Earth Science
Geology, the Environment, and the Universe

Consultant
Douglas Fisher, Ph.D.
About the Consultant

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

- **Note taking tools** based on the Cornell Note-Taking System.
- **K-W-L Charts** help you assess what you already know about a concept and identify what you would like to find out.
- **Science Journals** help you assess what you have learned in the Discovery Lab.
- **Vocabulary** helps you understand information better.

### Volcanic Activity

**Chapter Preview**

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

<table>
<thead>
<tr>
<th>What I Know</th>
<th>What I Want to Find Out</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>

**What happened to the colored water when it entered the beaker?**

The hot water is less dense than the cold water and therefore will rise.

**How might this be similar to what happens to magma beneath Earth's surface?**

Hot magma rises to the surface of Earth like the hot water in the experiment.

**Infer what would have happened if you had released the hot water at the surface of the cold water.**

It would not have moved because it was already at the top. It could not rise further.

**Think about the Discovery Lab you did to model magma movement and record your response in this science journal.**

**Vocabulary**

**New Academic Vocabulary**

- magma
- viscosity
- factor

**Define the following term.**

- Any of the circumstances or conditions that bring about a result; element that makes a thing what it is

**Use the text to define the following term.**

- Viscosity is the internal resistance to flow.

**Show your understanding of the word by writing a definition of your own.**

**Main Idea**

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

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

Write three facts you discovered about magma.

1. 
2. 
3. 

**Science Journals**

Help you assess what you have learned in the Discovery Lab.
Section 18.1 Magma

How Magma Forms

1. List three factors that affect the formation of magma.
   1. Temperature
   2. Pressure
   3. Water

Analyze Figure 18-1 to complete the table. Indicate in the table whether temperature, pressure, or melting point increase or decrease for each of the conditions.

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>DEPTH BELOW EARTH'S SURFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Pressure</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Melting Point</td>
<td>Increasing</td>
</tr>
</tbody>
</table>

Illustrate the relationship between the melting points of a wet rock and a dry piece of the same rock under the same amount of pressure by sketching a thermometer. Shade a parallel temperature line for each type of rock.

If you were the engineer on an oil-drilling expedition, explain how you might use a graph such as the one in Figure 18.1 in your text.

Possible answer: I would look up the melting point of the shale on the graph to estimate the depth of the oil.

The Chapter Wrap-Up helps you assess what you have learned in the chapter and prepare for chapter tests.

Graphic Organizers help you summarize information in a visual format.

Writing activities help you understand the information being presented and make connections between the concepts and the real-world.
Your notes are a reminder of what you learned in class. Taking good notes can help you succeed in science. The following tips will help you take better classroom notes.

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

<table>
<thead>
<tr>
<th>Word or Phrase</th>
<th>Symbol or Abbreviation</th>
<th>Word or Phrase</th>
<th>Symbol or Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>for example</td>
<td>e.g.</td>
<td>and</td>
<td>+</td>
</tr>
<tr>
<td>such as</td>
<td>i.e.</td>
<td>approximately</td>
<td>≈</td>
</tr>
<tr>
<td>with</td>
<td>w/</td>
<td>therefore</td>
<td>:</td>
</tr>
<tr>
<td>without</td>
<td>w/o</td>
<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.
- When working out an example, write what you are doing to solve the problem next to each step. Be sure to use your own words.
- Review you notes as soon as possible after class. During this time, organize and summarize new concepts and clarify misunderstandings.

**Note-Taking Don’ts**

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

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about science. Then list three questions you have about science 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>1.</td>
<td></td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Science Journal

Describe at least three ways people use Earth science. You may find examples in the news, in the chapter, or think of examples in daily life.

---

The Nature of Science
The Nature of Science
Section 1.1 Earth Science

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

1. ___________________________________________
2. ___________________________________________
3. ___________________________________________

Use your text to define each term.

- astronomy
- meteorology
- geology
- oceanography
- lithosphere
- asthenosphere
- hydrosphere
- atmosphere
- biosphere

Define the following term.

- interact
The Scope of Earth Science
Use with pages 6–7.

Organize information about the topics each kind of scientist studies in the table below.

<table>
<thead>
<tr>
<th>Type of Scientist</th>
<th>Topics Studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astronomer</td>
<td></td>
</tr>
<tr>
<td>Meteorologist</td>
<td></td>
</tr>
<tr>
<td>Geologist</td>
<td></td>
</tr>
<tr>
<td>Oceanographer</td>
<td></td>
</tr>
</tbody>
</table>

Classify the subspecialties of Earth Science by writing them under the appropriate areas of specialization. Use Table 1-1 to help you. You may write a subspecialty more than once.

Earth Science

<table>
<thead>
<tr>
<th>Meteorology</th>
<th>Geology</th>
<th>Oceanography</th>
<th>Astronomy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Identify two recent events from the news that would be of interest to an Earth scientist, state what kind of scientist they would most interest, and classify the events under the appropriate subspecialties listed above.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Earth’s Systems
Use with pages 8–9.

Main Idea

Details

Draw a diagram to help you understand and remember Earth’s four main systems. Label each system.

Earth Science in Your Everyday Life
Use with page 10.

List something from each of Earth’s systems that humans use.

Lithosphere: ________________________________
Hydrosphere: ______________________________
Atmosphere: ______________________________
Biosphere: ________________________________

SYNTHESIZE
Identify one way that humans have changed each of Earth’s systems.

Lithosphere: ______________________________
Hydrosphere: ______________________________
Atmosphere: ______________________________
Biosphere: ________________________________
The Nature of Science
Section 1.2 Methods of Scientists

**Main Idea**

**Details**

**Skim** Section 2. Using what you already know and what you learn from skimming the section, describe how scientists use mathematics in their work.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>hypothesis</strong></td>
<td></td>
</tr>
<tr>
<td><strong>independent variable</strong></td>
<td></td>
</tr>
<tr>
<td><strong>dependent variable</strong></td>
<td></td>
</tr>
<tr>
<td><strong>control</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Le Système Internationale d’Unités (SI)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>scientific notation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>evaluate</strong></td>
<td></td>
</tr>
</tbody>
</table>
Section 1.2 Methods of Scientists (continued)

Main Idea

The Nature of Scientific Investigations

Use with page 11.

Sequence the steps of the scientific method by completing the flow chart below. Use Figure 1–6 to help you. Then draw arrows to show the order.

Main Idea

Details

1. ________________
   ________________
2. ________________
3. ________________
4. State a hypothesis and make a prediction.

1. ________________
2. Determine how the variables will be controlled and measured.
3. ________________
4. ________________

1. ________________
2. Re-evaluate the hypothesis.
3. ________________
4. ________________

1. ________________
2. Look for trends in the data.
3. ________________
4. ________________

Experimentation

Use with page 12.

Compare independent and dependent variables by completing the following sentences.

The ________________ is a factor that is manipulated by the experimenter. A(n) ________________ is a factor that can change if the ________________ is changed.
Summarize in five words or less the safety rules given in Table 1-2.

<table>
<thead>
<tr>
<th>Important Safety Rules</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>

Design symbols to help you remember two lab safety rules from Table 1-2. Give reasons why you chose each symbol.

Rule: ________________________________
Symbol: ________________________________

Reason: ________________________________

Rule: ________________________________
Symbol: ________________________________

Reason: ________________________________
Section 1.2 Methods of Scientists (continued)

Main Idea

Measurement
Use with pages 14–16.

Organize the concepts of measurement by completing the table.

<table>
<thead>
<tr>
<th>Quantity represented</th>
<th>What is measured</th>
<th>SI Unit</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The amount of matter in an object</td>
<td>milliliter</td>
<td>mL</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average vibrations of the particles that make up material</td>
<td>degrees Celsius</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>The amount of space occupied by an object</td>
<td>cubic meter</td>
<td>m³</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of surface included within a set of boundaries</td>
<td>Kelvin</td>
<td>K</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A measure of the amount of matter that occupies a given space</td>
<td>g/cm³</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scientific Notation
Use with page 16.

Summarize scientific notation by completing this table with words from the list.

- after
- before
- negative
- positive

<table>
<thead>
<tr>
<th>Numbers Greater than 1</th>
<th>Numbers Less than 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zeroes are ____ the number.</td>
<td>Zeroes are ____ the number.</td>
</tr>
<tr>
<td>Exponent is ____ .</td>
<td>Exponent is ____ .</td>
</tr>
<tr>
<td>Example: 90 000 000 000 =</td>
<td>Example: 0.0000000001 =</td>
</tr>
</tbody>
</table>

Synthesize

Explain what a scientist should do if some data from an experiment confirms a hypothesis and some data does not. Could the scientist ignore the data that didn’t fit the hypotheses? Why or why not?
Scan Section 3 of your text. Use the checklist as a guide.

- Read all section titles.
- Read all bold words.
- Read all tables and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about communicating in science.

Write three facts you discovered about how scientists communicate.

1. 

2. 

3. 

Write a paragraph that explains the difference between a theory and a law in science.

Define the following term.

communicate
Section 1.3 Communicating in Science (continued)

Main Idea

Communicating Results

Use with pages 17–18.

Create an outline of the information under the heading “Communicating Results.”

I. Communicate data and results to others so they can:
   A. 
   B. 
   C. 

II. Ways scientific results are communicated
   A. 
   B. 

Identify the parts of this graph.
1. Highlight the title of the graph below.
2. Label the axis where the dependent variable is plotted “Dependent.”
3. Label the axis where the independent variable is plotted “Independent.”
4. Circle the labels that tell what units each variable is expressed in.
Summarize the information under the heading “Models” by completing the sentences below.

1. A scientific model is __________________________.
   __________________________

2. A model should be __________________________.

3. Models can change when __________________________.

Compare and contrast theories and laws. Place each statement in the Venn diagram to show whether it is true for theories, laws, or both.

- Based on observations
- Can change with the discovery of new data
- Describes a natural phenomenon
- May not explain what it describes
- Used to explain scientific laws

REAL-WORLD CONNECTION
Suppose you are a doctor who has discovered a cure for a fatal disease. What method would you use to communicate your discovery to the world? Why would you choose that method?
The Nature of Science  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I Wanted to Find Out</td>
<td>What I Learned</td>
</tr>
<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>

Review

Use this checklist to help you study.

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

SUMMARIZE
Write the main idea of each section of this chapter on the lines below.

1. 
2. 
3. 
Mapping Our World

Chapter Preview

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

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What I Know</strong></td>
<td><strong>What I Want to Find Out</strong></td>
</tr>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to make and use a map and record your response in this science journal. Which did you find more helpful, the verbal directions or the map? Explain your answer. What kind of information did you include in your map? What details would you add to your map?
Skim Section 1 of your text. Write three questions that come to mind from reading the headings and the illustration captions.

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

Use your text to define the following term.

__________________________________________
__________________________________________
__________________________________________

Use the terms to label the figure below.

180°  0°

Define the following term.

__________________________________________
Section 2.1 Latitude and Longitude (continued)

**Main Idea**

**Latitude**

Use with pages 27–28.

**Details**

Organize information about latitude by completing this graphic organizer. Use Figure 2-1 and other information in your text.

- They run _______ to the equator.
- Distances are in degrees ____ or ____ of the equator.

### Lines of Latitude

- The _______ is at 0° latitude.
- The poles are at ______ latitude.

**Summarize** the information about degrees of latitude by completing the table.

<table>
<thead>
<tr>
<th>Degree Symbol</th>
<th>Actual Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Longitude**

Use with page 29.

Complete each sentence to help you remember information about longitude.

Lines of longitude are also known as _______. Longitude is distance in degrees ____ or ____ of the prime meridian. The _____________ is the reference point for meridians. It represents _° longitude. The prime meridian goes through _______________.

Points west of the prime meridian are numbered from _° to ____° west longitude. Points east of the prime meridian are numbered from 0° to 180° ___________.
Section 2.1 Latitude and Longitude (continued)

Main Idea:

Compare and contrast information about latitude and longitude. Place each statement in the Venn diagram to show whether it is true for latitude, longitude, or both. Two statements have already been written in for you.

- Lines are parallel.
- Lines form circles.
- Degrees cover consistent distances.
- Degrees do not cover consistent distances.
- Necessary to precisely locate positions on Earth

Details:

- Lines converge at a point.
- Lines form semicircles.

Time Zones:

Analyze the figure below showing U.S. time zones. Assume that it is 9:00 in the Mountain time zone. Draw the hands on the other clocks to show the time it would be in each of the other U.S. time zones.

SYNTHESIZE:

Write the instructions you would give a classmate to locate the point 27°18’N, 19°2’E on a globe.
Mapping Our World
Section 2.2 Types of Maps

Main Idea

Details

Skim Section 2 of your text. List the three map projections mentioned in the headings and illustration captions.

1. 
2. 
3. 

New Vocabulary

In the left column, write the terms defined below.

a map made by projecting points and lines onto a piece of paper that touches a globe at a single point

a map that has parallel lines of latitude and longitude

a map that shows changes in elevation of Earth’s surface

a map made by projecting points and lines from a globe onto a cone

the ratio between distances on a map and actual distances on the surface of Earth

the difference in elevation between two side-by-side contour lines on a map

a table that explains what the symbols on a map represent

a line on a map that connects points of equal elevation

Define the following term.

distort
Section 2.2 Types of Maps (continued)

Mercator Projections
Use with page 32.

Complete the table to organize information about Mercator projections.

<table>
<thead>
<tr>
<th>Mercator Projections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made by</td>
</tr>
<tr>
<td>Advantages</td>
</tr>
<tr>
<td>Disadvantages</td>
</tr>
<tr>
<td>Uses</td>
</tr>
</tbody>
</table>

Conic Projections
Use with page 32.

Organize information about conic projections by filling in the graphic organizer.

Gnomonic Projections
Use with page 33.

Complete the following sentences to help you understand gnomonic projections.

Gnomonic projections are made by ____________________________

The advantage of these projections ____________________________

The disadvantage of gnomonic projections is ______________________

They are used by ____________________________
Section 2.2 Types of Maps (continued)

**Main Idea**

**Topographic Maps**

*Use with pages 33–34.*

**Assess** your understanding of topographic maps. Write two questions that might appear on a quiz. Then write the answers.

Question: Why can contour lines on a map never cross?

Answer: __________________________

__________________________________

__________________________________

Question: __________________________

Answer: __________________________

__________________________________

**Map Legends**

*Use with page 35.*

**Create** symbols for a map legend in the spaces below. Include symbols for four features in your house, school, or neighborhood.

**Map Scales**

*Use with pages 35–36.*

**Summarize** information about map scales by completing the table.

<table>
<thead>
<tr>
<th>Type of Scale</th>
<th>Expressed as</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graphic scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fractional scale</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**REAL-WORLD CONNECTION**

**Explain** which type of map you would probably find in each of the following places and why: a car; a hiker’s backpack; a sailboat.
Mapping Our World
Section 2.3 Remote Sensing

Main Idea

Predict what you will learn about in Section 3. Read the title of the section and the first paragraph after the section title. Then write what you think this section will be about.

Details

New Vocabulary

Use your text to define each term.

remote sensing

electromagnetic spectrum

frequency

Landsat satellite

Topex/Poseidon satellite

Global positioning system

sonar

Academic Vocabulary

Define the following term.

transmit
Section 2.3 Remote Sensing (continued)

**Main Idea**

The Electromagnetic Spectrum
*Use with pages 37-38.*

**Describe** the electromagnetic spectrum by completing the statements below.

- frequency  
- gamma waves  
- speed  
- radio wave  
- speed of light  
- wavelength

- 300 000 km/s is the __________

- three factors that describe electromagnetic waves are ________, ________, and ________

- type of wave with the highest frequency: __________

- type of wave with the greatest wavelength: __________

**Create** a diagram of the electromagnetic spectrum using Figure 2-14 in your text for reference. In the space below, draw an electromagnetic wave. Show how the wave is different in different parts of the spectrum. Label the parts of the spectrum.

---

**Details**

**Topex/Poseidon Satellite**
*Use with page 39.*

**Model** a Topex/Poseidon satellite by drawing a diagram. Use Figure 2-16 in your text for reference. Draw and label your diagram showing how these satellites map the ocean floor.
Section 2.3 Remote Sensing (continued)

**Main Idea**

Landsat and Topex/Poseidon Satellites The Global Positioning System and Sea Beam

*Use with pages 38-41.*

**Details**

**Distinguish** between the remote sensing methods discussed in this chapter by completing the table below.

<table>
<thead>
<tr>
<th>Type of Satellite</th>
<th>Kind of Waves</th>
<th>Where Waves are Emitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landsat satellite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOPEX/POSEIDEN satellite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global Positioning System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sea Beam</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Organize** information about Sea Beam technology by completing the graphic organizer below.

![Graphic Organizer]

**SYNTHESIZE**

Predict which satellite mentioned in this section will be used the most in the future. Describe how your chosen satellite works and compare its advantages and disadvantages with other satellites to explain your answer.
Think about what you have learned in this chapter about maps.
In the space below, design a map of your classroom.
Create a map legend to represent lights, electrical outlets, books, and other objects.
Try to make your map as accurate as possible.
Be sure to include a scale.
Mapping Our World  Chapter Wrap-Up

In the "What I Wanted to Find Out" column, copy the questions you listed in the Chapter Preview. In the "What I Learned" column, write down the answers you discovered as you worked through the chapter. Use this checklist to help you study.

<table>
<thead>
<tr>
<th>W What I Wanted to Find Out</th>
<th>L What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

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

Summarize

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

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
Matter and Atomic Structure

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about matter and atomic structure. Then list three questions you have about matter and atomic structures 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>1.</td>
<td></td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to identify one substance added to breakfast cereals and record your response in this science journal.

Describe what you see on the end of the pencil stirrer. Study the cereal box to determine what the substance on the end of the magnet might be.
Matter and Atomic Structure
Section 3.1 What are elements?

Main Idea

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

• Read all headings.
• Read all bold words.
• Read all tables and graphs.
• Look at all the pictures and read their captions.
• Think about what you already know about elements.

Review Vocabulary

Write one thing you would like to learn about elements.

New Vocabulary

In the left margin, write the terms defined below.

a substance that cannot be broken down into simpler substances by physical or chemical means
the smallest particle of an element that has all of the characteristics of that element
the center of an atom, made up of protons and neutrons
a particle that has mass and a positive electrical charge
a particle with about the same mass as a proton but with no electrical charge
the number of protons in an atom’s nucleus
the combined number of protons and neutrons in an atom
a particle with little mass and a negative electric charge
an area in an atom where an electron is most likely to be found
an electron in the outermost energy level of an atom
atoms of the same element with different mass numbers
the average mass numbers of the isotopes of an element
the spontaneous process through which unstable nuclei emit radiation

Academic Vocabulary

Define the following term.

consist
Section 3.1 What are elements?

**Main Idea**

**Elements**

*Use with pages 53–54.*

**Elements Are Made of Atoms**

*Use with page 54.*

**Details**

**Describe** elements by completing the prompts below.

An element is a __________________________. There are ___ elements that occur naturally in the universe. A chemical symbol is __________________________. ________________

**Organize** information about the structure of atoms by writing the letter for each statement in the correct area of the diagram. Some letters will be used more than once.

- a. consists of protons, neutrons, and electrons
- b. determines the atomic number
- c. has exactly the same number of protons and electrons
- d. has little mass
- e. has mass
- f. has negative charge
- g. has no charge
- h. has positive charge
- i. helps determine the mass number
- j. is found in an energy level around the nucleus
- k. is made up of protons and neutrons
Section 3.1 What are elements?

**Main Idea**

Electrons in Energy Levels
*Use with page 56.*

**Details**

Draw the figures below to help you understand isotopes and energy levels in atoms. Use Figure 3-2 and information from your book to help you.

1. Draw a chlorine-35 atom.
2. Label the nucleus with the number of protons and neutrons inside.
3. Circle the valence energy level.

| 1. Draw a chlorine-37 atom. |
| 2. Label the nucleus with the number of protons and neutrons inside. |
| 3. Circle the valence energy level. |

**Isotopes**
*Use with page 57.*

Name the relationship of the two atoms you drew above.

State if the two atoms would have the same properties, or not.

**What elements are most abundant?**
*Use with page 58.*

Analyze the circle graphs in Figure 3-4 in your text. Write the chemical symbols for elements that match the following descriptions.

- the 3 most common elements in Earth’s crust
- the most abundant element in the universe
- the element that makes up 5.0% of Earth’s crust
- 4 elements that are common both in the universe and in the earth’s crust

**SYNTHESIZE**

Make a concept map to organize facts you have learned in this section about elements.
Scan the objectives and the main headings for Section 2 of your text. Write three questions that come to mind.

1. 
2. 
3. 

Use your text to define each term.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>compound</td>
<td></td>
</tr>
<tr>
<td>chemical bond</td>
<td></td>
</tr>
<tr>
<td>covalent bond</td>
<td></td>
</tr>
<tr>
<td>molecule</td>
<td></td>
</tr>
<tr>
<td>ion</td>
<td></td>
</tr>
<tr>
<td>ionic bond</td>
<td></td>
</tr>
<tr>
<td>chemical reaction</td>
<td></td>
</tr>
<tr>
<td>solution</td>
<td></td>
</tr>
<tr>
<td>acid</td>
<td></td>
</tr>
<tr>
<td>base</td>
<td></td>
</tr>
</tbody>
</table>

Define the following term.

formula
**Section 3.2 How Atoms Combine** (continued)

**Main Idea**

Compounds
*Use with pages 60–62.*

Organize information about compounds by completing the graphic organizer below.

- **Compounds**
  - Substances composed of ____________ that are ____________.

- **Chemical Bond**
  - The forces that ____________ are _______.

- **Covalent Bonds**
  - Covalent bonds are created when atoms ____________.

- **Molecule**
  - A molecule is ____________

- **Polar Bonds**
  - Polar bonds are covalent bonds in which ____________

**Ions**
*Use with page 62.*

Organize information about the formation of ions by completing the flow chart below.

- **Ions**
  - If energy level is less than half full, an atom tends to lose electrons to become a ____________.
  - If energy level is exactly half full, an atom may ___ or ___ electrons to form either ____________
  - If energy level is ________, an atom tends to become a ____________.

**Metallic Bonds**
*Use with page 64.*

Create a drawing to help you understand metallic bonds. Label positive ions with plus signs and electrons with minus signs.
Section 3.2 How Atoms Combine (continued)

Main Idea

Chemical Reactions
Use with page 64.

Mixtures and Solutions
Use with pages 65–66.

Details

Identify the meaning of symbols in a chemical formula by writing the meaning in words below each symbol.

\[ 2H_2 + O_2 \rightarrow 2H_2O \]

Summarize information about mixtures and solutions by completing the graphic organizer below. Answers may vary for examples.

Homogeneous mixtures (or _____)

Mixtures

Gases

Example: _____

Example: _____

Example: _____

Mixtures

Example: _____

Label the pH scale to help you understand and remember pH. Write under the acidic and the base parts of the scale two facts about and an example of each.

Lemon ph 2
Tomato ph 4
Milk ph 6
Distilled water ph 7
Antacid ph 10
Household ammonia ph 11
Drain cleaner ph 13

More acidic
Neutral
More basic

Real-World Connection

Compare and contrast chemical equations and algebraic equations.
Predict what you will learn about in Section 3. Read the title and the first paragraph of the section. Then write what you think this section will be about.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>scientific law</td>
<td></td>
</tr>
<tr>
<td>crystalline structure</td>
<td></td>
</tr>
<tr>
<td>glass</td>
<td></td>
</tr>
<tr>
<td>evaporation</td>
<td></td>
</tr>
<tr>
<td>sublimation</td>
<td></td>
</tr>
<tr>
<td>plasma</td>
<td></td>
</tr>
<tr>
<td>condensation</td>
<td></td>
</tr>
<tr>
<td>consist</td>
<td></td>
</tr>
</tbody>
</table>
Matter and Atomic Structure

Section 3.3 States of Matter (continued)

**Main Idea**

**Solids**

Use with pages 67–68.

**Liquids**

Use with page 68.

**Gases**

Use with page 68.

**Organize information about solids by completing the table below.**

<table>
<thead>
<tr>
<th>Solids</th>
<th>Particles in solids</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
<td><strong>Particles in solids</strong></td>
</tr>
<tr>
<td>• Solids are ____________________</td>
<td></td>
</tr>
<tr>
<td>• Solids have definite _____ and _____</td>
<td></td>
</tr>
<tr>
<td><strong>Crystalline Solids</strong></td>
<td><strong>Glasses</strong></td>
</tr>
<tr>
<td>• Particles are arranged ______</td>
<td></td>
</tr>
<tr>
<td>• ____________________</td>
<td></td>
</tr>
<tr>
<td>• ____________________</td>
<td></td>
</tr>
<tr>
<td>• Most solid substances on Earth are ____________________</td>
<td></td>
</tr>
</tbody>
</table>
| **Gases**

Describe the behavior of particles as a solid becomes a liquid.

Organize information about gases by completing the graphic organizer below. Accept all reasonable responses.

- particles evaporate when ___________
  ___________
  ___________

- particles move _________

How gases form

Gases

Characteristics of gases

- sublimation is when ___________
  ___________
  ___________

- have ___________
  shape or volume

- gases _______ to fill space
Section 3.3 States of Matter (continued)

**Main Idea**

**Plasma**
*Use with page 69.*

*Describe how plasma forms.*

*List three places where plasma is found.*
1. 
2. 
3. 

**Changes of State**
*Use with page 69.*

*Label the diagram with the processes that occur when water changes state. Write “sublimation,” “evaporation,” “condensation,” and “freezing.” Discuss the transfer of thermal energy for the various state changes in this diagram.*

**Conservation of Matter and Energy**
*Use with page 69.*

*Restate the law of conservation of matter and the law of conservation of energy in your own words.*

Conservation of matter: 

Conservation of energy: 

**SYNTHESIZE**

*Compare and Contrast the arrangement and behavior of particles in the solid, liquid, gas, and plasma phases. Write a paragraph or make a concept map.*

---

*Section 3.3 States of Matter*
Tie-It-All-Together

Describe an electron in each of the following situations:

a. a valence electron on a free atom of an element
b. participating in an ionic bond
c. part of a polar covalent bond
d. conducting electricity through a metal
e. part of a block of ice that melts to liquid water and then evaporates to water vapor

a.

b.

c.

d.

e.
Matter and Atomic Structure Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I Wanted to Find Out</td>
<td>What I Learned</td>
</tr>
<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>

Use this checklist to help you study.

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

Summarize

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

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
## Minerals

### Chapter Preview

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

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ___________</td>
<td>1. ___________</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2. ___________</td>
<td>2. ___________</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3. ___________</td>
<td>3. ___________</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Science Journal**

Think about the Discovery Lab you did to observe mineral shapes and record your response in this science journal.

Compare and contrast the shapes of the samples of halite and quartz.

What might account for the differences you observed?

Describe some other physical properties of your mineral samples.
Minerals
Section 4.1 What is a mineral?

Scan Section 1 of your text. Use the checklist below as a guide.
- Read all headings.
- Read all bold words.
- Read all tables and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about minerals.

Write one thing you would like to learn about minerals.

Review Vocabulary
Use your text to define the following term.
crystalline structure

New Vocabulary
Use your text to define each term.
mineral

 crystal

 magma

 silicate

 Academic Vocabulary
Define the following term.
 occur
Section 4.1 What is a mineral? (continued)

**Main Idea**

**Mineral Characteristics**
*Use with pages 78–79.*

**Details**

**Define** minerals by completing the chart below. Rewrite each part of the definition in your own words.

- A mineral
  - is naturally occurring and inorganic
  - So, ____ is not a mineral.
  - is a solid with a specific composition
  - So, _______ is not a mineral.
  - has a definite crystalline structure

**Label** the six major crystal systems shown below.

- [Diagram of crystal systems]

**Minerals from Magma**
*Use with page 80.*

**Describe** how magma forms minerals by completing the flow chart below.

- Magma is
  - When magma is forced upward
    - If the magma reaches Earth's surface before crystallizing, _________
    - If the magma crystallizes in Earth's heated interior
Describe the two ways minerals can form from a solution.

Draw three ways that silica tetrahedrons can combine. Circle the diagram that shows how mica, which splits easily into sheets, would bond.

Compare three different mineral groups that oxygen plays a part in.

SYNTHESIZE
Compare and contrast minerals and elements.
Minerals

Section 4.2 Identifying Minerals

Main Idea

Details

Predict what you will learn in Section 2. Read the title of the section. Write three ways that you might be able to identify a mineral.

1. 
2. 
3. 

Review Vocabulary

Use your text to define the following term.

- element

New Vocabulary

Use your text to define each term.

- luster
- streak
- hardness
- cleavage
- fracture
- specific gravity
- ore
- gem

Academic Vocabulary

Define the following term.

- trace
Organize information about mineral identification by completing the outline below.

I. Color
   A. Caused by _____________________________.
   B. Milky appearance can be due to _____________________________.

II. ______
    A. Caused by ____________________________________.
    B. Described as ______ or ________.

III. ______
    A. Defined as _________________________________.
    B. Described as ______, ______, ______, ______, ______, or ______.

IV. ______
    A. Defined as ___________________________________
       _________________________________________________.
    B. Used only if _____________________________________.

V. ______
   A. Defined as _________________________________.
   B. Measured according to _________________________________.

VI. __________________
    A. Determined by _________________________________.
       1. A mineral has cleavage if ____________________________
          _________________________________.
       2. A mineral has fracture if ____________________________
          _____________.

VII. __________________
    A. Density is a ratio of ____________________________
       _________________________________.
    B. Density is useful because ____________________________
       _________________________________.
    C. Specific gravity, is ratio of ____________________________
       _________________________________.

Main Idea

Mineral Identification
Use with pages 84–87.
**Main Idea**

**Special Properties**

*Use with page 88.*

**Details**

Organize information about four minerals that can be identified by their special properties. The first one has been done for you.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Special property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iceland spar</td>
<td>double refraction</td>
</tr>
</tbody>
</table>

**Mineral Uses**

*Use with pages 89–90.*

**Gems**

*Use with page 90.*

Identify why gems are more valuable than other kinds of minerals.

**SYNTHESIZE**

Describe what factors would have to change for a mineral to be considered an ore.
Minerals  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” 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>1. ________________________</td>
<td>1. ________________________</td>
</tr>
<tr>
<td>__________________________</td>
<td>__________________________</td>
</tr>
<tr>
<td>2. ________________________</td>
<td>2. ________________________</td>
</tr>
<tr>
<td>__________________________</td>
<td>__________________________</td>
</tr>
<tr>
<td>3. ________________________</td>
<td>3. ________________________</td>
</tr>
<tr>
<td>__________________________</td>
<td>__________________________</td>
</tr>
</tbody>
</table>

Review

Use *this checklist to help you study.*

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

SUMMARIZE

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

________________________
________________________
________________________
Igneous Rocks

Chapter Preview

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

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to identify minerals in a sample of rock and record your response in this science journal.

How many different minerals did you observe in the rock?

What minerals can you identify?

Describe the sizes and shapes of the minerals.

Do you see any evidence that these minerals crystallized from molten rock? Explain.
Igneous Rocks
Section 5.1 What are igneous rocks?

Scan Section 1 of your text. Use the checklist below as a guide.
• Read all headings.
• Read all bold words.
• Read all tables and graphs.
• Look at all the pictures and read their captions.
• Think about what you already know about igneous rocks.

Hypothesize how igneous rocks are formed.

Review Vocabulary
Use your text to define the following term.
radioactivity

New Vocabulary
Use your text to define each term.
igneous rock
lava
extrusive
intrusive
partial melting
fractional crystallization
Bowen’s reaction series

Academic Vocabulary
Define the following term.
convert
Section 5.1 What are igneous rocks? (continued)

**Main Idea**

Types of Igneous Rocks

*Use with page 99.*

**Details**

Summarize *information about intrusive and extrusive igneous rocks by writing each statement in the correct area of the Venn diagram.*

- Coarse-grained
- Form above the surface
- Cool quickly
- Form beneath the surface
- Cool slowly

- Granite is an example
- Fine-grained
- Rhyolite is an example
- Formed by crystallization of magma

**Organize** *information about the composition and formation of magma by completing the outline and the concept web below.*

I. Composition of magma
   A. Magma is __________________________ .
   B. The elements in magma are __________________________
      1. The most abundant compound in magma is ________.
   C. Magmas are classified as ________, ________, and ________.
      1. Their classification depends on __________________________

II. __________________________
    __________________________
    increases with ______
    __________________________
    This is known as the ______ content
    As this increases, the melting point ______
    __________________________
    __________________________
    increases with ______
    __________________________
    which increases ______
    ______ content
    Different ______ have different melting points.
Section 5.1 What are igneous rocks? (continued)

**Main Idea**

How Rocks Melt

*Use with page 102.*

**Details**

Summarize how the composition of the melted material in magma changes as it melts and cools. How is partial melting the opposite of fractional crystallization?

---

Bowen’s Reaction Series

*Use with page 104.*

**Draw** the figure showing Bowen’s reaction series. Add the following labels to your drawing in the correct locations.

- Basaltic (low-silica)
- Rhyolitic (high-silica)
- Sodium-rich
- Continuous reaction series of Fe-Mg minerals
- Calcium-rich
- Simultaneous crystallization
- Continuous reaction series of plagioclase feldspar

**SYNTHESIZE**

Compare and contrast the changes that are represented in the left and right branches of Bowen’s reaction series.

---

5.1 What are igneous rocks?
Igneous Rocks
Section 5.2 Classifying Igneous Rocks

Main Idea

Details

Preview what you will be learning in Section 2. Read the title of the section and the first paragraph on page 107. Write three characteristics that geologists use to classify igneous rocks.

1. 
2. 
3. 

Review Vocabulary

Use your text to define the following term.

magma

New Vocabulary

Use your text to define each term.

felsic

mafic

ultramafic

porphyritic

pegmatite

kimberlite

Academic Vocabulary

Define the following term.

complex
Section 5.2 Classifying Igneous Rocks (continued)

### Main Idea

Interpret the diagram to list the components of each rock.

1. basalt: ____________________________

2. obsidian: _________________________

3. peridotite: _________________________

4. diorite: ___________________________

5. pegmatite: _________________________

### Details

#### Mineral Composition

Use with page 107.

#### Grain Size

Use with page 109.

#### Table 5-2 Classification of Igneous Rocks

<table>
<thead>
<tr>
<th>Texture</th>
<th>Extrusive</th>
<th>Intrusive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Felsic</td>
<td>Intermediate</td>
</tr>
<tr>
<td></td>
<td>Obsidian</td>
<td>Basaltic glass</td>
</tr>
<tr>
<td></td>
<td>Rhyolite</td>
<td>Andesite</td>
</tr>
<tr>
<td></td>
<td>Granite</td>
<td>Diorite</td>
</tr>
<tr>
<td></td>
<td>Pegmatite</td>
<td></td>
</tr>
</tbody>
</table>

**Describe the conditions that cause igneous rocks to form large grains or no visible grains.**

---

Table 5-2 Classification of Igneous Rocks

- Basaltic glass
- Basalt
- Gabbro
- Diorite
- Pegmatite
- Mount (pink to white)
- Quartz (clear to white)
- Plagioclase feldspar (white to gray)
- Biotite (black)
- Amphibole (black)
- Pyroxene (green)
- Olivine (green)
### Main Idea

**Texture**

*Use with page 109.*

**Details**

**Explain** how igneous rocks form mineral grains of different shapes by completing the paragraphs below.

- Mineral grains can have interlocking edges because ____________.
- Well-shaped crystals can form during ________________.
- When this happens, ____________
- ____________.
- Rocks with a porphyritic texture can form when ________________
- ____________
- ____________.
- This could happen because ________________
- ____________.

**Igneous Rocks as Resources**

*Use with page 111.*

**List** two characteristics of igneous rocks that make them good building materials.

1. ____________
2. ____________

**Ore Deposits**

*Use with page 111.*

**Organize** the steps in the formation of deposits in veins.

- The fluid from which magma crystallizes contains high levels of ____________ ____________.
- The fluid fills ____________
- ____________
- ____________.
- The fluid solidifies to form ____________ containing metals such as ____, ___, ___, ___, and rare elements such as ____, and ____. 

### SYNTHESIZE

Identify the characteristic of igneous rocks that you could use to quickly determine whether a rock is extrusive or intrusive. Explain how this characteristic develops.
Igneous Rocks  Chapter Wrap-Up

In the "What I Wanted to Find Out" column, copy the questions you listed in the Chapter Preview. In the "What I Learned" column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I Wanted to Find Out</td>
<td>What I Learned</td>
</tr>
<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>

Review

Use this checklist to help you study.

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

Summarize

Hypothesize how N. L. Bowen learned how magma cools in the reaction series. Do you think he performed experiments in a laboratory? Did he make observations in the field? Explain your answer.
Sedimentary and Metamorphic Rocks

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about sedimentary and metamorphic rocks. Then list three questions you have about them 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>1.</td>
<td></td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Think of the Discovery Lab you did to model sediment layering and record your responses in this Science Journal.

What type of particles settled out first?

What type of particles form the topmost layers?

How is this activity related to the layering that occurs in sedimentary rocks?
Sedimentary and Metamorphic Rocks

Section 6.1 Formation of Sedimentary Rocks

Main Idea

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

- Read all headings.
- Read all bold words.
- Read all tables and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about sedimentary rocks.

Write three questions that come to mind about how sedimentary rocks form.

1. 
2. 
3. 

Details

Use your text to define the following term.

Review Vocabulary

New Vocabulary

Define the following term.
Section 6.1 Formation of Sedimentary Rocks (continued)

Weathering

Use with page 121.

Describe how weathering produces sediments by completing the concept map below.

- Weathering
  - Produces ______ sediments
  - Occurs when ______
  - Physical processes
    - Minerals in rock are chemically ______. Rock fragments break off
  - Minerals in rock are chemically ______.

Erosion and Transport

Use with page 123.

Draw pictures to help you understand erosion. Use Figure 6-2 to help you. In the top part of each box, draw a picture of one of the four main causes of erosion: wind, moving water, gravity, and glaciers. In the bottom half, draw a picture of the kind of sediments that form from each cause of erosion: layered sediments, well-sorted sand, or unsorted piles.
Section 6.1 Formation of Sedimentary Rocks (continued)

**Main Idea**

Lithification
*Use with page 125.*

**Details**

Compare *lithification of sand and silt.* Describe cementation.

Describe the features of sedimentary rock.

Bedding

Graded bedding

Cross-bedding

Small sedimentary features

Fossils

**Features of Sedimentary Rock**
*Use with pages 126–127.*

**SYNTHESIZE**

A certain sedimentary formation contains two layers. The bottom layer is made up of jumbled, unsorted material. The top layer made up of fine, well-sorted sand. Describe how this formation might have been created.
Sedimentary and Metamorphic Rocks
Section 6.2 Types of Sedimentary Rocks

Scan the objectives for Section 2 in your text. Write three questions that come to mind.

1. 

2. 

3. 

Use your text to define the following term.

clastic

Use your text to define each term.

clastic sedimentary rock

porosity

evaporite

Define the following term.

feature
Section 6.2 Types of Sedimentary Rocks (continued)

**Main Idea**

**Clastic Sedimentary Rocks**

*Use with pages 128–129.*

**Chemical Sedimentary Rocks**

*Use with page 130.*

**Details**

**Organize** information about the three types of clastic sedimentary rocks.

<table>
<thead>
<tr>
<th>Clastic Sedimentary Rocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse-grained</td>
</tr>
<tr>
<td>Type of fragments:</td>
</tr>
<tr>
<td>Types of rock formed:</td>
</tr>
<tr>
<td>Formed by:</td>
</tr>
<tr>
<td>Medium-grained</td>
</tr>
<tr>
<td>Type of fragments:</td>
</tr>
<tr>
<td>Type of rock formed:</td>
</tr>
<tr>
<td>Formed by:</td>
</tr>
<tr>
<td>Fine-grained</td>
</tr>
<tr>
<td>Type of fragments:</td>
</tr>
<tr>
<td>Type of rock formed:</td>
</tr>
</tbody>
</table>

**Compare** the porosity of medium-grained clastics and fine-grained clastics. Explain the movement of oil and water through each type of rock.

<table>
<thead>
<tr>
<th>Medium-grained clastics</th>
<th>Fine-grained clastics</th>
</tr>
</thead>
</table>

**Sequence** the steps in the formation of sedimentary rocks from evaporation. *The first one has been completed for you.*

___ Thick layers of evaporites can accumulate as evaporation removes freshwater.

___ Water evaporates and leaves behind dissolved minerals.

1 Minerals are dissolved and carried into lakes and oceans by chemical weathering.

___ Layers of chemical sedimentary rocks called evaporites form.

___ The concentration of minerals reaches the saturation point.

___ Crystal grains precipitate out of the solution and settle on the bottom.
Importance of Sedimentary Rocks

Use with page 131.

Organize information about why sedimentary rocks are important by filling in the graphic organizer.

REAL-WORLD CONNECTION

A company wants to drill a new oil well. They know that a layer of oil-containing shale is located beneath a thick layer of siltstone. Describe challenges the company might face.
Sedimentary and Metamorphic Rocks
Section 6.3 Metamorphic Rocks

Main Idea

Skim Section 3 of your text. Read the headings and the illustration captions. Write three questions that come to mind.

1.
2.
3.

Details

Review Vocabulary

Use your text to define the following term.

intrusive

New Vocabulary

Use your text to define each term.

regional metamorphism
contact metamorphism
hydrothermal metamorphism
foliated
nonfoliated
porphyroblast
rock cycle

Academic Vocabulary

Define the following term.
cycle
Section 6.3 Metamorphic Rocks (continued)

**Main Idea**

**Causes of Metamorphism**

Use with page 133.

**Details**

Summarize information about causes of metamorphism by completing the graphic organizer.

<table>
<thead>
<tr>
<th>Conditions necessary for metamorphism</th>
<th>can be caused by</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Organize information about metamorphism by completing the outline.

I. Regional metamorphism
   A. Occurs when ____________________________
      ____________________________.
   B. Geologists can divide metamorphic rock belts into zones based on ____________________________.

II. ____________________________
   A. Occurs when ____________________________
   B. Can result in ____________________________

III. ____________________________
   A. Occurs when ____________________________
   B. Can result in ____________________________

**Metamorphic Textures**

Use with page 136.

Organize information about textures of metamorphic rock in the table below.

<table>
<thead>
<tr>
<th>Texture</th>
<th>Shape of crystals</th>
<th>How formed</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foliated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonfoliated</td>
<td></td>
<td>no pressure during metamorphism</td>
<td></td>
</tr>
<tr>
<td>Porphyroblast</td>
<td>very large</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 6.3 Metamorphic Rocks (continued)

Main Idea

Mineral Changes
Use with page 137.

Compare mineral changes in metamorphism to changes in fractional crystallization. Name the process of mineral change in metamorphism.

Details

Compositional Changes
Use with page 137.

Describe compositional changes in metamorphism by completing the paragraph below.

Hot fluids ________________ during metamorphism. This can change ________________. Chemical changes often happen during ________________
______________

Hydrothermal fluids ________________.

The Rock Cycle and Possible Paths
Use with pages 138–139.

Draw the rock cycle with the processes that change one kind of rock into another kind. Use Figure 6-21 in your text for help.

SYNTHESIZE

A geologist says that a certain rock is 500 million years old. Tell if this can be true, and why or why not.
Tie-It-All-Together

Analyze what you have learned in this chapter about how igneous, sedimentary, and metamorphic rocks are formed. Explain how a rock can undergo two different processes that change its texture, rock type, or composition.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
### Sedimentary and Metamorphic Rocks  Chapter Wrap-Up

**Before you read the chapter,** use the “What I Know” column to list three things you know about sedimentary and metamorphic rocks. Then list three questions you have about them in the “What I Wanted to Find Out” column.

<table>
<thead>
<tr>
<th>What I Wanted to Find Out</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
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<td>2.</td>
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### Review

*Use this checklist to help you study.*

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

### Real-World Connection

After reading this chapter, list three things you have learned about sedimentary and metamorphic rocks.
Weathering, Erosion, and Soil

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about weathering, erosion, and soil. Then list three questions you have about them 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>1.</td>
<td></td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

**Science Journal**

Think about the Discovery Lab you did to model interfaces and record your responses in this science journal.

Describe what happened to the sugar cube and the granulated sugar.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Explain why one form of sugar dissolved faster than the other. Infer how you could decrease the time required to dissolve the other form of sugar.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Weathering, Erosion, and Soil
Section 7.1 Weathering

Main Idea

Scan the objectives for Section 1 in your text. Write three questions that come to mind.

1. ______________________________________
2. ______________________________________
3. ______________________________________

Details

Use your text to define the following term. Hypothesize how the term might be important in this chapter.

chemical reaction

Use your text to define each term.

weathering

erosion

mechanical weathering

d frost wedging

exfoliation

chemical weathering

hydrolysis

oxidation

New Vocabulary

Academic Vocabulary

Define the following term.

expand
Sequence the processes by which factors in mechanical weathering break down rocks and minerals. Number the steps in each process 1–4. Use Figure 7-3 to help you.

**Mechanical Weathering**

**Temperature**

___ Freezing water exerts pressure on the rocks and make them split.
___ Water collects in the cracks of rocks and rock layers.
___ Water thaws and the cycle, called frost wedging, repeats.
___ Water expands as it freezes.

**Pressure**

___ Successive layers of rock are stripped away in a process called exfoliation.
___ The bedrock surface expands and long cracks form parallel to the surface of the rock.
___ The overlying rock layers are removed and the pressure on the bedrock is reduced.
___ Bedrock at great depths is under pressure from the overlying rock layers.

**Outline** information about how water, oxygen, and carbon dioxide contribute to chemical weathering to help you understand and remember this cause of erosion.

I. Water
   A. Important in chemical weathering because ____________
      ________________.
   B. Hydrolysis is ________________
      1. It occurs in the decomposition ________________.

II. _______
   A. Like water, it can ________________.
   B. This chemical reaction is called ________.

III. ____________
   A. Produced by ________________
   B. Combines with water in the atmosphere to form ________________.
   C. Carbonic acid reacts with minerals to ________________.
      1. Limestone caverns can form when ________________.
Section 7.1 Weathering (continued)

Main Idea

Organize information about acid precipitation by completing this graphic organizer.

Acid Precipitation

is caused by of materials from human activity

including


Summarize the conditions that can increase the rate of weathering by completing the table.

| Variables that Affect the Rate of Weathering |
|------------------|---------------------------------|
| Variable         | Most weathering happens with. . . |
| Climate          | warm, rainy (chemical) cool, dry (physical) |

What affects the rate of weathering?

Real-World Connection

You have been asked to evaluate a design for a stone monument. The monument will be located in a city that has a warm, rainy climate. The artist has made several errors in judgment. List what they might be, and why. Include information about its placement, design, and the materials you would use to make it.
Weathering, Erosion, and Soil

Section 7.2 Erosion and Deposition

**Main Idea**

**Details**

Consider the title of Section 7.2 of your book. Write 3 topics that might be discussed in this section.

1. 
2. 
3. 

**New Vocabulary**

Use your text to define each term. Make a sketch to help you understand and remember each term.

**deposition**

**rill erosion**

**gully erosion**

**Academic Vocabulary**

Define the following term.

**annual**
Gravity’s Role in Erosion

Use with page 162.

Erosion by Running Water

Use with page 162.

Identify gravity’s role in erosion. Include examples.

Write a sentence that tells how each of the following factors affect erosion and/or deposition.

Streams and rivers

Deltas

Ocean currents, waves, and tides

Dunes and beaches

Ocean floor and shorelines

Human development and population growth
Section 7.2 Erosion and Deposition (continued)

**Main Idea**

Wind Erosion

*Use with page 165.*

**Details**

Organize information about wind erosion by filling in the graphic organizer.

- Wind Erosion
  - Factors that contribute to wind erosion
  - One way to reduce wind erosion:

**Erosion by Plants, Animals, and Humans**

*Use with page 166.*

- **Formulate** additional examples of how plants, animals, and humans contribute to erosion. List examples from the book in the left column. Add your own examples in the right column.

<table>
<thead>
<tr>
<th>Examples from the book</th>
<th>Additional examples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SYNTHESIZE**

Is erosion a purely destructive force, or does it have constructive aspects as well? Explain your answer and give examples.

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________
Weathering, Erosion, and Soil
Section 7.3 Formation of Soil

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

• Read all headings.
• Read all bold words.
• Read all tables and graphs.
• Look at all the pictures and read their captions.
• Think about what you already know about soil.

Write two questions that come to mind about how soil forms.

1. ___________________________
2. ___________________________

Review Vocabulary
Use your text to define the following term.

sediment

New Vocabulary
Use your text to define each term. Make a sketch to help you understand and remember the terms.

soil

residual soil

transported soil

soil profile

soil horizon
Section 7.3 Formation of Soil (continued)

Main Idea

Development of Soil

Use with page 167.

Details

Sequence the steps in the development of soil by completing the flow chart.

- Weathering breaks solid bedrock into smaller pieces.

Soil Composition

Use with page 168.

Write a paragraph that explains the relationship between a soil and its parent rock.

Soil Profiles

Use with page 169.

Model a soil profile in the box below. Use Figure 7-21 and information from your book to help you. If the figure below shows a cross-section of the earth, write each of the labels below in the correct space in the soil profile.

- High concentrations of organic matter
- Horizon A
- Horizon B
- Sits directly above bedrock
- Subsoils enriched with clay minerals
- Horizon C
Section 7.3 Formation of Soil (continued)

Main Idea

Soil Types
Use with page 172.

Compare and Contrast polar, temperate, desert, and tropical soils by completing the table.

<table>
<thead>
<tr>
<th>Soil Types</th>
<th>Polar</th>
<th>Temperate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form at</td>
<td></td>
<td>Support environments such</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grassland soils</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forest soils</td>
</tr>
</tbody>
</table>

Desert

<table>
<thead>
<tr>
<th>Desert</th>
<th>Tropical</th>
</tr>
</thead>
<tbody>
<tr>
<td>of accumulated salts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grassland soils</td>
</tr>
<tr>
<td></td>
<td>Forest soils</td>
</tr>
</tbody>
</table>

Identify the five factors that affect soil fertility.

1. 
2. 
3. 
4. 
5. 

Real-World Connection

Every food we eat can be traced back to soil. Take ice cream, for example: ice cream is made with milk; milk comes from cows; cows eat grass; grass grows in soil. So, ice cream comes from soil! Think of a food you like to eat. Then trace the food back to its origin in soil.
Weathering and erosion are processes that occur continuously on Earth. Large changes to Earth’s surface features often take place slowly, over many years. People do not always consider the effects that these changes can have on the structures they erect. Examine your ideas, thoughts, and opinions about this issue by reading the scenario below and then answering the questions. Support your opinions with logical reasoning.

A large hotel was constructed more than 50 years ago on a high cliff overlooking the Pacific Ocean. Over the years, the cliff has eroded. Ten years ago, a developer built a wharf that reduced the deposition of sand on the beach below the cliff. This increased the rate of erosion of the cliff. Each year, the cliff’s edge advances closer and closer toward the hotel. The hotel now sits only 20 m from the edge.

The local government has condemned the hotel, saying that it is no longer safe. The hotel owners have protested the government’s decision. They say that the hotel could still be safe for years to come. Furthermore, if the hotel is condemned, they want to be paid for the loss of their property.

Should the hotel owners be allowed to keep the hotel open? Why or why not?

If the hotel did stay open and someone got hurt, would the owners be responsible, or should it just be considered an accident?

If the hotel is closed, should the owners receive any payment? Who would pay them? The local government? The builders of the wharf?

What steps could be taken to ensure that problems like this do not arise in the future?
Weathering, Erosion, and Soil  Chapter Wrap-Up

**In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.**

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I Wanted to Find Out</td>
<td>What I Learned</td>
</tr>
<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>

**Review**

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- [ ] Study the definitions of vocabulary words.
- [ ] Review daily homework assignments.
- [ ] Reread the chapter and review the tables, graphs, and illustrations.
- [ ] Review the Section Assessment questions at the end of each section.
- [ ] Look over the Study Guide at the end of the chapter.

**SUMMARIZE**

After reading this chapter, describe the connection between weathering, erosion, and soil.
Mass Movements, Wind, and Glaciers

Chapter Preview

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

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to model sand-slope and record your response in this science journal. Describe how the addition of water affected the sand’s ability to be molded in the three samples.

Science Journal

---

Mass Movements, Wind, and Glaciers 77
Scan the photos, diagrams, and captions in Section 1 of your text. List three topics that are discussed in this section.

1. ____________________________
2. ____________________________
3. ____________________________

Use your text to define each term.

**mass movement**

__________________________________________________________

**creep**

__________________________________________________________

**mudflow**

__________________________________________________________

**landslide**

__________________________________________________________

**slump**

__________________________________________________________

**avalanche**

__________________________________________________________

Define the following term.

**potential**

__________________________________________________________
Section 8.1 Mass Movements at Earth’s Surface (continued)

Mass Movements
Use with page 181.

Variables That Influence Mass Movements
Use with page 183.

Types of Mass Movements
Use with page 184.

List three variables that influence mass movement.
1. 
2. 
3. 

Illustrate how water can influence soil. Make one drawing to show how water can hold grains together, and one to show how it lubricates between grains.

Compare the types of mass movement in the table below. Make a simple sketch of each kind of movement.

<table>
<thead>
<tr>
<th>Mass movement</th>
<th>How material behaves</th>
<th>Effects/Results</th>
<th>Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td>creep</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>slide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>slump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>avalanche</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rock fall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 8.1 Mass Movements at Earth’s Surface (continued)

Main Idea

Mass Movements Affect People
Use with page 189.

Reduction the Risks
Use with page 189.

Details

List three ways human actions increase the destruction caused by mass movements.

1. ______________________________________________________________________

2. ______________________________________________________________________

3. ______________________________________________________________________

Analyze preventative actions by completing the graphic organizer below.

Real-World Connection

Infer why it is important to regulate development in areas of heavy rainfall and steep topography. Discuss what types of mass movement can occur and how people should use this information when they want to build or develop an area.

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________
### Main Idea

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

- Read all the section titles.
- Read all bold words.
- Look at all figures and photos and read their captions.
- Think about what you already know about rivers and streams.

### Details

**Review Vocabulary**

*Use your text to define the following term. How do you think it fits with the concepts discussed in this chapter?*

- **friction**

**New Vocabulary**

*Use your text to define each term.*

- **deflation**
- **abrasion**
- **ventifact**
- **dune**
- **loess**

**Academic Vocabulary**

*Define the following term.*

- **transport**
Organize information about sediment transport in the Venn diagram to show whether it is a characteristic of saltation, suspension, or both.

- airborne particles
- areas of low precipitation
- bouncing motion
- moves larger particles
- strong winds
- move smaller particles

**Main Idea**

**Wind Erosion and Transport**

*Use with page 191.*

**Details**

**Wind Deposition**

*Use with page 195.*

**Draw** diagrams of 4 types of sand dunes in the boxes below. Use Table 8-1 in your text to help. Use an arrow to show the direction the wind is blowing.
Section 8.2 Wind (continued)

Wind Deposition
*Use with page 194.*

**Main Idea**

**Details** *Synthesize* Turn the three bold-faced headings under “wind deposition” into questions. Then use the information from your text to answer your questions.

**Formation of Dunes**

**Question:** __________________________

**Answer:** __________________________

**Types of Dunes**

**Question:** __________________________

**Answer:** __________________________

**Loess**

**Question:** __________________________

**Answer:** __________________________

**Real-World Connection**

Imagine you are a conservation officer for an ocean side state park. How could you explain to the public that they must not damage the dunes? Make up three rules, and give three explanations of what could happen if the rules were not obeyed.

<table>
<thead>
<tr>
<th>Rule</th>
<th>Consequence</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>
Mass Movement, Wind, and Glaciers
Section 8.3 Glaciers

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

1. 
2. 
3. 

Use your text to define each term.

- **glacier**
- **valley glacier**
- **continental glacier**
- **cirque**
- **moraine**
- **outwash plain**
- **drumlin**
- **esker**

Define the following term.

- **accumulate**
Section 8.3 Glaciers (continued)

Main Idea

Use with page 198.

Moving Masses of Ice

Use with pages 199–201.

Glacial Erosion

Use with page 201.

Details

List three things glaciers do to rock.

__________________________, ________________________, and ________________________.

List three things scientists learn by studying the layers of glaciers.

1. ____________________________

2. ____________________________

3. ____________________________

Compare and Contrast valley glaciers and continental glaciers in the table below.

<table>
<thead>
<tr>
<th></th>
<th>Valley Glaciers</th>
<th>Continental Glaciers</th>
</tr>
</thead>
<tbody>
<tr>
<td>size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>flow begins when . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>part of glacier where movement occurs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>locations on Earth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Draw a diagram similar to Figure 8-24, or several separate pictures, to show the glacial features listed below.

- arête
- cirque
- hanging valley
- horn
- U-shaped valley
- waterfall
Section 8.3 Glaciers (continued)

**Main Idea**

Glacial Deposition

*Use with page 202.*

**Details**

Describe the differences between glacial till and glacial outwash.

Describe the differences between moraines, drumlins, and eskers.

**Sequence** the formation of a kettle lake.

1. Large block of ice breaks off glacier.

2.

3.

4. Kettle hole fills with water and becomes a kettle lake.

**ANALOGY**

Describe be how a glacier can be compared to each of the following: sand paper, a city bus system, a newspaper carrier.
Tie-It-All-Together

**Predict** why mudflows are common when a dry summer with numerous wildfires is followed by an autumn with torrential rains. What precautions can people in this area take to avoid problems?

- 
- 
- 
- 

**Identify** ways that past glacial action in New England and New York State might affect tourism and recreation in those areas.

- 
- 
- 
- 

**Design** a model of one of the types of mass movement mentioned in the chapter. Come up with a plan to stop the erosion or minimize the danger to surrounding areas and homes. Imagine you have an unlimited budget to carry out your plan.

- 
- 
- 
- 

---

*FURTHER INQUIRY*

---

*Mass Movements, Wind, and Glaciers* 87
In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K What I Wanted to Find Out</th>
<th>W What I Learned</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>

Review

Use this checklist to help you study.

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

Summarize

After reading this chapter, list three important ideas about mass movement, wind, and glaciers.

__________________________
__________________________
__________________________
Surface Water

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about surface water. Then list three questions you have about surface water 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>1.</td>
<td></td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to model water movement.

Describe what happens to the water after five minutes.

_________________________________________________________________________________________

_________________________________________________________________________________________

_________________________________________________________________________________________

Measure how much water passes through each clump and collects in the plastic shoe box. Explain any differences in the amount of water collected in each plastic shoe box.

_________________________________________________________________________________________

_________________________________________________________________________________________

_________________________________________________________________________________________
Surface Water
Section 9.1 Surface Water Movement

Main Idea

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

- Read all the section titles.
- Read all bold words.
- Look at all figures and photos and read their captions.
- Think about what you already know about rivers and streams.

New Vocabulary

In the left margin, write the terms defined below.

- water that flows downslope on Earth’s surface and may enter a stream, river, or lake; its rate is influenced by the angle of the slope, vegetation, rate of precipitation, and soil composition
- land area drained by a stream system
- elevated land that divides one watershed or drainage basin from another
- a mixture of materials dissolved in stream water
- when silt and sand are held up and carried along by turbulent stream water
- sediments too heavy to remain in solution, that are pushed or rolled along the bottom of a stream bed.
- a measure of the volume of stream water that flows over a location in an amount of time
- potentially devastating natural occurrence in which water spills over the sides of a stream’s banks onto adjacent land
- broad, flat, fertile area extending from a stream’s bank, covered with water during floods

Academic Vocabulary

Define the following term.

- process
Runoff

Use with page 212.

Draw the hydrologic cycle. Include all of the terms listed below. Use Figure 9-1 to help you.

- condensation
- groundwater
- precipitation
- transpiration
- infiltrates
- ocean
- land
- evaporation
- runoff

Stream Systems
Watersheds and Divides

Use with page 214.

Predict how different variables impact whether precipitation will seep into the ground or become runoff.

<table>
<thead>
<tr>
<th></th>
<th>seep into ground</th>
<th>become runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rate of precipitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>soil composition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>slope</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sequence the steps in the development of a stream.

1. _____________________________
2. _____________________________
3. _____________________________
4. _____________________________
**Main Idea**

Stream Load/Stream Velocity and Carrying Capacity

Use with page 218.

**Details**

Explain how minerals, such as calcium carbonate and soluble magnesium compounds found in surface water, compare to the sugar in lemonade.

---

Floodplains/ Floods

Use with page 220.

**Details**

Draw a diagram that illustrates the relationship between these terms:
- bedrock
- floodplain
- floodplain deposits
- river channel

---

**Real-World Connection**

Imagine you are a developer and have a chance to buy an area for a housing subdivision on a flood plain. Develop a report on this buying option for shareholders, including the risks and benefits of building there.
## Surface Water

### Section 9.2 Stream Development

**Main Idea**

**Details**

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

1. 
2. 
3. 

**Review Vocabulary**

Use your text to define the following term.

*deposition*

**New Vocabulary**

Use your text to define each term.

*stream channel*

*stream bank*

*meander*

*delta*

*rejuvenation*

**Academic Vocabulary**

Define the following term.

*contrast*
Describe the how moving water can carve a path by completing the paragraph below.

________ supplies the water needed for a stream to form. This water first accumulates in an area called the ________ . This is usually a spot high in the ________ . The water accumulates in small _____ at higher elevation and forms ___________ streams. Eventually, the water carves out a ___________ , which ______ and _______ as more water accumulates. Water is held in a stream by __________ .

Sequence the steps in the formation of V-shaped valleys. The first one has been done for you.

____ the stream reaches base level
____ broader valley with gentle slopes is formed
____ a stream erodes steep sided valley
____ erosion continues along side of V-shaped channel

Create a diagram of a meandering stream. Your diagram should include the following:

• places where deposition occurs
• spots where erosion occurs
• an oxbow lake
• an indication of the area of fastest and slowest flow
Section 9.2 Stream Development (continued)

**Main Idea**

**Deposition of Sediment**

*Use with page 226.*

**Details**

**Compare and Contrast** an alluvial fan and a delta in the table below.

<table>
<thead>
<tr>
<th>Shape and Composition</th>
<th>Area and means deposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alluvial Fan</td>
<td></td>
</tr>
<tr>
<td>Delta</td>
<td></td>
</tr>
</tbody>
</table>

**Rejuvenation**

*Use with page 227.*

Organize information about the rejuvenation of a stream by completing the cycle diagram below.

**SYNTHESIZE**

Write the history of a stream. Include information on how and where it was formed, what it experienced during its middle years, and how it aged. Diagrams may be useful in creating this life history story.

____________________

____________________

____________________

____________________

____________________

____________________
Surface Water
Section 9.3 Lakes and Freshwater Wetlands

Main Idea

Consider the title of Section 9. List three things that might be discussed in this section.

1. __________________________________________________________________________

2. __________________________________________________________________________

3. __________________________________________________________________________

Details

Review Vocabulary

Use your text to define the following term.

cirque

______________________________________________________________________________

______________________________________________________________________________

New Vocabulary

In the left margin, write the terms defined below.

__________________________

land covered in water for most of the year

__________________________

depression that holds water

__________________________

process where water becomes rich in nutrients

Academic Vocabulary

Define the following term.

maintain

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________
Section 9.3 Lakes and Freshwater Wetlands (continued)

**Main Idea**

**Origins of Lakes**
*Use with page 228.*

**Details**

List two kinds of man-made lakes and identify their purpose.

1. 

2. 

**Lakes Undergo Change**
*Use with page 229.*

Summarize the four major ways in which lakes form by describing each process and the type of lake that is formed.

<table>
<thead>
<tr>
<th>Streams</th>
<th>Landslides</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Glaciers</th>
<th>Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analyze the information on how lakes undergo change. In the question spaces provided, turn the bold-faced headings into questions. Then answer your questions.

**Eutrophication**

Question: ______________________________________

Answer: ______________________________________

**Freshwater Wetlands**

Question: ______________________________________

Answer: ______________________________________
Section 9.3 Lakes and Freshwater Wetlands (continued)

**Main Idea**

Lakes Undergo Change

*Use with page 229.*

**Details**

Identify two helpful functions that wetlands have.
1. trap __________, __________, ______________ from water sources
2. provide habitats and homes for __________________________

Create a concept web to show seven factors, natural and human-contributed, that contribute to the eutrophication of a lake.

![Concept Web Diagram]

**Real-World Connection**

Create a diagram that explains the probable origin of a lake in your state. Your diagram may include other nearby lakes or landforms to support your hypothesis.
Tie-It-All-Together

Describe the erosional and depositional abilities of a river.

Explain how a floodplain is a dynamic feature.

Design a model or several frames (cartoon-strip style) that can show the behavior of a river over its lifetime. Include the different stages and the features that will form and erode over time. Present your model to the class.
In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I Wanted to Find Out</td>
<td>What I Learned</td>
</tr>
<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>

Use this checklist to help you study.

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

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

__________________________

__________________________

__________________________
Describe how much water is present in the saturated sand.

Calculate the ratio of water volume to the volume of sand. Infer how many liters of water could be stored in a cubic meter of sand.
Groundwater

Section 10.1 Movement and Storage of Groundwater

Main Idea

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

1. 
2. 
3. 

Details

Use your text to define the following term.

renewable resource

Use your text to define each term.

infiltration

porosity

zone of saturation

water table

permeability

aquifer

Review Vocabulary

New Vocabulary

Academic Vocabulary

Define the following term.

resource
Section 10.1 Movement and Storage of Groundwater (continued)

**Main Idea**

**The Hydrosphere**

Use with page 240.

**Details**

Create a pie graph that compares the percentages of the sources of freshwater. Your graph should include the atmosphere, rivers and streams, groundwater, lakes, and ice caps and glaciers.

**Precipitation and Groundwater**

Use with page 240.

Sequence Number the steps in the movement of groundwater. The first one has been completed for you.

1. water infiltrates into the ground
2. seawater evaporates
3. water becomes part of groundwater
4. precipitation
5. groundwater returns to surface through springs
6. water flows from springs back to the oceans

**Groundwater Storage**

Use with page 240.

Draw diagrams of sediments with different porosity.

<table>
<thead>
<tr>
<th>Well-Sorted Sediment</th>
<th>Poorly Sorted Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypothesize why poorly sorted sediments might be less porous.
**Section 10.1 Movement and Storage of Groundwater** (continued)

<table>
<thead>
<tr>
<th>Main Idea</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Zone of Saturation</strong>&lt;br&gt;Use with page 241.</td>
<td>Explain how a kitchen sponge floating in the water compares to the zone of saturation and the water table.</td>
</tr>
<tr>
<td><strong>Groundwater Movement</strong>&lt;br&gt;Use with page 242.</td>
<td><strong>Draw</strong> a diagram similar to Figure 10-4 with an aquifer overlain by an impermeable layer of rock.&lt;br&gt;• Show where a reliable well could be dug.&lt;br&gt;• Draw a well that would be unreliably filled with water.&lt;br&gt;• Show where a well would be dry.</td>
</tr>
</tbody>
</table>

**Real-World Connection**

Draw a fictional topographic map. Show where the water table is at the surface, below the surface, and above the surface of the land. Using graph paper, create a topographic profile (or side view) through a portion of the map. On your profile, indicate the approximate location of the water table.
Groundwater
Section 10.2 Groundwater Erosion and Deposition

Main Idea

Details

Skim through Section 2 of your text. Read the headings and figure captions. Write three questions that come to mind.

1.                                                  

2.                                                  

3.                                                  

Review Vocabulary

Use your text to define the following term.

carbonate rocks

New Vocabulary

Use your text to define each term.

cave

sinkhole

karst topography

stalactite

stalagmite

travertine

Academic Vocabulary

Define the following term.
collapse
Analyze cave formation by completing the following sentences.
A _____ is a natural underground opening with a ______ to the surface. Caves form when _______ is dissolved by _________. The limestone becomes more _________ as it dissolves. Caves usually form in the zone of ________ below the _________.

Draw a diagram to show the landforms found in a karst region. Label the following features on your diagram:
- dry cave
- sinking stream
- water table
- sinkhole
- water-filled cave

Compare and contrast stalagmites and the white “scale” sometimes found in pipes and water kettles.

<table>
<thead>
<tr>
<th>Differences</th>
<th>Similarities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 10.2 Groundwater Erosion and Deposition (continued)

Skim the information about groundwater deposits. In the Question spaces provided, turn the bold-faced headings into questions. Then answer the questions.

**Groundwater Deposits**
*Use with page 247.*

**Hard Water**

Question: ____________________________

Answer: ____________________________

**Natural Deposits**

Question: ____________________________

Answer: ____________________________

**REAL-WORLD CONNECTION**

Marble is a metamorphic rock made from limestone that has undergone extreme heat and pressure. Many ancient marble statues are beginning to wear away. Acid rain is the culprit. Explain what is happening to cause this and compare it to the formation of a karst region.

[Additional text]
Groundwater
Section 10.3 Groundwater Systems

**Main Idea**

Scan Section 10.3 of your text. Use the checklist below as a guide.

- Read all the section titles.
- Read all bold words.
- Look at all figures and photos and read their captions.
- Think about what you already know about rivers and streams.

**New Vocabulary**

In the left margin, write the terms defined below.

- water being added back to zone of saturation
- holes dug or drilled to reach reservoir of groundwater
- natural discharge of water
- spring with temperatures greater than 40°C.
- well that the water does not need to be pumped from
- difference between original water table level and the level in a pumped well
- explosive hot springs

**Academic Vocabulary**

Define the following term.

transport
Section 10.3  Groundwater Systems (continued)

**Main Idea**

**Springs**
*Use with page 250.*

**Create** one diagram to illustrate these terms. Use Figure 10-12 to help you.
- impermeable layer
- perched water table
- main water table
- spring

**Wells**
*Use with page 252.*

**Describe** how pumping affects a water well by completing the cycle diagram below.

---

**Confined Aquifers**
*Use with page 253.*

**Explain concepts related to aquifers by completing the following sentences.**

Aquifers that are unconfined are called _________ aquifers.
Confined aquifers are located between two _________. If a confined aquifer is under pressure, a well dug in that area may form an _________. If water flows naturally from the ground, it may be an __________.
Section 10.3 Groundwater Systems (continued)

**Main Idea**

**Details**

**Threats to Our Water Supply**

*Use with page 254.*

**Protecting Our Water Supply**

*Use with page 257.*

**Summarize** threats to the water supply, causes, and consequences in the table below.

<table>
<thead>
<tr>
<th>Threat</th>
<th>Causes</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overuse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsidence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pollution of Groundwater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemicals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Identify** four ways that pollution that has entered the groundwater system can be controlled.

1. ____________________________________________

2. ____________________________________________

3. ____________________________________________

4. ____________________________________________

**SYNTHESIZE**

Imagine you are teaching a course for water-well drillers. List factors that would be important to teach drillers to consider when locating and using water wells, and land features useful for drillers to know about.
Tie-It-All-Together

**Describe** some of the problems associated with living in a karst region.

- 
- 
- 
- 

**Explain** how limestone is dissolved by groundwater.

- 
- 
- 
- 

**Design** a model of a cave. Show natural features. Describe animals or plant life. Indicate rock type as well as add the surface of the land to your diagram.
In the "What I Wanted to Find Out" column, copy the questions you listed in the Chapter Preview. In the "What I Learned" 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>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

☐ Study your Science Notebook for this chapter.

☐ Study the definitions of vocabulary words.

☐ Review daily homework assignments.

☐ Reread the chapter and review the tables, graphs, and illustrations.

☐ Review the Section Assessment questions at the end of each section.

☐ Look over the Study Guide at the end of the chapter.

Summarize

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

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about atmosphere. Then list three questions you have about atmospheres 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>1.</td>
<td>__________________</td>
<td>1.</td>
<td>__________________</td>
</tr>
<tr>
<td>2.</td>
<td>__________________</td>
<td>2.</td>
<td>__________________</td>
</tr>
<tr>
<td>3.</td>
<td>__________________</td>
<td>3.</td>
<td>__________________</td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to model the formation of dew and record your responses in this science journal.

Describe what happened to the outside of the glass in step 3 and step 4.

________________________________________________________

Relate your observations to the formation of dew.

________________________________________________________

________________________________________________________

Graph the temperature of the water during both experiments. Did the results vary with location?

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

- Read all the section titles.
- Read all bold words.
- Look at all figures and photos and read their captions.
- Think about what you already know about atmosphere.

**Review Vocabulary**

Use your text to define the following term. Predict how you think this term will apply to the Atmosphere chapter.

composition

New Vocabulary

Use your text to define each term.

ozone

troposphere

stratosphere

radiation

conduction

convection

Draw a sketch showing the relative positions of the mesosphere, thermosphere, and exosphere.
Organize information about the components of the atmosphere using the prompts provided. Use Figure 11-1 and other information from your book to help you.

The majority of air is made up of ____ (%) and ____ (____ %). ______ and _______ are two important gases that ____ in amount but are critical in determining the amount of ______ the atmosphere absorbs. ____ is either absorbed or released when water _________.

Three solids in the atmosphere are ___, ___, and ___.

A gas that controls the amount of ultraviolet light that enters the atmosphere is _____, a molecule made of three ____________.

Other major gases that can be found in the atmosphere include ___, ___, ___, ___, ___, ___, and ____.

Compare and Contrast the characteristics of the different layers of the atmosphere in the table below.

<table>
<thead>
<tr>
<th>Layer</th>
<th>Temperature Variation with Altitude</th>
<th>Composition</th>
<th>Special Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troposphere</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stratosphere</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesosphere</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermosphere</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Main Idea

Atmospheric Composition

Use with page 272.

Structure of the Atmosphere

Use with page 274.
Section 11.1 Atmospheric Basics (continued)

Solar Fundamentals
Use with pages 275-277.

**Main Idea**

**Details**

Summarize the three methods of energy transfer from the Sun to Earth’s atmosphere by completing the following chart.

<table>
<thead>
<tr>
<th>Movement of energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>occurs when molecules collide</td>
</tr>
</tbody>
</table>

Analyze how the Sun’s energy is affected as it hits Earth’s atmosphere. Fill in the table with the five ways it is reflected or absorbed and the percentage of sunlight that goes each way. Use Figure 11-4 to help you.

<table>
<thead>
<tr>
<th>Effect</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>percent</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**REAL-WORLD CONNECTION**

CFCs are banned in the United States because they can cause ozone to degrade. Explain which part of our atmosphere this protects and why that is important.
Atmosphere

Section 11.2 State of the Atmosphere

Main Idea

Details

Read the title of Section 2. Predict what you think the section might be about.

Review Vocabulary

Use your text to define the following term.

New Vocabulary

In the left margin, write the terms defined below.

Academic Vocabulary

Define the following term.

individual
Section 11.2 State of the Atmosphere (continued)

**Main Idea**

**Temperature Versus Heat**
*Use with page 278.*

**Details**

*Distinguish* between temperature and heat by completing the following sentences.

________ is the measurement of how quickly or slowly

________ move. _____ is the transfer of _____ . Heat flows from

areas of _____ temperature to areas of _____ temperatures.

Temperature can be measured in ______, ______, ______, or ______. There is no colder temperature

known than ______ on the _____ scale.

**Vertical Temperature Changes**
*Use with page 279.*

**Air Pressure and Density**
*Use with page 280.*

**Predict** whether water would boil on top of a mountain at a higher or lower temperature than at sea level. Explain.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
**Section 11.2 State of the Atmosphere** (continued)

**Main Idea**

Pressure-Temperature-Density Relationships

Use with page 280.

**Details**

Sequence the steps in the formation of temperature inversions.

1. Cool, clear winter night when the wind is calm

2.

3.

4.

Wind

Use with page 282.

**Details**

Describe how wind is created by completing the paragraph below.

Cool air ____ . This creates an area of ___________ .

Warm air ____ . This creates an area of ___________ .

Air masses move from areas of ___________ to ___________ .

This is what creates ____ .

Relative Humidity

Use with page 282.

**Details**

Draw a graph and write one sentence to explain why climate zones near the equator are more humid than climate zones closer to the poles. Use the Problem-Solving Lab to help you.

SYNTHESIZE

You are at the beach and notice that in the afternoon there is a cool breeze blowing onto the beach from the ocean. At night, the wind is blowing from the land out to sea. How would you explain to someone why this occurs?
Section 11.3 Moisture in the Atmosphere

Scan the section titles, boldface terms, and diagrams found in this section. Write three topics that will be discussed in this section about moisture in the atmosphere.

1. __________________________
2. __________________________
3. __________________________

Use your text to define each term.

condensation nuclei

orographic lifting

stability

latent heat

coalescence

precipitation

water cycle

evaporation

Define the following term.

method
Cloud Formation

Use with page 285.

Types of Clouds

Use with page 287.

Precipitation

Use with page 289.

Describe clouds by completing the paragraph below.

_____ can form as warm moist air rises, expands, and cools, and cooler air ____ in a _____________. Water vapor in the air condenses on a ______________ such as dust or __. As more and more droplets collect, a ____ is formed. Clouds also form from ______________ where moist air comes in contact with a _______ and rises. Another type of cloud forms when _______ of different temperatures collide.

Analyze the information on types of clouds. In the question spaces provided, turn the bold-faced headings into questions. Then answer your questions.

Low Clouds

Question: ________________________________

Answer: ________________________________

Middle Clouds

Question: ________________________________

Answer: ________________________________

High Clouds

Question: ________________________________

Answer: ________________________________

Sequence the formation of precipitation.

coalescence of cloud droplets

Sequence:

1. ________________________________
2. ________________________________
3. ________________________________
4. ________________________________
Section 11.3 Moisture in the Atmosphere (continued)

**Main Idea**

Create your own diagram of the water cycle. Include the following steps in your diagram: evaporation, precipitation, run off, groundwater, and condensation.

**Details**

The Water Cycle

*Use with page 291.*

**REAL-WORLD CONNECTION**

Clouds are more often formed in areas of higher air pollution than in areas that have cleaner air. Use what you have learned in this chapter to describe the process that causes polluted areas to be cloudier.
Tie-It-All-Together

**Explain** why the smog problem is so intense in Los Angeles. You may want to look at an atlas to answer this question.

**Compare** the difference between ozone in the atmosphere and ozone near Earth’s surface.

**Design** a model of a greenhouse. Discuss how the heat enters the greenhouse in similar ways that energy is transferred in the atmosphere.
**Atmosphere  Chapter Wrap-Up**

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I Wanted to Find Out</td>
<td>What I Learned</td>
</tr>
<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>

**Review**

*Use this checklist to help you study.*

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

**Summarize**

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

________________________________________

________________________________________

________________________________________
What happened to the temperature of the air beneath the tray and the air above the tray?

Explain how this model represents a cold air mass.
Main Idea

Scan Section 12.1 of your text. Use the checklist below as a guide.
• Read all the section titles.
• Read all bold words.
• Look at all figures and photos and read their captions.
• Think about what you already know about weather and forecasting.

Write three facts you discovered about causes of weather.
1. 
2. 
3. 

Details

Review Vocabulary

Use your text to define the following term.

temperature

New Vocabulary

Use your text to define each term.

meteorology

weather

climate

air mass

air mass modification

Fill in the flow chart below with key terms from the section.

is long term which is the current state of the

Academic Vocabulary

Define the following term.

phenomenon
Section 12.1 The Causes of Weather (continued)

Main Idea

Weather and Climate
Use with page 300.

Contrast weather and climate by completing the table below.

<table>
<thead>
<tr>
<th>Description</th>
<th>Weather</th>
<th>Climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short or long term; measure of variations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Model shadows of a person standing in their yard at 6 am, 12 noon, and 6 pm. Assume that north is to the top of the page. Label an approximate degree of latitude your diagram is illustrating.

Explain why it is warmest during the middle of the day and cooler in the morning and evening.
Section 12.1 The Causes of Weather (continued)

Air Masses
Use with pages 301–304.

Compare the major air masses impacting North America.

<table>
<thead>
<tr>
<th>Type of Air Mass</th>
<th>Source of Air Mass</th>
<th>Weather Associated with Air Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Hot, dry summers</td>
</tr>
<tr>
<td>Maritime tropical</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interior of Canada and Alaska</td>
<td>Heavy rains in winter on West Coast</td>
</tr>
<tr>
<td>Arctic</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What if you are visiting the deserts of the southwestern United States. A sudden thunderstorm moves in. Hypothesize what type of air mass could have brought that storm, and where it likely originated.

REAL-WORLD CONNECTION
Determine the type of air mass that typically plays a role in the weather in your area. Describe the type of weather that commonly is associated with the air mass and where the air mass originates. Describe the seasons in your area which result from that air mass.
### Main Idea

Scan Section 2 of your text. Read the headings and the figure captions. Write three questions that come to mind.

1. 

2. 

3. 

### New Vocabulary

Use your text to define each term.

- **Coriolis effect**: 

- **trade winds**: 

- **prevailing westerlies**: 

- **polar easterlies**: 

- **jet stream**: 

- **front**: 

### Academic Vocabulary

Define the following term.

- **migrate**: 

---

**Meteorology**

Section 12.2 Weather Systems

Earth Sciences 5.a, 5.b, 6.a
Section 12.2 Weather Systems (continued)

**Main Idea**

Global Wind Systems

*Use with pages 305–307.*

Jet Streams

*Use with pages 307–308.*

**Details**

Model the movement of air around the surface of Earth. Use Figure 12-4 to help you. Include the following features:

- doldrums
- equator
- horse latitudes
- northeast trade winds
- northern hemisphere
- polar easterlies
- prevailing westerlies
- southeast trade winds
- southern hemisphere

Predict what would happen to the weather in the north-eastern United States if the polar jet stream dipped to the south. How would the weather change if the jet stream moved to the north?
Section 12.2 Weather Systems (continued)

**Main Idea**

### Fronts

Use with page 308.

### Pressure Systems

Use with pages 310–311.

**Details**

**Compare** the four main types of fronts.

<table>
<thead>
<tr>
<th>Type of Front</th>
<th>Map Symbol</th>
<th>Description of Air Movement</th>
<th>Associated Weather</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Front</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warm Front</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stationary Front</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occluded Front</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Differentiate** between high-pressure systems and low-pressure systems. Use the list of characteristics below to complete the Venn diagram.

- air moves in circular motion
- rising air
- fair weather
- sinking air
- stormy weather
- winds move clockwise in northern hemisphere
- winds move counterclockwise in northern hemisphere

**SYNTHESIZE**

The doldrums along the equator is an area of very little wind. This gave early sailors a difficult time in their transoceanic trips. How could sailors avoid this trouble spot?
Section 12.3 Gathering Weather Data

Scan Section 3 of the text. Read the section title, bold words, figures and figure captions. Write four facts you discovered about tropical storms as you scanned the section.

1. 
2. 
3. 
4. 

Review Vocabulary

Use your text to define the following term.

humidity

New Vocabulary

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

measures temperature 
measures air pressure
measures wind speed 
measures relative humidity
measures height of clouds and estimate amount of cloud cover
balloon borne package to measure upper level atmospheric data
change in wave frequency that occurs in energy

Academic Vocabulary

Define the following term.

release
Section 12.3 Gathering Weather Data (continued)

**Main Idea**

**Surface Data**
Use with pages 312–313.

**Details**

Compare the different types of instruments that measure surface weather data.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>What does it measure?</th>
<th>How does it work?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barometer</td>
<td></td>
<td>Changes in pressure measured by changes in height of column of mercury</td>
</tr>
<tr>
<td>Anemometer</td>
<td></td>
<td>Wet- and dry-bulb thermometers</td>
</tr>
</tbody>
</table>

**Upper Level Data**
Use with pages 313–314.

Discuss collecting weather data in the upper atmosphere.

Upper-level weather data is collected by a ________ , which is a series of sensors carried by a ______ . Sensors that measure ________, ________, and ______ are carried.

Measurements are sent back by ________ . ______ is very important when measuring ________ data because it helps meteorologists determine wind speed and ________ .

**Weather Radar**
Use with page 314–315.

Sequence the way weather radar works in this flow chart.

1. Waves bounce off of large raindrops
2. Amplifier increases wave signal of scattered waves
3. Computer processes signals and displays them on a screen
**Main Idea**

**Weather Satellites**

Use with pages 315–316.

**Details**

Organize information about weather data collection for precipitation tracking by completing the graphic organizer.

<table>
<thead>
<tr>
<th>Scientists can determine location of precipitation and clouds using</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Analyze** how infrared imagery is used by meteorologists by completing the following statements.

Data can be collected in ________.

Infrared imagery detects differences in ____________.

Objects show up differently according to the ____________.

The temperature of a cloud tells meteorologists about its ____ and ____.

**Synthesize**

Suppose you wanted to explain to someone how meteorologists measure the speed of raindrops. How would you explain this procedure in terms that most people would understand?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Consider the title of Section 4. Think of three things that might be discussed in this section.

1. __________________________________________

2. __________________________________________

3. __________________________________________

Use your text to define the following term. What do you think it has to do with weather?

stability

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

a record of weather data at a particular site at a particular time

lines that connect points of equal or constant values

forecast that relies on numerical data

forecast that compares current weather patterns to patterns that took place in the past

Define the following term.

accuracy
Section 12.4 Weather Analysis (continued)

**Main Idea**

**Surface Analysis**
*Use with pages 318–319.*

Classify the different types of isopleths found on a weather map.

- **lines of equal temperature**
- **indicates how fast wind blowing**

**Short-Term Forecasts**
*Use with page 318.*

Categorize the following phrases as either digital or analog forecasting.

- compare current conditions to past
- looks at conditions in all levels of atmosphere
- monthly or seasonal forecasts
- the more data, the more accurate will be the forecast
- numerical data

**Details**

<table>
<thead>
<tr>
<th>Digital</th>
<th>Analog</th>
</tr>
</thead>
</table>

---

*Section 12.4 Weather Analysis*
Long-Term Forecasts

Use with pages 320–321.

Summarize three related factors that cause the accuracy of weather forecasts to decline with time.

1. 
2. 
3. 

Compare and Contrast short-term forecasting and long-term forecasting. Discuss reliability, the techniques used, and the type of information that is gathered in each case.

<table>
<thead>
<tr>
<th>Short-term forecasting</th>
<th>Long-term forecasting</th>
</tr>
</thead>
</table>

SYNTHESIZE: Imagine you are reading the newspaper forecast and you want to go downhill skiing the next weekend. Describe the type of information you would like to see on the weather map.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Meteorology  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>What I Wanted to Find Out</th>
<th>W</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>________________________</td>
<td>1.</td>
<td>________________________</td>
</tr>
<tr>
<td>2.</td>
<td>________________________</td>
<td>2.</td>
<td>________________________</td>
</tr>
<tr>
<td>3.</td>
<td>________________________</td>
<td>3.</td>
<td>________________________</td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

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

SUMMARIZE  After reading this chapter, list three things you have learned about weather systems and weather prediction.

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________
The Nature of Storms

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about the nature of storms. Then list three questions you have about the nature of storms in the “What I Want to Find Out” column.

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</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>

Think about the Discovery Lab you did to replicate thunder and record your response in this science journal.

What did you hear when the bag broke? How is this similar to the thunder produced by a lightning bolt?

__________________________________________________________________________________

__________________________________________________________________________________

__________________________________________________________________________________

Light moves much faster than sound. Knowing this, what can you infer about the movement of a thunderstorm if the amount of time between when you see the lightning and hear the thunder increases between lightning flashes?

__________________________________________________________________________________

__________________________________________________________________________________

__________________________________________________________________________________
The Nature of Storms
Section 13.1 Thunderstorms

Main Idea

Read the objectives on the first page of Section 1. List three questions that come to mind. Accept all reasonable responses.

1. 

2. 

3. 

Details

Review Vocabulary

Use your text to define the following term.

barometer

New Vocabulary

Use your text to define each term.

air-mass thunderstorm

sea-breeze thunderstorm

frontal thunderstorm

Academic Vocabulary

Define the following term.

initial
Section 13.1 Thunderstorms (continued)

How Thunderstorms Form


Air-Mass Thunderstorms

Use with page 331.

Frontal Thunderstorms

Use with page 331.

Main Idea

Details

Summarize three conditions that must be met for a thunderstorm to occur:

1. 

2. 

3. 

Organize information about the limits on the growth of thunderstorms.

Draw diagrams that explain the formation of a mountain thunderstorm and a sea-breeze thunderstorm. Use Figures 13-2 and 11-13 in your text to help you.

Analyze Figure 13-1 in your text. Use the diagrams you drew above to explain the reason for the placement of the red and orange zones in Figure 13-1.

Explain frontal thunderstorms by completing the following sentences.

The ____, ____ movement of air in a ____ front can produce a line of thunderstorms. These thunderstorms can occur at ____, because they do not depend on __________. Thunderstorms can also be associated with __________. These thunderstorms are usually fairly ____.
### Section 13.1 Thunderstorms (continued)

#### Main Idea

**Sequence** the steps in the process of thunderstorm formation. The first one has been completed for you.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Air rises vertically, creating updrafts</td>
</tr>
<tr>
<td>2</td>
<td>Supply of warm, moist air runs out, stopping the updrafts</td>
</tr>
<tr>
<td>3</td>
<td>Cloud droplet coalesce, until they are so latent they fall as precipitation</td>
</tr>
<tr>
<td>4</td>
<td>Downdrafts form</td>
</tr>
<tr>
<td>5</td>
<td>Moisture condenses and releases latent heat</td>
</tr>
<tr>
<td>6</td>
<td>Nearly equal amounts of updrafts and downdrafts exist with a cumulonimbus cloud</td>
</tr>
</tbody>
</table>

#### Details

**Compare and contrast** the stages of a thunderstorm. Use Figure 13-3 to help you make detailed sketches of the cumulus stage, the mature stage, and the dissipation stage. Note similarities and differences between the stages.

### Real-World Connection

Imagine there is a thunderstorm raging outside. You see the lightning flash long before the thunderclap is heard. Describe how you can estimate the distance to the storm.
The Nature of Storms

Section 13.2 Severe Weather

**Main Idea**

**Details**

**Scan** Section 13.2 in your text. Use the checklist below as a guide.

- Read all the section titles.
- Read all bold words.
- Look at all figures and photos and read their captions.
- Think about what you already know about severe weather and its causes.

**Review Vocabulary**

*Use your text to define the following term.*

- front

**New Vocabulary**

*Use your text to define each term.*

- supercell
- downburst
- tornado
- Fujita tornado intensity scale

**Academic Vocabulary**

*Define the following term.*

- proportion
**Main Idea**

Severe Thunderstorms

*Use with page 334.*

**Details**

Sequence the steps in the formation of a severe thunderstorm.

- Strength of storm’s updrafts and downdrafts intensifies.
- The cold, high air increases temperature differences.
- A severe storm is formed.
- Cold fronts formed with upper level, low-pressure systems.
- Air becomes more unstable.

1. Cold fronts formed with upper level, low-pressure systems.

2.

3.

4.

5.

**Lightning**

*Use with page 335.*

**Organize** information about downbursts in the graphic organizer.

Create a public service announcement detailing three ways to remain safe during a thunderstorm. Include tips for indoor and outdoor safety. Use Table 13-1 to help you.

- **downbursts**
  - macrobursts
    - path of destruction up to 5 km wide, wind speed of more than 200 km/h, 30 minutes in duration
  - microbursts
    - affect areas less than 3 km, winds of 250 km/h, less than 10 minutes in duration
Section 13.2 Severe Weather (continued)

Main Idea

Hail, Floods
Use with page 337.

Tornadoes
Use with page 337.

Details

Analogy An oyster forms a pearl by putting many layers of shell material over a grain of sand or other material. Tell how the formation of a hailstone is similar to the formation of a pearl.

Define Tornado Alley is a real place in the Midwestern United States. This area is more susceptible to tornadoes than other regions of the country. Explain why this is so.

Model tornado formation. Draw a series of pictures to show the formation of a tornado. Use Figure 13-8 as a guide.

Real-World Connection

What if you are fishing from a rowboat in the middle of a lake. You notice the clouds building, getting darker, and then it starts to rain. Are you in danger of being struck by lightning? Explain your answer.
The Nature of Storms
Section 13.3 Tropical Storms

Scan Section 3 of the text. Read the section title, bold words, figures and figure captions. Write three facts you discovered about tropical storms as you scanned the section.

1. 
2. 
3. 

Review Vocabulary

Use your text to define the following term.

Coriolis effect

New Vocabulary

In the left margin, write the terms defined below.

large, rotating low-pressure storm that gets its energy from the evaporation of warm ocean water and the release of heat

calm center of a hurricane

strongest winds of hurricane in a band surrounding the eye

classification of hurricanes based on wind speed, air pressure, and potential for property damage

mound of ocean water driven toward land by hurricane-force winds

Academic Vocabulary

Define the following term.

release
Section 13.3 Tropical Storms (continued)

**Main Idea**

Tropical Cyclones

*Use with pages 341–342.*

**Details**

*Sequence the steps in the process of the formation of a hurricane. The first one is done for you.*

1. disturbances produce more precipitation, more energy is released
2. as water evaporates from the ocean surface, latent heat is stored
3. the Coriolis effect causes moving air to turn counterclockwise in the northern hemisphere
4. rising air creates a low pressure area at ocean’s surface
5. latent heat released, when air begins to rise and clouds form
6. cyclonic rotation of a tropical cyclone

*List the three names used around the world for tropical cyclones, and identify the locations where each is used.*

<table>
<thead>
<tr>
<th>Name</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>i.</td>
</tr>
<tr>
<td>B.</td>
<td>i.</td>
</tr>
<tr>
<td>C.</td>
<td>i.</td>
</tr>
<tr>
<td></td>
<td>ii.</td>
</tr>
<tr>
<td></td>
<td>iii.</td>
</tr>
<tr>
<td></td>
<td>iv.</td>
</tr>
</tbody>
</table>

*Analyze the formation of tropical cyclones in the outline below.*

I. Two conditions required for a tropical cyclone to form:
   A. 
   B. 

II. Two tropical oceans where tropical cyclones do not form:
   A. 
   B. 

III. Two reasons tropical cyclones do not form in those two places:
   A. 
   B. 
Section 13.3 Tropical Storms (continued)

Main Idea

Model a hurricane, as seen from above. Use Figure 13-11 in your text as a guide. Your drawing should include:
- descending air
- eye
- warm moist air
- direction of rotation
- eyewall

Details

Complete the following sentences.

A hurricane usually strength as it moves over or because it has no access to the from which it draws its energy. Hurricanes in intensity over their life cycle as they interact with .

Classifying Hurricanes
Use with page 344.

Hurricane Hazards
Use with pages 345–346.

Analyze why flooding is an additional hazard of hurricanes by completing the statements.

Flooding occurs due to , caused by the .

Floods will be worse if , because .

Real-World Connection

Hurricanes that form during a new moon are potentially more damaging than those that form during the third quarter of the lunar cycle. Explain why this is true.
The Nature of Storms
Section 13.4 Recurring Weather

Main Idea

Consider the title of the section. Predict three topics that might be discussed in the section.

1. 

2. 

3. 

Review Vocabulary

Use your text to define the following term.

precipitation

New Vocabulary

Use your text to define each term.

drought

heat wave

cold wave

wind-chill factor

Academic Vocabulary

Define the following term.
persist
Floods and Droughts

Use with pages 347–348.

Compare and contrast floods and droughts.

<table>
<thead>
<tr>
<th></th>
<th>Definition</th>
<th>Cause</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drought</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analyze the problems associated with large domes of high pressure. Complete the flow chart below.

High Pressure

- air compresses and becomes warmer

- no uplift of moisture

- drought conditions
Section 13.4 Recurring Weather (continued)

Main Idea

Cold Waves
Use with pages 349–350.

Details

Analyze cold waves completing the following flow chart.

- large pools of cold air, which sinks
- snow-covered surfaces radiate heat back to space

Compare and Contrast heat waves and cold waves.

<table>
<thead>
<tr>
<th></th>
<th>Heat Waves</th>
<th>Cold Waves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Factors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Real-World Connection

Explain what happens to the water table, zone of saturation, and zone of aeration of an area during a flood.
The Nature of Storms  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K What I Wanted to Find Out</th>
<th>W What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ________________________</td>
<td>1. ________________________</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2. ________________________</td>
<td>2. ________________________</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3. ________________________</td>
<td>3. ________________________</td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

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

SUMMARIZE

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

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

152  Chapter Wrap-Up
Climate

Chapter Preview

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

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</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>

Describe any differences in dew formation that you observed.

How is the umbrella in this activity similar to clouds in the atmosphere?

Based on your observations, infer how temperatures during the night might differ between climates with extensive cloud cover and climates with fewer clouds.
Climate
Section 14.1 What is Climate?

Main Idea

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

1. __________________________________________
2. __________________________________________
3. __________________________________________

Details

Use your text to define the following term.

humidity

the study of Earth’s climate
the long-term weather patterns of an area
the standard values for an area
the area 23.5° south of the equator and 23.5° north of the equator
the area 23.5° and 66.5° north and south of the equator
the area located from 66.5° north and south of the equator to the poles

New Vocabulary

Academic Vocabulary

Define the following term.

affect

......

......

......

......

......

......

......

......
Section 14.1 What is Climate? (continued)

**Main Idea**

Climate: More than Just Average Weather

Use with page 359.

**Details**

Explain *climate* by completing the graphic organizer below.

Explain **why most meteorological data are gathered at airports.** Then discuss why airports may not be the best location to gather this data.

**Normals**

Use with page 360.

**What Causes Climates?**

Use with page 362.

**Sketch** Make a sketch of Earth similar to Figure 14-2 in your text. Label the following in your sketch:

- Polar zone
- 66.5°N and S latitudes
- two Temperate zones
- 23.5°N and S latitudes
- Tropics
- 0° latitude
- Polar zone
- Tropic of Cancer
- Equator
- Tropic of Capricorn

Explain why most meteorological data are gathered at airports. Then discuss why airports may not be the best location to gather this data.
Section 14.1 What is Climate? (continued)

What Causes Climates?

Describe topographic effects by completing the following paragraph.

_____ heats up and cools down more slowly than ____. Many coastal areas are _____ in the winter and _____ in the summer than inland areas of similar _____.

Temperatures in the lower atmosphere generally decrease with _____ . Thus, _____ climates are usually cooler than those at ___ ____ . In addition, climates often differ on either side of a mountain. The climate on one side of the mountain—the _____ side—is usually wet and cool. On the opposite side of the mountain—the _____ side—the air is ____, and it warms as it ______.

Label the following in the figure below: windward side, leeward side, moist air, and dry air. Also include arrows to indicate the direction of the airflow.

REAL-WORLD CONNECTION

Suppose a large reservoir is built in the middle of an arid region. Infer how normals for that area may change over the long term as a result.
Climate

Section 14.2 Climate Classification

Main Idea

Details

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

- Read all section titles.
- Read all bold words.
- Read all graphs and equations.
- Look at all the pictures and read their captions.
- Think about how the word “climate” is used on television weather shows.

Write three facts you discovered about climate as you scanned the section.

1. 
2. 
3. 

Review Vocabulary

Use your text to define the following term.

precipitation

New Vocabulary

Use your text to define each term.

Köppen classification system

microclimate

heat island

Academic Vocabulary

Define the following term.

classify
Section 14.2 Climate Classifications (continued)

Main Idea

Use with page 364.

Details

Describe the Koeppen classification system by completing the graphic organizer below.

The Koeppen classification system is based on the average monthly values of:

[Blank boxes]

Compare the five major climates in the Koeppen classification system by completing the table.

<table>
<thead>
<tr>
<th>Climate</th>
<th>Characteristics</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tropical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continental</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 14.2 Climate Classifications (continued)

**Main Idea**

**Polar Climates**
*Use with page 366.*

**Details**

**Explain** why precipitation is generally low in polar climates.

**Microclimates**
*Use with page 368.*

**Describe** the heat-island effect by completing the graphic organizer below.

<table>
<thead>
<tr>
<th>The heat-island effect occurs because</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>This causes mean temperatures in large cities to be</td>
<td></td>
</tr>
<tr>
<td>The heat-island effect also causes</td>
<td></td>
</tr>
<tr>
<td>This in turn produces</td>
<td></td>
</tr>
</tbody>
</table>

**SYNTHESIZE**

Scientists tell us that Central Park lowers the temperature of New York City by about 3 degrees. Explain this effect using your knowledge about microclimates.
Skim Section 3 of your text. Write three examples of climatic changes that come to mind from reading the headings and illustration captions.

1. 

2. 

3. 

Use your text to define the following term.

glacier

periods of time when parts of Earth were covered by glaciers

short-term periods of climatic change

warm ocean current that develops off the western coast of South America

period of very low sunspot activity

Define the following term.

constant
Section 14.3 Climatic Changes (continued)

Main Idea

Ice Ages
Use with page 369.

Details

Analyze the effects of the glaciers by completing the sentences below.

______ is the term that describes extensive glacial coverage. The most recent ice age ended about _______ years ago. During an ice age the average temperature of Earth decreased by ______. The glaciers eventually retreated, but left evidence in North America. Evidence of the glaciers are the _________ and the _____ Lakes of central New York. We are currently in an _________ period.

Describe the summer and winter seasons in North America. Also explain the cause for the differences in the two seasons.

<table>
<thead>
<tr>
<th>Seasons</th>
<th>Characteristics</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sequence the movements of El Niño, which lead to dramatic climate changes. The first and last steps have been completed for you.

Warm water from the western Pacific moves east toward the South American coast.

Dramatic climate changes result.
Section 14.3 Climatic Changes (continued)

**Main Idea**

**Change Can Be Natural**

*Use with pages 372–374.*

**Details**

**Summarize** the effects of increased and decreased solar activity on Earth’s climate.

---

**Sketch** Earth in a circular orbit around the Sun, and then in an elliptical orbit around the Sun. Refer to Figure 14-14 in your textbook for help.

---

**Explain** how Earth’s temperatures are affected when experiencing a circular orbit compared to an elliptical orbit.

---

**Relate** how major volcanic activity can result in climatic changes.

---

**REAL-WORLD CONNECTION**

Consider the effects that El Niño might have on the marine life that come in contact with the warmer ocean currents.
Scan Section 4 of your text. Use the checklist below as a guide.

• Read all section titles.
• Read all bold words.
• Read all graphs and equations.
• Look at all the pictures and read their captions.
• Think about what you already know about how humans influence Earth’s climate.

Write three facts you discovered about climate as you scanned the section.

1. __________________________________________________________
   __________________________________________________________
2. __________________________________________________________
   __________________________________________________________
3. __________________________________________________________
   __________________________________________________________

Use your text to define the following term.

carbon dioxide

Use your text to define each term.

greenhouse effect

Global warming

Define the following term.

consume
The Greenhouse Effect
Use with pages 375–376.

Main Idea

Sketch the greenhouse effect, similar to Figure 14-18 in your textbook. Use arrows to show how solar radiation reaches Earth and is redirected.

Details

Global Warming
Use with page 376.

Main Idea

Describe how an increase in greenhouse gases could affect global temperatures.

Details

Identify four possible consequences if the upward trend of worldwide temperatures continues.

Rising Temperatures

- 
- 
- 
-
Section 14.4 The Human Factor (continued)

**Main Idea**

**Impact of Human Activities**

*Use with page 377.*

**Details**

List two causes for rising levels of atmospheric carbon dioxide.

1. ____________________________________________________________

2. ____________________________________________________________

Relate how deforestation plays a role in increasing levels of atmospheric CO₂.

Describe four easy ways to conserve energy.

1. ____________________________________________________________

2. ____________________________________________________________

3. ____________________________________________________________

4. ____________________________________________________________

**SYNTHESIZE**

In 1988, most of the trees in heavily forested Yellowstone National Park burned. Although it is environmentally sound to let trees burn in order to re-forest, describe the effect that losing so many trees could have on global warming. Explain your reasoning.

___________________________________________________________

___________________________________________________________
In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K What I Wanted to Find Out</th>
<th>W What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ________________</td>
<td>1. ________________</td>
</tr>
<tr>
<td>__________________________</td>
<td>____________________</td>
</tr>
<tr>
<td>2. ________________</td>
<td>2. ________________</td>
</tr>
<tr>
<td>__________________________</td>
<td>____________________</td>
</tr>
<tr>
<td>3. ________________</td>
<td>3. ________________</td>
</tr>
<tr>
<td>__________________________</td>
<td>____________________</td>
</tr>
</tbody>
</table>

**Review**

*Use this checklist to help you study.*

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

**SUMMARIZE**

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

__________________________

__________________________

__________________________
Before you read the chapter, use the “What I Know” column to list three things you know about physical oceanography. Then list three questions you have about physical oceanography in the “What I Want to Find Out” column.

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to measure the amount of water on Earth’s surface, and record your response to this science journal.

What percentage of the globe’s equator is made up of oceans?

What percentage of the globe’s equator is made up of land?

Study the globe again. Are the oceans separate bodies of water, or do they interconnect?
Main Idea

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

1. ________________________________

2. ________________________________

3. ________________________________

Details

Review Vocabulary

Use your text to define the following term.

comet

______________________________

New Vocabulary

Use your text to define each term.

oceanography

______________________________

side-scan sonar

______________________________

sea level

______________________________

Academic Vocabulary

Define the following term.

investigate

______________________________
Section 15.1 The Oceans (continued)

**Main Idea**

**Modern Oceanography**

*Use with pages 385–386.*

**Details**

Create a timeline showing the advances in methods used to study Earth’s oceans. Your timeline should include specific vessels, technology used, and type of data gathered.

**Origin of the Oceans**

*Use with pages 387–388.*

Analyze the origins of Earth’s oceans.

Possible origins of oceans

- Early Earth may have contained 0.5% water
- Volcanic Activity
Section 15.1 The Oceans (continued)

Main Idea

Sequence the formation of sea ice by completing the flow chart below.

1. slush forms at surface

2. 

3. pancake ice continues to thicken and

4. 

Compare and Contrast oceans and seas. Organize each characteristic in the Venn diagram to show whether it is a trait of oceans, seas, or both.

- Aral, Mediterranean, Bering
- identical proportions of salt
- partly or mostly landlocked
- Atlantic, Indian, Pacific
- part of one global ocean

Real-World Connection

Imagine you are an astronaut. You are traveling through a newly discovered solar system. One of the planets has a blue tinge while another is brownish-red. What can you infer about the surface of those planets? What about the temperatures on the planet?

Name ___________________________ Date __________________

Distribution of Earth’s Water

Use with page 388.
Physical Oceanography

Section 15.2 Seawater

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

- Read all the section titles.
- Read all bold words.
- Look at all figures and photos and read their captions.
- Think about what you already know about water in the sea.

Review Vocabulary

Use your text to define the following term. How do you think it relates to seawater?

density

New Vocabulary

Use your text to define each term.

salinity

temperature profile

thermocline

Academic Vocabulary

Define the following term.

deviate
Chemical Properties of Seawater
Use with page 395.

Contrast seawater and fresh water. List three differences.

1. 
2. 
3. 

Physical Properties of Seawater
Use with page 395.

Model Draw your own graph of variations in ocean water temperatures.
Be sure to indicate:
• a layer of cold water • a thermocline • a layer of warm water

Section 15.2 Seawater (continued)

Analyze how salt is naturally added to and removed from seawater. List two ways salt is added to the sea, and three ways salt is removed from the sea. Use Figure 15-13 and information from your text to help you.

<table>
<thead>
<tr>
<th>Salt Added to Sea by . . .</th>
<th>Removed from Sea by . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ocean Layering
Use with page 396.
Section 15.2 Seawater (continued)

Water Masses
Use with page 397.

Main Idea

Details

Sequence the formation of a cold deep water mass.

___ salt ions accumulate under newly formed ice
___ salty water sinks
___ seawater freezes during arctic winter
___ cold, deep water mass migrates toward equator
___ sea ice forms
___ water beneath ice becomes saltier and denser

Organize information about water masses in the outline below.

I. Three water masses that account for most of the deep water in the Atlantic Ocean are:
   A. __________________________
      i. forms when __________________________
      ii. is the _____ and densest
   B. __________________________
      i. forms offshore from _________
      ii. overrides the ____________________
   C. __________________________
      i. forms when __________________________
       __________________________
      ii. least _____ and warmest
      iii. overrides the other ___ masses

II. Two oceans that only contain the two deep antarctic water masses
   A. ____________
   B. ____________

Real-World Connection

Suppose you go on vacation to Greenland. Your travel companions suggest that the water must be very salty in the ocean surrounding Greenland. How would you respond to this?

________________________________________________________________________

________________________________________________________________________
Physical Oceanography
Section 15.3 Ocean Movements

Main Idea

Scan Section 3 of the text. Look at the section titles, bold words, figures, and figure captions. Write three facts you discovered about ocean movements as you scanned the section.

1. 
2. 
3. 

Details

Review Vocabulary

Use your text to define the following term.

nutrients

New Vocabulary

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

a rhythmic movement that carries energy

highest point of a wave

lowest point of a wave

collapsing waves

periodic rise and fall of sea level

caused by differences in temperature and salinity of sea water

caused by wind, affects upper few hundred meters of ocean

upward movement of ocean water

Academic Vocabulary

Define the following term.

generate
Section 15.3 Ocean Movements (continued)

**Main Idea**

**Wave Characteristics**

*Use with page 399.*

**Details**

*Identify the characteristics of a wave and show how water moves in waves. Use Figure 15-18 in your text to help you make your own diagrams. Label the crest, half a wavelength, trough, wave base, wave height, wavelength, and where the water movement stops.*

**Tides, Causes of Tides**

*Use with page 403.*

**Details**

*Model the influence the Sun and the Moon have on Earth’s tides. Show a spring tide and a neap tide. Use Figure 15-22 to help you. Include the Sun, the Moon in its appropriate phase, Earth, and the oceans in your diagrams.*

**Main Idea**

**Details**

*Explain what causes tides by completing the following paragraph. Tides are caused by ________________ among Earth, the ____, and the _____. The fact that gravitational attraction decreases with ______ also plays a role. Unbalanced forces between Earth and the ____ create _____ on opposite sides of Earth. The ____ is farther from Earth, and therefore has a smaller ______ than the ____ despite its greater size.*
Ocean Currents
Use with page 403.

Compare the types of ocean currents by completing the table below.

<table>
<thead>
<tr>
<th>Ocean Current</th>
<th>Cause</th>
<th>Characteristics</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density current</td>
<td></td>
<td>Move slowly</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>move fast, follow predictable patterns</td>
<td></td>
</tr>
</tbody>
</table>

Model gyres of ocean currents by making a simplified sketch of Figure 15-23. Consider the effects of the Coriolis effect, land masses, and temperature on gyres as you draw.

Upwelling
Use with page 405.

Sequence the steps that show how upwelling supports marine ecosystems.
1. Trade winds move surface water away from the land.
2. ______________________________
   ______________________________
3. ______________________________
   ______________________________
4. ______________________________
   ______________________________

Imagine Earth was a planet that had two moons. How would this impact the tides on the planet?
Connect Ancient mariners traveled the oceans in primitive sailing ships. Imagine you are an ancient sea captain sent out to hunt for food. Explain how knowledge from this chapter would be helpful for navigation and food-finding. Include information on currents, seas and oceans, winds, wave movements, tides, layers, water masses, ice, salinity, and other factors.
Physical Oceanography  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>What I Wanted to Find Out</th>
<th>W</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>_________________________</td>
<td>1</td>
<td>_________________________</td>
</tr>
<tr>
<td></td>
<td>_________________________</td>
<td>2</td>
<td>_________________________</td>
</tr>
<tr>
<td>2</td>
<td>_________________________</td>
<td>3</td>
<td>_________________________</td>
</tr>
<tr>
<td>3</td>
<td>_________________________</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Review

*Use this checklist to help you study.*

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

**SUMMARIZE**

After reading this chapter, list three things you have learned about oceans. Consider their origin, composition, and the properties of the water.

--------------------------------------------------------------------------------

--------------------------------------------------------------------------------

--------------------------------------------------------------------------------

Chapter Wrap-Up
Marine Environments

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about marine environments. Then list three questions you have about them in the “What I Want to Find Out” column.

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</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>

Science Journal

Think about the Discovery Lab you did to find out the composition of chalk.

Describe the composition of the powdered chalk.

________________________________________________________

What is the origin of the chalk?

________________________________________________________

On what evidence do you base your conclusions?

________________________________________________________
Consider the title of Section 16.1 in your text. Predict three things that might be discussed in this section.

1. __________________________
2. __________________________
3. __________________________

Use your text to define the following term. Hypothesize how it affects the topic of this section.

- **erosion**

Use your text to define each term.

- **wave refraction**
- **beach**
- **estuary**
- **longshore bar**
- **longshore current**
- **barrier island**

Define the following term.

- **concentrate**
Sequence the steps in the process of straightening a shoreline. Use Figure 16-1 and information from your text to help you. The first one has been done for you.

1. Waves move faster in deep water than in shallow water.

2. ___________________________________________________________________________________

3. ___________________________________________________________________________________

4. ___________________________________________________________________________________

5. ___________________________________________________________________________________

6. ___________________________________________________________________________________

7. ___________________________________________________________________________________

Describe how the size and composition of beach sand is determined.

Predict what would happen to the estuaries if global sea level were to rise considerably.

Analyze the impact of longshore currents and rip currents on a shoreline by making a diagram similar to Figure 16-6. Your diagram should include longshore bar, shoreline, and an arrow indicating a rip current, an arrow indicating a longshore current, surf zone.
**Main Idea**

Depositional Features of Seashores, Protective Structures

Use with page 417.

**Details**

Identify depositional features by drawing a diagram of an eroding shoreline. Identify the following features on your diagram. Use Figure 16-7 and information from your text to help you.

- bay
- mainland beach
- tombolo
- baymouth bar
- spit
- lagoon
- barrier island

**Changes in Sea Level**

Use with page 420.

Analyze changes in sea level by completing the graphic organizer below.

```
Changes in sea level

Tectonic forces

has occurred in past
```

**Synthesize**

What if you have been elected to your town’s beach preservation committee. The committee wants to build a series of breakwaters to decrease erosion. Make a poster-like diagram to defend and argument in favor of or against the proposal.
The Marine Environment
Section 16.2 The Seafloor

Main Idea

Details

Scan Section 2 in your text. Look at the headings, photos, illustrations and captions. Write three facts you discovered about the seafloor.

1. 
2. 
3. 

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

- submerged parts of continents
- shallowest part of a continental margin extending seaward
- area where seafloor drops quickly to depths of several kilometers
- rapidly flowing water currents carrying heavy loads of sediment
- accumulation of deposits from turbidity currents
- plains with thick deposits of marine sediment above basaltic rock
- deepest part of ocean basin
- most prominent feature in ocean basin
- submerged basaltic volcanoes

Define the following term.

mechanism
Section 16.2 The Seafloor (continued)

Main Idea

Oceanic and Continental Crust

Use with page 422.

Compare oceanic and continental crust by completing the table below.

<table>
<thead>
<tr>
<th>Crust</th>
<th>Average thickness</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continental</td>
<td>40 km</td>
<td></td>
</tr>
<tr>
<td>Oceanic</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Details

Identify the features in the list below on a diagram of the continental margin. Use Figure 16-12 to help you.

- continental rise
- continental slope
- continental shelf
- oceanic crust
- shelf break
- abyssal plain
- submarine canyons
- continental margin
- continental crust
Section 16.2 The Seafloor (continued)

**Main Idea**

**Seafloor Volcanoes**

*Use with pages 427–428.*

**Details**

*Compare seamounts and hydrothermal vents in the Venn diagram below. Use the following phrases to fill in the circles.*

- hole in seafloor where magma erupts
- formed on ocean floor
- bottom of rifts in mid-ocean ridges
- in area of no current volcanism
- extinct volcanoes

---

**Marine Sediments**

*Use with pages 428–429.*

**Identify** the three types of marine sediment. Describe each of them.

1. __________________________

2. __________________________

3. __________________________

---

**Real-World Connection**

Hypothese where you would you find the youngest rock on the planet. Support your reasoning with information from the section.

---

*Marine Environments 185*
**Marine Environments Chapter Wrap-Up**

*In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.*

<table>
<thead>
<tr>
<th>K</th>
<th>What I Wanted to Find Out</th>
<th>W</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>________________________</td>
<td>1.</td>
<td>________________________</td>
</tr>
<tr>
<td>2.</td>
<td>________________________</td>
<td>2.</td>
<td>________________________</td>
</tr>
<tr>
<td>3.</td>
<td>________________________</td>
<td>3.</td>
<td>________________________</td>
</tr>
</tbody>
</table>

**Review**

Use this checklist to help you study.

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

**SUMMARIZE**

After reading this chapter, list three things you have learned about the marine environment, including shoreline features and the seafloor.

<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>
</tbody>
</table>
Plate Tectonics

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about plate tectonics. Then list three questions you have about plate tectonics 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>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</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>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Infer what might be causing these large pieces of land to move.

Think about the Discovery Lab you did to determine fault movement in California, and record your response to this science journal.

Infer what might be causing these large pieces of land to move.
Scan Section 1 of your text. Write three questions that come to mind from reading the headings and figure captions.

1. 
2. 
3. 

Review Vocabulary

Use your text to define the following term.

fossil

New Vocabulary

Use your text to define each term.

continental drift

Pangaea

Academic Vocabulary

Define the following term.

apparent
### Main Idea

**Early Observations**

Use with pages 443–444.

### Details

Analyze the growth of the continental drift theory by summarizing contributions by each person in the table below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Alfred Wegener</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nationality</td>
<td>Austrian</td>
</tr>
<tr>
<td>Date</td>
<td>late 1500s</td>
</tr>
<tr>
<td>Profession</td>
<td></td>
</tr>
<tr>
<td>Observation</td>
<td>built on matching coastline observations by other people</td>
</tr>
<tr>
<td>Proposed Explanation</td>
<td></td>
</tr>
</tbody>
</table>

### Continental Drift

Use with pages 444–445.

Create three diagrams to show how it is thought that the continents drifted. Use Figure 17-1 to help you draw what Earth looked like 200 million years ago, 135 million years ago, and in the present.

- 200 million years ago
- 135 million years ago
- Present
Analyze the evidence Wegener had supporting his hypothesis of continental drift.

<table>
<thead>
<tr>
<th>Evidence</th>
<th>Concept/Idea</th>
<th>Examples of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock evidence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fossil evidence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate evidence</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Identify two reasons why scientists rejected Wegener’s hypothesis of continental drift.

A Rejected Hypothesis

Use with pages 446–447.

Analogy

Compare the concept of continental drift to a jigsaw puzzle.
### Plate Tectonics

**Section 17.2 Seafloor Spreading**

---

#### Main Idea

**Consider** the objectives of Section 2. Write three questions that come to mind from reading these statements.

1. 
2. 
3. 

---

#### Details

**Review Vocabulary**  
*Use a dictionary to define the following term.*

- **topographic**

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

- **magnetometer**
- **paleomagnetism**
- **magnetic reversal**
- **isochron**
- **seafloor spreading**

---

**Academic Vocabulary**  
*Define the following term.*

- **depress**
Sequence the steps in the use of sonar to map the ocean floor:
• sound waves travel through the water
• regular pulses of sound sent out from a device aboard a ship
• the time it takes waves to travel from and to the receiver on the boat is used to calculate distance
• sound waves reflected off ocean floor

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

Organize information about ocean floor topography by completing the following flow chart.

Topographic features on ocean floor
- earthquakes and volcanoes common
- Deepest spot in ocean—11 km deep

Predict where the oldest rocks in the Atlantic Ocean are. Predict where the youngest rocks are. Use maps in your text to help you answer this question.
Section 17.2 Seafloor Spreading (continued)

**Main Idea**

**Magnetism**

Use with page 452.

**Details**

Illustrate magnetic symmetry around an ocean ridge. Use Figures 17-9 and 17-10 to help you. Show the following features:
- ocean ridge
- areas of normal polarity
- areas of reversed polarity
- relative ages of rocks

Describe how a scientist would know how to draw isochrons to connect basalt flows on land with the ocean floor.

Organize information about seafloor spreading by completing the following cycle diagram.

**Real-World Connection**

Suppose you could measure the distance between New York and London and between Los Angeles and Singapore over several thousand years. Describe how those distances would change compared to their distances today.
Plate Tectonics
Section 17.3 Theory of Plate Tectonics

Scan Section 9.1 of your text. Use the checklist below as a guide.

• Read all the section titles.
• Read all bold words.
• Look at all figures and photos and read their captions.
• Think about what you already know about plate tectonics.

Write three questions that you think will be answered in this section.

1. 
2. 
3. 

New Vocabulary

Define the following term.

Earth’s rigid crust and ridged upper mantle are broken into plates

place where two plates are moving apart

long, narrow depression caused by stretched crust

place where two plates are moving toward each other

when one of two plates is descending under the other

place where two plates slide horizontally past each other

involves

Define the following term.
### Section 17.3 Theory of Plate Tectonics (continued)

**Main Idea**

**Plate Boundaries**

*Use with page 455.*

**Details**

Illustrate a divergent plate boundary and the three types of convergent plate boundaries. Include the crust, asthenosphere, lithosphere, upper mantle, and ocean ridge on the divergent plate boundaries, and trench, volcanoes, upper mantle, oceanic crust, and continental crust on the convergent plate boundary diagrams.

Below your diagrams, list at least four products or results at each type of plate boundary. Use Figures 17-14 and 17-15 to help you.

<table>
<thead>
<tr>
<th>Divergent Plate Boundary</th>
<th>Oceanic-Oceanic Convergent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oceanic-Continental Convergent</th>
<th>Continental-Continental Convergent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**products/results:**

- 
-  
-  
-  

- 
-  
-  
-  

*Plate Tectonics* 195
Section 17.3 Theory of Plate Tectonics (continued)

Main Idea

Plate Boundaries
Use with pages 455–459.

Details

Predict Imagine that a fence perpendicularly crosses a transform plate. Draw diagrams of the fence and the two plates before and after the plates move. Use arrows to show the direction of movement of the plates.

Compare the three types of plate boundaries and their characteristics in the table

<table>
<thead>
<tr>
<th>Plate Boundary Type</th>
<th>Location</th>
<th>Impact on plates features involved</th>
<th>Associated geologic phenomena</th>
<th>New features formed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most on ocean floors</td>
<td>Two oceanic plates moving apart</td>
<td>Oceanic crust sinks beneath oceanic crust; oceanic crust sinks beneath continental crust; continental crust and continental crust collide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convergent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transform</td>
<td>Two plates moving past each other, plate edges</td>
<td></td>
<td>n/a</td>
<td></td>
</tr>
</tbody>
</table>

Synthesize The oldest rocks on the continents are almost four billion years old. The oldest rocks on the ocean floor are less than 200 million years old. Analyze the reasons for this difference.

Name ____________________________ Date ____________________________
Plate Tectonics
Section 17.4 Causes of Plate Motions

Main Idea

Consider the title of Section 4. List three things that might be discussed in this section.

1. 
2. 
3. 

Details

Use your text to define the following term.

asthenosphere

Use your text to define each term.

ridge push

slab pull

Define the following term.

mechanism
Section 17.4 Causes of Plate Motions (continued)

**Main Idea**

**Mantle Convection**

*Use with page 460.*

**Details**

**Identify** two factors that cause convection. Describe the movement of a convection current and sketch a current.

---

**Compare** the processes of ridge push and slab pull by filling in the table below.

<table>
<thead>
<tr>
<th>Type of plate boundary</th>
<th>Description of movement</th>
<th>Impact on plate tectonics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ridge push</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slab pull</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Explain** mantle convection currents by completing the following sentences.

_________ currents in the _____ are thought to be the mechanism behind _______________. The ___________ of the mantle is like soft _____, so it can be moved like a fluid by convection currents.

_______ energy inside Earth’s _____ starts the convection currents moving. Hot mantle material is ______ than the cooler mantle material. Therefore, it _____. Cooler parts of the mantle _____ toward the _____.

---

Use with page 461.
Section 17.4 Causes of Plate Motions (continued)

**Main Idea**

**Mantle Convection**

Use with page 461.

**Details**

Create a diagram to illustrate the following features. Use Figure 17-19 to help you.

- convection current
- asthenosphere
- upper mantle
- trench
- crust
- convergent plate boundary
- slab pull
- divergent plate boundary
- ridge push
- lithosphere

Use with page 463.

**ANALOGY**

Draw a connection between heating soup on the stove and convection currents in the Earth.

Identify unanswered questions that scientists still have about convection currents and plate tectonics.

Identify unanswered questions that scientists still have about convection currents and plate tectonics.

Identify unanswered questions that scientists still have about convection currents and plate tectonics.

Identify unanswered questions that scientists still have about convection currents and plate tectonics.

Identify unanswered questions that scientists still have about convection currents and plate tectonics.

Identify unanswered questions that scientists still have about convection currents and plate tectonics.

Identify unanswered questions that scientists still have about convection currents and plate tectonics.
Plate Tectonics  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>What I Wanted to Find Out</th>
<th>W</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>________________________</td>
<td>1.</td>
<td>________________________</td>
</tr>
<tr>
<td>2.</td>
<td>________________________</td>
<td>2.</td>
<td>________________________</td>
</tr>
<tr>
<td>3.</td>
<td>________________________</td>
<td>3.</td>
<td>________________________</td>
</tr>
</tbody>
</table>

**Review**

*Use this checklist to help you study.*
- [ ] Study your Science Notebook for this chapter.
- [ ] Study the definitions of vocabulary words.
- [ ] Review daily homework assignments.
- [ ] Reread the chapter and review the tables, graphs, and illustrations.
- [ ] Review the Section Assessment questions at the end of each section.
- [ ] Look over the Study Guide at the end of the chapter.

**SUMMARIZE**

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

_________________________

_________________________

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

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to model magma movement and record your response in this science journal.

Describe what happened to the colored water when it entered the beaker.

________________________________________________________________________

How might this be similar to what happens to magma beneath Earth’s surface?

________________________________________________________________________

Infer what would have happened if you had released the hot water at the surface of the cold water.

________________________________________________________________________
Volcanic Activity
Section 18.1 Magma

Main Idea

Scan Section 1 of your text. Use the checklist below as a guide.
• Read all section titles.
• Read all bold words.
• Read all tables and graphs.
• Look at all the pictures and read their captions.
• Think about what you already know about volcanoes.

Write three facts you discovered about magma.
1. 
2. 
3. 

Review Vocabulary

Use the text to define the following term.
magma

New Vocabulary

Use the text to define the following term.
viscosity

Show your understanding of the word by writing a definition of your own.

Academic Vocabulary

Define the following term.
factor
How Magma Forms

Use with page 472.

List three factors that affect the formation of magma.

1. 
2. 
3. 

Analyze Figure 18-1 to complete the table. Indicate in the table whether temperature, pressure, and melting point increase or decrease for each of the conditions.

<table>
<thead>
<tr>
<th></th>
<th>Pressure</th>
<th>Temperature</th>
<th>Melting Point of Wet Albite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing Depth Below Earth’s Surface</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreasing Depth Below Earth’s Surface</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Illustrate the relationship between the melting point of a wet rock and a dry piece of the same rock under the same amount of pressure by sketching a thermometer and marking a possible temperature for each type of rock.

SYNTHESIZE

If you were the engineer on an oil-drilling expedition, explain how you might use a graph such as the one in Figure 18.1 in your text.
Section 18.1 Magma (continued)

**Main Idea**

**Types of Magma**

*Use with page 473.*

**Viscosity**

*Use with page 475.*

**Details**

**Identify** types of volcanoes. Write basaltic, andesitic, or rhyolitic to the left of each description.

_______ Volcanoes that are found along continental margins. In the figure above, circle two such volcanoes in red.

_______ Volcanoes in which rocks in the upper mantle melt. In the figure above, circle two such volcanoes in blue.

**Compare** the explosiveness, viscosity, and gas content of Surtsey to Tambora.

**Organize** information about types of magma by completing the table below.

<table>
<thead>
<tr>
<th></th>
<th>Andesitic Magma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas content</td>
<td>4-6%</td>
</tr>
<tr>
<td>Silica Content</td>
<td>About 50%</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Explosives</td>
<td></td>
</tr>
</tbody>
</table>
Volcanic Activity
Section 18.2 Intrusive Activity

**Main Idea**

**Details**

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

1. 
2. 
3. 

**Review Vocabulary**

**New Vocabulary**

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

__________

intrusive igneous rock bodies

__________

irregularly shaped plutons that are similar to batholiths but smaller

__________

a platon that forms when magma intrudes parallel to layers of rock

__________

the largest plutons

__________

a mushroom-shaped ploton with a round top and a flat bottom

__________

a platon that cuts across preexisting rocks
List three ways intruding magma can affect Earth’s crust.

1. 

2. 

3. 

Record the three characteristics used to classify plutons.

1. 

2. 

3. 

Draw an illustration that includes the following features. Label the features on your drawing.

- a batholith
- a sill
- a dike
- a stock
- a laccolith
Section 18.2 Intrusive Activity (continued)

**Main Idea**

**Details**

**Compare** a sill and a dike. Place each characteristic below in the Venn diagram to show whether it is a characteristic of a sill, a dike, or both.

- cuts across preexisting rocks
- is parallel to the rocks it intrudes
- is a few centimeters to hundreds of meters thick
- many are coarse grained
- is a few centimeters to several meters wide
- is a pluton

![Venn Diagram](image)

**Sequence** the four steps involved in forming batholiths from mountain-building processes. The first step has been completed for you.

Two continental plates converge, forcing continental crust into the mantle.

OR

Two oceanic plates converge and one plate is subducted into the mantle.

Sequence:

1. 
2. 
3. 
4. 

**Plutons and Tectonics**

*Use with page 478.*
Volcanic Activity
Section 18.3 Volcanoes

Main Idea

Scan the photos and read the captions in this section. Write two questions you think may be answered in this section.

1. __________________________________________

2. __________________________________________

Review Vocabulary

Use your text to define the following term.

convergent boundary

New Vocabulary

Use your text to define each term.

vent

crater

caldera

tephra

pyroclastic flow

hot spot

Write each of the following terms on the line below its corresponding image.

- Cinder-cone volcano
- Composite volcano
- Shield volcano
Section 18.3 Volcanoes (continued)

**Main Idea**

Anatomy of a Volcano

Use with page 480.

**Details**

Create a cross section of a volcano. Show the interior of the volcano. Label the following:
- crater
- magma chamber
- vent

Sequence the steps in the formation of a lake in a caldera. Refer to Figure 18-11 for help. The first one has been completed for you.

____ Steam causes explosions.
____ A volcano erupts many times.
____ The caldera that is formed fills with water to form a lake.
____ The top of the partially empty magma chamber collapses.

Identify the two factors that affect the appearance of a volcano by completing the concept map below.
Section 18.3 Volcanoes

**Main Idea**

Compare and Contrast the three types of volcanoes by completing the table below.

<table>
<thead>
<tr>
<th>Type of volcano</th>
<th>Description</th>
<th>How does it form?</th>
<th>How explosive is its eruption?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cinder-cone</td>
<td>steep sides, generally small</td>
<td></td>
<td>more explosive than shield</td>
</tr>
<tr>
<td>Shield</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite</td>
<td>larger, with steep slopes that are concave</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Details**

Sketch a small volcano below at the left. Draw and label an example of each of the following types of tephra as it is ejected above or to the right of the volcano. Your drawing should illustrate relative sizes and possible places where the tephra might be found. Then write the size range for each next to the label.

- ash
- dust
- lapillli
- volcanic blocks
- volcanic bombs
Section 18.3 Volcanoes (continued)

Main Idea

Volcanic Material
Use with page 484.

Details

Analyze and describe the setting and eruption that results in a pyroclastic flow.

Where Do Volcanoes Occur?
Use with page 484–487.

Contrast convergent and divergent volcanism.

Complete the following sentences to better understand hot spots.

[students' responses]

**Real-World Connection**

Yellowstone National Park sits atop a caldera formed 650,000 years ago. Describe evidence showing that this area is still a geologic hot spot.

[students' responses]
In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>What I Wanted to Find Out</th>
<th>W</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>________________________</td>
<td>1.</td>
<td>________________________</td>
</tr>
<tr>
<td>2.</td>
<td>________________________</td>
<td>2.</td>
<td>________________________</td>
</tr>
<tr>
<td>3.</td>
<td>________________________</td>
<td>3.</td>
<td>________________________</td>
</tr>
</tbody>
</table>

**Review**

*Use this checklist to help you study.*

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

**SUMMARIZE**

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

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Earthquakes

Chapter Preview

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

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</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>

Think about the Discovery Lab you did to model an earthquake and record your response in this science journal.

Compare the two movements.

Infer which of the two scenarios models what happens during an earthquake.
Earthquakes
Section 19.1 Forces Within Earth

Main Idea

Consider the title of Section 1. List three topics that might be discussed in this section.

1. 
2. 
3. 

Details

Review Vocabulary

Use your text to define the following term.

fracture

New Vocabulary

Use your text to define each term.

stress
strain
fault
primary wave
secondary wave
surface wave
focus
epicenter

Academic Vocabulary

Define the following term.

exceed
Section 19.1 Forces Within Earth (continued)

**Main Idea**

**Stress and Strain**
*Use with pages 495–496.*

Identify the three kinds of stress that can act on Earth’s rocks. Explain how each type of stress affects rocks.

1. __________________________
2. __________________________
3. __________________________

Describe what happens to a rubber band as it is stretched at each point or segment on the stress-strain curve below.

**Details**

**Faults**
*Use with page 497.*

Compare the different types of faults, and their characteristics by completing the table below.

<table>
<thead>
<tr>
<th>Type of Fault</th>
<th>Cause</th>
<th>Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>horizontal tension</td>
<td></td>
</tr>
</tbody>
</table>
Earthquake Waves

Use page 498.

Differentiate between P-waves, S-waves, surface waves, both P- and S-waves, both S- and surface waves, or all three waves. Place each of the following characteristic in the Venn diagram below.

- are body waves
- move up and down
- are seismic waves
- pass through Earth’s interior
- cause rocks to move at right angles to the wave

- squeeze and pull rocks in the same direction as the waves
- move back and forth
- travel along Earth’s surface
- move in two directions as they pass through rock

**ANALOGY**

Describe how dropping a rock into a still pond models the movement of an earthquake.
Earthquakes
Section 19.2 Seismic Waves and Earth’s Interior

Scan Section 2 of your text. Use the checklist below as a guide.
• Read all section titles.
• Read all bold words.
• Read all tables and graphs.
• Look at all the pictures and read their captions.
• Think about what you already know about seismic waves.

Write three facts you discovered about seismic waves as you scanned the section.
1. 
2. 
3. 

Review Vocabulary
Use your text to define the following term.
lithosphere

New Vocabulary
Use your text to define each term.
seismometer

seismogram

Academic Vocabulary
Define the following term.
method
Seismometers and Seismograms

Use with page 500.

Label the parts of the seismometer below.

What if a younger student is looking at the diagram above with you. Explain to the student how the seismometer works.

Create two questions that can be answered using information from Figure 19-9 in your book. For example, “How long did it take the S-waves to move 2000 km from the epicenter of the earthquake?”

1. 

2. 
Main Idea

Clues to Earth’s Interior

Use with page 503.

Details

Sketch a model of the interior of Earth. Label the following:
- inner core
- mantle
- outer core

Once you have drawn your model, draw an earthquake focus on the left side of your model. Then add the following:
- P-waves
- P-wave shadow zones
- S-waves

Identify on your model where there are no direct P-waves and no direct S-waves.

SYNTHESIZE

What would happen if S-waves encountered a lake or pond?

Explain your reasoning.
Earthquakes
Section 19.3 Measuring and Locating Earthquakes

Main Idea

Consider the objectives on the first page of Section 3. Change each objective into a question that will be answered with information in the section.

1. 

2. 

3. 

Details

Use the terms in the left margin to complete the following sentences.

When an earthquake is reported on the news, reporters often refer to its _________. This is the amount of energy released during an earthquake. There is more than one way to measure it. One type of scale, the _____________, measures the amount of damage from an earthquake. The ______________ accounts for the magnitude, size of the fault rupture, amount of movement along the fault, and the rocks’ stiffness. The ____________ is based on the largest seismic waves made by an earthquake.

New Vocabulary

magnitude
Richter scale
moment magnitude scale
modified Mercalli scale

Academic Vocabulary

occur

Define the following term.

______________________________________________________________
Section 19.3 Measuring and Locating Earthquakes (continued)

Main Idea

Earthquake Magnitude and Intensity

Use with page 505–507.

Details

Differentiate between the three scales that are used to describe earthquakes. Write the name of each scale and describe what it measures in the concept map.

Describe the difference between the magnitude and the intensity of an earthquake.

State the three ways the depth of an earthquake’s focus can be classified.

1. 
2. 
3. 

From the three classifications above, circle the depth of focus for almost all catastrophic quakes.
Section 19.3 Measuring and Locating Earthquakes (continued)

**Main Idea**

**Locating an Earthquake**

*Use with page 508.*

Consider the locations of two seismic stations that have been plotted on a map as shown below. Explain why it is impossible to determine the location of an earthquake using only two seismic stations. Then continue your explanation to describe why three stations are needed to determine the location of an earthquake.

**Details**

**Seismic Belts**

*Use with page 509.*

Describe seismic belts by completing the paragraph below.

Most of the world’s earthquakes occur in narrow _________ that separate large regions of little or no _________. Most earthquakes are associated with _________. A ________ percentage of earthquakes happen far from ________ ________ and are distributed more or less at ________.

**Analogy**

Point out how you could use a simple puzzle to demonstrate where most earthquakes occur in the world. Describe what would happen if you shook the puzzle.
Earthquakes
Section 19.4 Earthquakes and Society

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

1. 
2. 
3. 

Review Vocabulary

Use your text to define the following term.
landslide

New Vocabulary

Use your text to define each term.
tsunami

seismic gap

Show your understanding of each of the above terms by using each one in a sentence of your own.

collapse

Define the following term.
**Main Idea**

**Some Earthquake Hazards**

*Use with page 511.*

**Details**

*Compare* Place each type of building on the continuum to show its strength and quality during an earthquake.

- buildings on large rubber structures
- high-rise, steel-frame buildings
- unreinforced buildings of stone or concrete
- wooden structures

<table>
<thead>
<tr>
<th>Least amount of earthquake damage</th>
<th>Greatest amount of earthquake damage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Outline* Information about earthquake hazards. Describe each hazard in detail.

I. The 4 types of earthquake hazards are:

A. 

1. Pancaking—

2. failure related to height—

B. 

1. Landslides—

2. 

3. 

C. —is an area of great vertical offset where the fault intersects the ground surface

D. 

---
Identify the four states that have the lowest seismic risk. Refer to the seismic risk map of the United States on page 514 of your text.
1. 
2. 
3. 
4. 

Infer whether any of these states will ever have an earthquake.

Organize information about earthquake prediction by completing the graphic organizer below.

Earthquake Prediction is based on

Real-World Connection
Imagine you live in an area that has had three minor earthquakes and one major earthquake in the last 100 years. It has been 40 years since the last earthquake. Assess the probability of another earthquake in your area.
Earthquakes  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What I Wanted to Find Out</strong></td>
<td><strong>What I Learned</strong></td>
</tr>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td>2.</td>
<td>2.</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

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

SUMMARIZE

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

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Mountain Building

Chapter Preview

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

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</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>

Think about the Discovery Lab you did to model crustal differences and record your response in this science journal.

How does density affect the height of flotation?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

How does thickness affect the height of flotation?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Which block represents oceanic crust? Continental crust?

________________________________________________________________________

________________________________________________________________________
Mountain Building
Section 20.1 Crust-Mantle Relationships

Main Idea

Consider the objectives on the first page of Section 1. Write three questions that come to mind while reading these statements.

1. __________________________________________
2. __________________________________________
3. __________________________________________

Details

Use your text to define the following term.

erosion
________________________________________
________________________________________

Use your text to define each term.

isostasy
________________________________________
________________________________________

isostatic rebound
________________________________________
________________________________________

Define the following term.

mode
________________________________________
________________________________________
Earth’s Topography

Use with page 524.

**Main Idea**

**Details**

Identify the two modes that most of Earth’s elevations cluster around. Then classify those elevations as oceanic crust or continental crust.

either or

_____ crust

_____ crust

**Name** the two main factors that lead to differences in elevation in Earth’s crust. Describe how each affects elevation.

1. ______________________________________________________________________
2. ______________________________________________________________________

**Infer** how the elevations of oceanic crust would be different if oceanic crust were thicker. Explain.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Section 20.1 Crust-Mantle Relationships (continued)

**Main Idea** — Isostasy

*Use with pages 525–526.*

**Details**

**Consider** the principle of isostasy and how it relates to mountains. Describe what happens to the roots of a mountain range as the mountain range is forming.

---

**Sequence** the steps in the process of isostatic rebound until mountains and their roots disappear.

___ The roots become smaller.

___ Isostatic equilibrium is achieved and the mountains are buoyantly supported.

___ This process continues until the mountains and their roots disappear.

___ Mountain peaks erode, decreasing the mass of the mountains.

___ Mountains rise above Earth’s surface, forming deep roots.

---

**Analogy**

Imagine a cargo boat loaded with grain is being unloaded in a harbor. Use this situation to illustrate isostatic rebound. Draw a series of images of the boat and explain how what is happening as it is unloaded is similar to erosion. Use Figure 20-4 in your text for help.
Mountain Building
Section 20.2 Convergent-Boundary Mountains

Main Idea

Details

Skim Section 2 of your text. Write three questions that come to mind while reading the headings and the illustration captions.

1._______________________________________

2._______________________________________

3._______________________________________

Review Vocabulary

Use your text to define the following term.

continental drift

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

New Vocabulary

Use your text to define the following term.

orogeny

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Show your understanding of the term by using it in a sentence.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Academic Vocabulary

Define the following term.

complex

________________________________________________________________________
________________________________________________________________________
Section 20.2 Convergent-Boundary Mountains (continued)

**Main Idea**

**Orogeny**

*Use with pages 528–531.*

**Details**

**Complete the graphic organizer about orogeny.**

```
results in

where compressive forces cause

which are associated with
```

**Compare the different types of mountains that form along convergent plate boundaries in the table below.**

<table>
<thead>
<tr>
<th>Type of Boundary</th>
<th>Types of Mountains that Form</th>
<th>How the Mountains are Formed</th>
<th>Type of Rocks Associated with Mountains</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
Section 20.2 Convergent-Boundary Mountains (continued)

Main Idea

The Appalachian Mountains—A Case Study

Use with page 533.

Details

Sequence the formation of the Appalachian Mountains. Some of the steps have been completed for you. In the smaller boxes, write the name of the region of the Appalachians that was formed at that step.

An island arc develops east of ancestral North America.

CONNECT

Suppose you were hiking and saw rock formations similar to those in Figure 20-12 in your text. Categorize the type of convergent boundary that created the rocks in the area. Defend your response.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Piedmont Province
Mountain Building
Section 20.3 Other Types of Mountains

Main Idea

Examine the photographs of different types of mountains in Section 3 of your text. Use the photos to create an informative drawing with an image of two types of mountains. Label each type.

Details

Review Vocabulary

Use your text to define the following term.

divergent boundary

New Vocabulary

Use your text to define each term.

pillow basalt

uplifted mountain

fault-block mountain

Academic Vocabulary

Define the following term.

dynamic
Section 20.3 Other Types of Mountains (continued)

**Main Idea**

**Divergent-Boundary Mountains**

*Use with pages 535–536.*

**Details**

Illustrate *how an ocean ridge forms.* Show the following:

- central rift
- magma upper
- new crust
- lithosphere
- mantle
- older crust

*Draw an arrow to show the direction that the magma and crust move in relation to the central rift. Refer to your model to describe the process of forming an ocean ridge.*

---

Illustrate *vertical dikes and pillow basalts, which are characteristic of ocean-ridge rocks.* Label each and write a description of how each is formed.
Section 20.3 Other Types of Mountains (continued)

**Main Idea**

**Nonboundary Mountains**

*Use with pages 537–538.*

**Details**

Compare and Contrast uplifted and fault-block mountains in the Venn diagram. Place each characteristic in the diagram to show whether it is a trait of uplifted mountains, fault-block mountains, or both.

- crust is uplifted as a unit
- form along faults
- pieces of crust are tilted, uplifted, or dropped
- have little structural deformation
- formed by internal forces

**Sequence** the steps in the formation of a volcano over a hot spot in the correct order.

- a chain of volcanoes forms
- a volcanic peak forms
- mantle material is forced up through the crust
- a tectonic plate moves over a hot spot through the crust

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

**Synthesize**

Recall what you learned in Chapter 18 about different types of volcanoes. Infer whether volcanoes that form over hot spots are more or less explosive than most volcanoes that form along plate boundaries. Explain your reasoning.

________________________________________

________________________________________

________________________________________

________________________________________
What if Earth was not a dynamic planet, but had stayed the same for millions of years? What might Earth’s surface look like today?

Compare mountains that form at plate boundaries to nonboundary mountains.

Design a model of one of the types of mountains in the chapter. It should be a working model that can show the formation of the type of mountain. Be creative, yet think about constructing a simple model. Sketch your model below, then build it. Demonstrate your model to your class.
In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>W</th>
<th>What I Wanted to Find Out</th>
<th>L</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>________________________</td>
<td>1.</td>
<td>________________________</td>
</tr>
<tr>
<td>2.</td>
<td>________________________</td>
<td>2.</td>
<td>________________________</td>
</tr>
<tr>
<td>3.</td>
<td>________________________</td>
<td>3.</td>
<td>________________________</td>
</tr>
</tbody>
</table>

**Review**

*Use this checklist to help you study.*

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

**Summarize**

After reading this chapter, state three things you have learned about how mountains are formed.

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

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
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<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to model a fossil hunt, and record your response in this science journal.

Explain how fossils can help determine the age of sediment or a rock.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Does categorizing the fossils provide any further clues about the environment in which the fossiliferous sediment formed? Explain.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Fossils and the Rock Record
Section 21.1 The Geologic Time Scale

Main Idea

Examine the geologic time scale in Figure 21-1 on page 554 of your text. Write three things about the geologic time scale that interest you.

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

Review Vocabulary

Use your text to define each term.

geologic time scale

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

eon

1. ____________________________________________
2. ____________________________________________

era

1. ____________________________________________
2. ____________________________________________

period

1. ____________________________________________
2. ____________________________________________

epoch

1. ____________________________________________
2. ____________________________________________

Academic Vocabulary

Define the following term.

decline

1. ____________________________________________
Section 21.1 The Geologic Time Scale (continued)

**Main Idea**

The Rock Record

*Use with pages 553–554.*

**Details**

Identify what scientists use to divide the history of Earth into time units.

List the three main factors that scientists consider when refining the geologic time scale.

1. 

2. 

3. 

Construct three quiz questions using information from the time scale in Figure 21-1. Then write the answers to the questions.

**Geologic Time**

*Use with page 554*

Label eon, era, epoch, and period in the correct location on the continuum.

<table>
<thead>
<tr>
<th>Shortest length of time</th>
<th>Longest length of time</th>
</tr>
</thead>
</table>

Fossils and Rock Record 241
Label the simplified geologic time scale below. Use Figure 21-1 to help you. Include the different eons and eras on your time scale. On the lines to the left and right, write important events about the appearance and development of different animals.

**Critique**

Critique the following statement: “Humans are relatively old according to the geologic time scale.” Explain whether you agree or disagree. Defend your answer.

---

**Main Ideas**

*Use with page 554.*

**Details**

**Critique**

Critique the following statement: “Humans are relatively old according to the geologic time scale.” Explain whether you agree or disagree. Defend your answer.

---

**Main Idea**

*Use with page 554.*

**Details**

Label the simplified geologic time scale below. Use Figure 21-1 to help you. Include the different eons and eras on your time scale. On the lines to the left and right, write important events about the appearance and development of different animals.
Fossils and the Rock Record
Section 21.2 Relative-Age Dating of Rocks

Main Idea

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

- Read all section titles.
- Read all bold words.
- Read all tables and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about the dating of rocks.

Write two facts you discovered about relative-age dating of rocks.

1. 
2. 

Review Vocabulary

Use your text to define the following term.

deposition

New Vocabulary

Use your text to define each term.

uniformitarianism

original horizontality

superposition

cross-cutting relationships

unconformity

correlation
Section 21.2 Relative-Age Dating of Rocks (continued)

Principles for Determining Relative Age
Use with page 558.

Identify the three geologic principles for determining the relative age of rocks.

1. ________________________________________________________________________

2. ________________________________________________________________________

3. ________________________________________________________________________

Draw two horizontal layers of rock. Then draw and label inclusions in the top layer. Describe how inclusions are formed.

Create a diagram of four or five rock layers. Include one layer with inclusion. Draw an intrusion that cuts through more than one layer. Label the layers A, B, C,.... Write three true statements about the relative ages of the rock layers in your diagram. State the geologic principle that helped you write each statement.

1. ________________________________________________________________________

2. ________________________________________________________________________

3. ________________________________________________________________________
Section 21.2 Relative-Age Dating of Rocks (continued)

Main Ideas

Compare the different types of unconformities using the graphic organizer.

Hypothesize what could have happened to separate the Permian Kaibab Formation that rims the top of the Grand Canyon and the Permian Kaibab Formation that is found 300 km away at the bottom of a 200-m gorge.
Fossils and the Rock Record

Section 21.3 Absolute-Age Dating of Rocks

Main Idea

**Skim** Section 3 of your text. Read the headings and captions more closely. Write three questions you think may be answered in this section.

1. 
2. 
3. 

Review Vocabulary

*Use your text to define the following term.*

- drought

New Vocabulary

*Use your text to define each term.*

- radioactive decay
- radiometric dating
- half-life
- dendochronology
- varve
- key bed

Academic Vocabulary

*Define the following term.*

- similar
Section 21.3 Absolute-Age Dating of Rocks (continued)

**Main Idea**
Use with page 562.

**Details**
Compare the relative-age dating of rocks to absolute-age dating of rocks using the graphic organizer.

Relative-age dating

Absolute-age dating

measures

Create an illustration to explain the concept of half-life. Use one of the radioactive isotopes listed in Table 21-1. Your illustration should show the amount of parent element at the beginning and the amount of parent and daughter elements after one half-life.

Explain the radioactive decay of Uranium-238 to Lead-206 in the table below. Use Tables 21-1 and 21-2 in your book for help.

<table>
<thead>
<tr>
<th>Time</th>
<th>Percent Parent Element</th>
<th>Percent Daughter Element</th>
<th>Elapsed Years</th>
<th>Number of Half-Lives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Time 3</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Time 4</td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Time 5</td>
<td></td>
<td></td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>
Section 21.3 Absolute-Age Dating of Rocks (continued)

**Main Idea**

**Other Ways to Determine Age**

*Use with pages 564-565.*

**Details**

**Compare and Contrast** tree rings and varves. Place each characteristic in the Venn diagram to show whether it is a trait of tree rings, varves, or both.

- determine ages of glacial lake sediments
- used to determine the age of an object
- show evidence of cyclic events
- widest in spring, thinnest in winter
- thickest in summer, thinnest in winter

**Draw a cross section of a tree that is six years old. The tree lives in a normal environment. Next to it, create a cross section of a tree that is six years old, but has lived through six years of drought. Explain why the two drawings look different from each other.**
Fossils and the Rock Record

Section 21.4 Remains of Organisms in the Rock Record

Predict three things that might be discussed in this section based on its title.

1. ______________________________________

2. ______________________________________

3. ______________________________________

New Vocabulary

Use your text to define each term.

fossil

-----------------------------------------------------------------------------------

evolution

-----------------------------------------------------------------------------------

original preservation

-----------------------------------------------------------------------------------

altered hard part

-----------------------------------------------------------------------------------

permineralization

-----------------------------------------------------------------------------------

index fossil

-----------------------------------------------------------------------------------

mold

-----------------------------------------------------------------------------------

cast

-----------------------------------------------------------------------------------
Section 21.4 Remains of Organisms in the Rock Record (continued)

**Main Idea**

*Use with page 566.*

**Details**

Identify *three ways fossils are useful.*

1. ____________________________
2. ____________________________
3. ____________________________

______________________________

**Types of Fossils**

*Use with page 566.*

Compare *types of fossils by completing the table below.*

<table>
<thead>
<tr>
<th>Type of Fossil</th>
<th>Description and Information about Its Formation</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original preservation</td>
<td></td>
<td>petrified wood</td>
</tr>
<tr>
<td>Index fossils</td>
<td></td>
<td>trilobite molds, casts of molds</td>
</tr>
<tr>
<td>Indirect evidence of past life</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sequence the steps in the process of forming a mold and a cast.

- The shell is buried.
- Sediment fills the mold.
- A hermit crab crawls out of its shell to find a bigger one.
- A mold is left in the shell’s place.
- Groundwater dissolves the shell.
- A cast of the shell is made.

Create an informational drawing describing why scientists study fossils.

Why Study Fossils?

Use with page 569.

Think about fossils that could be made from organisms that are currently living. Describe two fossils that you could create that would help future generations learn about how you lived. Be sure to include details about how the fossils might form.
In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>What I Wanted to Find Out</th>
<th>W</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

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

Summarize

After reading this chapter, describe three things you have learned about fossils and the rock record.

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
The Precambrian Era

Chapter Preview

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

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Science Journal

Observe

Describe what happened to the colored water and vegetable oil in the beaker.

_____________________________________________________________________

Explain how this is similar to what happened to the core and mantle when Earth formed.

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________
The Precambrian Earth
Section 22.1 The Early Earth

Main Idea

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

1. ________________________________
2. ________________________________
3. ________________________________

Details

Review Vocabulary

Use your text to define the following term.

isotope

New Vocabulary

Use your text to define each term.

zircon

asteroid

meteorite

Academic Vocabulary

Define the following term.

generate
Section 22.1 The Early Earth (continued)

**Main Idea**

**Earth’s “Birth”**

*Use with page 577.*

**Details**

Organize the four billion years that make up the Precambrian Era by completing the following flowchart.

- Precambrian
  - 4.6 billion years to 2.5 billion years ago

**How Old Is Earth?**

*Use with page 578.*

Examine the evidence scientists used to determine Earth’s age by completing the table below. The first one has been done for you.

<table>
<thead>
<tr>
<th>Rock or Mineral</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>rocks in Earth’s crusts</td>
<td>3.96 to 3.8 billion years old</td>
</tr>
<tr>
<td></td>
<td>4.1 to 4.2 billion years old</td>
</tr>
<tr>
<td></td>
<td>between 4.5 and 4.7 billion years old</td>
</tr>
<tr>
<td></td>
<td>approx 4.6 billion years old</td>
</tr>
</tbody>
</table>

Explain how scientists used the evidence in the chart to determine the age of Earth and give their conclusion.
Earth's Heat Sources
Use with page 578.

List the three heat sources of Earth shortly after it formed.
1. 
2. 
3. 

Predict what will happen to the number of radioactive isotopes as Earth continues to get older.

Create a diagram that shows how meteorites and asteroids in the early solar system could have created a tremendous amount of thermal energy on Earth.

Explain gravitational contraction by completing the following sentences.

Another source of Earth's heat was _________________.
Meteor bombardment and the resulting accumulation of meteorite material caused Earth to ___________. The _____ of the material caused ________________ of the layers beneath. This energy was converted into ___________. The meteorites material also caused a ___________ , which kept the ___ from escaping.

Real-World Connection
The interior of Earth is still generating heat. Hypothesize which of the three original sources this heat is coming from.
The Precambrian Earth
Section 22.2 Formation of the Crust and Continents

Main Idea

Details

Skim Section 2 of your text. Read the headings and the figure captions. Write three questions that come to mind.

1. 
2. 
3. 

Use your text to define the following term.

lithosphere

Use your text to define each term.

differentiation

Precambrian shield
Canadian Shield
microcontinent
Laurentia

Define the following term.

illustrate
Section 22.2 Formation of the Crust and Continents (continued)

**Main Idea**

Formation of the Crust

*Use with page 580–581.*

Model the differentiation of Earth. Draw a cross-section of Earth and label five layers. Use Figure 22-3 to help you.

**Details**

Analyze differentiation and the formation of the crust in the concept web below.

Earth’s early crust formed by ______ composed of ___

______

______

core is made of _____ and ___

crust is made of ___ density rocks which ______ at a _____ temperature

this rock weathered and formed a layer of ______

in current times, which were recycled into the _____ by ______

granite continental crust floats on top of the _____ below it

undersea crust is dense _____ which sinks _____ than _____ continental crust

**The Cores of the Continents**

*Use with page 581.*

Explain the cores of the continents by completing the following sentences.

Continents contain a core of ______ and _______ rock called a _________________. The Precambrian shield of North America is called the _______________. It is exposed in parts of _____, ________, ________, Michigan, _________, and Greenland.
Section 22.2 Formation of the Crust and Continents (continued)

**Main Idea**

Growth of Continents

*Use with page 582–583.*

**Details**

Create cartoon-strip style sketches to show a chronology of the formation of Earth's surface as we now know it. Draw at least four frames. Include events such as:

- collision of microcontinents
- formation of Laurentia
- formation of microcontinents
- formation of Rodinia
- Grenville orogeny
- suturing at orogenies to produce larger continents

**List** four important developments of Earth by the end of the Proterozoic.

1. 

2. 

3. 

4. 

**Real-World Connection**

Wegener mentioned Pangaea in his hypothesis about continental drift. Compare and contrast Pangaea and Rodinia.
The Precambrian Earth
Section 22.3 Formation of the Atmosphere and Oceans

Main Idea

Objectives Read the objectives on the first page of Section 3. Write three questions that come to mind from reading these statements.

1. 
2. 
3. 

Detail

Review Vocabulary Use your text to define the following term. Hypothesize how the atmosphere in early times was different from now.

atmosphere

New Vocabulary Use your text to define each term.

cyanobacteria

stromatolite

banded iron formation

red bed

Academic Vocabulary Define the following term.

dominate
Main Idea

The Precambrian Atmosphere

Use with page 584.

Details

Summarize the formation of seven gases in the early atmosphere.

- Early Atmosphere → decay of radioactive potassium-40
- out-gassing by
- chemical reactions

Oxygen in the Atmosphere

Use with pages 585–586.

Predict what would have happened to life on the planet if cyanobacteria had not evolved 3.46 billion years ago.

Compare the rocks related to oxygen in the atmosphere.

<table>
<thead>
<tr>
<th>Rock Type</th>
<th>Composition</th>
<th>Ages</th>
<th>Evidence of Oxygen?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Cyanobacteria</strong> were the first organisms to use photosynthesis, which produced oxygen.</td>
</tr>
<tr>
<td>Banded iron formation</td>
<td></td>
<td></td>
<td>The iron found in rocks began to oxidize in the presence of oxygen.</td>
</tr>
</tbody>
</table>
Importance of Oxygen
Use with page 587.

Formation of the Oceans
Use with page 588.

List two reasons oxygen is vital to life on Earth.
1. ____________________________
2. ____________________________

Create a diagram to show where water on Earth came from and why the water in the seas is salty. Include both ice and steam sources in your diagram.

Summarize changes described in this section that occurred during early Earth that made it a place for life.

__________________________________________________________

__________________________________________________________

__________________________________________________________

__________________________________________________________

Section 22.3 Formation of the Atmosphere and Oceans (continued)
The Precambrian Earth
Section 22.4 Early Life on Earth

Scan Section 4 in your text. Read the bold words, headings, and figure captions. Write four facts about early life that you discovered as you scanned the section.

1. ________________________________
2. ________________________________
3. ________________________________
4. ________________________________

Use your text to define the following term. Tell why it is an important concept when discussing early life on Earth.

period

Use your text to define each term.

amino acids
hydrothermal vent
prokaryote
eukaryote
Varangian Glaciation

Ediacara fauna

Define the following term.

constantly
Section 22.4 Early Life on Earth (continued)

Main Idea

Origin of Life on Earth
Use with pages 589–591.

Model the “primordial soup” experiment by drawing the Miller and Urey’s laboratory setup. Label the two chambers, write the products found in the condensation chamber, the gases found in the atmospheric chamber, and the metal used for the electrodes. Use Figure 22-12 to help you.

Details

Proterozoic Life
Use with pages 591–592.

Organize the information about DNA and RNA in the Venn diagram below.

- carries instructions necessary for cells to function
- first replicating molecules on Earth
- need enzymes to replicate
- ribozymes replicate without enzymes

Compare and Contrast the characteristics of early life forms by filling in the table below.

<table>
<thead>
<tr>
<th>Organism</th>
<th>Structure</th>
<th>Example</th>
<th>Approximate age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prokaryote</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eukaryote</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 22.4 Early Life on Earth (continued)

**Main Idea**

Ediacara Fossils

*Use with pages 592–593.*

**Details**

Model your own Ediacara animal. Be sure that the organism has all the features of Ediacaran fauna and that it lives in the appropriate location. Make your drawing in the space below. Label the different parts and describe how it lives.

---

Describe Ediacara fossils by completing the following sentences.

Some ______ fossils are similar to ______, ______, arthropods, and echinoderms. Some scientists believe that these animals were _______ of the modern look-alikes. Other scientists think that Ediacaran fauna do not lead to any modern animals. They had no ______, ______, ______, and probably did not ______. Ediacaran fossils have been found ________.

---

Synthesize

Tell where the Urey-Miller method of amino acid creation would have had to occur. Describe how the same process could have happened at hydrothermal vents and why scientists think life could have begun there.

---

The Precambrian Era 265
The Precambrian Era  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K What I Wanted to Find Out</th>
<th>W What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ________________</td>
<td>1. ________________</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2. ________________</td>
<td>2. ________________</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3. ________________</td>
<td>3. ________________</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

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

SUMMARIZE

After reading this chapter, list three things you have learned about the Precambrian Era.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
The Paleozoic Era

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about the Paleozoic Era. Then list three questions you have about the Paleozoic Era 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>1.</td>
<td></td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to observe how oil or water can be stored in solid rock and record your response in this science journal.

Sketch a cross-section of the rock or brick. Include sketches of both before and after you added the water to it. Include in your sketches what the inside of the brick might look like.

Infer what happened to the water.
The Paleozoic Era
Section 23.1 The Early Paleozoic

Main Idea

Write each objective from the beginning of the section in the form of a question. Answer your questions as you read your text.

1. 

2. 

3. 

Details

New Vocabulary

Use your text to define each term.

paleogeography

passive margin

transgression

regression

Burgess Shale

Academic Vocabulary

Define the following term.

indicate
Section 23.1 The Early Paleozoic (continued)

Main Idea

Continental Setting
Use with pages 601–602.

Details

Analyze Laurentia in the Cambrian Period by completing the table.

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic Sediments</td>
<td>Tectonic Activity</td>
</tr>
</tbody>
</table>

Define the word “passive.” Explain how it relates to the term “passive margin.”

Categorize each characteristic as being a trait of a transgression or a regression.

- deep-water deposits overlay shallow-water deposits
- shallow-water deposits overlay deep water deposits
- happens when sea level falls
- shoreline moves inland
- happens when sea level rises
- shoreline moves seaward

<table>
<thead>
<tr>
<th>Transgression</th>
<th>Regression</th>
</tr>
</thead>
</table>
Section 23.1 The Early Paleozoic (continued)

Main Idea

Early Paleozoic Life

Use with pages 604.

Details

Draw the cross-section of the shoreline of an ocean similar to Figure 23-4 on page 603. Label the original shoreline position. Then label the position of the shoreline after a transgression and the position of the shoreline after a regression.

Describe why the beginning of the Cambrian Period often is called the Cambrian “explosion.”

Identify three facts about the fossilized Cambrian organisms that come from the Burgess Shale.

1. 
2. 
3. 

Synthesize

Hypothesize what will happen to sediments that currently are being deposited if sea level were to rise.
The Paleozoic Era
Section 23.2 The Middle Paleozoic

Main Idea

Details

Scan Section 2 of your text. Use the checklist below as a guide.
• Read all section titles.
• Read all bold words.
• Read all tables and graphs.
• Look at all the pictures and read their captions.
• Think about what you already know about the Middle Paleozoic Era.

Write three facts you discovered about the Middle Paleozoic Era.

1. __________________________
2. __________________________
3. __________________________

New Vocabulary

Use your text to define each term.

Taconic Orogeny

Caledonian Orogeny

Acadian Orogeny

Antler Orogeny

Paleozoic fauna

vascular plant

mass extinction
Describe the Middle Paleozoic paleography of Laurentia by completing the paragraphs below.

During the early Ordovician, much of Laurentia’s margins were a _____ environment. In rock layers from this time, _________ is overlain by small amounts of _____ and large amounts of _______ deposits. These deposits contain ______.

Corals are confined to latitudes between 30° north and south of the _______. This means Laurentia was positioned across the _______ during the ___ _________.

Explain how reefs make it possible for depositions of evaporite minerals to form.

Identify the forms of evidence that geologists look for to determine that the Taconic Orogeny occurred. Describe each.

1. __________________________________________

2. __________________________________________

3. __________________________________________

4. __________________________________________
Identify four different animals of the Paleozoic fauna in the concept map. Write a brief description of each fauna.

---

Identify three groups of vascular spore-bearing plants that were living on land during the Middle Paleozoic.

1.
2.
3.

Explain what scientists were able to learn about Earth as a result of studying corals during the Paleozoic.

---

Middle Paleozoic Life

Use with page 609.

Life Moves to Land

Use with page 609.
Section 23.2 The Middle Paleozoic (continued)

**Main Idea**

New Plants Emerge

*Use with page 610.*

**Details**

Explain how seeds allowed plants to colonize dry land by completing the graphic organizer below.

```
Seeds

allowed plants to spread out and colonize dry land because they have
```

**Compare**

Consider the growth lines of Devonian horn coral to the growth rings of trees. Describe what the growth lines tell scientists about Earth in the Devonian Period.

<table>
<thead>
<tr>
<th>Time of Mass Extinction</th>
<th>Number of Species that Became Extinct</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Paleozoic Era

Section 23.3 The Late Paleozoic

Main Idea

Consider the objectives at the beginning of Section 3. Restate each objective in the form of a question. Answer your questions as you read the text.

1. 
2. 
3. 
4. 

Details

Review Vocabulary

Use your text to define the following term.

- glacier

New Vocabulary

Use your text to define each term.

- Gondwana
- amniote egg
- cyclothem
- ancestral Rockies
- Alleghenian Orogeny
- Ouachita Orogeny

Academic Vocabulary

Define the following term.

- major
Main Idea

Sea Level and Deposition

Use with page 613.

Organize information about the formation of cyclothsems in the graphic organizer below.

- Glaciers
- Sea level

- Glaciation

- Glaciers
- Sea level

Examine the general rock sequence of the cyclothem in Figure 23-16 from base to top. Construct two review questions that can be answered with information from the figure. Then give the answer to each question.

1. Question: 
Answer: 

2. Question: 
Answer: 

Contrast the rocks and sediments of the Great Permian Reef Complex with the evaporites associated with the Complex.
Section 23.3 The Late Paleozoic (continued)

**Main Idea**

**Continental Collisions and Mountain Building**

*Use with page 614.*

**Details**

*Sequence the events that describe the formation of Pangaea.*

- Ancestral Rockies formed.
- What is now Africa began to collide with Laurasia, causing the Alleghenian Orogeny.
- Gondwana collides with the southeastern margin of Laurasia.
- Pangaea formed.
- Ouachita Orogeny formed the Ouachita Mountains.
- The ocean between Gondwana and Laurasia closed.
- Appalachian Mountains formed.

**Late Paleozoic Life**

*Use with page 616.*

**The Permian Mass Extinction**

*Use with page 614.*

**Sketch** a representation of an amniote egg. Label each part of the egg and describe the purpose of each part.

**Explain** the Permo-Triassic Extinction Event by completing the graphic organizer below.

**SYNTHESIZE**

Describe why a major marine regression would have been more critical to marine organisms when there was only one continent, as opposed to several continents.
The Paleozoic Era   Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K What I Wanted to Find Out</th>
<th>W What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ______________________</td>
<td>1. ______________________</td>
</tr>
<tr>
<td>______________________</td>
<td>______________________</td>
</tr>
<tr>
<td>2. ______________________</td>
<td>2. ______________________</td>
</tr>
<tr>
<td>______________________</td>
<td>______________________</td>
</tr>
<tr>
<td>3. ______________________</td>
<td>3. ______________________</td>
</tr>
<tr>
<td>______________________</td>
<td>______________________</td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

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

SUMMARIZE

After reading this chapter, list three things you have learned about the Paleozoic Era.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
The Mesozoic and Cenozoic Eras

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about the Mesozoic and Cenozoic Eras. Then list three questions you have about these eras 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>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</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>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to determine the effect of shape on buoyancy and record your response in this science journal.

What effect does the shape of the spheres have on their buoyancy?

Based on your observations, which microfossil do you think floated in the water? Which one lived on the seafloor?
The Mesozoic and Cenozoic Eras
Section 24.1 Mesozoic Paleography

Main Idea

Skim Section 1. Look at the headings, photos, illustrations, and captions. Write three questions you have about the information you think may be covered in this section.

1. _______________________________________________________________________
2. _______________________________________________________________________
3. _______________________________________________________________________

Review Vocabulary

Use your text to define the following term.

subduction

______________________________________________________________________
______________________________________________________________________

New Vocabulary

Use your text to define the following term.

Cordillera

______________________________________________________________________
______________________________________________________________________

Show your understanding of the term by using it in a sentence of your own.

______________________________________________________________________
______________________________________________________________________

Academic Vocabulary

Define the following term.

define

______________________________________________________________________
Section 24.1 Mesozoic Paleography (continued)

**Main Idea**

The Breakup of Pangaea

*Use with page 625.*

**Details**

Complete the flow chart about the breakup of Pangaea.

- __ built up underneath ______.

  - Pangaea ______.

  - The ________ of Pangaea ______ and ________.

  - As large cracks widened, ________ spread apart and the _____ flooded the ________.

  - New _____ divided newly separated ________.

---

Active Tectonism in Western North America

*Use with page 626.*

Sketch an outline of North America. Identify which coast had a passive margin and which coast had an active margin during the Mesozoic Era.
Section 24.1 Mesozoic Paleography (continued)

**Main Idea**

**Active Tectonism in Western North America**

*Use with page 626.*

**Details**

Organize information about the three major episodes of orogenies along the western margin of North America during the Mesozoic Era.

<table>
<thead>
<tr>
<th>Orogeny</th>
<th>Characteristics of the Orogeny</th>
<th>Area of North America Affected</th>
<th>Era the Orogeny Took Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oldest Orogeny</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Seaways and Sand Dunes**

*Use with page 627.*

**Summarize** what happened to sea levels and how they affected North America during each of the three periods in the Mesozoic Era.

1. __________________________________________
   __________________________________________
   __________________________________________

2. __________________________________________
   __________________________________________
   __________________________________________

3. __________________________________________
   __________________________________________
   __________________________________________

**SYNTHESIZE**

Conclude where in North America you may find the most dinosaur fossils. Use information from “Seaways and Sand Dunes” to help you reach your conclusion. Support your conclusion with evidence from your text.

__________________________________________

__________________________________________
The Mesozoic and Cenozoic Eras
Section 24.2 Mesozoic Life

Main Idea

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

1. 
2. 
3. 

New Vocabulary

Use your text to define the following terms.

modern fauna

Define the following term.
dominate

Academic Vocabulary

angiosperm
dinosaur
Ornithischia
Saurischia
ectotherm
endotherm
Section 24.2 Mesozoic Life (continued)

Life in the Oceans
Use with page 629.

**Main Idea**

**Details**

Explain why the abundance of ammonite fossils indicates that they were successful predators. Describe what a small number of fossils of a species may indicate about that species’ predator abilities.

---

Life on the Land
Use with page 630.

**Main Idea**

**Details**

Identify the three types of plants that dominated the landscape of the Jurassic Period.

- Jurassic plants

**Main Idea**

**Details**

Compare the lower jaw, middle ear, and teeth of a reptile and a mammal.

<table>
<thead>
<tr>
<th></th>
<th>Reptile</th>
<th>Mammal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lower Jawbones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Earbones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description of Teeth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 24.2 Mesozoic Life (continued)

Main Idea

Dinosaurs Rule the Land

Use with pages 632–633.

Details

Distinguish between Ornithischia and Saurischia dinosaurs by writing each trait in the Venn diagram.

- bird-hipped
- “lizard-hipped”
- three bones made up hip
- ischium and pubis at an angle to one another

- ischium and pubis parallel
- includes sauropods and theropods
- all were herbivores

Mass Extinctions

Use with page 634.

Distinguish between Ornithischia and Saurischia dinosaurs by writing each trait in the Venn diagram.

- bird-hipped
- “lizard-hipped”
- three bones made up hip
- ischium and pubis at an angle to one another

- ischium and pubis parallel
- includes sauropods and theropods
- all were herbivores

Explain the connection between dinosaurs and birds.

Fossils of ______ _______ and a ______ provide evidence that _______ was a ___ even though it had ____ and a theropod-like ________.

Summarize the three main pieces of evidence that indicate a meteorite impact caused the Cretaceous-Paleogene mass extinction event.

1. ____________________________
   __________________________________________

2. ____________________________
   __________________________________________

3. ____________________________
   __________________________________________

Real-World Connection

Choose one animal living today that is an endotherm and one that is an ectotherm. Describe each animal.
The Mesozoic and Cenozoic Eras
Section 24.3 Cenozoic Paleogeography

Scan Section 3 of your text. Use 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 oceans.

Write three facts you discovered about Cenozoic paleogeography as you scanned the section.

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

Review Vocabulary
Use your text to define the following term.

climate

New Vocabulary
Use your text to define each term.

Basin and Range Province

Tethys Sea

Academic Vocabulary
Define the following term.

coincide
Section 24.3 Cenozoic Paleogeography (continued)

**Main Idea**

**The Ice Ages**

*Use with page 635.*

Organize information about the Ice Ages by completing the concept map below.

<table>
<thead>
<tr>
<th>Main Idea</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Middle-to-Late Eocene</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Oligocene</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Early Miocene</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Middle to Late Miocene</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Pliocene</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Late Pliocene through the Pleistocene</strong></td>
<td></td>
</tr>
</tbody>
</table>

List the three main points about the glaciation that occurred in North America during the Ice Ages.

1. 
2. 
3. 
**Main Idea**

**Tectonic Events**
*Use with pages 636–638.*

**Contrast** the different mountain ranges that were formed and the causes of their formation during the Cenozoic Era. Part of the chart has been completed for you.

<table>
<thead>
<tr>
<th>Mountains or Fault Formed</th>
<th>How Formed</th>
<th>When Formed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>subduction of an oceanic plate beneath the western coast of North America</td>
<td>end of ______</td>
</tr>
<tr>
<td>San Andreas Fault</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellowstone National Park</td>
<td></td>
<td>after the breakup of Pangaea</td>
</tr>
</tbody>
</table>

**Analogy**

Describe how hands slowly squeezing air out of a ball or balloon can be used as an analogy for the drying up of the Tethys Sea.

---

288  *Section 24.3 Cenozoic Paleography*
The Mesozoic and Cenozoic Eras
Cenozoic Life Section 24.4

Main Idea

Read the objectives at the beginning of the section. Write three questions you think may be answered in the section, based on the objectives.

1. 
2. 
3. 

Details

Review Vocabulary

Use your text to define the following term.

fossil

New Vocabulary

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

- group of primates, including hominids and the great apes
- mammal that developed specialized traits, such as opposable thumbs and two eyes directed forward, primarily because of arboreal ancestry
- species to which human beings belong
- group of upright, bipedal primates, including Homo sapiens

Academic Vocabulary

Define the following term.

survive
Life on Land
Use with page 639.

- Compare the landscape of the Paleocene and Eocene to the landscape of the late Eocene and the landscape of the Oligocene.

- Construct a cause-and-effect chart that shows the changes in animals in North America during the Cenozoic Era. List causes in the left column and effects in the right column. Remember that an effect of one event may be a cause of another event. The first one has been completed for you.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forests gave way to open land.</td>
<td>Grassy savannas grew.</td>
</tr>
</tbody>
</table>

Primates and Humans
Use with page 640.

- Describe in your own words why discovering the relationship between humans and other primates is so difficult. Explain why the discovery of one fossil can change our understanding so dramatically.
Section 24.4 Cenozoic Life 12 (continued)

Main Idea

Use with page 640.

Details

Identify the traits of primates. Write a different trait in each circle of the concept map.

Contrast hominids with hominoids. Complete the graphic organizer about their differences.

Hominids have:

__________________________

__________________________

__________________________

Hominids also use:

__________________________

and are

SYNTHESIZE

Classify Neandertals based on what you have learned in this section. Tell whether they are hominoids, hominids, or Homo sapiens, or more than one of these. Explain your reasoning.

__________________________

__________________________

__________________________

__________________________
The Mesozoic and Cenozoic Eras  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K What I Wanted to Find Out</th>
<th>W What I Learned</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>

**Review**

*Use this checklist to help you study.*

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

**SUMMARIZE**

After reading this chapter, describe three things you have learned about the Cenozoic and Mesozoic Eras.
Earth Resources

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about Earth resources. Then list three questions you have about Earth resources 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>1.</td>
<td></td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Think of the Discovery Lab you did to identify the origins of some common materials and record your responses in this science journal.

Which of the items were identified as coming from living things? Which came from nonliving things?

Which are easily replaced? Which are not replaceable?

What criteria did you use to classify each item? Were you unable to classify any items using just these categories? Explain.
Skim Section 1. Look at the headings, photos, illustrations, and captions. Write three questions you have about the information that you think may be covered in this section.

1. ________________________________
2. ________________________________
3. ________________________________

**Review Vocabulary**

Use your text to define the following term.

**water cycle**

______________________________

**New Vocabulary**

Use your text to define each term.

**natural resource**

______________________________

**renewable resource**

______________________________

**sustainable yield**

______________________________

**nonrenewable resource**

______________________________

**Academic Vocabulary**

Define the following term.

**transform**

______________________________
Section 25.1 What Are Resources? (continued)

**Main Idea**

**Details**

Organize information about natural resources using the information chart.

<table>
<thead>
<tr>
<th>Natural Resources</th>
<th>Definition:</th>
<th>What are some examples?</th>
</tr>
</thead>
<tbody>
<tr>
<td>How are they changed?</td>
<td>How can they be classified?</td>
<td></td>
</tr>
</tbody>
</table>

Describe renewable resources and nonrenewable resources in your own words. Distinguish between the two, and give an example of each one.

Identify a renewable resource that exists in an inexhaustible supply.
Renewable Resources and Nonrenewable Resources
Use with page 656.

Classify each of the following resources as renewable or nonrenewable.
- air
- carbon
- copper
- diamonds
- fertile soil
- gemstones
- fossil fuels
- gold
- natural gas
- nitrogen
- all living things
- phosphorus
- silver
- solar energy
- trees
- water

Distribution of Resources
Use with page 657.

Analyze the graph in Figure 25-4. Write a short paragraph comparing oil use per day in the United States to the rest of the world.

SYNTHESIZE
As fossil fuels like oil become depleted, what do you think will happen to the price of the gasoline we use to power our cars? Explain your reasoning.
**Earth Resources**

Section 25.2 Land Resources

**Main Idea**

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

1. 
2. 
3. 

**Details**

Use your text to define the following term.

moraine

Define the following term.

volume

**Review Vocabulary**

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

- naturally accumulating mixture of sand, gravel, and crushed stone found in floodplains, alluvial fans, or glacial deposits
- mineral that contains a valuable substance that can be mined at a profit; natural resource that may be associated with igneous rocks or formed by processes at Earth’s surface
- material left after ore is extracted that may release harmful chemicals into surface water or groundwater
- process by which productive land becomes desert; in arid areas this can occur through the loss of topsoil
- unweathered, solid parent rock that may consist of limestone, marble, granite, or other quarried rock

**New Vocabulary**

- mineral that contains a valuable substance that can be mined at a profit; natural resource that may be associated with igneous rocks or formed by processes at Earth’s surface
- material left after ore is extracted that may release harmful chemicals into surface water or groundwater
- process by which productive land becomes desert; in arid areas this can occur through the loss of topsoil
- unweathered, solid parent rock that may consist of limestone, marble, granite, or other quarried rock
Complete the sentences that discuss land as a natural resource.

- Materials that are derived from land include ____, ____, ____ , ____ , and ________________. Land provides places for humans and other ________ to ______________.
- Much of the land in the United States is certified _________. These lands exist to protect ____ , ____________ , ______ , and ________________ .
- National forests are managed for ________________. They include areas where ________ are used for many purposes. The national park system protects wildlife _______ and _________________. The national _______ refuges protect habitats and _______ areas for wildlife. Some also provide protection for ___________ species.

Organize information about bedrock and aggregates in the chart.

<table>
<thead>
<tr>
<th>Bedrock</th>
<th>Aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is it made of?</td>
<td></td>
</tr>
<tr>
<td>How is it used?</td>
<td></td>
</tr>
</tbody>
</table>
Section 25.2 Land Resources (continued)

**Main Idea**

**Ores**

*Use with pages 661–662.*

Complete the concept map by listing five ways that ores can form.

**How Ores Form**

**Details**

**Other Land Resources**

*Use with page 662.*

Identify other land resources found on Earth. Describe one use for each resource.

1. 
2. 
3. 
4. 
5. 

**Using Land Resources**

*Use with page 662.*

Analyze the negative impacts of extracting land resources. Choose one of the negative impacts and connect it to how it could negatively impact you in your everyday life.

________________________

________________________

________________________

**Synthesize**

Hypothese the natural resources of an area influence the type of housing that is constructed. Provide several examples.

________________________

________________________

________________________

________________________

________________________
Earth Resources
Section 25.3 Air Resources

Scan Section 3 of your text. Use 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 air resources.

Write three facts you discovered about air resources as you scanned the section.

1. ________________________________
2. ________________________________
3. ________________________________

Review Vocabulary

Use your text to define the following term.

global warming

New Vocabulary

Use your text to define each term.

pollutant

air pollution

Academic Vocabulary

Define the following term.

transport
Section 25.3 Air Resources (continued)

**Main Idea**

**Origin of Oxygen**

*Use with page 664.*

Sequence *the events that led to oxygen becoming part of Earth’s atmosphere.*

___ Earth’s atmosphere contained carbon dioxide, nitrogen, and water vapor.

___ Rains washed carbon dioxide out of the atmosphere and into the oceans.

___ Early life forms in the seas used carbon dioxide during photosynthesis.

___ Oxygen levels in the atmosphere built up.

___ Earth cooled and became more solid.

___ Early life forms released oxygen and water vapor.

**Disrupting Earth’s Cycles**

*Use with page 664.*

**Details**

Complete *the concept map by describing the pollutants released into the air by humans that are disrupting Earth’s cycles.*

**Sources of Air Pollution**

*Use with page 666.*

Classify *sources of air pollution as coming from human or natural origins.*

<table>
<thead>
<tr>
<th>Human Origins</th>
<th>Natural Origins</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sources of Air Pollution
Use with page 666.

Indoor Air Pollution
Use with page 667.

Main Idea

Detail

Explain the importance of having clean air.

Identify the four things that can happen to pollutants in the troposphere.

1. 

2. 

3. 

4. 

Examine the indoor pollutants shown in Figure 25-15 of your text. Describe which of the sources of pollutants can be easily eliminated from a house. Explain your reasoning.

Real-World Connection

Sketch a picture of one thing you can do to improve air quality in your area.
Earth Resources
Section 25.4 Water Resources

Main Idea

Details

Read the objectives for Section 3. Restate each objective as a question.
1. 
2. 
3. 

Review Vocabulary

molecule

Use your text to define the following term.

New Vocabulary

desalination

Use your text to define the following term.

Use “desalination” in a sentence that shows its meaning.

Academic Vocabulary

displace

Define the following term.

Section 25.4 Water Resources (continued)

**The Importance of Water**
*Use with page 669.*

Complete the graphic organizer about the importance of water.

<table>
<thead>
<tr>
<th>How are oceans important?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How is freshwater important?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Why is water important to organisms?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Describe four desirable properties of water.

1. __________________________________________

2. __________________________________________

3. __________________________________________

4. __________________________________________

Compare the major uses of freshwater in areas of the United States that receive a lot of precipitation to the major uses of freshwater in areas of the United States that receive little precipitation.

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

<p>| |</p>
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<th></th>
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</table>

Location of Freshwater Resources
*Use with page 670.*
Section 25.4 Water Resources (continued)

**Main Idea**

Use of Freshwater Resources

Use with pages 671–672.

**Details**

Infer from the bar graph in Figure 25-21 on page 672 which continent likely receives the most rainfall. Explain your reasoning.

Complete the graphic organizer about managing freshwater resources.

Identify ways humans can reduce the need for freshwater resources.

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

**Analogy**

Construct an analogy between the drawdown of groundwater from an aquifer and the drawdown of a glass of water using drinking straws. Explain your reasoning.
Earth Resources Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K What I Wanted to Find Out</th>
<th>W What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ________________________</td>
<td>1. ________________________</td>
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<tr>
<td>__________________________</td>
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<tr>
<td>2. ________________________</td>
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<td>__________________________</td>
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<td>3. ________________________</td>
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<tr>
<td>__________________________</td>
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</tbody>
</table>

Review

Use this checklist to help you study.

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

Summarize

After reading this chapter, describe three things you have learned about Earth resources.

______________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________
Energy Resources

Chapter Preview

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

<table>
<thead>
<tr>
<th>What I Know</th>
<th>What I Want to Find Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
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<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to observe a type of energy transfer that occurs every day and record your response in this science journal.

Trace the energy source used to bring the water to a boil back to its origin. Describe what happened to the energy as it was used to heat and boil the water. In your description, include an explanation of the source of most energy on Earth. Infer where the energy went when the water began to boil.

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Scan Section 1 of your text. Use 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 conventional energy resources.

Write three facts you discovered about conventional energy resources as you scanned the section.

1. _____________________________________________

2. _____________________________________________

3. _____________________________________________

Use your text to define the following term.

fossil

Use your text to define each term.

fuel

peat

fossil fuel

Define the following term.

subsequent
Section 26.1 Energy Resources (continued)

**Main Idea**

**Transfer of Solar Energy**

*Use with page 683.*

**Details**

Identify the ultimate source of most energy on Earth.

Complete the graphic organizer about the flow of solar energy in an ecosystem. In the circles, give an example of that type of organism in an ecosystem.

Energy flows from

![Diagram of energy flow]

Identify traditional fuels. Give an example of each type of fuel whenever possible.

[Diagram of traditional fuels]

---

**Traditional Sources of Energy**

*Use with page 684.*
Section 26.1 Energy Resources (continued)

Fossil Fuels
Use with page 687.

Main Idea

List and describe the four main types of fossil fuels.

1. __________________________________________________________________________

2. __________________________________________________________________________

3. __________________________________________________________________________

4. __________________________________________________________________________

Sequence the steps involved in the formation of coal in the graphic organizer. Some of the steps have been completed for you.

When these plants died, the organic material settled to the bottom of the swamp.

This compressed organic matter became coal.

REAL-WORLD CONNECTION

Explain how the energy you use to cook your food at home originated from the Sun. Describe how the fuel you use was formed.

_________________________________________________________________________

_________________________________________________________________________
Energy Resources
Section 26.2 Alternative Energy Resources

Main Idea

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

1. ________________________________
2. ________________________________
3. ________________________________

Details

Review Vocabulary

Use your text to define the following term.

electron

New Vocabulary

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

biomass fuel that is a mixture of gasoline and ethanol and can be used in conventional gasoline engines

thin, transparent wafers that convert sunlight into electric energy and are made up of layers of boron- and phosphorus-enriched silicon

biomass fuel that is a mixture of gases, primarily methane, produced when plant and animal wastes are acted on by anaerobic bacteria in a digester

energy produced from Earth’s own internal steam and hot water

Academic Vocabulary

Define the following term.

rely
Section 26.2 Alternative Energy Resources (continued)

Solar Energy
Use with page 690.

Compare how solar energy is collected and used in passive solar heating and in active solar heating.

Energy from Water
Use with page 692.

Sequence the steps used in producing hydroelectric power.

1. The generator produces electric energy.
2. The water turns the turbines.
3. The turbines produce mechanical energy.
4. Water from a waterfall is diverted into massive turbines.
5. The mechanical energy drives a generator.

Geothermal Energy
Use with page 693.

Analyze the photo in Figure 26-13. Describe why people are able to bathe in the water even though it is cold outside.

Wind Energy
Use with page 693.

Complete the flow chart to show how a windmill turns wind energy into usable energy.

```
  energy  →  energy  →  energy
```

Nuclear Energy
Use with page 695.

Analyze how the two major nuclear accidents affected the growth of the use of nuclear energy.
Section 26.2 Alternative Energy Resources (continued)

Main Idea

Biomass
Use with page 696.

Energy from Oil Shale and Tar Sand
Use with page 697.

Details

List and describe the three types of biomass fuels.
1. 
2. 
3. 

Summarize how tar sand is processed.

Identify a major advantage and a major disadvantage of each alternative energy resource.

<table>
<thead>
<tr>
<th>Energy Resource</th>
<th>Major Advantage</th>
<th>Major Disadvantage</th>
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</table>

Synthesize

Justify the advantages of one of the alternative energy resources over its disadvantages.
Energy Resources
Section 26.3 Conservation of Energy Resources

Main Idea

Read the objectives on the first page of Section 3. Restate each objective as a question that will be answered with information from the section.

1. 

2. 

Details

Review Vocabulary

Use your text to define the following term.

renewable resource

New Vocabulary

Use your text to define each term.

energy efficiency

cogeneration

sustainable energy

Academic Vocabulary

Define the following term.

conclude
Section 26.3 Conservation of Energy Resources (continued)

**Main Idea**

**Energy Efficiency**

*Use with page 698.*

**Details**

Examine the graphs in Figure 26-18. Write three questions that can be answered with information from the graphs. Write the answers to each question.

1. Question: __________________________________________
   Answer: __________________________________________
   __________________________________________

2. Question: __________________________________________
   Answer: __________________________________________
   __________________________________________

3. Question: __________________________________________
   Answer: __________________________________________
   __________________________________________

Complete the concept map about ways energy efficiency can be improved.

```
   Ways to Improve Energy Efficiency
   __________________________
   improve efficiency of older ______
   __________________________
   add install panels
   install new
   buy new energy
   efficient

   __________ old appliances and vehicles
   __________________________
   ______ companies
   dependence on
   __________________________

   __________ models

   government
   __________________________
   offer savings
   fund
```

Use with page 700.
Section 26.3 Conservation of Energy Resources (continued)

Getting More for Less
Use with pages 700–702.

Classify information about improving efficiency in transportation, industry, and at home. List as many things as you can under each heading that can be done to conserve energy.

<table>
<thead>
<tr>
<th>Transportation</th>
<th>Industry</th>
<th>At Home</th>
</tr>
</thead>
</table>

Sustainable Energy
Use with page 703.

Restate the four key parts of a good plan for global management of Earth’s natural resources to meet current and future energy needs without causing environmental damage.

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

Develop an analogy to explain why it is important to conserve energy resources.
**Predict** what the main source of fuel in the world will be 100 years from now. Explain your reasoning.

____________________________________________________________________________________

____________________________________________________________________________________

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**Connect** If you had to choose an alternative energy resource to develop into an energy resource to be used by the whole United States, which would you choose? Explain your reasoning.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

**Develop** a model to collect solar energy near your home. Draw a sketch of your idea and explain how it works.

____________________________________________________________________________________

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____________________________________________________________________________________
In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

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<tr>
<td>What I Wanted to Find Out</td>
<td>What I Learned</td>
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<td>1.</td>
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<tr>
<td>2.</td>
<td>2.</td>
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<tr>
<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>

**Review**

*Use this checklist to help you study.*

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

**SUMMARIZE**

After reading this chapter, describe three things you have learned about energy resources.

__________________________

__________________________

__________________________

318  Chapter Wrap-Up
Human Impact on Earth Resources

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about human impact on the Earth’s resources. Then list three questions you have about it in the “What I Want to Find Out” column.

<table>
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<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</th>
</tr>
</thead>
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<tr>
<td>2.</td>
<td></td>
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<tr>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Think of the Discovery Lab you did to explore the types of resources that you use and some of the global impacts of using them and record your response in this science journal.

How many different resources are represented by the items in your collection?

What are the percentages of renewable and nonrenewable resources?

Where were each of the objects made?
### Main Idea

**Skim** Section 1 of your text. Look at the headings, photos, illustrations, and captions. Write three questions you have about the information you think may be covered in this section.

1. 
2. 
3. 

### Details

#### Review Vocabulary

Use your text to define the following term.

**natural resource**

#### New Vocabulary

Use your text to define each term.

**exponential growth**

**carrying capacity**

**density independent factor**

**density dependent factor**

#### Academic Vocabulary

Define the following term.

**initial**
Section 27.1 Populations and the Use of Natural Resources (continued)

Main Idea

Resources and Organisms
Use with page 655.

Details

Identify the four main resources that organisms need.

1. ________________________________

2. ________________________________

3. ________________________________

4. ________________________________

Describe three ways humans alter their environment.

________________________________________________________________________________

________________________________________________________________________________

________________________________________________________________________________

Resources and Population Growth
Use with page 713.

Explain how as a population increases, its demand for natural resources increases as well.

________________________________________________________________________________

________________________________________________________________________________

________________________________________________________________________________

Draw a typical population curve for a population that is experiencing exponential growth.
**Limits to Population Growth**

Use with pages 713–714.

<table>
<thead>
<tr>
<th>Details</th>
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</thead>
</table>

Describe what happens to the number of births compared to the number of deaths in the following populations.

<table>
<thead>
<tr>
<th>A population below carrying capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A population at carrying capacity</td>
</tr>
<tr>
<td>A population that exceeds carrying capacity</td>
</tr>
</tbody>
</table>

Classify factors that affect population growth as either density-dependent factors or density-independent. Draw a circle for each factor you add.

[Diagram showing Density-dependent factors, Environmental Limits, Density-independent factors]

Identify the stage that human population growth on Earth is at—early, middle, or late. Explain your reasoning.

[Blank space for student response]

**Synthesize**

Describe what would have to happen for the human population on Earth to continue to grow exponentially. Explain why this is impossible.

[Blank space for student response]
Human Impact on Earth Resources
Section 27.2 Human Impact on Land Resources

Main Idea

Details

Scan Section 2 of your text. Use the checklist below as a guide.
• Read all section titles.
• Read all bold words.
• Read all tables and graphs.
• Look at all the pictures and read their captions.
• Think about what you already know about human impact on land resources.

Write three facts you discovered about land resources as you scanned the section.
1. 
2. 
3. 

Review Vocabulary
Use your text to define the following term.
wetland

New Vocabulary
In the left margin, write the terms defined below.
use of organisms to clean up toxic waste
biological diversity of an ecosystem, which is determined by the variety of species of plants and animals
process in which a mining company restores land used during mining operations to its original contours and replants vegetation
removal of trees from a forested area without adequate replanting, often using clear-cutting, which may result in loss of topsoil and water pollution
planting of a single plant species, such as corn or wheat, in a field
### Main Idea

**Extraction of Mineral Resources**
*Use with page 716.*

**Agriculture**
*Use with page 718.*

### Details

**Explain** the environmental impacts of each type of mineral extraction.

- Surface Mining
- Underground Mining

**Organize** the information about the advantages, problems, and solutions associated with agriculture and forestry.

<table>
<thead>
<tr>
<th></th>
<th>Advantages</th>
<th>Problems</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monoculture</td>
<td></td>
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<tr>
<td>Pesticides</td>
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<td>Topsoil</td>
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<tr>
<td>Forestry</td>
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</tbody>
</table>
Section 27.2 Human Impact on Land Resources (continued)

**Main Idea**

**Urban Development**

*Use with pages 721–723.*

**Details**

Illustrate the many ways urban growth impacts the environment. Label each part of your drawing to identify the specific impact shown in that part of your drawing.

**Real-World Connection**

Identify two methods for cleaning up industrial toxic-waste and briefly describe each.

1. ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

2. ____________________________________________________________
   ____________________________________________________________

Develop a plan for your family to create less solid waste each day. Explain ways you could change your habits to eliminate some of that solid waste.
Consider the title of Section 3 of your text. List three things that might be discussed in this section.

1. ______________________________________________________________________
2. ______________________________________________________________________
3. ______________________________________________________________________

Use your text to define the following term.

atmosphere

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Use your text to define each term.

smog

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

ozone

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

global warming

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

acid precipitation

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
Global Impacts of Air Pollution

Use with pages 725–726.

Main Idea

Use with page 724.

Details

Identify three air pollutants that combine to produce ground-level ozone and four types of air pollution in the form of particulate matter.

1. ____________________ 1. ____________________

2. ____________________ 2. ____________________

3. ____________________ 3. ____________________

4. ____________________

Compare and Contrast global warming and the greenhouse effect. Describe how they are similar and different.

Sequence the order of reactions that occur as CFCs cause ozone depletion. One of the steps has been completed for you.

The chlorine atom bonds with an oxygen atom, leaving a molecule of oxygen gas.

Human Impact on Earth Resources  327
### Main Idea

**Acid Precipitation**

*Use with pages 727–728.*

Organize the causes and effects of acid precipitation.

<table>
<thead>
<tr>
<th>Causes of Acid Precipitation</th>
<th>Effects of Acid Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Details

**Reducing Air Pollution**

*Use with page 728.*

Identify five ways air pollution has been or can be reduced.

1. 
2. 
3. 
4. 
5. 

**ANALOGY**

Formulate an analogy you can use to explain the greenhouse effect to a group of younger students. Think about how the greenhouse effect warms Earth and what kind of experiment could be used to show this.
Preview Section 4 of your text. Read the headings and captions of photographs and illustrations. Write three questions you think may be answered by the information in this section.

1. 
2. 
3. 

Review Vocabulary Use your text to define the following term.

pollutant

New Vocabulary Use your text to define each term.

point source

nonpoint source

Academic Vocabulary Define the following term.

generate
Section 27.4 Human Impact on Water Resources (continued)

Main Idea

Use of Water in the United States

Use with page 730.

Details

Analyze the graph in Figure 27-23. Construct two questions that can be answered by information in the graph. Write answers for the questions.

1. Question: ________________________________
   Answer: ________________________________

2. Question: ________________________________
   Answer: ________________________________

Water Pollution

Use with page 730.

Contrast point sources of water pollution and nonpoint sources of water pollution. Give an example of each.

Describe the causes and effects of different types of water pollution.

<table>
<thead>
<tr>
<th>Causes</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution of Groundwater</td>
<td></td>
</tr>
<tr>
<td>Pollution in Oceans</td>
<td></td>
</tr>
</tbody>
</table>
Reducing Water Pollution

Use with page 732.

Describe the two laws passed in the United States to fight water pollution. Explain the purpose of each law and describe how each law is working.

1.

2.

Identify ways to conserve water. In each box, list ways water can be conserved in each of those areas.

Ways to Conserve Water

Irrigation

Industry

In the home

Synthesize

Create a journal entry about how you used water today. Also include an explanation of how you conserved water today.

Today I used water to...
Human Impact on Earth Resources    Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>What I Wanted to Find Out</th>
<th>W</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>_________________________</td>
<td>1.</td>
<td>_________________________</td>
</tr>
<tr>
<td></td>
<td>_________________________</td>
<td>2.</td>
<td>_________________________</td>
</tr>
<tr>
<td>2.</td>
<td>_________________________</td>
<td></td>
<td>_________________________</td>
</tr>
<tr>
<td>3.</td>
<td>_________________________</td>
<td>3.</td>
<td>_________________________</td>
</tr>
</tbody>
</table>

Review

Use this checklist to help you study.

☐ Study your Science Notebook for this chapter.

☐ Study the definitions of vocabulary words.

☐ Review daily homework assignments.

☐ Reread the chapter and review the tables, graphs, and illustrations.

☐ Review the Section Assessment questions at the end of each section.

☐ Look over the Study Guide at the end of the chapter.

SUMMARIZE

After reading this chapter, describe three things you have learned about how humans impact Earth resources.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
The Sun-Earth-Moon System

Chapter Preview

Before you read the chapter, use the “What I Know” column to list three things you know about the Sun-Earth-Moon system. Then list three questions you have about this system in the “What I Want to Find Out” column.

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Science Journal

Think about the Discovery Lab you did to compare relative sizes and distances within the Sun-Earth-Moon system and record your response in this science journal.

Describe the sizes of your cutout Earth and Moon compared to the distance between them.

_________________________________________________________________________

Infer why you were not instructed to cut out a scaled Sun and place it at the scaled distance.

_________________________________________________________________________

How would you change this model so that it would fit in your classroom?

_________________________________________________________________________

_________________________________________________________________________
The Sun-Earth-Moon System
Section 28.1 The Tools of Astronomy

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

- Read all section titles.
- Read all bold words.
- Look at all the pictures and read their captions.
- Think about what you already know about the tools of astronomy.

Write three facts you discovered about the tools that scientists use to observe objects in space.

1. 
2. 
3. 

New Vocabulary

Use your text to define each term.

refracting telescope

reflecting telescope

interferometry

spinoff

Define the following term.

adapt
Section 28.1 Tools of Astronomy (continued)

Radiation
Use with page 748.

Sequence each type of electromagnetic radiation by order of decreasing wavelength. Then write one fact about each type of electromagnetic radiation in the space to the right.

____ Gamma rays: ____________________________
____ Infrared radiation: ________________________
____ Microwaves: _____________________________
____ Radio waves: _____________________________
____ Ultraviolet radiation: _____________________
____ Visible light: ____________________________
____ X-rays: __________________________________

Telescopes
Use with page 748.

Identify the major benefits of telescopes by completing the graphic organizer below.

Sketch how a magnifying glass collects light and brings it to a focus. Refer to Figure 28-2 for help.
Section 28.1 Tools of Astronomy (continued)

Main Idea

**Satellites, Probes, and Space-Based Astronomy**

*Use with pages 751–752.*

Classify Complete the chart by writing *telescope*, *satellite*, or *robot* beside its description. Then give two examples of each.

<table>
<thead>
<tr>
<th>Description</th>
<th>Object</th>
<th>Two examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observes wavelengths blocked by Earth’s atmosphere</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collects light from a distant object and focuses it at a point.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collects objects from other planets</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Describe one advantage that space stations have over the space shuttle when studying the effects of space.

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

**Real-World Connection**

Payload is the term astronomers use to describe all the equipment a satellite needs to do its job. Infer from the information in your textbook what kinds of equipment might be on the Hubble Space Telescope.

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________
The Sun-Earth-Moon System

Section 28.2 The Moon

**Main Idea**

Consider the title of Section 2. List three things that might be discussed in this section.

1. 
2. 
3. 

**Details**

Use your text to define the following term.

interferometry

**Review Vocabulary**

In the left margin, write the terms defined below.

1. the amount of sunlight that the surface of the Moon reflects
2. mountainous regions of the Moon
3. dark, smooth plains of the Moon
4. craters that formed when objects from space crashed onto the Moon’s surface
5. material that blasted out of the moon’s surface and fell back to the surface
6. long trails of ejecta
7. Structures that resemble valleys
8. Loose, ground up rock on the surface of the moon

**New Vocabulary**

Define the following term.

unique
Section 28.2 The Moon

**Main Idea**

Reaching for the Moon

*Use with page 753.*

*Create a time line of the following developments in Moon exploration. Be sure to mark the year that each development took place.*

- Alan B. Shepard Jr. becomes first American in space.
- The Soviet Union launches *Sputnik I*.
- Apollo 11 lands on the Moon.
- Yuri A. Gagarin becomes first human in space.
- Plans for a crewed lunar expedition begin.

**Details**

Describe four unique features of Earth’s moon.

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

*Use with page 753.*
Section 28.2 The Moon

Main Idea
Organize the characteristics of Earth and the Moon in the Venn diagram.
- has an average albedo of about 7 percent
- has an average albedo of about 31 percent erosion
- mineral make up is mostly silicates
- surface has not been altered by erosion
- has no flowing water
- has very few craters

Details

History of the Moon
Use with page 757.

Sequence the stages in the process of the impact theory.
1. Material merged together to form the Moon.
2. The impact threw material from the body and Earth into space.
3. A mars-sized body collided with Earth.

Point out one piece of evidence that supports the idea of the impact theory.

Real-World Connection
Consider the following statement: The study of Earth's surface provides us with a more accurate history of our solar system than the Moon's surface. Explain why you agree or disagree with this statement.
The Sun-Earth-Moon System
Section 28.3 The Sun-Earth-Moon System

Main Idea

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

1. 
2. 
3. 

Details

Review Vocabulary

Use your text to define the following term.

rilles

New Vocabulary

Use your text to define each term.

summer solstice

winter solstice

autumnal equinox

vernal equinox

solar eclipse

lunar eclipse

Academic Vocabulary

Define the following term.

distribute

ESGEU-333-344-C28-877272-9  5/18/06  4:33 PM  Page 340    (Black plate)
Section 28.3 The Sun-Earth-Moon System

Main Idea

Daily Motions
Use with page 758.

Complete the flow chart below to show how a Foucault pendulum demonstrates that Earth is rotating.

1. The pendulum swings in a constant direction.

2.

3.

Sketch your own example of the Coriolis effect using air flow. Be sure to label your sketch and use arrows to indicate air direction. Briefly explain your work in the lines below.

Annual Motions
Use with page 759.

Describe the tilt of Earth’s axis during winter and summer in the northern hemisphere.

winter

summer
Section 3 The Sun-Earth-Moon System

Phases of the Moon

Use with page 763.

Sequence the phases of the moon as it orbits Earth. The first phase has been done for you.

- ___ first quarter
- ___ full moon
- ___ new moon
- ___ third quarter
- ___ waning crescent
- ___ waning gibbous
- ___ waxing crescent
- ___ waxing gibbous

Solar and Lunar Eclipses

Use with page 765.

Identify the eclipses below as either solar or lunar. Then label Earth, the Moon, the Sun, the umbra, and the penumbra in each figure.

Real-World Connection

Hypothesize the effect there would be on the tides if Earth’s and the Moon’s rotations were not synchronous.

Name ___________________________ Date ______________

342  Section 28.3 The Sun-Earth-Moon System
Relate how you think the phrase “the dark side of the Moon” originated.

__________________________________________

__________________________________________

__________________________________________

__________________________________________

Compare the Moon’s properties with the properties of one other planet in our solar system. How are they different? How are they the same?

__________________________________________

__________________________________________

__________________________________________

__________________________________________

Design a page for a middle school science book describing the Moon’s effect on Earth’s tides. Explain in simple terms how the Moon effects the tides. Include a sketch with labels and a caption. Share your page with the class.

__________________________________________

__________________________________________

__________________________________________

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

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I Wanted to Find Out</td>
<td>What I Learned</td>
</tr>
<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>

Review

*Use this checklist to help you study.*

☐ Study your Science Notebook for this chapter.

☐ Study the definitions of vocabulary words.

☐ Review daily homework assignments.

☐ Reread the chapter and review the tables, graphs, and illustrations.

☐ Review the Section Assessment questions at the end of each section.

☐ Look over the Study Guide at the end of the chapter.

Summarize

After reading this chapter, list three things you have learned about Earth, the Sun, and the Moon.
Before you read the chapter, use the “What I Know” column to list three things you know about fossils. Then list three questions you have about fossils in the “What I Want to Find Out” column.

<table>
<thead>
<tr>
<th></th>
<th>What I Know</th>
<th></th>
<th>What I Want to Find Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Think about the Discovery Lab you did to learn about space missions and their discoveries and record your responses in this science journal.

Make an outline for each mission. Include the type of mission (flyby, lander, or orbiter), the scientific goals, the launch date and the date of arrival at the planet, and a summary of what was learned, or what scientists hope will be learned.
### Our Solar System

#### Section 29.1 Overview of Our Solar System

**Main Idea**

**Skim** Section 1 of your text. Focus on the headings and the illustration captions. List three topics that might be discussed in this section.

1. 
2. 
3. 

**Details**

**Review Vocabulary**

Use your text to define the following term.

**maria**

**New Vocabulary**

Use your text to define each term.

**retrograde motion**

**astronomical unit**

**perihelion**

**aphelion**

**eccentricity**

**Academic Vocabulary**

Define the following term.

**focus**
Section 29.1 Overview of Our Solar System (continued)

**Main Idea**

**Early Ideas**

*Use with pages 775–778.*

**Details**

**Compare** the geocentric model with the heliocentric model using the table.

<table>
<thead>
<tr>
<th>Geocentric Model</th>
<th>Heliocentric Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Description:</td>
</tr>
</tbody>
</table>

**Identify** six early ideas about planetary motion.

**Confirm** Kepler’s second law using Mercury, which has an orbital period of about 0.24 and a semimajor axis of about 0.387. Explain your findings.
Gravity and Orbits

*Use with page 779.*

**Main Idea**

**Details**

Explain *Newton’s law of universal gravitation* by completing the following sentence.

Every pair of bodies in the universe _______ each other with a _______ that is proportional to the _______ of their masses and inversely _______ to the square of the distance between them.

Illustrate the center of mass using two people on a see-saw, where one person is much heavier than the other. Be sure to include the balance point in your sketch. Refer to Figure 29-5 on page 779 for help.

Compare the masses of two people on a see-saw if the balance point is near the middle of the see-saw. Explain your reasoning.

Analogy

Relate how one car passing another car on a highway might be similar to the retrograde motion of planets.

---

Section 29.1 Overview of Our Solar System (continued)
Our Solar System
Section 29.2 The Terrestrial Planets

Scan Section 2 of your text. Use the checklist below as a guide.
• Read all section titles.
• Read all bold words.
• Read all tables.
• Look at all the photos of each planet and read their captions.
• Think about what you already know about Mercury, Venus, Mars, and Earth.

Write three facts you discovered about Mercury, Venus, Mars, and Earth as you scanned the section.

1. ____________________________
2. ____________________________
3. ____________________________

Use your text to define the following term.
interferometry

Use your text to define the each term.
aphelion
terrestrial planets
gas giant planet
precession

Define the following term.
similar
Section 29.2 The Terrestrial Planets (continued)

Main Idea

Mercury, Venus, Earth, Mars

Details

Describe four characteristics of Venus using the graphic organizer.

Compare the features of the terrestrial planets by completing the table below.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Mercury</th>
<th>Venus</th>
<th>Earth</th>
<th>Mars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative position from the Sun</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atmosphere</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weather</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># of moons</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 29.2 The Terrestrial Planets (continued)

**Main Idea**

**Mercury, Venus, Earth, and Mars**

*Use with pages 780–785.*

**Details**

Describe Mercury by completing the following sentences.

Unlike Earth, Mercury has little _________. What does exist is made up of mostly _______ and _______. Mercury’s surface is similar to the _______ surface because it is covered with craters and plains. The surface gravity is _________ than that of the Moon. The _________ of Mercury suggests the planet has a large _________ core.

Identify three reasons why life can exist on Earth.

1. _______________________________________________________

2. _______________________________________________________

3. _______________________________________________________

Create a postcard describing the atmosphere and the surface of Mars. Imaging that you are visiting Mars and sending your postcard to a friend at home.

**REAL-WORLD CONNECTION**

Hypothesize what conditions on the terrestrial planets would be like today if their atmospheres had been warmer and richer in carbon dioxide.
Our Solar System
Section 29.3 The Gas Giant Planets

Consider the title of Section 3. List three topics that might be discussed in this section.

1. 
2. 
3. 

Synchronous rotation

Use your text to define the following term.

liquid metallic hydrogen

belt

zone

hypothesize

Define the following term.

Use your text to define the each term.
Section 29.3 The Gas Giant Planets (continued)

**Main Idea**

**Details**

**Jupiter**

*Use with page 786.*

**Compare** the four largest moons of Jupiter by completing the table. State at least three facts about each moon.

<table>
<thead>
<tr>
<th></th>
<th>Io</th>
<th>Europa</th>
<th>Ganymede</th>
<th>Callisto</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compare</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Details</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Saturn**

*Use with page 788.*

**Describe** Saturn’s rings by completing the following paragraph.

Saturn’s rings are composed of pieces of _______ and _______ that range from _______ to the size of _______. There are _______ major rings, but each ring is actually made up of narrower rings, called _______ , and many open _______.

**Uranus and Neptune**

*Use with page 789.*

**Examine** Figures 29-21B and 29-23 in your book. Then fill in the missing information below.

**Uranus**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₄</td>
<td>_____%</td>
</tr>
<tr>
<td>He</td>
<td>_____%</td>
</tr>
<tr>
<td>H₂</td>
<td>_____%</td>
</tr>
</tbody>
</table>

**Neptune**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₄</td>
<td>_____%</td>
</tr>
<tr>
<td>He</td>
<td>_____%</td>
</tr>
<tr>
<td>H₂</td>
<td>_____%</td>
</tr>
</tbody>
</table>
Section 29.3 The Gas Giant Planets (continued)

Main Idea

Use with page 789.

Details

Describe several characteristics of each planet’s atmosphere and moons and rings.

<table>
<thead>
<tr>
<th></th>
<th>Uranus</th>
<th>Neptune</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Atmosphere</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Moons and Rings</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pluto

Use with page 791.

Identify five unique characteristics of Pluto.

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

Real-World Connection

There is a possibility that Europa, one of Jupiter’s moons, may have oceans. Astronomers already know that Europa has a variety of basic chemicals and a source of heat energy. Assess the possibility that life may have developed on Europa. Explain your reasoning.
Section 29.4 Formation of Our Solar System

Scan Section 4 of your text. Use the checklist below to preview.
- Read all section titles.
- Read all bold words.
- Read all tables and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about how the formation of our solar system.

Write three facts you learned about the formation of our solar system as you scanned the section.

1. ________________________________________________________________
2. ________________________________________________________________
3. ________________________________________________________________

In the left margin, write the terms defined below.
- space object built of solid particles
- bodies that orbit the Sun within the planetary orbits
- interplanetary material that falls toward Earth and enters Earth’s atmosphere
- streak of light produced as a meteoroid burns up in Earth’s atmosphere
- meteoroid that strikes Earth’s surface
- small, orbiting body made of rock and ice
- glowing gas that forms when a comet’s nucleus is heated
- small, solid core of a comet
- occurs when comet particles burn up entering Earth’s upper atmosphere

Define the following term.
- eventual
Section 29.4 Formation of Our Solar System (continued)

Main Idea

A Collapsing Interstellar Cloud

Use with page 793.

Details

Sequence the events of a collapsing interstellar cloud. The first one has been done for you.

___ The cloud becomes denser at the center.

___ Rotation slows and the cloud flattens

___ The cloud spins faster and faster.

___ The cloud becomes a rotating disk.

___ The collapse of the cloud begins to accelerate.

Sun and Planet Formation

Use with page 795.

Compare the formation and composition of the planets in the data table below. Refer to Figure 29-28 for help.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Temperature Range (K) at Formation</th>
<th>Distance from Sun (AU)</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 – 100</td>
<td>about 30</td>
<td>Ices</td>
</tr>
<tr>
<td>Uranus</td>
<td>0 – ~150</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>about 10</td>
<td>Ices</td>
</tr>
<tr>
<td>Jupiter</td>
<td>200 – 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mars</td>
<td>400 – 1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venus</td>
<td></td>
<td>about 1</td>
<td>Iron</td>
</tr>
</tbody>
</table>
Section 29.4 Formation of Our Solar System (continued)

Main Idea

Asteroids

Use with page 795.

**Details**

**Identify** the events that are associated with the formation of a meteorite by filling in the blanks below.

1. __________ orbit, collide, and break into fragments.

2. These fragments enter Earth’s atmosphere and become __________.

3. Meteoroids burn up in Earth’s atmosphere, producing a streak of light called a __________.

4. If the meteoroid does not completely burn up, part of it will collide with the ground and is then called a __________.

Comets

Use with page 797.

**Sketch** a comet in the space below. Label the nucleus, coma, and tail.

**Real-World Connection**

Draw a time line starting 4.6 billion years ago. Indicate the times of the formation of Earth and the Moon, the appearance of oceans on Earth, and the beginnings of life on Earth. Explain what you notice about the location of these events.
**Our Solar System  Chapter Wrap-Up**

*In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.*

<table>
<thead>
<tr>
<th>K</th>
<th>What I Wanted to Find Out</th>
<th>W</th>
<th>What I Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>__________________________</td>
<td>1.</td>
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<td></td>
<td>__________________________</td>
<td>2.</td>
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<tr>
<td>3.</td>
<td>__________________________</td>
<td>3.</td>
<td>__________________________</td>
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</tbody>
</table>

**Review**

*Use this checklist to help you study.*

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

**SUMMARIZE**

After reading this chapter, list three things you have learned about our solar system.

________________________________________

________________________________________

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

<table>
<thead>
<tr>
<th>K What I Know</th>
<th>W What I Want to Find Out</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>

Think of the Discovery Lab you did to monitor the Sun and record your response in this science journal.

Is the sun near the peak of its activity cycle?

Do the solar images that you observed fit with your expectation of where the Sun is in its activity cycle? Compare and contrast the images obtained at different wavelengths.

---

**Stars**

**Chapter Preview**
Main Idea

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

1. __________________________
2. __________________________
3. __________________________

Details

Review Vocabulary

Use your text to define the following term.

perihelion

New Vocabulary

In the left margin, write the terms defined below.

- the lowest visible layer of the Sun’s atmosphere and the surface of the Sun
- layer of the Sun’s atmosphere above the photosphere and below the corona
- top layers of the Sun’s atmosphere
- a stream of high-speed, ionized particles flowing outward through the solar system from the Sun’s corona
- relatively cool, dark spots appearing on the surface of the photosphere
- a sudden eruption of particles and radiation from the surface of the Sun
- an arc of flaming gas rising from the chromosphere
- a nuclear reaction in which lightweight nuclei combine into heavier nuclei
- a nuclear reaction in which an atomic nucleus splits into smaller, lighter nuclei releasing energy
- visible light arranged according to wavelengths
Properties of the Sun

Use with page 805.

Identify four unique characteristics of the Sun.

The Sun’s Atmosphere

Use with page 806.

State three facts about each layer of the Sun’s atmosphere in the table below.

<table>
<thead>
<tr>
<th>Photosphere</th>
<th>Chromosphere</th>
<th>Corona</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>
Section 30.1 The Sun (continued)

**Main Idea**

**Solar Activity**
*Use with page 808.*

Sequence *the solar activity cycle by completing the flow chart.*

1. The Sun’s magnetic field reverses in polarity.

2. 

3. 

4. The magnetic field returns to its original polarity.

**The Solar Interior**
*Use with page 811.*

Analyze *Figure 30-7 in your text. Make your own sketch of a cross section of the Sun. Label the following in your sketch:*

- the core
- the radioactive zone
- the convective zone

- radiation
- convection
Section 30.1 The Sun (continued)

**Main Idea**

**Spectra**
*Use with page 811.*

**Details**

**Compare** continuous, emission, and absorption spectra. Write each characteristic in the correct location in the diagram below.

- appears as bright lines  
- has no breaks in spectrum  
- appears as a series of dark bands  
- produced by a solid, liquid, or gas  
- comes from a non-compressed gas  
- visible light arranged by wavelength

**Solar Composition**
*Use with page 812.*

**Real-World Connection**

**Hypothesize** how the planets would be affected if the Sun did not make up more than 99% of the mass of the entire solar system.

**Explain** solar composition by completing the sentence.

The Sun consists of ________, about ____ percent by mass, and ________, ____ percent, as well as a small amount of other ________.
Stars
Section 30.2 Measuring the Stars

Main Idea

Consider the objectives on the first page of the section. Write three questions you think may be answered in the section based on the objectives.

1. __________________________
2. __________________________
3. __________________________

Details

Review Vocabulary

Use your text to define the following term.

astronomical unit

New Vocabulary

Use your text to define each term.

constellation

binary star

parallax

apparent magnitude

absolute magnitude

luminosity

Hertzsprung-Russell diagram

main sequence

Academic Vocabulary

Define the following term.

isolate
Section 30.2 Measuring the Stars (continued)

Main Idea

Groups of Stars

Use with page 813.

Details

Organize information about star clusters by completing the diagram below.

Basic Properties of Stars

Use with pages 815–816.

Identify the six basic properties that scientists use to categorize stars.

1. __________________________
2. __________________________
3. __________________________
4. __________________________
5. __________________________
6. __________________________

Sequence the celestial objects in order of increasing absolute magnitude. The first one has been done for you.

___ Sirius                  ___ most luminous galaxies
___ most luminous stars    ___ Uranus
1  Pluto                  ___ Venus
___ Sun                    ___ Full moon
Section 30.2 Measuring the Stars (continued)

Main Idea

Spectra of Stars
Use with pages 817–818.

Write review question related to the classification of stars. Then write a second review question related to wavelength shifts. Give the answer to each of your questions.

1. Question: 
Answer: 

2. Question: 
Answer: 

Analyze Figure 30-17 in your text. Describe the general characteristics of stars found in different locations on the H-R diagram. The first one has been done for you.

<table>
<thead>
<tr>
<th>Upper-left corner</th>
<th>Upper right-corner</th>
<th>Lower-left corner</th>
</tr>
</thead>
<tbody>
<tr>
<td>large, hot and luminous</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Summarize In your own words, summarize how scientists calculate distances from Earth to stars.

366  Section 30.2 Measuring the Stars
**Stars**

Section 30.3 Stellar Evolution

Scan Section 3 of your text. Use the checklist below to preview.
- Read all section titles.
- Read all bold words.
- Read all tables and graphs.
- Look at all the pictures and read their captions.
- Think about what you already know about stellar evolution.

Write three facts you discovered about stellar evolution as you scanned the section.

1. 
2. 
3. 

In the left margin, write the terms defined below.

- a cloud of interstellar dust or gas or both, which collapses on itself as a result of its own gravity
- the hot condensed disk-shaped object at the center of a collapsing star
- collapsed, dense core of a star that forms quickly while its outer layers are falling inward
- massive explosion that occurs when the outer layers of a star are blown off
- small, extremely dense remnant of a star whose gravity is so immense that not even light can escape its gravity field

Define the following term.

dynamic
Section 30.3 Stellar Evolution (continued)

**Basic Structure of Stars**
*Use with page 821.*

**Main Idea**

**Details**

What if you were explaining hydrostatic equilibrium to a middle school student. Draw a diagram in the space below, that you could use to illustrate the concept then write a brief explanation.

---

**Stellar Evolution and Life Cycles**
*Use with page 822.*

**Main Idea**

**Details**

Sequence the steps in the formation of a star by completing the flow chart.

The cloud’s rotation forces it into a disk shape, with a hot condensed object at the center called a protostar.
**Main Idea**

**The Sun’s Life Cycle**

*Use with page 822.*

Sequence the steps in the life cycle of the Sun.

- Converts hydrogen into helium in its core
- Star contracts back to normal size and becomes stable
- As the core runs out of hydrogen and then helium, the core contracts and the outer layers expand, cool, and become less bright.
- Stars are born in nebulae.
- Outer layers expand again and are driven off entirely leaving a planetary nebula
- The star becomes a red giant, the core becomes hot enough for the core to become carbon
- The core becomes exposed and is a white dwarf
- The star loses gas from its outer layers
- Huge clouds of dust and gas collapse under gravitational forces, forming protostars.

**Life Cycles of Massive Stars**

*Use with page 824.*

Compare the evolution of a massive star with the evolution of the Sun. Write each description in the correct place in the Venn diagram.

- Begins as a nebula
- Becomes a red giant once
- Becomes a red giant several times
- Fewer reaction phases
- Loses less of its mass
- Loses much of its mass
- More reaction phases

**Analogy**

Compare a star that is using up its nuclear fuel with a tire that has a leak. Explain your reasoning.

---

**Section 30.3 Stellar Evolution (continued)**
### Stars  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What I Wanted to Find Out</strong></td>
<td><strong>What I Learned</strong></td>
</tr>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
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<tr>
<td>3.</td>
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</table>

---

**Review**

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---

**SUMMARIZE**

After reading this chapter, describe three things you have learned about stars.

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

<table>
<thead>
<tr>
<th>K What I know</th>
<th>W What I Want to Find Out</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>

Think about the Discovery Lab you did to model the Milky Way.

Describe what your model of the Milky Way would look like if you actually built it.


Explain why it would be a problem to show the size of our solar system in comparison to the Milky Way.


Explain how you would change your model to include the size of Earth.


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

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

Write three facts you discovered about the Milky Way as you scanned the section.

1. 
2. 
3.

Review Vocabulary

Use your text to define the following term.

corona

New Vocabulary

Use your text to define each term.

variable star

RR Lyrae variable

Cepheid variable

halo

spiral density wave

Academic Vocabulary

Define the following term.

interpret
Section 31.1 The Milky Way Galaxy (continued)

**Main Idea**

Discovering the Milky Way, The Shape of the Milky Way

*Use with page 835.*

**Details**

Mass of the Milky Way

*Use with page 836.*

Organize the masses of different locations of the Milky Way by completing the chart below.

<table>
<thead>
<tr>
<th>Location</th>
<th>Description of the Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within the circle of the Sun's orbit</td>
<td>100 billion times the mass of the Sun</td>
</tr>
<tr>
<td>The halo</td>
<td>2.6 million times the mass of the Sun</td>
</tr>
</tbody>
</table>

Stars in the Milky Way

*Use with page 836.*

Describe the evidence that is used to indicate the extreme age of globular cluster stars.

Sketch the Milky Way below. Be sure to include the following parts:

- Sun
- Halo
- Globular clusters
- Disk
- Nuclear bulge
Section 31.1 The Milky Way Galaxy (continued)

**Main Idea**

**Stellar Populations**
*Use with page 837.*

**Details**

**Classify** the populations of stars by completing the table below.

<table>
<thead>
<tr>
<th>Classification of Stars</th>
<th>Location of Stars</th>
<th>Brief Description of Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population I Stars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population II Stars</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Formation and Evolution of the Milky Way, Maintaining Spiral Arms**
*Use with page 837.*

**Sequence** the steps in the evolution of the Milky Way by completing the information below.

- **Step One:**
- **Step Two:**
- **Step Three:**
- **Step Four:**
- **Step Five:**

**COMPARE**

Explain how the composition of a star that will form a billion years in the future will differ from the composition of our Sun.
### Main Idea

#### Predict

Read the title of Section 2. List three topics that might be discussed in this section.

1. 
2. 
3. 

### Details

#### Review Vocabulary

Use your text to define the following term.

**mass**

#### New Vocabulary

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

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster of galaxies</td>
<td>________</td>
</tr>
<tr>
<td>formulaic method of representing the expansion of the universe</td>
<td>________</td>
</tr>
<tr>
<td>giant galaxies that emit more radio waves than waves of visible light</td>
<td>________</td>
</tr>
<tr>
<td>core of a galaxy where a highly energized object is located</td>
<td>________</td>
</tr>
<tr>
<td>star-like objects with emission lines in their spectra</td>
<td>________</td>
</tr>
</tbody>
</table>

#### Academic Vocabulary

Define the following term.

**positive**

__________
Discovering Other Galaxies

Use with page 839.

Classify and describe the different galaxies discovered by Hubble. Three of the boxes have been completed for you.

<table>
<thead>
<tr>
<th>Type of Galaxy</th>
<th>Description</th>
<th>Subclasses</th>
<th>Subdivisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
</tbody>
</table>

The Expanding Universe

Use with page 842.

Make your own simple graph representing Hubble’s Law by following the directions given in the Problem-Solving Lab. Label the horizontal axis “Distance”, and label the vertical axis “Speed.” Include a straight line from the lower-left corner to the upper-right corner.

Explain what Hubble’s graph shows us about the expanding universe.
Section 31.2 Other Galaxies in the Universe (continued)

**Main Idea**

**Active Galaxies**
*Use with page 844.*

**Details**

Describe three unusual properties of radio galaxies.

1. 

2. 

3. 

**Quasars**
*Use with page 844.*

**Compare and Contrast** two characteristics of stars and two characteristics of quasars in the organizer below.

<table>
<thead>
<tr>
<th>Stars:</th>
<th>Quasars:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
</tbody>
</table>

**SYNTHESIZE**
Hypothesize what the stars at night would look like at night if we lived in an irregular galaxy instead of an elliptical galaxy.
Galaxies And the Universe
Section 31.3 Cosmology

Main Idea

Skim Section 3 of your text. Look at the headings, photos, illustrations, and captions. Write three questions you have about the information you think may be covered in this section.

1. ____________________________________________

2. ____________________________________________

3. ____________________________________________

Details

Review Vocabulary

Use your text to define the following terms.

radiation

New Vocabulary

Use your text to define each term.

cosmology

Big Bang theory

steady-state theory

cosmic background radiation

inflationary universe

Academic Vocabulary

Define the following term.

correspond
Discuss models of the universe.

The theory that the universe began as a _____ and has been _____ ever since is called the _____ theory. The Big Bang theory is not an _____ into space, but instead is an _____ of space with _____ going along for the ride.

Supporters of the _______ theory propose that new matter is _____ and added to the universe as it _____, and thus, the overall _____ of the universe does not change.

Sequence the steps involved in the explanation of cosmic background radiation. The last step has been done for you.

1. 

2. 

3. The universe expands and cools, and radiation is Doppler shifted to lower energies and longer wavelengths.

State one of the major reasons why some astronomers do not accept the steady-state universe theory.
Section 31.3 Cosmology (continued)

Main Idea

The Big Bang Model

Use with pages 849–851.

Details

Identify the three possible outcomes of a constantly expanding universe.

<table>
<thead>
<tr>
<th>Open Universe</th>
<th>Closed Universe</th>
<th>Flat Universe</th>
</tr>
</thead>
</table>

Examine Make a basic sketch of the inflationary model of the universe, as shown in Figure 31-20. Label the two parts of the graph where expansion is increasing more slowly. Then label the part of the graph where expansion is increasing drastically.

Real-World Connection

Hypothesize what the universe might be like in a flat universe scenario.
**Tie-It-All-Together**

**Compare** The Sun is the center of our solar system, controlling the motions of the planets and other objects. Point out how the universe differs from the Sun in this respect.

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

**Connect** The Milky Way is a spiral-shaped galaxy. Describe some real-world objects that also have a spiral shape. Include objects that are controlled by a rotational movement.

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

**Relate** how astronomers are “looking back in time” when they observe light from far away places such as the Andromeda Galaxy.

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
Galaxies and the Universe  Chapter Wrap-Up

In the “What I Wanted to Find Out” column, copy the questions you listed in the Chapter Preview. In the “What I Learned” column, write down the answers you discovered as you worked through the chapter.

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SUMMARIZE

After reading this chapter, list three things you have learned about galaxies and the universe.

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________