About the Consultant

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*Physical Science with Earth Science*
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 clearly and concisely 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 emphasize important concepts. Place a question mark (?) next to anything that you do not understand.

- Ask questions and participate in class discussion.

- Draw and label pictures or diagrams to help clarify a concept.

**Note-Taking Don’ts**

- Don’t write every word. Concentrate on the main ideas and concepts.
- Don’t use someone else’s notes—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.
Using Your Science Notebook

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

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

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

- **Science Journal**
  Write about what you know.

- **Writing Activities**
  These activities help you think about what you’re learning and make connections to your life.

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

Properties of Atoms and the Periodic Table

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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 the smallest unit of an element</td>
<td>A</td>
</tr>
<tr>
<td>that still has all the properties of the element</td>
<td></td>
</tr>
<tr>
<td>An atom is made up of a positively charged nucleus and negatively charged electrons</td>
<td>A</td>
</tr>
<tr>
<td>Quarks are so tiny that they orbit the nucleus with the electron</td>
<td>D</td>
</tr>
<tr>
<td>Isotopes of an element only differ in their number of neutrons</td>
<td>A</td>
</tr>
<tr>
<td>An element’s chemical and physical properties may be predicted by its location on the periodic table</td>
<td>A</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 chapter’s 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.

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.

List possible reasons that scientists study space.
The Nature of Science

Section 1 The Methods of Science

Skim the headings and bold words in this section. Write four steps scientists might take to solve a problem.

________________________________________

________________________________________

________________________________________

________________________________________

Review Vocabulary

Define investigation to show its scientific meaning.

________________________________________

New Vocabulary

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

variable whose value changes as a result of changes in other variables

standard used to compare the results of the experiment

a factor that can cause a change in the results of an experiment

the application of science to help people

a factor in an experiment that does not change

represents an idea, event, or object to help people observe or test it

the variable you change to see how it affects another variable

occurs when a scientist’s expectations change how the results are viewed

Academic Vocabulary

Use a dictionary to define survey.

________________________________________

________________________________________
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
Identify the three main categories of science. Summarize the topic studied in each category.
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 _________ 4. _________________________
2. _________________________ 5. _________________________
3. _________________________ 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

Distinguish between a scientific theory and a scientific law.

The Limitations of Science

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

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

CONNECT IT

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

Name ___________________________ Date ____________

4 The Nature of Science
### The Nature of Science

**Section 2 Standards of Measurement**

<table>
<thead>
<tr>
<th>New Vocabulary</th>
<th><strong>Define</strong> ratio to show its scientific meaning. Then use it in a sentence as a noun.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>measurement</strong></td>
<td><strong>Skim</strong> the headings in Section 2. Write three questions that come to mind about measurement.</td>
</tr>
<tr>
<td><strong>precision</strong></td>
<td><strong>Define</strong> measurement to show its scientific meaning.</td>
</tr>
<tr>
<td><strong>accuracy</strong></td>
<td></td>
</tr>
<tr>
<td><strong>volume</strong></td>
<td></td>
</tr>
<tr>
<td><strong>mass</strong></td>
<td></td>
</tr>
<tr>
<td><strong>density</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Review Vocabulary**

Use your book to define the following terms.

- **measurement**
- **precision**
- **accuracy**
- **volume**
- **mass**
- **density**
Summarize 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>s</td>
</tr>
<tr>
<td>kilogram</td>
<td>K</td>
<td>K</td>
</tr>
<tr>
<td>candela</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>mole</td>
<td>A</td>
</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.

1.
2.
3.
4.
Section 2 Standards of Measurement (continued)

Main Idea

Measuring Matter
I found this information on page __________.

Measuring Time and Temperature
I found this information on page __________.

Details

Identify 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/cm(^3))</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 (m(^3))</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.
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></td>
<td>5</td>
</tr>
<tr>
<td>y-axis</td>
<td>minimum bar height</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>horizontal scale</td>
<td>maximum class size</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>vertical scale</td>
<td>minimum class size</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>
Main Idea

Circle Graphs
I found this information on page ___________.

Details

Complete the following paragraph.

A ____________ graph is used to show how a certain quantity is ____________ into parts. The circle represents the ____________ and the segments represent the ____________ of the whole. The segments are usually given as _________________ of the whole.

Analyze the circle graph titled “Heating Fuel Usage” in your book to complete the first column in the table. Then use the formula provided for you in the table to complete the second column. Remember to use the decimal form of the percent of whole in the formula when finding angle of slice. The first one has been done for you.

<table>
<thead>
<tr>
<th>Heating Fuel</th>
<th>Percent of whole</th>
<th>Angle of Slice [percent of whole $\times 360^\circ = \text{angle of slice}^\circ$]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>50</td>
<td>$0.5 \times 360^\circ = 180^\circ$</td>
</tr>
<tr>
<td>Steam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</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.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Tie It Together

The Nature of Science

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 and complete the table below. Compare your previous answers to these.

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>• A scientific experiment is valid as long as you don’t vary more than two factors.</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>• Any type of graph is appropriate for displaying any type of information.</td>
<td></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, identify three things you have learned about 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>Science, Technology, and Society</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• The study of science usually leads to a better understanding of the world around you.</td>
</tr>
<tr>
<td></td>
<td>• The development of technology is not affected by society.</td>
</tr>
<tr>
<td></td>
<td>• Engineers use scientific information to develop products or solve problems.</td>
</tr>
<tr>
<td></td>
<td>• Building a prototype is usually the first step taken to find a technological solution.</td>
</tr>
</tbody>
</table>

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

List 10 types of technology you have used today.

<table>
<thead>
<tr>
<th>Type of Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Scan the section headings, boldface words, and illustrations. Write four facts you discovered as you scanned the section.

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________
4. ____________________________________________

**Review Vocabulary**

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

- technology

**New Vocabulary**

Use your book or a dictionary to define the key term.

- agricultural biotechnology

**Academic Vocabulary**

Use a dictionary to define technique. Then use the word technique in a sentence to show its scientific meaning.

- technique
Complete the statement about science.

The study of science usually leads to ____________________________

Now write three examples of science.

1. ____________________________

2. ____________________________

3. ____________________________

Organize examples of how scientific insight has contributed to disease prevention and improved weather forecasting.

<table>
<thead>
<tr>
<th>Disease Prevention</th>
<th>Weather Forecasting</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></td>
</tr>
</tbody>
</table>

Compare and contrast science and technology.

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________
Main Idea

Organize information about types of technology by completing the concept web. Provide two examples of each type of technology.

- Objects
  1. 
  2. 

- Methods or Techniques
  1. 
  2. 

- Knowledge or Skills
  1. 
  2. 

- Systems
  1. 
  2. 

Global Technological Needs

Summarize how global technological needs differ in developing countries and industrialized countries.

- Developing Countries
- Industrialized Countries

Global Technological Needs

Connect It

What is the most important piece of technology you use on a daily basis? Support your choice with an example.
Science, Technology, and Society
Section 2 Forces that Shape Technology

Predict three things that might be discussed in this section after you read the Section 2 title.
1. __________________________________________
2. __________________________________________
3. __________________________________________

Review Vocabulary

Define ecosystem to show its scientific meaning.

ecosystem

Use your book to define society. Then write a sentence that includes the term society and the term technology.

society

Definition: __________________________________________
__________________________________________
__________________________________________
Sentence: __________________________________________
__________________________________________
__________________________________________

New Vocabulary

Use a dictionary to define benefit to show its scientific meaning. List three examples of things that are benefits to people.

benefit

Example: __________________________________________
__________________________________________
__________________________________________
Examples: __________________________________________
__________________________________________
__________________________________________
Section 2 Forces that Shape Technology (continued)

**Main Idea**

**Social Forces that Shape Technology**

I found this information on page __________.

**Economic Forces that Shape Technology**

I found this information on page __________.

**Details**

**Complete** the concept web to identify the social forces that shape technology.

- Social Forces that Shape Technology

  - include

- include

**Summarize** how social forces shape technology.

- ______________________
- ______________________
- ______________________
- ______________________

**Organize** information about economic forces that shape technology by completing the concept web.

- Economic Forces that Shape Technology

  - include

- include

- which

- which

- which

- which
Complete the statement below about developing technology responsibly.
To develop technology responsibly, people must evaluate both the _________ and the ______________ consequences of the technology.

Summarize the types of issues involved when developing technology responsibly by completing the table.

<table>
<thead>
<tr>
<th>Issues Involved when Developing Technology Responsibly</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Issue</strong></td>
</tr>
<tr>
<td>Environmental</td>
</tr>
<tr>
<td>Moral</td>
</tr>
<tr>
<td>Ethical</td>
</tr>
</tbody>
</table>

SYNTHESIZE IT
Evaluate how moral and ethical values related to animals and humans have affected the methods by which technology is developed.

---

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Science, Technology, and Society 19
Preview the What You’ll Learn statements for Section 3. Predict three topics that will be discussed in this section.

1. 

2. 

3. 

Review Vocabulary

Define system to show its scientific meaning.

system

New Vocabulary

Write the correct vocabulary word next to each definition.

device or collection of devices used to monitor a system and limit system failures

researcher who uses scientific information or ideas to solve problems or human needs and bring technology to consumers

performance-testing method using a computer to imitate a process or procedure or to gather data

first full-scale model built to performance-test a new product

scaled-down version of real production equipment that closely models actual manufacturing conditions and is used to test a new manufacturing process

design limitations placed on products by outside factors, such as available materials, cost, and environmental impact

Academic Vocabulary

Use a dictionary to define factor to show its scientific meaning.

factor
Main Idea

Scientists and Engineers

I found this information on page __________.

Details

Summarize important characteristics of scientists and engineers.

A scientist is someone who studies _________________.

Scientists often do research in _________________, although some work is done in the _________________.

Scientists may not know whether or how their work will be used.

An engineer is a _________________ who is responsible for bringing _________________ to the consumer. Engineers use scientific information or ideas to _________________ or _________________.

Identify seven different areas in which engineers work.

<table>
<thead>
<tr>
<th>Some Areas in Which Engineers Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
</tr>
<tr>
<td>6.</td>
</tr>
<tr>
<td>7.</td>
</tr>
</tbody>
</table>
Complete the flowchart to identify the processes used by scientists and engineers to find technological solutions to problems. Use the information provided and your book to help you.

1. __________________
   Clearly define the problem.

2. __________________
   Begin the search for a solution.

3. __________________
   Use models to find design flaws.

   which helps to

4. __________________

Identify two types of intellectual property.

1. __________________

2. __________________

CONNECT IT

A prototype is a model. Think of a time when you have used a prototype to study or learn about something. Identify an advantage of a model. Identify a disadvantage.
Tie It Together

Synthesize It

Suppose you are part of a team that designs robots. In the spaces provided, describe the robot you would like to build and some things you would have to consider to actually build it. Use the writing prompts to help you.

**Jobs my robot would do:**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

**Features my robot would need:**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

**Constraints of building my robot:**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Science, Technology, and Society
Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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

<table>
<thead>
<tr>
<th>Science, Technology, and Society</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The study of science usually leads to a better understanding of the world around you.</td>
<td></td>
</tr>
<tr>
<td>• The development of technology is not affected by society.</td>
<td></td>
</tr>
<tr>
<td>• Engineers use scientific information to develop products or solve problems.</td>
<td></td>
</tr>
<tr>
<td>• Building a prototype is usually the first step taken to find a technological solution.</td>
<td></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, identify three things you have learned about science, technology, and society.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
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, Acceleration, and Forces</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, Acceleration, and Forces
Section 1 Describing Motion

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

Review Vocabulary

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

instantaneous

Define each vocabulary term by writing it next to the correct definition.

the distance and direction that something moved from a starting point

a quantity that is specified by size and direction

the distance an object travels in an amount of time

a measure of the speed of an object and the direction it is traveling

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

average speed

instantaneous speed

Use a dictionary to define constant to show its scientific meaning.
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 average speed by looking at the diagram and filling in the prompts.

Put your finger over the $\bar{v}$ on the diagram. Now write the formula for average speed.

\[
\bar{v} = \frac{d}{t}
\]

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

\[
d = \bar{v}t
\]

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

$\bar{v} = \frac{d}{t}$

- $d$ has units of ______, and $t$ has units of ______.
- Therefore, $\bar{v}$ has units of ______________.

$d = \bar{v}t$

- $\bar{v}$ has units of ______________, and $t$ has units of ______.
- Therefore, $d$ has units of ______.
Analyzing 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.

---

**Main Idea**

**Velocity**

I found this information on page _________.

---

**Details**

**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.

---

**Graphing Motion**

I found this information on page _________.

---

**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
Motion, Acceleration, and Forces
Section 2 Acceleration

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.

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

velocity

New Vocabulary Use your book to define the word acceleration.

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.

Academic Vocabulary Use a dictionary to define the word positive. Then write a scientific sentence that includes the word.

positive
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.

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.
Analyze why the SI unit of acceleration is \( \text{m/s}^2 \).

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.

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

Predict the acceleration of a roller coaster that goes from 0 to 190 km/h in 4 s. Express your answer in \( \text{km/s}^2 \). Round to three decimal places.
Motion, Acceleration, and Forces
Section 3 Motion and Forces

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

1. __________________________________________
2. __________________________________________
3. __________________________________________

**Review Vocabulary**

**Define** vector in a sentence to show its scientific meaning.

vector

**New Vocabulary**

Use your book or dictionary to define the following terms.

force

net force

balanced forces

unbalanced forces

**Academic Vocabulary**

Use a dictionary to define survive.

survive
Main Idea

What is force?

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.

Friction

I found this information on page ________.

Complete the concept map about types of friction.

Types of Friction

- sliding friction
  - prevents two surfaces from sliding past each other
- less than sliding friction
Section 3 Motion and Forces (continued)

Main Idea

Air Resistance

Contrast the terminal velocity of a parachutist with an open chute to the terminal velocity of the same parachutist with a closed chute. Draw sketches below to show the forces in each case.

Details

I found this information on page __________.

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.
Tie It Together

Motion, Acceleration, and Forces

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.
Motion, Acceleration, and Forces
Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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, Acceleration, and Forces</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Distance and displacement are the same thing.</td>
<td></td>
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<td>• Velocity and speed are the same thing.</td>
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<td></td>
</tr>
</tbody>
</table>

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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, identify three things you have learned about motion, acceleration, and forces.
The Laws of Motion

Before You Read

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

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

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________
The Laws of Motion
Section 1 The First Two Laws of Motion

Objectives Read the section objectives. Then write three questions that come to mind from reading these statements.

1. 
2. 
3. 

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

net force

Define each vocabulary term by writing it next to the correct definition.

if the net force acting on an object is zero, the object remains at rest, or if the object is moving, it continues in a straight line with constant speed

the tendency of an object to resist a change in its motion

the acceleration of an object is in the same direction as the net force on the object

New Vocabulary

Define the term period using a dictionary.

period
Complete the concept map by defining Newton’s first law of motion.

**Main Idea**

**The First Law of Motion**

I found this information on page ________.

**Details**

**Summarize** the concept of inertia by completing the statements.

Inertia is the _________________. The amount of inertia that an object has depends on its ________________. A large truck, for example, has ________________ than a small car. This is why it is more difficult to stop a ________________ in a short distance.
Analyze the effects on a passenger riding in a car traveling at 50 km/h that collides head-on with a solid object.

## Without Restraints
<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration</td>
<td></td>
</tr>
<tr>
<td>Net force</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td></td>
</tr>
</tbody>
</table>

## With Safety Belts and Air Bags
<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration</td>
<td></td>
</tr>
<tr>
<td>Net force</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td></td>
</tr>
</tbody>
</table>

Organize the three 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.

### Newton’s Second Law of Motion

<table>
<thead>
<tr>
<th>Unknown Variable</th>
<th>Known Variables</th>
<th>Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net force</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

Define the following key terms using a dictionary or your book.

- gravity
- weight
- centripetal acceleration
- centripetal force

Use the word range in a scientific sentence.
Main Idea

**What is gravity?**

I found this information on page __________.

**The Law of Universal Gravitation**

I found this information on page __________.

**Earth’s Gravitational Acceleration**

I found this information on page __________.

Details

**Complete** the concept map to explain why the force of gravity varies.

Gravitational force

- increases if __________ increases
- decreases if __________ increases

**Summarize** the law of universal gravitation by writing the equation in the space below. Define each variable or constant in the equation.

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

---

*The Laws of Motion*
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.

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.

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.

Centripetal Force

I found this information on page _________.

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.]
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. 

Describe the difference between velocity and speed.

- speed
- velocity

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

Define the following key terms using a dictionary or your book.

- momentum

law of conservation of momentum

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

- initial
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.
Section 3 The Third Law of Motion (continued)

**Main Idea**

Momentum

I found this information on page _________.

**Details**

**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.

---

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Tie It Together

The Laws of Motion

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.
The Laws of Motion  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 What I wanted to find out</th>
<th>L What I learned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></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, identify three things you have learned about the laws of motion.
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>• 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>

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

Science Journal

Which takes more energy: walking up stairs or taking an escalator? Explain your reasoning.
Energy
Section 1 The Nature of Energy

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

Define gravity to show its scientific meaning.

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

1. the ability to do work
2. energy a moving object has because of its motion
3. the standard unit for measuring energy
4. energy stored in an object
5. energy stored by things that stretch or shrink
6. energy stored in chemical bonds
7. energy stored in objects because of their position above Earth’s surface

Use a dictionary to define analogy.
Section 1 The Nature of Energy (continued)

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:

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

symbol equation:
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
- $\frac{1}{2} \text{mass} \times \text{velocity}^2$

---

ke =

GPE =

---

**Main Idea**

**Potential Energy**

I found this information on page ________.

---

**Details**

---

**ANALYZE IT**

Make an analogy comparing energy and money.

---

Section 1 The Nature of Energy (continued)

---
Energy
Section 2 Conservation of Energy

Predict three things you think might be discussed in this section. Read the section title to help you make your predictions.

1. 
2. 
3. 

Define friction in a sentence that shows its scientific meaning.

friction

New Vocabulary

Use your book to define the following key terms.

mechanical energy

law of conservation of energy

Academic Vocabulary

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

convert
Section 2 Conservation of Energy (continued)

**Main Idea**

**Changing Forms of Energy**

I found this information on page _____.

**Details**

**Sequence** four energy transformations, such as those related to fossil fuels.

1. _____________________________________________________________

2. _____________________________________________________________

3. _____________________________________________________________

4. _____________________________________________________________

**Conversions Between Kinetic and Potential Energy**

I found this information on page _____.

**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

**The Law of Conservation of Energy**

I found this information on page _____.

**Predict** the energy transformations when a fast-moving roller coaster finishes its ride and comes to a stop. Give three possibilities.

1. _____________________________________________________________

2. _____________________________________________________________

3. _____________________________________________________________
Main Idea

The Law of Conservation of Energy

I found this information on page __________.

Details

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.

I found this information on page __________.

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

The Human Body—Balancing the Energy Equation

I found this information on page __________.

Analyze 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 understand 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. Compare your previous answers to these.*

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>

## 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, identify three things you have learned about energy.*

---

56  *Energy*
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>• A person does work on a heavy object while holding it up above the ground.</td>
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<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.

Diagram a bicycle and identify the parts you think are simple machines.
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

_____________________________________________________

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.

_____________________________________________________

_____________________________________________________

_____________________________________________________

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 force is not in the direction of motion.
A force is not doing work because there is no 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.

Work (in joules) = ____________________________

W =

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 ____________ in ________________ time or ________________ in ________________ time.

To decrease power, one must either do ____________ in ________________ time or ________________ in ________________ 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.

Power (in watts) =

---

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.
Review Vocabulary

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

force

New Vocabulary

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

the force applied by a machine
the force that is applied to a machine
a device that makes doing work easier
ratio of output work done by a machine to the input work done on the machine
the ratio of the output force to the input force

Academic Vocabulary

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

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

Analyze why it might be useful to know a machine’s efficiency.

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

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

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

- a bar that is free to pivot or turn around a fixed point
- a sloping surface that reduces the amount of force required to do work
- an inclined plane wrapped in a spiral around a cylindrical post
- an inclined plane with one or two sloping sides
- a grooved wheel with a rope, chain, or cable running along the groove
- a simple machine consisting of a shaft, or axle, attached to the center a larger wheel so that the wheel and axle rotate together
- a machine that does work with only one movement of the machine
- two or more simple machines that operate together

Academic Vocabulary  Define reverse as a verb using a dictionary.
reverse  

Work and Machines
Section 3 Simple Machines

Name ___________________________ Date ______________________
Section 3 Simple Machines (continued)

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 in the chart below.

<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>
Main Idea

Wheel and Axle

I found this information on page _______.

Details

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.

Inclined Planes, the Screw, the Wedge

I found this information on page _______.

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

- Inclined plane ________________________________
- Screw ________________________________
- Wedge ________________________________

Compound Machines

I found this information on page _______.

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.

![Diagram of ideal machine with input force at A, output force at C, and mechanical advantage at B.]

**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>36 newtons</td>
<td></td>
<td></td>
<td>21 newtons</td>
<td>4 joules</td>
</tr>
<tr>
<td>12 newtons</td>
<td>7 joules</td>
<td></td>
<td>10 newtons</td>
<td></td>
</tr>
<tr>
<td>21 newtons</td>
<td>11 joules</td>
<td></td>
<td>6 newtons</td>
<td></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>1.5 joules</td>
<td>10 newtons</td>
<td></td>
<td></td>
<td>7 joules</td>
</tr>
<tr>
<td>2 joules</td>
<td></td>
<td></td>
<td>6 newtons</td>
<td></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. Compare your previous answers to these.

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>
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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, identify three things you have learned about work and machines.
The Earth-Moon-Sun System

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 Earth-Moon-Sun System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth’s orbit around the Sun is shaped like an ellipse.</td>
<td>• Earth’s orbit around the Sun is shaped like an ellipse.</td>
</tr>
<tr>
<td>Seasons on Earth change partly because Earth is tilted on its axis.</td>
<td>• Seasons on Earth change partly because Earth is tilted on its axis.</td>
</tr>
<tr>
<td>Mountains exist on the Moon.</td>
<td>• Mountains exist on the Moon.</td>
</tr>
<tr>
<td>The same side of the Moon always faces Earth.</td>
<td>• The same side of the Moon always faces Earth.</td>
</tr>
</tbody>
</table>

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

Science Journal

Research to discover what landforms or events are affected by the Moon’s gravitational force on Earth.
The Earth-Moon-Sun System
Section 1 Earth in Space

Skim the headings in Section 1. Write three questions that come to mind.

1. 
2. 
3. 

Define orbit to show its scientific meaning.

orbit

Define sphere to show its scientific meaning.

sphere

Define gravity to show its scientific meaning.

gravity

Define ellipse to show its scientific meaning.

ellipse

Define physical to show its scientific meaning.

physical
Main Idea

Earth’s Size and Shape

I found this information on page [ ].

Details

Summarize four pieces of evidence that indicate that Earth is a sphere.

1. 

2. 

3. 

4. 

Model Earth’s magnetic field.

- Draw Earth. Show Earth’s tilt on its axis in your drawing.
- Add a line through Earth to show where Earth’s magnetic field is centered.
- Label important features on the diagram with the following terms.
  - north magnetic pole
  - south magnetic pole
  - Van Allen belts
  - magnetic axis
- Identify with Xs the two points where Earth’s magnetic field is strongest.
Organize information about Earth’s orbit around the Sun by completing the paragraph.

The average distance between Earth and the Sun is _______________ kilometers. Because Earth’s orbit is an _______________, the actual distance between Earth and the Sun varies throughout the year. Earth comes closest to the Sun on _______________ when it is _______________ kilometers away from the Sun. Earth is farthest from the Sun on _______________ when it is _______________ kilometers from the Sun.

Compare and contrast Earth and Venus. Complete the Venn diagram with at least eight different facts.

Imagine the shape of Earth’s orbit. If Earth is nearest the Sun in winter and farthest from the Sun in summer, analyze at which two times of the year Earth is nearest to its average distance from the Sun. Predict the approximate dates of these events.
Scan the section headings, bold words, and illustrations. Write two facts that you discovered as you scanned the section.

1. 
2. 

Define latitude to show its scientific meaning.

Write the vocabulary term that matches each definition.

15˚-wide area on Earth’s surface in which the time is the same

spinning of Earth on its imaginary axis and causes day and night to occur

Use a dictionary to define intense to show its scientific meaning.
**Main Idea**

**Measuring Time on Earth**

I found this information on page  .

---

**Details**

**Summarize** information about how Earth movements are related to time. Complete the diagram.

<table>
<thead>
<tr>
<th>Earth Movement</th>
<th>Relationship to Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth spins 15° in one hour.</td>
<td>Time is measured in days, which last 24 hours.</td>
</tr>
<tr>
<td>Earth orbits the Sun in 365 days.</td>
<td></td>
</tr>
</tbody>
</table>

**Define** the international date line. *Explain why it is necessary.*

---

**Name**  
**Date**
Identify the two factors that cause seasonal change.

**Main Idea**

**Why do seasons change?**

I found this information on page ________.

**Details**

**Identify** the two factors that cause seasonal change.

Causes of Seasonal Change

Complete the paragraphs with key characteristics of equinoxes and solstices.

An equinox occurs when the Sun is _____________________________. During an equinox, the number of ___________ hours are equal all over the world. Equinoxes occur twice a year, in the _________________ and in the ___________________.

A ________________ occurs when the Sun reaches _________________ of the equator. On the summer solstice, there are more hours of ________________ than on any other day of the year. On the winter solstice, there are more ________________ hours than on any other day of the year.

**SYNTHESIZE IT**

The southern hemisphere has summer when the northern hemisphere has winter. Explain why the southern hemisphere has warmer temperatures at this time of the year.

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________
The Earth-Moon-Sun System
Section 3 Earth’s Moon

Preview the What You’ll Learn statements for Section 3. Predict three topics that will be discussed in this section.

1. ________________________________
2. ________________________________
3. ________________________________

Define lava to show its scientific meaning.

lava

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

periodic rise and fall in sea level caused by the gravitational attraction among Earth, the Moon and the Sun

change in appearance of the Moon as viewed from Earth, due to the relative positions of Earth, the Sun, and the Moon

occurs when the Moon passes between the Sun and Earth, and casts a shadow on part of Earth

occurs when Earth’s shadow falls on the Moon

relatively flat, dark-colored regions on the Moon’s surface

layer of loose, ground-up rock on the lunar surface formed by the accumulation of impact material

Use a dictionary to define phase to show its scientific meaning.

phase

__________________________________________
Main Idea

Movement of the Moon

I found this information on page _________.

How does the Moon affect Earth?

I found this information on page _________.

Details

Identify and summarize the 2 movements of the Moon.

Model the Earth-Moon-Sun system during spring and neap tides.

• Show the positions of each body during each type of tide.
• Label Earth, the Sun, the Moon, and the Tidal bulge.

Spring Tide

Neap Tide

Create and label a cycle diagram of the phases of the Moon.

Moonlight

I found this information on page _________.

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**Main Idea**

**Eclipses**

I found this information on page _________.

**The Moon’s Surface**

I found this information on page _________.

**The Moon’s Interior**

I found this information on page _________.

**Exploring the Moon**

I found this information on page _________.

**Origin of the Moon**

I found this information on page _________.

---

**Details**

**Model** the 2 types of eclipses to show the positions of Earth, the Sun, and the Moon.

<table>
<thead>
<tr>
<th>Lunar eclipse</th>
<th>Solar eclipse</th>
</tr>
</thead>
</table>

**Distinguish** features on the Moon’s surface.

Crater: ____________________________

Maria: ____________________________

Mountains: ____________________________

**Sequence** the 4 parts of the Moon’s interior.

outermost | Moon’s Interior | innermost

**Summarize** results from Clementine and Lunar Prospector.

__________________________________________

__________________________________________

__________________________________________

**Summarize** the current theory of the Moon’s origin.

__________________________________________

__________________________________________

__________________________________________
Tie It Together

Synthesize It

Make a drawing of the Earth-Moon-Sun system in the space below. Use arrows to show orbital motion.

List and explain at least three ways that objects in the Earth-Moon-Sun system affect each other.

1. 

2. 

3. 

4. 

5. 

6. 

The Earth-Moon-Sun System
The Earth-Moon-Sun System
Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

1. Write an A if you agree with the statement.
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<table>
<thead>
<tr>
<th>The Earth-Moon-Sun System</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
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</tr>
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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, identify three things you have learned about the Earth-Moon-Sun system.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
**The Solar System**

**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 Solar System</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• The planets of the solar system orbit Earth.</td>
</tr>
<tr>
<td></td>
<td>• Mercury, Venus, Earth, and Mars are the planets nearest the Sun.</td>
</tr>
<tr>
<td></td>
<td>• Uranus has no moons.</td>
</tr>
<tr>
<td></td>
<td>• Life as we know it is carbon-based and requires water for survival.</td>
</tr>
</tbody>
</table>

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

**Science Journal**

*Write a hypothesis about whether life exists beyond Earth, or even beyond the solar system. Write how you would test the hypothesis.*

---

Name __________________________ Date ____________

The Solar System

81
The Solar System
Section 1 Planet Motion

**Preview** the What You’ll Learn statements for Section 1. Predict three topics that will be discussed in this section.

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

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

**New Vocabulary**
- ellipse
- geocentric model
- heliocentric model
- astronomical unit
- extrasolar planet

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

**Academic Vocabulary**
- sphere

**Use a dictionary to define sphere to show its scientific meaning.**
Main Idea

Models of the Solar System

I found this information on page _________.

Details

Compare and contrast the geocentric and heliocentric models of the solar system.

<table>
<thead>
<tr>
<th></th>
<th>Geocentric Model</th>
<th>Heliocentric Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>What it is</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence that supported the model</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model devised by</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Understanding the Solar System

I found this information on page _________.

Model the shape of the planets’ orbits as described by Copernicus and Kepler. Write the name of each shape next to your drawing.

Copernicus | Kepler

Identify and describe three ways to classify the planets of the solar system.

1. ____________________________________________
   ____________________________________________

2. ____________________________________________
   ____________________________________________

3. ____________________________________________
   ____________________________________________
Complete the sentences in the sequence of events that led to the formation of the solar system.

1. A nebula began contracting about ______ billion years ago.
   It might have been caused by a ________________________.

2. The contracting nebula broke into _________________________. The fragment that became the solar system ________________________, causing it to flatten into _________________________.

3. Temperature rose near the ________________ of the disk.

4. ________________ began to fuse to form helium.

5. The ________________ formed.

6. Leftover matter in the cloud fragment formed ________________________
   _________________________.

Evaluate why scientists are eager to detect Earth-like planets around other stars.

______________________
______________________
______________________
______________________
______________________
The Solar System
Section 2 The Inner Planets

**Scan** the section headings, bold words, and illustrations. Write two facts you find as you scan the section.
1. 
2. 

**Define** robot lander to show its scientific meaning.

**New Vocabulary**

- robot lander

Write the vocabulary term that matches each definition.
- third planet from the Sun; the only planet known to support life and the only planet to have temperatures that allow water to exist as a gas, a liquid, and a solid
- second planet from the Sun; has a dense atmosphere of mostly carbon dioxide and very high surface temperatures
- fourth planet from the Sun; called the red planet because of high concentrations of iron oxide in the soil
- closest planet to the Sun; has a larger than expected iron core

**Academic Vocabulary**

Use a dictionary to define core to show its scientific meaning. Then use the term in a sentence that reflects the scientific meaning.
Section 2 The Inner Planets (continued)

**Main Idea**

**Mercury**

I found this information on page ________.

**Details**

Summarize information about Mercury by filling in the blanks.

1. Relative size and location: ________________________________

2. Surface features: ________________________________

3. Atmosphere: ________________________________

**Venus and Earth**

I found this information on page ________.

**Contrast** Earth with Venus.

<table>
<thead>
<tr>
<th>Property</th>
<th>Earth</th>
<th>Venus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of life</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Mars**

I found this information on page ________.

**Compare and contrast** Mars and Earth in the Venn diagram.

![Venn diagram](https://via.placeholder.com/150)
Main Idea

NASA on Mars

I found this information on page __________.

Details

Summarize NASA missions to Mars in the table.

<table>
<thead>
<tr>
<th>Mission</th>
<th>Year(s)</th>
<th>What Was Studied/Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mariner 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viking 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viking 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Organize discoveries resulting from each mission to Mars.

1. Global Surveyor: __________________________
   __________________________

2. Mars Odyssey: __________________________
   __________________________

3. Mars Pathfinder and Sojourner: ______________
   __________________________

4. Opportunity rover: ______________________
   __________________________

5. Spirit rover: __________________________
   __________________________

SYNTHESIZE IT

Some rovers sent to Mars are similar to the radio-controlled vehicles that people use as toys on Earth. Describe features or special equipment you would include if you designed a rover to travel to Mars or another planet.

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________
The Solar System
Section 3 The Outer Planets

Skim the headings in Section 3. Write three questions that come to mind.

1. 
2. 
3. 

Define space probe to show its scientific meaning.

Write the vocabulary term that matches each definition.

- unofficial name for object 2003 VB12, a distant planetoid with a very elliptical orbit
- rocky solar system object that often is a piece from a comet or an asteroid
- second-largest planet and sixth from the Sun; has the most complex system of rings
- eighth planet from the Sun; has storms similar to Jupiter’s and appears blue because of atmospheric methane
- dwarf planet with three moons, a thin atmosphere, and an ice-rock surface
- rocky solar system object of widely varying size often found between the orbits of Mars and Jupiter
- mass of dust, rock particles, frozen water, methane, and ammonia that travels through space and develops a bright, distinctive tail as it approaches the Sun
- seventh planet from the Sun; appears blue-green because of atmospheric methane; axis of rotation is tilted on its side
- largest and fifth planet from the Sun; has continuous, swirling, high-pressure gas storms, the largest of which is the Great Red Spot
Section 3  The Outer Planets (continued)

Main Idea

Why are the outer planets so different?
I found this information on page _________.

Jupiter and Saturn
I found this information on page _________.

Uranus and Neptune
I found this information on page _________.

Contrast the main difference between the outer planets and the inner planets.

Organize information about Jupiter and Saturn in the table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Jupiter</th>
<th>Saturn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sequence from Sun</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of moons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special features</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Compare and contrast Uranus and Neptune. Complete the Venn diagram with at least nine different facts.
Distinguish three ways dwarf planets are more like asteroids and comet than planets.

1. 

2. 

3. 

Analyze comets, asteroids, meteoroids, and Sedna by completing the table.

<table>
<thead>
<tr>
<th>Body</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comet</td>
<td></td>
</tr>
<tr>
<td>Asteroid</td>
<td></td>
</tr>
<tr>
<td>Meteoroid</td>
<td></td>
</tr>
<tr>
<td>Sedna</td>
<td></td>
</tr>
</tbody>
</table>

Describe why scientists are puzzled about how to classify Sedna.
Preview the What You’ll Learn statements for Section 4. Predict three topics that will be discussed in this section.

1. 

2. 

3. 

Define fossil to show its scientific meaning.

fossil

Define the vocabulary term.

extraterrestrial life

Use a dictionary to define environment. Write a sentence about planets that includes the term and shows its scientific meaning.

environment
Section 4 Life in the Solar System (continued)

Main Idea

Life as We Know It

I found this information on page __________.

I found this information on page __________.

Details

Identify two substances that are required for life as we know it.

1. ____________________________

2. ____________________________

Create a concept web showing at least three ways scientists might determine whether life as we know it exists or once existed on another planet.

Create a flow chart to show how organisms in extreme volcanic vent ecosystems on Earth get the energy they need to carry out life processes.

I found this information on page __________.
Section 4 Life in the Solar System (continued)

Main Idea

Can life exist on other worlds?

I found this information on page ___________.

I found this information on page ___________.

Details

Summarize features of each planet listed that make it unlikely that life could exist there.

1. Mercury: ____________________________

2. Venus: ______________________________

3. Jupiter: ______________________________

Compare and contrast the features of the planet and moons listed that suggest that these objects may be capable of supporting life, or may have supported life in the past.

<table>
<thead>
<tr>
<th>Mars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Europa</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Titan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

SYNTHESIZE IT

A news report states that large organisms capable of movement have been identified on the surface of Pluto. Critique this statement. Explain if you think it is reasonable or not.

________________________

________________________

________________________

________________________

________________________

________________________

The Solar System 93
The Solar System  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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 Solar System</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The planets of the solar system orbit Earth.</td>
<td></td>
</tr>
<tr>
<td>• Mercury, Venus, Earth, and Mars are the planets nearest the Sun.</td>
<td></td>
</tr>
<tr>
<td>• Uranus has no moons.</td>
<td></td>
</tr>
<tr>
<td>• Life as we know it is carbon-based and requires water for survival.</td>
<td></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, identify three things you have learned about the solar system.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Heat and States of Matter

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>
<tbody>
<tr>
<td>W</td>
<td>What I want to find out</td>
</tr>
</tbody>
</table>

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

Construct the Foldable as directed at the beginning of this chapter.
Heat and States of Matter
Section 1 Temperature and Thermal Energy

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.

kinetic theory

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 Thermal Energy (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 molecules to cold 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.
Section 1 Temperature and Thermal Energy (continued)

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.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Heat and States of Matter
Section 2 States of Matter

Scan the headings, figures, and captions in Section 1 of your book. Write four facts about the states of matter you learned.

1. 
2. 
3. 
4. 

Define force.

force

Read the definitions below. Write the term that matches the definition on the blank in the left column.

state of matter consisting of positively and negatively charged particles

the amount of energy required for 1 kg of a liquid at its boiling point to become a gas

the amount of energy required to change 1 kg of a substance from solid to liquid at its melting point

Use a dictionary to define the term potential.

potential
Complete the outline as you read about the states of matter.

States of Matter

I. Solid
   A. Example: ________________________________
   B. Particle kinetic energy: ________________________________
   C. Other fact(s): ________________________________

II. Liquid
   A. Example: ________________________________
   B. Particle kinetic energy: ________________________________
   C. Other fact(s): ________________________________

III. Gas
   A. Example: ________________________________
   B. Particle kinetic energy: ________________________________
   C. Other fact(s): ________________________________

IV. Plasma
   A. Example: ________________________________
   B. Particle kinetic energy: ________________________________
   C. Other fact(s): ________________________________
**Main Idea**

**Thermal Expansion**

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

*Compare and contrast the thermal expansion of solids, liquids, and gases by filling in two facts about each in the concept organizer.*

- Solid: expand when temperature increases
- Liquid: expand when temperature increases
- Gas: expand when temperature increases

---

**Synthesize It**

Refer to the graph titled “The Heating Curve of Water.” 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.

---

*Heat and States of Matter 101*
Skim Section 3 of your text. Read the headings and the illustration captions. Write four questions that come to mind.

1. 
2. 
3. 
4. 

Define density in a sentence that shows its scientific meaning.

density 

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

conduction 

convection 

radiation 

thermal insulator 

Use a dictionary to define the word adapt.

adapt 

102 Heat and States of Matter
Section 3  Transferring Thermal Energy (continued)

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 ___________.
Main Idea

The Flow of Thermal Energy
I found this information on page ________.

Details

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></td>
<td></td>
</tr>
</tbody>
</table>

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

Thermal Insulators
I found this information on page ________.

CONNECT IT

List the methods you use to control the flow of heat to and from your body. Explain the purpose of each method.

________________________
________________________
________________________
________________________
________________________
________________________
________________________
Heat and States of Matter

Section 4 Using Thermal Energy

Predict  Read the title of Section 4. List three things that might be discussed in this section.
1. 
2. 
3. 

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.

heat cannot flow from a cool object to a warmer object unless work is done

a measure of how dispersed, or spreadout, energy is

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

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Section 4 Using Thermal Energy (continued)

Main Idea

Heating Systems
I found this information on page __________.

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

<table>
<thead>
<tr>
<th>System Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forced air</td>
<td></td>
</tr>
<tr>
<td>radiator-based</td>
<td></td>
</tr>
<tr>
<td>electric</td>
<td></td>
</tr>
</tbody>
</table>

Details

Thermodynamics
I found this information on page __________.

Complete the equation to define the first law of thermodynamics.

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

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

Refer to your textbook to fill in the blanks in the paragraph below.

A car has an internal combustion engine, or __________ engine.

Fuel burns inside the internal combustion engine in __________ called __________. A typical car engine has __________ or more cylinders. Inside the cylinders, __________ move up and down.

A __________ refers to each up-and-down movement a piston makes. A car engine has a __________ cycle.

Converting Thermal Energy to Work
I found this information on page __________.
Moving Thermal Energy

I found this information on page ____________.

Entropy

I found this information on page ____________.

Analyse 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.

Define entropy. Then use an example from your physical education class to explain briefly how entropy increases. Sketch a picture of your example.

---

**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.

- colder
- gas
- heat
- liquid
- warmer
- work

Liquid coolant changes into a _________.

In doing so, it becomes _________.

Gas releases _______ to the room, and the gas becomes _______. The gas turns into a _________.

Cold gas absorbs _______ from refrigerator interior, and the gas becomes _________.

The compressor does _______ compressing the gas, which becomes even _________.

---
Heat and States of Matter
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>What I wanted to find out</th>
<th>L</th>
<th>What I learned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></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, identify three things you have learned about thermal energy.

____________________________________________________
____________________________________________________
____________________________________________________

108  Heat and States of Matter
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.

Science Journal

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

---

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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. 

**Review Vocabulary**  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  

Name ___________________________ Date ____________

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Section 1 The Nature of Waves (continued)

Main Idea

What’s in a wave?
I found this information on page ___________.

Waves and Energy
I found this information on page ___________.

Details

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**

I found this information on page __________.

## Details

**Classify** each type of wave, mechanical wave or not and by whether or not it needs a medium to move through.

<table>
<thead>
<tr>
<th>Type of Wave</th>
<th>Is a medium required?</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>

**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.

---

112 Waves
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 vibration to show its scientific meaning.

vibration

New Vocabulary

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

the highest points of a transverse wave
the amount of time it takes one wavelength to pass a fixed point
the least dense compression regions of a wave
the lowest points of a transverse wave
measure of the energy carried by a wave
the number of wavelengths that pass a fixed point in one second
the distance between one point on a wave and the nearest point just like it

Use a dictionary to define impact.

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

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.

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
Section 2  Wave Properties (continued)

Main Idea

Wave Speed
I found this information on page __________.

Amplitude and Energy
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.

\[ f = \quad \lambda = \quad \]

\[ v = f \times \lambda \]

\[ v = \quad \times \quad \]

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

Model two compressional waves by drawing them with two different colors. One wave should have more energy than the other. Label the energy of each wave.

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.
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. _______________________________________

Define  perpendicular to show its scientific meaning.

perpendicular

_____________________________________

_____________________________________

________________________________________________________________________________

Write the correct vocabulary term next to each definition.

the bending of a wave caused by a change in its speed as it moves from one medium to another

the process by which an object vibrates by absorbing energy at its natural frequencies

the process by which two or more waves overlap to form a new wave

the bending of a wave around an obstacle

Use a dictionary to define the word negate.

_____________________________________

________________________________________________________________________________
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 • incident beam • the normal
• angle of reflection • reflected beam

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.

Similarity

Difference
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>Constructive Interference</th>
<th>Destructive Interference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cause:</strong></td>
<td><strong>Cause:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Standing Waves**

*Summarize what causes a standing wave to form.*

- __________________________________________________________
- __________________________________________________________
- __________________________________________________________
- __________________________________________________________
- __________________________________________________________
- __________________________________________________________
- __________________________________________________________
- __________________________________________________________

**Resonance**

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

- __________________________________________________________
- __________________________________________________________
- __________________________________________________________
- __________________________________________________________
- __________________________________________________________
- __________________________________________________________

**EVALUATE IT**

While in the mountains, you yell to a friend and hear your voice three times—Janet, Janet, Janet. Explain.

- __________________________________________________________
- __________________________________________________________
- __________________________________________________________
- __________________________________________________________
Tie It Together

Waves

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 and complete the table below. Compare your previous answers to these.

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 move only through water.</td>
<td></td>
</tr>
<tr>
<td>• Waves can bend.</td>
<td></td>
</tr>
<tr>
<td>• Waves can be different sizes and move at different speeds.</td>
<td></td>
</tr>
<tr>
<td>• When a wave moves, the substance in which it travels moves with it.</td>
<td></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, identify three things you have learned about waves.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

120 Waves
Sound and Light

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

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

Science Journal

Write three things you would like to learn about sound.

__________________________
__________________________
__________________________
__________________________
__________________________
__________________________
__________________________
Sound and Light
Section 1 Sound

Preview the photos and illustrations in Section 1. Read the captions. Write three things you think will be discussed in this section.

1. ______________________________________________________________________
2. ______________________________________________________________________
3. ______________________________________________________________________

**Review Vocabulary**

Define vibration in a sentence that shows its scientific meaning.

vibration

**New Vocabulary**

Define the following key terms.

intensity

loudness

decibel

pitch

Doppler effect

**Academic Vocabulary**

Use a dictionary to define expand to show its scientific meaning.

expand
Sound Waves

Summarize how sound forms on the lines below. Include one example of an object that is making sound.

Complete the sentence about sound waves.

Sound waves are ________________, which are waves that consist of alternating ________________ and ________________.

Model a sound wave moving through air in the space below. Draw molecules as the molecules would appear in compressions and in rarefactions. Label each region.

Sequence the words liquid, solid, and gas on the continuum below. Then describe how temperature affects the speed of sound on the lines below.

sound travels slowest sound travels fastest
Section 1 Sound (continued)

**Main Idea**

**Intensity and Loudness**

*I found this information on page ________.*

**Pitch and Frequency**

*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>Can humans 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 the source of sound is moving ____________ you, compressions are ____________, so the sound has a ____________ frequency and a ____________ pitch.

When the source of sound is moving ____________ 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.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

124  Sound and Light
Scan the headings, boldfaced words, figures, and captions in Section 2 of your book. Write four facts about light you learned as you scanned the section.

1.

2.

3.

4.

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.

allows some light to pass through

transmits almost all light

absorbs or reflects all light

calculate

calculate

calculate

Use a dictionary to define individual to show its scientific meaning.
Main Idea

The Interaction of Light and Matter
I found this information on page _________.

Details

Summarize each term below in your own words. Give three examples of a material that has the light-transmitting property.

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 draw the angles. Include these labels.

- the angle of incidence
- the angle of reflection
- the normal

Contrast regular reflection and diffuse reflection. Provide two examples of each.

I found this information on page _________.

I found this information on page _________.

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Section 2 Reflection and Refraction 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 different 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.

  - ______ 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 how mirages form.

  - __________

**SYNTHESIZE IT**

Create a concept map on a separate sheet of paper to summarize facts and effects of reflection and refraction you learned in this chapter.
Predict  Read the title of Section 3. List three things that might be discussed in this section.

1. _________________________________________
2. _________________________________________
3. _________________________________________

Define reflection by using it in a sentence.

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

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

____________________________________________________________________________________
A flat, smooth mirror

____________________________________________________________________________________
A curved mirror with edges that are closer to the viewer than the center of the mirror

____________________________________________________________________________________
A curved mirror with a center that is closer to the viewer than the edges of the mirror are

____________________________________________________________________________________
A lens that is thicker in the middle than at the edges

____________________________________________________________________________________
A lens that is thinner in the middle and thicker at the edges

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

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
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.

- 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.

Contrast concave and convex mirrors below by filling in the table.

<table>
<thead>
<tr>
<th>Mirror</th>
<th>Direction of Curvature</th>
<th>Direction of Reflected Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concave</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convex</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Main Idea**

**Lenses**

I found this information on page .

**Details**

**Contrast** convex lenses with concave lenses. Draw how light rays travel through each type of lens in the space below. Label the optic axis in each drawing. Label the focal point and focal length of the convex lens.

### Convex Lens

### Concave Lens

**Vision Problems**

I found this information on page .

**Organize** information on common vision problems.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Can See</th>
<th>Cause</th>
<th>Image Location</th>
<th>Eyeglass Lens Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near-sighted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Far-sighted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SYNTHESIZE IT**

Explain how glasses help nearsighted and farsighted people see clearly and in focus.

---

130  *Sound and Light*
Predict Read the title of Section 4. List three topics that might be discussed in this section.

1. 
2. 
3. 

Review Vocabulary Define retina to show its scientific meaning. Write a sentence to demonstrate the meaning.

retina

New Vocabulary Use your book to define pigment. Write a sentence to demonstrate the scientific meaning.

pigment

Academic Vocabulary Use a dictionary to define the term visible. Write a sentence to show its scientific meaning.

visible
**Main Idea**

Why Objects Have Color

I found this information on page ____________.

**Details**

Complete the graphic organizer about white and black objects.

<table>
<thead>
<tr>
<th>A white object</th>
<th>all __________________ of light back to your eyes.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>A black object</th>
<th>all colors of light and reflects little or no light back to your eyes.</th>
</tr>
</thead>
</table>

Distinguish the color reflected from the colors absorbed by each block. Fill in the table below. Part of the table has been filled in for you.

![Image of colored blocks: red, orange, green]

<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></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorbed</td>
<td>orange, yellow, green, blue, indigo, violet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Complete the following paragraph 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 ________________________.
**Main Idea**

**Seeing Color**

I found this information on page __________.

**Details**

**Distinguish** between the color blocks A (red), B (orange), and C (green) would look through a red filter. Label each block according to the color that it appears through the red filter.

![Box Diagram]

**Organize** information about retinal cells.

**Retinal Cells**

- Three types include:
- Most useful for seeing during the:
- Most useful for seeing during the:

**CONNECT IT**

Describe how a rainbow would look if viewed through an indigo filter. Explain why the rainbow would appear this way.
Sound and Light  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 What I know</th>
<th>W What I want to find out</th>
<th>L What I learned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Review

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☐ 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, identify three things you have learned about sound and light.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Earth’s Internal Processes

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>Earth’s Internal Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Scientists believe that Earth’s continents were once joined as a single landmass.</td>
</tr>
<tr>
<td></td>
<td>• Earthquakes are distributed randomly around Earth.</td>
</tr>
<tr>
<td></td>
<td>• Earth’s core is made of metal.</td>
</tr>
<tr>
<td></td>
<td>• There are several kinds of volcanoes.</td>
</tr>
</tbody>
</table>

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

**Science Journal**

*Do you know of any volcanic eruptions that have happened? Explain the effects of volcanoes that you know about.*
Earth’s Internal Processes
Section 1 Evolution of Earth’s Crust

**Skim** the headings in Section 1. Then write three questions that come to mind.

1. __________________________________________
2. __________________________________________
3. __________________________________________

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

**Review Vocabulary**

**New Vocabulary**

Write the vocabulary term that matches each definition.

- plate tectonic boundary where lithospheric plates are moving apart
- a continuous system of twin mountain ranges with a rift valley between them that extends around Earth on the seafloor
- plate tectonic boundary that exists as a large fault, or crack, along which lithospheric plates move in a horizontal direction
- long, linear, dropped-down valley between twin, parallel mountain ranges produced by faulting
- plate tectonic boundary where lithospheric plates collide
- occurs when lithospheric plates converge and the edge of one plate is forced downward beneath another

**Academic Vocabulary**

Use a dictionary to define theory to show its scientific meaning.

---

136 Earth’s Internal Processes
Summarize the continental drift hypothesis.

Identify three pieces of evidence that support Wegener’s hypothesis about continental drift.

1. 
2. 
3. 

Create a flow chart or concept diagram to sequence the steps in the process of seafloor spreading.
### Main Idea

**Theory of Plate Tectonics**

*I found this information on page __________.*

### Details

**Model and label the 3 types of plate motion.**
- Make a drawing to show the movement of plates.
- Use arrows to show the direction the plates move.
- Label the lithosphere, continental crust, and oceanic crust in your drawings.

![Blank drawing area](image)

**What drives the plates?**

*I found this information on page __________.*

### Identify four factors that affect plate movement.

1. __________________________
2. __________________________
3. __________________________
4. __________________________

### Connect It

Convection plays an important role in the movement of tectonic plates. Describe three other activities that rely on convection to occur.

<table>
<thead>
<tr>
<th>Line 1</th>
<th>Line 2</th>
<th>Line 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Earth’s Internal Processes
Section 2 Earthquakes

Scan the section headings, bold words, and illustrations. Write two facts that you discovered as you scanned the section.

1. 

2. 

Define friction to show its scientific meaning.

friction

Write the vocabulary term that matches each definition.

________________________
point of origin of an earthquake

________________________
sudden energy release that accompanies fault movement and causes earthquakes, or seismic vibrations

________________________
crack in Earth’s crust along which movement has taken place

________________________
point on Earth’s surface directly above an earthquake’s focus

Use a dictionary to define infer to show its scientific meaning.

________________________
### Main Idea

#### Global Earthquake Distribution

*Describe the distribution of earthquakes on Earth.*

---

**Details**

#### Describe the distribution of earthquakes on Earth.

---

**Complete each sentence below about the depths of earthquakes.**

1. Boundaries associated with transform faulting produce _________________.
2. Areas of convergent boundaries that are near the trench produce _________________.
3. Areas of convergent boundaries that are far from the trench produce _________________.

---

**Explain the concept of deformation.**

---

**Distinguish four types of stress that cause deformation of Earth’s crust.**

1. _________________
2. _________________
3. _________________
4. _________________

---
In 1906, a major earthquake struck the city of San Francisco. It measured 8.3 on the Richter scale, and its epicenter was along the San Andreas fault. Use the information you have been given and your knowledge of earthquakes to hypothesize what types of damage may have occurred in the city.
Preview the What You’ll Learn statements for Section 3. Predict two topics that will be discussed in this section.

1. ________________________________________

2. ________________________________________

Define refraction to show its scientific meaning.

refraction ________________________________________

Write the definition for each vocabulary term. Use your book or a dictionary for help.

shadow zone ________________________________________

asthenosphere ________________________________________

discontinuity ________________________________________

Use a dictionary to define uniform to show its scientific meaning.

uniform ________________________________________
Main Idea

What's inside?
I found this information on page __________.

Earthquake Observations
I found this information on page __________.

Details

Summarize how scientists are able to use seismic waves to show that Earth is not uniform in its structure and composition.

Model the shadow zone by labeling the illustration below. Mark the region where both P-waves and S-waves are absent and the region where only S-waves are absent.

Complete the sentences below about Earth’s solid inner core. Use your book to help you choose correct words or phrases.

Deep inside Earth ___________ and ___________ are very high. Earth materials ___________ at high temperatures. In the outer core, temperatures are high enough to overcome the___________ and the material is ___________. In the inner core ___________, overcomes the effects of ___________ and the inner core material is ____________.
Section 3 Earth’s Interior (continued)

**Main Idea**

**Composition of Earth’s Layers**

I found this information on page ___________.

**Details**

**Distinguish** the layers of Earth to complete the table below.

<table>
<thead>
<tr>
<th>Earth’s Layers</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crust</td>
<td>below the lithosphere; made of weaker, plasticlike rock</td>
</tr>
<tr>
<td></td>
<td>below the asthenosphere; made of silicates similar to crust and mantle, mineral structure is different because of higher pressure</td>
</tr>
<tr>
<td>Outer core</td>
<td>innermost layer composed of solid metallic materials, including nickel and iron</td>
</tr>
</tbody>
</table>

**Summarize** how astronomers believe early Earth formed.

________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________

**CONNECT IT**

Explain why scientists must infer what Earth’s interior looks like.

________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
Scan the section headings, bold words, and illustrations. Write two facts you discovered as you scanned the section.

1. _____________________________________________________________
2. _____________________________________________________________

Define melting point to show its scientific meaning.

melting point

Use your book to define each vocabulary term.

viscosity

cinder cone volcano

shield volcano

composite volcano

Use a dictionary to define generate to show its scientific meaning.

generate

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Section 4 Volcanoes (continued)

Main Idea

Origin of Magma

I found this information on page __________.

Details

Summarize why and how magma that forms within Earth can rise to the surface.

Distinguish between the 2 physical settings on Earth where most lava flows occur.

1. __________

2. __________

Complete the table to describe the types of products released during a volcanic eruption.

<table>
<thead>
<tr>
<th>Eruptive Products</th>
<th>Description of Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solids</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Gases</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I found this information on page __________.

Eruptive Products

I found this information on page __________.

I found this information on page __________.
**Eruptive Styles**

I found this information on page __________.

**Details**

Compare and contrast the types of eruptions that occur at each location by completing the table.

<table>
<thead>
<tr>
<th>Location of Eruption</th>
<th>Eruption Style (Description of Eruption)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>violent volcanic eruptions with a variety of magma types</td>
</tr>
<tr>
<td></td>
<td>most activity under water and unseen by people; usually low viscosity, basaltic lava may occur on land with a variety of lava compositions</td>
</tr>
<tr>
<td></td>
<td>magma moves to surface in plumes; lava is fluid and basaltic</td>
</tr>
</tbody>
</table>

**Types of Volcanoes**

I found this information on page __________.

**Model** the shapes and sizes of the 3 types of volcanoes.

**CONNECT IT**

The Cascade Range in the northwestern United States has many volcanoes, including Mount St. Helens. The Cascades are at a convergent plate boundary. Identify the type of volcano you would most expect to find in the Cascade Range and the nature of the eruptions.

---

Earth's Internal Processes 147
Earth’s Internal Processes  
Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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

<table>
<thead>
<tr>
<th>Earth’s Internal Processes</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Scientists believe that Earth’s continents were once joined as a single landmass.</td>
<td></td>
</tr>
<tr>
<td>• Earthquakes are distributed randomly around Earth.</td>
<td></td>
</tr>
<tr>
<td>• Earth’s core is made of metal.</td>
<td></td>
</tr>
<tr>
<td>• There are several kinds of volcanoes.</td>
<td></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, identify three things you have learned about Earth’s internal processes.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
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>Electricity</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.

____

____

____

____

____

____
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. 

Describe the structure of an atom.

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
- when electrons on a neutral object are moved by a charged object
- the buildup of electric charge on an object
- a material in which electrons cannot move easily
- the process of transferring charge by touching or rubbing
- charge can be transferred from one thing to another, but it cannot be created or destroyed

Define the term create to show its scientific meaning.
Section 1 Electric Charge (continued)

**Main Idea**

**Positive and Negative Charge**

*I found this information on page ____________.*

**Details**

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

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

<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>

**Conductors and Insulators**

*I found this information on page ____________.*

**Classify** five conductors and five insulators in the correct space below.

**Conductors**

**Insulators**
Section 1 Electric Charge (continued)

**Main Idea**

Charging Objects

*I found this information on page ___________.*

**Details**

Describe the type of 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.

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.

2. ____________________________

3. ____________________________

4. ____________________________

**CONNECT IT**

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

_____________________________

_____________________________

_____________________________

_____________________________

_____________________________
Scan 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.

pressure

Define the following key terms.

electric current

electric current

evoltage difference

Use a dictionary to define terminate.

terminate

New Vocabulary

Review Vocabulary

Academic Vocabulary
Section 2 Electric Current (continued)

Main Idea

Current and Voltage Difference

I found this information on page _________.

Details

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.

________________________

________________________

________________________

________________________

________________________


Compare dry-cell batteries to wet-cell batteries. Describe the components of each type of battery. In your own words, explain how each 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 the 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></td>
</tr>
<tr>
<td>Resistance</td>
<td>Resistance</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.

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

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

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>series circuit</td>
<td></td>
</tr>
<tr>
<td>parallel circuit</td>
<td></td>
</tr>
<tr>
<td>electrical power</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>parallel</td>
<td></td>
</tr>
</tbody>
</table>
Electric charges move:

Heat is produced:

Air is moved:

Describe the circuits in 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>
Section 3 Electrical Energy (continued)

**Main Idea**

**Electric Power**

*I found this information on page __________.*

**Details**

**Identify** three ways electrical energy is converted to other types of energy, and provide an example of each.

<table>
<thead>
<tr>
<th>Electrical Energy</th>
<th>Converted to</th>
<th>Example</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>

**Evaluate** the three 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.*

---

**COMPARE IT**

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

---

**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. Be creative!
Electricity Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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

<table>
<thead>
<tr>
<th>Electricity</th>
<th>After You Read</th>
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☐ Look over the Chapter Review at the end of the chapter.

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

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Magnetism

Before You Read

Before you read the chapter, respond to these statements.

1. Write an A if you agree with the statement.
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<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Magnetism</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 produce magnetic fields.</td>
<td></td>
</tr>
<tr>
<td>• Windmills change chemical energy into electrical energy.</td>
<td></td>
</tr>
</tbody>
</table>

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

Science Journal

List three things you know about magnets.
Magnetism
Section 1 Magnetism

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

1. ______________________________________
2. ______________________________________
3. ______________________________________

Review Vocabulary

Define electric field to show its scientific meaning.

electric field

_____________________________________

_____________________________________

New Vocabulary

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

groups of atoms with aligned magnetic poles

_____________________________________

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

_____________________________________

Academic Vocabulary

Define region as it might be used in science.

region

_____________________________________

_____________________________________

162 Magnetism
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. Interaction of two magnets
      a. 
      b. 

D. Compass
   1. 
   2. 
   3. 

E. Earth as a magnet
   1. 
   2. 
   3. 

Classify each metal as magnetic or nonmagnetic.

Magnetic Materials

Classify each metal as magnetic or nonmagnetic.

<table>
<thead>
<tr>
<th>Material</th>
<th>Magnetic</th>
<th>Nonmagnetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cobalt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mercury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>copper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nickel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>gold</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
- Magnet is removed

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

Outline the steps a recycling company might use to separate metallic, nonmetallic, and other recyclable materials. (Hint: Some of the materials are magnetic.)

Outline the steps a recycling company might use to separate metallic, nonmetallic, and other recyclable materials. (Hint: Some of the materials are magnetic.)
Magnetism
Section 2 Electricity and Magnetism

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.
Main Idea

Electric Current and Magnetism, Electromagnets

I found this information on page __________.

I found this information on page __________.

Details

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**

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

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

**Details**

*Model and label a galvanometer and describe how it works.*

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

*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.

1. 
2. 
3. 
4. 
5. 
6.
Scan the headings, figures, and captions in Section 3 of your book. Write three questions that come to mind.

1. 
2. 
3. 

Define voltage difference to show its scientific meaning.

Use your book to define the following vocabulary terms.

- **voltage difference**
- **emerges from**
- **induction**
- **generator**
- **turbine**
- **direct current (DC)**
- **alternating current (AC)**
- **transformer**

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

**regulate**
Main Idea

From Mechanical to Electrical Energy

I found this information on page ____________.

Details

Organize the process of changing mechanical energy to electrical energy. Complete the concept map.

Predict and list three electrical devices that will stop working in a power failure, and three that will continue to work. Describe the type 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 at the correct voltage to your home.

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

**Transmitting Electrical Energy**

- I found this information on page ________.

**Transformers**

- I found this information on page ________.

**Synthesize It**

Evaluate how the current produced from a hand-crank generator would change as the handle is rotated forward and then backward.
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. Compare your previous answers to these.

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<table>
<thead>
<tr>
<th>Magnetism</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
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<tr>
<td>• The north pole of a compass always points to Earth’s south magnetic pole.</td>
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</tr>
<tr>
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SUMMARIZE IT

After reading this chapter, identify three ways magnets are used.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Electromagnetic Radiation

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 Radiation</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.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
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.

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 and whose energy depends on the frequency of the wave

Use a dictionary to define enable.
Main Idea

Waves in Space
I found this information on page __________.

Details

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

All magnets are surrounded by

a/an ____________ field.

a/an ____________ field.

Making Electromagnetic Waves
I found this information on page __________.

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

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

Analyze which wave above has a greater frequency.

Summarize waves and particles by completing the paragraph. Model a diagram of the electron wave pattern described below.

All ___________ can behave like ___________. One example of this behavior is electrons passing through two slits to form _____________________.

Synthesize It

Predict how jewelers could use electromagnetic waves to determine the composition of unknown materials in the course of their job.
### Electromagnetic Radiation

Section 2 The Electromagnetic Spectrum

#### Review Vocabulary

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

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>spectrum</td>
<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>radio waves</td>
<td></td>
</tr>
<tr>
<td>microwaves</td>
<td></td>
</tr>
<tr>
<td>infrared waves</td>
<td></td>
</tr>
<tr>
<td>visible light</td>
<td></td>
</tr>
<tr>
<td>ultraviolet waves</td>
<td></td>
</tr>
<tr>
<td>X rays</td>
<td></td>
</tr>
<tr>
<td>gamma rays</td>
<td></td>
</tr>
</tbody>
</table>

#### Academic Vocabulary

**Use a dictionary to define internal to show its scientific meaning.**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>internal</td>
<td></td>
</tr>
</tbody>
</table>
A Range of Frequencies

I found this information on page _________.

Organize 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 ____________________________ with wavelengths longer than about 1 mm. Radio waves that are less than 30 cm, called ____________, make it possible to ______________ ___________. Some ______________ are used for finding the location of planes and boats by a method called _____________. Satellites may have ______________ to help identify vegetation on Earth. Near the middle of the frequency range, ____________ makes it possible for us to _____________________________. Some electromagnetic waves can be dangerous. Both ____________ and ____________ can kill ______________. This is useful in treating _____________, but doctors must be careful not to kill healthy cells as well.

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>

Name __________________________ Date ____________
Compare the advantages and disadvantages to humans of ultraviolet waves by filling in the blanks in the following graphic organizer.

**Ultraviolet Waves**

**Main Idea**

**Details**

**Advantages**
1. 
2. 

**Disadvantages**
1. 
2. 

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

*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.
Electromagnetic Radiation
Section 3 Radio Communication

**Predict** three topics that might be discussed in Section 3.
1. 
2. 
3. 

**Review Vocabulary**
**Define** modulate to show its scientific meaning.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>modulate</td>
<td></td>
</tr>
<tr>
<td>carrier wave</td>
<td></td>
</tr>
<tr>
<td>cathode-ray tube</td>
<td></td>
</tr>
<tr>
<td>transceiver</td>
<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>Global Positioning System (GPS)</td>
<td></td>
</tr>
</tbody>
</table>

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

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

Radio Transmission

I found this information on page __________.

Details

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

Radio Transmission

AM radio stations broadcast information by

FM radio stations broadcast information by

Television

I found this information on page __________.

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 _____ signals.

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.
Main Idea

**Telephones**
*I found this information on page ___________.*

**Details**

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 consistent signal</td>
<td>must use in one place</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>not linked to the base</td>
</tr>
<tr>
<td>Pager</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Communications

Satellites, The Global Positioning System
*I found this information on page ___________.*

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

ANALYZE IT

Analyze the information on GPS. Infer why the system uses 24 satellites to get 24-hour around-the-world coverage.
Tie It Together

Electromagnetic Radiation

**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 Radiation

Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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 Radiation</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>

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, identify three things you have learned about Electromagnetic Radiation.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
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>• According to the law of conservation of energy, energy cannot be created or destroyed.</td>
<td></td>
</tr>
<tr>
<td>• Nonrenewable resources cannot quickly be replaced by natural processes.</td>
<td></td>
</tr>
<tr>
<td>• Nuclear power plants produce about eight percent of the energy consumed in the United States.</td>
<td></td>
</tr>
<tr>
<td>• Nuclear fusion releases energy when nuclei are split.</td>
<td></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 of 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 from the decayed remains of ancient organisms

__________

a liquid fossil fuel formed from remains of decayed organisms

__________

resource that cannot be replaced by natural processes as quickly as it is used

**Using Energy**

I found this information on page ____________.

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. ________________ 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 ____________.
Making Fossil Fuels

I found this information on page __________.

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

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

Complete the paragraph about fossil fuels.

Fossil fuels store ___________ energy in ___________. When a fossil fuel burns, a chemical reaction takes place. ___________ and ___________ in the fuel combine with ___________ in the air to form ___________, 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
- hydrocarbons with high boiling points
- hydrocarbons with low boiling points
Use the diagram to summarize the types and uses of fossil fuels.

Three types of fossil fuels

are used for
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.

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 that comes from nuclear power plants

______ percent of energy used in the United States produced by nuclear plants

______ number of nuclear power plants in the United States in 2003

______ number of nuclear reactors contained in these power plants
### Main Idea

#### Nuclear Reactors

I found this information on page __________.

### Details

**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 splits 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.**
**Main Idea**

**Nuclear Power Plants**

* I found this information on page __________.

**Details**

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

- A coolant is pumped through the reactor.
- ...
- ...

**The Risks of Nuclear Power, Nuclear Fusion**

* I found this information on page __________.

**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>

**SYNTHESIZE IT**

Compare and contrast nuclear fusion to nuclear fission.

- ...
- ...
- ...

* Energy Sources 191*
Energy Sources
Section 3 Renewable Energy Sources

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

geothermal energy

biomass

Use a dictionary to define migrate.

migrate
Main Idea

Energy Options

I found this information on page __________.

Details

Summarize the need for alternative energy sources.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Complete the statements to make them true.

The solar energy that falls on the United States in one day is more than ________________________________.

When sunlight strikes a solar cell, _______________ flow through the system.

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

Another way to generate electricity from solar energy is in a ________________________________.

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.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
**Main Idea**

**Energy from the Tides, Harnessing the Wind, Energy from Inside Earth**

I found this information on page __________.

**Details**

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></td>
<td></td>
<td></td>
</tr>
<tr>
<td>availability</td>
<td></td>
<td>must be in areas where</td>
<td></td>
</tr>
<tr>
<td>of the source</td>
<td></td>
<td>wind blows steadily</td>
<td></td>
</tr>
<tr>
<td>effect on</td>
<td></td>
<td>can disturb marine life</td>
<td></td>
</tr>
<tr>
<td>plants and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>animals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pollution</td>
<td></td>
<td></td>
<td>can release some gases</td>
</tr>
<tr>
<td>created</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Alternative Fuels**

Identify three other alternative fuels.

I found this information on page __________.

**ANALYZE IT**

Evaluate one renewable energy source that you think is promising for our future energy needs. Support your choice.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

194  Energy Sources
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.
Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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<thead>
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- Look over the Chapter Review at the end of the chapter.

Summarize It

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

---

196 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>Weather and Climate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• The words weather and climate have basically the same meaning.</td>
</tr>
<tr>
<td></td>
<td>• Wind blows across lines of equal pressure.</td>
</tr>
<tr>
<td></td>
<td>• Oceans and mountains have an important effect on the climate of a region.</td>
</tr>
<tr>
<td></td>
<td>• Much of the northern United States was covered by glacier ice 18,000 years ago.</td>
</tr>
</tbody>
</table>

FOLDABLES

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

Science Journal

Describe some severe weather that you have observed. Hypothesize what might cause these weather events.
Weather and Climate

Section 1 Earth’s Atmosphere

Scan the headings and illustrations in Section 1. Write three questions that come to mind about Earth’s atmosphere.

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

Review Vocabulary

Define nucleus. Then use the word in a scientific sentence.

nucleus

Define

New Vocabulary

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

latent heat

temperature inversion

troposphere

greenhouse effect

Academic Vocabulary

Use a dictionary to define the term structure to reflect its scientific meaning.

structure
Main Idea

Atmospheric Composition
*I found this information on page ________________.*

Atmospheric Structure
*I found this information on page ________________.*

Heating the Atmosphere
*I found this information on page ________________.*

Details

Complete the graph by identifying the main components of the atmosphere and indicating the percentage of each.

Percentage of Gases in the Atmosphere

- Nitrogen: ____% 
- ________________ : ____%
  
  ________________ : 1%

Organize information about the layers of the atmosphere.

Stratosphere: __________________________________

Troposphere: __________________________________

Complete the chart by describing the factors that contribute to heating Earth’s atmosphere.

<table>
<thead>
<tr>
<th>Heating the Atmosphere</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar radiation</td>
<td></td>
</tr>
<tr>
<td>Ozone layer</td>
<td></td>
</tr>
<tr>
<td>Earth’s surface</td>
<td></td>
</tr>
<tr>
<td>Trace gases</td>
<td></td>
</tr>
<tr>
<td>Latent heat</td>
<td></td>
</tr>
</tbody>
</table>
Main Idea

A Varied Surface
I found this information on page __________.

Details

Compare the rates at which dry land and water absorb and release heat into the atmosphere.

Dry Land

Water

Summarize cloud formation by completing the paragraph.

As air rises in the atmosphere, it _______________ and _______________. For droplets to form, _______________. _______________ must cool enough for _______________ to occur. Cloud droplets are so small that _______________ can keep them from falling to Earth.

Model the water cycle in the space below.

SYNTHESIZE IT
Write a short explanation of how the Sun affects the water cycle.
**Weather and Climate**

**Section 2 Weather**

**Scan** the headings in Section 2 of your book. Predict three topics that will be discussed in this section.

1. 
2. 
3. 

**Review Vocabulary**

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

<table>
<thead>
<tr>
<th>gradient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**New Vocabulary**

**Define** the following terms. Use each term in a scientific sentence.

<table>
<thead>
<tr>
<th>westerlies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>jet stream</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>subtropical high</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

| weather front |
|               |
|               |

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

<table>
<thead>
<tr>
<th>source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Complete the statements about air pressure.

The _______________ exerts pressure on objects within it.
When air is heated, _______________ and becomes _______________.
Warm air weighs less and _______________. Uneven heating of Earth’s surface causes _______________ in air pressure.

Summarize the causes of Earth’s major wind belts by completing the graphic organizer.

Global winds are produced by _______________.

Compare and contrast high and low pressure systems by completing the Venn diagram using at least 10 different facts.
Main Idea

Air Masses and Weather Fronts
I found this information on page __________.

Severe Weather
I found this information on page __________.

Details

List the 4 types of weather fronts.
1.  
2.  
3.  
4.  

Classify severe weather by completing the outline.

Severe Weather

I. Thunderstorms
   A. Characteristics
      1.  
      2.  
   B. Hazards
      1.  
      2.  

II. Rotating windstorms
   A. Characteristics of tornadoes
      1.  
      2.  
   B. Characteristics of Hurricanes
      1.  
      2.  

SYNTHESIZE IT

A warm front is approaching your area and is expected to arrive in three days. Predict the weather you should expect during this three-day period.
Scan the headings and illustrations in this section. Predict three things that you will learn about climate.

1. 
2. 
3. 

Define boreal to show its scientific meaning.

boreal

Use your book to define the following terms.

biosphere

continental climate

maritime climate

lee rain shadow

sea breeze

Use a dictionary to define environment to show its scientific meaning.

environment
Distinguish climate and weather by writing the correct word in front of its definition.

climate means the day-to-day conditions of temperature, wind, precipitation, pressure, and more.

weather means the long-term averages of weather for a region.

Identify and define each of the 5 spheres that make up the Earth system.

Summarize the interaction of the five spheres on the lines below.

---

I found this information on page ____________.

I found this information on page ____________.
Main Idea

What causes climate?

I found this information on page __________.

Details

Summarize factors that affect large-scale climate in the concept map.

Forces that affect climate

Describe how climate can vary on a small scale by completing the paragraph below.

Climates vary both _____________ and _____________.

Cities create a condition called the ________________ effect.

This effect occurs because ________________ heat ____________ rapidly than land. For example, on clear, calm nights, San Francisco may be _____________ warmer than surrounding areas.

Summarize how climates are classified. Give a reason why it is useful to classify Earth’s climates.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Scan the headings in Section 4. Write three questions that you have about how and why climates change.

1. 
2. 
3. 

Define trace to show its scientific meaning.

New Vocabulary

global warming

Use your book to define the following terms.

El Niño

La Niña

Use a dictionary to define the term link. Then explain how the term applies to the ocean and the atmosphere.
Section 4 Earth’s Changing Climates (continued)

Main Idea

Seasonal Changes
I found this information on page _________.

Long-term Changes
I found this information on page _________.

The Human Factor
I found this information on page _________.

Details

Complete the statements about seasonal changes.

Seasonal changes occur because _________________.

When Earth revolves to a position in which one hemisphere is tilted toward the Sun, that hemisphere experiences _________________.

Temperatures drop during winter because the intensity of ________________ decreases. Seasonal changes are smallest near _________________.

Summarize factors that cause climate change by completing the chart.

<table>
<thead>
<tr>
<th>Factors That Cause Climate Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over hundreds or thousands of years</td>
</tr>
<tr>
<td>Over millions of years</td>
</tr>
</tbody>
</table>

Summarize human factors that may affect climate by completing the diagram.

Human factors include

__________________________

__________________________

__________________________

__________________________
**Main Idea**

**The Human Factor**

*I found this information on page _________.*

**Details**

**Contrast** global warming *with* ozone layer depletion *by completing the cause-and-effect table.*

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming</td>
<td></td>
</tr>
<tr>
<td>Ozone layer depletion</td>
<td></td>
</tr>
</tbody>
</table>

**Compare and contrast** El Niño *and* La Niña *by completing the Venn diagram.* *Give at least seven different facts.*

![Venn Diagram]

**SYNTHESIZE IT**

Explain why an understanding of the carbon cycle is important for understanding global warming.

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________
Weather and Climate Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

1. Write an A if you agree with the statement.
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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, identify three things you have learned about weather and climate.

__________________________

__________________________

__________________________

__________________________
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>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I know</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

Describe the physical changes that take place as paint dries.
Predict three things that might be discussed in this section.
1. 
2. 
3. 

Define property by circling the phrase that comes closest to the meaning of the word as it is used in your book.
- property
  - a piece of land
  - something that is owned
  - a quality or attribute
  - a stage prop

Use the terms on the left to fill in the blanks.

- A ____________ is an ____________ if all the atoms in the substance are the same. A ____________ is a substance in which two or more elements are combined in the same proportion.
- A ____________ contains two or more substances blended evenly throughout. A ____________ is a mixture in which different materials can be identified easily.
- A ____________ is a homogeneous mixture of particles too small to see with a microscope and too small to settle. A ____________ is a heterogeneous mixture containing a liquid in which you can see particles settle.

The ____________ is observed when light passes through a ____________.

Use a dictionary to define error.
Classification of Matter

Main Idea

Pure Substances
I found this information on page __________.

Mixtures
I found this information on page __________.

Details

Classify each substance as an element or a compound.
calcium chalk graphite sugar
carbon hydrogen salt water
carbon dioxide mercury sodium zinc

<table>
<thead>
<tr>
<th>Elements</th>
<th>Compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<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: ______________________
Section 1 Composition of Matter (continued)

**Main Idea**

**Mixtures**

Sequence the types of mixtures according to particle size.

- **Colloids**
  - Largest particles
  - Smallest particles

- **Solutions**

- **Suspensions**

I found this information on page __________.

**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
  - vinegar
- milk
  - perfume
  - smoke

<table>
<thead>
<tr>
<th>colloid</th>
<th>suspension</th>
<th>solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
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 feature or characteristic that describes an object or substance

__________ a change in size, shape, or state of matter

__________ change of one substance to another

__________ characteristic of a substance that indicates whether it can undergo a certain chemical change

__________ the process of separating substances in a mixture by evaporating a liquid and condensing its vapor

__________ the mass of all substances that are present before a chemical change equals the mass of all substances that remain after the change

Define the word identify using a dictionary.

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 [blank].

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>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Conservation of Mass

I found this information on page [blank].

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

- [Blank lines for description]
- [Blank lines for continuation]
- [Blank lines for continuation]
- [Blank lines for continuation]
- [Blank lines for continuation]

Connect It

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

- [Blank lines for description]
- [Blank lines for continuation]
- [Blank lines for continuation]
- [Blank lines for continuation]
- [Blank lines for continuation]
- [Blank lines for continuation]
- [Blank lines for continuation]
- [Blank lines for continuation]
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>What I know</th>
<th>W</th>
<th>What I want to find out</th>
<th>L</th>
<th>What I learned</th>
</tr>
</thead>
</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, identify three things you have learned about matter and how substances are classified.

__________________________________________________________

__________________________________________________________

__________________________________________________________
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>
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</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.

Write a few sentences telling what you know about atoms.
## Properties of Atoms and the Periodic Table

**Section 1 Structure of the Atom**

### Scan
Section 1. Write two things you might learn from the section.

1. 

2. 

### Review Vocabulary
**Define** element to show its scientific meaning.

- **element**

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

- **atom**
- **electron**
- **electron cloud**
- **neutron**
- **nucleus**
- **proton**
- **quark**

### Academic Vocabulary
*Use a dictionary to define neutral.*

- **neutral**
Identify some of the elements and their symbols by filling in the table. Reference the Symbols of Some Elements table in your book.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na</td>
<td>oxygen</td>
</tr>
<tr>
<td>Hg</td>
<td>hydrogen</td>
</tr>
<tr>
<td>Cl</td>
<td>calcium</td>
</tr>
<tr>
<td>K</td>
<td>nitrogen</td>
</tr>
<tr>
<td>Fe</td>
<td>gold</td>
</tr>
<tr>
<td>C</td>
<td>aluminum</td>
</tr>
</tbody>
</table>

Complete the diagram showing how the parts of an atom are related. Indicate the charge of each particle where applicable.
Main Idea

**Quarks: Even Smaller Particles**

*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>

Details

**Models—Tools for Scientists**

*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

I found this information on page __________.

I found this information on page __________.
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.
- Look at all the illustrations and read their captions.

Write three facts you learned.
1. 
2. 
3. 

Define mass to show its scientific meaning.

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. 
   3. 

I found this information on page ________.
Section 2 Masses of Atoms (continued)

**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**

**Summarize** how to calculate the average atomic mass of an element. Then perform the calculation for the element Chlorine using these data: Cl-35 *makes up* about \( \frac{76}{100} \) of the abundance and Cl-37 *makes up* about \( \frac{24}{100} \) of the abundance.

---

**CONNECT IT**

While exploring on your grandfather’s farm, you find a layer of charcoal that might represent a campfire built by Native Americans. Explain how you could find the age of the charcoal layer.
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

group

electron dot diagram

period

**Academic Vocabulary**

Use a dictionary to define similar to show its scientific meaning.

similar
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.
Tie It Together

Properties of Atoms and 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. Compare your previous answers to these.

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>
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</tr>
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<td></td>
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<td>• An element’s chemical and physical properties may be predicted by its location on the periodic table.</td>
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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, identify three things you have learned about the properties of atoms and the periodic table.
Earth Materials

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>Earth Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Most of Earth’s crust is made of only a few elements.</td>
</tr>
<tr>
<td></td>
<td>• The composition of magma changes as minerals crystallize from it.</td>
</tr>
<tr>
<td></td>
<td>• Metamorphic rocks can form within a few years.</td>
</tr>
<tr>
<td></td>
<td>• Some Earth processes, such as weathering, destroy matter and reduce the mass of Earth.</td>
</tr>
</tbody>
</table>

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

*Science Journal*

*List ten of the most important materials you can think of and where you think they come from.*

________________________
________________________
________________________
________________________
________________________
________________________
________________________
________________________
Scan the headings and illustrations in Section 1. Write three questions you have about minerals. Look for answers to your questions as you read.

1. 
2. 
3. 

Define ionic bond to show its scientific meaning.

irregular break characteristic of some minerals

naturally occurring inorganic solid with a crystalline structure that forms from magma or supersaturated solution

measure of how easily a mineral can be scratched

molten material found beneath Earth’s crust

color a mineral leaves when rubbed across an unglazed porcelain plate or in powdered form

ability of a mineral to break easily and evenly along one or more flat planes

Use a dictionary to define bond to show its scientific meaning.
Main Idea

**Common Elements**

*I found this information on page _________.

**Details**

Organize information about the 8 most abundant elements in Earth's crust by labeling the circle graph.

![Circle graph showing major elements in Earth's crust]

1. Oxygen: ___%
2. Sodium: ___%
3. Potassium: ___%
4. Magnesium: ___%
5. Other: ___%

Complete the concept map about characteristics of minerals.

![Concept map of minerals]

**Physical Properties**

*I found this information on page _________.

Identify six physical properties of minerals.

1. ___
2. ___
3. ___
4. ___
5. ___
6. ___
Main Idea

Mineral Formation
I found this information on page ________.

Mineral Groups
I found this information on page ________.

Mineral Uses
I found this information on page ________.

Details

Complete the concept map about ways minerals form.

Ways minerals form

Summarize your knowledge of mineral groups by completing the paragraph.

Minerals are categorized according to their ________________
______________ and ________________.

The most common group in Earth’s crust is the ________________.

These minerals contain ________________ and ________________.

Other important groups in the crust include ________________.

Organize information about the uses of minerals in the chart.

<table>
<thead>
<tr>
<th>Some Uses of Minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral</td>
</tr>
<tr>
<td>Gold</td>
</tr>
<tr>
<td>Hematite</td>
</tr>
<tr>
<td>Quartz</td>
</tr>
</tbody>
</table>

Connect It

Describe at least 3 ways that you used minerals today.

___

___

___
Earth Materials
Section 2 Igneous Rocks

Scan Section 2. Identify three topics that will be discussed.
1. ____________________________
2. ____________________________
3. ____________________________

Review Vocabulary Define mixture to show its scientific meaning.
mixture

New Vocabulary Define each vocabulary term. Then use each term in a sentence.
rock

texture

intrusive igneous rock

extrusive igneous rock

Academic Vocabulary Use a dictionary to define intermediate.
intermediate
Contrast a rock with a mineral.

**Main Idea**

What’s a rock?

I found this information on page __________.

**Details**

**Contrast** a rock with a mineral.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Rock</th>
</tr>
</thead>
</table>

**Intrusive Igneous Rocks**

I found this information on page __________.

**Sequence** the process by which rocks with different compositions can form from the same original magma as it cools beneath Earth’s surface.

As the magma starts to cool, minerals ________________

including _____________________________________________.

Because these minerals are ________________ than magma, they ________________

______________________________________________________.

The magma now contains a higher percentage of ________________ such as ________________

______________________________________________________.

When the remaining magma cools, ________________,

such as _____________________________________________.
Section 2 Igneous Rocks (continued)

**Main Idea**

**Extrusive Igneous Rocks**
I found this information on page ___________.

**Details**

**Distinguish** igneous textures by completing the concept map.

Molten Rock

- rapid cooling
- slow cooling

**Compare** intrusive and extrusive igneous rocks by completing the chart.

<table>
<thead>
<tr>
<th></th>
<th>Intrusive</th>
<th>Extrusive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where formed</td>
<td>within crust</td>
<td></td>
</tr>
<tr>
<td>Formed from</td>
<td>lava</td>
<td></td>
</tr>
<tr>
<td>Texture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of cooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examples</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COMPARE IT**

Two igneous rocks have exactly the same composition. One is dense and has coarse crystals. The other has low density and is full of holes. Predict how each rock formed.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
### Review Vocabulary

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

**precipitate**

---

### New Vocabulary

*Use each vocabulary term in a scientific sentence.*

<table>
<thead>
<tr>
<th>Term</th>
<th>Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>clast</td>
<td></td>
</tr>
<tr>
<td>porosity</td>
<td></td>
</tr>
<tr>
<td>cementation</td>
<td></td>
</tr>
</tbody>
</table>

### Academic Vocabulary

*Use a dictionary to define aggregate as a noun.*

**aggregate**

---

Scan the headings and illustrations in this section. Predict three things that you will learn about sedimentary rocks.

1. 
2. 
3. 

---

Name __________________________ Date __________

Earth Materials

Section 3 Sedimentary Rocks

---
Main Idea

Rocks from Surface Materials

I found this information on page __________.

Details

Model the formation of sandstone by writing the correct processes in the concept map.

- Preexisting rock
- Weathering and erosion
- Sediment grains
- Layer of sediment
- Consolidated sandstone

Classify detrital sedimentary rocks by completing the table.

<table>
<thead>
<tr>
<th>Detrital Sedimentary Rocks</th>
<th>Sediment</th>
<th>Rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarsest</td>
<td>gravel</td>
<td></td>
</tr>
<tr>
<td>Finest</td>
<td></td>
<td>shale</td>
</tr>
</tbody>
</table>

Detrital Sedimentary Rocks

I found this information on page __________.
Main Idea

Chemical Sedimentary Rocks

Organize information about chemical sedimentary rocks by completing the chart.

<table>
<thead>
<tr>
<th>Process</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Biochemical Sedimentary Rocks

Complete the steps by which biochemical sedimentary rock is formed.

- marine organisms containing calcium carbonate
- plant matter such as peat

EVALUATE IT

A sedimentary rock consists entirely of large, interlocking crystals. Classify which type of sedimentary rock it is. Support your answer with details from this chapter.
Scan the headings in Section 4. Write three questions that you have about metamorphic rocks and the rock cycle.

1. 
2. 
3. 

Define chemical reaction using your book or a dictionary.

chemical reaction

Define both new vocabulary terms. Then write a short paragraph to show the scientific meanings of both terms.

foliated

rock cycle

Use a dictionary to define cycle to show its scientific meaning.
Complete the paragraph about how metamorphic rocks form.

Metamorphic rocks form from preexisting _______________ that might be igneous, _______________, or even other _______________. In order for metamorphic rocks to form, conditions of high _______________, high _______________, or the presence of _______________ must exist. Metamorphic rocks normally require _______________ of years to form.

Summarize two environments of metamorphism by completing the chart.

Complete the chart:

<table>
<thead>
<tr>
<th>Metamorphic Rock Formation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Metamorphism</td>
</tr>
<tr>
<td>Regional</td>
</tr>
<tr>
<td>Contact</td>
</tr>
</tbody>
</table>

Model foliated and nonfoliated rocks by drawing an example of each.

Foliated

Nonfoliated
Section 4 Metamorphic Rocks and the Rock Cycle (continued)

**Main Idea**

**Metamorphic Rock Classification**

I found this information on page ________.

**The Rock Cycle**

I found this information on page ________.

---

**Details**

Complete the concept map about metamorphic rock classification.

Criteria for classifying metamorphic rocks include

---

Model the rock cycle in the space below.

---

**EVALUATE IT**

You find a shiny, layered metamorphic rock. Predict what type of rock it may be. Support your answer with details from the chapter.

---
Earth Materials  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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

<table>
<thead>
<tr>
<th>Earth Materials</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Most of Earth’s crust is made of only a few elements.</td>
<td></td>
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<tr>
<td>• The composition of magma changes as minerals crystallize from it.</td>
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</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, identify three things you have learned about Earth materials.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Earth’s Changing Surface

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>Earth’s Changing Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A region’s climate can affect the soil that develops there.</td>
<td></td>
</tr>
<tr>
<td>• Water in the Mississippi River comes from a region that stretches from the Appalachian Mountains to the Rocky Mountains.</td>
<td></td>
</tr>
<tr>
<td>• Most of the land in deserts is covered by sand dunes.</td>
<td></td>
</tr>
<tr>
<td>• Some water wells flow without pumping.</td>
<td></td>
</tr>
</tbody>
</table>

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

Science Journal

Describe some clues that could indicate a glacier once covered a region.

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________
Scan the headings and illustrations in Section 1. Write three questions that you have about weathering and soil. Look for answers to your questions as you read.

1. 
2. 
3. 

Use the term sediment in a scientific sentence.

Define the following terms to show their scientific meaning.

weathering

soil

Use a dictionary to define expand. Then use the term in a sentence that shows its scientific meaning.

expand
Weathering

Identify factors that affect the weathering of rock by completing the concept map.

Factors that Affect Weathering

Mechanical Weathering and Chemical Weathering

Compare and contrast mechanical weathering and chemical weathering by completing the Venn diagram. Use the phrases listed below.

- weakens rock
- decreases surface area of rock being weathered
- forms new minerals
- increases surface area of rock being weathered
- forms new minerals
- releases ions into water solution
- does not affect composition of rock
**Section 1 Weathering and Soil (continued)**

**Main Idea**

**Soil**

* I found this information on page __________.

**Details**

**Summarize** characteristics of soil horizons below.

<table>
<thead>
<tr>
<th>Horizon</th>
</tr>
</thead>
<tbody>
<tr>
<td>O Horizon</td>
</tr>
<tr>
<td>A Horizon</td>
</tr>
<tr>
<td>E Horizon</td>
</tr>
<tr>
<td>B Horizon</td>
</tr>
<tr>
<td>C Horizon</td>
</tr>
<tr>
<td>R Horizon</td>
</tr>
</tbody>
</table>

**Soil Conservation**

* I found this information on page __________.

**Complete** the graphic organizer about soil conservation.

- soil conservation includes

**SYNTHESIZE IT**

Describe the relationship between weathering and soil.

---

* Name ____________________________ Date ____________________________

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Scan the headings in Section 2 of your book. Identify three topics that will be discussed in this section.

1. 
2. 
3. 

Define physical change to show its scientific meaning.

Physical change

Write a scientific sentence using each of the vocabulary terms.

Erosion

Sediment transport

Deposition

Drainage basin

Longshore current

Use a dictionary to define the term transport to show its scientific meaning.

Transport
Main Idea

Erosion, Transport, and Deposition

I found this information on page ________.

Details

Complete the following paragraph about how the landscape is shaped.

______________ is the process by which rock, sediment, and soil are picked up and removed from an area. ________________ all can cause erosion.

Once the material has been picked up, it can be moved to another location. This process of moving sediment from one place to another is called ________________. Eventually, the transporting agent no longer will be able to move the sediment and ________________ will occur.

Running Water

Model a river system in the space below. Include tributaries, a trunk stream, and a delta in your sketch. Label and describe places where you think erosion, transportation, and deposition are occurring.

250 Earth’s Changing Surface
**Main Idea**

**Glaciers**
*I found this information on page ___________.

**Wind**
*I found this information on page ___________.

**Details**

**Classify** glacial features as erosional or depositional by writing as many features as you can in the table.

<table>
<thead>
<tr>
<th>Erosional Features</th>
<th>Depositional Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sequence** the migration of a dune. Draw a sand dune in the space below. Label the dune $T_1$. Then draw the position of the dune at two times in the future ($T_2$ and $T_3$).

**Summarize** how dunes migrate.

**SYNTHESIZE IT**
Mudflows are a dangerous type of mass-wasting event. Describe a mudflow. How might damage and loss of life from mudflows be prevented?

---

Earth’s Changing Surface 251
Scan the illustrations in this section. Write three things that you learned about water or groundwater.

1. 
2. 
3. 

Define pore space to show its scientific meaning.

pore space: 

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

infiltration: 

water table: 

aquifer: 

porosity: 

Use a dictionary to define transmit to show its scientific meaning.

transmit: 
Summarize on the lines below how the water cycle provides water to the groundwater system.

Create a drawing of porous sediment in the space below. Label your drawing to show where groundwater could be held.

Model an aquifer in the space below. Label the land's surface, the water table, the unsaturated zone, and the saturated zone. Add arrows to your sketch to show how groundwater moves in your aquifer.
Section 3  Groundwater  (continued)

**Main Idea**

**Water Resources**

I found this information on page _________.

**Details**

Summarize how groundwater is obtained by completing the chart.

<table>
<thead>
<tr>
<th>Sources of Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
</tr>
<tr>
<td>springs</td>
</tr>
<tr>
<td>wells</td>
</tr>
</tbody>
</table>

Organize information about artesian wells by sketching a cross section of one. Label the aquifer and aquitards. Then describe how water flows from an artesian well.

---

**EVALUATE IT**

Polluted groundwater is a difficult problem. Infer why a polluted aquifer might remain polluted for a long period of time.

---

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Scan the headings in Section 4. Write three questions that you have about geologic time.

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

Define radioactivity to show its scientific meaning.

Radioactivity

Write the correct vocabulary term on the blank next to each definition.

Hutton’s concept that the laws of nature act today as they have in the past

Gap in the rock record that represents a period of erosion or nondeposition

Remains or traces of an organism in the geologic rock record

States that the oldest rocks in an undisturbed sequence of rock layers are at the bottom of the undisturbed sequence

Process of dating objects or events in time order or sequence

Process of assigning a precise numerical age to an organism, object, or event based on its absolute reference

Use a dictionary to define structure to show its scientific meaning.

Structure
Main Idea

Time
I found this information on page _________.

Distinguish absolute ages and relative ages by writing three everyday examples of each type in the table below.

Everyday Examples of Relative Ages and Absolute Ages

<table>
<thead>
<tr>
<th>Relative ages</th>
<th>Absolute ages</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>

Classify the following statements according to whether the statement reflects use of the principle of superposition, the principle of uniformitarianism, or the principle of original horizontality.

1. The principle of ___________________________ allows me to conclude that a sandstone near the bottom of an undisturbed sequence of rock layers must be older than a limestone near the top.

2. The principle of ___________________________ allows me to conclude that folded or tilted rock layers must have been disturbed sometime after the layers formed.

3. The principle of ___________________________ allows me to conclude that ancient rock that is similar to volcanic rock forming today in Hawaii probably formed in the same way.

Fossils
I found this information on page _________.

Sequence the units of geologic time from the longest type of unit to the shortest type of unit.

Longest unit ← _________ ← _________ ← _________ Shortest unit
Main Idea

**Absolute Dating**

I found this information on page _________.

**Details**

Define a pattern of half-life by completing the blanks to show how much parent isotope and daughter isotope remain. Assume that no atoms can enter or escape from the system.

<table>
<thead>
<tr>
<th>Half-lives</th>
<th>Amount of daughter and parent (moles)</th>
<th>Daughter to parent ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>D: 0 P: 16</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>D: ____ P: ____</td>
<td>____</td>
</tr>
<tr>
<td>2</td>
<td>D: ____ P: ____</td>
<td>____</td>
</tr>
<tr>
<td>3</td>
<td>D: ____ P: ____</td>
<td>____</td>
</tr>
<tr>
<td>4</td>
<td>D: ____ P: ____</td>
<td>____</td>
</tr>
</tbody>
</table>

Summarize how knowing the half-life of an isotope and the daughter to parent ratio of a rock sample allows scientists to determine the age of rocks.

SYNTHESIZE IT

After oil forms, it tends to rise toward the surface. Hypothesize how folded rocks can trap oil in economic amounts. Include a description of which type of fold would be most effective at trapping oil.

__________________________________________________________________________________
Earth’s Changing Surface
Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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

<table>
<thead>
<tr>
<th>Earth’s Changing Surface</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A region’s climate can affect the soil that develops there.</td>
<td></td>
</tr>
<tr>
<td>• Water in the Mississippi River comes from a region that stretches from the Appalachian Mountains to the Rocky Mountains.</td>
<td></td>
</tr>
<tr>
<td>• Most of the land in deserts is covered by sand dunes.</td>
<td></td>
</tr>
<tr>
<td>• Some water wells flow without pumping.</td>
<td></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, identify three things you have learned about Earth’s surface.
Chemical Bonds

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 Bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• The properties of a chemical compound are the same as the properties of each element it contains.</td>
</tr>
<tr>
<td></td>
<td>• An ion forms when an atom gains or loses electrons in its outer shell.</td>
</tr>
<tr>
<td></td>
<td>• Covalent bonds form when atoms share electrons.</td>
</tr>
<tr>
<td></td>
<td>• The oxidation number is the number of oxygen atoms in a molecule.</td>
</tr>
</tbody>
</table>

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

Science Journal

Describe how glue is similar to chemical bonds.
Predict four topics that might be discussed after reviewing the objectives of Section 1.

1. 
2. 
3. 
4. 

Define compound.

Define the following vocabulary terms.

chemical formula

ion

Use a dictionary to define unique. Then use the word in a sentence that demonstrates its scientific meaning.

unique
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.
Main Idea

Atomic Stability
I found this information on page __________.

Create your own electron dot diagrams for sodium and chlorine. Explain how both atoms could become more stable.

Details

Complete the statements about ions.

To become more ________, atoms _________ and _________ electrons. An atom that has gained or lost an electron is called an _________. An ion is a _________ particle that has _________ or _________ electrons than protons. An ion does not have a ________ charge. ____________________ between ions can hold compounds together.

CONNECT IT

Make an analogy between the sharing of electrons and the completion of a jigsaw puzzle.

I found this information on page __________.
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 using your book or a dictionary.

atom

Read the definitions below. Then write the vocabulary word that matches each definition in the left column.

the force that holds atoms together in a compound

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 where the electrons are shared equally in the bond

Use a dictionary to define neutral.
**Main Idea**

**Gain or Loss of Electrons**

I found this information on page __________.

**The Ionic Bond and Sharing Electrons**

I found this information on page __________.

**Details**

**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.**

![Venn Diagram]

**Analyze and discuss why it is much easier for Group 14 elements to become stable by sharing instead of transferring electrons.**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

264 Chemical Bonds
### Covalent Bonds
1. 
2. 

### Polar Covalent Bonds
1. 
2. 

### Unequal Sharing
1. 
2. 

### Sharing Electrons
1. Sharing requires less energy.
2. A covalent bond is formed.

### Nonpolar Covalent Bonds
1. 
2. 

---

**Main Idea**

**Details**

---

**SUMMARIZE IT**

Write two key facts in each of the boxes below.
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 using your book or a dictionary.

Define the following vocabulary words. Use your book for help.

- binary compound
- oxidation number
- polyatomic ion
- hydrate

Use a dictionary to define 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. 

Section 3 Writing Formulas and Naming Compounds (continued)
Compounds with Polyatomic Ions

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: ____________________________

Compounds with Added Water

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 CaSO$_4$ • 2H$_2$O is named ____________________________, whose common name is gypsum.

The ___________ form (without water), ___________ is the common powder known as plaster of paris.
### Main Idea

**Naming Binary Covalent Bonds**

*I found this information on page ____________.*

### Details

Analyze *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.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chemical Bonds  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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>

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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, identify three things you learned about chemical bonds.

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

270  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 Reactions</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.
Chemical Reactions
Section 1 Chemical Changes

**Predict** Review the objectives of Section 1. Predict three topics that might be discussed.

1. ____________________________
2. ____________________________
3. ____________________________

**Define** chemical change. Give an example of chemical change you might see in your everyday life.

chemical change

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

chemical reaction

reactant

product

chemical equation

**Academic Vocabulary** Use a dictionary to define component. Then give an example of a component.

component
Main Idea

Describing Chemical Reactions

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>

Conservation of Mass

I found this information on page __________.

Writing Equations

I found this information on page __________.

Summarize the contributions of Lavoisier by filling out the organizer. Include information on his experiments, observations, and theories.

Lavoisier

Conservation of Mass: Father of Modern Chemistry: Naming Compounds:

Complete the graphic organizer about symbols used in chemical equations.

Symbols Used in Chemical Equations

states of matter

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 \underline{\text{_____________}} oxygen \underline{\text{_____________}} magnesium oxide and \underline{\text{_____________}}.

Analyze the role of coefficients as unit managers in writing chemical equations.

Evaluate how students balanced the equation.

\[
\text{Mg}_{(s)} + \text{O}_{2(g)} \rightarrow \text{MgO}_{(s)}
\]

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Student's Answer</th>
<th>Evaluation: Would the equation balance? What does the student's answer mean?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melinda</td>
<td>put a 2 in front of the Mg and a 2 in front of MgO</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>This would mathematically balance the equation, but you cannot really cut the molecule in half and then combine it.</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.

Use your book or a dictionary to define balanced chemical equation.

Use a dictionary to define formula. Then use the word in a sentence that shows its scientific meaning.
Summarize information about balancing equations by completing the prompts.

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 3 Na 4 Al₂O₃

3 HCl 6 AlH₃ 3 H₂

Complete the right side of the equation. The first one has been started for you.

<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></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td></td>
<td></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.

______________________________
Main Idea

Balanced Equations

Sequence and describe the 4 steps involved in balancing a chemical equation. In the right column, write an example for each step.

1. Write equation. Check that symbols and formulas for reactants and products are correct.

2. Identify coefficients that balance each equation.

3. 

4. 

Identify coefficients that balance each equation.

1. \( \text{P}_(s) + \text{O}_2(g) \rightarrow \text{P}_4\text{O}_{10}(s) \)

2. \( \text{KClO}_3(s) \rightarrow \text{KCl}(s) + \text{O}_2(g) \)

3. \( \text{H}_2\text{O}(l) \rightarrow \text{H}_2(s) + \text{O}_2(g) \)

4. \( \text{CH}_4(s) + \text{O}_2(g) \rightarrow \text{CO}_2(g) + \text{H}_2\text{O}(g) \)

5. \( \text{Al}_2\text{O}_3(s) \rightarrow \text{Al}(s) + \text{O}_2(g) \)

6. \( \text{MgSO}_4(aq) + \text{KCl}(aq) \rightarrow \text{MgCl}_2(s) + \text{K}_2\text{SO}_4(aq) \)

Connect It

Analyze how chemical equations and mathematical equations are similar. Provide an example to illustrate your point.
Chemical Reactions
Section 3 Classifying Chemical Reactions

Skim Section 3. Write two statements about what you plan to learn from the reading.
1. ____________________________________________
   ____________________________________________
2. ____________________________________________
   ____________________________________________

Define states of matter to show its scientific meaning.
   ____________________________________________
   ____________________________________________

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

Use a dictionary to define accumulate. Then use the term in a scientific sentence.
   ____________________________________________
   ____________________________________________
   ____________________________________________

New Vocabulary
states of matter

Review Vocabulary

Academic Vocabulary
accumulate
Describe each type of chemical reaction in words. Give the general form if it exists and an example for each.

I. Combustion Reaction
   Description: ..............................................................
   Example: ..............................................................

II. Synthesis Reaction
   Description: ..............................................................
   General form: ..............................................................
   Example: ..............................................................

III. Decomposition Reaction
   Description: ..............................................................
   General form: ..............................................................
   Example: ..............................................................

IV. Single-Displacement Reaction
   Description: ..............................................................
   General form: ..............................................................
   Example: ..............................................................

V. Double-Displacement Reaction
   Description: ..............................................................
   General form: ..............................................................
   Example: ..............................................................

VI. Oxidation-Reduction Reaction
   Description: ..............................................................
   Example: ..............................................................
Analyze the activity series chart in your book to decide which metal will replace the other in a displacement reaction.

1. calcium lead
2. tin zinc
3. copper aluminum

Classify each chemical reaction by writing the reaction type in the blank to the left.

- decomposition
- double displacement
- single displacement
- synthesis

2LiBr + Pb(NO₃)₂ → 2LiNO₃ + PbBr₂
Fe + 2HCl → FeCl₂ + H₂
CaO + H₂O → Ca(OH)₂
NiCl₂ → Ni + Cl₂

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.
Preview Section 4 of this chapter. Read the headings and the illustration captions. Write three questions that come to mind.

1. 
2. 
3. 

Define chemical bond to show its scientific meaning.

chemical bond

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

activation energy

endothermic reaction

exothermic reaction

rate of reaction

catalyst

inhibitor

Use a dictionary to define release to show its scientific meaning.

release
Main Idea

Chemical Reactions and Energy

I found this information on page __________.

Details

Identify three facts about chemical reactions and energy.
1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

Complete the following paragraphs about energy reactions.

All exothermic reactions are __________, but not all exergonic reactions are __________. __________ reactions give off heat energy, while __________ reactions 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>
Chemical Reaction Rates

I found this information on page ___________.

Match the condition that controls reaction rates to its clue by placing the correct letter on the line.

___ 1. temperature
___ 2. concentration
___ 3. surface area
___ 4. agitation
___ 5. pressure

a. stirring helps reactants collide more often
b. increasing this reduces the amount of space atoms have to move in
c. raising this makes atoms and molecules move faster
d. this increases when a substance is split into pieces
e. the closer atoms are to one another, the more likely they are to collide

Compare and contrast the roles of catalysts and inhibitors in reactions. Fill in the Venn diagram with the phrases below.

- does not enter into the reaction itself
- enzymes in body
- food preservatives
- temperature change
- used in auto industry
- used to make polymers

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. Compare your previous answers to these.

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>
<td></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, identify three things you have learned about 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>Solutions, Acids, and Bases</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>• pH measures how acidic a solution is.</td>
<td></td>
</tr>
<tr>
<td>• Bases are commonly found in household cleaners.</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 solutions, and are all solutions liquids? Check your answer later and revise it if you’ve learned differently.

---

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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 homogeneous mixture.

homogeneous mixture

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

solution

solute

solvent

aqueous solution

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?**

**Solutes and Solvents**

_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>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sequence a three-step process of dissolving a polar solid in a polar liquid.**

- **Step 1.**
  - ...
  - ...
  - ...

- **Step 2.**
  - ...
  - ...
  - ...

- **Step 3.**
  - ...
  - ...
  - ...
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.

CONNECT IT

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.

Name

Date

Section 1 How Solutions Form (continued)

Main Idea

How Substances Dissolve

I found this information on page __________.

Details

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
Skim the objectives of Section 2 in your book. Write three topics you expect to be covered in the reading.

1. 
2. 
3. 

Define substance to reflect its scientific meaning.

substance

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

how much solute is in a solution compared to how much solvent

a mixture that contains all the solute it can hold at a given temperature

a mixture that can dissolve more solute at a given temperature

a mixture that has more solute than a saturated solution at the same temperature

Use a dictionary to define precise.

precise
Main Idea

How much can dissolve?
I found this information on page ____________

Details

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.

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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Section 2  Solubility and Concentration (continued)

Main Idea

Types of Solutions

Evaluate why many people prefer to store carbonated beverages in the refrigerator.

Details

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.

- Increasing the pressure of a gas over a liquid increases

- Cooling the liquid increases

Evaluate why many people prefer to store carbonated beverages in the refrigerator.

Connect It

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.
**Solutions, Acids, and Bases**

**Section 3 Acids, Bases, and Salts**

**Skim Section 3.** 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.

**Review Vocabulary**

electrolyte

**New Vocabulary**

- a substance that produces hydrogen ions, H⁺, in a water solution
- an organic compound that changes color in an acid or a base
- any substance that forms hydroxide ions, OH⁻ in a water solution, or a substance that accepts H⁺ ions from acids

**Academic Vocabulary**

Use a dictionary to define predict to show its scientific meaning.
Section 3 Acids, Bases, and Salts (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>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition:</td>
<td>Four Common Properties:</td>
</tr>
<tr>
<td>Four Common Acids:</td>
<td>Four Uses of Acids:</td>
</tr>
</tbody>
</table>

Identify a fact or example about bases on each line.

![Diagram of relationships between common properties, bases, and common bases]
The smell of fish is caused by a base. Hypothesize why lemon juice can be used to neutralize the smell of fish.

**CONNECT IT**

**Main Idea**

_Solutions of Acids and Bases_

_I found this information on page _________.

**Details**

_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._

**Create**

Question: __________________________________________________________________________?

Answer: ______________________________________________________________________________

_______________________________________________________________________________________

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 \(-\text{OH}\).
Predict **Look at the headings in Section 4. Write two predictions about what you will learn in this section.**

1. __________________________________________

   __________________________________________

2. __________________________________________

   __________________________________________

Define **acid strength in a sentence to show its scientific meaning.**

   __________________________________________

   __________________________________________

New Vocabulary **Read the definitions below. Then write the key term for each one in the blank in the left column.**

an acid in which almost all the acid molecules dissociate in water

a base that dissociates completely in solution

a measure of the concentration of $\text{H}^+$ ions in a solution

an acid in which only a small number of the acid molecules dissociate in water

a base that does not dissociate completely in solution

Academic Vocabulary **Use a dictionary to define conduct as a verb in science.**

   __________________________________________

   __________________________________________
**Main Idea**

**Strong and Weak Acids and Bases**

*Evaluate* why acids are able to conduct electricity. Then describe which types of acids are better conductors and why.

---

**Details**

*Evaluate* why acids are able to conduct electricity. Then describe which types of acids are better conductors and why.

---

*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>Arrow Directions Demonstrate</td>
</tr>
<tr>
<td>Strong acid</td>
<td>Arrow Directions Demonstrate</td>
</tr>
<tr>
<td>Strong base</td>
<td>Arrow Directions Demonstrate</td>
</tr>
</tbody>
</table>

*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></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.

Analyze how buffers allow you to eat acidic and basic foods without changing your blood pH.
Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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, Acids, and Bases</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>• pH measures how acidic a solution is.</td>
<td></td>
</tr>
<tr>
<td>• Bases are commonly found in household cleaners.</td>
<td></td>
</tr>
</tbody>
</table>

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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, identify three things you have learned about solutions, acids, and bases.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
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>Nuclear Changes</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>• Mass and energy are interchangeable according to Einstein’s theory of relativity.</td>
</tr>
</tbody>
</table>

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

Science Journal

Write a paragraph describing your impressions of the Sun.
Nuclear Changes
Section 1 Radioactivity

Scan Section 1 and write down three topics that might be covered in this section.

1. ________________________________
2. ________________________________
3. ________________________________

Review Vocabulary Define long-range force.

long-range force

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

strong force

radioactivity

Academic Vocabulary Use a dictionary to define stable as it might be used in this section.

stable
Describe the nucleus. Discuss its size and what it contains.

Compare and contrast the strong force and the electrical force in the nuclei of atoms. Describe each force for a small and a large nucleus.

<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; holds nucleus tightly together because</td>
<td></td>
</tr>
<tr>
<td>large</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Main Idea

Radioactivity

I found this information on page __________.

Details

Organize important information about radioactivity in the boxes below.

Isotopes

Nuclear Decay

Radioactivity

Discovery

Element Symbols

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.

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.
**Main Idea**

Nuclear Radiation;
Alpha Particles;
Beta Particles;
Gamma Rays

I found this information on page ___________.

**Details**

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></td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td></td>
<td>faster than alpha</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>
Section 2 Nuclear Decay (continued)

Main Idea

Alpha Particles; Beta Particles

I found this information on page 792–793.

Details

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 ________________.

Radioactive Half-Life, Radiocative Dating

I found this information on page 794–795.

Radioactive Dating

Carbon Dating

Uranium Dating

Summarize information about radioactive dating.

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 to show its scientific meaning.

**New Vocabulary**

*cloud chamber*

*bubble chamber*

*Geiger counter*

**Academic Vocabulary**

Use a dictionary to define expose as it might be used in this section. Then use it in a sentence that reflects this definition.

---

**Nuclear Changes**

Section 3 Detecting Radioactivity

306  Nuclear Changes
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>Percent of Total Radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocks and soil</td>
<td>11%</td>
</tr>
<tr>
<td>Rocks and soil</td>
<td></td>
</tr>
</tbody>
</table>
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.
Nuclear Changes
Section 4 Nuclear Reactions

**Skim** Section 4. Write three uses for nuclear reactions.
1. 
2. 
3. 

**Review Vocabulary**

**Define** kinetic energy using your book or a dictionary.

**kinetic energy**

**New Vocabulary**

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

**nuclear fission**

**chain reaction**

**critical mass**

**nuclear fusion**

**tracer**

**Academic Vocabulary**

Use a dictionary to define target.

**target**
**Main Idea**

Nuclear Fission

I found this information on page __________.

---

**Details**

**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></td>
<td>Found that when a neutron hits a uranium-235 nucleus, the nucleus splits apart into smaller nuclei.</td>
</tr>
<tr>
<td>1939</td>
<td>Lise Meitner</td>
<td></td>
</tr>
</tbody>
</table>

**Summarize** the process of nuclear fission of uranium.

A neutron collides \[\text{this produces}\] \[\text{several } \_\_\_\_\_\_\_\_\_\_\_\_\_\_\] \[\text{nucleus}\] \[\text{nucleus}\]

Some mass is lost because ____________________.

**Define** Einstein’s mass-energy equation in words and then write the formula.

Words:

\[\text{Energy} (\text{joules}) = \text{mass} (\text{kg}) \times \left[ \frac{\text{speed of light}^2}{2} \right] (\text{m/s})\]

Formula: ____________________
Section 4 Nuclear Reactions (continued)

Main Idea

Nuclear Fusion
I found this information on page 803.

Details

Summarize the energy requirements of nuclear fusion.
what must be overcome: ____________________________________________
this is in order to: ______________________________________________
type of energy that can do it: ______________________________________
this type of energy increases with: _________________________________
common places to find enough energy: _____________________________

Using Nuclear Reactions in Medicine
I found this information on page 804–806.

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>
</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.

__________________________________________

__________________________________________

__________________________________________

__________________________________________
Nuclear Changes  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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

<table>
<thead>
<tr>
<th>Nuclear Changes</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>• An atom’s nucleus contains nearly all the mass of 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>• Mass and energy are interchangeable according to Einstein’s theory of relativity.</td>
<td></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, identify three things you have learned about 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>Stars and Galaxies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The constellations that are visible in the night sky change throughout the year.</td>
<td></td>
</tr>
<tr>
<td>• The Sun’s interior contains a core, radiation layer, and a convection layer.</td>
<td></td>
</tr>
<tr>
<td>• Stars outside the Milky Way galaxy can be seen from Earth.</td>
<td></td>
</tr>
<tr>
<td>• Much of the matter in the universe cannot be seen.</td>
<td></td>
</tr>
</tbody>
</table>

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

Write a paragraph about what you know about the Sun as a star.
Stars and Galaxies
Section 1 Observing the Universe

Scan the headings and illustrations in Section 1. Write three questions you have about constellations or telescopes. Look for answers to your questions as you read.

1. __________________________________________
2. __________________________________________
3. __________________________________________

Define electromagnetic spectrum using your book or a dictionary.

Read the definitions below. Use your book to fill in the correct vocabulary term.

optical instrument that uses a concave mirror to collect light and a lens to magnify an image

distance that light travels in one year, about 9.5 trillion km

star pattern that appears to form an image and often is named for a mythological figure

telescope that collects and amplifies radiowaves coming from objects in space

instrument that disperses light into its component wavelengths using a prism or diffraction grating

optical instrument that uses double convex lenses to collect light and magnify an image

Use a dictionary to define the term image. Then use the term in a sentence that shows its scientific meaning.

______________________________________________

______________________________________________
Summarize the origin of the names of constellations.

Identify the 2 types of optical telescopes. Then state three facts about each kind of telescope.

Complete the paragraph below about radio telescopes.

Radio waves are a form of ___________________________.

Radio waves can be detected during both ____________________

and travel through Earth’s ______________________ on both clear
days and ______________________. A ______________________
collects and amplifies ______________________. These instruments
usually are built with a very ______________________, similar to a
large dish antenna, to collect and amplify the radio waves.
Summarize four kinds of information a scientist can learn about a star by using a spectroscope.

1. 
2. 
3. 
4. 

Create a concept map to help identify and sequence the colors of the spectrum.

Evaluate how a star’s spectrum can be used to determine its surface temperature. Provide an example to support your reasoning.

COMPARE IT Compare optical telescopes on Earth with the Hubble Space Telescope. Describe advantages and disadvantages of each.
Stars and Galaxies
Section 2 Evolution of Stars

Scan the headings in Section 2 of your book. Identify three topics that will be discussed in this section.

1. __________________________________________________________________________
2. __________________________________________________________________________
3. __________________________________________________________________________

Define absolute magnitude to show its scientific meaning.

absolute magnitude

Read the definitions below. Use your book to fill in the correct vocabulary term.

section from the upper left to the lower right of an H-R diagram that contains 90 percent of all stars

late stage in a star’s life cycle that occurs when its hydrogen fuel is depleted, its core contracts, and its outer layers expand and cool

giant star that has lost its outer layers, leaving behind a hot, dense core that continues to contract under gravity

surface layer of the Sun that gives off light

cool, darker areas of the Sun’s photosphere

Use a dictionary to define the term evolve to show its scientific meaning.

evolve
Write the 5 steps of star formation.

<table>
<thead>
<tr>
<th>Formation of a Star</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
</tr>
</tbody>
</table>

Complete the statement about stellar equilibrium in a main sequence star. Then complete the table to summarize how stars change based on their total mass once they move off the main sequence.

Stellar equilibrium exists when ____________________________

<table>
<thead>
<tr>
<th>Mass</th>
<th>Initial Stage</th>
<th>Middle Stage</th>
<th>Final Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 8 solar masses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 to 25 solar masses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 or more solar masses</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 2  Evolution of Stars (continued)

**Main Idea**

The Sun—A Main Sequence Star

---

**Details**

Sketch a diagram of the Sun below. Label your diagram with these terms.
- radiation zone
- corona
- core
- photosphere
- convection zone

---

Compare prominences, flares, and CMEs in the table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flare</td>
<td></td>
</tr>
<tr>
<td>CME</td>
<td></td>
</tr>
<tr>
<td>Prominence</td>
<td></td>
</tr>
</tbody>
</table>

---

EVALUATE IT

A star in the sky suddenly brightens to many times its original brightness and then fades gradually over the next several years. Hypothesize what happened in terms of a star’s life cycle.

---

---
Scan the bold headings in this section. List three things you might learn about galaxies or the Milky Way.

1. 
2. 
3. 

Review Vocabulary

Define ellipse to show its scientific meaning.

ellipse

New Vocabulary

Use your book to define the following key terms.

galaxy

Milky Way

Local Group

Academic Vocabulary

Use a dictionary to define core. Then write a scientific sentence that includes the word.

core
Section 3  Galaxies and the Milky Way (continued)

**Main Idea**

**Galaxies**

_I found this information on page ___________.

**How do galaxies form?**

_I found this information on page ___________.

**Details**

**Classify** galaxies into the 3 types and identify three facts about each. Record your information in the graphic organizer below.

**Summarize** how galaxies might have formed and grown.

_I found this information on page ___________.

____________________

____________________

____________________

____________________

____________________

____________________
The Milky Way

The Sun is about light-years from the center of the Milky Way.

It takes the Sun million years traveling at km/s to orbit the Milky Way.

In the center of the Milky Way is a bulge that measures light-years in diameter.

The Milky Way has been gobbling up the Sagittarius dwarf galaxy for about billion years.

The Milky Way’s disk is about light-years thick.

The Milky Way contains about billion stars.

The Milky Way measures nearly light-years across.

Connect It

We live in the Milky Way galaxy. Yet the Milky Way is not the most common type of galaxy. Identify three ways the Milky Way differs from the most common type of galaxy in the universe.
Scan the headings in Section 4. List three questions you have about cosmology.

1. 

2. 

3. 

Define universe to show its scientific meaning.

Write the correct vocabulary term on the blank next to each definition.

- study of how the universe began, what it is made of, and how it continues to evolve
- unseen mass that adds to the gravity of a galaxy, but cannot be detected or seen
- energy that might be causing accelerated expansion of the universe
- the theory that the universe started with a big bang, or explosion, and has been expanding ever since

Use a dictionary to define the term expansion to show its scientific meaning.
**Main Idea**

**How did it begin?**

*I found this information on page ______."

**Details**

**Explain** how to model the expansion of the universe by inflating a balloon.

<table>
<thead>
<tr>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
</tr>
<tr>
<td>_______</td>
</tr>
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</tr>
<tr>
<td>_______</td>
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**The Big Bang Theory**

*I found this information on page ______."

**Summarize** the microwave background radiation and two scientific findings about the universe in the graphic organizer below.

<table>
<thead>
<tr>
<th>Microwave Background Radiation</th>
</tr>
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<tbody>
<tr>
<td>_______</td>
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<table>
<thead>
<tr>
<th>Wilkinson Microwave Anisotropy Probe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. _______</td>
</tr>
<tr>
<td>2. _______</td>
</tr>
</tbody>
</table>
Analyze why dark matter and dark energy are referred to as dark.

Complete the following paragraph about the Doppler shift.

The ____________________ is a change in the wavelength of ____________________ waves or ____________________ waves that occurs when the waves are ____________________ or ____________________.

When a galaxy is moving toward the Milky Way, its light waves are ____________________, causing a ______________. Light waves from a galaxy moving away from the Milky Way are ____________________, causing a ______________.

Organize information about dark matter and dark energy.

<table>
<thead>
<tr>
<th>Dark Matter</th>
<th>Dark Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
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SYNTHESIZE IT

Analyze why dark matter and dark energy are referred to as dark.

---

Name ___________________________ Date __________________

Section 4 Cosmology (continued)

Main Idea

Expansion of the Universe

I found this information on page ____________.

Details

What is the universe made of?

I found this information on page ____________.

Stars and Galaxies 325
Stars and Galaxies  Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned and complete the table below. Compare your previous answers to these.

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SUMMARIZE IT

After reading this chapter, identify three things you have learned about stars and galaxies.

____________________________________________________
____________________________________________________
____________________________________________________

Stars and Galaxies  Chapter Wrap-Up

326  Stars and Galaxies