About the Consultant

Douglas Fisher, Ph.D., is a Professor in the Department of Teacher Education at San Diego State University. He is the recipient of an International Reading Association Celebrate Literacy Award as well as a Christa McAuliffe award for Excellence in Teacher Education. He has published numerous articles on reading and literacy, differentiated instruction, and curriculum design as well as books, such as Improving Adolescent Literacy: Strategies at Work and Responsive Curriculum Design in Secondary Schools: Meeting the Diverse Needs of Students. He has taught a variety of courses in SDSU’s teacher-credentialing program as well as graduate-level courses on English language development and literacy. He also has taught classes in English, writing, and literacy development to secondary school students.
# Table of Contents

Note-Taking Tips ........................................... v  
Using Your Science Notebook ......................... vi  

## Chapter 1 The Nature of Science

- **Chapter Preview** ......................... 1  
  - 1-1 ........................................ 2  
  - 1-2 ........................................ 5  
  - 1-3 ........................................ 8  
- **Wrap-Up** ....................................... 12  

## Chapter 2 Science, Technology, and Society

- **Chapter Preview** ......................... 13  
  - 2-1 ........................................ 14  
  - 2-2 ........................................ 17  
  - 2-3 ........................................ 20  
- **Wrap-Up** ....................................... 24  

## Chapter 3 Motion, Acceleration, and Forces

- **Chapter Preview** ......................... 25  
  - 3-1 ........................................ 26  
  - 3-2 ........................................ 29  
  - 3-3 ........................................ 32  
- **Wrap-Up** ....................................... 36  

## Chapter 4 The Laws of Motion

- **Chapter Preview** ......................... 37  
  - 4-1 ........................................ 38  
  - 4-2 ........................................ 41  
  - 4-3 ........................................ 44  
- **Wrap-Up** ....................................... 48  

## Chapter 5 Energy

- **Chapter Preview** ......................... 49  
  - 5-1 ........................................ 50  
  - 5-2 ........................................ 53  
- **Wrap-Up** ....................................... 56  

## Chapter 6 Work and Machines

- **Chapter Preview** ......................... 57  
  - 6-1 ........................................ 58  
  - 6-2 ........................................ 61  
  - 6-3 ........................................ 64  
- **Wrap-Up** ....................................... 68  

## Chapter 7 The Earth-Moon-Sun System

- **Chapter Preview** ......................... 69  
  - 7-1 ........................................ 70  
  - 7-2 ........................................ 73  

- **7-3** ........................................... 76  
- **Wrap-Up** ....................................... 80  

## Chapter 8 The Solar System

- **Chapter Preview** ......................... 81  
  - 8-1 ........................................... 82  
  - 8-2 ........................................... 85  
  - 8-3 ........................................... 88  
  - 8-4 ........................................... 91  
- **Wrap-Up** ....................................... 94  

## Chapter 9 Heat and States of Matter

- **Chapter Preview** ......................... 95  
  - 9-1 ........................................... 96  
  - 9-2 ........................................... 99  
  - 9-3 ........................................... 102  
  - 9-4 ........................................... 105  
- **Wrap-Up** ....................................... 108  

## Chapter 10 Waves

- **Chapter Preview** ......................... 109  
  - 10-1 ........................................ 110  
  - 10-2 ........................................ 113  
  - 10-3 ........................................ 116  
- **Wrap-Up** ....................................... 120  

## Chapter 11 Sound and Light

- **Chapter Preview** ......................... 121  
  - 11-1 ........................................ 122  
  - 11-2 ........................................ 125  
  - 11-3 ........................................ 128  
  - 11-4 ........................................ 131  
- **Wrap-Up** ....................................... 134  

## Chapter 12 Earth’s Internal Processes

- **Chapter Preview** ......................... 135  
  - 12-1 ........................................ 136  
  - 12-2 ........................................ 139  
  - 12-3 ........................................ 142  
  - 12-4 ........................................ 145  
- **Wrap-Up** ....................................... 148  

## Chapter 13 Electricity

- **Chapter Preview** ......................... 149  
  - 13-1 ........................................ 150  
  - 13-2 ........................................ 153  
  - 13-3 ........................................ 156  
- **Wrap-Up** ....................................... 160  

Physical Science with Earth Science
## Table of Contents

**Chapter 14 Magnetism**  
Chapter Preview ................................ 161  
14-1 ........................................... 162  
14-2 ........................................... 165  
14-3 ........................................... 168  
Wrap-Up ....................................... 172

**Chapter 15 Electromagnetic Radiation**  
Chapter Preview ................................ 173  
15-1 ........................................... 174  
15-2 ........................................... 177  
15-3 ........................................... 180  
Wrap-Up ....................................... 184

**Chapter 16 Energy Sources**  
Chapter Preview ................................ 185  
16-1 ........................................... 186  
16-2 ........................................... 189  
16-3 ........................................... 192  
Wrap-Up ....................................... 196

**Chapter 17 Weather and Climate**  
Chapter Preview ................................ 197  
17-1 ........................................... 198  
17-2 ........................................... 201  
17-3 ........................................... 204  
17-4 ........................................... 207  
Wrap-Up ....................................... 210

**Chapter 18 Classification of Matter**  
Chapter Preview ................................ 211  
18-1 ........................................... 212  
18-2 ........................................... 215  
Wrap-Up ....................................... 218

**Chapter 19 Properties of Atoms and the Periodic Table**  
Chapter Preview ................................ 219  
19-1 ........................................... 220  
19-2 ........................................... 223  
19-3 ........................................... 226  
Wrap-Up ....................................... 230

**Chapter 20 Earth Materials**  
Chapter Preview ................................ 231  
20-1 ........................................... 232  
20-2 ........................................... 235  
20-3 ........................................... 238  
20-4 ........................................... 241  
Wrap-Up ....................................... 244

**Chapter 21 Earth’s Changing Surface**  
Chapter Preview ................................ 245  
21-1 ........................................... 246  
21-2 ........................................... 249  
21-3 ........................................... 252  
21-4 ........................................... 255  
Wrap-Up ....................................... 258

**Chapter 22 Chemical Bonds**  
Chapter Preview ................................ 259  
22-1 ........................................... 260  
22-2 ........................................... 263  
22-3 ........................................... 266  
Wrap-Up ....................................... 270

**Chapter 23 Chemical Reactions**  
Chapter Preview ................................ 271  
23-1 ........................................... 272  
23-2 ........................................... 275  
23-3 ........................................... 278  
23-4 ........................................... 281  
Wrap-Up ....................................... 284

**Chapter 24 Solutions, Acids, and Bases**  
Chapter Preview ................................ 285  
24-1 ........................................... 286  
24-2 ........................................... 289  
24-3 ........................................... 292  
24-4 ........................................... 295  
Wrap-Up ....................................... 298

**Chapter 25 Nuclear Changes**  
Chapter Preview ................................ 299  
25-1 ........................................... 300  
25-2 ........................................... 303  
25-3 ........................................... 306  
25-4 ........................................... 309  
Wrap-Up ....................................... 312

**Chapter 26 Stars and Galaxies**  
Chapter Preview ................................ 313  
26-1 ........................................... 314  
26-2 ........................................... 317  
26-3 ........................................... 320  
26-4 ........................................... 323  
Wrap-Up ....................................... 326

**FCAT Vocabulary Glossary** ..................... 327

**Florida Science Academic Vocabulary Glossary** ..................... 329
Note-Taking Tips

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

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

- Write your notes as 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 emphasis 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.
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.

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.

Properties of Atoms and the Periodic Table

Chapter Wrap-Up

How to use 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.

Properties of Atoms and the Periodic Table

<table>
<thead>
<tr>
<th>After You Read</th>
<th>Properties of Atoms and the Periodic Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>An atom is the smallest unit of an element 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></td>
</tr>
<tr>
<td>Quarks are so tiny that they orbit the nucleus with the electrons.</td>
<td></td>
</tr>
<tr>
<td>Isotopes of an element only differ in their number of neutrons.</td>
<td></td>
</tr>
<tr>
<td>An element’s chemical and physical properties may be predicted by its location on the periodic table.</td>
<td></td>
</tr>
</tbody>
</table>

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, tables, 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

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

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

**Benchmarks**—SC.H.1.4.4: The student knows that scientists in any one research group tend to see things alike and that therefore scientific teams are expected to seek out the possible sources of bias in the design of their investigations and in their data analysis. Also covers: SC.H.1.4.1, SC.H.1.4.2, SC.H.1.4.3, SC.H.1.4.5, SC.H.1.4.6, SC.H.1.4.7, SC.H.2.4.1, SC.H.2.4.2

---

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

---

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

---

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

- variable whose value changes 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

---

**Use a dictionary to define survey.**

---

2  *The Nature of Science*
Section 1 The Methods of Science (continued)

**Main Idea**

**What is science?**

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>

**Scientific Methods**

I found this information on page _________.

**Visualizing with Models**

I found this information on page _________.

The Nature of Science 3
Section 1 The Methods of Science (continued)

**Main Idea**

**Scientific Theories and Laws**

I found this information on page __________.

**The Limitations of Science**

I found this information on page __________.

**Using Science—Technology**

I found this information on page __________.

**Details**

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

I found this information on page __________.

**Complete the paragraph about the limitations of science.**

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

Science cannot answer questions about ________ and ________.

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

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

I found this information on page __________.

**CONNECT IT**

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

I found this information on page __________.

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

1. 
2. 
3. 

Define measurement to show its scientific meaning.

Use your book to define the following terms.

- precision
- accuracy
- volume
- mass
- density

Define ratio to show its scientific meaning. Then use it in a sentence as a noun.
Section 2 Standards of Measurement (continued)

Main Idea

Units and Standards
I found this information on page __________.

International System of Units
I found this information on page __________.

Measuring Distance
I found this information on page __________.

Measuring Volume
I found this information on page __________.

Details

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></td>
<td>kilogram</td>
<td>K</td>
</tr>
<tr>
<td></td>
<td>candela</td>
<td>A</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.
Section 2 Standards of Measurement (continued)

Main Idea

Measuring Matter
I found this information on page __________.

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/cm³)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>decimeter (dm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>liter (L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>meter cubed (m³)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kilogram (kg)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

SYNTHESIZE IT

Compare the advantages and disadvantages of converting our system of measurement in the United States from the English system to the International System of units.
The Nature of Science
Section 3  Communicating with Graphs

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.

data

New Vocabulary

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

graph

Academic Vocabulary

Use a dictionary to define the word detect.

detect

A Visual Display
I found this information on page __________.

Distinguish between the three types of graphs described in this section. Draw and label a simple example of each graph.

[Blank spaces for drawings]
Section 3 Communicating with Graphs (continued)

Main Idea

A Visual Display

I found this information on page __________.

Bar Graphs

I found this information on page __________.

Details

Summarize four reasons scientists graph the results of their experiments.

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>

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>maximum class size</td>
<td>5</td>
</tr>
<tr>
<td>y-axis</td>
<td>minimum bar height</td>
<td>minimum class size</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>
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 × 360° = angle of slice°]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>50</td>
<td>0.5 × 360° = 180°</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.

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________
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>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.

Science Journal

List 10 types of technology you have used today.

____________________

____________________

____________________

____________________

____________________

____________________

____________________

____________________

____________________
Scan the section headings, boldface words, and illustrations. Write four facts you discovered as you scanned the section.

1. ____________________________
2. ____________________________
3. ____________________________
4. ____________________________

Define technology to show its scientific meaning.

technology

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

agricultural

biotechnology

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

technique
Section 1 Science and Technology (continued)

Main Idea

Scientific Discovery
*I found this information on page ____________.*

Complete the statement about science.
The study of science usually leads to ________________________

Now write three examples of science.
1. ________________________
2. ________________________
3. ________________________

Scientific Insight
*I found this information on page ____________.*

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>

What is technology?
*I found this information on page ____________.*

Compare and contrast science and technology.

________________________________________

________________________________________

________________________________________

________________________________________

Science, Technology, and Society 15
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. 

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

- **Developing Countries**
- **Industrialized Countries**

**Global Technological Needs**

I found this information on page __________.

**Main Idea**

I found this information on page __________.

**Details**

What is the most important piece of technology you use on a daily basis? Support your choice with an example.

CONNECT IT
Science, Technology, and Society
Section 2 Forces that Shape Technology

Benchmarks—SC.H.3.4.4: The student knows that funds for science research come from various agencies and industries, and that this funding influences areas of discovery.

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

____________________________________________

____________________________________________

New Vocabulary

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

society

Definition: __________________________________________

____________________________________________

Sentence: __________________________________________

____________________________________________

____________________________________________

Academic Vocabulary

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

List three examples of things that are benefits to people.

benefit

____________________________________________

____________________________________________

Examples:

____________________________________________

____________________________________________

____________________________________________
Section 2 Forces that Shape Technology (continued)

Main Idea

Social 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

I found this information on page ___________.

Economic Forces that Shape Technology

I found this information on page ___________.

Summarize how social forces shape technology.

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

Economic Forces that Shape Technology

I found this information on page ___________.

- Social Forces that Shape Technology
- Economic Forces that Shape Technology

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
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>Type of Issue</th>
<th>Description of Issue</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental</td>
<td>how technology affects plants, animals, and ecosystems</td>
<td></td>
</tr>
<tr>
<td>Moral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical</td>
<td>Humane treatment of organisms should occur during scientific investigations</td>
<td></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.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
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

Define system to show its scientific meaning.


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
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.

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:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
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.

---

Science, Technology, and Society
Chapter Wrap-Up
Motion, Acceleration, and Forces

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

Benchmarks—SC.C.1.4.1: The student knows that all motion is relative to whatever frame of reference is chosen and that there is no absolute frame of reference from which to observe all motion.

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

1. 
2. 

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.

canstant
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.

**Main Idea**

**Motion**

I found this information on page ________.

**Details**

**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. __________

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

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 ________.
Section 1 Describing Motion (continued)

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

Analyze It

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

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Benchmarks—SC.C.1.4.2: The student knows that any change in velocity is an 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.

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

**New Vocabulary**

- **velocity**

**Use your book to define the word acceleration.**

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

**Academic Vocabulary**

- **positive**

Use a dictionary to define the word positive. Then write a scientific sentence that includes the word.
Section 2 Acceleration (continued)

**Main Idea**

**Acceleration, Speed, and Velocity**

I found this information on page ___________.

**Details**

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

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

**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.

Name __________________________________________________________________________ Date __________

Motion, Acceleration, and Forces
Analyze why the SI unit of acceleration is m/s².

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

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

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

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

Distinguish between average acceleration and instantaneous acceleration.
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. 

Define vector in a sentence to show its scientific meaning.

vector

Use your book or dictionary to define the following terms.

force

net force

balanced forces

unbalanced forces

Use a dictionary to define survive.

survive
Main Idea

What is force?
The forces acting on the apple in each drawing and how they combine to form the net force.

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
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.

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>
</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>

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 motion, acceleration, and forces.

---

36  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 37
The Laws of Motion
Section 1 The First Two Laws of Motion

Benchmarks—SC.H.1.4.1: The student knows that investigations are conducted to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare different theories. Also covers: SC.C.1.4.2

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 

New Vocabulary 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

Academic Vocabulary Define the term period using a dictionary.

period 

The Laws of Motion
Complete the concept map by defining Newton’s first law of motion.

Newton’s First Law of Motion

states that

net force equals zero

states that

if

if

Inertia and Mass

I found this information on page _________.

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.

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

<table>
<thead>
<tr>
<th>Newton’s Second Law of Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown Variable</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Acceleration</td>
</tr>
<tr>
<td>Net force</td>
</tr>
<tr>
<td>Mass</td>
</tr>
</tbody>
</table>

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

I found this information on page ____________.
The Laws of Motion
Section 2 Gravity

Benchmarks—SC.C.2.4.1: The student knows that acceleration due to gravitational force is proportional to mass and inversely proportional to the square of the distance between the objects. Also covers: SC.C.2.4.4; SC.E.1.4.1; SC.H.1.4.1; SC.H.1.4.3; SC.H.1.4.6; SC.H.1.4.7; SC.H.2.4.1; SC.H.2.4.2; SC.H.3.4.1; SC.H.3.4.6

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.

Review Vocabulary

acceleration

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

gravity

weight

centripetal acceleration

centripetal force

Academic Vocabulary Use the word range in a scientific sentence.

range

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Section 2 Gravity (continued)

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 _________.

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

Gravitational force

- increases if
- decreases if

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

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.

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

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.]
The Laws of Motion
Section 3 The Third Law of Motion

Benchmarks—SC.C.2.4.6: The student explains that all forces come in pairs commonly called action and reaction.
Also covers: SC.E.1.4.1; SC.H.1.4.1-SC.H.1.4.7; SC.H.2.4.1; SC.H.2.4.2

**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.

- third law of motion

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

- **momentum**

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

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

**Main Idea**

**Newton’s Third Law**

I found this information on page ____________.

I found this information on page ____________.

**Details**

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

Predict the corresponding reaction for each action.

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

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

I found this information on page ____________.
Momentum

I found this information on page ___________.

Analyze the property of momentum in words and with an equation. Include units and identify all variables.

Words

Equation

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

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

 CONNECT IT

Use what you know about force and momentum to explain why a baseball player’s position determines the amount of padding in the baseball glove.

Name ____________________________ Date ___________

Section 3 The Third Law of Motion (continued)

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.

46 The Laws of Motion
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</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What I wanted to find out</strong></td>
<td><strong>What I learned</strong></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.

---

48  _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

Benchmarks—SC.B.1.4.1: The student understands how knowledge of energy is fundamental to all the scientific disciplines. Also covers: SC.B.1.4.3, SC.H.1.4.7, SC.H.2.4.2

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

_____________________________________________________________________
_____________________________________________________________________

Define gravity to show its scientific meaning.

gravity
_____________________________________________________________________
_____________________________________________________________________

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

the ability to do work

energy a moving object has because of its motion

the standard unit for measuring energy

energy stored in an object

energy stored by things that stretch or shrink

energy stored in chemical bonds

energy stored in objects because of their position above Earth’s surface

Use a dictionary to define analogy.

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>
</tbody>
</table>

Create an analogy to show how energy is like water.

_________________________________________________________

Kinetic Energy
I found this information on page __________.

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:

_________________________________________________________

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
- \( \frac{1}{2} \text{ mass} \times \text{velocity}^2 \)

**Potential Energy**

I found this information on page ________.

**Main Idea**

**Details**

**ANALYZE IT**

Make an analogy comparing energy and money.

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________
Energy
Section 2 Conservation of Energy

Benchmarks—SC.B.1.4.2: There is conservation of mass and energy when matter is transformed.
Also covers: SC.F.1.4.4, SC.G.1.4.2, SC.H.1.4.1, SC.H.1.4.6, SC.H.1.4.7, SC.H.2.4.2

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

Use your book to define the following key terms.

mechanical energy

law of conservation of energy

Find convert in a dictionary, and then use it as a verb in a scientific sentence.
convert
Sequence four energy transformations, such as those related to fossil fuels.

1. 

2. 

3. 

4. 

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

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

1. 

2. 

3. 

The Law of Conservation of Energy

I found this information on page __________.
Main Idea

**The Law of Conservation of Energy**

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

I found this information on page __________.

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

<table>
<thead>
<tr>
<th>Nuclear Fission</th>
<th>Nuclear Fusion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td></td>
</tr>
</tbody>
</table>

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

I found this information on page __________.

**The Human Body—Balancing the Energy Equation**

I found this information on page __________.

Connect It

Describe an experience where it would have been helpful for you or someone you know to understand how energy can change form.

Name _____________________________ Date ______________
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></td>
<td>• A person does work on a heavy object while holding it up above the ground.</td>
</tr>
<tr>
<td></td>
<td>• Machines are tools for making work easier.</td>
</tr>
<tr>
<td></td>
<td>• A machine is a device that creates energy.</td>
</tr>
<tr>
<td></td>
<td>• A baseball bat can be considered a machine.</td>
</tr>
</tbody>
</table>

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

Science Journal

Diagram a bicycle and identify the parts you think are simple machines.
Skim Section 1 of your text. Write three questions that come to mind from reading the headings and the illustration captions.

1. ____________________________
2. ____________________________
3. ____________________________

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

energy: ____________________________

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

work: ____________________________

power: ____________________________

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

______________________________

______________________________

______________________________

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

transfer: ____________________________

______________________________
### Main Idea

**What is work?**

I found this information on page __________.

### Details

**Create three sketches showing the following situations involving work.**

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

### Work and Energy

I found this information on page __________.

**Complete the concept map relating work and energy.**

- Work (in joules) = \[ W = \text{force} \times \text{distance} \]

### Complete the equation for the calculation of work when force and distance are known.

Work (in joules) = \[ W = \frac{1}{100} \text{newtons} \times \text{meters} \]

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

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

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

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

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

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

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

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

force ____________________________________________

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

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 ____________________________

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

percent ____________________________________________

______________________________________________________

______________________________________________________

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

1. 

2. 

3. 

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

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

**Mechanical Advantage, Efficiency**

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>

I found this information on page __________.

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.

I found this information on page __________.

ANALYZE IT

Suppose that someone claims to have invented a machine with an efficiency greater than 100%. Explain what would have to be true for the person’s claim to be correct.
Work and Machines
Section 3 Simple Machines

Benchmarks—SC.H.3.4.5: The student knows that the value of technology may differ for different people and at different times. Also covers: SC.B.1.4.7, SC.F.1.4.2, SC.H.1.4.1, SC.H.1.4.4, SC.H.3.4.1, SC.H.3.4.5, SC.H.3.4.6

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

1. 
2. 
3. 

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

compound

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

a bar that 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

Define reverse as a verb using a dictionary.
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 _________.

Inclined Planes, the Screw, the Wedge
I found this information on page _________.

Compound Machines
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.

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

Inclined plane ___________________________
Screw ___________________________
Wedge ___________________________

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

SYNTHESIZE IT

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

____________________________________

____________________________________

____________________________________

____________________________________
Tie It Together

Work and Machines

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

![Ideal Machine Diagram]

**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></td>
</tr>
<tr>
<td>18 newtons</td>
<td></td>
<td></td>
<td>2.5 joules</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>12 newtons</td>
<td></td>
<td></td>
<td>7 joules</td>
<td></td>
</tr>
<tr>
<td>1.5 joules</td>
<td></td>
<td></td>
<td>10 newtons</td>
<td></td>
</tr>
<tr>
<td>2 newtons</td>
<td></td>
<td></td>
<td>6 joules</td>
<td></td>
</tr>
<tr>
<td>21 newtons</td>
<td></td>
<td></td>
<td>11 joules</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.)**
Work and Machines  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>Work and Machines</th>
<th>After You Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A person does work on a heavy object while holding it up above the ground.</td>
<td></td>
</tr>
<tr>
<td>• Machines are tools for making work easier.</td>
<td></td>
</tr>
<tr>
<td>• A machine is a device that creates energy.</td>
<td></td>
</tr>
<tr>
<td>• A baseball bat can be considered a machine.</td>
<td></td>
</tr>
</tbody>
</table>

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 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></td>
<td>• Earth’s orbit around the Sun is shaped like an ellipse.</td>
</tr>
<tr>
<td></td>
<td>• Seasons on Earth change partly because Earth is tilted on its axis.</td>
</tr>
<tr>
<td></td>
<td>• Mountains exist on the Moon.</td>
</tr>
<tr>
<td></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.

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________

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

1. 

2. 

3. 

Define orbit to show its scientific meaning.

orbit

Use your book to define each vocabulary term.

sphere

gravity

ellipse

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

physical
Earth’s Size and Shape

I found this information on page __________.

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

1. _____________________________________________________________
   _____________________________________________________________
2. _____________________________________________________________
   _____________________________________________________________
3. _____________________________________________________________
   _____________________________________________________________
4. _____________________________________________________________
   _____________________________________________________________

Earth’s Magnetic Field

I found this information on page __________.

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.
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.
The Earth-Moon-Sun System
Section 2 Time and Seasons

**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.

**New Vocabulary**

Write the vocabulary term that matches each definition.

- **latitude**: twice yearly time at which the Sun reaches its greatest distance north or south of the equator
- **movement of Earth in its orbit around the Sun; used to measure time in years**: twice yearly time when the Sun is directly over Earth’s equator and the number of daylight and nighttime hours are equal worldwide
- **15˚-wide area on Earth’s surface in which the time is the same**: plane that contains Earth’s orbit around the Sun
- **spinning of Earth on its imaginary axis and causes day and night to occur**: 

**Academic Vocabulary**

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

- **intense**: 

---

**Benchmarks—SC.E.1.4.1: The student understands the relationships between events on Earth and the movements of the Earth. Also covers: SC.E.2.4.3**
Main Idea

Measuring Time on Earth

I found this information on page __________.

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></td>
<td>Time is measured in days, which last 24 hours.</td>
</tr>
<tr>
<td>Earth spins 15° in one hour.</td>
<td></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.

I found this information on page __________.
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

Benchmarks—SC.E.1.4.1: The student understands the relationships between events on Earth and the movements of the Earth.

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 lava to show its scientific meaning.

lava

New Vocabulary
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

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

phase

____________________
Section 3 Earth’s Moon (continued)

Main Idea

Movement of the Moon
I found this information on page _________.

How does the Moon affect Earth?
I found this information on page _________.

Moonlight
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.

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

Spring Tide

Neap Tide

The Earth-Moon-Sun System 77
### Main Idea

#### Eclipses
*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>

#### The Moon's Surface
*Distinguish features on the Moon’s surface.*

- **Crater:**
  - 
  - 

- **Maria:**
  - 
  - 

- **Mountains:**
  - 
  - 

#### The Moon's Interior
*Sequence the 4 parts of the Moon’s interior.*

- outermost
- Moon's Interior
- innermost

#### Exploring the Moon
*Summarize results from Clementine and Lunar Prospector.*


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


---

**I found this information on page 78.**
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. 
After reading this chapter, identify three things you have learned about the Earth-Moon-Sun system.

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

Write a hypothesis about whether life exists beyond Earth, or even beyond the solar system. Write how you would test the hypothesis.
The Solar System
Section 1 Planet Motion

Benchmarks—SC.E.1.4.1: The student understands the relationship between events on Earth and the movements of the Earth, its moon, the outer planets, and the sun. Also covers: SC.E.2.4.3, SC.H.1.4.2, SC.H.1.4.5, SC.H.1.4.6, SC.H.2.4.1

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.

Use your book to define the following terms.

geocentric model

heliocentric model

astronomical unit

extrasolar planet

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

Models of the Solar System

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</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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

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

1. 
2. 
3. 

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
Main Idea

Understanding the Solar System

I found this information on page __________.

Details

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.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

CONNECT IT

Describe two ways to classify Mars according to its location.

Name one way to classify Mars that shows it has characteristics similar to Earth’s. Support your responses with details from the section.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
The Solar System
Section 2 The Inner Planets

Benchmarks—SC.E.2.4.6: The student knows the ways in which scientists collect and generate data about our universe.
Also covers: SC.E.1.4.2, SC.H.1.4.1, SC.H.1.4.2, SC.H.1.4.4

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.

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

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 .

Venus and Earth
I found this information on page .

Mars
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: __________________________

Contrast Earth with Venus.

<table>
<thead>
<tr>
<th>Property</th>
<th>Earth</th>
<th>Venus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric temperature 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>

Compare and contrast Mars and Earth in the Venn diagram.

Mars

Both

Earth
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>and 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

Benchmarks—SC.E.2.4.6: The student knows the ways in which scientists collect and generate data about our universe.
Also covers: SC.E.1.4.2, SC.H.1.4.1

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

1. 
2. 
3. 

**Define** space probe to show its scientific meaning.

**New Vocabulary**

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
- smallest planet and ninth from the Sun; has a thin atmosphere and a solid, 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 ________.

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>

Uranus and Neptune

I found this information on page ________.

Compare and contrast Uranus and Neptune. Complete the Venn diagram with at least nine different facts.

Uranus

Both

Neptune
Main Idea

Pluto

I found this information on page __________.

Distinguish **three ways Pluto differs from the other outer planets.**

1. __________________________________________

2. __________________________________________

3. __________________________________________

Comets and Other Objects

I found this information on page __________.

**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>

CONNECT IT

Describe why scientists are puzzled about how to classify Sedna.

___________________________________________

___________________________________________

___________________________________________

___________________________________________
The Solar System
Section 4 Life in the Solar System

Benchmarks—SC.E.1.4.2: The student knows how the characteristics of other planets and satellites are similar to and different from those of the Earth. Also covers: SC.E.1.4.3, SC.E.1.4.2, SC.E.2.4.6, SC.F.2.4.3, SC.H.1.4.5, SC.H.3.4.2

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
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.
Can life exist on other worlds?

I found this information on page ________.

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>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>W</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

Describe things you do to make yourself feel warmer and cooler.
Read the section objectives. Write three questions that come to mind.

1. 
2. 
3. 

Define kinetic energy by using it in a sentence.

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

kinetic theory

thermal energy

heat

specific heat

Look up the word random in a dictionary. Then use the definition to describe the phrase random motion.
Section 1 Temperature and Thermal Energy (continued)

**Main Idea**

**Temperature**

*Compare the motion of hot molecules to cold molecules.*

**Thermal Energy**

*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.

### Actions that Increase Thermal Energy

<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.

**Specific Heat**

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

*I found this information on page __________.*
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. 

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

Benchmarks—SC.A.1.4.3: The student knows that a change from one phase of matter to another involves a gain or loss of energy.

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.


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.
Section 2 States of Matter (continued)

Main Idea

Four States of Matter

I found this information on page ____________.

Details

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

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

**Conduction**

*I found this information on page __________.*

**Convection**

*I found this information on page __________.*

**Radiation**

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

<table>
<thead>
<tr>
<th>Animal</th>
<th>Feature</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antarctic fur seal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emperor penguin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desert spiny lizard</td>
<td></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.

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

CONNECT IT
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

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

Use a dictionary to define the word cycle.

cycle
**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.

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

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.
Main Idea

Moving Thermal Energy

I found this information on page ___________.

Details

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 ___________.

Cold gas absorbs ________ from refrigerator interior, and the gas becomes ___________.

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

The compressor does ________ compressing the gas, which becomes even ___________.

Entropy

I found this information on page ___________.

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

_____________________________________
_____________________________________
_____________________________________
_____________________________________
_____________________________________
_____________________________________

ANALYZE IT

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

_____________________________________
_____________________________________
_____________________________________
_____________________________________
_____________________________________

Heat and States of Matter 107
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 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 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.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Waves
Section 1 The Nature of Waves

Benchmarks—SC.B.1.4.1: The student understands how knowledge of energy is fundamental to all the scientific disciplines (e.g., the energy required for biological processes in living organisms and the energy required for the building, erosion, and rebuilding of the Earth). Also covers: SC.D.1.4.2

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 ______________________________________
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.

---

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Name ____________________________________________ Date ______________

Waves
Section 2 Wave Properties

Benchmarks—SC.H.1.4.1: The student knows that investigations are conducted to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare different theories. Also covers: SC.H.1.4.7

**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

**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
Main Idea

The Parts of a Wave and Wavelength

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

I found this information on page _________.

Frequency and Period

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.

I found this information on page _________.

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

When the frequency of a wave

the wavelength of the wave

increases,
Section 2 Wave Properties (continued)

Main Idea

Wave Speed

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

\[ v = f \times \lambda \]

\[ v = \text{______} \times \text{______} \]

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

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.

Amplitude and Energy

I found this information on page __________.

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

Connect It

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

New Vocabulary  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

a wave pattern that forms when waves of equal wavelength and amplitude but traveling in opposite directions continually interfere with each other

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.

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.

<table>
<thead>
<tr>
<th>Similarity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference</td>
<td></td>
</tr>
</tbody>
</table>
**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>Cause:</td>
<td>Cause:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Result:</td>
<td>Result:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Summarize what causes a standing wave to form.

______________________________

______________________________

Analyze why an opera singer singing a high note into a microphone can cause a nearby 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.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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>K What I know</th>
<th>W 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.*

---

Name ___________________________ Date ______________
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. __________________________________________________________________________

Define vibration in a sentence that shows its scientific meaning.

vibration

Define the following key terms.

intensity

loudness

decibel

pitch

Doppler effect

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

expand
Main Idea

Sound Waves
I found this information on page __________.

Details

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.

Name __________________________ Date __________________________

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
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
ratio of the speed of light in a vacuum to the speed of light in a material

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 ________.

Reflection of Light
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: ___________________________________________

Translucent: _________________________________________
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.

_____________________________________________________
_____________________________________________________
_____________________________________________________
_____________________________________________________
_____________________________________________________
_____________________________________________________
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.
Benchmarks—SC.F.1.4.6: The student knows that separate parts of the body communicate with each other using electrical and/or chemical signals.

**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.

**New Vocabulary** 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

**Academic Vocabulary** Use a dictionary to define the term source as a noun.

128  Sound and Light
Section 3 Mirrors, Lenses, and the Eye (continued)

Main Idea

Mirrors
I found this information on page _________.

Details

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>
Section 3 Mirrors, Lenses, and the Eye (continued)

**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.

<table>
<thead>
<tr>
<th>Convex Lens</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concave Lens</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**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
Sound and Light
Section 4  Light and Color

Benchmarks—SC.F.1.4.2: The student knows that body structures are uniquely designed and adapted for their function. Also covers: SC.F.1.4.6

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

1. 
2. 
3. 

**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
Complete the graphic organizer about white and black objects.

| A white object | reflected all __________________ of light back to your eyes. |
| A black object | reflected all colors of light and reflects little or no light back to your eyes. |

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.

<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 __________________.
Seeing Color
I found this information on page ___________.

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.

A B C

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

Review

Use this checklist to help you study.

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

SUMMARIZE IT

After reading this chapter, identify three things you have learned about sound and light.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

134  Sound and Light
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>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>

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

Benchmarks—SC.D.1.4.2: The student knows that the solid crust of Earth consists of slow-moving, separate plates. Also covers: SC.A.1.4.1, SC.H.1.4.1, SC.H.1.4.2, SC.H.1.4.3, SC.H.1.4.6, SC.H.2.4.1

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

1. ____________________________

2. ____________________________

3. ____________________________

Define hypothesis to show its scientific meaning.

hypothesis __________________________

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

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

theory __________________________

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Section 1 Evolution of Earth’s Crust (continued)

**Main Idea**

**Continental Drift**

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

1. 

2. 

3. 

**Seafloor Spreading Hypothesis**

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

Identify four factors that affect plate movement.  
1. _____________________  3. _____________________  
2. _____________________  4. _____________________

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

infer
Describe the distribution of earthquakes on Earth.

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 ________________.

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.

1. ________________
2. ________________
3. ________________
4. ________________

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.

**Earthquake Waves**

I found this information on page ________.

**Earthquake Measurement**

I found this information on page ________.

**Compare and contrast the 2 main types of earthquake waves by completing the table.**

<table>
<thead>
<tr>
<th>Body Waves</th>
<th>Types/Descriptions:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surface Waves</th>
<th>Where they travel:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

**Compare and contrast the two ways to measure earthquakes.**

**Earthquake Measurement Scales**

- __________ , or ground shaking and damage it causes
- magnitude, or the __________ released during an earthquake

**Synthesize It**

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 ___________.

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

Earthquake Observations
I found this information on page ___________.

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.

I found this information on page ___________.

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

The refraction of ________________ as the waves pass through ________________ proves that the ________________ is more dense than the ________________. The inner core consists of solid ________________, whereas the outer core is made of ________________.

The reason that the inner core is solid is because ________________

Earth’s Internal Processes  143
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.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Earth’s Internal Processes
Section 4 Volcanoes

Benchmarks—SC.A.1.4.2: The student knows that the diversity of the properties of materials is due to variations in forces that hold molecules together. Also covers: SC.A.1.4.3, SC.D.1.4.2

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
   ________________________________________________________________
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>Liquids</td>
<td></td>
</tr>
<tr>
<td>Gases</td>
<td></td>
</tr>
</tbody>
</table>
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.

**Main Idea**

**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 ________.

**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
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.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

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

Benchmarks—SC.C.2.4.2: The student knows that electrical forces exist between any two charged objects.
Also covers: SC.C.2.4.5, SC.H.1.4.1, SC.H.1.4.7

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

1.  
2.  
3.  

**Review Vocabulary**

Describe the structure of an atom.

- atom

**New Vocabulary**

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

- a material in which electrons are able to move easily
- 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.

Name ___________________________ Date ________________
Section 1 Electric Charge (continued)

Main Idea

Positive and Negative Charge

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

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

Main Idea

Charging Objects

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.

Detecting Electric Charge

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.
Electricity
Section 2 Electric Current

Benchmarks—SC.H.1.4.1: The student knows that investigations are conducted to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare different theories. Also covers: SC.H.1.4.7, SC.H.2.4.1

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. __________________________________________

Review Vocabulary Use the term pressure in a scientific sentence.
pressure

New Vocabulary Define the following key terms.
electric current
voltage difference
circuit
resistance
Ohm’s law

Academic Vocabulary Use a dictionary to define terminate.
terminate
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 ________.

Summarize the source of resistance in a material.

I found this information on page ________.

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>Resistance</td>
</tr>
<tr>
<td>Resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage difference</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SYNTHESIZE IT

Electricians use different thickness of copper wire when they create the electrical circuits in a home. Use your knowledge of resistance to explain why an electrician would choose a thicker wire for a circuit that will provide power to a high-current appliance.
Electricity
Section 3 Electrical Energy

Predict Read the title of Section 3. 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.
series circuit

parallel circuit
electrical power

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

_______________________________________________________

_______________________________________________________

_______________________________________________________

_______________________________________________________
Tie It Together

Electricity

Use your knowledge of electricity to become an “Electrical Detective.”
Draw a wiring diagram of a room in your house, and imagine that a problem has occurred. One of the appliances has suddenly stopped working, and it is your job to figure out why. Describe the steps you might take to analyze the problem and list several possible causes and solutions. 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>
</tr>
</thead>
<tbody>
<tr>
<td>• Electrical forces act at a distance.</td>
<td></td>
</tr>
<tr>
<td>• Electric charges can be created and destroyed.</td>
<td></td>
</tr>
<tr>
<td>• All circuits contain electrical resistance.</td>
<td></td>
</tr>
<tr>
<td>• Electricity can flow only through an open circuit.</td>
<td></td>
</tr>
</tbody>
</table>

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 that will help you make better decisions about electricity use.

________________________________________

________________________________________

________________________________________

________________________________________

160 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>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.

List three things you know about magnets.

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

1. 
2. 
3. 

Define electric field to show its scientific meaning.

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

Main Idea

Magnets

I found this information on page 163.

Details

Organize important facts about magnets by completing the outline.

Magnets

A. Magnetic force
   1. 
   2. 
   3. 

B. Magnetic field
   1. 
   2. 
   3. 

C. Magnetic poles
   1. 
   2. 
   3. 
   4. Interaction of two magnets
      a. 
      b. 

D. Compass
   1. 
   2. 
   3. 

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

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Section 1 Magnetism (continued)

**Main Idea**

**Magnetic Materials**

Classify each metal as magnetic or nonmagnetic.
- aluminum
- cobalt
- copper
- gold
- iron
- mercury
- nickel
- silver

**Details**

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

- normal state
- rod is brought near magnet
- magnet is removed

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

**CONNECT IT** 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

Sunshine State Standards: SC.C.2.4: The student understands that the types of force that act on an object and the effect of that force can be described, measured, and predicted.

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.

electric current

electromagnet

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

solenoid

galvanometer

electric motor

Use temporary in a sentence that shows its scientific meaning.

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

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

amount  current  direction  electromagnet
magnetic field  repels  reproduces  voltage

The CD player produces a ____________.

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

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

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

The electromagnet attracts or ____________ the permanent magnet.

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

**Main Idea**

**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.

__________________________

__________________________

__________________________

__________________________

__________________________

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

1. ______________________

   ______________________

   ______________________

2. ______________________

   ______________________

   ______________________

3. ______________________

   ______________________

   ______________________

**Synthesize It**

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

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________
Magnetism
Section 3 Producing Electric Current

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.

voltage difference

Use your book to define the following vocabulary terms.

emagnetic
induction

generator

turbine

direct current (DC)

alternating current (AC)

transformer

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

regulate
Section 3 Producing Electric Current (continued)

Main Idea

From Mechanical to Electrical Energy

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

Details

Direct and Alternating Currents

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.

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

Magnetism

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

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________
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.

Science Journal

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

Section 1 What are electromagnetic waves?

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

1. 

2. 

3. 

4. 

Define hertz.

hertz

New Vocabulary

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.
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.

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

1. The changing electric field

2.

3.
Section 1 What are electromagnetic waves? (continued)

Main Idea

Properties of Electromagnetic Waves

I found this information on page _________.

Details

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

Waves and Particles

I found this information on page _________.

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**

Benchmarks—SC.H.3.4.5: The student knows that the value of a technology may differ for different people and at different times. Also covers: SC.H.1.4.1, SC.H.1.4.4, SC.H.1.4.7, SC.H.3.4.1, SC.H.3.4.2, SC.H.3.4.6

**Review Vocabulary**

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

**spectrum**

**New Vocabulary**

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

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

**Academic Vocabulary**

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

**internal**

---

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

1. __________________________
2. __________________________
Main Idea

A Range of Frequencies

I found this information on page __________.

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

I found this information on page __________.

Details

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>
Compare the advantages and disadvantages to humans of ultraviolet waves by filling in the blanks in the following graphic organizer.

**Main Idea**

**Ultraviolet Waves**

I found this information on page ________.

**Details**

**Ultraviolet Waves**

I found this information on page ________.

**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.
**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>modulate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**New Vocabulary**

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

<table>
<thead>
<tr>
<th>carrier wave</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>cathode-ray tube</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Global Positioning System (GPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Academic Vocabulary**

**Use a dictionary to define transmit.**

<table>
<thead>
<tr>
<th>transmit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
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**

**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 ________ waves.

FM radio stations broadcast information by ________ waves.

**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.
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>not linked to the base</td>
</tr>
<tr>
<td>Pager</td>
<td></td>
<td></td>
<td>tower needed</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.

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
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.

---

Name ________________________________  Date __________

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
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.
Before You Read

Before you read the chapter, respond to these statements.

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

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

**Foldables Study Organizer**

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

**Science Journal**

Describe how your day would be different if the electric power were off all day.
Energy Sources
Section 1 Fossil Fuels

Benchmarks—SC.B.1.4.5: The student knows that each source of energy presents advantages and disadvantages to its use in society. Also covers: SC.H.3.4.5, SC.H.3.4.6

**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

**Use a dictionary to define** generate.

__________

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

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

Making Fossil Fuels

I found this information on page ___________.

Details

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

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 ___________.

Petroleum

I found this information on page ___________.

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

- crude oil
- hydrocarbons with high boiling points
- hydrocarbons with low boiling points
Complete the paragraphs below.

Because fossil fuels are ____________, their supply is ______. As the human population grows and ____________ demands ____________, reserves are ____________. This means that ____________ the remaining supplies is extremely important.

In addition to being limited, fossil fuels cause air ____________ in the form of ____________, ____________, and ____________.

Natural gas contains more ____________, and burns more cleanly than other ____________. ____________ is mainly used in ____________ to _____________. When the fuel is ____________, chemical energy is converted to _____________.

This energy heats water, which changes to ____________ and turns a ____________ connected to a ____________, producing ____________.

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

Summarize It

Use the diagram to summarize the types and uses of fossil fuels.

Three types of fossil fuels

[Diagram with branches labeled as Three types of fossil fuels and a question: are used for]
Energy Sources
Section 2 Nuclear Energy

Benchmarks—SC.B.1.4.5: The student knows that each source of energy presents advantages and disadvantages to its use in society (e.g., political and economic implications may determine a society’s selection of renewable or nonrenewable energy sources). Also covers: SC.H.3.4.6

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
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.
Section 2 Nuclear Energy (continued)

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
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.

<table>
<thead>
<tr>
<th>Vocabulary</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>radiant energy</td>
<td>____________________________</td>
</tr>
</tbody>
</table>

Use your book to define the following key terms.

- renewable resource: ____________________________
- photovoltaic cell: ____________________________
- hydroelectricity: ____________________________
- geothermal energy: ____________________________
- biomass: ____________________________

Use a dictionary to define migrate.

<table>
<thead>
<tr>
<th>Vocabulary</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>migrate</td>
<td>____________________________</td>
</tr>
</tbody>
</table>
Section 3 Renewable Energy Sources (continued)

---

**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.

---

**Energy from the Sun**
*I found this information on page __________.*

---

**Energy from Water**
*I found this information on page __________.*

---

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

Identify three other alternative fuels.

Alternative Fuels

ANALYZE IT

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

________________________________________________________________________

________________________________________________________________________

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

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

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

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

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Weather and Climate

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

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

Science Journal

Construct the Foldable as directed at the beginning of this chapter.
Weather and Climate
Section 1 Earth’s Atmosphere

Benchmarks—SC.D.1.4.4: The student knows that Earth’s systems and organisms are the result of long, continuous change over time. Also covers: SC.A.1.4.4, SC.B.1.4.1, SC.G.1.4.3

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

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

latent heat

temperature inversion

troposphere

greenhouse effect

New Vocabulary

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 ____________.

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%

Atmospheric Structure
I found this information on page ____________.

Organize information about the layers of the atmosphere.

Stratosphere: ________________________________

Troposphere: ________________________________

Heating the Atmosphere
I found this information on page ____________.

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

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

A Varied Surface
I found this information on page ____________.

Water in the Atmosphere
I found this information on page ____________.

Global Water Cycle
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 _______________. When the air temperature reaches its ______________, condensation can occur. Water droplets or ice crystals begin to form on small ______________. If the droplets or ice crystals grow large, ______________ may occur.

Model the water cycle in the space below.

Synthesize It

Write a short explanation of how people affect the water cycle.

Weather and Climate
Weather and Climate
Section 2 Weather

Benchmarks—SC.D.1.4.1: The student knows how climatic patterns on Earth result from an interplay of many factors.

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

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

Define gradient to show its scientific meaning.

gradient

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

westerlies

jet stream

subtropical high

weather front

Use a dictionary to define the term source.

source
Complete the statements about air pressure.

The _______________ exerts pressure on objects within it.

Air pressure is caused by ____________________________
_________________________. Air pressure _______________
with altitude because the _______________ of air molecules
_____________________

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.
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.

**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. __________________  3. __________________
2. __________________  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.
Weather and Climate

Section 3 Climate

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.

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

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

_________ 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 ___________.

I found this information on page ___________.

I found this information on page ___________.
Section 3 Climate (continued)

Main Idea

What causes climate?

I found this information on page _________.

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. Also, air ___________ tends to retain heat. 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.

<table>
<thead>
<tr>
<th>Summarize It</th>
</tr>
</thead>
</table>

Weather and Climate
Weather and Climate
Section 4 Earth’s Changing Climates

Benchmarks—SC.D.1.4.3: The student knows that changes in Earth’s climate, geological activity, and life forms may be traced and compared. Also covers: SC.D.1.4.1, SC.D.1.4.4, SC.E.1.4.1, SC.H.1.4.1, SC.H.1.4.4, SC.H.2.4.1, SC.H.3.4.3, SC.H.3.4.6

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.

trace

New Vocabulary

Use your book to define the following terms.

global warming

El Niño

La Niña

Use a dictionary to define the term link. Then explain how the term applies to the ocean and the atmosphere.

link
**Main Idea**

<table>
<thead>
<tr>
<th><strong>Seasonal Changes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I found this information on page __________.</td>
</tr>
</tbody>
</table>

**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 __________. In the mid-latitudes, seasonal changes are __________ because of the temperature contrast between the __________ and __________.

**Long-term Changes**

I found this information on page __________.

**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>

**The Human Factor**

I found this information on page __________.

**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>

**El Niño and La Niña**
*I found this information on page ________.*

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

**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.
2. Write a D if you disagree with the statement.

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

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

210  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.
Benchmarks—SC.A.2.4.2: The student knows the difference between an element, a molecule, and a compound.

Classification of Matter
Section 1 Composition of Matter

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.

- 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.

error
**Main Idea**

**Pure Substances**
*Classify each substance as an element or a compound.*

<table>
<thead>
<tr>
<th>Elements</th>
<th>Compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>calcium</td>
<td>chalk</td>
</tr>
<tr>
<td>carbon</td>
<td>graphite</td>
</tr>
<tr>
<td>carbon dioxide</td>
<td>sugar</td>
</tr>
<tr>
<td>hydrogen</td>
<td>salt</td>
</tr>
<tr>
<td>mercury</td>
<td>sodium</td>
</tr>
<tr>
<td>zinc</td>
<td>water</td>
</tr>
</tbody>
</table>

**Mixtures**
*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: 

* I found this information on page _________.

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Section 1 Composition of Matter (continued)

Main Idea

Mixtures
I found this information on page ____________.

Details

Sequence the types of mixtures according to particle size.

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

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.

__________________________

__________________________

SYNTHESIZE IT

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

<table>
<thead>
<tr>
<th></th>
<th>colloids</th>
<th>suspensions</th>
<th>solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>herbed salad dressing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>paint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>milk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>perfume</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pulp  orange juice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>smoke</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vinegar</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Skim Section 2 of your book. Write three questions that come to mind from reading the headings and the illustration captions.

1. ______________________________________________________
2. ______________________________________________________
3. ______________________________________________________

Use the phrase state of matter in a sentence.

state of matter

________________________________________________________

________________________________________________________

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

__________________________ a 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

________________________________________________________

________________________________________________________

Benchmarks—SC.B.1.4.2: The student understands that there is conservation of mass and energy when matter is transformed. Also covers: SC.D.1.4.4
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.
Weathering—Chemical or Physical Change?

I found this information on page __________.

The Conservation of Mass

I found this information on page __________.

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

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

CONNECT IT

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

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Classification of Matter
Chapter Wrap-Up

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

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

Review

Use this checklist to help you study.

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

SUMMARIZE IT

After reading this chapter, 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>• An atom is the smallest unit of an element 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></td>
</tr>
<tr>
<td>• Quarks are so tiny that they orbit the nucleus with the electrons.</td>
<td></td>
</tr>
<tr>
<td>• Isotopes of an element only differ in their number of neutrons.</td>
<td></td>
</tr>
<tr>
<td>• An element’s chemical and physical properties may be predicted by its location on the periodic table.</td>
<td></td>
</tr>
</tbody>
</table>

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

Science Journal

Write a few sentences telling what you know about atoms.

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________
Properties of Atoms and the Periodic Table

Section 1 Structure of the Atom

Benchmarks—SC.E.2.4.6: The student knows the various ways in which scientists collect and generate data about our universe (e.g., X-ray telescopes, computer simulations of gravitational systems, nuclear reactions, space probes, and supercollider simulations). Also covers: SC.H.1.4.2, SC.H.1.4.3

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

neutral

Use a dictionary to define neutral.
Throughout the atom:

- The nucleus contains protons and neutrons.
- Electrons are found in shells around the nucleus.
- The number of protons determines the element.
- The number of neutrons can vary, giving rise to isotopes.

**Table: Elements and Symbols**

<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>

**Diagram:**

- Protons and neutrons form the nucleus.
- Electrons orbit the nucleus in shells.
- The number of protons equals the number of electrons in a neutral atom.
- Isotopes are atoms with the same number of protons but different numbers of neutrons.
Section 1 Structure of the Atom (continued)

Main Idea

Quarks: Even Smaller Particles

I found this information on page _________.

Details

Summarize key ideas about quarks.

<table>
<thead>
<tr>
<th>Theories about Quarks</th>
<th>Finding Quarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detecting Quarks</td>
<td>Sixth Quark</td>
</tr>
</tbody>
</table>

Models—Tools for Scientists

I found this information on page _________.

Create a time line of the changes that have occurred in modeling the atomic structure since the 1800s. Sketch and label each model.

Dalton

Rutherford

Thomson

Bohr

Electron Cloud

222  Properties of Atoms and the Periodic Table
Properties of Atoms and the Periodic Table

Section 2 Masses of Atoms

Benchmarks—SC.D.1.4.3: The student knows that changes in Earth’s climate, geological activity, and life forms may be traced and compared.

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.

mass

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

atomic number

mass number

isotope

average atomic mass

Use a dictionary to find the scientific meaning of define.

define
Section 2 Masses of Atoms (continued)

Main Idea

Atomic Mass

I found this information on page ________.

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. ____________________________
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.
Properties of Atoms and the Periodic Table

Section 3 The Periodic Table

Benchmarks—SC.A.2.4.1: The student knows that the number and configuration of electrons will equal the number of protons in an electrically neutral atom and when an atom gains or loses electrons, the charge is unbalanced. Also covers: SC.A.1.4.1, SC.A.1.4.5, SC.A.2.4.5

Skim Section 3 and write three questions based on your brief preview.

1. ____________________________________________
   ____________________________________________

2. ____________________________________________
   ____________________________________________

3. ____________________________________________
   ____________________________________________

Define chemical property to show its scientific meaning.

chemical property

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

periodic table

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

similar
Main Idea

Organizing the Elements

I found this information on page _________.

Details

Compare Mendeleev’s early periodic table to that of today by completing the Venn diagram.

Mendeleev

Today (Moseley)

Both

The Atom and the Periodic Table

I found this information on page _________.

Sequence the energy levels in the electron cloud diagram and write the maximum number of electrons that can be contained in each level.

- 
- 
- 
- 
- 

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Section 3 The Periodic Table (continued)

**Main Idea**

The Atom and the Periodic Table

I found this information on page ________.

**Details**

**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.

---

**Synthesize It**

Write a paragraph showing the relationship between chemistry and physics based on what you’ve learned from the periodic table.

---

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
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>
<tr>
<td>• An atom is the smallest unit of an element 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></td>
</tr>
<tr>
<td>• Quarks are so tiny that they orbit the nucleus with the electrons.</td>
<td></td>
</tr>
<tr>
<td>• Isotopes of an element only differ in their number of neutrons.</td>
<td></td>
</tr>
<tr>
<td>• An element’s chemical and physical properties may be predicted by its location on the periodic table.</td>
<td></td>
</tr>
</tbody>
</table>

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 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.

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

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

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Earth Materials
Section 1 Minerals

Benchmarks—SC.A.1.4.2: The student knows that the vast diversity of the properties of materials is primarily due to variations in the forces that hold molecules together. Also covers: SC.A.1.4.4, SC.A.1.4.5, SC.A.2.4.2, SC.H.2.4.2, SC.H.3.4.1, SC.H.3.4.5

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.

Write the correct vocabulary word next to each definition.
Section 1 Minerals (continued)

Main Idea

Common Elements
I found this information on page __________.

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

Details

Major Elements in Earth’s Crust

Oxygen: __ __ __ __ %

Sodium: ___ %

Potassium: ___ %

Magnesium: ____ %

All others: ____ __ __ %

What’s a mineral?
I found this information on page __________.

Complete the concept map about characteristics of minerals.

Minerals

inorganic

Physical Properties
I found this information on page __________.

Identify six physical properties of minerals.

1. _____________________________ 4. _____________________________
2. _____________________________ 5. _____________________________
3. _____________________________ 6. _____________________________

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Section 1 Minerals (continued)

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

Benchmarks—SC.A.1.4.3: The student knows that a change from one phase of matter to another involves a gain or loss of energy.

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

Define mixture to show its scientific meaning.
mixture

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

texture

intrusive igneous rock

extrusive igneous rock

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

**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.

__________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________
Earth Materials
Section 3 Sedimentary Rocks

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

1. _________________________________________________________________________
2. _________________________________________________________________________
3. _________________________________________________________________________

Define precipitate to show its scientific meaning.

precipitate _________________________________________________________________________

Use each vocabulary term in a scientific sentence.

clast ____________________________________________________________________________

porosity __________________________________________________________________________

cementation _________________________________________________________________________

Use a dictionary to define aggregate as a noun.

aggregate _________________________________________________________________________
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>
Main Idea

Chemical Sedimentary Rocks

I found this information on page ___________.

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

I found this information on page ___________.

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.

Name ___________________________ Date __________

Section 3 Sedimentary Rocks (continued)

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.

Section 3 Sedimentary Rocks (continued)

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.

Section 3 Sedimentary Rocks (continued)

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.

Section 3 Sedimentary Rocks (continued)

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.
Earth Materials
Section 4 Metamorphic Rocks and the Rock Cycle

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.

<table>
<thead>
<tr>
<th>Metamorphic Rock Formation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Metamorphism</strong></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
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>
</tr>
<tr>
<td>• The composition of magma changes as minerals crystallize from it.</td>
<td></td>
</tr>
<tr>
<td>• Metamorphic rocks can form within a few years.</td>
<td></td>
</tr>
<tr>
<td>• Some Earth processes, such as weathering, destroy matter and reduce the mass of Earth.</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 materials.

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

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

*Foldables* Study Organizer

*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.*

---

*Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.*
Earth’s Changing Surface
Section 1 Weathering and Soil

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. 

Review Vocabulary

Use the term sediment in a scientific sentence.

sediment

New Vocabulary

Define the following terms to show their scientific meaning.

weathering

soil

Academic Vocabulary

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

expand
Section 1 Weathering and Soil (continued)

Main Idea

Weathering

I found this information on page _________.

Mechanical Weathering and Chemical Weathering

I found this information on page _________.

Details

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

Factors that Affect Weathering

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

- weakens rock
- releases ions into water solution
- does not affect composition of rock
- increases surface area of rock being weathered
- forms new minerals

Mechanical

Both

Chemical
Section 1 Weathering and Soil (continued)

**Main Idea**

**Soil**

*Summarize characteristics of soil horizons below.*

- O Horizon
- A Horizon
- E Horizon
- B Horizon
- C Horizon
- R Horizon

**Soil Conservation**

*Complete the graphic organizer about soil conservation.*

Soil conservation includes

**SYNTHESIZE IT**

Describe the relationship between weathering and soil.
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 ____________________________
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.

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.
Section 2  Shaping the Landscape (continued)

**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 T₁. Then draw the position of the dune at two times in the future (T₂ and T₃).

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
## Earth’s Changing Surface
### Section 3  Groundwater

Benchmarks—SC.D.1.4: The student recognizes that processes in the lithosphere, atmosphere, hydrosphere, and biosphere interact to shape the Earth. Also covers: SC.A.2.4

**Scan** the illustrations in this section. Write three things that you learned about water or groundwater.

1. ______________________________________________________________________
2. ______________________________________________________________________
3. ______________________________________________________________________

**Review Vocabulary**

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

<table>
<thead>
<tr>
<th>porosity</th>
</tr>
</thead>
<tbody>
<tr>
<td>______________________________________________________________________</td>
</tr>
</tbody>
</table>

**New Vocabulary**

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

| infiltration |
| ______________________________________________________________________ |
| ______________________________________________________________________ |
| ______________________________________________________________________ |

| water table |
| ______________________________________________________________________ |
| ______________________________________________________________________ |
| ______________________________________________________________________ |

| aquifer |
| ______________________________________________________________________ |
| ______________________________________________________________________ |
| ______________________________________________________________________ |

| permeability |
| ______________________________________________________________________ |
| ______________________________________________________________________ |
| ______________________________________________________________________ |

**Academic Vocabulary**

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 __________.

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>springs</td>
<td></td>
</tr>
<tr>
<td>wells</td>
<td></td>
</tr>
</tbody>
</table>

Details

Summarize how groundwater is obtained *by completing the chart.*

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.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></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>

I found this information on page __________.
Earth’s Changing Surface
Section 4 Geologic Time

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**

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

<table>
<thead>
<tr>
<th>Everyday Examples of Relative Ages and Absolute Ages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative ages</strong></td>
</tr>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<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.

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

<table>
<thead>
<tr>
<th>Longest unit</th>
<th></th>
<th></th>
<th></th>
<th>Shortest unit</th>
</tr>
</thead>
</table>

### Details

**Fossils**

I found this information on page ___________.

---

Name _______________________________ Date ________________

Section 4 Geologic Time (continued)
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.

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.

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.

---

Section 1 Stability in Bonding (continued)

Main Idea

Combined Elements
I found this information on page ________.

Formulas
I found this information on page ________.

Atomic Stability
I found this information on page ________.
Main Idea

Atomic Stability

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

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.
Chemical Bonds
Section 2 Types of Bonds

Benchmarks—SC.A.1.4.1: The student knows that the electron configuration in atoms determines how a substance reacts and how much energy is involved in its reactions. Also covers: SC.A.1.4.2; SC.A.1.4.5; SC.A.2.4.1; SC.A.2.4.5

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.
Section 2 Types of Bonds (continued)

**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 _____________.
5. The symbol for a positive potassium ion is _____________.

Compare ionic and covalent bonds in the Venn diagram below with at least eight facts.

I found this information on page _________.

---

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

I found this information on page _________.

---

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Section 2 Types of Bonds (continued)

Main Idea

Details

SUMMARIZE IT Write two key facts in each of the boxes below.

**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. 

**Chemical Bonds**
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.

anion

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

binary compound

oxidation number

polyatomic ion

hydrate

Use a dictionary to define negate.

negate
Section 3 Writing Formulas and Naming Compounds (continued)

**Main Idea**

**Binary Ionic Compounds**

I found this information on page __________.

**Details**

**Complete** the table below for sodium and chlorine. Use the periodic table in your book.

<table>
<thead>
<tr>
<th>Element</th>
<th>Oxidation Number</th>
<th>Positive or Negative Charge?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Define** what an oxidation number of $1^+$ means.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

**Summarize** the three steps in writing a formula for an ionic compound by completing the graphic organizer below.

1. _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________

2. _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________

3. _______________________________________________________________________
   _______________________________________________________________________
Organize the steps for finding the formula for ammonium sulfate by completing the questions and answers below. Look at the Polyatomic Ions table in your book for help.

Question: What is the positive ion and its charge?
Answer: ________________________________

Question: What is the negative ion and its charge?
Answer: ________________________________

Question: Balance the charges to make the compound neutral.
Answer: ________________________________

The formula is: ________________________________

Summarize the information about hydrates by filling in the blanks below.

Some ionic compounds have ________________ as part of their structure. A __________ has water ________________ ________________ and written into its ________________.
The __________ can be removed from the hydrate crystals by __________ them. The form of the compound without water is described as __________. The formula CaSO₄ • 2H₂O is named ________________, whose common name is gypsum. The __________ form (without water), __________ is the common powder known as plaster of paris.
Section 3 Writing Formulas and Naming Compounds (continued)

**Main Idea**

**Naming Binary Covalent Bonds**

I found this information on page ________.

**Details**

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

**CONNECT IT**

Think of three common chemical compounds people use every day. Based on the rules listed throughout this section, write out the chemical formulas and chemical names of each one.

__________

__________

__________

__________

__________

__________
Chemical Bonds Chapter Wrap-Up

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

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 learned about chemical bonds.
Chemical Reactions

Before You Read

Before you read the chapter, respond to these statements.

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

<table>
<thead>
<tr>
<th>Before You Read</th>
<th>Chemical 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.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
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

Use your book to define the following key terms.

chemical reaction

reactant

product

chemical equation

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

component
Identify the reactants and the products in the following chemical equations.

<table>
<thead>
<tr>
<th>Chemical Equation</th>
<th>Reactants</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zn + S → ZnS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AgNO₃ + NaCl → AgCl + NaNO₃</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C₁₂H₂₂O₁₁ → 12C + 11H₂O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fe + CuSO₄ → FeSO₄ + Cu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CaCO₃ + 2HCl → H₂O + CO₂ + CaCl₂</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Writing Equations
I found this information on page _________.

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.

\[ 2Mg + ____ \rightarrow 2MgO + \text{light} \]

Magnesium ______ oxygen ______ magnesium oxide and ________.

Evaluate how students balanced the equation.

\[ \text{Mg}_2 + O_2 \rightarrow \text{MgO}_2 \]

<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></td>
<td>This would mathematically balance the equation, but you cannot really cut the molecule in half and then combine it.</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.
Chemical Reactions
Section 2 Chemical Equations

Benchmarks—SC.A.1.4: The student understands that all matter has observable, measurable properties.
Also covers: SC.B.1.4

Scan Section 2 of your book, using the checklist below.

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

Write two questions about what you would like to learn.

1. _______________________________________________________________________
2. _______________________________________________________________________

Define subscript. Write a chemical formula that has a subscript and draw an arrow pointing to the subscript.

subscript

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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

balanced chemical equation

________________________________________________________________________
________________________________________________________________________

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

formula

________________________________________________________________________
________________________________________________________________________
Balancing Equations

I found this information on page ________.

**Main Idea**

**Balanced Equations**

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**

*I found this information on page __________.*

### Details

**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. 

3. 

4. 

---

**Identify coefficients that balance each equation.**

1. 

2. 

3. 

4. 

5. 

6. 

---

**CONNECT IT**

Analyze how chemical equations and mathematical equations are similar. Provide an example to illustrate your point.

---

Name ___________________________  Date __________________

Section 2 Chemical Equations (continued)

---

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Chemical Reactions
Section 3  Classifying Chemical Reactions

Benchmarks—SC.A.1.4: The student understands that all matter has observable, measurable properties.
Also covers: SC.B.1.4

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

1. _____________________________________________________________
   _____________________________________________________________

2. _____________________________________________________________
   _____________________________________________________________

Review Vocabulary

Define states of matter to show its scientific meaning.

states of matter

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

New Vocabulary

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

accumulate

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.
Types of Reactions

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: ____________________________

Describe each type of chemical reaction in words. Give the general form if it exists and an example for each.
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 2LiBr + Pb(NO₃)₂ → 2LiNO₃ + PbBr₂
- single displacement Fe + 2HCl → FeCl₂ + H₂
- double displacement CaO + H₂O → Ca(OH)₂
- synthesis 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.

Name ____________________________ Date ____________

Section 3 Classifying Chemical Reactions (continued)
Chemical Reactions
Section 4 Reaction Rates and Energy

Benchmarks—SC.A.1.4.4: The student experiments and determines that the rates of reaction among atoms and molecules depend on the concentration, pressure, and temperature of the reactants and the presence or absence of catalysts.

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

New Vocabulary

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

activation energy

dermospheric reaction

rate of reaction

catalyst

inhibitor

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

release
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>

Endergonic and Exergonic Reactions

I found this information on page ____________.
Main Idea

Chemical Reaction Rates

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

**Catylst**

**Inhibitors**

**Both**

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></td>
<td>• A solution is a mixture that has the same composition, color, density, and taste throughout.</td>
</tr>
<tr>
<td></td>
<td>• The solubility of a compound cannot be measured.</td>
</tr>
<tr>
<td></td>
<td>• pH measures how acidic a solution is.</td>
</tr>
<tr>
<td></td>
<td>• Bases are commonly found in household cleaners.</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.
## Solutions, Acids, and Bases

### Section 1 How Solutions Form

**Benchmarks—SC.A.1.4:** The student understands that all matter has observable, measurable properties.

<table>
<thead>
<tr>
<th><strong>Scan</strong></th>
<th>the headings, charts, graphs, and illustrations of Section 1. List 3 solutions not mentioned in your book that you might find in your house.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

### Review Vocabulary

**Define** homogeneous mixture.

<table>
<thead>
<tr>
<th>homogeneous mixture</th>
<th></th>
</tr>
</thead>
</table>

### New Vocabulary

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

<table>
<thead>
<tr>
<th>solution</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>solute</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>solvent</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>aqueous solution</th>
<th></th>
</tr>
</thead>
</table>

### Academic Vocabulary

**Use a dictionary to define process. Then use the word in a sentence that demonstrates you know its scientific meaning.**

<table>
<thead>
<tr>
<th>process</th>
<th></th>
</tr>
</thead>
</table>
**Main Idea**

**What is a solution?**
**Solute** and **Solvent**

*I found this information on page _________.*

**Details**

Create an example of a gas, liquid, and solid phase of a solution in the boxes below. Label the solute and solvent in each box. Use the figures in your book for help.

<table>
<thead>
<tr>
<th>Gas Phase</th>
<th>Liquid Phase</th>
<th>Solid Phase</th>
</tr>
</thead>
</table>

**How Substances Dissolve**

*I found this information on page _________.*

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

**Step 1.**

[Blank lines for student response]

**Step 2.**

[Blank lines for student response]

**Step 3.**

[Blank lines for student response]
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:

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.
Solutions, Acids, and Bases
Section 2 Solubility and Concentration

Benchmarks—SC.A.1.4.3: The student knows that a change from one phase of matter to another involves a gain or loss of energy. Also covers: SC.A.1.4.4

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
Section 2 Solubility and Concentration (continued)

**Main Idea**

**How much can dissolve?**

*Suppose you and a friend are making iced tea using identical glasses. You both use the same amount of water, and the water temperature is the same in both glasses. Explain how can you tell who added more ice tea mix to the glass.*

**Details**

**Synthesize**

**Identify** four items that you might buy in concentrated form but would dilute before using them.

1. 

2. 

3. 

4. 

**Organize**, name, and define the three types of solutions discussed in your book.

**Types of Solutions**

**Concentration**

*I found this information on page ____________*

**Types of Solutions**

*I found this information on page ____________*
Section 2  Solubility and Concentration (continued)

Main Idea

Types of Solutions

I found this information on page _________.

Solubility of Gases

I found this information on page _________.

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.

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.

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

Name _______________________________  Date ____________

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.

Solutions, Acids, and Bases  291
Solutions, Acids, and Bases
Section 3 Acids, Bases, and Salts

Benchmarks—SC.A.1.4.2: The student knows that the vast diversity of the properties of materials is primarily due to variations in the forces that hold molecules together.

**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: ?

**Review Vocabulary**

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

**New Vocabulary**

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

- a substance that produces hydrogen ions, \( \text{H}^+ \), in a water solution
- an organic compound that changes color in an acid or a base
- any substance that forms hydroxide ions, \( \text{OH}^- \), in a water solution, or a substance that accepts \( \text{H}^+ \) 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>
</tr>
</thead>
<tbody>
<tr>
<td>Definition:</td>
</tr>
<tr>
<td>Four Common Properties:</td>
</tr>
<tr>
<td>Four Common Acids:</td>
</tr>
<tr>
<td>Four Uses of Acids:</td>
</tr>
</tbody>
</table>

**Identify** a fact or example about bases on each line.
The smell of fish is caused by a base. Hypothesize why lemon juice can be used to neutralize the smell of fish.
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.

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

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.

Analyze information about strong and weak acids and bases.

Contrast the terms weak and dilute as they describe acids and bases.

Describe what the particles of an acid or base would look like with each combination of characteristics listed below.

### Table: Equation for Dissociation and Arrow Directions

<table>
<thead>
<tr>
<th>Equation for Dissociation</th>
<th>Arrow Directions Demonstrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak acid</td>
<td></td>
</tr>
<tr>
<td>Weak base</td>
<td></td>
</tr>
<tr>
<td>Strong acid</td>
<td></td>
</tr>
<tr>
<td>Strong base</td>
<td></td>
</tr>
</tbody>
</table>

### Table: Weak and Dilute

<table>
<thead>
<tr>
<th>Weak</th>
<th>Dilute</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table: Concentrate and Diluted

<table>
<thead>
<tr>
<th>Concentrate</th>
<th>Diluted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak</td>
<td></td>
</tr>
<tr>
<td></td>
<td>There are many particles, but not all are dissociated ions.</td>
</tr>
<tr>
<td>Strong</td>
<td></td>
</tr>
</tbody>
</table>
Main Idea

Solution pH

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.

Details

Analyze how buffers allow you to eat acidic and basic foods without changing your blood pH.

People with fish tanks test the water regularly to check its pH. Predict what the fish owner would do if the water were too acidic or too basic. Predict how these conditions might affect the fish.
Solutions, Acids, and Bases

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>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>

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 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>• 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>

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

Science Journal

Write a paragraph describing your impressions of the Sun.
Scan Section 1 and write down three topics that might be covered in this section.

1. ________________________________

2. ________________________________

3. ________________________________

Define long-range force.

long-range force

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

strong force

radioactivity

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

stable
Describe the nucleus. Discuss its size and what 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;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>holds nucleus tightly together because</td>
<td></td>
<td></td>
</tr>
<tr>
<td>large</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 1 Radioactivity (continued)

**Main Idea**

**Radioactivity**

I found this information on page ________.

**Details**

Organize *important information about radioactivity* in the boxes below.

<table>
<thead>
<tr>
<th>Isotopes</th>
<th>Nuclear Decay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONNECT IT**

Describe how “finding a needle in a haystack” is similar to finding the nucleus in an atom.
## Nuclear Changes

### Section 2 Nuclear Decay

Benchmarks—SC.A.2.4.3: The student knows that a number of elements have heavier, unstable nuclei that decay, spontaneously giving off smaller particles and waves that result in a small loss of mass and release a large amount of energy. Also covers: SC.H.3.4.5

<table>
<thead>
<tr>
<th>Preview the section and list three possible effects of radiation exposure.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
</tbody>
</table>

**Define** electromagnetic wave.

**electromagnetic wave**

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**New Vocabulary**

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

**alpha particle**

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**transmutation**

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**beta particle**

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**gamma rays**

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**half-life**

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Academic Vocabulary**

*Use a dictionary to define nuclear.*

**nuclear**

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
**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>γ</td>
<td></td>
</tr>
<tr>
<td>Form</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cause</td>
<td>weak force causes a neutron to decay into a proton plus beta radiation</td>
<td></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></td>
<td>sheet of paper</td>
<td></td>
</tr>
<tr>
<td>Effect on cells</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

304  *Nuclear Changes*
Compare the transmutation that occurs in alpha radiation and the transmutation that occurs in beta radiation.

In both alpha and beta transmutation, a nucleus becomes a ___________. In alpha radiation, a nucleus emits ________ and ________, so its atomic number ________ by 2 and the mass number decreases by ________.

In beta radiation, _________ decays into a proton, emitting __________. The atomic number ________________, but the mass number ________________.

Summarize information about radioactive dating.

Radioactive Half-Life, Radioactive Dating

Radioactive Dating

Carbon Dating

Uranium Dating

Hypothesize how a museum might validate the age of an ancient art masterpiece.
Nuclear Changes
Section 3 Detecting Radioactivity

Benchmarks—SC.A.2.4.3: The student knows that a number of elements have heavier, unstable nuclei that decay, spontaneously giving off smaller particles and waves that result in a small loss of mass and release a large amount of energy.

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. ___________________________

Review Vocabulary
Define ion to show its scientific meaning.

ion

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

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.

expose
Describe how each instrument works to detect or measure radiation.

Cloud Chamber: 

Bubble Chamber: 

Electroscope: 

Geiger Counter: 

Sequence the sources of background radiation that occur in nature. Order them from greatest percentage to least percentage.

<table>
<thead>
<tr>
<th>Background Radiation</th>
<th>Source</th>
<th>Percent of Total Radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rocks and soil</td>
<td>11%</td>
</tr>
</tbody>
</table>
Section 3  Detecting Radioactivity (continued)

I found this information on page ____________.

Identify **four facts about radiation in the human body**.
1. ________________________________________
2. ________________________________________
3. ________________________________________
4. ________________________________________

**Synthesize It**

Describe how to model a bubble chamber using a billiard table and billiard balls. Make a sketch of sample paths of your billiard balls in the space provided.
Nuclear Changes
Section 4 Nuclear Reactions

Benchmarks—SC.A.2.4.4: The student knows that nuclear energy is released when small, light atoms are fused into heavier ones. Also covers: SC.B.1.4.2, SC.B.2.4.1, SC.C.2.4.4, SC.H.1.4.1, SC.H.1.4.2, SC.H.1.4.3, SC.H.1.4.5; SC.H.1.4.7, SC.H.3.4.3, SC.H.3.4.5, SC.H.3.4.6

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

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

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

chain reaction

critical mass

nuclear fusion

tracer

Use a dictionary to define target.
target
Section 4 Nuclear Reactions (continued)

**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></td>
<td></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 with a uranium-235 nucleus.

This produces several __________________________.

nucleus

nucleus

Some mass is lost because __________________________.

Define Einstein's mass-energy equation in words and then write the formula.

Words:

_______ (joules) = _______ (kg) \( \times \) [___________ (m/s)]

Formula: __________________________

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.

310 Nuclear Changes
Section 4 Nuclear Reactions (continued)

Main Idea

Nuclear Fusion

I found this information on page __________.

Details

Summarize the energy requirements of nuclear fusion.

what must be overcome: _____________________________

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 __________.

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.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

312 Nuclear Changes
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.*

*Science Journal*

Write a paragraph about what you know about the Sun as a star.

---

Stars and Galaxies 313
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.

electromagnetic spectrum

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.

image
Main Idea

Constellations

I found this information on page __________.

Details

Summarize the origin of the names of constellations.

Identify the 2 types of optical telescopes. Then state three facts about each kind of telescope.

Optical Telescopes

I found this information on page __________.

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 ___________________ ___________________ of radio waves.
Main Idea

**Spectroscopes**

I found this information on page __________.

Details

**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.

![Concept Map]

**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.

______________________________________________

______________________________________________

______________________________________________

______________________________________________

Name ________________________________ Date ________________

Section 1 Observing the Universe (continued)

Stars and Galaxies
Stars and Galaxies
Section 2 Evolution of Stars

Benchmarks—SC.E.2.4.1: The student knows that stars have the approximate mass of our sun, and that stellar masses develop into neutron stars or black holes. Also covers: SC.E.2.4.4

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

mass of the Sun

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
Section 2 Evolution of Stars (continued)

How do stars form?

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

I found this information on page __________.

Details

Sketch a diagram of the Sun below. Label your diagram with these terms.

- radiation zone
- photosphere
- core
- corona
- convection zone

I found this information on page __________.

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.

Stars and Galaxies 319
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
Classify galaxies into the 3 types and identify three facts about each. Record your information in the graphic organizer below.

Galaxies

How do galaxies form?

Summarize how galaxies might have formed and grown.

I found this information on page _________.

I found this information on page _________.

Stars and Galaxies  321
Section 3 Galaxies and the Milky Way (continued)

Main Idea

The Milky Way

I found this information on page __________

Details

Choose the correct number from the box below to complete each sentence.

26,000 2 10,000 225 400 1,000 100,000 220

1. The Sun is about _______ light-years from the center of the Milky Way.

2. It takes the Sun _______ million years traveling at _______ km/s to orbit the Milky Way.

3. In the center of the Milky Way is a bulge that measures _______ light-years in diameter.

4. The Milky Way has been gobbling up the Sagittarius dwarf galaxy for about _______ billion years.

5. The Milky Way’s disk is about _______ light-years thick.

6. The Milky Way contains about _______ billion stars.

7. 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.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Stars and Galaxies
Section 4 Cosmology

Scan the headings in Section 4. List three questions you have about cosmology.

1. ____________________________________________________________
2. ____________________________________________________________
3. ____________________________________________________________

Define universe to show its scientific meaning.

universe

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.

expansion

Name ___________________________ Date ________________
Identify two early theories given for the origin of the universe.

Restate each theory.

<table>
<thead>
<tr>
<th>Early Theories About How the Universe Formed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
</tr>
<tr>
<td>Description:</td>
</tr>
</tbody>
</table>

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>
</thead>
</table>

Wilkinson Microwave Anisotropy Probe

1. 

2. 
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>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>

Synthesize It

Analyze why dark matter and dark energy are referred to as dark.
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>Stars and Galaxies</th>
<th>After You Read</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>

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 stars and galaxies.
accuracy: the extent to which a measurement is in proximity to the standard or expected value
acid: a substance that increases the H+ concentration when added to a water solution
activation energy: the least amount of energy required to start a particular chemical reaction
adaptation: a particular development, behavior, or physiological change in a population of organisms, in response to changes in the environment
amino acids: an organic molecule containing an amino (-NH₂) and a carboxyl (-COOH) group from which proteins are synthesized
aqueous: a solution containing water
astronomical unit: the average distance from Earth to the Sun, approximately 150 million kilometers
atomic number: the number of protons in an atom’s nucleus; the atomic number determines an element’s placement on the periodic table
base: a substance that increases the OH- concentration of a solution; a proton acceptor
biome: a complex biotic community characterized by the interaction of living organisms and climatic factors
substrate: a substance that speeds up or slows down the rate of a reaction without being consumed or altered
centrifugal: the motion away from center or axis
centripetal force: the force on an object required to keep this object on a circular path, pulling toward the center of the circle
compound: a substance made up of at least two different elements held together by chemical bonds that can only be broken down into elements by chemical processes
concentration: the relative amount of a particular substance, a solute, or mixture
conservation of mass: the principle that mass cannot be created or destroyed; also conservation of matter
convergent boundary: area where two tectonic plates collide
covalent bond: a chemical bond between two atoms of the same or different elements in which each atom shares an electron
diffraction: the bending of a wave around an obstruction
DNA: a nucleic acid that carries genetic material; present in all cellular organisms
electromagnet: a magnet consisting of a coil of wire wrapped around a core that becomes strongly magnetized when current flows through the coil producing a magnetic field
electromagnetic waves: waves generated by the oscillation of a charged particle and characterized by periodic variations of electric and magnetic fields
fault: a rock fracture along which movement or displacement of Earth’s crust has taken place
first law of thermodynamics: a law that states that the increase in thermal energy of a system equals the work done on the system plus the heat added to the system
genotype: the sum total of the genetic information contained in an organism
half-life: the amount of time required for half of an original sample of radioactive material to decay or undergo radioactive transformation
heat of fusion: the amount of heat energy required to convert a unit mass of substance from a solid to a liquid through melting at a constant temperature and pressure
heat of vaporization: the amount of heat energy needed to change a unit mass of substance from a liquid to a gas at its boiling point
indicator: a chemical compound that changes color depending on the pH of the solution or other chemical change
isotope: the form of an element with the same number of protons but a different number of neutrons
Kelvin: fundamental SI unit of temperature where zero degrees Kelvin is equal to absolute zero (One degree Kelvin equals one degree Celsius.)
mass number: the total number of protons and neutrons in a nucleus
<table>
<thead>
<tr>
<th>Vocabulary</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>membrane</strong></td>
<td>a thin layer of tissue that surrounds or lines a cell, a group of cells, or a cavity; any barrier separating two fluids</td>
</tr>
<tr>
<td><strong>mid-ocean ridge</strong></td>
<td>a continuous, seismic mountain range extending across the floor of the world's major oceans; area where two oceanic plates are moving away from each other; area where new crustal material may be released</td>
</tr>
<tr>
<td><strong>molecule</strong></td>
<td>the smallest unit of matter of a substance that retains all the physical and chemical properties of that substance; consists of a single atom or a group of atoms bonded together</td>
</tr>
<tr>
<td><strong>momentum</strong></td>
<td>a vector quantity that is the product of an object's mass and velocity; the general effect of ongoing motion</td>
</tr>
<tr>
<td><strong>mutation</strong></td>
<td>the process by which a gene undergoes a change in DNA sequence or a structural change</td>
</tr>
<tr>
<td><strong>natural selection</strong></td>
<td>the theory stating every organism displays slight variations from other organisms of its kind, and the struggle for limited natural resources results in individuals with certain natural variations adapted to their specific environments</td>
</tr>
<tr>
<td><strong>niche</strong></td>
<td>the unique position occupied by a particular species in terms of the area it inhabits and the function it performs within the community</td>
</tr>
<tr>
<td><strong>nuclear fission</strong></td>
<td>the process by which an atomic nucleus splits into two or more large fragments of comparable mass, simultaneously producing additional neutrons and vast amounts of energy</td>
</tr>
<tr>
<td><strong>nuclear fusion</strong></td>
<td>the process by which two lighter atomic nuclei combine at extremely high temperatures to form a heavier nucleus and release vast amounts of energy</td>
</tr>
<tr>
<td><strong>permeability</strong></td>
<td>the capability of a porous substance or membrane to allow a fluid or gas to enter it; the measure or degree to which a substance can be penetrated by a liquid or gas</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>a symbol for the measure of the acidity or alkalinity of a solution</td>
</tr>
<tr>
<td><strong>phenotype</strong></td>
<td>the appearance or other observable characteristic of an organism resulting from the interaction of its genetic makeup and its environment</td>
</tr>
<tr>
<td><strong>precision</strong></td>
<td>how closely measurements are to each other and how carefully measurements were made</td>
</tr>
<tr>
<td><strong>product</strong></td>
<td>a substance or compound resulting from a chemical reaction</td>
</tr>
<tr>
<td><strong>protein</strong></td>
<td>a biological macromolecule composed of one or more chains of amino acids</td>
</tr>
<tr>
<td><strong>rate of reaction</strong></td>
<td>the speed at which reactants are consumed and products are produced in a given reaction</td>
</tr>
<tr>
<td><strong>reactant</strong></td>
<td>any substance or molecule that participates in a chemical reaction</td>
</tr>
<tr>
<td><strong>rift valley</strong></td>
<td>a long, narrow valley in Earth's crust where two continental plates are separating or between two faults</td>
</tr>
<tr>
<td><strong>RNA</strong></td>
<td>a single-stranded nucleic acid consisting of a phosphate group and one of four nitrogenous bases that encodes information needed to synthesize proteins</td>
</tr>
<tr>
<td><strong>second law of thermodynamics</strong></td>
<td>a law that states all natural processes proceed in a preferred direction (e.g., heat flows from high temperature regions to low temperature regions)</td>
</tr>
<tr>
<td><strong>solar mass</strong></td>
<td>the quantity equal to the mass of the Sun</td>
</tr>
<tr>
<td><strong>solubility</strong></td>
<td>the ability or tendency of one substance to dissolve in another at a given temperature and pressure</td>
</tr>
<tr>
<td><strong>species</strong></td>
<td>a group of organisms of common ancestry able to reproduce only among themselves and usually geographically distinct</td>
</tr>
<tr>
<td><strong>stimulus</strong></td>
<td>a condition that produces a response</td>
</tr>
<tr>
<td><strong>succession</strong></td>
<td>the progressive replacement, on a single site, of one type of community by another</td>
</tr>
<tr>
<td><strong>vector</strong></td>
<td>a physical quantity with both a magnitude and direction</td>
</tr>
<tr>
<td><strong>velocity</strong></td>
<td>the time rate at which a body changes its position vector; quantity whose magnitude is expressed in units of distance over time</td>
</tr>
</tbody>
</table>
accumulate: to increase in amount
accurate: free from error; close to the correct amount
achieve: to gain, accomplish, attain, reach
adapt: to change to fit new conditions; to change in order to make suitable
adjacent: near, close, or adjoining
adjust: to arrange the parts of something to make it work correctly
adult: fully developed; grown
affect: to bring about a change in
aggregate: material, such as sand or gravel, that is used to make concrete or mortar
analogy: a comparison involving a similarity between two otherwise dissimilar objects or situations
apparent: appearing to be but not necessarily so; seeming; readily seen, visible, readily understood or perceived; evident; obvious
approach: to come near
available: ready to use
benefit: something that helps or betters a person or thing; advantage
bond: to cause to adhere or stick together
capable: able to do things; fit
category: group or class of things; a division in a classification system
chart: a sheet that gives information about something in the form of a diagram, graph, or table
chemical: any substance used in or obtained by a chemical process
code: (noun) set of signals representing letters or numerals, used to send messages; (verb) to put in the form of symbols of a code
collapse: to fall together, shrink
communicate: to make known or give information
compensate: to make up for
component: part of a machine or system
compound: made up of individual parts; made of two or more separate parts or elements
concentrate: to bring or come close together in one place
conduct: to transmit energy such as heat, light, sound, or electricity
constant: not changing, especially not changing over time
contact: the act or state of touching or meeting
contract: to draw together; shrink in size
controversy: argument or debate
convert: to change from one form or use to another; to alter the physical or chemical nature or properties of
coordinate: to cause to work well together
core: a central part; center
create: to bring into existence
cycle: a repeating sequence of events
Florida Science Academic Vocabulary Glossary

**decline**: to become less in health, power, value, or number

**define**: to determine or identify the essential qualities or meaning of something

**definite**: clear; without doubt

**derive**: to get or receive from a source

**detect**: to perceive, discover, or uncover

**device**: tool or instrument designed for a particular purpose

**differentiate**: to tell or see the difference

**displace**: to take the place of or remove from the usual or proper place

**dominate**: to have a command place; to exert mastery control, or preeminence; to control or rule

**eliminate**: to get rid of

**emerge**: to come out; to appear

**enable**: to make something possible or feasible

**encounter**: to meet or experience

**enormous**: having great size

**environment**: surroundings; all of the conditions, circumstances, and influences surrounding and affecting the development of an organism or group of organisms

**erode**: to wear away

**error**: an unintentional deviation from accuracy; a mistake

**estimate**: (noun) an opinion of the value, quality, size, or cost of something; (verb) to form an opinion by reasoning

**evaluate**: to determine the significance of something

**evolve**: to change in a certain way

**exclude**: to restrict or stop the entrance of

**expand**: to get bigger; to increase in extent, number, volume, or scope

**expose**: to subject to

**external**: positioned outside; beyond

**extract**: to take, get, or pull out

**factor**: one of several elements that bring about a result; a substance that functions in a body system

**feature**: part, appearance, or characteristic of something

**formula**: a general rule or principle represented in symbols, numbers, or letters, often in the form of an equation

**function**: (noun) a specific job or purpose; (verb) to carry out a specific action

**fundamental**: original or basic

**generate**: to produce or cause to exist

**goal**: objective or end that one strives to achieve

**hierarchy**: a ranked series or order

**hypothesis**: something that is suggested as being true for the purposes of argument or of further investigation

**identical**: exactly the same; same as

**identify**: to establish the identity of

**image**: an optical representation of an object produced by a mirror or lens
Florida Science Academic Vocabulary Glossary

**impact:** a strong, immediate effect; the action of one object hitting another

**indicate:** to make known or show; to be or give a sign of; to point out

**individual:** being or characteristic of a single thing; a single object or organism

**infer:** to conclude or decide from something known or assumed

**initial:** of or relating to the beginning; the first

**insert:** to put or fit (something) into something else

**intense:** occurring or existing in a high degree; very strong, violent, extreme, sharp, or vivid

**interact:** to act upon one another; to influence one another

**intermediate:** in the middle or being between

**internal:** of or on the inside

**interval:** space or time between things

**investigate:** to search into something in order to learn the facts

**item:** object or thing

**layer:** one thickness of something over another, horizon

**likewise:** in the same way

**link:** a connecting structure

**mechanism:** part or piece of machinery

**medium:** substance through which a force or effect is transmitted

**method:** particular procedure, technique, or way to do something; a process

**migrate:** to move from one habitat or environment to another

**negate:** to prove something to be false; to nullify or cancel an effect or action

**neutral:** not favoring either side; without an electric charge

**normal:** conforming to a type; standard, or regular pattern

**nuclear:** pertaining to the central point, group, or mass about which a gathering or concentration takes place; of or relating to the atomic nucleus

**obtain:** to get through effort; gain

**occur:** to happen; to take place

**overlap:** one thing extends over another

**parallel:** extending in the same direction, everywhere equidistant, and not meeting

**passive:** induced by an outside agent

**perceive:** to observe or become aware of through the senses

**percent:** in, to, or for every one hundred

**period:** the completion of a cycle, a series of events, or a single action; row of the periodic table

**phase:** a state in a repeating cycle of change

**phenomenon:** any fact, condition, or happening that can be seen, heard, etc. and described in a scientific way
**Florida Science Academic Vocabulary Glossary**

**physical**: of or produced by the forces of nature; of or according to the laws of nature

**positive**: real and numerically greater than zero

**potential**: existing in possibility; capable of development into actuality

**precise**: exactly or sharply defined or stated; minutely exact; correct

**predict**: to tell what one thinks will happen in the future; to foretell in advance on the basis of observation, experience, or scientific reason

**principle**: basic generalization that is accepted as true and that can be used as a basis for reasoning

**process**: a series of changes by which something develops or that leads to a result; a natural phenomenon marked by gradual changes that lead toward a particular result

**promote**: to contribute to the growth of; to help bring into being

**random**: lacking a definite plan, purpose, or pattern

**range**: the distance over which an object or force extends

**ratio**: a relationship in quantity, amount, or size

**react**: to act because something has happened; to respond

**recover**: to get back something that has been lost

**refine**: to separate from impurities

**region**: an area

**regulate**: to fix or adjust the time, amount, degree, or rate of something

**reject**: to refuse to accept or use

**release**: to set free; to let go

**require**: to be in need of

**resource**: something that lies ready for use or that can be drawn on for aid or to take care of a need

**respond**: to react to a stimulus

**reveal**: to make known; to show or display

**reverse**: to turn completely about in position or direction

**rigid**: not bending or moving; stiff and hard

**section**: one of several parts that together make up a whole

**sequence**: series; an order of events; one thing following another in a fixed order

**series**: a number of similar things coming one after another

**significant**: important; having meaning or effect

**similar**: having many but not all qualities in common; almost, but not exactly the same

**source**: a point or region of origin; that from which something comes into existence, develops, or derives

**sphere**: a round body, such as a ball, on which all points are the same distance from the center
stable: firmly established; not changing or fluctuating; not easily moved or changed

strategy: plan, scheme, or system

structure: arrangement of parts or the way parts are arranged

survey: to look at or study in detail; to query someone in order to collect data for the analysis of some aspect of a group or area

survive: to remain alive or in existence; to continue to function or prosper

symbol: something that represents something else

target: something to be affected by an action or development; a goal to be achieved

technique: manner of attending to, performing, or accomplishing the particulars and specialized procedures of a science, art, or profession

technology: use of science for practical reasons, especially in engineering and industry

temporary: lasting for only a limited time

terminate: come to an end or capable of ending

theory: plausible or scientifically acceptable general principle or body of principles offered to explain phenomena

transfer: to move something from one place or category to another

transform: to change the condition, nature, or function of; to convert

transmit: to send from one location to another; to pass through space or a medium

transport: move from one place to another place

trend: a general movement or tendency

undergo: to go through; have happen to one

underlie: to lie beneath

uniform: always the same; not varying

unique: being the only one; being without a like or equal

vary: to change; to make or become different

version: variant of an original

visible: capable of being seen by the human eye

voluntary: acting, done, or given of one’s own free will; by choice

widespread: widely scattered or prevalent