block has the same volume. Make sketches that show the forces acting on each block, and whether each block sinks or floats.

Organize the physical properties of two identical pieces of foil formed into different shapes. One piece of foil is crumpled tightly into a ball. The other is folded into a box that is open on top. What happens when both pieces are dropped into a container of water? Use the terms below to complete the Venn diagram.

- floats
- foil and air displace water
- higher density
- less volume displaced
- lower density
- mass
- more volume displaced
- only foil displaces water
- sinks
- weight

Ball   Box   Both

Pascal’s Principle

Summarize Pascal’s principle in your own words. Include two examples of objects that work because of Pascal’s principle, other than those given in your book.

Examples
1. 
2. 

I found this information on page ____________.
Complete the chart below explaining how an airplane’s wings hold the airplane up during flight. A cross-section of a wing is shown.

**Main Idea**

**Bernoulli’s Principle**

I found this information on page ____________.

**Details**

**Fluid Flow**

I found this information on page ____________.

As an airplane moves forward, air flows past the wing.

The air flowing over the top of the wing travels _______ in the same amount of time than the air flowing beneath the wing.

Therefore, the air flowing over the _________ of the wing is moving at a higher velocity than the air flowing beneath ________.

Applying Bernoulli’s principle, the pressure above the wing is ____________ the pressure below the wing.

The net force pushes the plane ________.

**Connect It**

Use Bernoulli’s principle to explain low and high-pressure atmospheric conditions and how they might affect weather.

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Scan the figures and read the captions in Section 3. Predict three things that might be discussed in this section.

1. 

2. 

3. 

Define temperature.

Use your book or a dictionary to define the following vocabulary terms.

pressure

pascal

Use a dictionary to define the term proportion.
Section 3 Behavior of Gases (continued)

Main Idea

Pressure

I found this information on page __________.

Boyle’s Law

I found this information on page __________.

Details

Compare the different pressures that result as you add air to a balloon and as you add air to a steel tank.

Define Boyle’s Law in your own words and as a mathematical equation.

Predict the volume $V_2$ of the gas at pressure $P_2$ of 425 kPa using the equation for Boyle’s Law. Then predict the volume of the gas at 425 kPa using the graph in your book titled “Volume v. Pressure for a Fixed Amount of Gas at Constant Temperature.” Compare the two predictions.

Solve Equation

\[ P_1V_1 = P_2V_2 \]
\[ (225 \text{ kPa})(200 \text{ L}) = (425 \text{ kPa})V_2 \]

Use Graph

Compare
Main Idea

The Pressure-Temperature Relationship

Model the relationship between temperature and pressure of a gas when the volume is constant. Make one drawing for each of two temperatures.

Low Temperature

High Temperature

Charles’s Law

Compare the three gases depicted in the graph titled “Temperature v. Volume for a Fixed Amount of Gas at Constant Pressure” in your book. Explain how you would determine which one had the greatest change in volume for the same change in temperature.

Distinguish between the key features of Charles’s Law and Boyle’s Law.

<table>
<thead>
<tr>
<th>Constant Property</th>
<th>Charles’s Law</th>
<th>Boyle’s Law</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varying Properties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Variance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formula</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Connect It

You can combine the proportional relationships of Boyle’s Law \((P_1 V_1 = P_2 V_2)\), Charles’s Law \((V_1 / T_1 = V_2 / T_2)\), and the pressure-temperature relationship \((P_1 / T_1 = P_2 / T_2)\), to get \((P_1 V_1) / T_1 = (P_2 V_2) T_2\). Explain in your own words how the combined laws could help you study.
You are about to work some magic with matter. You have a rectangular cube of matter in its solid state. It measures 3 in $\times$ 4 in $\times$ 5 in. You have available a rectangular container measuring 5 in $\times$ 6 in $\times$ 3 in. You also have a cylindrical container with base radius of 2.5 in and height 8 in. Illustrate how the matter “fits” in each container when it is in its solid, liquid, and gaseous states.

**Solid**

**Liquid**

**Gas**
Solids, Liquids, and Gases Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Solids, Liquids, and Gases</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Solid, liquid, and gaseous states of matter are determined only by temperature.</td>
<td></td>
</tr>
<tr>
<td>• Plasma is the most abundant state of matter in the universe.</td>
<td></td>
</tr>
<tr>
<td>• Earth’s atmosphere is a fluid system.</td>
<td></td>
</tr>
<tr>
<td>• Hydraulic lifts and squeezing toothpaste onto your toothbrush both apply Pascal’s principle.</td>
<td></td>
</tr>
<tr>
<td>• Pressure and temperature are directly proportional properties of a gas.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT

After reading this chapter, list three things you have learned about solids, liquids, and gases.

________________________________________

________________________________________

________________________________________
Properties of Atoms and the Periodic Table

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Properties of Atoms and the Periodic Table</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• An atom is the smallest unit of an element that still has all the properties of the element.</td>
</tr>
<tr>
<td></td>
<td>• An atom is made up of a positively charged nucleus and negatively charged electrons.</td>
</tr>
<tr>
<td></td>
<td>• Quarks are so tiny that they orbit the nucleus with the electrons.</td>
</tr>
<tr>
<td></td>
<td>• Isotopes of an element only differ in their number of neutrons.</td>
</tr>
<tr>
<td></td>
<td>• An element’s chemical and physical properties may be predicted by its location on the periodic table.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Write a few sentences about what you know about atoms.
Properties of Atoms and the Periodic Table

Section 1 Structure of the Atom

Scan Section 1 and write down three things you might learn from this section.

1. ____________________________________________________________

2. ____________________________________________________________

3. ____________________________________________________________

Define element to show its scientific meaning.

element: ______________________________________________________

Use your book or a dictionary to define the following terms.

atom: _________________________________________________________

electron: _____________________________________________________

electron cloud: _________________________________________________

neutron: _____________________________________________________

nucleus: _____________________________________________________

proton: ______________________________________________________

quark: _______________________________________________________

Use a dictionary to define neutral as it might be used in this section.

neutral: ______________________________________________________
### Scientific Shorthand

**I found this information on page _____.**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt</td>
<td>tungsten</td>
</tr>
<tr>
<td>Rn</td>
<td>iodine</td>
</tr>
<tr>
<td>B</td>
<td>lithium</td>
</tr>
<tr>
<td>Cu</td>
<td>cesium</td>
</tr>
<tr>
<td>Ni</td>
<td>lead</td>
</tr>
<tr>
<td>Es</td>
<td>helium</td>
</tr>
</tbody>
</table>

### Atomic Components

**I found this information on page _____.**

- atom
- proton
- nucleus
- electron
- neutron
- quark

### Identify

Identify some of the elements and their symbols by filling in the table. Reference a periodic table to help you.

### Complete

Complete the diagram showing how the parts of an atom are related. Indicate the charge of each particle where applicable.
Section 1 Structure of the Atom (continued)

Main Idea

Quarks—Even Smaller Particles
I found this information on page _________.

Details

Summarize key ideas about quarks.

<table>
<thead>
<tr>
<th>Theories about Quarks</th>
<th>Finding Quarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detecting Quarks</td>
<td>Sixth Quark</td>
</tr>
</tbody>
</table>

Models—Tools for Scientists
I found this information on page _________.

Create a time line of the changes that have occurred in modeling the atomic structure since the 1800s. Sketch and label each model.

- Dalton
- Rutherford
- Thomson
- Bohr
- Electron Cloud
Properties of Atoms and the Periodic Table
Section 2 Masses of Atoms

Preview Section 2 of your book, using the checklist below.

• Read all section titles.
• Read all boldfaced words.
• Read all charts and graphs.
• Look at all the pictures and read their captions.
• Think about what you already know about masses of atoms.

Write three facts you learned.
1. __________________________________________________________
2. __________________________________________________________
3. __________________________________________________________

Define mass to show its scientific meaning.

mass

Use your book or dictionary to define the following key terms.

atomic number
mass number
isotope
average atomic mass

Use a dictionary to find the scientific meaning of define.
Organize the information on atomic mass to complete the outline.

**Atomic Mass**

A. Nucleus of atom

1. 

2. 

3. 

B. Atomic mass unit

1. 

2. 

3. 

C. Protons

1. 

2. 

3. 

4. 

D. Mass number

1. 

2. 

I found this information on page __________.
Main Idea

**Isotopes**

I found this information on page __________.

Details

Model carbon-12 and carbon-14 by sketching each atom.

- Remember that carbon’s atomic number is 6.
- Label each atom’s protons, neutrons, and electrons.
- Show the charges of the particles.

![Carbon-12](#)

![Carbon-14](#)

**Analyze** how you would determine which isotope of an element is the most abundant if you know the element’s average atomic mass.

CONNECT IT

While exploring on your grandfather’s farm, you come across what appears to be ancient Native American artifacts, arrowheads, and tools. Explain how you could find out the age of these pieces and if they are, in fact, an archeological find.

Name ____________________________ Date ____________________________

Section 2 Masses of Atoms (continued)

While exploring on your grandfather’s farm, you come across what appears to be ancient Native American artifacts, arrowheads, and tools. Explain how you could find out the age of these pieces and if they are, in fact, an archeological find.
Properties of Atoms and the Periodic Table
Section 3 The Periodic Table

Skim Section 3 and write three questions based on your brief preview.

1. 

2. 

3. 

Review Vocabulary

define chemical property to show its scientific meaning.

chemical property

New Vocabulary

Use your book or a dictionary to define the following terms.

periodic table

period

electron dot diagram

group

Academic Vocabulary

Use a dictionary to define similar to show its scientific meaning.

similar

Name __________________________ Date ____________
Main Idea

Organizing the Elements

I found this information on page __________.

Details

Compare Mendeleev’s early periodic table to that of today by completing the Venn diagram.

Mendeleev

Today (Moseley)

Both

Sequence the energy levels in the electron cloud diagram and write the maximum number of electrons that can be contained in each level.
Analyze how electron dot diagrams show similarities between elements within a group.

Classify the regions of the periodic table as metals, nonmetals, or metalloids.
- Shade the regions on the blank periodic table.
- Label each region and write its characteristics.

Write a paragraph showing the relationship between chemistry and physics based on what you’ve learned from the periodic table.
Since organizing the elements into a periodic table worked so well for scientists, create your own periodic table to organize another category of items. Pick a group containing many items which exhibit repeating, predictable patterns of behavior. List characteristics by which they are ordered and sorted, and organize them into columns and rows. Justify your methods for organization. Some suggestions include fashion trends or fads, types of music, beverages, or political and voting trends.
Properties of Atoms and the Periodic Table  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Properties of Atoms and the Periodic Table</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• An atom is smallest unit of an element with all the element’s properties intact is a molecule.</td>
<td></td>
</tr>
<tr>
<td>• An atom is made up of a positively charged nucleus and negatively charged electrons.</td>
<td></td>
</tr>
<tr>
<td>• Quarks are so tiny that they orbit the nucleus with the electrons.</td>
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</tr>
<tr>
<td>• Isotopes of an element only differ in their number of neutrons.</td>
<td></td>
</tr>
<tr>
<td>• An element’s chemical and physical properties may be predicted by its location on the periodic table.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your *Science Notebook* on this chapter.
☐ Study the definitions of vocabulary words.
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☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

**SUMMARIZE IT**

After reading this chapter, list three things you have learned about the properties of atoms and the periodic table.

________________________
________________________
________________________
Radioactivity and Nuclear Reactions

Before You Read

Before you read the chapter, respond to these statements.
1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Radioactivity and Nuclear Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• An atom’s nucleus takes up most of the space occupied by the atom.</td>
</tr>
<tr>
<td></td>
<td>• An atom’s nucleus contains nearly all the mass of the atom.</td>
</tr>
<tr>
<td></td>
<td>• The strong force holds large nuclei together more effectively than small nuclei.</td>
</tr>
<tr>
<td></td>
<td>• Radioactive dating uses radioactive isotopes and their half-lives.</td>
</tr>
<tr>
<td></td>
<td>• Radiation is visible to the naked eye.</td>
</tr>
<tr>
<td></td>
<td>• Mass and energy are interchangeable according to Einstein’s theory of relativity.</td>
</tr>
</tbody>
</table>

Conduct the Foldable as directed at the beginning of this chapter.

Science Journal

Write a paragraph describing your impressions of the Sun.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Scan Section 1 and write down three topics that might be covered in this section.

1. ________________________________
2. ________________________________
3. ________________________________

Define long-range force.

long-range force ________________________________
                                                                                           

Use your book or a dictionary to define the following key terms.

strong force ________________________________
                                                                                           
radioactivity ________________________________
                                                                                           
Use a dictionary to define stable as it might be used in this section.

stable ________________________________
Describe the nucleus. Discuss its size and what makes it up.

<table>
<thead>
<tr>
<th>Nucleus Size</th>
<th>Strong Force</th>
<th>Electrical Force</th>
<th>Comparison: Total Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>small</td>
<td>between</td>
<td>relatively weak</td>
<td></td>
</tr>
<tr>
<td></td>
<td>holds nucleus tightly together because</td>
<td></td>
<td></td>
</tr>
<tr>
<td>large</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Connect It

Describe how “finding a needle in a haystack” is similar to finding the nucleus in an atom.
Preview the section and list three possible effects of radiation exposure.

1. 
2. 
3. 

Define electromagnetic wave.

**electromagnetic wave**

Use your book or a dictionary to define the key terms.

**alpha particle**

**transmutation**

**beta particle**

**gamma rays**

**half-life**

Use a dictionary to define nuclear.

**nuclear**
Compare and contrast the properties of alpha, beta, and gamma radiation. For mass, speed, and penetration, write words that compare the three types.

<table>
<thead>
<tr>
<th>Nuclear Radiation</th>
<th>Alpha</th>
<th>Beta</th>
<th>Gamma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td></td>
<td></td>
<td>γ</td>
</tr>
<tr>
<td>Form</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cause</td>
<td></td>
<td>weak force causes a neutron to decay into a proton plus beta radiation</td>
<td></td>
</tr>
<tr>
<td>Charge</td>
<td>none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>faster than alpha</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example of a material that can stop it</td>
<td>sheet of paper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effect on cells</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Compare the transmutation that occurs in alpha radiation and the transmutation that occurs in beta radiation.

In both alpha and beta transmutation, a nucleus becomes a __________. In alpha radiation, a nucleus emits ______ and ______, so its atomic number ______ by 2 and the mass number decreases by ____.

In beta radiation, ______ decays into a proton, emitting ______. The atomic number ____________, but the mass number ____________.

Summarize information about radioactive dating.

Radioactive Half-Life, Radioactive Dating

I found this information on page ____________.

CONNECT IT

Hypothesize how a museum might validate the age of an ancient art masterpiece.

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________
Scan Section 3 of your book, using the checklist below.

- Read all section titles.
- Read all bold words.
- Read all charts and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about detecting radioactivity.

Write three questions that come to mind after scanning this section.

1. __________________________
2. __________________________
3. __________________________

Define ion. Use your book for help.

Use your book or a dictionary to define the following key terms.

cloud chamber

bubble chamber

Geiger counter

Use a dictionary to define expose as it might be used in this section. Then use it in a sentence that reflects this definition.

expose
Main Idea

Radiation Detectors; Measuring Radiation

I found this information on page __________.

Details

Describe how each instrument works to detect or measure radiation.

Cloud Chamber: __________________________________________

________________________________________________________________________________________

Bubble Chamber: __________________________________________

________________________________________________________________________________________

Electroscope: ____________________________________________

________________________________________________________________________________________

Geiger Counter: __________________________________________

________________________________________________________________________________________

Sequence the sources of background radiation that occur in nature. Order them from greatest percentage to least percentage.

<table>
<thead>
<tr>
<th>Background Radiation</th>
<th>Source</th>
<th>Percent of Total Radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocks and soil</td>
<td></td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 3 Detecting Radioactivity (continued)

Main Idea

I found this information on page __________.

Details

Identify four facts about radiation in the human body.

1. ____________________________
2. ____________________________
3. ____________________________
4. ____________________________

Synthesize It

Describe how to model a bubble chamber using a billiard table and billiard balls. Make a sketch of sample paths of your billiard balls in the space provided.
Skim Section 4. Write three uses for nuclear reactions.

1. 
2. 
3. 

Use your book or a dictionary to define kinetic energy.
kinetic energy

Use your book or a dictionary to define the key terms.
nuclear fission
chain reaction
critical mass
nuclear fusion
tracer

Use a dictionary to define target.
target
Nuclear Fission

I found this information on page _________.

Complete the table listing nuclear scientists and their contributions to the theories of nuclear fission.

<table>
<thead>
<tr>
<th>Year</th>
<th>Scientist</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930s</td>
<td>Enrico Fermi</td>
<td></td>
</tr>
<tr>
<td>1938</td>
<td>Found that when a neutron hits a uranium-235 nucleus, the nucleus splits apart into smaller nuclei.</td>
<td></td>
</tr>
<tr>
<td>1939</td>
<td>Lise Meitner</td>
<td></td>
</tr>
</tbody>
</table>

Summarize the process of nuclear fission of uranium.

Define Einstein’s mass-energy equation in words and then write the formula.

Words: _____ (joules) = _____ (kg) × [_________ (m/s)]

Formula: _____
Section 4 Nuclear Reactions (continued)

Main Idea

Nuclear Fusion

I found this information on page ________.

Details

Summarize the energy requirements of nuclear fusion.

what must be overcome: _______________________

dis is in order to: _______________________

type of energy that can do it: _______________________

dis type of energy increases with: _______________________

common places to find enough energy: _______________________

Using Nuclear Reactions in Medicine

I found this information on page ________.

Describe two ways nuclear reactions are used in medicine.

<table>
<thead>
<tr>
<th>Tracers</th>
<th>Cancer Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Synthesize It

Using Einstein’s mass-energy equation, explain in your own words why a tremendous amount of energy is produced by a small amount of mass.

_________________________________________________________________________________________

_________________________________________________________________________________________

_________________________________________________________________________________________

_________________________________________________________________________________________
Radioactivity and Nuclear Reactions Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Radioactivity and Nuclear Reactions</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• An atom’s nucleus takes up most of the space occupied by the atom.</td>
<td></td>
</tr>
<tr>
<td>• The strong force holds large nuclei together more effectively than small nuclei.</td>
<td></td>
</tr>
<tr>
<td>• Radioactive dating uses radioactive isotopes and their half-lives.</td>
<td></td>
</tr>
<tr>
<td>• Radiation is visible to the naked eye.</td>
<td></td>
</tr>
<tr>
<td>• Mass and energy are interchangeable according to Einstein’s theory of relativity.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT

After reading this chapter, list three things you learned about radioactivity and nuclear reactions.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

214 Radioactivity and Nuclear Reactions
Elements and Their Properties

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Elements and Their Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>A metal is malleable, ductile, and a good electrical conductor due to metallic bonding.</td>
<td></td>
</tr>
<tr>
<td>Mercury is not a metal because it is liquid at room temperature.</td>
<td></td>
</tr>
<tr>
<td>Noble gases are highly reactive.</td>
<td></td>
</tr>
<tr>
<td>A metalloid is always a synthetic metal.</td>
<td></td>
</tr>
<tr>
<td>Synthetic elements are unstable and short-lived.</td>
<td></td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Describe some of the most important elements found on Earth. Describe the properties of these elements that make them so important.
Predict four topics that might be discussed after reviewing the headings, boldface terms, pictures, and charts of Section 1.

1. 
2. 
3. 
4. 

Define element. Use your book for help.

Define the following words.

- metal
- malleable
- ductile
- metallic bonding
- radioactive element
- transition element

Define extract when used as a verb. Use a dictionary for help.
Main Idea

Properties of Metals

I found this information on page ____________.

Details

Complete the outline of important points involving the physical properties and bonds of metals.

I. Metals
   A. Five Physical Properties

   B. Bonding
      1. Ionic Bonding
      2. Metallic Bonding

The Alkali Metals; The Alkaline Earth Metals

I found this information on page ____________.

Compare the Alkali and Alkaline Earth Metals in the Venn diagram.

Alkali Metals       Alkaline Earth Metals

Both

Elements and Their Properties  217
**Main Idea**

**Transition Elements; The Inner Transition Metals**

I found this information on page __________.

**Details**

Organize the transition elements and inner transition metals in the following chart.

<table>
<thead>
<tr>
<th>Elements</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td></td>
</tr>
<tr>
<td>Cobalt</td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td></td>
</tr>
<tr>
<td>Gold</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td></td>
</tr>
<tr>
<td>Lanthanides</td>
<td></td>
</tr>
<tr>
<td>Actinides</td>
<td></td>
</tr>
</tbody>
</table>

**Metals in the Crust**

I found this information on page __________.

**Sequence** the steps used to extract metal from the Earth’s crust.

1. __________________________________________
2. __________________________________________
3. __________________________________________
4. __________________________________________

**CREATE IT**

Design a piece of jewelry using several of the metals discussed in this section. Explain why you chose each metal. Draw a picture of your design.

Name ___________________________ Date ____________

Section 1 Metals (continued)
Skim through Section 2 of this chapter. Read the headings and the illustration captions. Write two questions that come to mind.

1. 

2. 

Define molecule.

Define the following words. Use your book or a dictionary for help.

molecule

nonmetals

diatom molecule

salt

sublimation

Use a dictionary to define react.
Main Idea

Properties of Nonmetals

I found this information on page _________.

Details

Organize the physical and bonding properties of nonmetals by completing the concept map.

Nonmetals

Physical Properties

Bonding Properties

Ionic compounds

Covalent compounds

Hydrogen

I found this information on page _________.

Classify hydrogen as a Group 1 metal and as a nonmetal. In the table below, list the reasons it could be placed in each group of the periodic table.

<table>
<thead>
<tr>
<th>Group I Metal</th>
<th>Nonmetal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Halogens

Halogens are the Group ____ elements. They are highly reactive and have _____________ in their outer shell. They become _____________ when they gain an electron from a metal. The resulting compound is a ___________. Halogens can also share electrons to form _____________ compounds.

Fluorine

Chlorine

Bromine

Iodine

Astatine

The Noble Gases

Distinguish the noble gases from other elements by writing their characteristics and uses in the spaces provided.

Noble gases

SYNTHESIZE IT

You have developed a process to extract elements, and it seems you have discovered a new nonmetallic element. Use your imagination and knowledge of the periodic table to describe your element’s characteristics and behaviors. Classify and name your element.
Skim the goals of Section 3 and formulate four questions based on those goals.

1. 
2. 
3. 
4. 

Define substance. Use your book for help.

substance

Define the following words. Use your book or a dictionary for help.

metalloid

allotrope

semiconductor

transuranium element

Define structure as it might be used in this section. Use a dictionary or your book for help.

structure
Section 3  Mixed Groups (continued)

**Main Idea**

Properties of Metalloids

I found this information on page ________.

The Boron Group

I found this information on page ________.

The Carbon Group

I found this information on page ________.

**Details**

**Summarize** the characteristics of metalloids.

<table>
<thead>
<tr>
<th>Characteristics and Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
</tr>
</tbody>
</table>

**Complete** the graphic organizer with facts about the Boron Group.

<table>
<thead>
<tr>
<th>Characteristics and Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
</tr>
</tbody>
</table>

**Organize** the properties and uses of the Carbon Group in the chart below.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Silicon</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Germanium</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Tin and Lead</td>
<td></td>
</tr>
</tbody>
</table>
Compare the Nitrogen and Oxygen Groups. List three characteristics these two groups have in common.

Classify these elements as nonmetal, metalloid, or metal. Use the periodic table in your book to help you.

- nitrogen __________ oxygen __________
- phosphorus __________ sulfur __________
- arsenic __________ selenium __________
- antimony __________ tellurium __________
- bismuth __________ polonium __________

Model the process used by scientists to produce americium. Create a diagram that shows the elements involved and how the process begins.

Create a new grouping for elements. Describe the criteria you chose for your new grouping.
For three days keep a journal of observations. Observe elements as they play a role in your daily routine at home, school, and in your activities. Write down the object observed, and the element(s) it is made of. Also describe each element’s properties and how they differ from the properties of compounds containing that element.

Day 1: date:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Day 2: date:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Day 3: date:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Elements and Their Properties  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Elements and Their Properties</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>A metal is malleable, ductile, and a good electrical conductor due to metallic bonding.</td>
<td></td>
</tr>
<tr>
<td>Mercury is not a metal because it is liquid at room temperature.</td>
<td></td>
</tr>
<tr>
<td>Noble gases are highly reactive.</td>
<td></td>
</tr>
<tr>
<td>A metalloid is always a synthetic metal.</td>
<td></td>
</tr>
<tr>
<td>Synthetic elements are unstable and short-lived.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review
Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

Summarize It
After reading this chapter, list three things you learned about elements and their properties.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Elements and Their Properties

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Before You Read

Before you read the chapter, respond to these statements.
1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

Before You Read | Chemical Bonds
--- | ---
 | • The properties of a chemical compound are the same as the properties of each element it contains.
 | • An ion forms when an atom gains or loses electrons in its outer shell.
 | • Covalent bonds form when atoms share electrons.
 | • The oxidation number is the number of oxygen atoms in a molecule.

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Describe what makes some chemical bonds more stable than others.
Predict four topics that might be discussed after reviewing the objectives of Section 1.

1. 
2. 
3. 
4. 

Define compound. Use your book for help.

compound

Define the following vocabulary terms. Use your book for help.

chemical formula

chemical bond

Define unique. Use a dictionary for help. Then use the word in a sentence that demonstrates its scientific meaning.

unique
Section 1 Stability in Bonding (continued)

Main Idea

Combined Elements
I found this information on page _________.

Formulas
I found this information on page _________.

Atomic Stability
I found this information on page _________.

Details

Evaluate why sodium chloride is not like the elements that form it.

Complete the graphic organizer. Use the table in your book for information.

Silicon dioxide contains

one atom of ___________ and ___________ atoms of ___________.

Summarize what can be learned about an element from its electron dot diagram. Then draw an electron dot diagram of lithium below your answer. Use the examples of electron dot diagrams shown in your book for help.
Create your own electron dot diagrams for sodium and chlorine. Explain how both atoms could become more stable.
Chemical Bonds
Section 2 Types of Bonds

Skim through Section 2 of the book. Write three questions that come to mind from reading the headings and the illustration captions.

1. .........................................................................................................
2. .........................................................................................................
3. .........................................................................................................

Define atom. Use your book for help.

atom
.........................................................................................................

Read the definitions below. Then write the vocabulary word that matches each definition in the left column.

- a charged particle that has either more or fewer electrons than it has protons
- the force of attraction between a positive ion and a negative ion in an ionic compound
- the force of attraction between two atoms that share electrons
- the neutral particle that forms when atoms share electrons
- a molecule that has a slightly positive end and a slightly negative end, but the molecule itself is neutral
- a molecule in which the electrons are shared equally between atoms in the chemical bond

Define neutral. Use a dictionary for help.

neutral
.........................................................................................................
Complete the steps in the formation of a potassium ion.

1. An atom of potassium has _________ electron in its _________.
2. A potassium atom _________ one electron in its outer level when it combines with an _________.
3. The potassium atom is now a _________.
4. The potassium ion has a _________ charge.
5. The symbol for a positive potassium ion is _________.

Compare ionic and covalent bonds in the Venn diagram below with at least eight facts.

The Ionic Bond

I found this information on page _________.

Sharing Electrons

I found this information on page _________.

Analyze and discuss why it is much easier for Group 14 elements to become stable by sharing instead of transferring electrons.
## Section 2 Types of Bonds (continued)

**Main Idea**

**Details**

### Summarize It
Write two key facts in each of the boxes below.

<table>
<thead>
<tr>
<th>Covalent Bonds</th>
<th>Polar Covalent Bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
</tbody>
</table>

### Sharing Electrons
1. Sharing requires less energy.
2. A covalent bond is formed.

### Unequal Sharing
1. 
2. 

### Nonpolar Covalent Bonds
1. 
2. 
Chemical Bonds
Section 3 Writing Formulas and Naming Compounds

Scan Section 3 of your book, using the checklist below.

- Read all section titles.
- Read all bold words.
- Read all charts and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about chemical formulas and compounds.

Formulate two questions about what you would like to learn.

1. _____________________________
2. _____________________________

Define anion. Use your book for help.

anion

Define the following vocabulary words. Use your book for help.

binary compound

oxidation number

polyatomic ion

hydrate

Define negate. Use a dictionary for help.

negate
Complete the table below for sodium and chlorine. Use the periodic table in your book.

<table>
<thead>
<tr>
<th>Element</th>
<th>Oxidation Number</th>
<th>Positive or Negative Charge?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Define** what an oxidation number of 1+ means.

Summarize the three steps in writing a formula for an ionic compound by completing the graphic organizer below.

1. ________________________________________
   ________________________________________
   ________________________________________

2. ________________________________________
   ________________________________________
   ________________________________________

3. ________________________________________
   ________________________________________
   ________________________________________
Organize the steps for finding the formula for ammonium sulfate by completing the questions and answers below. Look at the Polyatomic Ions table in your book for help.

Question: What is the positive ion and its charge?
Answer: 

Question: What is the negative ion and its charge?
Answer: 

Question: Balance the charges to make the compound neutral.
Answer: 

The formula is: 

Summarize the information about hydrates by filling in the blanks below.

Some ionic compounds have __________ as part of their structure. A __________ has water __________ and written into its __________. The __________ can be removed from the hydrate crystals by __________ them. The form of the compound without water is described as __________.

The formula CaSO₄ • 2H₂O is named __________, whose common name is gypsum. The __________ form (without water), __________ is the common powder known as plaster of paris.
Section 3  Writing Formulas and Naming Compounds (continued)

Main Idea

**Naming Binary Covalent Bonds**

I found this information on page __________.

Details

**Analyse** eight different binary covalent compounds of your choice. Write the formula for each compound in the left column. Write out the name in the right column. Use the Prefixes for Covalent Compounds table in your book for help.

<table>
<thead>
<tr>
<th>Formula</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CONNECT IT

Think of three common chemical compounds people use every day. Based on the rules listed throughout this section, write out the chemical formulas and chemical names of each one.

__________________________________________________________________________________________________________________________________________________________

__________________________________________________________________________________________________________________________________________________________

__________________________________________________________________________________________________________________________________________________________
Chemical Bonds Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Chemical Bonds</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The properties of a chemical compound are the same as the properties of each element it contains.</td>
<td></td>
</tr>
<tr>
<td>• An ion forms when an atom gains or loses electrons in its outer shell.</td>
<td></td>
</tr>
<tr>
<td>• Covalent bonds form when atoms share electrons.</td>
<td></td>
</tr>
<tr>
<td>• The oxidation number is the number of oxygen atoms in a molecule.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

After reading this chapter, list three things you learned about chemical bonds.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Chemical Reactions

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Chemical Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• There is no gain or loss of matter in a chemical reaction.</td>
</tr>
<tr>
<td></td>
<td>• In synthesis reactions, one element replaces another in a compound.</td>
</tr>
<tr>
<td></td>
<td>• Energy is required to initiate a chemical reaction.</td>
</tr>
<tr>
<td></td>
<td>• A catalyst is used to slow down a chemical reaction.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Describe several cause-and-effect types of events that might happen in your refrigerator. Decide which of the events are chemical reactions.
Predict Review the objectives of Section 1. Predict three topics that might be discussed.

1. 
2. 
3. 


equation

New Vocabulary Use your book to define the following key terms.

chemical reaction

reactants

products

chemical equation

coefficient

Academic Vocabulary Use a dictionary to define component. Then give an example of a component.

component
Section 1 Chemical Changes (continued)

Main Idea

Describing Chemical Reactions

I found this information on page ____________.

Conservation of Mass

I found this information on page ____________.

Details

Identify the reactants and the products in the following chemical equations.

<table>
<thead>
<tr>
<th>Chemical Equation</th>
<th>Reactants</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zn + S → ZnS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AgNO₃ + NaCl → AgCl + NaNO₃</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C₁₂H₂₂O₁₁ → 12C + 11H₂O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fe + CuSO₄ → FeSO₄ + Cu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CaCO₃ + 2HCl → H₂O + CO₂ + CaCl₂</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Summarize the contributions of Lavoisier by filling out the organizer. Include information on his experiments, observations, and theories.

Complete the graphic organizer about symbols used in chemical equations.

symbols used in chemical equations

4 states of matter

3 conditions that may be required for a reaction to occur
Complete the following chemical formula and its translation.

\[ 2\text{Mg} + \_ \rightarrow 2\text{MgO} + \text{light} \]

Magnesium ___ oxygen
________ magnesium oxide
and __________.

Analyze the role of coefficients as unit managers in writing chemical equations.

Evaluate the student responses. The science teacher gave students the equation to balance, and three students made responses as shown in the chart. State who is correct, and give an explanation of what the meaning of the two wrong responses would be and why those solutions do not work.

\[ \text{Mg}(s) + \text{O}_2(g) \rightarrow \text{MgO}(s) \]

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Student’s Answer</th>
<th>Evaluation: Are they right or wrong? What does the student’s answer mean?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melinda</td>
<td>put a 2 in front of the Mg</td>
<td></td>
</tr>
<tr>
<td>Barni</td>
<td>put a 2 in front of the MgO</td>
<td></td>
</tr>
<tr>
<td>Ali</td>
<td>put a 0.5 in front of the O_2</td>
<td></td>
</tr>
</tbody>
</table>

Compare It

Use what you have learned about chemical reactions to contrast the processes of cooking a hard-boiled egg and cutting paper to make confetti.
Scan Section 2 of your book, using the checklist below.

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

Write two questions about what you would like to learn.

1. 
2. 

Define subscript. Write a chemical formula that has a subscript and draw an arrow pointing to the subscript.

subscript

Use your book to define balanced chemical equation.

balanced chemical equation

Use a dictionary to define formula. Then use the word in a sentence that shows its scientific meaning.

formula
Balancing an equation means _________________________________.

Coefficients are the numbers that show _________________________________.

Subscripts are numbers that show there is _________________________________.

Identify each number 3 below as a coefficient (C) or a subscript (S).

| 2 FeSO₃ | 6 AlH₃ |
| 3 HCl  | 4 Al₂O₃ |
| 3 Na   | 3 H₂    |

Complete The number of atoms for each element on the left side of the equation has been filled out for you. Complete the right side of the equation.

<table>
<thead>
<tr>
<th>Atoms</th>
<th>BaCl₂</th>
<th>+</th>
<th>H₂SO₄</th>
<th>→</th>
<th>BaSO₄</th>
<th>+</th>
<th>HCl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ba</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cl</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Evaluate whether the equation above is balanced. Give the total number of atoms on the left side and the total number on the right side.

Identify the coefficient for HCl that would balance the equation above.
### Sequence and describe 4 steps involved in balancing a chemical equation. In the right column, write an example for each step.

<table>
<thead>
<tr>
<th>Step</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>( \text{P}_s + \text{O}_2(g) \rightarrow \text{P}<em>4\text{O}</em>{10}(s) )</td>
</tr>
<tr>
<td>2.</td>
<td>( \text{KClO}_3(s) \rightarrow \text{KCl}(s) + \text{O}_2(g) )</td>
</tr>
<tr>
<td>3.</td>
<td>( \text{H}_2\text{O}(l) \rightarrow \text{H}_2(s) + \text{O}_2(g) )</td>
</tr>
<tr>
<td>4.</td>
<td>( \text{CH}_4(s) + \text{O}_2(g) \rightarrow \text{CO}_2(g) + \text{H}_2\text{O}(g) )</td>
</tr>
</tbody>
</table>

### Identify coefficients that balance each equation.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Balanced Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( \text{P}_s + \text{O}_2(g) \rightarrow \text{P}<em>4\text{O}</em>{10}(s) )</td>
<td>( \text{P}<em>4 ) ( \text{O}</em>{10} )</td>
</tr>
<tr>
<td>2. ( \text{KClO}_3(s) \rightarrow \text{KCl}(s) + \text{O}_2(g) )</td>
<td>( \text{KCl} ) ( \text{O}_2 )</td>
</tr>
<tr>
<td>3. ( \text{H}_2\text{O}(l) \rightarrow \text{H}_2(s) + \text{O}_2(g) )</td>
<td>( \text{H}_2 ) ( \text{O}_2 )</td>
</tr>
<tr>
<td>4. ( \text{CH}_4(s) + \text{O}_2(g) \rightarrow \text{CO}_2(g) + \text{H}_2\text{O}(g) )</td>
<td>( \text{CH}_4 ) ( \text{CO}_2 ) ( \text{H}_2\text{O} )</td>
</tr>
<tr>
<td>5. ( \text{Al}_2\text{O}_3(s) \rightarrow \text{Al}(s) + \text{O}_2(g) )</td>
<td>( \text{Al}_2 ) ( \text{O}_3 ) ( \text{Al} ) ( \text{O}_2 )</td>
</tr>
<tr>
<td>6. ( \text{MgSO}_4(aq) + \text{KCl}(aq) \rightarrow \text{MgCl}_2(s) + \text{K}_2\text{SO}_4(aq) )</td>
<td>( \text{MgSO}_4 ) ( \text{KCl} ) ( \text{MgCl}_2 ) ( \text{K}_2\text{SO}_4 )</td>
</tr>
</tbody>
</table>

### Connect It

Compare chemical equations and mathematical equations.
Skim Section 3. Write two statements about what you plan to learn from the reading.

1. ____________________________
   ____________________________

2. ____________________________

Read the definitions below. Then write the key term for each one in the left column.

__________________________
a reaction in which a substance reacts with oxygen to produce heat and light

__________________________
a reaction in which two or more substances combine to form another substance

__________________________
a reaction in which one substance breaks down, or decomposes, into two or more substances

__________________________
a reaction in which one element replaces another element in a compound

__________________________
a reaction in which the positive ion of one compound replaces the positive ion of the other compound to form two new compounds

__________________________
an insoluble compound that comes out of a solution during a double-displacement reaction

__________________________
a loss of electrons during a chemical reaction

__________________________
a gain of electrons during a chemical reaction
**Main Idea**

Types of Reactions

I found this information on page ___________.

**Details**

Describe each type of chemical reaction in words. Give the general form if it exists and an example for each.

<table>
<thead>
<tr>
<th>Reaction Type</th>
<th>Description</th>
<th>General Form</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Combustion Reaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. Synthesis Reaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III. Decomposition Reaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV. Single-Displacement Reaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V. Double-Displacement Reaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI. Oxidation-Reduction Reaction</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Main Idea

Type of Reactions

I found this information on page ________.

Details

Analyze the activity series chart in your book to decide which metal will replace the other in a displacement reaction.

1. calcium 2. tin 3. copper
   lead zinc aluminum

Classify each chemical reaction by writing the reaction type in the blank to the left.

- decomposition  •  single displacement
- double displacement  •  synthesis

\[
2\text{LiBr} + \text{Pb(NO}_3\text{)}_2 \rightarrow 2\text{LiNO}_3 + \text{PbBr}_2
\]

\[
\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2
\]

\[
\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2
\]

\[
\text{NiCl}_2 \rightarrow \text{Ni} + \text{Cl}_2
\]

Model the reaction setup for the decomposition of water. Use the figure in your book to help you.

- Label the test tubes, beaker, and battery.
- Show the electrodes that conduct the electricity to the water to make the reaction happen.
- Show the amounts of hydrogen and oxygen that are produced.

Connect It

Select an example of a chemical reaction that you have observed in real life. Describe the reaction and try to write an equation for it.
### Chemical Reactions

Section 4 Chemical Reactions and Energy

---

**Preview** Section 4 of this chapter. Read the headings and the illustration captions. Write three questions that come to mind.

1. 
2. 
3. 

---

**Review Vocabulary**

**Define** chemical bond.

**chemical bond**

**New Vocabulary**

*Use your book to define the following key terms.*

**exergonic reaction**

**exothermic reaction**

**endergonic reaction**

**endothermic reaction**

**catalyst**

**inhibitor**

**Academic Vocabulary**

*Use a dictionary to define release.*

**release**

---
Identify three pieces of information about chemical reactions and energy.

1. 
2. 
3. 

Complete the following sentences about energy reactions.

All exothermic reactions are ________, but not all exergonic reactions are ________. ________________ give off heat energy, while ________________ give off any sort of energy.

All ________ reactions are endergonic, but not all ________ reactions are endothermic. ____________ reactions absorb heat energy, while ____________ reactions absorb any sort of energy.

Classify each reaction as endergonic or exergonic.

- combustion of fossil fuels
- dissolving salt in water
- dynamite explosions
- electroplating
- fireflies’ light
- glow sticks
- photosynthesis
- rusting iron
- separating aluminum metal from its ore

<table>
<thead>
<tr>
<th>Exergonic</th>
<th>Endergonic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
More Energy Out, More Energy In

I found this information on page _________.

Main Idea

Details

Model the exergonic/exothermic and endothermic/endergonic relationships by completing the Venn Diagram below. The first step has been done for you.

Exothermic

Compare and contrast the roles of catalysts and inhibitors in reactions. Fill in the Venn diagram with phrases from the bank.

- does not enter into the reaction itself
- enzymes in body
- food preservatives
- temperature change
- used in auto industry
- used to make polymers

Catylst

Both

Inhibitors

I found this information on page _________.

CONNECT IT

Use what you have learned in this section to explain why a match will not light if you do not strike it hard enough.
Chemical Reactions Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Chemical Reactions</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• There is no gain or loss of matter in a chemical reaction.</td>
<td></td>
</tr>
<tr>
<td>• In synthesis reactions, one element replaces another in a compound.</td>
<td></td>
</tr>
<tr>
<td>• Energy is required to initiate a chemical reaction.</td>
<td></td>
</tr>
<tr>
<td>• A catalyst is used to slow down a chemical reaction.</td>
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</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT

After reading this chapter, list three things you learned about chemical reactions.
Solutions

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A solution is a mixture that has the same composition, color, density, and taste throughout.</td>
<td></td>
</tr>
<tr>
<td>• The solubility of a compound cannot be measured.</td>
<td></td>
</tr>
<tr>
<td>• Substances that dissolve in water to produce solutions that conduct electricity are called ions.</td>
<td></td>
</tr>
<tr>
<td>• Some vitamins are nonpolar and dissolve in the fat contained in some body cells.</td>
<td></td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Write an answer to this question: Are all liquids necessarily solutions, and are all solutions liquids? Check your answer later and revise it if you’ve learned differently.
Scan the headings, charts, graphs, and illustrations of Section 1. List 3 solutions not mentioned in your book that you might find in your house.

1. 

2. 

3. 

Define alloy.

Use your book or a dictionary to define the following key terms.

solution

solute

solvent

polar

Use a dictionary to define process. Then use the word in a sentence that demonstrates you know its scientific meaning.

process
Main Idea

What is a solution?
Solute and Solvent

I found this information on page ____________.

Details

Create an example of a gas, liquid, and solid phase of a solution in the boxes below. Label the solute and solvent in each box. Use the figures in your book for help.

<table>
<thead>
<tr>
<th>Gas Phase</th>
<th>Liquid Phase</th>
<th>Solid Phase</th>
</tr>
</thead>
</table>

How Substances Dissolve

I found this information on page ____________.

Sequence a three-step process of dissolving a polar solid in a polar liquid.

Step 1.

Step 2.

Step 3.
Define one unique characteristic of dissolving a gas in a liquid and one unique characteristic of dissolving a solid in a solid.

Dissolving a gas in a liquid: ____________________________________________

Dissolving a solid in a solid: ____________________________________________

Organize how crystal size, stirring, and temperature are used to speed up the rate of dissolving.

Stirring:

Temperature:

Crystal Size:

Increasing the Rate of Dissolving

The instructions for a medication say to “crush tablets before stirring into water at room temperature.” Consider why this would be more effective than simply dropping the whole tablets in cold water. Explain your reasoning.

____________________________________________________________________

____________________________________________________________________
Solutions
Section 2 Solubility and Concentration

Skim the objectives of Section 2 in your book. Write three topics you expect to be covered in the reading.

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

Define concentration to reflect its scientific meaning.

- ____________________________________________
- ____________________________________________

Read the definitions below. Then write the key term for each one in the left column.

- the greatest amount of solute that can dissolve in a specific amount of solvent at a given temperature
- a solution that contains all the solute it can hold at a given temperature
- a solution that can dissolve more solute at a given temperature
- a solution that has more solute than a saturated solution at the same temperature

Use a dictionary to define precise.

- ____________________________________________
- ____________________________________________
Main Idea

How much can dissolve?
I found this information on page _________

Synthesize Suppose you and a friend are making iced tea using identical glasses. You both use the same amount of water, and the water temperature is the same in both glasses. Explain how can you tell who added more ice tea mix to the glass.

Details

Concentration
I found this information on page _________

Identify four items that you might buy in concentrated form but would dilute before using them.

1. __________
2. __________
3. __________
4. __________

Types of Solutions
I found this information on page _________

Organize, name, and define the three types of solutions discussed in your book.

Types of Solutions

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Analyze the Temperature Effects on Solubility graph in your book. Then list the four substances from least soluble to most soluble at 70°C.

1. 
2. 
3. 
4. 

Complete the graphic organizer about the solubility of gases.

Solubility of Gases

Types of Solutions

Complete the graphic organizer about the solubility of gases.

Evaluate why many people prefer to store carbonated beverages in the refrigerator.

Relate how a household sponge and water can be used to model the concept of an unsaturated solution, a saturated solution, and a supersaturated solution.
Scan Section 3 of your book, using the checklist below.

- Read all section titles.
- Read all bold words.
- Read all charts and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about particles in solution.

Write three facts you discovered about particles in solution as you scanned the section.

1. 
   
2. 
   
3. 

Review Vocabulary

Define conductivity.

conductivity

New Vocabulary

Use your book to define the following key terms.

ion

electrolyte

nonelectrolyte

ionization

dissociation
Complete the table by describing the current that can be conducted by each type of solution. Give an example for each.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description of Current</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>strong electrolytes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>weak electrolytes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nonelectrolytes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Model the ionization process of hydrogen chloride, as shown in your book. Label the positive ion and negative ions in your drawing.

Summarize in your own words how ionic solutions form.

Ionization:

Dissociation:
Main Idea

Effects of Solute Particles

I found this information on page ________.

Details

Organize the effects of solute particles by completing the organizer.

The effect that a solute has on the freezing point or boiling point of a solvent

depends on

does not depend on

Predict three animals that you would expect to have their own kind of antifreeze.

1. __________________________
2. __________________________
3. __________________________

Synthesize why antifreeze is important to a car's radiator in both the summer and in the winter.

Connect It

Describe how adding salt to a pot of boiling water might help food cook faster.

I found this information on page ________.

Name __________________________ Date ____________

Section 3 Particles in Solution (continued)

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**Skim** Section 4. Look at the headings, photos, illustrations, and captions. Write three questions you have about the information you think may be covered in this section.

1. 
2. 
3. 

**Define** hydrocarbon. *Then use the term in a sentence that shows its scientific meaning.*

hydrocarbon

**New Vocabulary**

*Use your book to define nonpolar.*

nonpolar

**Academic Vocabulary**

*Use a dictionary to define accumulate. Then use the term in a sentence that shows its scientific meaning.*

accumulate
Section 4 Dissolving Without Water (continued)

Main Idea

When Water Won’t Work

I found this information on page __________.

Details

Summarize information about nonpolar solutes and alcohol as a solvent in the table below.

<table>
<thead>
<tr>
<th>Nonpolar Solutes</th>
<th>Alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Model an ethanol molecule similar to the one shown in your book. Label the nonpolar end and the polar end of the molecule.

Useful Nonpolar Molecules

I found this information on page __________.

Classify four nonpolar materials you may find around your home.

1. ______________________________________
2. ______________________________________
3. ______________________________________
4. ______________________________________
Main Idea

Useful Nonpolar Molecules

I. Drawbacks of Nonpolar Solvents
   A. 
   B. 
      1. 
      2. 
   
   II. How Soap Works
       A. 
       1. 
       
       B. 
       C. 
          1. 

Connect It

Compare the phrases “like dissolves like” and “opposites attract.”

Summarize information about useful nonpolar molecules.

I. Drawbacks of Nonpolar Solvents
   A. 
   B. 
      1. 
      2. 
   
   II. How Soap Works
       A. 
       1. 
       
       B. 
       C. 
          1. 

Classify Vitamins A, B, C, D, E, and K as being either fat soluble or water soluble.

Polarity and Vitamins

I found this information on page ___________.

Fat Soluble:

Water Soluble:

I found this information on page ___________.

Solutions 265
Solutions  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Solutions</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A solution is a mixture that has the same composition, color, density, and taste throughout.</td>
<td></td>
</tr>
<tr>
<td>• The solubility of a compound cannot be measured.</td>
<td></td>
</tr>
<tr>
<td>• Substances that dissolve in water to produce solutions that conduct electricity are called ions.</td>
<td></td>
</tr>
<tr>
<td>• Some vitamins are nonpolar and dissolve in the fat contained in some body cells.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review

Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT

After reading this chapter, list three things you learned about solutions.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Acids, Bases, and Salts

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Acids, Bases, and Salts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• pH measures how acidic a solution is.</td>
</tr>
<tr>
<td></td>
<td>• All acids will burn your skin.</td>
</tr>
<tr>
<td></td>
<td>• Bases commonly are found in household cleaners.</td>
</tr>
<tr>
<td></td>
<td>• Most animals need salt.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Research to find out why your body needs salt, then write a brief summary and identify several ways that you can safely get the salt you need.

Name ___________________________ Date ____________

Acids, Bases, and Salts 267
Acids, Bases, and Salts

Section 1  Acids and Bases

Skim Section 1. Look at the headings, photos, illustrations, and captions. Write three questions you have about the information you think may be covered in this section. Try to answer your questions as you read.

Question: ____________________________________________
Answer: _______________________________________________

Question: ____________________________________________
Answer: _______________________________________________

Question: ____________________________________________
Answer: _______________________________________________

Define electrolyte to show its scientific meaning.

electrolyte

Read the definitions below. Then write the key term for each one in the left column.

H₃O⁺ ions that are formed when an acid dissolves in water and H⁺ ions interact with water molecules

an organic compound that changes color in acid and base

any substance that forms hydroxide ions, OH⁻ in a water solution

Use a dictionary to define predict to show its scientific meaning.

predict
Section 1 Acids and Bases (continued)

Main Idea

Acids

I found this information on page ________.

Bases

I found this information on page ________.

Details

Organize information about acids using the table below.

<table>
<thead>
<tr>
<th>Acids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition:</td>
</tr>
<tr>
<td>Four Common Properties:</td>
</tr>
<tr>
<td>Four Common Acids:</td>
</tr>
<tr>
<td>Four Uses of Acids:</td>
</tr>
</tbody>
</table>

Identify a fact or example about bases on each line.

Common Properties

Bases

Common Bases
Create one review question dealing with the dissociation of acids and one review question dealing with the dissociation of bases. Give answers to your two questions.

1. Question: 
   Answer: 
   
2. Question: 
   Answer: 
   
Model an ammonia molecule and a water molecule. Show what happens during dissociation.

Analyze how ammonia can be a base even though it does not contain –OH.

The smell of fish is caused by a base. Hypothesize why lemon juice can be used to neutralize the smell of fish.
Acids, Bases, and Salts
Section 2 Strengths of Acids and Bases

**Predict** Look at the headings in Section 2. Write two predictions about what you will learn in this section.

1. 
2. 

**Define** acid strength in a sentence to show its scientific meaning.

an acid that dissociates almost completely in solution

a base that dissociates completely in solution

solutions containing ions that react with added acids or bases to decrease their effects on pH

a measure of the concentration of $H^+$ ions in a solution

an acid that only partly dissociates in solution

a base that does not dissociate completely in solution

**Use a dictionary to define conduct as a verb in science.**

Read the definitions below. Then write the key term for each one in the blank in the left column.

Review Vocabulary

Academic Vocabulary

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Section 2 Strengths of Acids and Bases (continued)

**Main Idea**

**Strong and Weak Acids and Bases**

I found this information on page _________.

**Details**

**Analyze** information about strong and weak acids and bases.

<table>
<thead>
<tr>
<th>Equation for Dissociation</th>
<th>Arrow Directions Demonstrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak acid</td>
<td></td>
</tr>
<tr>
<td>Weak base</td>
<td></td>
</tr>
<tr>
<td>Strong acid</td>
<td></td>
</tr>
<tr>
<td>Strong base</td>
<td></td>
</tr>
</tbody>
</table>

**Evaluate** why acids are able to conduct electricity. Then describe which types of acids are better conductors and why.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

**Contrast** the terms weak and dilute as they describe acids and bases.

<table>
<thead>
<tr>
<th>Weak</th>
<th>Dilute</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Describe** what the particles of an acid or base would look like with each combination of characteristics listed below.

<table>
<thead>
<tr>
<th>Concentrate</th>
<th>Diluted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak</td>
<td>There are many particles, but not all are dissociated ions.</td>
</tr>
<tr>
<td>Strong</td>
<td></td>
</tr>
</tbody>
</table>
Model a pH scale from 0 to 14. Then complete the following:

- Circle and label a neutral pH.
- Use arrows to show which direction indicates more acidic and which direction indicates more basic.
- Circle and label the pH level with the highest concentration of H⁺ ions and the pH level with the lowest concentration of H⁺ ions.

I found this information on page __________.

Analyze how buffers allow you to eat acidic and basic foods without changing your blood pH.

CONNECT IT

People with fish tanks test the water regularly to check its pH. Predict what the fish owner would do if the water were too acidic or too basic. Predict how these conditions might affect the fish.

I found this information on page __________.

Name ___________________________ Date ________________
Scan Use the checklist below to preview Section 3 of your book.

- Read all section titles.
- Read all bold words.
- Read all charts and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about acids, bases, and salts.

Write two facts you discovered about acids, bases, and salts as you scanned the section.

1. ________________________________
2. ________________________________

Define ester to show its scientific meaning.

ester

Define the following key terms.

neutralization

salt

titration

soap
Section 3 Salts (continued)

Main Idea

Neutralization, and Salts

I found this information on page __________.

I found this information on page __________.

Titration

I found this information on page __________.

Details

Identify the acid, base, salt, and water in the neutralization reaction below.

HCl + NaHCO₃ → NaCl + CO₂ + H₂O

Complete the graphic organizer describing the formation of a salt.

negative ions from an acid + ________ → salt

Sequence the steps used to find the concentration of an acid solution by titration. The last step has been completed for you.

Use the volume of base used and the known concentration of the base to calculate the concentration of the acid.

Connect It

Imagine that there were no salts available for manufacturing or personal use. Describe three ways your life might be different.

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________
Compare and contrast characteristics of soaps and detergents in the Venn diagram below.

- contain a sulfonic acid group
- have carboxylic acid
- have long hydrocarbon chains
- insoluble in hard water
- may cause excess foam

- made from fatty acids
- made from petroleum molecules
- makes soap scum
- used for cleaning

Soaps

Detergents

Both

Versatile Esters

I found this information on page _________.

Identify four uses of esters.

Design a simple experiment to show how neutralization works using a natural indicator with a kitchen acid and a kitchen base.
Connect It  Research scientists often measure the pH of lakes, streams, and rivers. Consider why they would do this. Describe what you think they can learn from the pH of the water. Write a fictional newspaper article reporting a real-world scenario about the pH of a local lake or river, its condition, possible causes, and how scientists are studying the aquatic environment. Include a map of the environment.
Acids, Bases, and Salts  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Acids, Bases, and Salts</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• pH measures how acidic a solution is.</td>
<td></td>
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</tr>
<tr>
<td>• Most animals need salt.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review
Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT
Write three new facts you learned about acids, bases, and salts.

________________________________________
________________________________________
________________________________________

278  Acids, Bases, and Salts
Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Organic Compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humans contain compounds of the element carbon.</td>
<td></td>
</tr>
<tr>
<td>All aromatic compounds are smelly.</td>
<td></td>
</tr>
<tr>
<td>Petroleum, coal, and natural gas are all produced in the laboratory.</td>
<td></td>
</tr>
<tr>
<td>Many important biological compounds in your body are polymers.</td>
<td></td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

Science Journal

Can you think of any medicines that come from natural sources, such as plants?

---

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Skim Before you read Section 1, skim the headings, illustrations, and captions. Write three questions you have about what may be discussed in this section.

1. 
2. 
3. 

Define compound.

Use your book to define the following key terms.

**organic compound**

**hydrocarbon**

**saturated hydrocarbon**

**isomer**

**unsaturated hydrocarbon**

Use a dictionary to define complex.
Section 1 Simple Organic Compounds (continued)

**Main Idea**

**Organic Compounds**

I found this information on page _________.

**Details**

**Compare** organic and inorganic compounds. Give examples of each type.

<table>
<thead>
<tr>
<th>Organic</th>
<th>Inorganic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Complete** the concept map by describing how carbon can form so many organic compounds through bonding and arrangement.

- bonding
- arrangement

**Hydrocarbons**

I found this information on page _________.

**Create** Draw the structural formula for one of the hydrocarbons in this section. Name the hydrocarbon and explain why it is a hydrocarbon on the lines below.

---

Organic Compounds 281
Section 1 Simple Organic Compounds (continued)

Main Idea

Single Bonds
I found this information on page _________.

Multiple Bonds
I found this information on page _________.

Details

Complete the graphic organizer about isomers.

Isomers have

Identical ________ ________.
Different ________ and ________.
Different ________ and ________ points.

Identify the type of bonds in each hydrocarbon. Make a sketch of each molecule. Then categorize each hydrocarbon as being saturated or unsaturated.

<table>
<thead>
<tr>
<th>Hydrocarbon</th>
<th>Type of Bond</th>
<th>Sketch</th>
<th>Saturated or Unsaturated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethene</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethyne</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propene</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CREATE IT

Develop a model of a saturated hydrocarbon using toothpicks and colored marshmallows. Draw and describe your model below. Describe how the model shows it is a saturated hydrocarbon.

[Diagram or description of a saturated hydrocarbon model]

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Organic Compounds
Section 2 Other Organic Compounds

**Predict** Before you read Section 2, look at the headings in the section. Write two predictions about what you will learn in this section.

1. 

2. 

**Review Vocabulary**

**Define** physical property.

physical property

**New Vocabulary**

*Use your book to define each of the following terms.*

aromatic compound

substituted hydrocarbon

alcohol

**Academic Vocabulary**

*Use a dictionary to define framework.*

framework
Complete the table about aromatic compounds.

<table>
<thead>
<tr>
<th>Definition</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure found in all aromatic compounds</td>
<td>Examples</td>
</tr>
</tbody>
</table>

Model the structural formula and symbol for benzene. Place a C at each of the six corners of the symbol, then add the single and double bonds between the carbon atoms. Use the figures in your book to help you.

Identify the number of carbon atoms, hydrogen atoms, and fused rings in naphthalene. Draw the structure of this compound.
Evaluate two ways that chemists can change hydrocarbons into other compounds.

1. 
2. 

Compare alcohols and organic acids using the table below.

<table>
<thead>
<tr>
<th></th>
<th>How are they formed?</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohols</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic Acids</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Identify five elements other than carbon, hydrogen, and oxygen that can be added to hydrocarbons.

1. 
2. 
3. 
4. 
5. 

Write a journal entry about some organic compounds you use. Identify at least one aromatic compound, one alcohol, and one acid.
Organic Compounds
Section 3 Petroleum—A Source of Carbon Compounds

Scan Use the checklist below to preview Section 3 of your book.

- Read all section titles.
- Read all bold words.
- Read all charts and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about petroleum.

Write two facts you discovered about petroleum as you scanned the section.

1. ________________________________
2. ________________________________

Review Vocabulary
Define condensation.
condensation
______________________________________________________________
______________________________________________________________

New Vocabulary
Read the definitions below. Then write the key term on the blank in the left column.

_________________________________
a process that uses heat or chemicals to break long polymer chains into monomer fragments
_________________________________
the polymer formed when ethylene combines with itself repeatedly
_________________________________
a very large molecule made from small molecules that link together
_________________________________
a small molecule that forms a link in the polymer chain

Academic Vocabulary
Use a dictionary to define link.
link
______________________________________________________________
______________________________________________________________
Define *fraction*. Define *distill*. *Use a dictionary to help you. Then describe what fractional distillation does to petroleum molecules.*

**Sequence** the steps in fractional distillation until the first fraction is separated. One step has been completed for you.

1. 

2. 

3. The hydrocarbons start to turn into vapor and the vapors rise up inside the tower.

4. 

5. 

**Model** a fractionating tower. *Use the figure in your book for help. Next to the tower, draw an arrow from the bottom to the top. Along the arrow, show where the higher-boiling fractions condense, the middle-boiling fractions condense, and the lowest-boiling fractions condense.*
### Main Idea

**Uses for Petroleum Compounds**

*I found this information on page _______.*

### Details

**Organize information about the uses of petroleum compounds.** In the middle column of boxes, describe the fractions. In the right column, tell what each fraction is used to make.

<table>
<thead>
<tr>
<th>Lightest Fractions</th>
<th>Kerosene and Jet Fuel</th>
<th>Paving Asphalt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses for Petroleum</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Model a polymer if one paper clip is a monomer.**

**Describe at least one benefit and one challenge associated with depolymerization.**

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONNECT IT**

Consider how your life today would be different without petroleum products. Hypothesize what might be used to replace the petroleum products you use.

---

Organize information about the uses of petroleum compounds. **In the middle column of boxes, describe the fractions. In the right column, tell what each fraction is used to make.**

- **Uses for Petroleum Compounds**

  I found this information on page _______.
Organic Compounds
Section 4 Biological Compounds

Skim Before you read Section 4, skim the headings, illustrations, and captions. Write three questions you have about what may be discussed in this section.

1. _______________________________________

2. _______________________________________

3. _______________________________________

Review Vocabulary

Define molecule.

molecule

New Vocabulary

Use your book to define the following key terms.

protein

nucleic acid

deoxyribonucleic acid (DNA)
carbohydrate

lipid

Academic Vocabulary

Use a dictionary to define identical.

identical
Main Idea

**Biological Polymers**

I found this information on page ________.

**Proteins**

I found this information on page ________.

**Nucleic Acids**

I found this information on page ________.

Details

**Compare and contrast** biological polymers to other polymers.

<table>
<thead>
<tr>
<th>Similarities</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Complete the graphic organizer about** protein monomers.

- _______ groups of one amino acid
- form a bond with the _______ acid group of another amino acid
- to make a _______.

- muscles, _______, and _______.
- which the body uses to create the molecule is called a _______.
- When a peptide contains about 50 or more _______ acids

**Organize** information about DNA using the table below.

<table>
<thead>
<tr>
<th>DNA</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Structure</td>
<td></td>
</tr>
<tr>
<td>Where found</td>
<td>Practical use</td>
<td></td>
</tr>
</tbody>
</table>

290  Organic Compounds
Section 4 Biological Compounds (continued)

Main Idea

Carbohydrates

I found this information on page _________.

Details

Complete the graphic organizer about carbohydrates.

Carbohydrates contain 3 elements: ________, ________, and _________.

Starches provide ________, ________, fuel. ________ - provide a quick burst of energy.

Energy from starches can be stored in the ________ and ________ cells in the form of _________.

Common table sugar, called ________, is broken down by digestion into ________ (fruit sugar) and ________ (blood sugar).

Lipids

I found this information on page _________.

I found this information on page _________.

Identify three lipids.

1. ________ 2. ________ 3. ________

Contrast saturated, monounsaturated, and polyunsaturated fats and oils.

<table>
<thead>
<tr>
<th>Saturated</th>
<th>Monounsaturated</th>
<th>Polyunsaturated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Connect It

Describe ways you could change your diet to consume less cholesterol and saturated fats. Explain what foods you might replace in your diet and why.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Organic Compounds 291
Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Organic Compounds</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Humans contain compounds of the element carbon.</td>
<td></td>
</tr>
<tr>
<td>• All aromatic compounds are smelly.</td>
<td></td>
</tr>
<tr>
<td>• Petroleum, coal, and natural gas are all produced in the laboratory.</td>
<td></td>
</tr>
<tr>
<td>• Many important biological compounds in your body are polymers.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review
Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT Write three new facts you learned about organic compounds.

________________________________________

________________________________________

________________________________________

292 Organic Compounds
New Materials Through Chemistry

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>New Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Polymers can not be made without living enzymes.</td>
</tr>
<tr>
<td></td>
<td>• Ceramics are ancient pottery materials.</td>
</tr>
<tr>
<td></td>
<td>• Ceramics are modern materials used in replacement surgery.</td>
</tr>
<tr>
<td></td>
<td>• Alloys are less useful materials than pure metals.</td>
</tr>
<tr>
<td></td>
<td>• Semiconductors do not conduct as well as metals.</td>
</tr>
</tbody>
</table>

Construct the Foldable as directed at the beginning of this chapter.

How do manufacturers find materials to meet their needs?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Scan Section 1 of your book. Use the checklist below to preview the section.

- Read all headings.
- Read all boldfaced words.
- Read all charts and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about materials and their history.

Write one thing you would like to learn about the history of materials.

Define metal.

metal

Define alloy.

alloy

Define luster.

luster

Define ductility.

ductility

Define malleability.

malleability

Define conductivity.

conductivity

Define innovate.

innovate

Use a dictionary to define each of the key terms.

Use your book or a dictionary to define each of the key terms.

Use a dictionary to define innovate.
Identify four advantages alloys may have over pure elements.

1. 
2. 
3. 
4. 

Create a journal entry. Imagine you are a jewelry maker or metalworker in ancient or modern times. Write two paragraphs or draw a cartoon strip to tell about your day working with metals. Discuss the metals’ ductility, luster, malleability, and conductivity.

Classify each alloy below as containing copper, tin, both, or neither.

- bronze  • gold for a ring  • solder  • tooth fillings
- brass  • pewter  • sterling silver  • wrought iron

Copper  Tin  Neither

Both
Organize information about properties of metals and alloys. Match uses with important properties and examples.

<table>
<thead>
<tr>
<th>Uses</th>
<th>Important Properties</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jewelry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drill bit</td>
<td>stainless steel</td>
<td>copper</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>low melting point</td>
<td>lead and tin steel</td>
</tr>
<tr>
<td>Aircraft</td>
<td>malleability</td>
<td></td>
</tr>
</tbody>
</table>

Ancient Sumerians had bronze, but not other metals. Describe the properties of some modern alloys and explain how these alloys would have helped the ancient Sumerians in their lives.

Ancient Sumerians had bronze, but not other metals. Describe the properties of some modern alloys and explain how these alloys would have helped the ancient Sumerians in their lives.

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Ancient Sumerians had bronze, but not other metals. Describe the properties of some modern alloys and explain how these alloys would have helped the ancient Sumerians in their lives.

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Ancient Sumerians had bronze, but not other metals. Describe the properties of some modern alloys and explain how these alloys would have helped the ancient Sumerians in their lives.
Predict Read the title and the headings of Section 2 in your book. Write three topics that might be discussed in this section.

1. 
2. 
3. 

Define element to show its scientific meaning.

<table>
<thead>
<tr>
<th>New Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>element</td>
</tr>
</tbody>
</table>

Use your book or a dictionary to define each key term.

<table>
<thead>
<tr>
<th>New Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>ceramics</td>
</tr>
<tr>
<td>semiconductor</td>
</tr>
<tr>
<td>doping</td>
</tr>
<tr>
<td>integrated circuit</td>
</tr>
</tbody>
</table>

Use a dictionary to define tradition.
Complete the information about the history of ceramic materials on the timeline.

10,000 B.C.  

Pieces of ____________ from this time have been found.

The first ____________, called ____________, was built.

Walls of towns and homes were made of ____________ baked in the Sun.

_______  

_______ first was used to make cups and bottles.

_______ invented ____________. Some of their structures are still standing today.

Organize materials used to make ceramics in the Venn diagram.

- carbon
- clay
- feldspar
- metals
- nitrogen
- sand
- straw
- sulfur

Ancient Ceramics  

Modern Ceramics

Model the effect of heating on ceramics by drawing ceramic structure before and after firing.

Before

After

Identify four characteristics of ceramics.

______________________,  

______________________,  

______________________,  

______________________
Semiconductors

I found this information on page 1.

Model an n-type semiconductor and a p-type semiconductor side by side.

Contrast n-type and p-type semiconductors. Explain exactly why the electric current (or electron flow) can only travel in one direction between the two types.

Identify five devices that use integrated circuits.

CONNECT IT

Contrast human lifestyles before and after the invention of ceramics. Describe human lifestyles before and after the invention of semiconductors. Use specific examples of how certain activities would be performed before and after these inventions. State which invention you think changed human life more—ceramics or semiconductors.
Predict what you will be learning about in Section 3. Read the title of the section. Then write three questions that might be answered in this section.

1. 
2. 
3. 

Define protein to show its scientific meaning.

protein

Use your book or a dictionary to define each key term.

polymer

monomer

synthetic

composite

Use a dictionary to define manipulate.

manipulate
Main Idea

Polymers

Organize information about polymers in the outline.

I. Common Polymers and Their Uses
   A. Polyethylene: _______________________
   B. ____________________ (PVC) _______________________
   C. ____________________:
   D. Polystyrene: ________________________.

II. Examples of Natural Polymers
    ____________________:

III. Useful Properties of plastics
     ____________________:
     ____________________:
     ____________________:
     ____________________:

IV. Synthetic fibers and things that are made from them
    A. Nylon: ________________________
    B. ____________________:
    C. Polyester: ________________________
    D. Aramids: Fireproof: ________________________
       Bulletproof: ________________________

V. Adhesives and Their Uses
   A. ____________________: bonds instantly, gets stronger as it dries
   B. ____________________: are used in construction
   C. ____________________:
   D. ____________________:
      bond after ____________________

VI. Surface Coatings and Elastic Polymers
    A. ____________________: used to ____________________
    B. ____________________: contain synthetic polymers
    C. ____________________: used in ____________________
       ____________________,
Complete the timeline with notes about synthetic polymer inventions.

I found this information on page __________.

Identify two creatures that produce polymerlike substances and describe a modern material that copied these natural wonders.

1. ____________________________
2. ____________________________

Create a concept map to describe fiberglass.

Identify three advantages of composites.

__________, ____________, ____________

Describe at least three polymers or composites you learned about in this section that you use every day.
Tie It Together

New Materials Through Chemistry

Choose A or B for a topic.

A. Look through news and media sources for articles about new devices and new materials that have been developed.

B. Find a historical example of the development of a material.

Make a report or poster about the materials. Provide key information about the product:

• how the new product was developed
• materials used to make the new product
• how are those materials were obtained
• the properties of these materials
• the advantages of the new product and its materials compared to products that were made before
New Materials Through Chemistry  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below.

1. Write an A if you agree with the statement.
2. Write a D if you disagree with the statement.

<table>
<thead>
<tr>
<th>New Materials</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Polymers can not be made without living enzymes.</td>
<td></td>
</tr>
<tr>
<td>• Ceramics are ancient pottery materials.</td>
<td></td>
</tr>
<tr>
<td>• Ceramics are modern materials used in replacement surgery.</td>
<td></td>
</tr>
<tr>
<td>• Alloys are less useful materials than pure metals.</td>
<td></td>
</tr>
<tr>
<td>• Semiconductors do not conduct as well as metals.</td>
<td></td>
</tr>
</tbody>
</table>

Compare your previous answers to these.

Review
Use this checklist to help you study.

☐ Review the information you included in your Foldable.
☐ Study your Science Notebook on this chapter.
☐ Study the definitions of vocabulary words.
☐ Review daily homework assignments.
☐ Re-read the chapter and review the charts, graphs, and illustrations.
☐ Review the Self Check at the end of each section.
☐ Look over the Chapter Review at the end of the chapter.

SUMMARIZE IT
List three interesting things you learned in this chapter.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________