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**SCIENCE
EXPLORER**



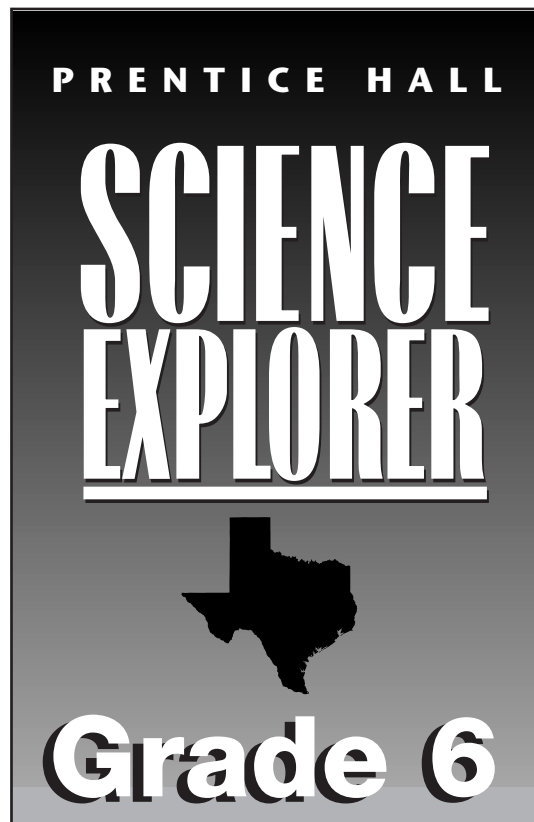
Grade 6

Guided Reading and Study Workbook

- ◆ Promotes active reading and enhances students' study skills using innovative questioning strategies and exercises linked to the student text
- ◆ Builds a record of students' work to use as a study aid for quizzes and tests
- ◆ Provides a wide range of question formats—for every section of the text—to reach a wide variety of learners
- ◆ Gives parents a handy resource to help students study and learn

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Guided Reading and Study Workbook

Teacher's Edition



Needham, Massachusetts
Upper Saddle River, New Jersey
Glenview, Illinois

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WHAT IS SCIENCE?

(pages 10-19)

This section describes how scientists explore problems and seek answers to questions about the natural world. The section also describes the branches of science.

► Introduction (page 10)

1. What is science? Science is a way of learning about the natural world and the knowledge gained through that process.
2. The many ways in which scientists explore the problems and seek answers to questions about the natural world is referred to as scientific inquiry.

► Thinking Like a Scientist (pages 11-15)

3. What skills do scientists use? Posing questions, making observations and inferences, developing hypotheses, designing experiments, collecting data and making measurements, interpreting data, and drawing conclusions.

Match the term with its definition.

Term	Definition
<u> b </u> 4. observation	a. An interpretation based on gathered information and prior knowledge
<u> a </u> 5. inference	b. Using sight, hearing, smell, and sometimes taste to gather information
6. A possible explanation for observations that relate to a scientific question is called a(n) <u> hypothesis </u> .	

What Is Science? *(continued)*

7. A hypothesis can be tested by observation or experimentation.
8. Complete the compare/contrast table.

Variables	
Type of Variable	Definition
Manipulated variable	Variable that the scientist changes
Responding variable	Variable that changes as a result

9. Is the following sentence true or false? In a controlled experiment, scientists keep all the variables constant. false
10. Is the following sentence true or false? Scientists who study processes that take millions of years cannot conduct experiments. false
11. The facts, figures, and other evidence collected in an experiment are called data.
12. Circle the letter of the units of measurement that are used by scientists worldwide.
- a. IS units b. International units
 c. SI units d. Data units
13. A model that imitates something in the real world is called a(n) simulation.

► Scientific Laws and Theories (page 16)

14. A statement that describes what scientists expect to happen every time under a particular set of conditions is a(n) scientific law.
15. A well-tested scientific concept that explains a wide range of observations is a(n) scientific theory.

16. Is the following sentence true or false? If tests fail to support a theory, scientists do more tests until the theory is supported. false

► **Laboratory Safety (page 16)**

17. Why is it important to follow safe laboratory practices? They protect everyone from injury and make investigations go more smoothly.

► **Branches of Science (page 18)**

18. What are the four main branches of science? Physical science, Earth science, life science, and environmental science.

19. Knowledge about Earth and its place in the universe is referred to as Earth science.

20. Circle the letter of each kind of work scientists do.

a. Test water supplies

b. Study weather

c. Design safer cars

d. Study rain forests

21. Scientists who study the universe are called astronomers.

22. Circle the letter of each sentence that is true about environmental scientists.

a. They study the effects of using Earth's resources.

b. They determine the effects of human activities on the environment.

c. They try to solve problems such as pollution.

d. They focus on the solar system.

23. Is the following sentence true or false? The branches of science are not separate from one another. true

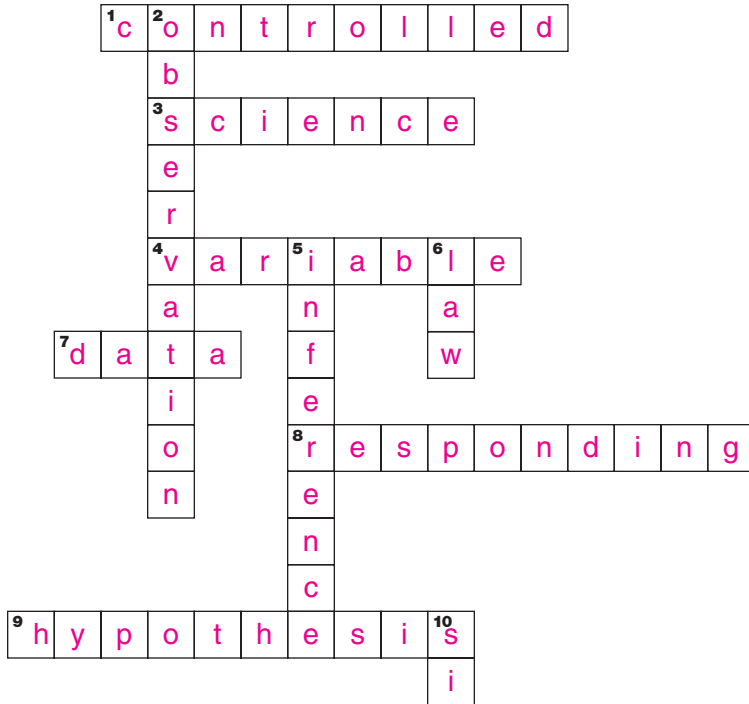
► **Technology and the Internet (page 19)**

24. What are two ways that technology helps scientists? Technology helps scientists collect and analyze data. It also helps them communicate their discoveries to other scientists and to the public.

What Is Science? *(continued)*

WordWise

Use your knowledge of the key terms to solve the crossword puzzle.



Clues across

1. Experiment in which only one variable is manipulated
3. Way of learning about the natural world and knowledge gained through that process
4. Any factor that can change in an experiment
7. The facts, figures, and other evidence gained through observation
8. The variable that changes as a result of the manipulated variable
9. A possible explanation for a set of observations or answer to a scientific question

Clues down

2. Use of all five senses to gather information
5. An interpretation based on observation and prior knowledge
6. A statement that describes what scientists expect to happen every time
10. Units of measurements used by scientists

CHAPTER 1**MATTER AND ENERGY****SECTION**
1-1 **Describing Matter and Energy**
(pages 24-33)

This section describes matter and energy. It also describes properties of matter and explains the two basic ways that matter can change.

► Defining Matter and Energy (pages 24-25)

1. In science, what is the meaning of the word *matter*? Matter is anything that has mass and takes up space.
2. Is the following sentence true or false? Air is not considered matter because it is invisible. false
3. What is energy? Energy is the ability to do work or cause change.
4. What is chemistry? Chemistry is the study of the properties of matter and how matter changes.

► Classifying Matter by Its Physical and Chemical Properties (pages 25-26)

5. What two groups of properties are used to identify, describe, and classify matter?
a. physical properties b. chemical properties
6. A single kind of matter that has distinct physical and chemical properties is called a(n) substance.
7. Color, texture, odor, and the temperature at which a substance melts are examples of physical properties.

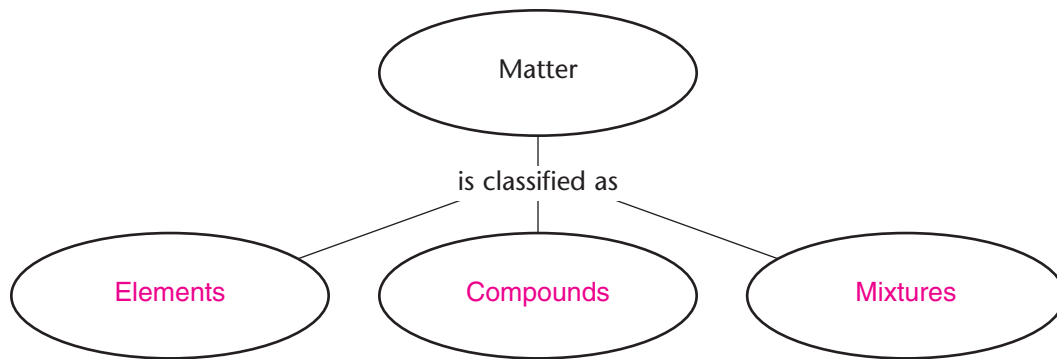
CHAPTER 1, Matter and Energy (continued)

8. A characteristic that is observed when a substance interacts with another substance is a(n) chemical property.

► Kinds of Matter (pages 27–29)

9. What is an element? An element is a substance that cannot be broken down into any other substances by chemical or physical means.
10. What is a compound? A compound is a substance made of two or more elements chemically combined in a set ratio.
11. Table sugar is an example of a(n) compound.
12. What is a mixture? A mixture is made from two or more substances—elements, compounds, or both—that are in the same place but are not chemically combined.
13. Is the following sentence true or false? Most matter occurs in the environment as mixtures. true
14. What are two ways that mixtures differ from compounds?
- a. The substances in a mixture keep their individual properties.
- b. The parts of a mixture are not necessarily present in set ratios.

15. Complete the concept map about types of matter.



► **Changes in Matter (pages 30–31)**

16. What are two kinds of changes in matter?

- a. physical changes b. chemical changes

17. What is a physical change in matter? A physical change is a change that alters the form or appearance of a material but does not make the material into another substance.

18. What are the three principal states of matter?

- a. solids b. liquids c. gases

19. Is the following sentence true or false? Water remains the same substance regardless of its physical state. true

20. What is a chemical change of matter? A chemical change is a change in matter that produces new substances.

21. Another name for a chemical change is chemical reaction.

22. Circle the letter of each sentence that is true about what can occur in a chemical change.

- a. Compounds may be broken down into elements.
- b. Elements may combine to form compounds.
- c. Compounds may change from one state to another.
- d. Compounds may change into other compounds.

CHAPTER 1, Matter and Energy (continued)

23. Complete the table by classifying each change as either a physical change or a chemical change.

Changes in Matter	
Change	Physical or Chemical Change?
Milk turns sour.	Chemical change
Wood is chopped in half.	Physical change
Wood is burned.	Chemical change
Ice melts into liquid water.	Physical change

► **Energy and Matter** (pages 31–33)

24. Is the following sentence true or false? Energy is always involved when physical and chemical changes in matter occur. true

25. Energy related to the motion or position of matter is mechanical energy.

26. The energy you sense as heat is thermal energy.

27. Is the following sentence true or false? If thermal energy is added to matter, the particles of matter move more slowly. false

28. Light, X-rays, TV signals, and ultraviolet rays are examples of electromagnetic energy.

29. In a microwave oven, electromagnetic energy is changed to thermal energy.

30. The energy of moving electric charges is called electrical energy.

31. Electrical energy can be turned into mechanical energy, which turns motors.

32. The energy that is transferred to other forms of energy in a chemical reaction is called chemical energy.

SECTION
1-2 **Measuring Matter**
(pages 34-39)

This section explains the difference between mass and weight. It also explains what the density of a substance is.

► **Mass (pages 34-35)**

1. A measure of the force of gravity on an object is called weight.
2. Why would you weigh less on the moon than you do on Earth? The force of gravity is much less on the moon than it is on Earth.
3. What is mass? Mass is a measurement of how much matter an object contains.
4. Why do scientists rely on mass rather than weight as the measurement of how much matter an object contains? Mass does not change if the force of gravity changes, but weight does change.
5. What system of units do scientists use to measure the properties of matter? They use the International System of Units.
6. The SI unit for mass is kilogram.

► **Volume (pages 35-37)**

7. The amount of space that matter occupies is called its volume.
8. What formula do you use to find the volume of a rectangular object?
Volume = Length × Width × Height
9. What are the SI/metric units for volume listed in Figure 11 on page 38?
 - a. cubic meter (m³)
 - b. liter (L)
 - c. milliliter (mL)
 - d. cubic centimeter (cm³)

CHAPTER 1, Matter and Energy (continued)

► **Density—A Physical Property of Matter** (pages 38–39)

10. What is density? Density is a physical property that relates the mass and volume of an object or material.
11. Why does a kilogram of bricks take up a much smaller space than a kilogram of feathers? Bricks and feathers have different densities.
12. What formula do you use to calculate the density of an object?

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$
13. One unit of density is g/cm³. How do you say that unit in words?
Grams per cubic centimeter
14. What unit of measurement is often used for the density of liquids?
Grams per milliliter, or g/mL
15. If you drop a block of gold and a block of wood into water, the gold sinks and the wood floats. What can you conclude about the density of gold and wood compared to the density of water? Water has a density of 1.0 g/cm³. Since wood floats, its density must be less than 1.0 g/cm³. Since gold sinks, its density must be greater than 1.0 g/cm³.
16. Is the following sentence true or false? The density of a substance varies with the samples of that substance. false



Reading Skill Practice

Outlining is a way to help yourself understand and remember what you have read. Write an outline of Section 1–2, *Measuring Matter*. In your outline, copy the headings in the textbook. Under each heading, write the main idea. Then list the details that support, or back up, the main idea. Do your work on a separate sheet of paper.

The major heads of students' outlines of the section should be *Mass*, *Volume*, and *Density*. The section's subheads should form the next level of the outline.

SECTION **Particles of Matter**
1-3 (pages 41-45)

This section explains what atoms are and describes how scientists model atoms today.

► **Early Ideas About Atoms** (page 42)

- Who was Democritus? Democritus was a Greek philosopher.
- Why did Democritus call the smallest piece of matter *atomos*? That is the Greek word for "uncuttable."
- The smallest particle of an element is called a(n) atom.

► **Dalton's Ideas About Atoms** (pages 42-43)

- Who was John Dalton? He was a British school teacher.
- Complete the table about Dalton's ideas about atoms.

Atoms	
Dalton's Ideas	Result
Atoms can't be broken down into <u>smaller pieces</u> .	Atoms are nearly impossible to break apart.
In any element, all atoms are <u>exactly alike</u> .	An element always has the same properties.
Atoms of different elements are <u>different</u> .	Different elements have their own set of properties.
Atoms of two or more elements can combine to form <u>compounds</u> .	Compounds break down into elements.
Atoms of each element have a unique <u>mass</u> .	The atoms of any element have an identifiable mass.
The masses of elements in a compound are always in a(n) <u>constant ratio</u> .	In any sample of a compound, the ratio of the masses of elements is always the same.

CHAPTER 1, Matter and Energy (continued)

6. Circle the letter of each sentence that is true about how Dalton's ideas are considered today.
- a. Scientists have discovered that all of his statements are true.
 - b. His ideas form the basis of our understanding of atoms.
 - c. Scientists have identified exceptions to Dalton's statements.
 - d. His ideas have been completely abandoned by modern scientists.

► Ideas About Atoms Today (page 44)

7. Is the following sentence true or false? Each dot of ink on a newspaper contains a few hundred atoms. false
8. What tool did scientists use to capture the image of silicon atoms, as shown in Figure 15 on page 44? scanning tunneling microscope

► Atoms and Molecules (page 44)

9. What is a chemical bond? A chemical bond is the force that holds two atoms together.
10. Circle the letter of the term that often means a combination of two or more atoms that are bonded together.
- a. atom b. compound c. molecule d. element
11. Circle the letter of each sentence that is true about molecules.
- a. Some molecules are made up of atoms that are alike.
 - b. There are no molecules that contain over a million atoms.
 - c. Most molecules are made of more than one type of atom.
 - d. Each water molecule contains only 1 oxygen atom.

► The Atom as a Model (page 45)

12. What is a model? A model is a diagram, mental picture, mathematical statement, or object that helps explain ideas about the natural world.
- _____

SECTION**1-4****Elements From Earth****(pages 46-50)**

This section explains how the density of gold allows it to be separated from other substances. It also describes how copper and iron can be separated from rocks that contain them.

► Gold and Density (page 47)

1. Why can density be used to separate gold from surrounding material?

Gold is much denser than the sand and dirt with which it is mixed, and it is also much denser than its look-alike, pyrite.

2. What is gold's density compared to pyrite? Gold's density is 19.3 g/cm^3 ,

while pyrite's density is only 5.0 g/cm^3 .

3. The technique of separating gold from a mixture of gold, dirt, and sand is called panning.

4. Today, gold mining is done with big machines called dredges.

► Copper and Electrolysis (pages 47-49)

5. How are most elements found in nature? Most elements are usually found as compounds.

6. What is an ore? An ore is any rock that contains a metal or some other economically useful material.

7. What must be done to obtain an element from its compound ore? To obtain an element from its compound ore, it is necessary to cause a chemical reaction to take place.

8. A process by which an electric current breaks a chemical bond is called electrolysis.

CHAPTER 1, Matter and Energy (continued)

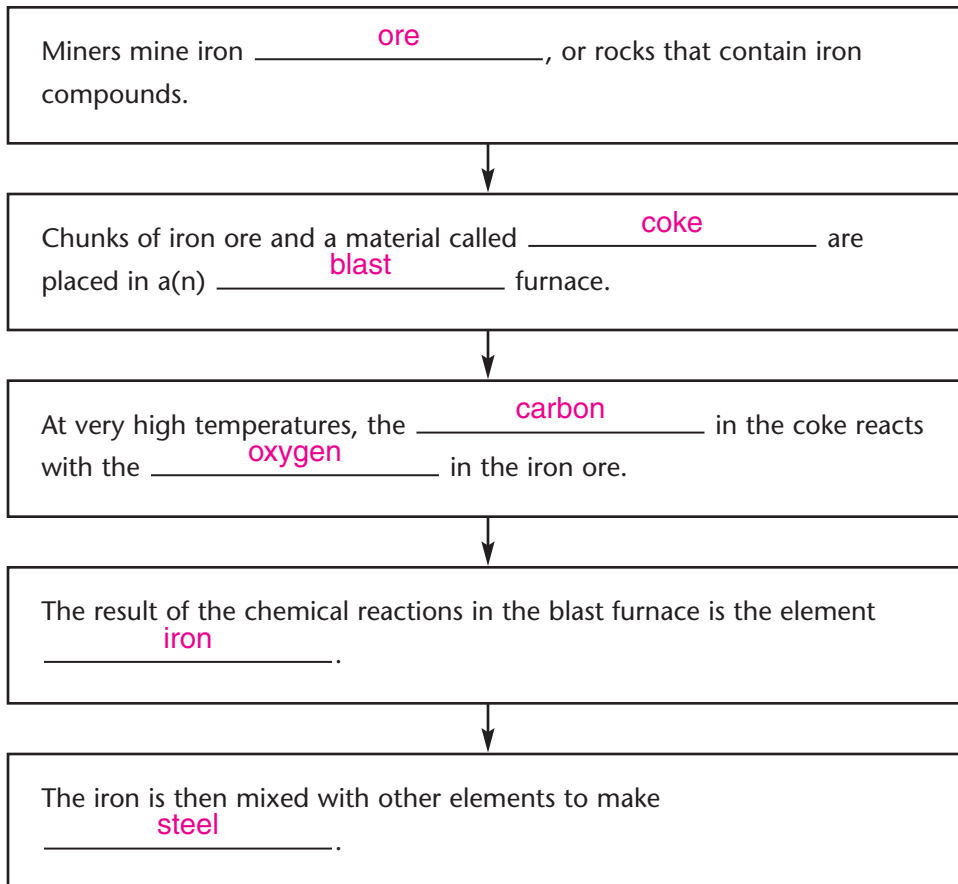
9. What are the metal strips called that are placed in the copper compound solution during electrolysis? electrodes

► Iron and the Blast Furnace (page 50)

10. What must be done to iron ore to produce the element iron? The element iron must be separated from its compounds by a chemical reaction.

11. Where does the carbon that is used to purify iron come from? It comes from a material called coke, which is made from coal.

12. Complete the flowchart about how purified iron is produced.



WordWise

Complete the following paragraphs using key terms from Chapter 1 below. Each term may be used only once.

Word Bank

atom chemistry density molecule element
mixture chemical change mass compound chemical bond
physical change volume weight

The study of the properties of matter and how matter changes is called _____ **chemistry** _____. A substance that cannot be broken down into any other substances by chemical or physical means is a(n) _____ **element** _____. A substance made of two or more elements chemically combined in a specific ratio is a(n) _____ **compound** _____. A(n) _____ **mixture** _____ is made of two or more substances that are in the same place but are not chemically combined into a new substance.

There are two basic ways that matter can change. A change that alters the form or appearance of a material but does not make the material into another substance is a(n) _____ **physical change** _____. A change in matter that produces new substances is a(n) _____ **chemical change** _____.

There are all sorts of ways of measuring matter. The measurement of the force of gravity on an object is _____ **weight** _____. The measurement of how much matter an object contains is _____ **mass** _____. The measurement of the amount of space that matter occupies is _____ **volume** _____. The physical property that relates the mass and volume of a material is _____ **density** _____.

The smallest particle of an element is a(n) _____ **atom** _____. The force that holds two atoms together is a(n) _____ **chemical bond** _____. A combination of two or more atoms that are bonded together is a(n) _____ **molecule** _____.

CHAPTER 1, Matter and Energy (continued)**MathWise**

For the problems below, show your calculations. If you need more space, use another sheet of paper. Write the answers for the problems on the lines below.

► Calculating Volume of a Rectangular Object (page 36)

1. Volume = $10 \text{ cm} \times 5 \text{ cm} \times 6 \text{ cm} = \underline{\hspace{2cm} 300 \text{ cm}^3 \hspace{2cm}}$

2. A box has a length of 25 centimeters, a width of 8 centimeters, and a height of 12 centimeters. What is its volume?

$$\text{Volume} = 25 \text{ cm} \times 8 \text{ cm} \times 12 \text{ cm} = 2,400 \text{ cm}^3$$

Answer: $\underline{\hspace{2cm} \text{Volume} = 2,400 \text{ cm}^3 \hspace{2cm}}$

► Calculating Density (pages 38–39)

3. Density = $\frac{24 \text{ g}}{8 \text{ cm}^3} = \underline{\hspace{2cm} 3 \text{ g/cm}^3 \hspace{2cm}}$

4. A sample of water has a mass of 13 grams and a volume of 13 milliliters. What is the density of water?

$$\text{Density} = \frac{13 \text{ g}}{13 \text{ mL}} = 1 \text{ g/mL}$$

Answer: $\underline{\hspace{2cm} \text{Density} = 1 \text{ g/mL} \hspace{2cm}}$

5. A sample of metal has a mass of 94.5 grams and a volume of 7 cubic centimeters. What is its density?

$$\text{Density} = \frac{94.5 \text{ g}}{7 \text{ cm}^3} = 13.5 \text{ g/cm}^3$$

Answer: $\underline{\hspace{2cm} \text{Density} = 13.5 \text{ g/cm}^3 \hspace{2cm}}$

6. A sample of liquid has a mass of 26 grams and a volume of 20 milliliters. What is its density?

$$\text{Density} = \frac{26 \text{ g}}{20 \text{ mL}} = 1.3 \text{ g/mL}$$

Answer: $\underline{\hspace{2cm} \text{Density} = 1.3 \text{ g/mL} \hspace{2cm}}$

CHAPTER 2

SOLIDS, LIQUIDS, AND GASES

SECTION 2-1 **States of Matter**
(pages 56-60)

This section explains how shape, volume, and the motion of particles are useful in describing solids, liquids, and gases.

► **Solids (pages 57-58)**

1. Which state of matter has a definite volume and a definite shape?
solid

2. Why do solids have a definite shape and a definite volume? The _____
particles in a solid are packed tightly together and stay in fixed positions.

3. When a crystalline solid is heated, it melts at a distinct temperature called its melting point _____.

4. Complete the table about types of solids.

Solids			
Type of Solid	Description	Examples	Melting Point
Crystalline solids	Made up of crystals	Salt, sugar, sand, snow	Distinct melting point
Amorphous solids	Particles not arranged in a regular pattern	Plastics, rubber, glass	No distinct melting point

CHAPTER 2, Solids, Liquids, and Gases *(continued)*

5. Circle the letter of each sentence that is true about particles in a solid.
- a. They are completely motionless.
 - b.** They stay in about the same position.
 - c.** They vibrate back and forth.
 - d. They switch positions occasionally.

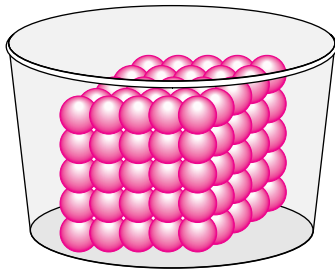
► **Liquids (pages 58–59)**

6. Which state of matter has no definite shape but does have a definite volume? liquid
7. Is the following sentence true or false? A liquid’s volume does not change no matter the shape of the container. true
8. What does a liquid do when it is not in a container? It spreads out into a wide, shallow puddle.
-
9. Circle the letter of the term that means the resistance of a liquid to flowing.
- a. amorphous
 - b. solid
 - c.** viscosity
 - d. insulator
10. Is the following sentence true or false? Liquids with high viscosity flow quickly. false

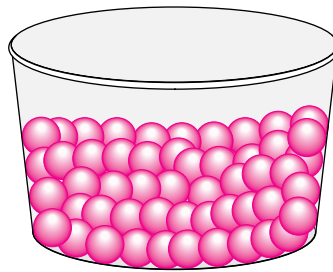
► **Gases (pages 59–60)**

11. Which state of matter has neither definite shape nor volume?
gas
12. If you put a gas into a sealed container, what will the gas do? It will spread apart or squeeze together to fill that container.
-
13. The volume and shape of a gas are determined by its container.

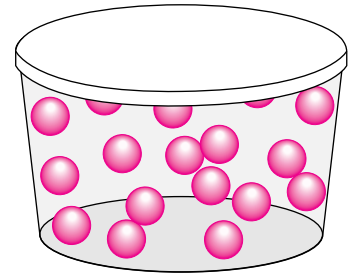
14. In the containers below, draw how the particles are arranged in the three states of matter.



Solid



Liquid



Gas

SECTION **Gas Behavior**
2-2 (pages 61-67)

This section explains how the volume, temperature, and pressure of a gas are related.

► **Measuring Gases** (pages 62-63)

- The volume of a gas is the same as the volume of its container.
- What is temperature? Temperature is a measure of the average energy of motion of the particles of a substance.
- The force of a gas's outward push divided by the area of the walls of its container is the gas's pressure.
- What is the formula you use to calculate pressure?

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

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► **Relating Pressure and Volume** (pages 63-64)

- What does Boyle's law say about the relationship between the pressure and volume of a gas? When the pressure of a gas is increased at constant temperature, the volume of the gas decreases. When the pressure is decreased, the volume increases.

CHAPTER 2, Solids, Liquids, and Gases (continued)

6. Complete the table about the relationship between the pressure and volume of a gas.

Pressure and Volume of Gases at Constant Temperature	
Change	Increases or Decreases?
Pressure decreases	Volume increases
Pressure increases	Volume decreases
Volume increases	Pressure decreases
Volume decreases	Pressure increases

► **Relating Pressure and Temperature** (pages 64–65)

7. How is pressure affected by the collisions of gas particles? The more collisions there are, the greater the pressure will be.

8. Suppose a gas is kept in a closed, rigid container. If the temperature of the gas increases, what happens to its pressure on the container?

The pressure increases.

9. If the temperature of that gas in the container decreases, what happens to its pressure? The pressure decreases.

► **Relating Volume and Temperature** (pages 66–67)

10. What is Charles’s law? When the temperature of a gas is increased at constant pressure, its volume increases. When the temperature of a gas is decreased, its volume decreases.

11. Is the following sentence true or false? At higher temperatures, the particles of a gas move slower. false

12. If the volume of a container can change, what will happen to a gas in the container if the temperature is decreased? The volume of the gas will decrease.

13. What would happen if a partially inflated party balloon were heated? The air inside the balloon would be heated. As the temperature of the air increased, so would its volume. The increasing volume of the gas would make the balloon grow larger.



Reading Skill Practice

By looking carefully at photographs and illustrations in textbooks, you can better understand what you have read. Look carefully at Figure 12 on page 64. What important idea does this illustration communicate? Do your work on a separate sheet of paper.

The illustration communicates visually the relationship known as Boyle's law. As the pressure of a gas increases at constant temperature, its volume decreases.



SECTION 2-3 **Graphing Gas Behavior** (pages 68-71)

This section describes graphs for Charles's law and Boyle's law.

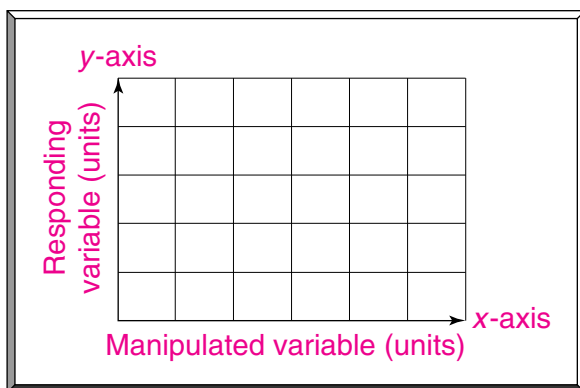
► **Introduction** (page 68)

1. What is a graph? A graph is a diagram that shows how two variables, or factors, are related.
2. Is the following sentence true or false? Graphs show how changes in one variable result in changes in a second variable. true

CHAPTER 2, Solids, Liquids, and Gases (continued)

► **Temperature and Volume** (pages 69–70)

- In the experiment represented in Figure 17 on page 69, what is the volume of gas when the temperature is 0°C? 50 mL
- When the temperature of the gas rises to 353 kelvins, what is the volume of the gas? 66 mL
- On the graph below, label the *x*-axis and the *y*-axis.



- Write labels on the graph above that show on which axis the units for the manipulated variable should be placed and on which axis the units for the responding variable should be placed.
- Where did the data come from that was used to create the graph in Figure 19 on page 70? The data came from the experiment shown in Figure 17.
- Compare Figure 18 on page 69 with Figure 19 on page 70. In Figure 19, what is the manipulated variable? The manipulated variable is the temperature in kelvins of the gas.
- What is the responding variable in Figure 19? The responding variable is the volume in milliliters of the gas.

10. When a graph of two variables is a straight line passing through the (0, 0) point, the relationship is linear and the variables are said to be _____ **directly proportional** _____ to each other.

11. What does the graph of Charles's law show about the relationship between the temperature and volume of a gas? _____ **The graph shows that the volume of a gas is directly proportional to its kelvin temperature under constant pressure.** _____

► **Pressure and Volume (pages 70–71)**

12. In the experiment shown in Figure 20 on page 70, what is the volume and pressure of the gas when the experiment begins? _____ **The volume is 100 mL and the pressure is 60 kPa.** _____

13. In that experiment, does the pressure increase or decrease as the volume decreases? _____ **The pressure increases.** _____

14. On the graph in Figure 21 on page 71, what is the manipulated variable and what is the responding variable? _____ **The manipulated variable is volume in milliliters, and the responding variable is pressure in kilopascals.** _____

15. When a graph of two measurements forms a curve that becomes less steep close to the horizontal axis, the relationship is nonlinear and the measurements are said to _____ **vary inversely** _____ with each other.

16. What does the graph for Boyle's law show about the relationship between the pressure and volume of a gas? _____ **The pressure of a gas varies inversely with its volume at constant temperature.** _____

CHAPTER 2, Solids, Liquids, and Gases *(continued)*

SECTION **Changes in State**
2-4 (pages 74-79)

This section explains how energy is transferred when substances change state. It also describes changes in state.

► **Energy and Changes in State** (pages 74-75)

1. What is thermal energy? Thermal energy is the energy that the particles of a substance have.
2. Thermal energy is transferred from one substance to another as heat.
3. Is the following sentence true or false? Thermal energy always flows from a cooler substance to a warmer substance. false
4. Complete the table about the transfer of thermal energy.

Transfer of Thermal Energy	
Cause	Effect on Particles of Substance
Heat flows into a substance.	The particles gain energy and move faster.
Heat flows from a substance.	The particles lose energy and move more slowly.

5. Circle the letter of each sentence that is true about thermal energy.
 - a. The particles of a solid have the most thermal energy.
 - b. The particles of a liquid have the least thermal energy.
 - c.** The particles of a solid have the least thermal energy.
 - d.** The particles of a gas have the most thermal energy.

6. When does a substance change state? A substance changes state when its thermal energy increases or decreases by a sufficient amount.

► **Changes Between Liquid and Solid** (pages 75–76)

7. The change in state from a solid to a liquid is called melting.

8. How strongly a substance's particles attract one another is what determines the substance's melting point.

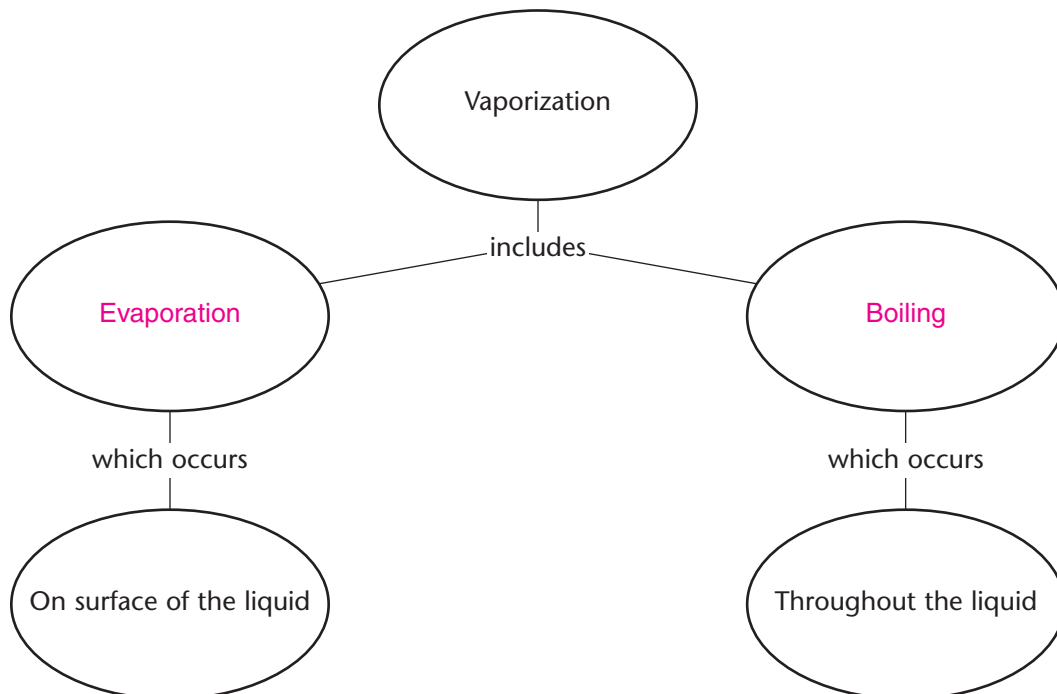
9. The change of state from liquid to solid is called freezing.

10. Is the following sentence true or false? When water freezes, the temperature stays at 0°C until freezing is complete and all the water molecules have formed ice crystals. true

► **Changes Between Liquid and Gas** (pages 76–77)

11. The change from the liquid to the gas state of matter is called vaporization.

12. Complete the concept map about vaporization.



CHAPTER 2, Solids, Liquids, and Gases *(continued)*

13. Each liquid boils only at a certain temperature, which is called its _____ **boiling point** _____.
14. Why is the boiling point of water lower in the mountains than it is at sea level? **Air pressure is lower in the mountains. The lower the air pressure above a liquid, the less energy that liquid molecules need to escape into the air.**
15. The change in state from a gas to a liquid is called **condensation**.
16. Is the following sentence true or false? Condensation is the opposite of vaporization. **true**
17. When condensation occurs, does a gas lose or gain thermal energy? **It loses thermal energy.**

Match the term with its example.

Term	Example
<u> b </u> 18. vaporization	a. A pot of water on a stove reaches its boiling point.
<u> d </u> 19. evaporation	b. Liquid water changes into water vapor.
<u> a </u> 20. boiling	c. Clouds form from water vapor in the sky.
<u> c </u> 21. condensation	d. A puddle dries up after a rain shower.

► Changes Between Solid and Gas (pages 78–79)

22. The change of state from a solid directly to a gas without passing through the liquid state is called **sublimation**.

23. Why does “dry ice” keep materials near it cold and dry? As solid carbon dioxide changes directly into a gas, it absorbs thermal energy. That keeps materials near it cold. Since it does not pass through the liquid state, materials near it stay dry.

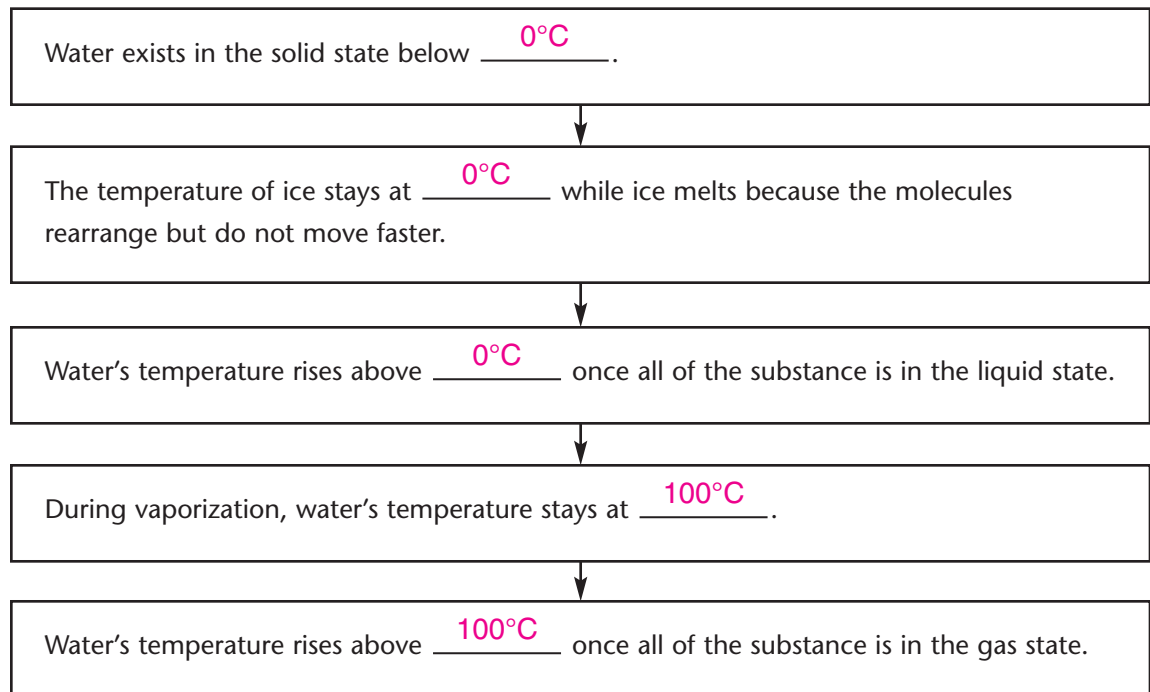
► **Identifying Substances Through Changes of State** (page 79)

24. Is the following sentence true or false? Comparing melting points and boiling points can help identify an unknown substance.

true

25. Suppose you know that a liquid is either ethanol or chloroform, but you don’t know which it is. How could you identify the liquid? The liquid could be identified by observing at what temperature it boils, since ethanol boils at 79°C and chloroform boils at 61°C.

26. Use *Exploring Changes of State* on page 78 to complete the flowchart.



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CHAPTER 2, Solids, Liquids, and Gases *(continued)*

WordWise

The block of letters below contains 10 key terms from Chapter 2. Use the clues to identify the terms you need to find. Then find the terms across, down, or on the diagonal. Circle each term in the hidden-word puzzle.

Clues

The force exerted on a surface divided by the total area over which the force is exerted

The change from the liquid to the gas state of matter

A state of matter with no definite shape or volume

The resistance of a liquid to flowing

Vaporization that occurs on and below the surface of a liquid

A state of matter that has no definite shape but has a definite volume

The change in state from a liquid to a solid

A state of matter that has a definite volume and a definite shape

The change in state from a solid to a liquid

A diagram that shows how two variables are related

Key Terms

pressure

vaporization

gas

viscosity

boiling

liquid

freezing

solid

melting

graph

v	a	p	o	r	i	z	a	t	i	o	n
i	u	r	l	m	l	i	q	u	i	d	f
s	s	e	n	e	y	q	i	d	x	g	r
c	o	s	o	l	i	d	w	n	n	r	e
o	w	s	m	t	p	e	f	i	p	a	e
s	x	u	m	i	a	s	l	d	d	p	z
i	t	r	c	n	a	i	c	u	p	h	i
t	t	e	g	g	o	x	c	i	f	x	n
y	c	i	p	b	t	w	q	m	c	d	g

CHAPTER 3

RELATING FORCE AND MOTION

SECTION **3-1** **Describing, Measuring, and Graphing Motion**
(pages 86-95)

This section explains how to recognize when an object is in motion and how to determine how fast it is moving.

► **Changing Position—Recognizing Motion** (pages 87–88)

1. An object is in motion when its distance from another object is changing.
2. What is a reference point? A reference point is a place or object used for comparison to determine if something is in motion.
3. An object is in motion if it changes position relative to a(n) reference point .

► **Describing Distance** (pages 88–89)

4. Complete the table about SI.

SI	
Question	Answer
What is its whole name?	International System of Units
What number is it based on?	Ten
What is its basic unit of length?	Meter

5. How many centimeters are there in a meter? 100
6. How many meters are there in a kilometer? 1,000

CHAPTER 3, Relating Force and Motion (continued)

► **Calculating Speed** (pages 90–91)

7. What is the formula used to calculate the speed of an object?

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

8. How would you find the average speed of a cyclist throughout an entire race? Divide the total distance the cyclist traveled by the total time.

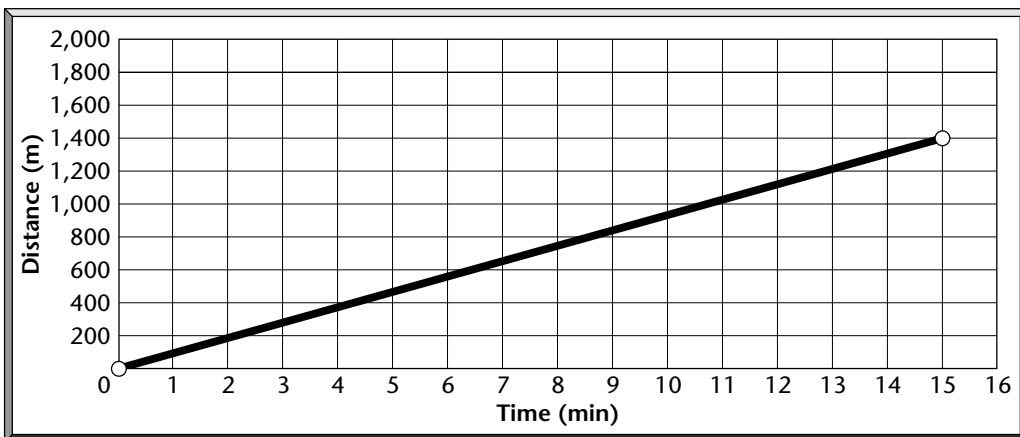
► **Describing Velocity** (pages 92–93)

9. Speed in a given direction is called velocity.

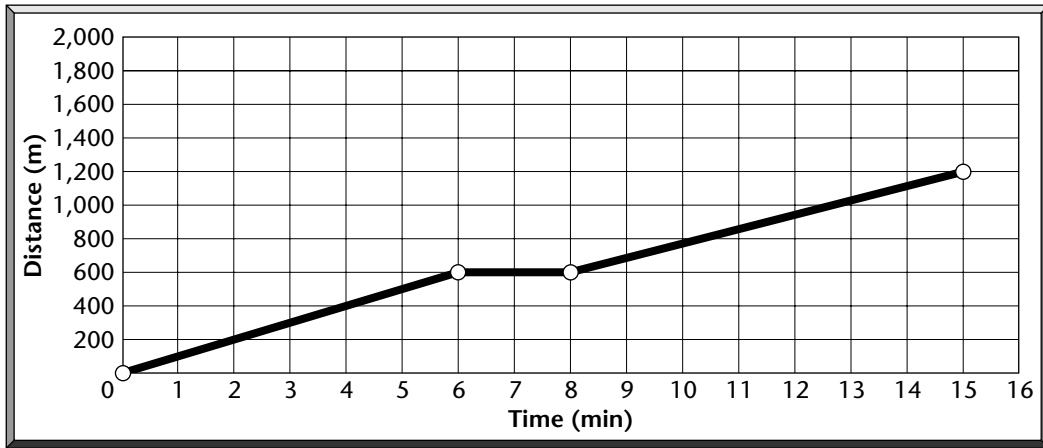
10. An approaching storm is moving at 15 km/hr. What do you need to know to determine its velocity? The direction in which it is moving

► **Graphing Motion** (pages 94–95)

11. On a graph of motion, on which axis is time shown? The horizontal, or x-axis.



12. The motion graph above graphs the motion of a jogger on a run one day. How far did the jogger run in 15 minutes? 1,400 m



13. The motion graph above also shows the motion of a jogger on a run one day. The line is divided into segments. The middle segment is horizontal. What does that tell you about the jogger’s progress between minute 6 and minute 8? The jogger traveled no distance during those minutes; the jogger rested.

SECTION **Force and Acceleration**
3-2 (pages 98-105)

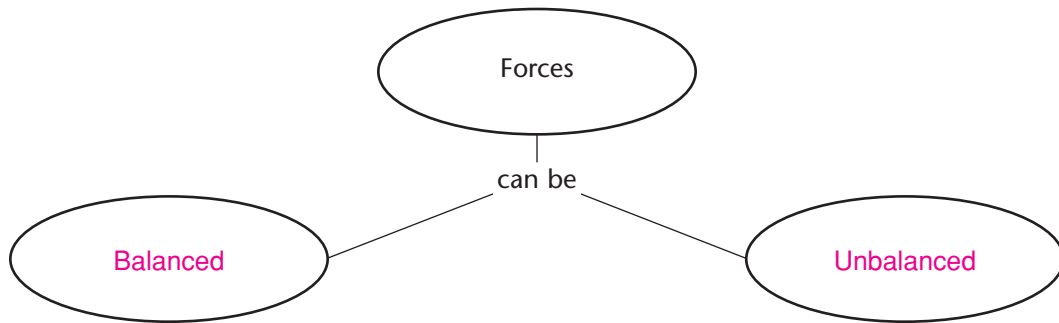
This section describes how unbalanced forces cause motion. It also describes what happens to the motion of an object as it accelerates, or changes velocity.

► **Forces and Motion** (pages 98-100)

1. What is a force? A force is a push or a pull on an object.
2. List three ways an unbalanced force can affect an object’s motion.
 - a. Start it moving
 - b. Stop the object
 - c. Change the direction it is moving

CHAPTER 3, Relating Force and Motion (continued)

3. Complete the concept map.



4. The overall force acting on an object is called the net force.

5. When a net force changes an object's motion, the force is said to be a(n) unbalanced force.

6. Equal and opposite forces acting on the same object are called balanced forces.

7. Is the following sentence true or false? An unbalanced force will not change an object's motion. false

► Types of Forces (pages 100–101)

8. What is a contact force? When two objects are in contact, each exerts a force on the other that pushes it away. This force is called a contact force.

9. The force that one substance exerts on another when the two rub against each other is called friction.

10. Is the following sentence true or false? Earth's gravitational force pulls everything near Earth's surface toward Earth's center.

true

11. Circle the letter of each sentence that is true about forces.

- a. Friction helps you walk and run.
- b. Mass is a measure of the force of gravity.
- c. Like poles of magnets repel.
- d. Electrical forces result from charged particles.

► **Acceleration (pages 102–103)**

12. What is acceleration? Acceleration is the rate at which velocity changes.

13. Acceleration involves a change in what two components?

speed and direction

14. Any time the speed of an object increases, the object experiences

acceleration.

15. Is the following sentence true or false? Acceleration refers to increasing speed, decreasing speed, or changing direction. true

16. Deceleration is another word for acceleration in which speed

decreases.

17. Is the following sentence true or false? An object can be accelerating even if its speed is constant. true

18. Circle the letter of each sentence that describes an example of acceleration.

- a. A car follows a gentle curve in the road.
- b. A batter swings a bat to hit a ball.
- c. A truck parked on a hill doesn't move all day.
- d. A runner slows down after finishing a race.

19. The moon revolves around Earth at a fairly constant speed. Is the moon accelerating? The moon is accelerating because it is constantly changing

direction as it revolves around Earth.

CHAPTER 3, Relating Force and Motion (continued)

► **Calculating Acceleration** (pages 103–105)

20. What must you calculate to determine the acceleration of an object?

The change in velocity during each unit of time

21. What is the formula you use to determine acceleration?

Acceleration = $\frac{\text{Final velocity} - \text{Initial velocity}}{\text{Time}}$

22. Is the following sentence true or false? To calculate the acceleration of an airplane, you must first subtract the final speed from the initial speed. false

23. Circle the letter of each sentence that is true about calculating the acceleration of a moving object.

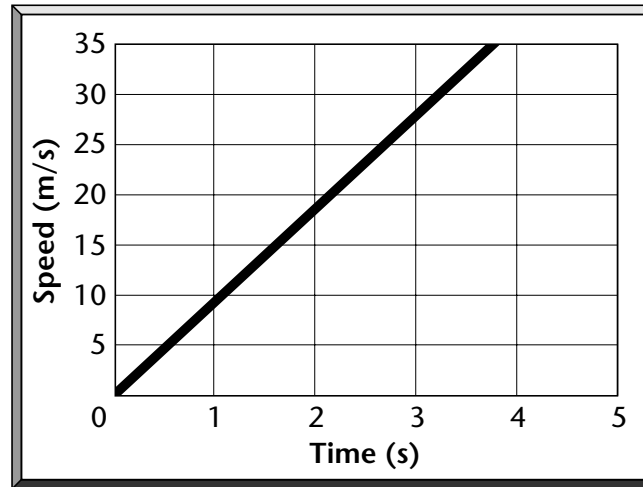
- a. If an object is moving without changing direction, then its acceleration is the change in its speed during one unit of time.
- b. If an object’s speed changes by the same amount during each unit of time, then the acceleration of the object at any time is the same.
- c. To determine the average acceleration of an object, you must calculate the change in velocity during only one unit of time.
- d. If an object’s acceleration varies, then you can describe only average acceleration.

24. Suppose velocity is measured in kilometers/hour and time is measured in hours. What is the unit of acceleration? km/h²

► **Graphing Acceleration** (page 105)

25. If a graph of distance versus time is a straight line, the graph shows a(n) linear relationship.

26. If a graph of distance versus time is a curved line, the graph shows a(n) nonlinear relationship.



27. The graph above shows the motion of an object that is accelerating.

What happens to the speed of the object over time? The speed increases over time.

28. The graph line is slanted and straight. What does this line show about the acceleration of the object? The acceleration is constant.



Reading Skill Practice

Knowing the meanings of the key terms in a section will help you better understand what you are reading. Make a list of key terms in this section. Write the meanings of these terms using your own words. In this way, the key terms become a natural part of your vocabulary. Do your work on a separate sheet of paper.

Definitions for the key terms should be written in the students' own words, but based on the information on pages 98–105.

CHAPTER 3, Relating Force and Motion *(continued)*

SECTION **Water in Motion**

3-3 (pages 108-112)

This section describes how moving water shapes Earth's surface and tells how a flood affects the land near a river.

► **Rivers Shape the Land** (pages 108-109)

1. What is erosion? Erosion is the process by which fragments of soil and rock are broken off from the ground and carried away.

2. The process by which soil and rock are dropped in a new location is called deposition.

3. How does the force of moving water shape Earth's surface? Rivers wear away landforms through erosion and build new landforms through deposition.

4. Circle the letter of each sentence that is true about rivers.

- a. The faster water flows, the more force it has.
- b. A river deposits lighter sediments before heavier ones.
- c. Water flows faster down a mountain than across a flat plain.
- d. The more water in a river, the faster the river flows.

► **Profile of a River** (pages 109-111)

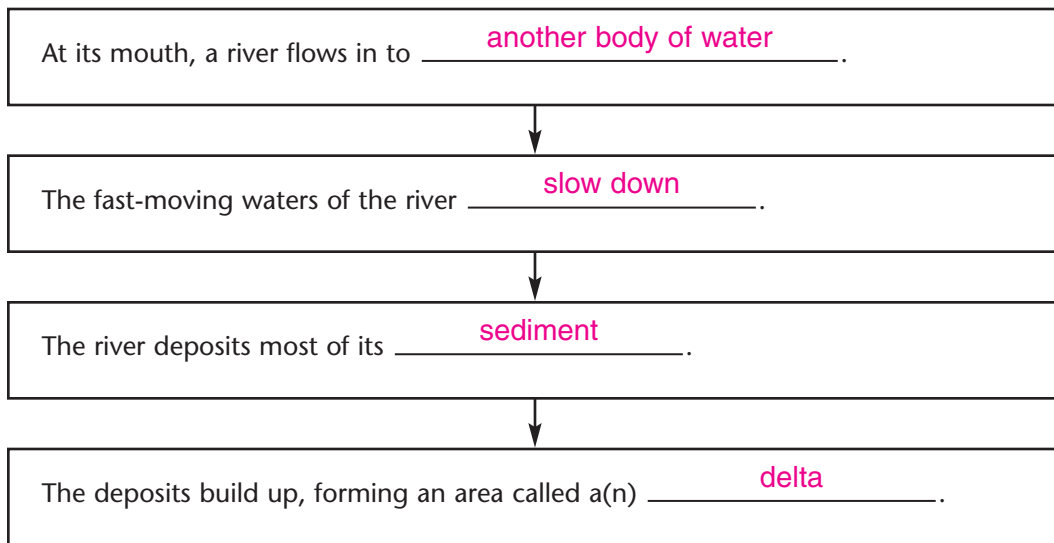
5. The many small streams that come together at the source of a river are called the headwaters.

6. The broad, flat valley through which a river flows is called the flood plain.

7. How does a meander become an oxbow lake? A meander is a looping curve in a river. The river channel may break through the ends of the meander, carving a new, straighter channel. The crescent-shaped, cutoff body of water that remains is called an oxbow lake.

8. Complete the flowchart

Formation of a Delta



► **Rivers and Floods (pages 111–112)**

9. How do floods change land features? A flooding river can erode and deposit huge amounts of soil, sand, and gravel. Floods can uproot trees and pluck boulders from the ground.

10. Deposits along a channel build up over time into levees, long ridges that parallel the river.

CHAPTER 3, Relating Force and Motion (continued)

WordWise

Match each definition in the left column with the correct term in the right column. Then write the number of each term in the appropriate box below. When you have filled in all the boxes, add up the numbers in each column, row, and two diagonals. All the sums should be the same.

- | | |
|---|--|
| <p>A. When an object’s distance from another object is changing</p> <p>B. A place or object used for comparison to determine if something is in motion</p> <p>C. The process by which soil and rock are dropped in a new location</p> <p>D. The basic SI unit of length</p> <p>E. The distance an object travels in one unit of time</p> <p>F. Speed in a given direction</p> <p>G. Looping curves in a river</p> <p>H. The overall force acting on an object</p> <p>I. The rate at which velocity changes</p> | <p>1. reference point</p> <p>2. meanders</p> <p>3. velocity</p> <p>4. acceleration</p> <p>5. speed</p> <p>6. motion</p> <p>7. meter</p> <p>8. deposition</p> <p>9. net force</p> |
|---|--|

A	B	C	=	<u>15</u>
<u>6</u>	<u>1</u>	<u>8</u>	=	<u>15</u>
D	E	F	=	<u>15</u>
<u>7</u>	<u>5</u>	<u>3</u>	=	<u>15</u>
G	H	I	=	<u>15</u>
<u>2</u>	<u>9</u>	<u>4</u>	=	<u>15</u>
=	=	=	=	<u>15</u>
<u>15</u>	<u>15</u>	<u>15</u>		

MathWise

For the problems below, show your calculations. If you need more space, use another sheet of paper. Write the answers for the problems on the lines below.

► Calculating Speed (pages 90–91)

1. $\text{Speed} = \frac{32 \text{ m}}{8 \text{ s}} = \underline{4 \text{ m/s}}$

2. A car travels 66 kilometers in 3 hours. What is its speed?

$$\text{Speed} = \frac{66 \text{ km}}{3 \text{ h}} = 22 \text{ km/h}$$

Answer: Speed = 22 km/h

► Average Speed (page 91)

3. $\text{Average Speed} = \frac{200 \text{ km}}{5 \text{ hr}} = \underline{40 \text{ km/h}}$

4. Suppose a car travels 60 kilometers the first two hours and 15 kilometers the next hour. What is the car's average speed?

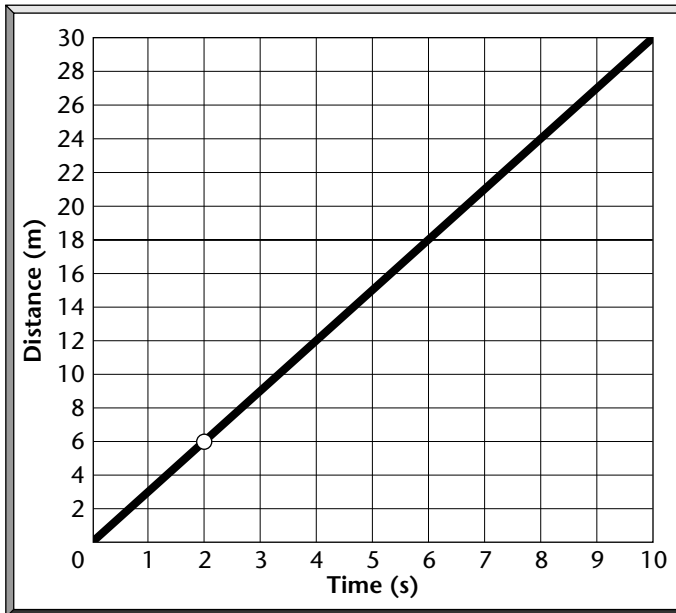
$$\text{Average speed} = \frac{75 \text{ km}}{3 \text{ h}} = 25 \text{ km/h}$$

Answer: Average speed = 25 km/h

5. On a trip in a car, you travel 180 km for the first two and a half hours, then stop for a half hour, and then travel 40 km in the last hour. What is the car's average speed for the trip?

$$\text{Average speed} = \frac{220 \text{ km}}{4 \text{ h}} = 55 \text{ km/h}$$

Answer: Average speed = 55 km/h

CHAPTER 3, Relating Force and Motion (continued)**► Graphing Motion** (page 95)

6. The graph shows the motion of an object. What is the object's speed at the point marked on the graph?

$$\text{Speed} = \frac{6 \text{ m}}{2 \text{ s}} = 3 \text{ m/s}$$

Answer: Speed = 3 m/s

► Calculating Acceleration (pages 103–105)

7. Acceleration = $\frac{20 \text{ m/s} - 4 \text{ m/s}}{4 \text{ s}} = \underline{4 \text{ m/s}^2}$

8. A cheetah accelerates from 2 m/s to 16 m/s in 7 seconds. What is the cheetah's average acceleration?

$$\text{Acceleration} = \frac{16 \text{ m/s} - 2 \text{ m/s}}{7 \text{ s}} = 2 \text{ m/s}^2$$

Answer: Acceleration = 2 m/s²

CHAPTER 4**CELLS: THE BUILDING BLOCKS OF LIFE****SECTION**
4-1 **What Is Life?**
(pages 122-129)

This section explains the characteristics of living things and what living things need to survive.

► The Characteristics of Living Things (pages 122-125)

1. What is an organism? An organism is a living thing.
2. List six characteristics that all living things share.
 - a. Made of cells
 - b. Contain similar chemicals
 - c. Use energy
 - d. Grow and develop
 - e. Respond to their surroundings
 - f. Reproduce
3. The basic units of structure and function in an organism are cells.
4. Is the following sentence true or false? An organism's structure is the way it is made. true
5. Is the following sentence true or false? An organism made of many cells is a unicellular organism. false
6. Circle the letter of the most abundant chemical in cells.

a. proteins b. carbohydrates **c.** water d. nucleic acids
7. Lipids and proteins are the building materials of cells.
8. Is the following sentence true or false? The cells of organisms use energy for growth and repair. true

CHAPTER 4, Cells: The Building Blocks of Life (continued)

9. What is development? Development is the process of change that occurs during an organism's life to produce a more complex organism.

10. Circle the letter of a change in an organism's surroundings that causes the organism to react.

- a. growth b. response **c.** stimulus d. development

11. Give one example of an external stimulus and one example of an internal stimulus.

External stimulus: Answers might include temperature, light, or sound.

Internal stimulus: Answers might include hunger or thirst.

12. All organisms can reproduce, or produce offspring that are similar to the parents.

► Life Comes From Life (pages 125–126)

13. Is the following sentence true or false? Frogs can sprout from mud in ponds. false

14. The idea that living things can come from nonliving sources is called spontaneous generation.

15. What did Francesco Redi show in his experiment? He showed that flies do not spontaneously arise from decaying meat.

16. The factor that a scientist changes in a controlled experiment is the variable.

17. Look carefully at *Exploring the Experiments of Redi and Pasteur* on pages 126–127. Circle the letter of the variable in Redi's experiment.

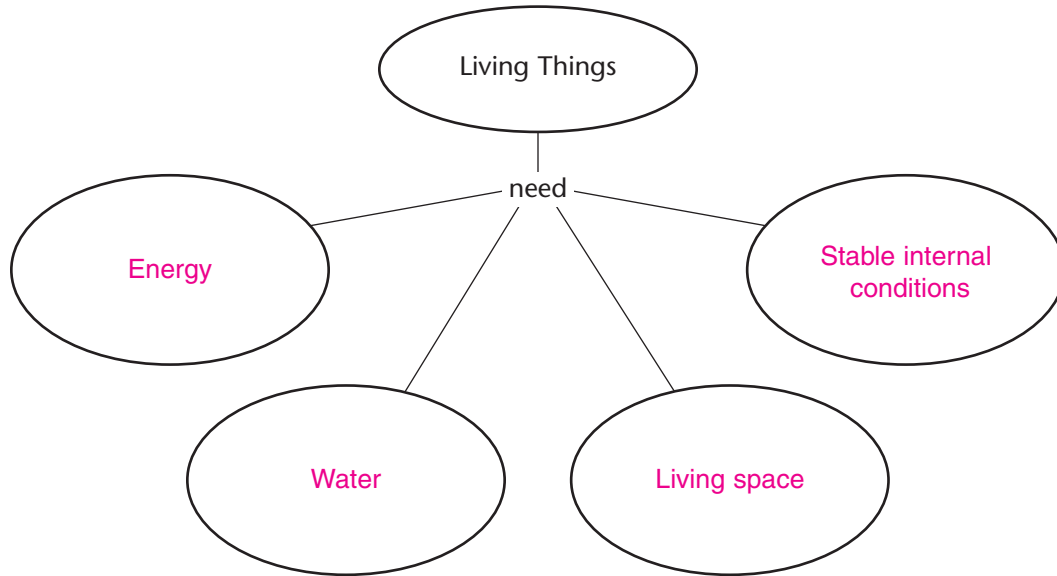
- a. meat b. jars **c.** cloth d. flies

18. Is the following sentence true or false? Louis Pasteur used a controlled experiment to show that bacteria arise from spontaneous generation.

false

► **The Needs of Living Things** (pages 127–129)

19. Complete this concept map to show what living things need to survive.



20. Is the following sentence true or false? Living things use food as their energy source to carry out their life functions. true

21. Organisms that make their own food are called autotrophs. Organisms that cannot make their own food are called heterotrophs.

22. Is the following sentence true or false? Living things can live without water for long periods of time. false

23. What property of water makes it vital to living things? Water can dissolve more chemicals than any other substance on Earth.

24. Is the following sentence true or false? Some organisms must compete with each other for space to live. true

25. Why must living things be able to maintain homeostasis, or stable internal conditions? Conditions in the surroundings of a living thing can change significantly.

CHAPTER 4, Cells: The Building Blocks of Life (continued)



Reading Skill Practice

Illustrations can help you understand what you have read. Look at *Exploring the Experiments of Redi and Pasteur* on pages 126–127. Study the diagrams showing Pasteur’s experiment. Use your own words to describe Pasteur’s experiment. Identify the variable in his experiment. Do your work on a separate sheet of paper.

Students should describe Pasteur’s experiment. The variable is boiling the broth.

SECTION 4-2 Discovering Cells
(pages 131-137)

This section describes how the invention of the microscope led to the development of a theory on cells. The section also explains how a light microscope works.

► **First Sightings of Cells** (pages 132-133)

1. An instrument that makes small objects look larger is a(n) microscope.
2. Is the following sentence true or false? A compound microscope has only one lens. false
3. Complete the following table about the first people to observe cells.

The First People to Observe Cells		
Questions	Robert Hooke	Anton van Leeuwenhoek
What kind of microscope did he use?	Compound microscope	Simple microscope
What did he first look at with the microscope?	A thin slice of cork	Pond water
What did he name what he saw?	Cells	Animalcules

4. Is the following sentence true or false? Theodor Schwann worked alone to develop the cell theory. false

► **The Cell Theory (pages 134–135)**

5. List the three points of the cell theory.
- a. All living things are composed of cells.
 - b. Cells are the basic unit of structure and function in living things.
 - c. All cells are produced from other cells.
6. Is the following sentence true or false? The cell theory is only true for living things that are small. false

► **How a Light Microscope Works (pages 136–137)**

7. Is the following sentence true or false? Magnification is the ability to make things look larger than they are. true
8. How do the lenses of a light microscope make an object look larger?
The lenses bend the light that passes through them.
9. In a convex lens, the center of the lens is thicker than the edges.
10. What is resolution? Resolution is the ability to clearly distinguish the individual parts of an object.

► **Electron Microscopes (page 137)**

11. A microscope that uses a beam of electrons to examine a specimen is called a(n) electron microscope.
12. Circle the letter of the microscope that has better resolution.
- a. light microscope
 - b.** electron microscope

CHAPTER 4, Cells: The Building Blocks of Life *(continued)*

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SECTION **Looking Inside Cells** **4-3** (pages 138-147)

This section describes cell structure and function in plant cells, animal cells, and bacteria.

► **Introduction** (pages 138-139)

1. What are organelles? They are tiny cell structures inside a cell that carry out specific functions within the cell.

► **Cell Wall** (page 139)

2. The rigid layer of nonliving material that surrounds plant cells is the cell wall.
3. Circle the letter of each sentence that is true about the cell wall.
- a. Cell walls are made of cellulose.
 - b. Plant cells have cell walls.
 - c. Animal cells have cell walls.
 - d. Water and oxygen cannot pass through the cell wall.

► **Cell Membrane** (pages 139-140)

4. Where is the cell membrane located in cells that have cell walls?
The cell membrane is just inside the cell wall.
5. Is the following sentence true or false? The main function of the cell membrane is to control what comes into and out of a cell. true

► **Nucleus** (pages 140-141)

6. The cell's control center, which directs all of the cell's activities, is the nucleus.

7. Circle the letter of each sentence that is true about the nucleus.
- a. Materials move into the nucleus through pores in the nuclear membrane.
 - b. Chromatin contains the instructions that direct the functions of a cell.
 - c. The nucleolus is part of the nuclear membrane.
 - d. Ribosomes are made in the nucleolus.

► **Organelles in the Cytoplasm** (pages 141–145)

8. Circle the letter of the part of the cell that is the region between the cell membrane and the nucleus.
- a. organelle b. nucleus c. cytoplasm d. chromatin
9. In the table below, describe the function of each organelle in the cytoplasm.

Organelles in Cytoplasm	
Organelle	Function
Mitochondria	Produce most of the energy the cell needs to carry out its functions
Endoplasmic reticulum	Carries proteins and other materials from one part of the cell to another
Ribosomes	Produce proteins
Golgi bodies	Receive proteins and other materials from the endoplasmic reticulum, package them, and send them to other parts of the cell
Chloroplasts	Found only in plant cells; capture energy from sunlight and use it to make food for the cell
Vacuoles	Are the storage areas of the cell
Lysosomes	Contain chemicals that break down large food particles into smaller ones and break down old cell parts

CHAPTER 4, Cells: The Building Blocks of Life (continued)

► Bacterial Cells (page 145)

10. Circle the letter of each sentence that is true about bacterial cells.
- a. Bacterial cells are eukaryotes
 - b.** Bacterial cells have a cell wall and a cell membrane.
 - c.** Bacterial cells do not have a nucleus.
 - d. Bacterial cells do not have genetic material.

► Structure and Function in Cells (page 146)

11. The structure of specialized cells enables them to perform their _____ functions.
12. How does the structure of nerve cells help them carry messages throughout the body? Nerve cells are long and thin, like telephone wires.
-

► Levels of Organization (pages 146–147)

13. List the four levels of organization in the body of a multicellular organism, starting with the smallest unit.
Cell, tissue, organ, organ system
14. The stomach, heart, and bones are examples of _____ organs.
15. How does the strength and hardness of bones help the skeleton perform its functions? The strength and hardness of bones make it possible for the skeleton to support the body and protect internal organs.
16. What is a population? A population is all the members of one kind of organism in a particular area.
17. Why do many environmental scientists add population as another level of organization? Every organism interacts with other organisms and the environment in which it lives.
-

SECTION
4-4 **Introduction to Genetics**
(pages 149-152)

This section compares asexual and sexual reproduction. It also describes how traits are passed from parents to offspring.

► **Introduction (page 149)**

1. What are traits? Traits are the physical characteristics that an organism can pass to its offspring.

► **Parents to Offspring (page 149)**

2. The process by which traits pass from parents to offspring is called heredity.
3. Why do offspring resemble their parents? Offspring resemble their parents because they inherit genetic material from their parents.
4. Is the following sentence true or false? Genetic material is contained in cells. true
5. What is genetics? Genetics is the scientific study of heredity.

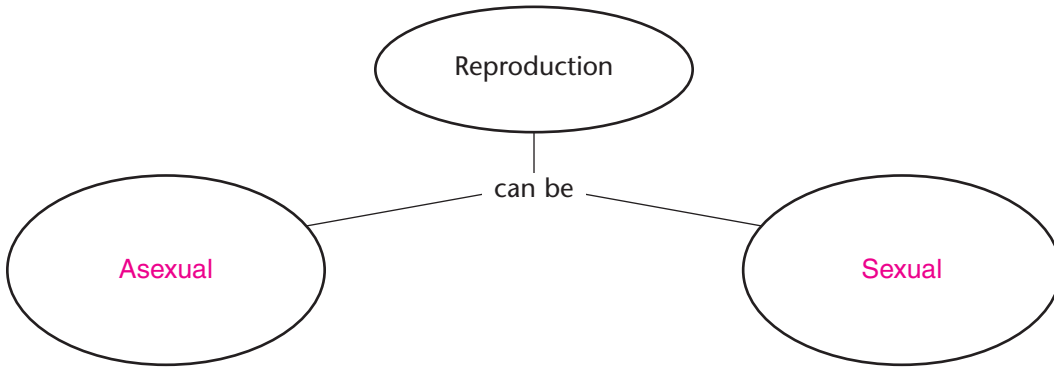
► **The Role of Genes in Inheritance (page 150)**

6. The genetic material that carries information about an organism is DNA.
7. A section of DNA that controls a trait that an organism inherits is called a(n) gene.

CHAPTER 4, Cells: The Building Blocks of Life (continued)

► Asexual and Sexual Reproduction (page 150)

8. Complete the concept map.



9. Is the following sentence true or false? Asexual reproduction is a reproductive process that involves only one parent.

true

10. The offspring of asexual reproduction have genes that are

identical to those of the parent organism.

11. In sexual reproduction, new organisms are produced by the joining of

sperm and eggs.

12. Is the following sentence true or false? Only the egg contains genetic material. false

► Sexual Reproduction and Change (page 151)

13. Is the following sentence true or false? The offspring of sexual reproduction look exactly like their parents. false

14. Why do organisms that reproduce sexually change from generation to generation? The genetic information is re-sorted, over and over, each

time reproduction occurs.

► **Changing Traits by Selective Breeding** (pages 151–152)

15. What is selective breeding? Selective breeding is a technique used to improve the quality of organisms by selecting, or choosing, certain organisms for reproduction.
16. Is the following sentence true or false? In selective breeding, the desired traits in the offspring are produced by the combination of genetic material that the offspring inherit from both of their parents.
true
17. Give two examples of organisms produced by selective breeding.
a. prize-winning racehorses
b. cotton plants that yield strong fibers
18. Santa Gertrudis cattle were produced through mating Brahman cattle with shorthorn cattle.
19. What desirable traits do Santa Gertrudis cattle have? They are heat resistant and produce tender, flavorful beef.

► **Changing Traits in Nature** (page 152)

20. Is the following sentence true or false? The changes that occur in organisms naturally over generations often help those organisms survive in their environment. true
21. How does a population of insects become resistant to pesticides over many generations? When a pesticide is first used on a field, it kills almost all the insects in the field. But a few insects survive because they have genes that help them resist the pesticide. The surviving insects reproduce. Some of their offspring inherit genes that enable them to resist the pesticide. After many years, most of the insects in the field will be resistant to the pesticide.

CHAPTER 4, Cells: The Building Blocks of Life (continued)

Word Wise

Match each definition on the left with the correct term on the right. Then write the number of each term in the appropriate box below. When you have filled in all the boxes, add up the numbers in each column, row, and two diagonals. The sums should be the same. Some terms may not be used.

- | | |
|---|---|
| <ul style="list-style-type: none"> A. Acts as the cell’s control center B. Area between the cell membrane and the nucleus C. Male sex cell D. A change in an organism’s surroundings E. Basic unit of structure and function in living things F. Organism whose cell lacks a nucleus G. Make things look larger than they are H. Process by which traits pass to offspring I. Organism that makes its own food | <ul style="list-style-type: none"> 1. cytoplasm 2. stimulus 3. magnification 4. autotroph 5. prokaryote 6. cell 7. response 8. nucleus 9. sperm 10. resolution 11. heredity 12. heterotroph |
|---|---|

A <u>8</u>	B <u>1</u>	C <u>9</u>		= <u>18</u>
D <u>7</u>	E <u>6</u>	F <u>5</u>	=	<u>18</u>
G <u>3</u>	H <u>11</u>	I <u>4</u>	=	<u>18</u>
=	=	=	=	<u>18</u>
<u>18</u>	<u>18</u>	<u>18</u>		

CHAPTER 5

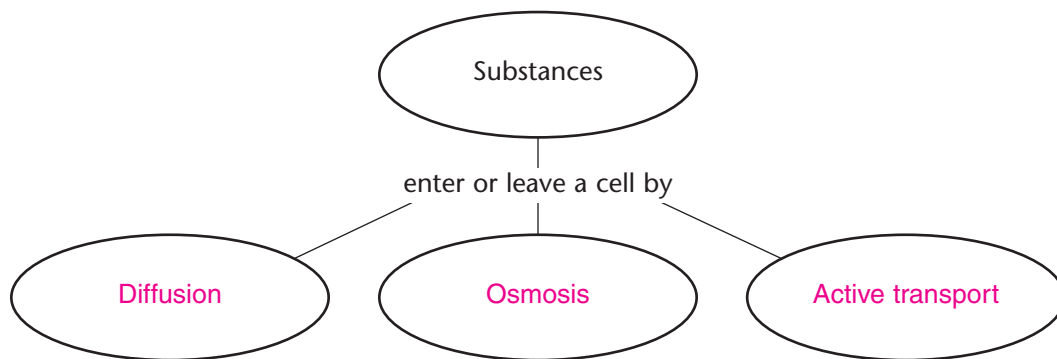
CELL PROCESSES AND ENERGY

SECTION **The Cell in Its Environment**
5-1 (pages 158-162)

This section tells how things move into and out of cells.

► **The Cell Membrane as Gatekeeper** (page 158)

1. The cell membrane has a structure that makes it selectively permeable.
2. Is the following sentence true or false? A selectively permeable membrane allows all substances to pass through it. false
3. Is the following sentence true or false? A cell membrane is usually permeable to oxygen, water, and carbon dioxide. true
4. Complete the concept map.



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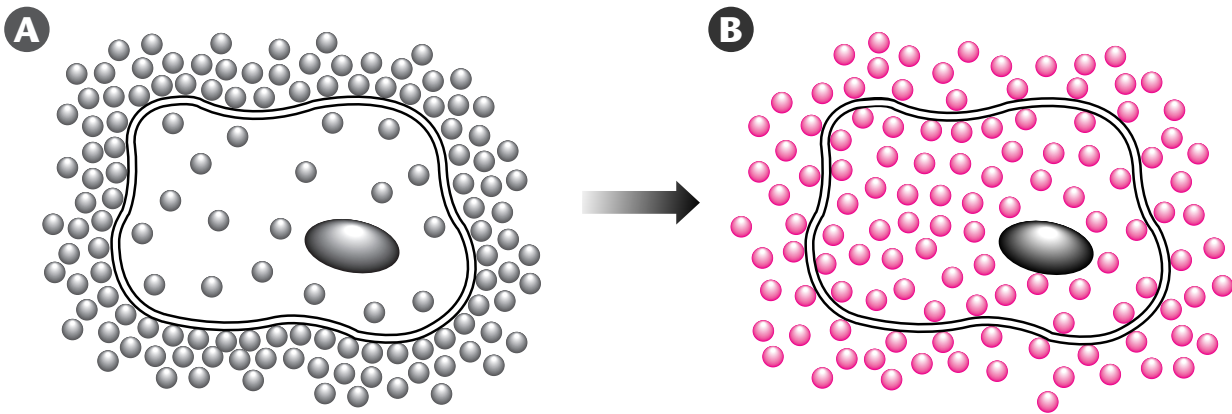
► **Diffusion—Molecules in Motion** (page 159)

5. Is the following sentence true or false? Diffusion is the main method by which small molecules move into and out of cells. true

CHAPTER 5, Cell Processes and Energy (continued)

6. In diffusion, molecules move from an area of higher concentration to an area of lower concentration.
7. What is concentration? The concentration of a substance is the amount of that substance in a given volume.

8. Draw molecules on Part B of the diagram below to show how the molecules are distributed inside and outside the cell after diffusion has occurred.



► Osmosis—The Diffusion of Water Molecules (page 160)

9. The diffusion of water molecules through a selectively permeable membrane is called osmosis.

Match the shape of each red blood cell with the concentration of water it is floating in. See Figure 2 on page 160.

Shape of Cell	Water Concentration
<u> b </u> 10. normal	a. Low concentration of water molecules outside the cell
<u> a </u> 11. shrunken	b. Concentration of water molecules is the same inside and outside of the cell
<u> c </u> 12. swollen	c. High concentration of water molecules outside the cell

► **Active Transport** (pages 161–162)

13. Two ways of moving things into and out of cells that do NOT need energy are diffusion and osmosis.
14. Moving materials through a cell membrane without using energy is called passive transport.
15. How does active transport differ from passive transport?
Active transport requires the cell to use energy while passive transport does not.
16. List two ways that the cell moves things by active transport.
a. Transfer proteins carry molecules into and out of the cell.
b. The cell membrane engulfs a particle.

► **Why Are Cells Small?** (page 162)

17. Is the following sentence true or false? As a cell gets larger, it takes longer for a molecule to reach the middle of the cell. true

SECTION **The Cell and Energy**
5-2 (pages 163–168)

This section explains how plants make food by using the energy from sunlight. This section also explains how cells get energy from food.

► **What Is Photosynthesis?** (page 163)

1. In the process of photosynthesis, plants use the energy from sunlight to make food.
2. The green pigment in chloroplasts, called chlorophyll, absorbs light energy from the sun.

CHAPTER 5, Cell Processes and Energy *(continued)*

► **The Events of Photosynthesis** (page 164)

3. List the two stages in the process of photosynthesis.

- a. Capturing the sun's energy
- b. Producing oxygen and sugars

4. Is the following sentence true or false? Besides the energy from sunlight, the cell needs water and carbon dioxide to make sugar. true

5. Circle the letter of each product of photosynthesis.

- a. water
- b. carbon dioxide
- c. oxygen
- d. sugars

6. Write the chemical equation for the process of photosynthesis.



7. What word does the arrow in the chemical equation stand for?

yields

8. Circle the letter of each raw material of photosynthesis.

- a. carbon dioxide
- b. glucose
- c. water
- d. oxygen

► **Storing and Releasing the Energy in Food** (page 165)

9. Circle the letter of each sentence that is true about the products of photosynthesis.

- a. Plant cells use the glucose for food.
- b. Some of the glucose is made into other compounds, such as cellulose.
- c. Most of the oxygen passes out of the plant.
- d. Most of the glucose passes out of the plant.

10. Is the following sentence true or false? Photosynthesis produces the carbon dioxide that most living things need to survive. false

11. Complete the following table about how living things use the sun's energy.

How Living Things Use Energy From the Sun		
Living Thing	Autotroph or Heterotroph?	Obtains Energy From the Sun Directly or Indirectly?
Plant	Autotroph	Directly
Caterpillar	Heterotroph	Indirectly
Bluebird	Heterotroph	Indirectly

12. How do cells get energy? Cells break down stored food to get energy.

► **What is Respiration?** (page 166)

13. What happens during respiration? Cells break down simple food molecules such as glucose and release the energy they contain.

14. Why do cells carry out respiration continuously? Because living things need an ongoing supply of energy

15. Is the following sentence true or false? Respiration that takes place inside of cells is the same as breathing air in and out of the lungs.

false

16. Write the chemical equation for the process of cellular respiration.



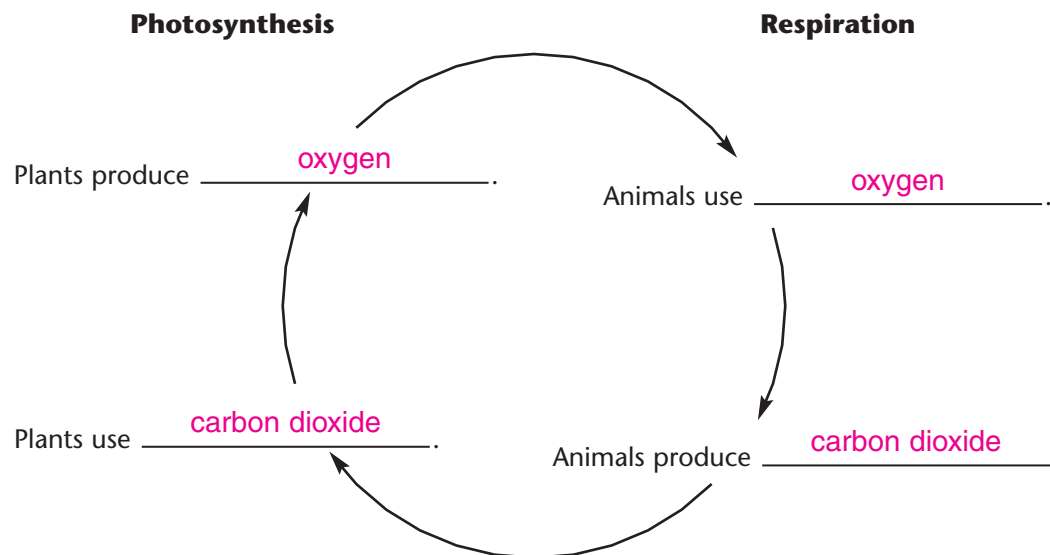
CHAPTER 5, Cell Processes and Energy *(continued)*

17. Use the table below to list the raw materials and products of respiration.

Respiration	
Raw Materials	Products
Glucose Oxygen	Carbon dioxide Water Energy

► **Comparing Photosynthesis and Respiration** (page 167)

18. Complete the cycle diagram below, which describes the relationship between photosynthesis and respiration. See Figure 9 on page 167.



19. Is the following sentence true or false? Together, photosynthesis and respiration form a cycle that keeps the levels of oxygen and carbon dioxide fairly constant in Earth’s atmosphere. true

► **Fermentation** (pages 167–168)

20. What is fermentation? Fermentation is an energy-releasing process that does not require oxygen.
21. Is the following sentence true or false? Fermentation releases more energy than respiration. false
22. List the two types of fermentation, and tell where each takes place.
- a. Alcoholic fermentation occurs in yeast.
 - b. Lactic-acid fermentation occurs in muscle cells in the body.
23. Is the following sentence true or false? Lactic acid fermentation takes place when cells use oxygen more slowly than it is replaced.
- false



Reading Skill Practice

Writing a summary can help you remember the important ideas of what you have read. Write a summary of the process of photosynthesis. Your summary should be much shorter than the text on which it is based. Do your work on a separate sheet of paper.

Summaries should be about one paragraph long. Check students' answers with the information given in the textbook on pages 163–165.

SECTION
5-3 **Cell Division**
(pages 170–177)

This section explains how cells grow and divide.

► **The Cell Cycle** (page 171)

1. The regular sequence of growth and division that cells undergo is called the cell cycle.

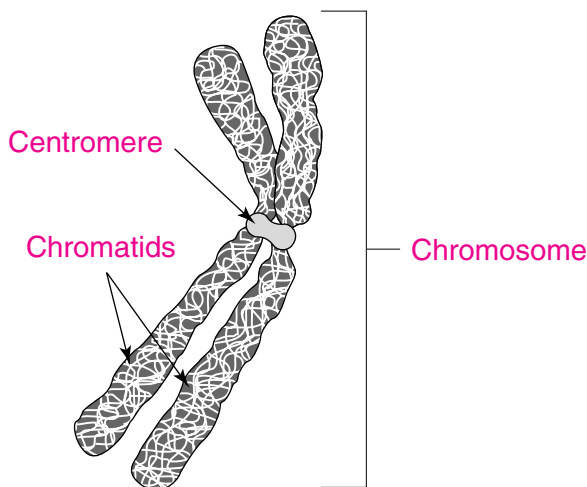
CHAPTER 5, Cell Processes and Energy (continued)

► Stage 1: Interphase (pages 171–172)

2. List three things that the cell is doing during interphase.
- a. Growing to its mature size
 - b. Making a copy of its DNA
 - c. Preparing to divide into two cells
3. Circle the letter of the process in which the cell copies its DNA.
- a. interphase
 - b. cell cycle
 - c.** replication
 - d. division

► Stage 2: Mitosis (page 172)

4. Circle the letter of each sentence that is true about mitosis.
- a. The cell makes a copy of its DNA.
 - b. The cell divides into two new cells.
 - c.** The cell's nucleus divides into two new nuclei.
 - d.** One copy of DNA is distributed into each daughter cell.
5. List the four phases of mitosis.
- a. prophase
 - b. metaphase
 - c. anaphase
 - d. telophase
6. Label the parts of the structure in the diagram below.



► **Stage 3: Cytokinesis** (page 173)

7. During cytokinesis, the cytoplasm divides and the organelles are divided between the two new cells.
8. Is the following sentence true or false? During cytokinesis in plant cells, the new cell membrane forms before the new cell wall does.
true

► **Length of the Cell Cycle** (pages 173–175)

9. Is the following sentence true or false? All cells have a cell cycle that lasts the same amount of time. false
10. Look at the circle graph in Figure 13 on page 173. How long is interphase in a human liver cell? 21 hours

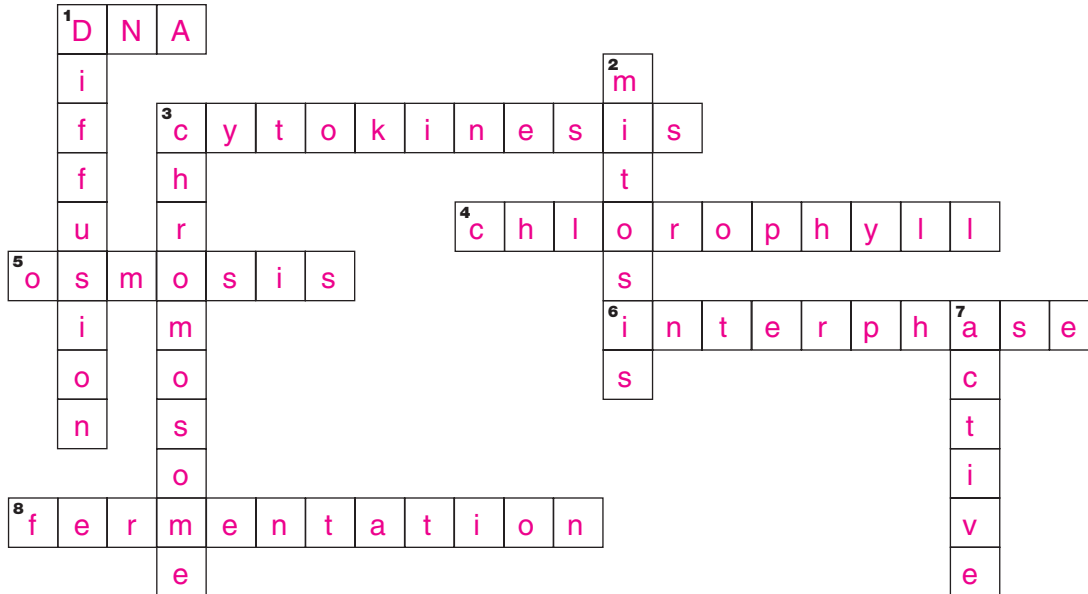
► **DNA Replication** (pages 176–177)

11. Why does a cell make a copy of its DNA before mitosis occurs?
DNA replication ensures that each daughter cell will have all of the genetic information it needs to carry out its activities.
12. Circle the letter of each molecule that makes up the sides of the DNA ladder.
 a. deoxyribose b. glucose c. phosphate d. nitrogen
13. Name the nitrogen bases that pair up to make up the rungs of the DNA ladder.
 a. Adenine pairs with thymine.
 b. Guanine pairs with cytosine.
14. Is the following sentence true or false? DNA replication begins when the two sides of the DNA molecule unwind and separate. true
15. At the end of replication, two new DNA molecules are formed.

CHAPTER 5, Cell Processes and Energy *(continued)*

WordWise

Answer the clues to solve the crossword puzzle.



Clues down

1. Process in which molecules move from an area of higher concentration to an area of lower concentration
2. The stage of the cell cycle in which the cell's nucleus divides
3. Condensed genetic material, or chromatin, that is double stranded
7. The movement of materials through a cell membrane using energy is _____ transport.

Clues across

1. Nucleic acid that is passed from parent to offspring
3. The final stage of the cell cycle in which the cytoplasm divides
4. A pigment found in chloroplasts
5. The diffusion of water through a selectively permeable membrane
6. The first stage of the cell cycle in which the cell prepares to divide
8. A process by which cells get energy from food without using oxygen

CHAPTER 6**FROM BACTERIA TO PLANTS****SECTION**
6-1 **Classifying Living Things**
(pages 184-189)

This section tells how scientists divide living things into groups. It also describes how scientists name living things.

► Why Do Scientists Classify Organisms? (pages 184-185)

1. The process of grouping things based on their similarities is classification.
2. Why do biologists use classification? Biologists organize living things into groups so that the organisms are easier to study.
3. The scientific study of how living things are classified is called taxonomy.
4. Is the following sentence true or false? Once an organism is classified, a scientist knows a lot about that organism. true

► The Classification System of Linnaeus (page 185)

5. Is the following sentence true or false? Linnaeus placed organisms into groups based on their features that he could observe. true
6. In Linnaeus's naming system, called binomial nomenclature, each organism is given a two-part name.
7. Is the following sentence true or false? A species is a classification grouping that contains similar, closely related organisms. false

CHAPTER 6, From Bacteria to Plants (continued)

8. In the scientific name for mountain lions, *Felis concolor*, which is the genus name and which is the species name?

Genus: *Felis* Species: *concolor*

9. Circle the letter of each sentence that is true about binomial nomenclature.

- a. An organism's name is its genus and a species name together.
- b. Genus and species names often are in Latin.
- c. The genus name begins with a small letter.
- d. Each species includes several genera.

► **Classification Today** (pages 186–187)

10. List three things biologists consider when they classify an organism.

- a. its structure
- b. how it develops
- c. its DNA

11. List the seven levels of classification used by modern biologists in order from the broadest level to the most specific level. kingdom, phylum,

class, order, family, genus, species

12. Is the following sentence true or false? The more classification levels that two organisms share, the more characteristics they have in common. true

13. Look carefully at Figure 2 on page 187. What order does the great horned owl belong to? It belongs to the order Strigiformes.

► **Six Kingdoms (pages 188–189)**

14. List the six kingdoms of living things.

- a. archaeobacteria
- b. eubacteria
- c. protists
- d. fungi
- e. plants
- f. animals

15. Complete the concept map to show how organisms are placed into kingdoms.



16. Is the following sentence true or false? All organisms in a kingdom share many characteristics and are very similar. false

17. Circle the letter of each sentence that is true about archaeobacteria.

- a. Archaeobacteria can be autotrophic, or able to make their own food.
- b. Archaeobacteria are prokaryotes.
- c. Archaeobacteria have a cell nucleus.
- d. Archaeobacteria do not have nucleic acids.

18. Eubacteria are unicellular prokaryotes.

19. Is the following sentence true or false? Eubacteria have a similar chemical makeup to archaeobacteria. false

20. Are eubacteria autotrophs or heterotrophs? Some eubacteria are autotrophs while others are heterotrophs.

CHAPTER 6, From Bacteria to Plants (continued)

21. Is the following sentence true or false? Protists can be either unicellular or multicellular. true

22. How do protists differ from archaeobacteria and eubacteria? Protists are eukaryotes—their cells contain nuclei.

23. Is the following sentence true or false? Mushrooms, molds, and yeast are all fungi. true

24. Circle the letter of each characteristic of fungi.

- a. eukaryotes b. prokaryotes
- c. autotrophs d. heterotrophs

25. What do most fungi feed on? Most feed on dead or decaying organisms.

26. Plants are autotrophs; they can make their own food.

27. Is the following true or false? All plants produce flowers.
false

28. Circle the letter of each characteristic of animals.

- a. unicellular b. heterotrophs
- c. eukaryotes d. autotrophs

29. Is the following sentence true or false? All animals are multicellular.
true

30. Is the following sentence true or false? At some point in their lives, most animals can move from one place to another.
true

SECTION **Bacteria**
6-2 (pages 190-193)

This section explains what bacteria are, their positive roles, and how they reproduce.

► **The Bacterial Cell** (pages 190-191)

1. Bacteria are prokaryotes. The genetic material in their cells is not contained in a nucleus.

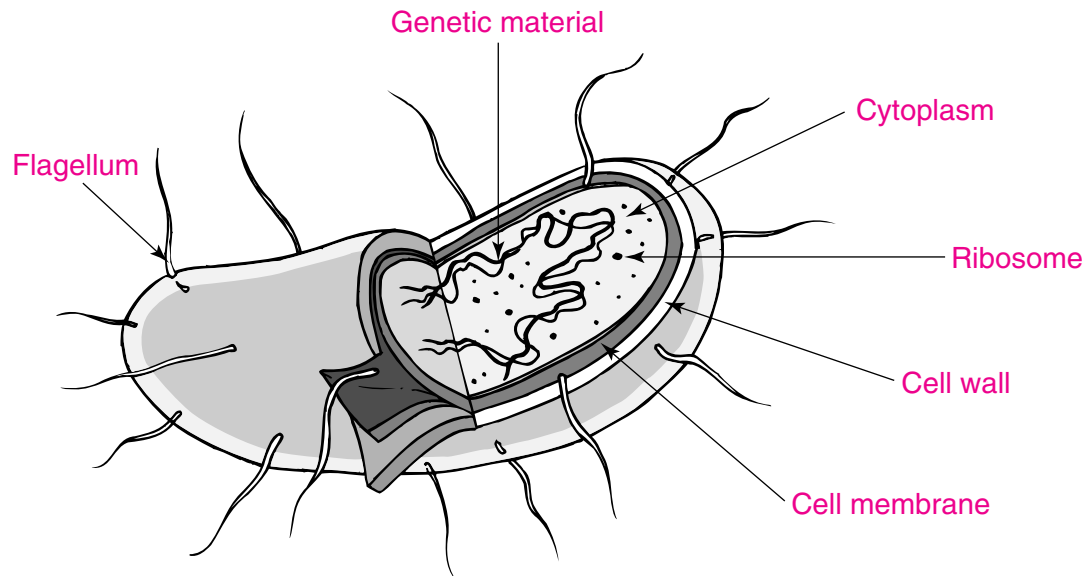
2. Is the following sentence true or false? Bacteria are living organisms because they use energy, grow, and respond to their surroundings.

true

3. What three shapes can bacterial cells have?

a. spherical b. rodlike c. spiral shaped

4. Label the parts of a bacterial cell in this diagram.



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5. Circle the letter of the cell structure that helps a cell to move.

a. cell wall b. cytoplasm c. ribosomes **d. flagellum**

6. Is the following sentence true or false? Air, water, and clothing can move

bacteria from one place to another. true

CHAPTER 6, From Bacteria to Plants (continued)

► **Energy Needs** (page 191)

7. List the two ways in which autotrophic bacteria make food.
- Capture and use the sun's energy _____
 - Use the energy from chemical substances in their environment _____
8. How do heterotrophic bacteria get food? Heterotrophic bacteria
consume autotrophs or other heterotrophs.
9. Is the following sentence true or false? All bacteria must use oxygen to break down food for energy. false

► **Reproduction** (page 192)

10. Complete the table below about reproduction in bacteria.

Reproduction in Bacteria		
	Asexual Reproduction	Sexual Reproduction
Name of Process	Binary fission	Conjugation
Number of Parents	One	Two
What Occurs in Process	The cell duplicates its genetic material. Then the cell divides into two separate cells.	One bacterium transfers some of its genetic material into another through a thin, threadlike bridge that joins the cells.
Result of Process	Two cells that contain the same genetic material	Bacteria that are genetically different from parents

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► **Survival Needs** (page 192)

11. When do bacteria form endospores? Bacteria form endospores when
conditions in the environment become unfavorable for growth.

► **Bacteria and The Living World** (page 193)

12. Circle the letter of each sentence that is true about bacteria.
- a. All bacteria are harmful and cause disease.
 - b.** Methane gas produced by archaeobacteria living millions of years ago helps to heat homes.
 - c.** Bacteria help produce foods such as buttermilk and cheese.
 - d.** Decomposers recycle Earth's matter.
13. Is the following sentence true or false? Bacteria are used to clean up oil spills and gasoline leaks. true



SECTION **Protists and Fungi**
6-3 (pages 196-203)

This section describes the characteristics of protists. This section also explains what fungi are and how they get food.

► **The Protist Kingdom** (pages 196-197)

1. Circle the letter of each sentence that is true about protists.
- a.** All protists are eukaryotes, organisms that have cells with nuclei.
 - b. All protists live in dry surroundings.
 - c. All protists are unicellular.
 - d.** Some protists are heterotrophs, some are autotrophs, and some are both.
2. List the three categories into which scientists group protists.
- a. animal-like protists
 - b. fungus-like protists
 - c. plantlike protists

► **Animal-like Protists** (pages 197-199)

3. Circle the letter of each characteristic that animal-like protists share with animals.
- a. autotroph **b.** heterotroph c. movement d. unicellular

CHAPTER 6, From Bacteria to Plants (continued)

- 4. Another name for an animal-like protist is protozoan.
- 5. Circle the letter of the cell part in an ameba that removes excess water.
a. pseudopod b. cilia
c. contractile vacuole d. cell membrane
- 6. Is the following sentence true or false? Paramecia have two nuclei.
true

Match the animal-like protist with the cell part it uses for movement.

Protist	Cell Part
<u>c</u> 7. ameba	a. cilia
<u>a</u> 8. paramecium	b. flagella
<u>b</u> 9. sporozoan	c. pseudopods

- 10. Animal-like protists called sporozoans are parasites that feed on the cells and body fluids of their hosts.

► Plantlike Protists (page 200)

- 11. Plantlike protists are commonly called algae.
- 12. The one characteristic that all algae share is that, like plants, they are autotrophs.
- 13. Why are algae important to other organisms? Algae that live on the surface of ponds, lakes, and oceans are an important source of food and oxygen.
- 14. How does a colony of algae differ from algae that are multicellular organisms? A colony contains few or no cells that are specialized to perform specific functions. A multicellular organism contains specialized cells.

► **Fungus-like Protists (page 201)**

15. Circle the letter of each sentence that is true about fungus-like protists.

- a. Like fungi, fungus-like protists are heterotrophs.
- b. Fungus-like protists do not have cell walls.
- c. Fungus-like protists use spores to reproduce.
- d. Fungus-like protists never move during their lives.

► **The Fungi Kingdom (page 201)**

16. Circle the letter before each sentence that is true about fungi.

- a. All fungi are multicellular organisms.
- b. Most fungi are eukaryotes.
- c. Most fungi use spores to reproduce.
- d. Most fungi are autotrophs.

17. What are three examples of fungi? Examples include cricket-killing fungus, bread mold, mushrooms, and yeast.

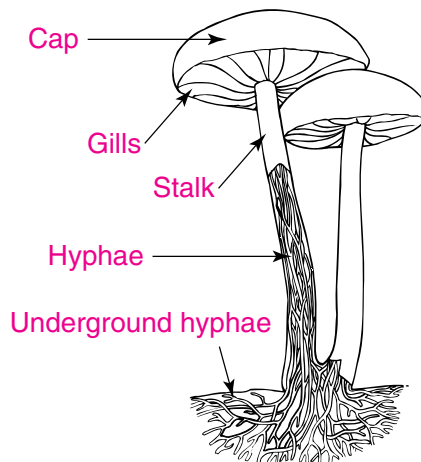
► **Cell Structure of Fungi (page 202)**

18. The cells of fungi are arranged in branching, threadlike tubes called hyphae.

19. Is the following sentence true or false? Fuzzy-looking molds that grow on food have hyphae that are packed tightly together.

false

20. Identify the structures of the mushroom shown here.



CHAPTER 6, From Bacteria to Plants *(continued)*

► How Do Fungi Obtain Food? (page 202)

21. Is the following sentence true or false? Some fungi are parasites.

 true

22. Describe the process by which a fungus feeds. Hyphae from the fungus
grow into a food source. Digestive chemicals ooze from the hyphae into the
food. The digestive chemicals break down the food so the hyphae can
absorb it.

► Reproduction in Fungi (page 203)

23. Fungi most often reproduce by spores.

24. Is the following sentence true or false? Fungi reproduce sexually only
when growing conditions become unfavorable. true



Reading Skill Practice

Concept maps are useful in organizing information. Make a concept map to show the characteristics of the four different types of animal-like protists. For more information about concept maps, see page 588 in the Skills Handbook of your textbook. Do your work on a separate sheet of paper.

Concept maps should include the name of each animal-like protist and include characteristics from pages 197–199.

SECTION The Plant Kingdom **6-4** (pages 204-211)

This section explains the features that all plants have. It also describes what plants need to survive and how they reproduce.

► What Is a Plant? (pages 205–208)

1. Circle the letter of each characteristic that all plants share.

- a. heterotroph **(b.)** autotroph c. prokaryote **(d.)** eukaryote

2. Some plants move water, minerals, and food with an internal system of tubelike structures called vascular tissue.

3. Is the following sentence true or false? Nonvascular plants can pass materials only from one cell to the next. true

4. Is the following sentence true or false? Nonvascular plants can become very large and tall because of their support system.
false

5. What role do leaves play in a plant? Leaves carry out photosynthesis.

6. Carbon dioxide enters a leaf through tiny pores called stomata, which control the movement of gases into and out of the leaf.

7. List two characteristics that ferns and club mosses share.

a. Have vascular tissue

b. Use spores to reproduce

8. Is the following sentence true or false? Gymnosperms have seeds that do not have a protective covering. true

9. A plant that produces seeds that are enclosed in a fruit is called a(n) angiosperm.

10. List two functions of roots.

a. Anchor plants in the ground

b. Absorb water and nutrients from the soil

11. List three functions of stems.

a. Carry substances between the leaves and roots

b. Support the plant

c. Hold up leaves to the sun

CHAPTER 6, From Bacteria to Plants *(continued)*

► **Reproduction** (pages 208–210)

12. The process in which a sperm unites with an egg is called

fertilization.

13. Circle the letter of the name of a fertilized egg.

a. spore

b. sperm

c. zygote

d. embryo

14. What is a seed? A seed is a plant structure that contains a young plant

inside a protective covering.

Match the part of the seed with its function.

Seed Part

Function

b

15. embryo

a. Keeps the seed from drying out

c

16. cotyledon

b. Young plant that develops from the fertilized egg

a

17. seed coat

c. A seed leaf that stores food

18. Is the following sentence true or false? Seeds can begin to grow in any place they land. false

19. What do seeds need to develop into a new plant? Seeds need light,

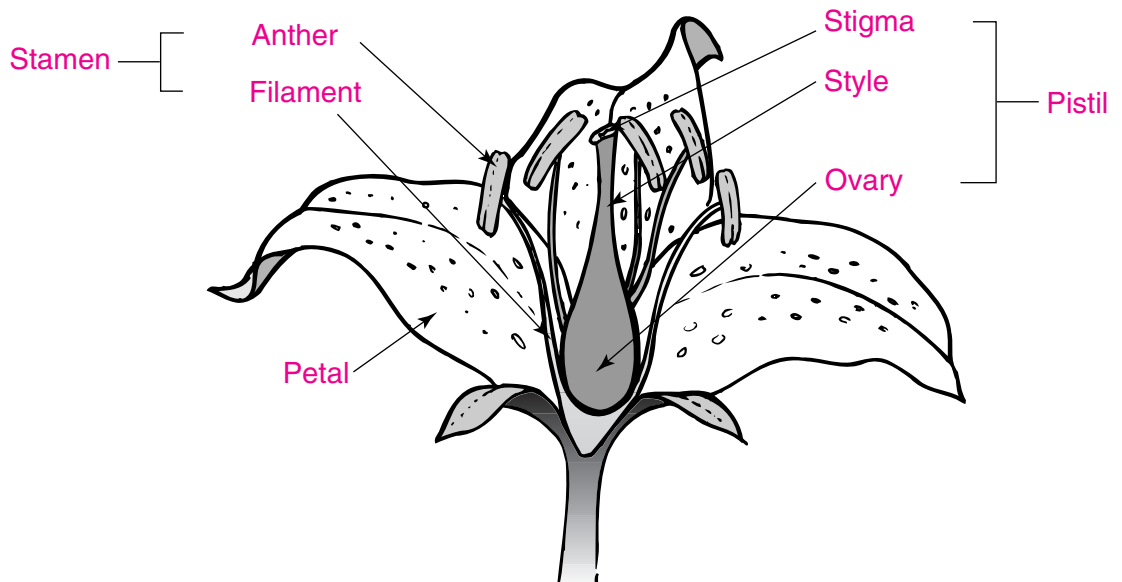
water, and nutrients.

20. Describe three ways seeds are dispersed. Wind carries some seeds.

Animals may eat seeds and deposit them elsewhere in wastes. Seeds may

stick to an animal's fur and be carried to a new place.

21. Most gymnosperms have reproductive structures called cones.
22. What is pollen? Pollen contains the microscopic cells that will later become sperm cells.
23. A structure that contains an egg cell is a(n) ovule.
24. Circle the letter of the reproductive structure of an angiosperm.
 a. seed **b.** flower c. petals d. sepals
25. Label the parts of the flower in this diagram.



► **Plant Responses and Growth** (pages 210–211)

26. What is a tropism? A tropism is a plant's growth response toward or away from a stimulus.
27. Circle the letter of each stimulus to which plants respond.
a. touch **b.** light c. food **d.** gravity
28. A chemical that affects how a plant grows and develops is a(n) hormone.
29. How long is the life cycle of a perennial? A perennial usually lives for more than two years.

CHAPTER 6, From Bacteria to Plants (continued)

WordWise

Match each definition on the left with the correct term on the right. Then write the number of each term in the appropriate box below. When you have filled in all the boxes, add up the numbers in each column, row, and two diagonals. The sums should be the same.

- | | |
|--|--|
| <p>A. Branching, threadlike tubes that make up fungi</p> <p>B. Animal-like protists</p> <p>C. A small, thick walled resting cell inside a bacterial cell</p> <p>D. Fertilized egg</p> <p>E. A group of similar organisms that can mate and produce fertile offspring</p> <p>F. Scientific study of how living things are classified</p> <p>G. Process by which one cell divides to form two identical cells</p> <p>H. A plant's growth toward or away from a stimulus</p> <p>I. Tiny pores in leaves</p> | <p>1. protozoans</p> <p>2. binary fission</p> <p>3. taxonomy</p> <p>4. stomata</p> <p>5. species</p> <p>6. hyphae</p> <p>7. zygote</p> <p>8. endospore</p> <p>9. tropism</p> |
|--|--|

A <u>6</u>	B <u>1</u>	C <u>8</u>		= <u>15</u>
D <u>7</u>	E <u>5</u>	F <u>3</u>	=	<u>15</u>
G <u>2</u>	H <u>9</u>	I <u>4</u>	=	<u>15</u>
=	=	=	=	<u>15</u>
<u>15</u>	<u>15</u>	<u>15</u>		

CHAPTER 7

ANIMALS

SECTION **What Is an Animal?**
7-1 (pages 218-220)

This section explains the characteristics of animals and how biologists classify animals into groups. It also describes some animal adaptations.

► **Characteristics of Animals** (page 218)

1. List four characteristics of animals.
 - a. Many-celled organism
 - b. Heterotrophs
 - c. Most reproduce sexually
 - d. Can move from place to place
2. Animals get water, food, and oxygen from their environment.
3. Is the following sentence true or false? An animal responds to stimuli in its environment. true

► **How Animals Reproduce** (page 219)

4. What is sexual reproduction? Sexual reproduction is the process by which sperm and egg unite, producing a new individual.
5. Is the following sentence true or false? A hydra reproduces sexually by forming buds that break off to form new hydras. false

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CHAPTER 7, Animals (continued)

► **Structure and Function in Animals** (pages 219–220)

6. What is an adaptation? An adaptation is a characteristic that helps an organism survive in its environment or reproduce.

Match the type of animal with what it eats.

Type of Animal	What It Eats
<u>c</u> 7. herbivore	a. both plants and animals
<u>b</u> 8. carnivore	b. other animals
<u>a</u> 9. omnivore	c. plants only

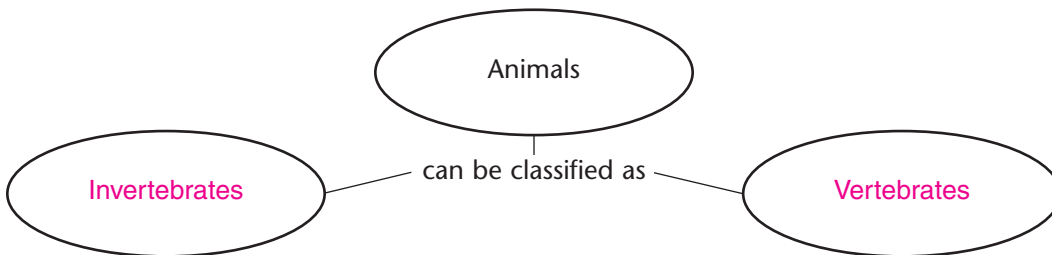
10. Carnivores that hunt and kill other animals are called predators. The animals that these carnivores capture and feed upon are called prey.

11. Is the following sentence true or false? The bristly tongue of a bee is an adaptation for protection. false

► **Classification of Animals** (page 220)

12. Biologists classify animals in the animal kingdom into about 35 major groups, called phyla.

13. Complete the concept map.



14. Is the following sentence true or false? Most animal species are vertebrates. false

15. Circle the letter of the animal that is a vertebrate.

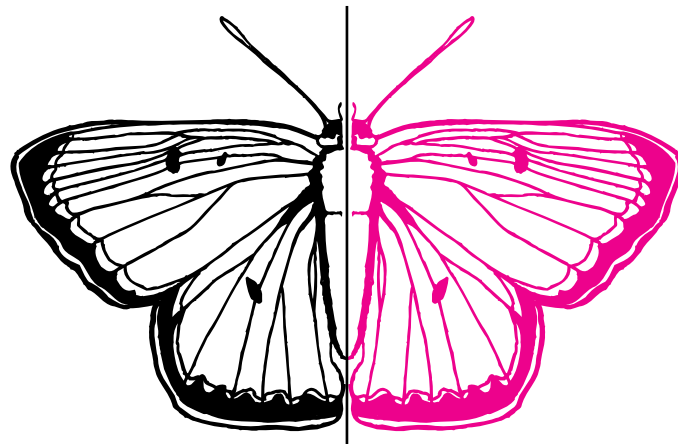
- a.** bird **b.** jellyfish **c.** spider **d.** crab

SECTION
7-2 **Symmetry**
(pages 221-222)

This section explains the balanced arrangement of animal bodies.

► **Introduction** (page 221)

1. The balanced arrangement of the body of a complex animal is called symmetry.
2. Is the following sentence true or false? The bodies of complex animals all have either radial or bilateral symmetry. true
3. Complete the drawing of the butterfly's body on the other side of the line of symmetry.



4. Because the butterfly can be divided into two halves that are mirror images of each other, it has bilateral symmetry.
5. Objects with many lines of symmetry that all go through a central point have radial symmetry.

► **Animals With Radial Symmetry** (page 222)

6. Circle the letter of each object that has radial symmetry.
 a. oak leaf **(b.)** sea anemone c. pair of eyeglasses **(d.)** bicycle wheel

CHAPTER 7, Animals (continued)

► Animals With Bilateral Symmetry (pages 222)

7. Circle the letter of each sentence that is true about animals with bilateral symmetry.

- a. Human bodies have bilateral symmetry.
- b. Radially symmetrical animals have distinct front and back ends.
- c. Bilateral symmetry allows animals to move quickly and efficiently.
- d. Most bilaterally symmetrical animals have sense organs in their back ends.

SECTION 7-3 Sponges, Cnidarians, Worms, and Mollusks (pages 223-228)

This section describes the characteristics of sponges and cnidarians. It also tells about the characteristics of the major groups of worms and mollusks.

► Characteristics of Sponges (pages 223-224)

1. Describe the body of a sponge. The body of a sponge is something like a bag that is pierced all over with openings called pores.

2. Circle the letter of each sentence that is true about sponges.

- a. Sponges remove bacteria and protists from the water that enters them.
- b. Pores in the sponge's body trap food particles and digest them.
- c. A sponge gets oxygen from water.
- d. Water that leaves a sponge carries waste material away.

► Cnidarians (page 224)

3. What are cnidarians? Cnidarians are soft-bodied, radially symmetrical invertebrates that have long, wavy tentacles arranged around an opening called a mouth.

4. How does a cnidarian capture prey? A cnidarian captures prey by using its stinging cells to inject venom to paralyze prey. Then its tentacles pull the prey to its mouth.

5. Is the following sentence true or false? A cnidarian's nerve net helps the animal to respond quickly to external stimuli. true

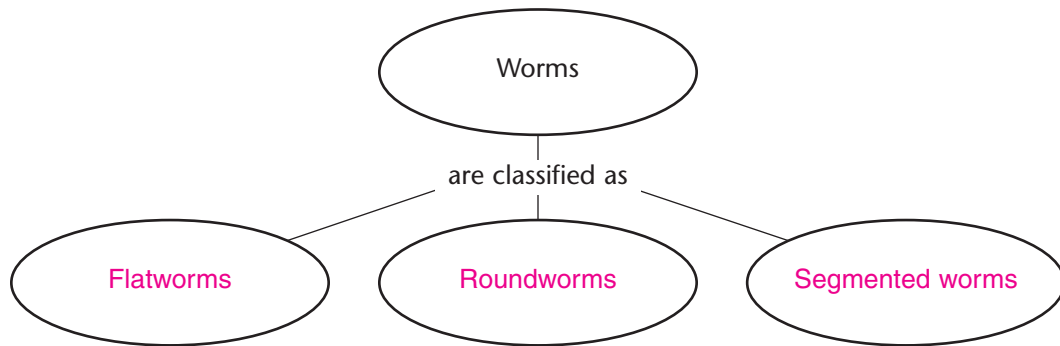
► **Worms (page 225)**

6. List five characteristics shared by all worms.

- a. Invertebrates
- b. Bilateral symmetry
- c. Long, narrow bodies without legs
- d. Tissues, organs, and organ systems
- e. Have head and tail ends

► **Flatworms (page 225)**

7. Complete the concept map to show the three major groups of worms.



8. The characteristics that distinguishes flatworms from other worms are their flat bodies.

► **Roundworms (pages 225–226)**

9. Is the following sentence true or false? Unlike flatworms, roundworms have a digestive tract that is like a tube, open at both ends.
true

CHAPTER 7, Animals (continued)

► Segmented Worms (page 226)

10. Earthworms have bodies made up of many linked sections called segments.
11. Earthworms have a digestive system with two opening(s).
12. What is the advantage of a closed circulatory system? A closed circulatory system moves the blood around an animal's body more quickly.

► What Are Mollusks? (pages 227–228)

13. Circle the letter of each characteristic of a mollusk.
- a. vertebrate b. invertebrate
 - c. segmented body d. unsegmented body
14. Give the function of each of the following parts of a mollusk.
- hard outer shell: Protects the soft body
- mantle: Covers the internal organs and produces the shell
- foot: Adapted for crawling, digging, or catching prey

Match the body part with its function.

Body Part	Function
<u> a </u> 15. gills	a. Organs that remove oxygen from water
<u> c </u> 16. cilia	b. A flexible ribbon of tiny teeth that scrapes food from a surface
<u> b </u> 17. radula	c. Tiny, hairlike structures that move water over the gills



Reading Skill Practice

By looking carefully at illustrations, you can help yourself understand what you have read. Look at Figure 8 on page 226. What does this illustration show?

The diagram shows that an earthworm has a segmented body with many organs.

SECTION**7-4****Arthropods and Echinoderms**

(pages 230-236)

This section describes the characteristics of arthropods, and tells about the major groups of arthropods. It also describes spiny-skinned animals called echinoderms.

► The Arthropod Phylum (pages 230-231)

1. What are the characteristics of an arthropod? An arthropod is a bilaterally symmetrical invertebrate that has an external skeleton, a segmented body, and jointed attachments called appendages.
2. What happens to the exoskeleton when an arthropod grows? The arthropod sheds its exoskeleton in a process called molting.
3. Look at the table in Figure 6 on page 231. Crustaceans have two pairs of antennae. Arachnids have two body segments. Insects have three pairs of legs.
4. Is the following sentence true or false? Joints in their appendages give arthropods flexibility and the ability to move. true

► Insects (page 232)

5. What is an insect? Insects are arthropods with three body sections, six legs, one pair of antennae, and usually one or two pairs of wings.
6. Circle the letter of the body segment to which wings and legs are attached.
a. head **b.** thorax c. abdomen d. exoskeleton
7. In complete metamorphosis, the larva stage is followed by the pupa stage.
8. In gradual metamorphosis, the egg hatches into a(n) nymph, which looks much like a small adult.

CHAPTER 7, Animals (continued)

► **Crustaceans** (page 234)

9. What is a crustacean? A crustacean is an arthropod that has two or three body sections and usually has three pairs of appendages for chewing.
-
10. Is the following sentence true or false? Very few watery environments are home to crustaceans. false

► **Arachnids** (page 234)

11. An arthropod with only two body sections is a(n) arachnid.
12. Circle the letter of each characteristic of arachnids.
- a. Abdomen with reproductive organs and digestive tract
 - b. Eight legs
 - c. Four antennae
 - d. Book lungs
13. Circle the letter of each sentence that is true about spiders.
- a. All spiders are herbivores.
 - b. All spiders build webs.
 - c. Spiders have hollow fangs that inject venom into prey.
 - d. Spiders have an exoskeleton.

► **Centipedes and Millipedes** (page 235)

Match the arthropod with its characteristics. Each kind of arthropod may be used more than once.

Characteristics	Arthropods
<u> b </u> 14. Two pairs of legs on each segment	a. centipede
<u> a </u> 15. One pair of legs on each segment	b. millipede
<u> a </u> 16. Predators with sharp jaws	
<u> b </u> 17. Herbivores	

► **The Echinoderm Phylum** (pages 235–236)

18. What is an echinoderm? An echinoderm is a radially symmetrical invertebrate that lives on the ocean floor.
19. The skin of most echinoderms is supported by a spiny internal skeleton, called a(n) endoskeleton.
20. What is a water vascular system? The water vascular system is made up of fluid-filled tubes inside the echinoderm's body.

.....

SECTION **Fishes, Amphibians, and Reptiles**
7-5 (pages 237-245)

This section describes animals with backbones and identifies the characteristics of fishes, amphibians, and reptiles.

► **Vertebrates** (pages 237–238)

1. The backbone is formed by many similar bones, called vertebrae, which are lined up in a row.
2. A vertebrate's backbone is part of a(n) endoskeleton, or internal skeleton.
3. List the functions of the endoskeleton.
- a. Support and protect the body
 - b. Give the body its shape
 - c. Give muscles a place to attach

► **Regulating Body Temperature** (page 238)

4. What is an ectotherm? An ectotherm is an animal whose body temperature is close to that of its environment.
5. Is the following sentence true or false? Ectotherms can live in a greater variety of environments than endotherms can. false

CHAPTER 7, Animals (continued)

► **Characteristics of Fishes** (pages 238–239)

6. What is a fish? A fish is an ectothermic vertebrate that lives in the water and has fins.
7. Circle the letter of each characteristic of fishes.
 a. gills b. feathers
 c. scales d. hair
8. Fishes obtain oxygen from water.
9. Is the following sentence true or false? In a fish’s circulatory system, blood flows through two loops. false

► **Kinds of Fishes** (pages 239–240)

10. List the three groups of fishes.
 a. jawless fishes
 b. cartilaginous fishes
 c. bony fishes
11. The skeletons of cartilaginous fishes are made of cartilage.
12. Circle the letter of each characteristic of cartilaginous fishes.
 a. jaws b. fins c. scales d. bones

Match the parts of bony fishes with their functions. See *Exploring a Bony Fish* on page 240.

Part	Function
<u> d </u> 13. gill cover	a. Helps stabilize the fish at different levels in the water
<u> b </u> 14. scales	b. Cover the body by overlapping each other
<u> c </u> 15. lateral line	c. Sense organ that picks up vibrations and pressure changes in water
<u> a </u> 16. swim bladder	d. A flexible flap that opens to release water from the gills

► **Amphibians** (pages 241–242)

17. What is an amphibian? An amphibian is an ectothermic vertebrate that spends its early life in water and its adult life on land.
18. Describe the path blood takes in the circulatory system of an adult amphibian. Blood from the heart moves to the lungs, then returns to the heart. Then blood pumps from the heart to the rest of the body and returns back to the heart.
19. Circle the letter of the two upper chambers of the heart that receive blood.
a. ventricles **b.**atria c. vessels d. lungs

► **Kinds of Amphibians** (page 242)

20. Is the following sentence true or false? A land animal must have a strong skeleton to support the body against the pull of gravity.
true
21. How are frogs and toads adapted for hopping and leaping? Frogs and toads have powerful hind-leg muscles and a skeleton that can absorb the shock of landing.
22. Amphibians with long, slender bodies that keep their tails as adults are called salamanders.

► **Reptiles** (pages 243–244)

23. What is a reptile? A reptile is an ectothermic vertebrate that has lungs and scaly skin.
24. What are two functions of a reptile's scaly skin? It helps protect the reptile and keeps water in the body.
25. How do the kidneys keep reptiles from losing water? The kidneys concentrate the urine so that they lose very little water.

CHAPTER 7, Animals (continued)

► Kinds of Reptiles (pages 244–245)

26. Reptiles with slender bodies and four legs with claws are _____
_____ **lizards** _____.
27. Is the following sentence true or false? A snake can swallow prey that is larger in diameter than the snake itself. _____ **true** _____
28. What is a turtle? _____ **A turtle is a reptile whose body is covered by a protective shell.** _____
29. Is the following sentence true or false? All turtles can pull their head, legs, and tail inside their shell. _____ **false** _____

SECTION **Birds and Mammals** **7-6** (pages 247–255)

This section tells about the characteristics of birds and how they care for their young. It also describes the characteristics of mammals.

► What Is a Bird? (pages 247–248)

1. List six characteristics of birds.
- | | |
|---|------------------------------|
| a. Endothermic vertebrate _____ | b. Feathers _____ |
| c. Four-chambered heart _____ | d. Lay eggs _____ |
| e. Scales on feet and legs _____ | f. Most can fly _____ |
2. Circle the letter of each adaptation that enables birds to fly.
a. feathers **b.** hollow bones c. scales **d.** large chest muscles

► Eating Like a Bird (page 248)

3. Why do birds need a lot of energy? _____ **They need energy to maintain their body temperature and to power the muscles used in flight.** _____

4. Circle the letter of each sentence that is true about birds.
- a. Birds have teeth.
 - b.** Each bird species has a bill shaped to help it feed.
 - c.** The crop stores food in the body after the bird swallows it.
 - d. Chemicals break down food in the gizzard.

► **Delivering Oxygen to Cells** (pages 248–249)

5. Cells must have enough oxygen to release the energy from food.
6. What is the function of air sacs? Air sacs, attached to the lungs, enable birds to get much more oxygen from each breath of air than other animals can.
7. What is the advantage of a four-chambered heart? There is no mixing of oxygen-rich and oxygen-poor blood, so blood arriving in the body tissues has plenty of oxygen.

► **Quick Response to Stimuli** (page 250)

8. Circle the letter of each sentence that is true about the nervous system.
- a.** Birds have very quick reactions.
 - b. Birds cannot see well.
 - c. Birds have a poorly developed brain.
 - d.** Birds have well developed ears.

► **Reproducing and Caring for Young** (page 250)

9. Circle the letter of a characteristic of bird eggs.
- a. soft shell b. leathery shell **c.** hard shell d. no shell
10. How do birds keep their eggs warm so that they will develop? A parent bird usually sits on the eggs to keep them warm.
11. How long do parent birds care for their young? Most parent birds feed and protect their young until they are able to fly.

CHAPTER 7, Animals *(continued)*

► **Why Birds Are Important** (page 250)

12. Is the following sentence true or false? Birds help pollinate flowers and carry seeds to new places. true
13. How do predator birds help people? Predator birds eat many pest animals, such as rats, mice, and insect pests.

► **What is a Mammal?** (page 251)

14. Circle the letter of each characteristic of mammals.

- a. endothermic vertebrate b. feathers
 c. three-chambered heart d. teeth

► **Fur and Hair** (page 251)

15. Is the following sentence true or false? All mammals have fur or hair at some point in their lives. true
16. How do fur and hair help mammals? Fur and hair prevent body heat from escaping and help maintain a stable body temperature in cold weather.

► **Structure and Function of Teeth** (page 252)

Match the type of teeth with their function.

Teeth	Function
<u> b </u> 17. canines	a. Bite off and cut parts of food
<u> c </u> 18. molars	b. Stab food and tear it
<u> a </u> 19. incisors	c. Grind and shred food into tiny bits

► **Breathing** (page 252)

20. Is the following sentence true or false? All mammals, except whales, breathe with lungs. false

► **Nervous System and Senses (page 252)**

21. Circle the letter of each sentence that is true about mammals' nervous system.

- a. The brain helps mammals learn, remember, and behave in complex ways.
- b. Squirrels cannot remember what they have learned.
- c. The senses of mammals are adapted for the ways that individual species live.
- d. All mammals can see in color.

► **Reproduction (page 253)**

22. Is the following sentence true or false? Some mammals lay eggs.

 true

23. All mammals feed their young with milk produced in mammary glands .

► **Monotremes (page 254)**

24. What are monotremes? Monotremes are mammals that lay eggs.

► **Marsupials (page 254)**

25. What are marsupials? Marsupials are mammals whose young are born
 alive, but at an early age of development, and they usually continue to
 develop in a pouch on their mother's body.

26. Marsupials have a short gestation period , the length of time between fertilization and birth.

► **Placental Mammals (page 255)**

27. What is a placental mammal? A placental mammal develops inside its
 mother's body until its body systems can function independently.

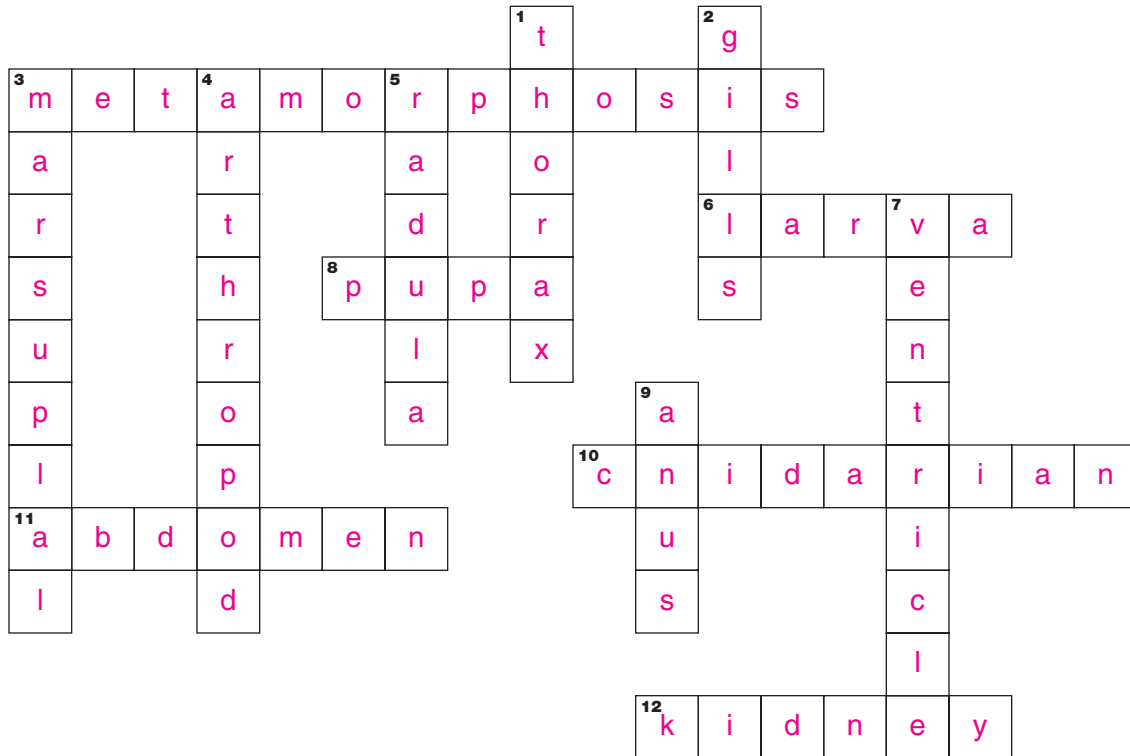
28. Circle the letter of each item that passes from the mother to her young through the placenta.

- a. wastes b. water c. food d. oxygen

CHAPTER 7, Animals (continued)

Word Wise

Complete the crossword puzzle by using the clues below.



Clues down

1. Midsection of an insect, to which the wings and legs are attached
2. Structures that remove oxygen from water
3. Mammal whose young are born at an early stage of development and complete development in the mother's pouch
4. Invertebrate with an exoskeleton and jointed appendages
5. Mollusk's flexible ribbon of teeth
7. Lower chamber of a vertebrate's heart
9. Opening in the digestive tract through which wastes leave the body

Clues across

3. Process in which an animal's body undergoes dramatic changes in form
6. Immature form of an animal that looks very different from the adult
8. Stage in which an insect gradually changes into the adult form
10. Carnivores that use stinging cells to capture their prey
11. Section of an insect's body that contains many of the internal organs
12. Organs of the excretory system

CHAPTER 8**ECOSYSTEMS****SECTION**
8-1 **Components of an Ecosystem**
(pages 266-271)

This section describes what organisms need and how their environments provide for their needs. The section also describes how organisms live together in populations and communities.

► Introduction (pages 266-267)

1. All the living and nonliving things that interact in a particular area make up a(n) ecosystem.

► Habitats (page 267)

2. The place where an organism lives and that provides the things the organism needs is called its habitat.
3. What needs of an organism are provided by its habitat? Needs include food, water, and shelter.
4. Is the following sentence true or false? Each ecosystem contains one habitat. false

► Biotic Factors (page 267)

5. Circle the letter of each choice that is a biotic factor in a prairie dog ecosystem.
 - a. Grass and other plants that the prairie dog eats
 - b. Hawks, ferrets, and other animals that hunt the prairie dog
 - c. The soil that provides the prairie dog with a home
 - d. Worms, fungi, and bacteria that also live in the soil

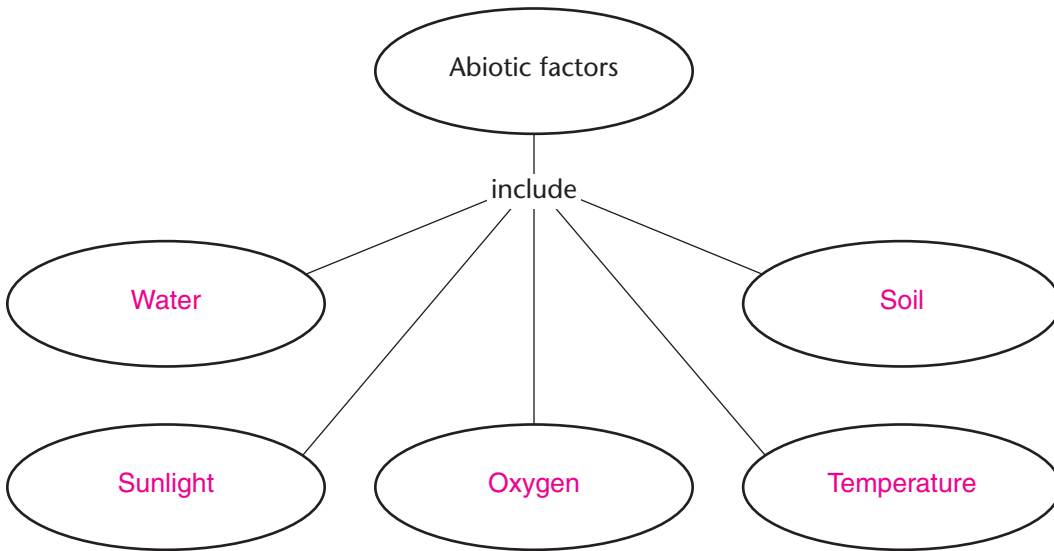
CHAPTER 8, Ecosystems (continued)

6. The living parts of an ecosystem are called biotic factors.

► Abiotic Factors (pages 268–269)

7. The nonliving parts of an ecosystem are called abiotic factors.

8. Complete the concept map.



9. Circle the letter of each sentence that is true about water.

- a. It is needed by all living things.
- b. It makes up 20 percent of the air.
- c. It is needed by algae and plants to make food.
- d. It is an abiotic factor only for organisms that actually live in the water.

► Structure and Function in Populations (page 269)

10. What is a population? A population is all the members of one species in a particular area.

11. Circle the letter of each choice that is an example of a population.

- a. All the prairie dogs in a prairie dog town
- b. All the daisies in a field
- c. All the bull frogs in a pond
- d. All the trees in a forest

12. Is the following sentence true or false? All populations live in the same-sized area. false

13. What is a society? A society is a closely related population of animals that work together for the benefit of the whole group.

► **Communities** (page 270)

14. All the different populations that live together in an area make up a(n) community.

15. Circle the letter of the choice that lists the levels of organization in an ecosystem from the smallest unit of organization to the largest.

a. Population, organism, community, ecosystem

b. Organism, population, ecosystem, community

c. Organism, community, population, ecosystem

d. Organism, population, community, ecosystem

16. In addition to a community of different species, what else does an ecosystem include? An ecosystem also includes abiotic factors.

17. Is the following sentence true or false? To be considered a community, populations must live close enough together to interact. true

► **What Is Ecology?** (pages 270–271)

18. What is ecology? Ecology is the study of how living things interact with each other and with their environment.

19. Scientists who study how living things interact with each other and with their environment are called ecologists.

20. Is the following sentence true or false? In an ecosystem, responses to changes in the environment always take place quickly.

false

CHAPTER 8, Ecosystems (continued)

SECTION
8-2 **Studying Populations**
(pages 273-278)

This section describes how scientists study population density, size, and growth. The section also explains how factors such as food, space, and weather limit how large populations can become.

► **Population Density** (page 273)

1. Is the following sentence true or false? Population density is the number of individuals in a specific area. true

2. Write the equation you would use to find population density.

Population density = $\frac{\text{Number of individuals}}{\text{Unit area}}$

► **Determining Population Size** (pages 274-275)

Match the type of study with its example.

Type of Study	Example
<u> b </u> 3. direct observation	a. Counting the number of nesting sites in an area
<u> a </u> 4. indirect observation	b. Counting all the bald eagles that live along a river
<u> d </u> 5. sampling	c. Counting hawks with and without bands on their legs
<u> c </u> 6. mark-and-recapture study	d. Counting the number of red maples in a small area to estimate the number in the entire forest

► **Changes in Population Size** (pages 275-276)

7. How can populations change in size? Populations can change in size
when new members enter the population or when members leave the
population.

8. What is the major way in which new individuals are added to a population? The major way new individuals are added is through the birth of offspring.
9. The number of births in a population in a certain amount of time is the birth rate.
10. What is the major way that individuals leave a population? The major way individuals leave is by dying.
11. The number of deaths in a population in a certain amount of time is the death rate.
12. Is the following sentence true or false? If the birth rate is greater than the death rate, population size decreases. false

Match the term with its definition

Term	Definition
<u> b </u> 13. immigration	a. Leaving a population
<u> a </u> 14. emigration	b. Moving into a population

► **Limiting Factors (pages 277–278)**

15. An environmental factor that prevents a population from increasing is called a(n) limiting factor.
16. What are some limiting factors for populations? Some limiting factors are food, space, and weather conditions.
17. The largest population that an environment can support is called its carrying capacity.
18. Is the following sentence true or false? Space is often a limiting factor for plants. true

CHAPTER 8, Ecosystems (continued)



Reading Skill Practice

(pages 273-278)

Outlining is a way to help yourself understand what you have read. Write an outline of this section on studying populations. In the outline, copy the headings in the textbook. Under each heading, write the main idea and list the details that support the main idea.

Outlines should be organized under the headings *Population Density*, *Determining Population Size*, *Changes in Population Size*, and *Limiting Factors* and include information from pages 271-278

SECTION Energy in a Ecosystem

8-3 (pages 280-286)

This section explains the source of energy for ecosystems and describes how energy and matter interact in ecosystems.

► An Ecosystem's Energy Source (pages 280-281)

1. Energy enters most ecosystems from sunlight.
2. Where do heterotrophs such as cattle get energy? From the stored energy in plants

► Energy Roles in Ecosystems (pages 281-282)

Match the three energy roles with their definitions.

Energy Roles	Definitions
<u>c</u> 3. producers	a. Obtain food and energy by eating other organisms
<u>a</u> 4. consumers	b. Obtain energy by breaking down wastes and remains of other organisms
<u>b</u> 5. decomposers	c. Produce food and store energy

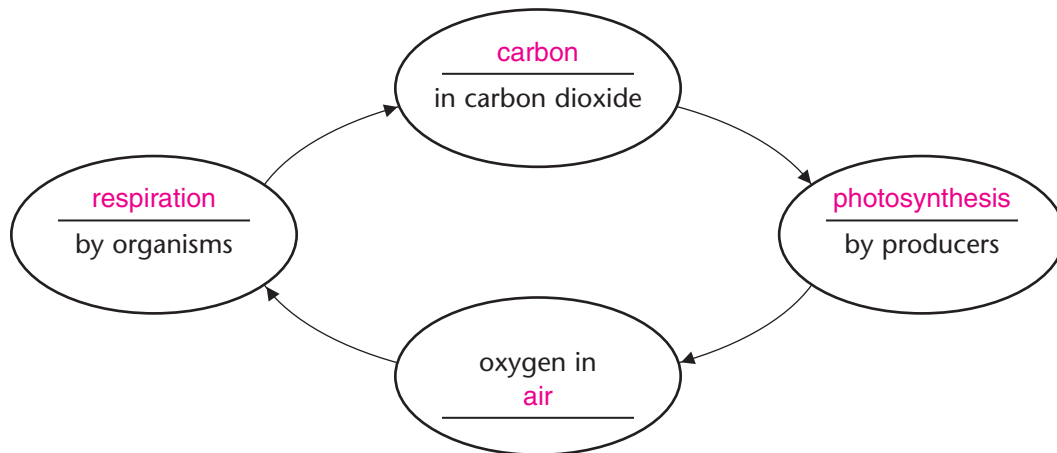
► Energy Flow in Food Chains and Food Webs (pages 282-284)

6. What is a food chain? A food chain is a diagram that shows the flow of energy from organism to organism.

7. Is the following sentence true or false? In general, energy flows from decomposers, to consumers, to producers in an ecosystem. false
8. A diagram that shows how many food chains are connected is called a(n) food web.

► **Cycles in Ecosystems (pages 284–285)**

9. What are three cycles in which matter and energy interact in ecosystems? Water cycle, carbon and oxygen cycles, nitrogen cycle
10. Complete the cycle diagram that shows the carbon and oxygen cycles.



11. Is the following sentence true or false? Most organisms cannot use the “free” nitrogen in air. true
12. What is nitrogen fixation? Nitrogen fixation is the process of combining free nitrogen with other elements.

► **The Decay of Biomass (page 286)**

13. The total amount of living matter, and the remains of dead organisms in an area, is the area's biomass.
14. What are the two results of the decay of biomass?
- a. It produces matter in the form of small molecules.
- b. It releases the energy stored in the chemical compounds in the biomass.

CHAPTER 8, Ecosystems (continued)

WordWise

Match each definition in the left column with the correct term in the right column. Then write the number of each term in the appropriate box below. When you have filled all the boxes, add up the numbers in each column, row, and two diagonals. All the sums should be the same.

Definitions

- A. All the living and nonliving things that interact in a particular area
- B. Leaving a population
- C. All the members of one species in a particular area
- D. Total amount of living matter and the remains of dead organisms in an area
- E. Number of births in a population in a certain amount of time
- F. Diagram that shows how many food chains are connected
- G. Place where an organism lives
- H. Organisms that produce food and store energy
- I. Moving into a population

Terms

- 1. emigration
- 2. habitat
- 3. food web
- 4. immigration
- 5. birth rate
- 6. ecosystem
- 7. biomass
- 8. population
- 9. producers

A <u>6</u>	B <u>1</u>	C <u>8</u>	= <u>15</u>
D <u>7</u>	E <u>5</u>	F <u>3</u>	= <u>15</u>
G <u>2</u>	H <u>9</u>	I <u>4</u>	= <u>15</u>
= <u>15</u>	= <u>15</u>	= <u>15</u>	= <u>15</u>

CHAPTER 9**ENERGY RESOURCES****SECTION**
9-1 **Energy and Fossil Fuels**
(pages 292-298)

This section explains how fuels provide energy. The section also explains what fossil fuels are and compares and contrasts the different types of fossil fuels.

► Energy Transformation (page 292)

1. A change from one form of energy to another is called a(n) energy transformation, or energy conversion.
2. Is the following sentence true or false? Any form of energy can be converted to another form. true

► Fuels and Energy (page 293)

3. A substance that provides a form of energy, such as heat, as a result of a chemical change, is a(n) fuel.
4. The process of burning a fuel is called combustion.
5. Circle the letter of each sentence that is true about the production of electric power.
 - a. In most power plants, water is boiled to make steam.
 - b. The chemical energy of steam turns the blades of a turbine.
 - c. Powerful magnets turn inside a wire coil, generating electric current.
 - d. Electricity is produced by a turbine.

► Energy Transformations in the Home (page 294)

6. Some hot water heaters convert electrical energy into thermal energy

CHAPTER 9, Energy Resources (continued)

7. In a refrigerator, a(n) refrigerant, is pumped through the walls, where it absorbs thermal energy.

► **What Are Fossil Fuels?** (page 295)

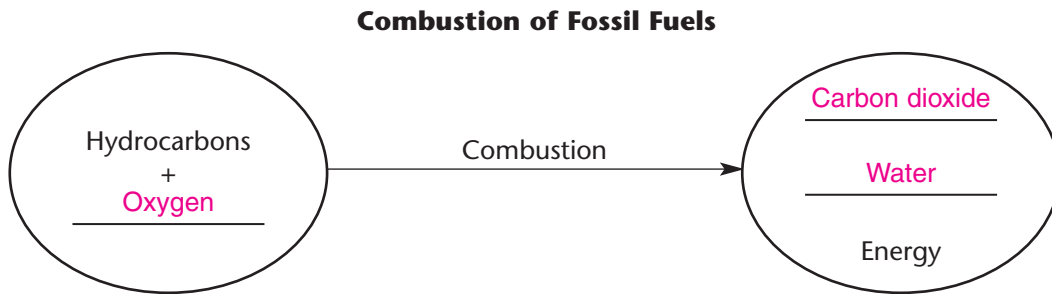
8. Energy-rich substances formed from the remains of once-living organisms are called fossil fuels.

9. List the three major fossil fuels.

- a. coal b. oil c. natural gas

10. Energy-rich chemical compounds that contain carbon and hydrogen atoms are called hydrocarbons.

11. Complete the flow chart.



12. Circle the letter of each sentence that is true about fossil fuels.

- a. Fossil fuels take hundreds of millions of years to form.
- b. Three fourths of Earth’s known oil reserves have already been used.
- c. The rate at which fossil fuels are used is decreasing.
- d. Fossil fuels are considered a nonrenewable resource.

► **Oil** (pages 296–297)

13. Circle the letter of each sentence that is true about petroleum.

- a. Petroleum accounts for most of the energy produced in the world.
- b. Petroleum fuels most cars, airplanes, trains, and ships.
- c. The United States consumes a third of the oil produced in the world.
- d. Three percent of the world’s oil supply is located in the United States.

14. Scientists can use sound waves to test an area for oil without drilling.
15. Is the following sentence true or false? Most of the oil wells that are drilled produce usable amounts of oil. false
16. When oil is first pumped out of the ground, it is called crude oil.
17. A factory where crude oil is separated into fuels and other products by heating is called a(n) refinery.
18. Compounds that are made from oil are called petrochemicals.

► **Natural Gas (page 297)**

19. Natural gas is a mixture of methane and other gases.
20. Is the following sentence true or false? Because natural gas is less dense than oil, it often rises above an oil deposit. true
21. Circle the letter of each sentence that is true about natural gas.
- a. It produces a lot of energy.
 - b. It produces more air pollutants than oil.
 - c. It is easy to transport using pipelines.
 - d. A gas leak can cause a violent explosion and fire.

► **Coal (page 298)**

22. What is coal? Coal is a solid fossil fuel formed from plant remains.
23. Is the following sentence true or false? Today, coal provides 23 percent of the energy used worldwide. false
24. Is the following sentence true or false? The major use of coal is to fuel factories. false
25. Known deposits of coal and other fossil fuels that can be obtained using current technology are called reserves.

CHAPTER 9, Energy Resources (continued)

26. Circle the letter of the sentence that is true about coal as an energy source.
- a. It is the least plentiful fossil fuel in the United States.
 - b. It is difficult to transport.
 - c. It provides a lot of energy when burned.
 - d. It produces less air pollution than other fossil fuels.
27. How can coal mining harm the environment? Coal mining can increase erosion, and runoff from mines can cause water pollution. Burning coal produces air pollution.
-

SECTION **Renewable Sources of Energy** **9-2** (pages 299-304)

This section describes several renewable sources of energy and explains the advantages and disadvantages of each energy source.

► **Introduction** (page 299)

1. Energy sources that are constantly being supplied are called renewable resources.

► **Energy From the Sun** (pages 299-300)

2. Circle the letter of each sentence that is true about solar energy.
- a. It is the source of most other renewable energy resources.
 - b. It causes pollution.
 - c. It will not run out for billions of years.
 - d. It is available only when the sun is shining.

► **Solar Technologies** (pages 300-301)

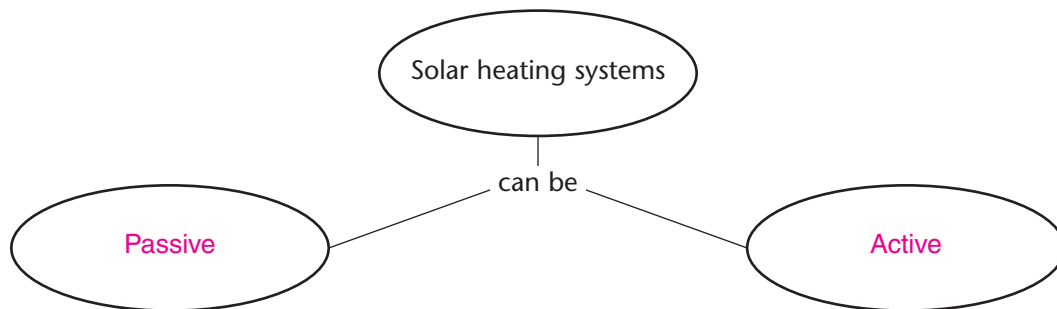
3. How do solar plants capture energy and use it to generate electricity?
Rows of giant mirrors focus the sun's rays to heat a tank of water. The water boils, making steam that can be used to generate electricity.

4. Is the following sentence true or false? Solar energy can be converted directly into electricity in a solar cell. true

5. What are solar cells used to power? They are used to power calculators, lights, telephones, and other small devices.

6. Is the following sentence true or false? Solar heating systems convert sunlight into mechanical energy. false

7. Complete the concept map.



8. How do active solar heating systems differ from passive solar heating systems? In a passive solar heating system, sunlight passes through windows, is absorbed by walls and floors, and then is converted to heat.

Active solar heating systems use fans and pumps to distribute the heat.

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► Other Sources of Renewable Energy (pages 302–303)

9. List other renewable sources of energy besides the sun.

a. water b. biomass material c. wind

d. Earth's interior e. hydrogen

10. Electricity produced by flowing water is called hydroelectric power.

11. Is the following sentence true or false? Hydroelectric power is the least widely used source of renewable energy in the world today.

false

CHAPTER 9, Energy Resources (continued)

12. Is the following sentence true or false? Hydroelectric power is expensive and creates air pollution. false

13. What are two limitations on hydroelectric power in the United States?
Most of the suitable rivers have already been dammed, and dams can have negative effects on the environment.

14. Fuels made from things that were once alive are called biomass fuels .

15. Circle the letter of each sentence that is true about biomass fuels.

- a. They include leaves, food wastes, and manure.
- b. They can be converted to other fuels.
- c. They are widely used today.
- d. They are renewable resources.

16. What type of fuel is wood? Wood is a biomass fuel.

17. Is the following sentence true or false? Corn can be used to make alcohol. true

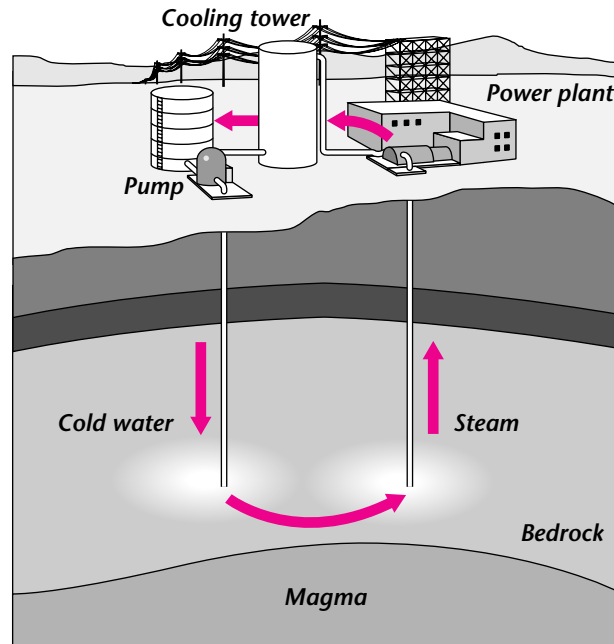
18. What is gasohol, and what is it used for? Gasohol is a mixture of alcohol and gasoline. It can be used as fuel for cars and trucks.

19. What fuel is produced in some landfills? Methane gas, a heating fuel, is produced in some landfills.

20. Intense heat from Earth's interior is called geothermal energy .

21. Is the following sentence true or false? Geothermal energy is an unlimited source of cheap energy. true

22. Add arrows to the drawing to show how water flows through a geothermal power plant.



23. Circle the letter of each sentence that is true about wind energy.

- a. It provides 10 percent of the world's electricity.
- b. It is the fastest-growing energy source.
- c. It causes pollution.
- d. It is free.

► **Hydrogen Power** (page 304)

24. What is the obstacle to using hydrogen as a fuel? It takes more energy
to obtain pure hydrogen than is produced by burning the hydrogen.

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Reading Skill Practice

When you read a long section, identifying the sentence that best expresses the main topic under each heading can help you focus on the most important points. Identify and write the sentence that best expresses the main topic under each heading in Section 9-2. Do your work on a separate sheet of paper.

The boldfaced sentences are good choices for topic sentences under the headings where they occur.

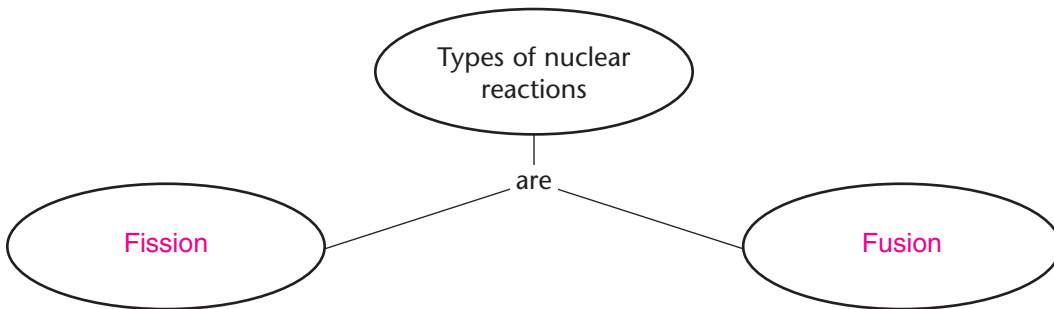
CHAPTER 9, Energy Resources (continued)

SECTION 9-3 Nuclear Energy
(pages 307-311)

This section explains how nuclear reactions inside atoms can produce energy. The section also describes the advantages and disadvantages of nuclear energy.

► Introduction (page 307)

1. The central core of an atom that contains the protons and neutrons is called the nucleus.
2. Complete the concept map.



► Fission Reactions and Energy (pages 307-308)

3. Is the following sentence true or false? Nuclear reactions convert matter into energy. true
4. What formula, developed by Albert Einstein, describes the relationship between energy and matter? $E = mc^2$
5. The splitting of an atom's nucleus into two smaller nuclei is called nuclear fission.
6. Circle the letter of each sentence that is true about nuclear fission.
 - a. It can use uranium as a fuel.
 - b. It is a chain reaction.
 - c. It is extremely safe.
 - d. It can be used to generate electricity.

► **Nuclear Power Plants (pages 308–309)**

7. How is electricity produced in a nuclear power plant? The heat released from the reactions is used to change water into steam. The steam then turns the blades of a turbine to generate electricity.

Match the part of a nuclear reactor with its function.

Part of Reactor	Function
<u> b </u> 8. reactor vessel	a. It contains the uranium.
<u> a </u> 9. fuel rod	b. It is where nuclear fission occurs.
<u> d </u> 10. control rod	c. It changes hot water to steam.
<u> c </u> 11. heat exchanger	d. It controls the reactions.

► **The Risks of Nuclear Fission (pages 309–310)**

12. When fuel rods in a nuclear power plant generate so much heat that they start to melt, the condition is called a(n) meltdown.

13. Why is it difficult to dispose of radioactive wastes produced by power plants? It is difficult because they remain dangerous for many thousands of years.

► **The Quest to Control Fusion (pages 310–311)**

14. The combining of two atomic nuclei to produce a single larger nucleus is called nuclear fusion.

15. Circle the letter of each sentence that is true about nuclear fusion.

- a. It produces less energy per atom than nuclear fission.
- (b.)** The fuel it needs is readily available.
- (c.)** Scientists have not yet been able to control a large-scale fusion reaction.
- d. It is widely used today to produce electricity.

CHAPTER 9, Energy Resources (continued)

SECTION Energy Conservation

9-4 (pages 313-316)

This section describes several ways that energy use can be reduced to make available fuels last as long as possible.

► Introduction (page 313)

1. What are two approaches to the problem of the limited supply of fossil fuels? One approach to the problem is to find new sources of energy.
Another approach is to make the fuels that are available now last as long as possible.

► Conservation and Efficiency (pages 313-316)

2. Reducing energy use is called energy conservation.
3. The percentage of energy from a fuel that is actually used to perform work is its efficiency.
4. What happens to the energy from a fuel that is not used to perform work?
Most of the rest of the energy is "lost" to the surroundings, usually as heat.
5. Is the following sentence true or false? Incandescent light bulbs waste less energy than compact fluorescent bulbs. false
6. A layer of material that helps block the transfer of heat between the air inside and outside a building is called insulation.
7. How does insulation work? Insulation traps air, and this layer of trapped air helps keep the building from losing or gaining heat from the outside.

8. Circle the letter of the choice that is the best material for insulation.

- a. fiberglass b. brick c. stone d. glass

9. Why do new windows have two panes of glass with space between them?

The air between the panes of glass acts as insulation to help prevent heat loss through the windows.

10. How have engineers improved the energy efficiency of cars?

Engineers have designed better engines and tires.

11. What are some ways to reduce the number of cars on the road?

Communities can maintain public transit systems that provide an alternative to driving. They can also encourage carpooling, for example, by setting aside lanes for cars containing two or more people.

12. Is the following sentence true or false? A car that runs on electricity is less energy-efficient than one that runs directly on fuel. false

► **What You Can Do** (page 316)

13. Circle the letter of each sentence that describes a way you can reduce your personal energy use.

- a. Use air conditioners instead of fans.
b. Use electric lights whenever possible.
 c. Ride buses and trains.
d. Keep your home warmer in winter and cooler in summer.

14. Why does recycling aluminum help to save energy? Recycling an aluminum can uses only 5 percent of the energy that making a new can uses.

CHAPTER 9, Energy Resources (continued)

WordWise

Solve the clues by filling in the blanks with key terms from Chapter 9. Then write the numbered letters in the correct order to find the hidden message.

Clues

Substance that provides energy as the result of a chemical change

Compound made from oil

Liquid fossil fuel

A known deposit of fuels

Factory where crude oil is separated into fuels and other products

Dangerous condition caused by overheating inside a nuclear reactor

Percentage of energy that is used by a device to perform work

Building material that blocks heat transfer between the air inside and outside

Reducing energy use

Electricity produced by the kinetic energy of moving water

Energy from heat in Earth's interior

Compound that contains carbon and hydrogen atoms

Key Terms

f u e l
1 2

p e t r o c h e m i c a l
3 4

p e t r o l e u m
5 6 7

r e s e r v e
8

r e f i n e r y
9

m e l t d o w n
10

e f f i c i e n c y
11

i n s u l a t i o n
12

c o n s e r v a t i o n
13 14

h y d r o e l e c t r i c
15 16

g e o t h e r m a l
17

h y d r o c a r b o n
18

Hidden Message

F u e l p r o v i d e s e n e r g y .
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

CHAPTER 10

SOLID EARTH

SECTION **Inside Earth**
10-1 (pages 326-329)

This section describes the science of geology and identifies the layers of Earth.

► **Introduction** (pages 326)

1. What is rock? Rock is the material that makes up Earth's hard outer surface.
2. The layer of solid rock that surrounds Earth's surface is called the crust.

The Science of Geology (page 327)

3. What is geology? Geology is the study of planet Earth, including Earth's surface and interior.
4. What do geologists study? Geologists study Earth's surface and interior. They also study the physical and chemical characteristics of rocks.

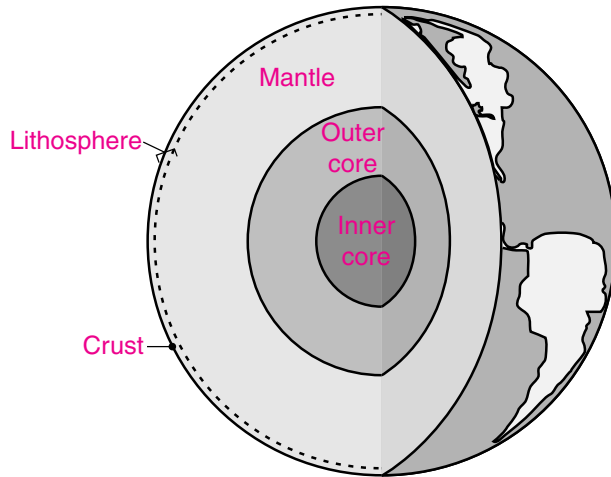
Earth's Interior (pages 328-329)

5. List the major layers that make up Earth.

a. <u>inner core</u>	b. <u>outer core</u>
c. <u>mantle</u>	d. <u>lithosphere</u>
6. Is the following sentence true or false? The inner core is liquid and the outer core is solid. false

CHAPTER 10, Solid Earth *(continued)*

7. On the diagram of Earth, label the crust, mantle, lithosphere, inner core, and outer core.



8. Is the following sentence true or false? The upper part of the mantle is soft, but solid and can flow very slowly. true

SECTION 10-2 Minerals
(pages 330-337)

This section describes properties of minerals and explains how these properties are used to identify minerals. It also explains how minerals form.

► What Is a Mineral? (pages 331-332)

1. Circle the letter of each sentence that is true about minerals.
 - a. Mineral are solids.
 - b. Minerals are formed from living things.
 - c. Minerals form naturally.
 - d. Each mineral has a definite chemical composition.
2. The atoms that make up a mineral line up in a pattern that repeats over and over, forming a solid called a(n) crystal .
3. Is the following sentence true or false? Some elements are made up of only one element. true

► **Identifying Minerals** (pages 333–335)

4. List six properties of minerals.

- | | |
|-------------------------------|-------------------|
| a. <u>hardness</u> | b. <u>color</u> |
| c. <u>streak</u> | d. <u>luster</u> |
| e. <u>how it breaks apart</u> | f. <u>density</u> |

5. To classify minerals according to their hardness, geologists use the

Mohs hardness scale.

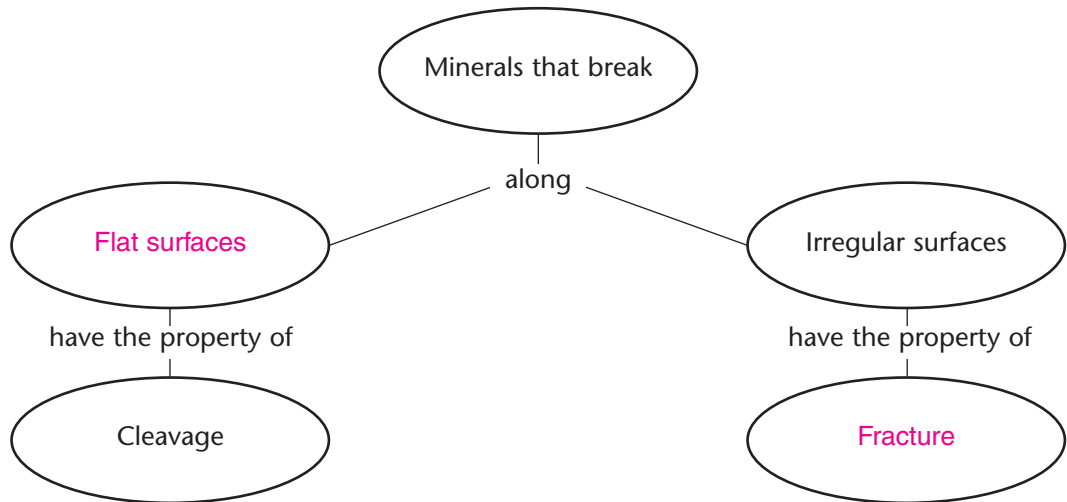
6. Is the following sentence true or false? All forms of a mineral have the

same color. false

7. The way a mineral reflects light from its surface is called

luster.

8. Complete the concept map.



9. A measurement of how much mass is contained in a given volume is

called density.

► **How Minerals Form** (page 336)

10. What are two ways that minerals can form? Minerals form when

molten material cools and hardens inside Earth or on the surface.

Other minerals form when materials dissolved in water come out of solution.

CHAPTER 10, Solid Earth (continued)

Match the terms with their definitions.

Terms	Definitions
<u> b </u> 11. magma	a. Narrow band of minerals that form from solutions
<u> c </u> 12. lava	b. Molten material inside Earth
<u> d </u> 13. vein	c. Molten material that reaches Earth's surface

14. Is the following sentence true or false? Large crystals form when magma and lava cool slowly. true

► **How People Use Minerals** (pages 336–337)

15. What is a gemstone? A gemstone is a mineral that is valued for its beautiful color, hardness, and glassy luster.

16. Is the following sentence true or false? Everything that is made of metal began as minerals inside Earth. true

17. Fertilizers, medicines, and petroleum refining make use of the mineral sulfur .

18. List two uses of clay minerals.

a. ceramics

b. building materials such as bricks



Reading Skill Practice

Outlining is a way to help yourself remember what you have read. Write an outline of this section on minerals. In the outline, copy the headings in the textbook. Under each heading, write the main idea of that part of the section. Then list the details that support the main idea.

Outlines should be organized under the heads *What Is a Mineral?*, *Identifying Minerals*, *How Minerals Form*, and *How People Use Minerals*. Outlines should include subheads and information on pages 330–337.

SECTION
10-3 **Rocks and the Rock Cycle**
(pages 340-347)

This section identifies three kinds of rocks and describes how they form. This section also explains the rock cycle.

► **Building Blocks of the Crust** (page 340)

1. A solid material made up of one or more minerals or other substances, including the remains of once-living things is called rock.
2. The 20 common minerals that make up most of Earth's rocks are called the rock-forming minerals.

► **Classifying Rocks** (pages 341-342)

3. List four ways geologists classify rocks.

a. <u>color</u>	b. <u>texture</u>
c. <u>composition</u>	d. <u>how they formed</u>
4. Is the following sentence true or false? Texture refers to the size, shape, and arrangement of a rock's grains. true
5. What are the three major groups of rocks?

a. <u>igneous</u>	b. <u>sedimentary</u>
c. <u>metamorphic</u>	

► **Igneous Rock** (page 342)

6. How does igneous rock form? Igneous rock forms when magma or lava cools and hardens.
7. Circle the letter of each sentence that is true about igneous rock.
 - a. Magma that cools quickly forms igneous rocks with large crystals.
 - (b)** Igneous rock that formed beneath Earth's surface is intrusive rock.
 - c. Granite is an extrusive rock.
 - (d)** Basalt is extrusive rock that makes up the ocean floor.

CHAPTER 10, Solid Earth *(continued)*

► **Sedimentary Rock** (pages 343–344)

8. How does sedimentary rock form? Sedimentary rock forms when particles of rock and other material are pressed and stuck together.
9. Sand, gravel, and mud are examples of sediment.
10. Sediment is moved from place to place on Earth’s surface by the process of erosion.
11. Sediment is laid down in the process of deposition.
12. What two processes form rock from sediment? Compaction and cementation

Match the kind of rock with their definitions and examples.

Definitions and Examples	Rocks
<u> a </u> 13. Pieces of rock that have been pressed and stuck together	a. clastic
<u> c </u> 14. Rock formed when dissolved minerals come out of solution	b. organic
<u> b </u> 15. Rock formed from the remains of plants and animals	c. chemical
<u> c </u> 16. Halite	
<u> b </u> 17. Limestone	

► **Metamorphic Rock** (page 345)

18. Other types of rock are changed to metamorphic rock by heat and pressure beneath Earth’s surface.
19. As metamorphic rock forms, chemical changes may change the minerals in the rock.
20. Is the following sentence true or false? Only sedimentary rock can become metamorphic rock. false

21. The metamorphic rock gneiss forms from granite.

► **The Rock Cycle** (pages 346–347)

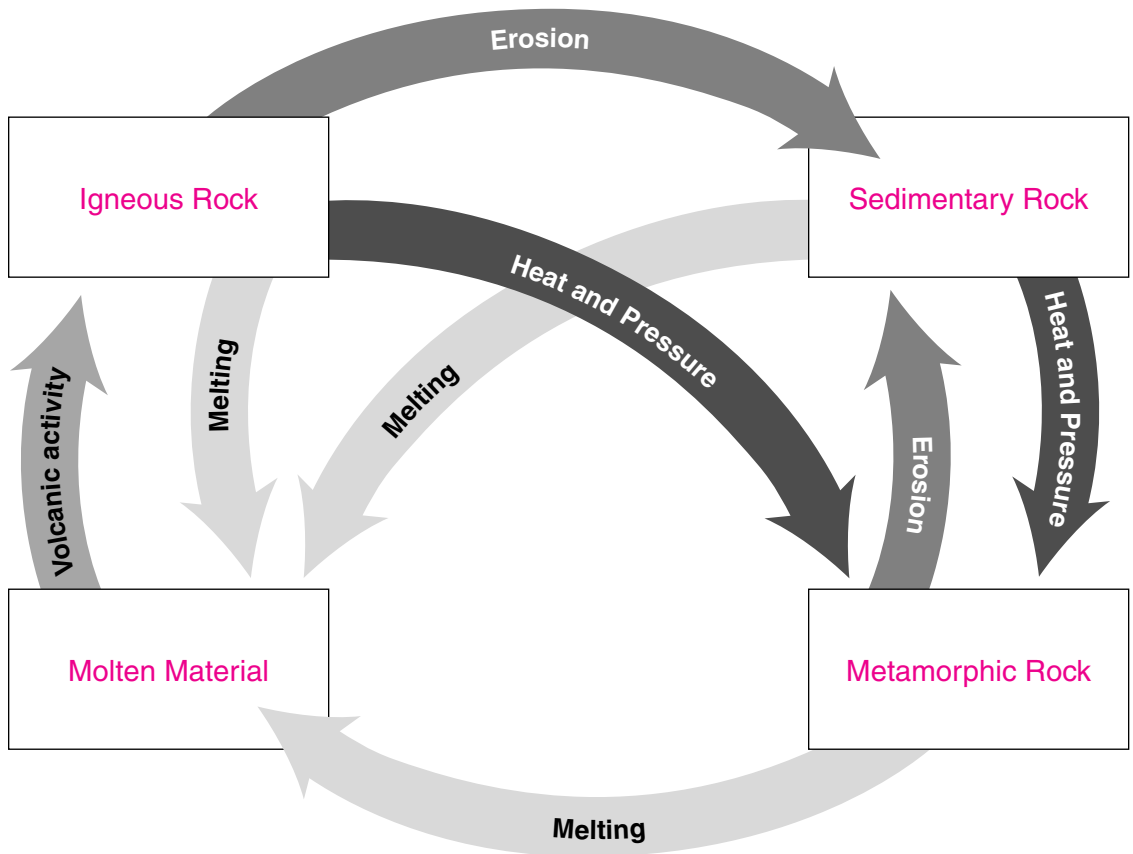
22. The rock cycle is a series of processes that builds,
destroys, and changes rocks in Earth’s crust.

23. In the rock cycle, water and weather wear away rock by the process of
erosion.

24. In the rock cycle, sediments are pressed together and
cemented to form sedimentary rock.

25. In the rock cycle, the heat of Earth’s interior can melt rock. This molten
material can form new igneous rock.

26. On the diagram of the rock cycle, label the four kinds of material
involved in the rock cycle.

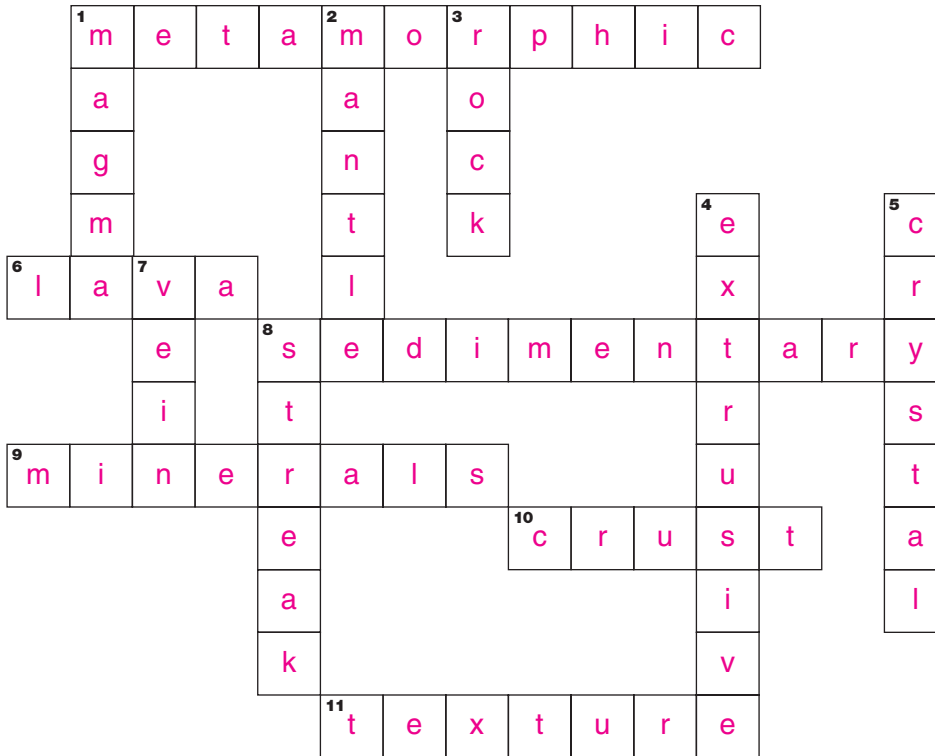


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CHAPTER 10, Solid Earth *(continued)*

Word Wise

Complete the crossword puzzle by using the clues below.



Clues Across

1. Rock that forms from other rock due to heat and pressure beneath Earth's surface
6. Molten rock material that reaches Earth's surface
8. Rock that forms when particles of rock and other materials are pressed and stuck together
9. Solid, inorganic materials that form naturally on or beneath Earth's surface
10. Layer of solid rock that surrounds Earth's surface
11. Size, shape, and arrangement of grains of rock

Clues Down

1. Molten rock material inside Earth
2. Layer that surrounds Earth's core
3. Solid material made of one or more minerals or other substances
4. Igneous rock that forms from lava on Earth's surface
5. Repeating pattern of a mineral's atoms in a solid shape
7. Narrow band of mineral formed from a solution
8. Color of a mineral's powder

CHAPTER 11

EARTHQUAKES AND VOLCANOES

SECTION **Plate Tectonics**
11-1 (pages 354-357)

This section explains how Earth’s plates move and interact, causing changes in Earth’s surface.

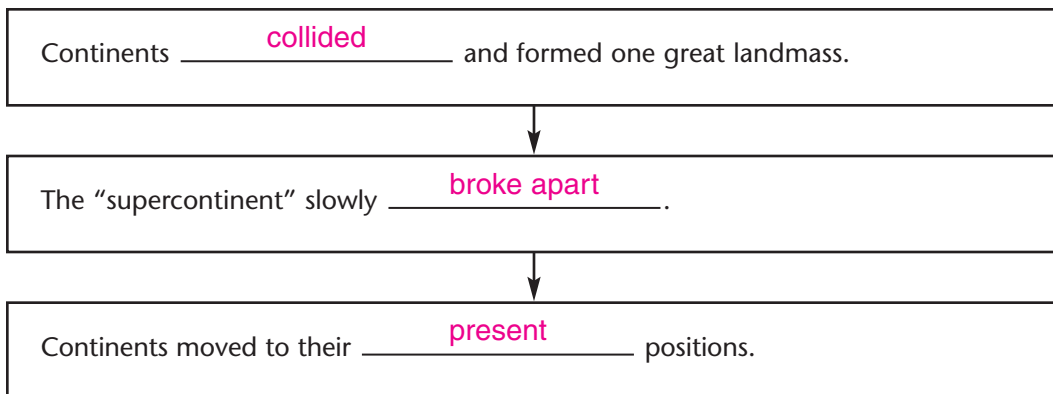
► **Introduction** (page 354)

1. The lithosphere is broken into a number of large pieces called _____ plates _____.
2. Most of the United States is located on the _____ North American _____ plate.

► **Earth’s Moving Plates** (pages 354-355)

3. Is the following sentence true or false? Earth’s plates move very rapidly.
 _____ false _____
4. Complete the flowchart.

Wegener’s Hypothesis



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CHAPTER 11, Earthquakes and Volcanoes (continued)

► The Theory of Plate Tectonics (pages 355–356)

5. Is the following sentence true or false? During most of the twentieth century, geologists did not accept the idea of continental drift.

true

6. What is the theory of plate tectonics? Plate tectonics states that Earth's plates are in constant, slow motion.

7. What does the theory of plate tectonics explain? It explains how Earth's plates form and move. It also explains how plates interact, producing volcanoes, mountain ranges, earthquakes, and features of the ocean floor.

8. The plates of the lithosphere float on material in the mantle.

► Effects of Plate Movement (pages 356–357)

9. The cracks between the plates of the lithosphere are called plate boundaries.

10. Where oceanic crust sinks toward the mantle beneath continental crust, a deep-ocean trench may form.

11. The mountain range that winds through Earth's oceans is called the mid-ocean ridge.

12. As oceanic plates pull apart along the mid-ocean ridge, the process of sea-floor spreading occurs.

13. When two pieces of continental crust pull apart, a(n) rift valley forms.

14. When two plates slide past each other, moving slowly in opposite directions, they can cause earthquakes.

15. What happens if two plates carrying continental crust collide? The
plates fold and pile on top of each other, forming a mountain range.

SECTION **Earth's Crust in Motion**

11-2 (pages 358-365)

This section explains how stresses in Earth's crust cause breaks in the crust called faults. The section also explains how faults and folds in Earth's crust form mountains.

► **Stress in the Crust** (page 358)

1. The shaking and trembling that results from the movement of rock beneath Earth's surface is called a(n) earthquake.
2. The movement of Earth's plates creates powerful forces called stress, which squeeze or pull the rock in the crust.

► **Types of Stress** (page 359)

3. List the three types of stress that occur in Earth's crust.
a. shearing b. tension c. compression
4. Define shearing, and describe how it can affect rock. Shearing is stress
that pushes a mass of rock in two opposite directions. It can cause rock to
break and slip apart or to change its shape.
5. Define tension, and describe how it can affect rock. Tension is stress
that pulls on the crust. It can cause rock to stretch so that it becomes thinner
in the middle.

CHAPTER 11, Earthquakes and Volcanoes (continued)

6. Define compression, and describe how it can affect rock. Compression is stress that squeezes rock. Compression can cause rock to fold or break.

7. Circle the letter of the term that means any change in the volume or shape of Earth’s crust.

- a. deformation b. compression c. tension d. stress

► **Kinds of Faults** (pages 360–361)

8. A break in Earth’s crust is a(n) fault.

Match the kind of fault with its description.

Kind of Fault	Description
<u> b </u> 9. strike-slip fault	a. The hanging wall slides up and over the footwall.
<u> c </u> 10. normal fault	b. There is little up or down motion.
<u> a </u> 11. reverse fault	c. The hanging wall slips downward below the footwall.

12. Is the following sentence true or false? A strike-slip fault that forms the boundary between two plates is called a convergent boundary.

 false

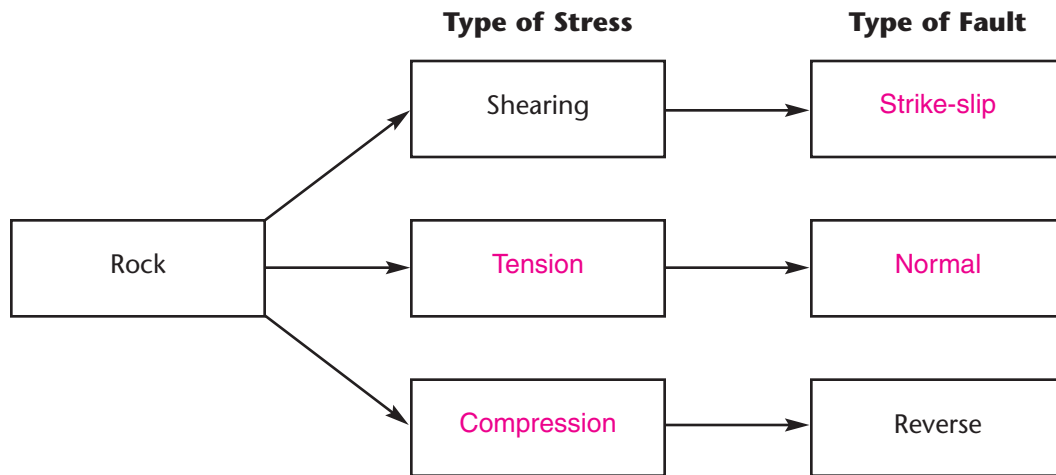
13. Circle the letter of each sentence that is true about a hanging wall.

- a. It is the half of a fault that lies above the fault.
 b. It is the half of a fault that lies below the fault.
 c. It is the same as a footwall.
 d. It occurs when the fault is at an angle.

14. Circle the letter of each sentence that is true about both normal and reverse faults.

- a. The faults are at an angle. b. The faults are caused by tension.
 c. The faults are caused by compression. d. The faults have footwalls.

15. Complete the flowchart.



Match the landform with the type of fault that produced it.

Landform	Type of Fault
<u> b </u> 16. San Andreas Fault	a. reverse fault
<u> c </u> 17. Rio Grande Valley	b. strike-slip fault
<u> a </u> 18. Appalachian Mountains	c. normal fault

► **Friction Along Faults** (page 362)

19. The force that opposes the motion of one surface as it moves across another surface is referred to as friction.

► **Mountain Building and Uplift** (pages 362–365)

20. Circle the letter of the sentence that describes how a fault-block mountain is created.

- a. It is created by two normal faults.
- b. It is created by two reverse faults.
- c. It is created by a strike-slip fault.
- d. It is created by shearing.

21. Circle the letter of each mountain range that was formed by folding.

- a. Alps
- b. Himalayas
- c. Tetons
- d. Sierra Nevadas

CHAPTER 11, Earthquakes and Volcanoes *(continued)*

Match the term with its definition.

Term	Definition
<u> a </u> 22. anticline	a. Fold in rock that bends upward
<u> c </u> 23. syncline	b. Large area of flat land high above sea level
<u> b </u> 24. plateau	c. Fold in rock that bends downward



Reading Skill Practice

When reading about related processes, drawings can help you appreciate their similarities and differences. Study Figures 6, 7, and 8 in Section 11-1 and explain how the figures are similar and how they are different. Do your work on a separate sheet of paper.

All three figures show two slabs of crust moving past each other, but they differ in how and why the movements occur. For example, the hanging wall slides downward in the normal fault due to tension but upward in the reverse fault due to compression.

SECTION 11-3 Measuring Earthquakes
(pages 368-373)

This section explains how energy from an earthquake can be detected and how the size of an earthquake can be measured.

► **Introduction** (page 368)

- The point where a rock under stress breaks and triggers an earthquake is called the focus .
- The point on the surface directly above the focus is the epicenter .

► **Seismic Waves** (pages 368-370)

- What are seismic waves? Seismic waves are vibrations that travel through Earth carrying the energy released during an earthquake.

4. Is the following sentence true or false? Seismic waves carry the energy of an earthquake away from the focus in all directions. true

5. Circle the letter of each term that is a category of seismic wave.

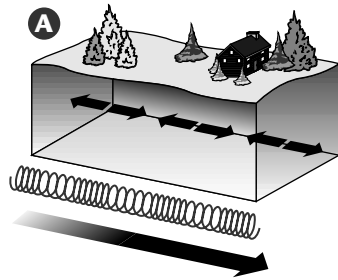
a. P wave

b. S wave

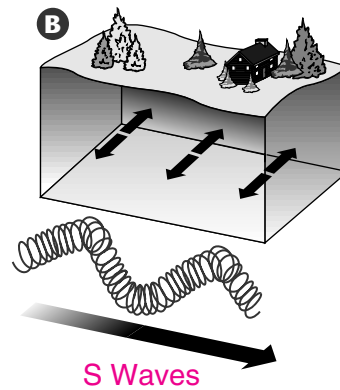
c. surface wave

d. underground wave

6. Label each drawing as *S Waves* or *P Waves*.



P Waves



S Waves

7. Is the following sentence true or false? Surface waves move more quickly than P waves and S waves. false

► **Detecting Seismic Waves** (page 370)

8. A device that records the ground movements caused by seismic waves is a(n) seismograph.

► **Measuring Earthquakes** (pages 371–372)

9. List the three scales that are used for measuring earthquakes.

a. Mercalli scale

b. Richter scale

c. moment magnitude scale

► **Locating the Epicenter** (pages 372–373)

10. Is the following sentence true or false? The closer an earthquake, the greater the time between the arrival of P waves and the arrival of S waves. false

CHAPTER 11, Earthquakes and Volcanoes (continued)

SECTION 11-4 **Volcanic Activity**
(pages 374-383)

This section explains how volcanoes erupt and describes types of volcanic activity. The section also describes how geologists monitor volcanoes.

► How Magma Reaches Earth's Surface (pages 374-375)

1. Is the following sentence true or false? Liquid magma rises until it reaches the surface or until it becomes trapped beneath layers of rock.

_____ true _____

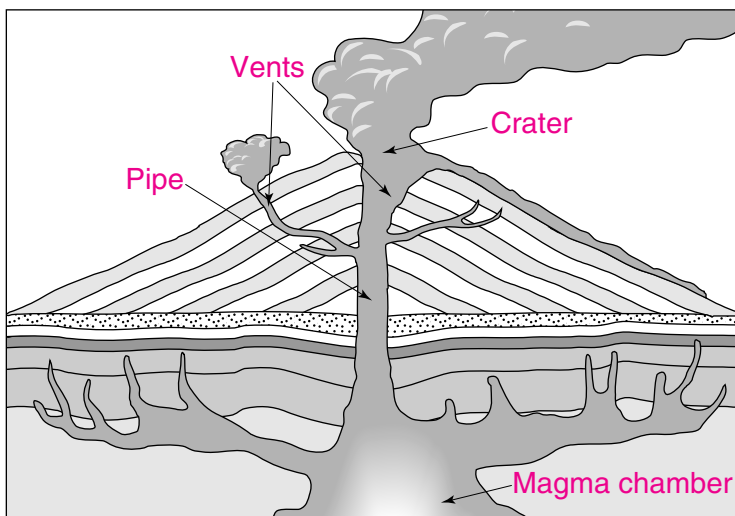
2. What happens during a volcanic eruption? The gases dissolved in magma rush out, carrying the magma with them.

► Inside a Volcano (pages 375-376)

3. Circle the letter of each feature that all volcanoes share.

- a. pocket of magma beneath the surface b. crack to the surface
c. side vents d. crater

4. Label the drawing with the following terms: magma chamber, pipe, vent, and crater.



5. What is a lava flow? A lava flow is the area covered by lava as it pours out of a vent.
6. Where does a crater form? A crater forms at the top of a volcano around the central vent.
7. Is the following sentence true or false? The pipe of a volcano is a horizontal crack in the crust. false

► **Characteristics of Magma (page 377)**

8. What factors determine the force of a volcanic eruption? Factors include the amount of gas dissolved in the magma, how thick or thin the magma is, its temperature, and its silica content.
9. Circle the letter of each sentence that is true about silica.
- a. It is formed from oxygen and nitrogen.
 - b.** It makes magma thicker.
 - c. It is rarely found in the crust.
 - d.** It produces light-colored lava.

Match the type of rock with its description.

Rock	Description
<u> a </u> 10. rhyolite	a. Has the same composition as granite
<u> c </u> 11. obsidian	b. Forms from low-silica lava
<u> d </u> 12. pumice	c. Forms when high-silica lava cools very quickly
<u> b </u> 13. basalt	d. Forms when gas bubbles are trapped in cooling lava

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► **Types of Volcanic Eruptions (pages 378–379)**

14. Hot, fast-moving lava is called pahoehoe.
15. Cool, slow-moving lava is called aa.

CHAPTER 11, Earthquakes and Volcanoes *(continued)*

16. Is the following sentence true or false? A volcano erupts quietly if its magma is thick and sticky. false

Match the type of lava fragment with its description.

Type of Fragment	Description
<u> c </u> 17. volcanic ash	a. Pebble-sized particles
<u> a </u> 18. cinders	b. Particles ranging from the size of a baseball to the size of a car
<u> b </u> 19. bombs	c. Fine rocky particles as small as a grain of sand

20. What is a pyroclastic flow? A pyroclastic flow is an explosive eruption of ash, cinders, bombs, and gases.

► **Stages of a Volcano** (page 380)

21. Is the following sentence true or false? The activity of a volcano may last from less than a decade to more than 10 million years.
 true

22. Is the following sentence true or false? Most long-lived volcanoes erupt continuously. false

23. Complete the compare/contrast table.

Volcanic Stages	
Stage	Description
Extinct	Unlikely to erupt ever again
Active	Erupting or showing signs that it soon will erupt
Dormant	No longer active but may become active again

24. Is the following sentence true or false? The length of time between eruptions of a dormant volcano is always less than a thousand years.

false

► **Monitoring Volcanoes** (page 381)

25. Circle the letter of the sentence that is true about monitoring and predicting volcanic eruptions.

- a. Geologists monitor the water level in a volcano's crater lake.
- b. There is never any warning when a volcano will erupt.
- c. Geologists cannot detect magma moving underground.
- d. Many small earthquakes occur around a volcano before it erupts.

► **Other Types of Volcanic Activity** (page 382)

26. Is the following sentence true or false? Some types of volcanic activity do not involve the eruption of lava. true

27. When groundwater heated by a nearby body of magma rises to the surface and collects in a natural pool, it is called a(n) hot spring.

28. A fountain of water and steam that erupts from the ground is referred to as a(n) geyser.

29. How can geothermal energy be converted to electricity? Steam from deep underground spins the wheel in a turbine, and the moving wheel turns a generator that produces electricity.

► **Volcano Hazards** (pages 382–383)

30. Why might people living near a dormant volcano be unaware of the danger? They might be unaware of the danger because the time between volcanic eruptions may span hundreds of years.

CHAPTER 11, Earthquakes and Volcanoes (continued)

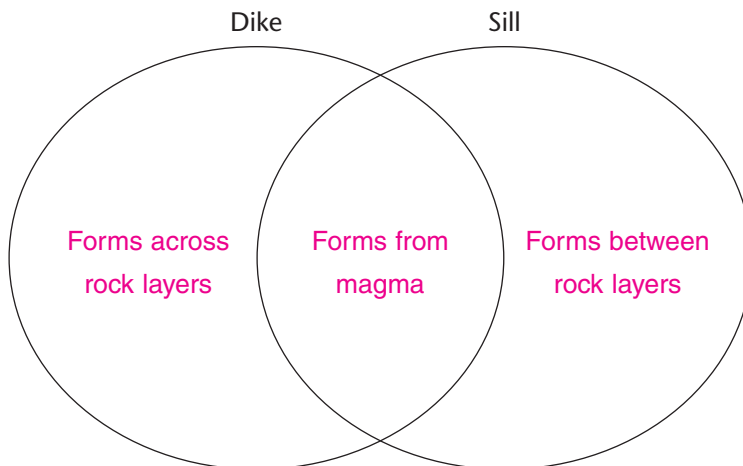
31. Is the following sentence true or false? Volcanic eruptions only cause damage close to the crater's rim. false
32. What kinds of damage can volcanoes cause? Volcanoes can start fires, bury towns, damage crops, clog car engines, collapse roofs, stall airplane engines, and create landslides and avalanches.

SECTION **Volcanic Landforms**
11-5 (pages 388-390)

This section describes landforms and soils that are created by volcanoes.

► Landforms from Magma (pages 386-388)

1. List five features formed by magma.
- a. volcanic necks c. dikes e. sills
b. batholiths d. dome mountains
2. Complete the Venn diagram using the following phrases: forms from magma, forms across rock layers, forms between rock layers.



3. A mass of rock formed when a large body of magma cools inside the crust is called a(n) batholith.

4. Is the following sentence true or false? A dome mountain forms when rising magma is blocked by horizontal layers of rock. true

► **Landforms From Lava and Ash** (pages 389–390)

5. List four landforms created from lava and ash.

- a. shield volcanoes b. cinder cone volcanoes
 c. composite volcanoes d. lava plateaus

6. Shield volcanoes form from many thin layers of lava.

7. Is the following sentence true or false? The Hawaiian Islands are cinder cone volcanoes. false

8. Name three examples of composite volcanoes. Examples include Mount Fuji, Mount St. Helens, and Mount Hood.

9. Is the following sentence true or false? A composite volcano has both quiet and explosive eruptions. true

Match the landform with its description.

Landform	Description
<u>e</u> 10. shield volcano	a. High, level area formed by repeated lava flows
<u>c</u> 11. cinder cone	b. Mountain formed by lava flows alternating with explosive eruptions
<u>b</u> 12. composite volcano	c. Cone-shaped mountain formed from ash, cinders, and bombs
<u>a</u> 13. lava plateau	d. Hole left by the collapse of a volcanic mountain
<u>d</u> 14. caldera	e. Gently sloping mountain formed by repeated lava flows

► **Soils from Lava and Ash** (page 390)

15. When volcanic ash breaks down, it releases potassium, phosphorus, and other materials needed by plants.

CHAPTER 11, Earthquakes and Volcanoes *(continued)*

WordWise

Read the clues below, and then find the key terms from Chapter 11 that are hidden in the puzzle. The hidden terms may occur vertically, horizontally, or diagonally.

Clues

- | | |
|--|---|
| 1. The shaking and trembling of Earth's crust | 7. Fast-moving, hot lava |
| 2. Large pieces of the lithosphere | 8. Stress that pushes rock in opposite directions |
| 3. A stress force that squeezes rock | 9. Huge hole left by the collapse of a volcanic mountain |
| 4. A large area of elevated flat land | 10. An instrument that records ground movements caused by seismic waves |
| 5. A force that changes rock's shape or volume | 11. The bottom half of a fault |
| 6. A mass of rock formed when a large body of magma cools inside the crust | 12. Volcano that is unlikely to erupt again |

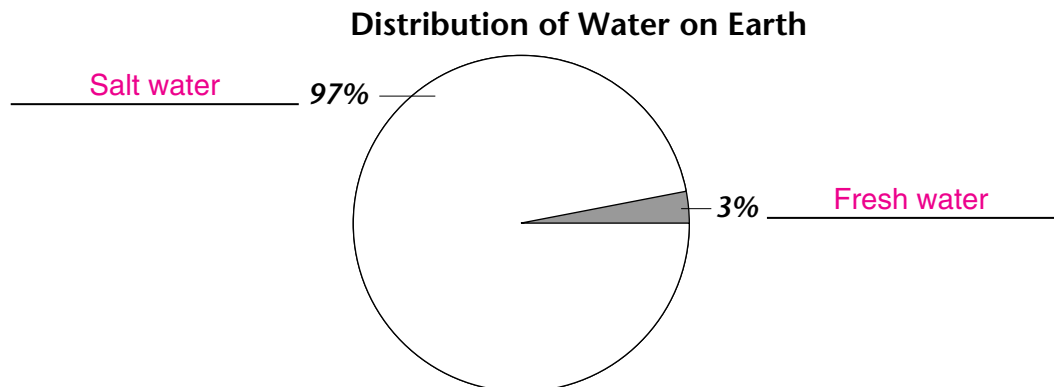
s	t	i	o	n	s	c	o	d	d	l	n	p	m
f	a	e	a	r	t	h	q	u	a	k	e	v	p
w	d	e	f	t	r	m	b	t	r	o	n	d	a
y	p	l	a	t	e	s	u	r	c	a	f	t	h
d	u	p	c	o	s	h	e	a	r	i	n	g	o
s	w	n	o	f	s	a	z	s	e	p	t	w	e
e	e	o	m	i	p	h	o	r	v	a	d	t	h
i	x	m	p	f	g	t	p	u	l	a	c	m	o
s	t	d	r	s	b	n	m	l	i	q	e	p	e
m	i	c	e	o	m	u	a	q	a	v	b	c	t
o	n	e	s	j	m	w	u	c	k	t	i	b	d
g	c	n	s	o	t	h	u	m	b	b	e	y	t
r	t	t	i	o	k	v	o	o	x	l	e	a	n
a	w	o	o	p	l	y	i	m	s	s	a	h	u
p	u	f	n	t	t	c	a	l	d	e	r	a	s
h	a	l	e	t	b	a	t	h	o	l	i	t	h

CHAPTER 12**FRESH WATER****SECTION** **The Water Cycle**
12-1 (pages 396-402)

This section describes how water is distributed on Earth and recycled in a series of processes called the water cycle. The section also describes ways that people use water and explains why living things need water.

► Water on Earth (pages 396-397)

1. Label the circle graph to show the percentage of Earth's water that is salt water and the percentage that is fresh water.



2. The gaseous form of water is called water vapor.
3. Circle the letter of each sentence that is true about fresh water on Earth.
 - a. About three quarters of Earth's fresh water is in ice masses near the poles.
 - b. Most fresh water in the atmosphere is in the form of water vapor.
 - c. Less than 1 percent of all the water on Earth is fresh water that humans can use.
 - d. Some of Earth's fresh water is deep underground.
4. Is the following sentence true or false? All Earth's oceans are connected to form a single world ocean. true

CHAPTER 12, Fresh Water (continued)

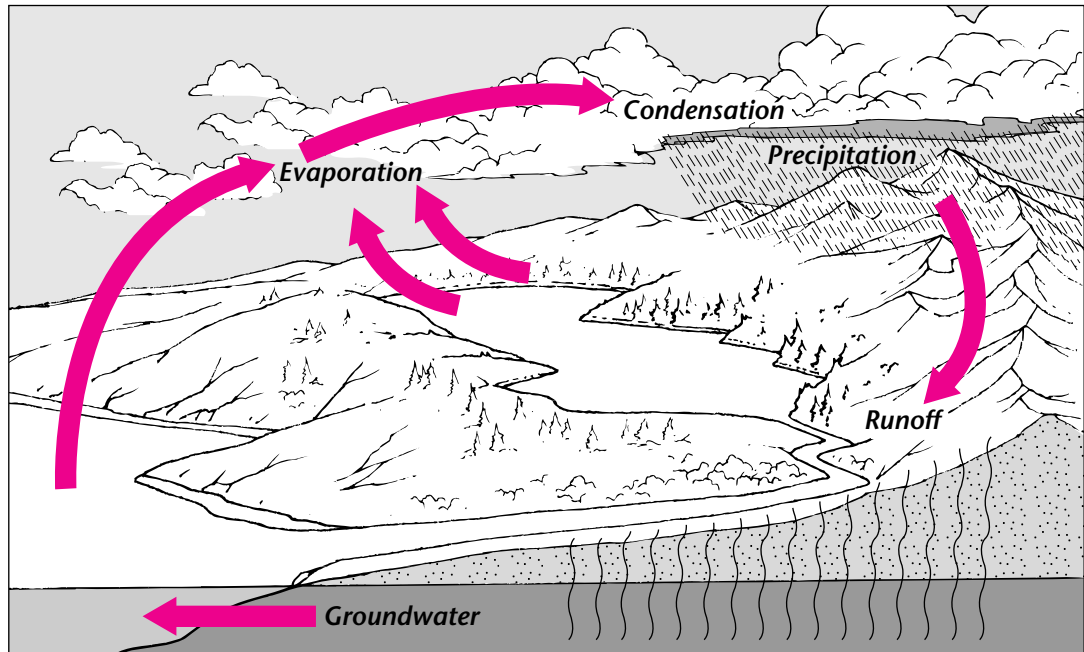
5. Is the following sentence true or false? Icebergs are formed from frozen salt water. false
6. Water that fills the cracks and spaces in underground soil and rock layers is called groundwater.
7. Is the following sentence true or false? Far less fresh water is located underground than in all Earth's rivers and lakes. false

► The Water Cycle (pages 398–399)

8. Circle the letter of each sentence that is true about the water cycle.
- a. It naturally recycles water.
 - b. It is powered by energy from the sun.
 - c. It is a continuous process.
 - d. It does not involve living things.
9. Is the following sentence true or false? All the water on Earth has been through the water cycle. true
10. Is the following sentence true or false? The water cycle has a beginning and an end. false
11. How do plants take in water? Plants draw in water from the soil through their roots.
12. Is the following sentence true or false? Plants give off only a small amount of water. false
13. Why isn't water vapor that comes from the ocean salty? It isn't salty because the salt remains in the ocean when the water evaporates.

14. Add arrows to the diagram to show how water moves through the water cycle.

The Water Cycle



15. Complete the table.

Processes in the Water Cycle	
Process	Role in the Water Cycle
Evaporation	Produces water vapor from bodies of water
Transpiration	Produces water vapor from plants
Condensation	Forms clouds from water vapor
Precipitation	Returns water to Earth's surface

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16. Why does water vapor condense when it travels far above Earth?

Higher up, the air is colder. Cold air holds less water vapor than warm air, so some of the water vapor condenses.

CHAPTER 12, Fresh Water (continued)

17. Describe how clouds form. Clouds form when condensed water droplets clump together around tiny dust particles in the air.

18. How does precipitation occur? Water droplets in a cloud grow larger and larger. Eventually they become so heavy that they fall to Earth.

19. List four forms of precipitation.

- a. rain
- b. snow
- c. hail
- d. sleet

20. Is the following sentence true or false? Little precipitation actually falls directly into the oceans. false

21. If groundwater reaches the surface, how can it continue through the water cycle? It can continue by evaporating again.

22. Circle the letter of each sentence that is true about Earth’s water supply.

- a. Precipitation is the source of all fresh water on Earth.
- b. The water cycle uses up Earth’s fresh water supply.
- c. Earth’s total water supply has decreased greatly over the past million years.
- d. In the world as a whole, rates of evaporation and precipitation are balanced.

► How Do People Use Water? (pages 400–402)

23. What are the ways that people use water? People use water for household purposes, agriculture, industry, transportation, and recreation.

24. Is the following sentence true or false? All parts of the United States receive enough regular rainfall for agriculture. false

25. The process of supplying water to areas of land to make them suitable for growing crops is called irrigation.
26. Is the following sentence true or false? In the United States, more water is used for industry than for any other single purpose. false
27. What is one way water is used in industry? Water is used to cool down hot machinery.
28. Is the following sentence true or false? Oceans and rivers have been used for transporting people and goods since ancient times.
true
29. What led to the growth of port cities in the United States? Ocean travel led to their growth.
30. Name several ways that water is used for recreation. Water is used for swimming, fishing, boating, skiing, and skating.

► **Water and Living Things (page 402)**

31. Is the following sentence true or false? Water makes up one third of the human body. false
32. Plants use water to make food in a process called photosynthesis.
33. The place where an organism lives and that provides the things it needs to survive is its habitat.



Reading Skill Practice

When you read a long section, turning the headings into questions and then trying to find the answers can help you focus on the most important points. Turn each heading in Section 12-1 into a question, and then find and write the answer. Do your work on a separate sheet of paper.

A sample question for the heading “Water and Living Things” might be “How do living things need water?” A good answer would be: “Water is essential for living things to grow, reproduce, and carry out other important processes.”

CHAPTER 12, Fresh Water (continued)

SECTION
12-2 **Surface Water**
(pages 404-411)

This section describes fresh water on Earth’s surface, including rivers, lakes, ponds, and icebergs.

► **River Systems, Watersheds, and Divides** (pages 404–406)

1. The smaller streams and rivers that feed into a main river are called tributaries.

Match the term with its definition.

Term	Definition
<u> a </u> 2. river system	a. A river and all its tributaries together
<u> c </u> 3. watershed	b. The ridge that separates one watershed from another
<u> b </u> 4. divide	c. The land area that supplies water to a river system

► **Rivers and Floods** (page 406)

5. Is the following sentence true or false? Spring floods occur frequently on rivers in the Midwest. true

6. When does a flood occur? A flood occurs when the volume of water in a river increases so much that the river overflows its channel.

7. Why have people both feared and welcomed floods? Deposition from regular floods improves farm land, but floods can also destroy farms and crops and kill people.

► **Can Floods Be Controlled?** (page 407)

8. How can dams help to control floods? Dams can help by redirecting or storing extra water.

9. Long ridges of sediments alongside the channel of a river are called
levees.

10. Why may building up levees to prevent floods sometimes backfire?

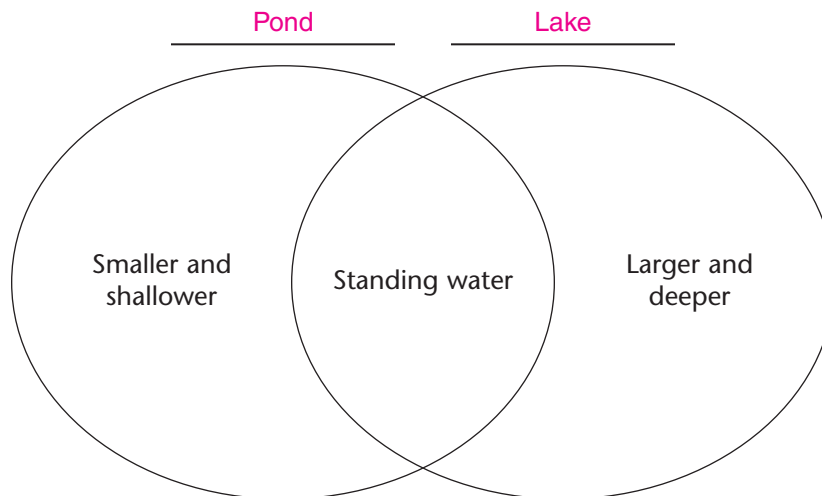
Levees may make heavy flooding worse for areas farther downstream

because the water has nowhere to go except downstream.

► **Bodies of Fresh Water** (page 407)

11. When do ponds and lakes form? They form when water collects in
hollows and low-lying areas.

12. Complete the Venn diagram by labeling each circle.



► **Ponds** (pages 408–409)

13. Circle the letter of each sentence that is true about ponds.

a. Ponds provide only one type of habitat.

b. All ponds exist year-round.

c. Algae are the basic food producers in ponds.

d. Pond animals include fish.

14. Why does ice form on the surface of a pond? Ice is less dense than

liquid water, so it floats on the surface.

CHAPTER 12, Fresh Water (continued)

15. Circle the letter of the sentence that explains why plants grow throughout a pond.

- a. Pond water is shallow. b. Animals live throughout a pond.
c. Some ponds dry up. d. Algae grow in a pond.

► Lakes (pages 409–410)

16. How is the bottom of a lake different from the bottom of a pond? The bottom of a lake has sand, pebbles, or rock. The bottom of a pond is muddy.

17. What are ways a lake may be used by people? A lake may be used for supplying drinking water, irrigating fields, and boating and fishing.

18. A lake that stores water for human use is called a(n) reservoir.

19. Is the following sentence true or false? Wildlife near the shore in a lake is similar to wildlife in a pond. true

20. Is the following sentence true or false? Compared with the center of a pond, the center of a lake has more organisms on the bottom.
false

► Icebergs (page 411)

21. Large chunks that break off a glacier and float away in the ocean are called icebergs.

22. Circle the letter of each sentence that is true about icebergs.

- a. Icebergs are made of frozen salt water.
 b. Many North Atlantic icebergs come from Greenland.
c. Icebergs are smallest near Antarctica.
d. About 90 percent of an iceberg is visible above water.

SECTION
12-3 **Groundwater**
(pages 412-415)

This section explains how water gets underground from the surface and how underground water is stored in rock layers. The section also describes how underground water gets back to the surface.

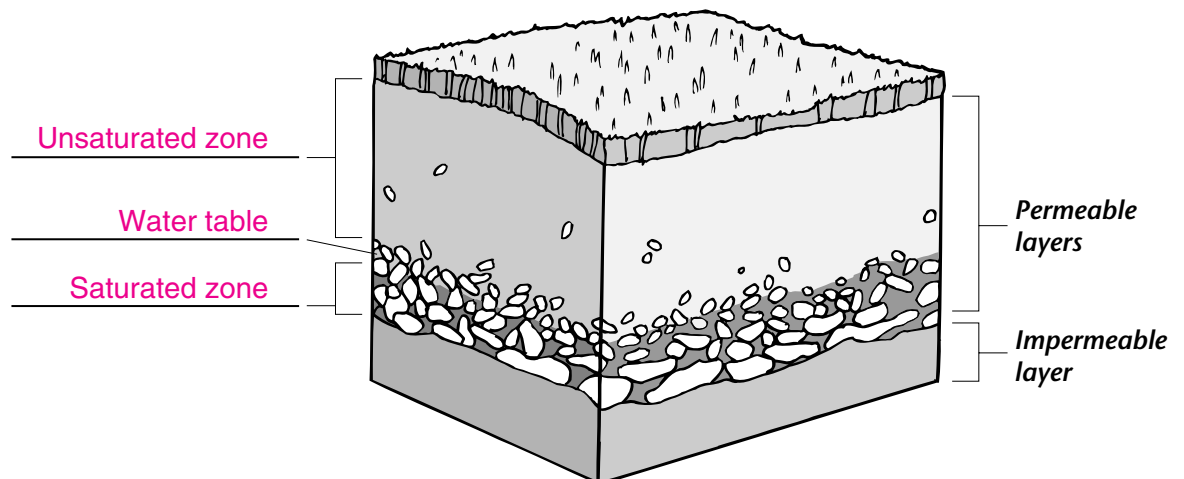
► **Underground Layers** (pages 412-413)

1. Precipitation that soaks into the ground trickles downward due to gravity.

Match the term with its definition.

Term	Definition
<u>c</u> 2. pore	a. Allows water to pass through
<u>a</u> 3. permeable	b. Area that is totally filled with water
<u>d</u> 4. impermeable	c. Space between rock and soil particles
<u>b</u> 5. saturated zone	d. Does not let water pass through
<u>f</u> 6. water table	e. Layer above the water table
<u>e</u> 7. unsaturated zone	f. Top of the saturated zone

8. In the drawing, label the water table and the saturated and unsaturated zones.



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CHAPTER 12, Fresh Water (continued)**► Aquifers** (page 414)

9. Any underground layer of rock or sediment that holds water is called

a(n) aquifer.

10. Circle the letter of each sentence that is true about aquifers.

a. All of them are very large.

b. They can provide drinking water.

c. They can provide water for crops.

d. They contain moving water.

► Bringing Groundwater to the Surface (pages 414–415)

11. Is the following sentence true or false? The depth of the water table is always the same, even over a large area of land. false

12. What raises the level of the water table, and when does the level fall?

Heavy rain or lots of melting snow raise the level of the water table. The level falls in dry weather.

13. Where the water table meets the ground surface, groundwater bubbles or flows out of cracks in the rock in places called springs.

14. Circle the letter of the choice that best explains how to get water from an aquifer with a well.

a. By drilling below the water table

b. By drilling below the aquifer

c. By drilling through impermeable rock

d. By drilling near a dry well

15. Is the following sentence true or false? Pumping water out of an aquifer in a well raises the water level near the well. false

16. New water that enters an aquifer from the surface is called

recharge.

17. A well in which water rises because of pressure within an aquifer is called a(n) artesian well.



SECTION **Wetland Systems**
12-4 (pages 418-422)

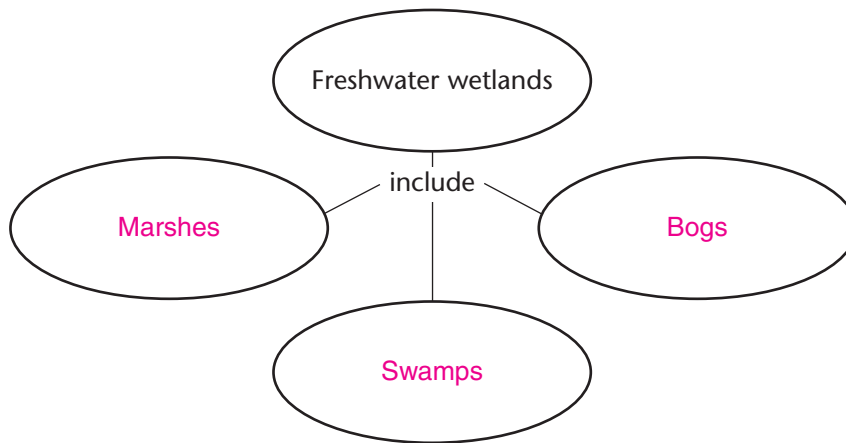
This section describes what wetlands are and the habitats they provide. The section also explains why wetlands are important.

► Introduction (page 418)

1. Circle the letter of each sentence that is true about a wetland.

- a. It is an area of land covered with shallow water.
- b. It always contains salt water.
- c. It can form where water is trapped in low areas.
- d. It may form where groundwater seeps onto the surface.

2. Complete the concept map.



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► What Is a Wetland System? (page 418)

3. Is the following sentence true or false? A wetland is a system made up of all of the living things in a given area and their physical environment. true

4. What are the two main parts of a wetland system?

- a. abiotic factors
- b. biotic factors

CHAPTER 12, Fresh Water *(continued)*

► **Abiotic Parts of a Wetland System** (page 419)

5. Is the following sentence true or false? The layer of water covering a wetland can range from several centimeters to a few meters deep.

 true

6. What two abiotic factors affect the amount of water available in a wetland system?

a. precipitation

b. temperature

7. Is the following sentence true or false? Due to the lack of movement of water in many wetland systems, there is a large amount of oxygen.

 false

► **Biotic Parts of a Wetland System** (pages 419–421)

8. The producers in a wetland ecosystem capture the energy of sunlight through photosynthesis and store it as chemical energy in food.

9. Match the plants with the wetland system in which they live.

Plants	Wetland System
<u> b </u> 9. Grasses and cattails	a. bog
<u> c </u> 10. Cypress trees	b. marsh
<u> a </u> 11. Sphagnum moss	c. swamp

12. Is the following sentence true or false? The consumers found in a wetland system depend on the types of producers that live there.

 true

13. What is the role of decomposers in a wetland system? Decomposers

break down the wastes and remains of plants and animals.

► **Properties of Wetland Systems (pages 421–422)**

14. Is the following sentence true or false? The properties of a wetland ecosystem differ from the properties of its parts. true
15. A wetland system provides habitats and niches for the organisms that live there.
16. Give an example of how incoming energy can affect the abiotic parts of a wetland system. Sunlight warms the water, causing it to evaporate and continue the water cycle.
17. Is the following sentence true or false? A wetland ecosystem tends to remain stable unless it is disturbed by a change in its abiotic or biotic factors. true

► **The Everglades: A Unique Wetland System (page 422)**

18. Circle the letter of each sentence that is true about the Everglades.
- a. The water in the Everglades does not flow.
 - b. No trees grow in the Everglades.
 - c. Many unusual species live in the Everglades.
 - d. The Everglades are a unique region.

► **The Importance of Wetland Systems (page 422)**

19. Circle the letter of each choice that is a natural function of wetlands.
- a. Helping control floods
 - b. Filtering water
 - c. Trapping silt and mud
 - d. Providing farmland
20. What happens when wetlands are drained or paved over? The water cannot be absorbed, so it runs off the land quickly and can cause floods.

CHAPTER 12, Fresh Water (continued)**SECTION**
12-5 **Water Resources**
(pages 423-425)

This section explains how the supply of water and the demand for water can change. The section also describes ways to conserve water and new ways of obtaining fresh water that may be used in the future.

► Water Supply and Demand (pages 424-425)

1. Is the following sentence true or false? Water is a nonrenewable resource. false
2. When does a water shortage occur? A water shortage occurs when there is too little water, too great a demand, or both.
3. The condition of scarce rainfall for a few years is known as a(n) drought.
4. Circle the letter of each sentence that is true about droughts.
 - a. They affect the supply of surface water.
 - b. They affect the supply of groundwater.
 - c. They cause the water table to rise.
 - d. They may cause wells to run dry.

► Conserving Water (pages 425-426)

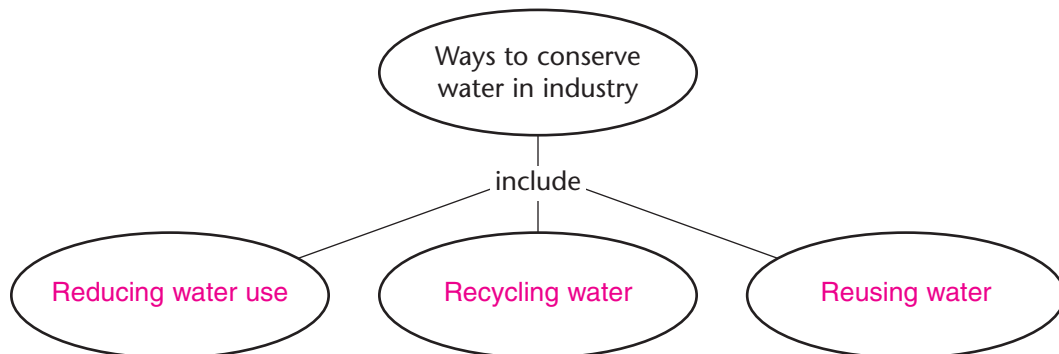
5. Using a resource wisely so that it will not be used up is called conservation.
6. Circle the letter of each choice that helps conserve water in the home.
 - a. Taking shorter showers
 - b. Watering the lawn around noon instead of early or late in the day
 - c. Keeping a pitcher of drinking water in the refrigerator
 - d. Running the washing machine only when you have small loads

7. Is the following sentence true or false? In the United States, the biggest use of water is for agriculture. true

8. How do sprinkler and drip irrigation systems help conserve water?

They help conserve water by reducing evaporation.

9. Complete the concept map.



► **Fresh Water for the Future** (pages 426–427)

10. The process of obtaining fresh water from salt water is called

desalination.

11. Circle the letter of the choice that gives the correct sequence of steps in distillation.

a. Evaporation, boiling, condensation

b. Boiling, condensation, evaporation

c. Boiling, evaporation, condensation

d. Condensation, boiling, evaporation

12. How could an iceberg be used to supply fresh water to a dry region on the coast of Africa or South America? The iceberg could be wrapped

and tugged to the area, and the water could be piped ashore as the iceberg

melted.

13. What environmental questions have been raised about using icebergs

for fresh water? Questions include how the ice would affect local weather

and what would happen to living things as the ice cooled the water around it.

CHAPTER 12, Fresh Water (continued)

WordWise

Match each definition in the left column with the correct term in the right column. Then write the number of each term in the appropriate box below. When you have filled in all the boxes, add up the numbers in each column, row, and two diagonals. All the sums should be the same.

- | | |
|--|-------------------|
| A. Lake that stores water for human use | 1. levee |
| B. Long ridge of sediments deposited alongside a river channel | 2. watershed |
| C. Layer of permeable rock or soil that is saturated with water | 3. drought |
| D. Top of the saturated zone | 4. groundwater |
| E. Area covered with shallow water some or all of the year | 5. wetland |
| F. A few years of scarce rainfall | 6. reservoir |
| G. Land area that supplies water to a river system | 7. water table |
| H. New water that enters an aquifer from the surface | 8. saturated zone |
| I. Water that fills the cracks and spaces in underground soil and rock layers. | 9. recharge |

A	B	C	=	<u>15</u>
<u>6</u>	<u>1</u>	<u>8</u>	=	<u>15</u>
D	E	F	=	<u>15</u>
<u>7</u>	<u>5</u>	<u>3</u>	=	<u>15</u>
G	H	I	=	<u>15</u>
<u>2</u>	<u>9</u>	<u>4</u>	=	<u>15</u>
=	=	=	=	<u>15</u>
<u>15</u>	<u>15</u>	<u>15</u>	=	<u>15</u>

CHAPTER 13

EARTH'S ATMOSPHERE

SECTION **The Air Around You**
13-1 (pages 434-437)

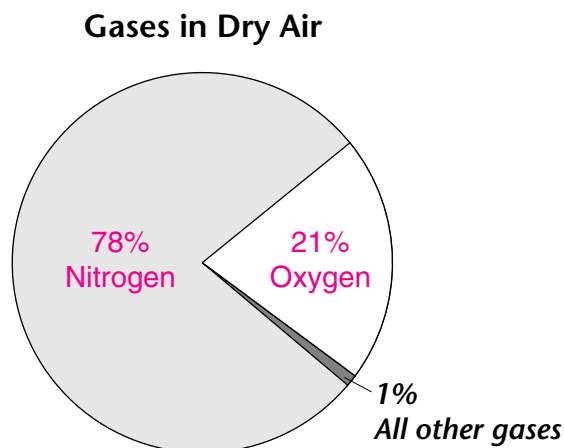
This section describes Earth's atmosphere, or the layer of gases that surrounds the planet.

► **Importance of the Atmosphere** (pages 434-435)

1. The condition of Earth's atmosphere at a particular time and place is called weather.
2. How does Earth's atmosphere make conditions on Earth suitable for living things? The atmosphere contains oxygen and other gases living things need to live. The atmosphere also keeps most of Earth's surface warm enough for water to exist as a liquid, which living things need, and it protects living things from dangerous radiation and meteoroids.

► **Composition of the Atmosphere** (pages 435-437)

3. Label the two larger pieces of the graph with the gases they represent.



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CHAPTER 13, Earth's Atmosphere *(continued)*

4. Circle the letter of each sentence that is true about nitrogen.

- a. It is essential to living things.
- b. It is found in proteins.
- c. It is needed for growth and repair of cells.
- d. It is obtained directly from the air by all living things.

5. Circle the letter of each sentence that is true about oxygen.

- a. It is needed by animals but not plants.
- b. It is needed to release energy from food.
- c. It is released by fuels when they burn.
- d. It forms ozone when it interacts with lightning.

6. Circle the letter of each sentence that is true about carbon dioxide.

- a. It is essential to life.
- b. It is given off by animals as a waste product.
- c. It is used by animals to digest food.
- d. It is needed by fuels to burn.

7. Is the following sentence true or false? Carbon dioxide alone makes up almost 1 percent of dry air. false

8. Water in the form of a gas is called water vapor .

9. Is the following sentence true or false? Water vapor is the same as steam.
 false

10. What role does water vapor play in Earth's weather? Water vapor forms
 clouds when it condenses out of the air to form tiny droplets of water or
 crystals of ice. The droplets or crystals fall as rain or snow if they become
 large enough.

11. What particles does air contain? Air contains tiny solid and liquid
 particles of dust, smoke, salt, and other chemicals.

SECTION
13-2 **Air Quality**
(pages 440-443)

This section describes harmful substances in the air and explains how they can affect people and things. The section also describes what has been done to improve air quality.

► **Air Pollution** (pages 440-441)

1. Harmful substances in the air, water, or soil are known as
pollutants.

2. How can air pollution affect human health? Air pollution can cause
dizziness and headaches; eye, nose, and throat irritation; allergies; cough;
lung diseases; and chest pains.

3. Circle the letter of each sentence that is true about the causes of air pollution.
 - a. Some air pollution occurs naturally.
 - b. Much of air pollution is caused by human activities.
 - c. Motor vehicles cause almost half the air pollution from human activities.
 - d. Factories and power plants cause a little more than half of all air pollution.

► **Particles** (page 441)

4. What are some natural sources of particles in the atmosphere? Natural
sources include ocean spray, molds, plant pollen, forest fires, soil erosion,
dust storms, and erupting volcanoes.

5. The average number of pollen grains in a cubic meter of air is known as the
pollen count.

6. The particles in smoke that give it its dark color are soot.

CHAPTER 13, Earth's Atmosphere (continued)

► Smog (page 442)

7. The brown haze that forms over sunny cities like Los Angeles is called photochemical smog.
8. Is the following sentence true or false? Photochemical smog is caused by the action of sunlight on chemicals. true
9. What effects does ozone have on living and nonliving things? It irritates breathing passages, harms plants, and damages rubber, paint, and some plastics.

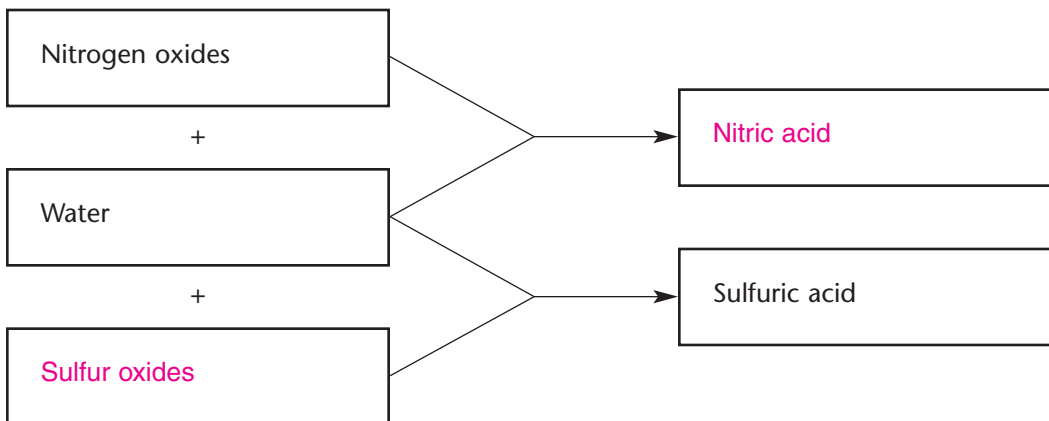
► Temperature Inversion (page 442)

10. When a layer of warm air holds polluted air close to the surface, it is called a(n) temperature inversion.

► Acid Rain (page 443)

11. Is the following sentence true or false? One result of air pollution is acid rain. true
12. Complete the flow chart.

Formation of Acid Rain



13. Rain that contains more acid than normal is known as

acid rain.

14. How can acid rain affect trees such as pines and spruce? It may make

tree needles turn brown or fall off.

15. How can acid rain harm lakes and ponds? It can make water so acidic

that plants, amphibians, fish, and insects can no longer survive in it.

► Improving Air Quality (page 443)

16. What are some laws and regulations that have been passed to reduce air pollution? Pollution-control devices are required on cars; factories and

power plants must install filters in smokestacks.

17. Is the following sentence true or false? Air quality in this country has worsened over the past 30 years. false

18. Is the following sentence true or false? The air in many American cities is still polluted. true



Reading Skill Practice

When you read about a complex process, representing the process with a flowchart can help you understand it. Make a flowchart to show how photochemical smog forms. For more information on flowcharts, see page 589 of the Skills Handbook in your text. Do your work on a separate sheet of paper.

Students' flowcharts should show that nitrogen oxides, hydrocarbons, and other air pollutants react with each other in the presence of sunlight to form the mixture of ozone and other chemicals that is called photochemical smog.

CHAPTER 13, Earth's Atmosphere *(continued)*

SECTION
13-3 **Air Pressure**
(pages 445-450)

This section describes several properties of air, including density and air pressure. The section also explains how air pressure is measured and how it changes with altitude.

► **Properties of Air** (pages 445-446)

- Circle the letter of each sentence that is true about air.
 - Air has mass because it is composed of atoms and molecules.
 - Because air has mass, it has density and pressure.
 - The more molecules in a given volume of air, the greater its density.
 - The greater the density of air, the less pressure it exerts.
- Complete the table.

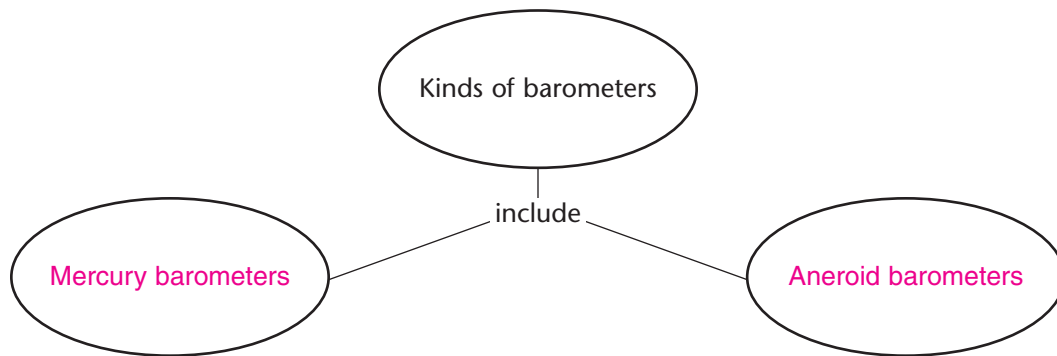
Properties of Air	
Property	Definition
Density	Amount of mass in a given volume of air
Pressure	Weight of the air pushing down on an area

- Why doesn't air pressure crush your desk? Air pressure doesn't crush your desk because the molecules in air push in all directions. So the air pushing down on the top of your desk is balanced by the air pushing up on the bottom.

► **Measuring Air Pressure** (pages 446-447)

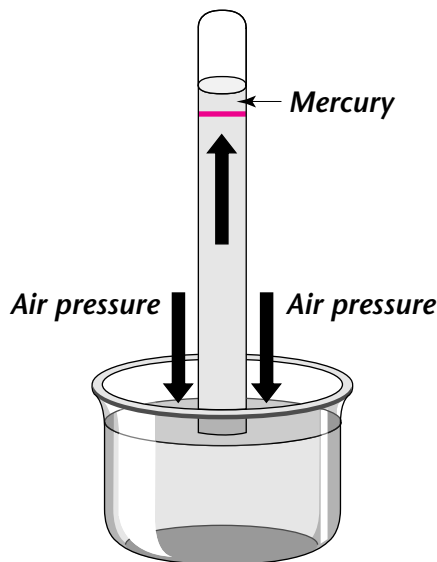
- Is the following sentence true or false? Falling air pressure usually indicates that a storm is approaching. true
- An instrument that is used to measure changes in air pressure is a(n) barometer.

6. Complete the concept map.



7. Is the following sentence true or false? The first barometers invented were aneroid barometers. false

8. Draw a line on the glass tube to show where the level of the mercury might be if the air pressure fell.



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9. Why are aneroid barometers often more practical than mercury barometers? They are often more practical because they are smaller and do not contain liquid.

10. Two different units used to measure air pressure are inches and millibars.

CHAPTER 13, Earth's Atmosphere (continued)

11. If the air pressure is 30 inches, how many millibars of air pressure are there? There are about 1,016 millibars.

► Increasing Altitude (pages 448–450)

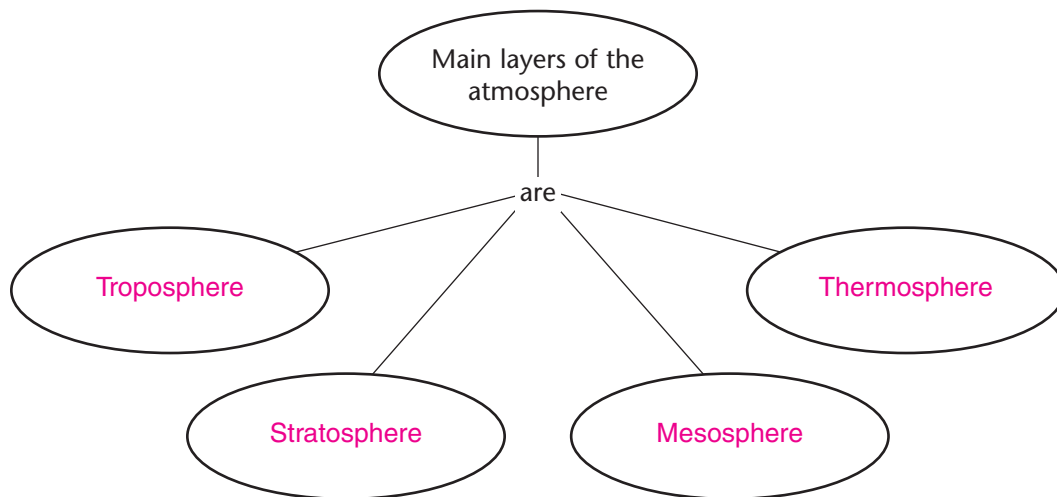
12. Another word for elevation, or distance above sea level, is altitude.
13. Is the following sentence true or false? Air pressure increases as altitude increases. false
14. Is the following sentence true or false? As air pressure decreases, so does air density. true
15. Why is air pressure greatest at sea level? Air pressure is greatest at sea level because sea-level air has the weight of the whole atmosphere pressing down on it.
16. Why is the air pressure on top of a mountain less than the air pressure at sea level? The air on top of a mountain has less weight pressing down on it, and thus has lower air pressure.
17. Is the following sentence true or false? As altitude increases, so does air density. false
18. Circle the letter of the sentence that helps explain why you would have more difficulty breathing at high altitudes than at sea level.
- a. Air pressure is higher at high altitudes.
 - b. Density of the air is greater at high altitudes.
 - c. The percentage of oxygen in the air is lower at high altitudes.
 - d.** The amount of oxygen in each breath is less at high altitudes.

SECTION **Layers of the Atmosphere**
13-4 (pages 451-456)

This section describes the four main layers of the atmosphere.

► **Introduction** (page 451)

- The four main layers of the atmosphere are classified according to changes in temperature.
- Complete the concept map.



► **The Troposphere** (pages 451-452)

- Circle the letter of each sentence that is true about the troposphere.
 - a. It is the lowest layer of Earth’s atmosphere.
 - b. It has less variable conditions than other layers.
 - c. It is where Earth’s weather occurs.
 - d. It is the shallowest layer of the atmosphere.
- Is the following sentence true or false? The troposphere contains almost all of the mass of the atmosphere. true
- Is the following sentence true or false? As altitude increases in the troposphere, temperature also increases. false

CHAPTER 13, Earth's Atmosphere *(continued)*

6. How does the depth of the troposphere vary? The depth varies from more than 16 kilometers above the equator to less than 9 kilometers above the North and South poles.
7. Is the following sentence true or false? At the top of the troposphere, the temperature stays constant. true

► The Stratosphere (page 452)

8. How far does the stratosphere extend above Earth's surface? It extends to about 50 kilometers above Earth's surface.
9. Circle the letter of each sentence that is true about the stratosphere.
- a. The temperature of the lower stratosphere is about -60°C .
 - b. The upper stratosphere is colder than the lower stratosphere.
 - c. The upper stratosphere contains a layer of ozone.
 - d. The ozone in the stratosphere reflects energy from the sun.
10. Why does a weather balloon keep increasing in volume as it rises through the stratosphere? It keeps increasing in volume because the air pressure outside the balloon is decreasing.

► The Mesosphere (pages 452–454)

11. Where does the mesosphere begin? It begins 50 kilometers above Earth's surface.
12. Circle the letter of each sentence that is true about the mesosphere.
- a. It is the middle layer of the atmosphere.
 - b. In its outer part, temperatures approach -90°C .
 - c. It protects Earth's surface from being hit by most meteoroids.
 - d. It ends at 320 kilometers above sea level.

► **The Thermosphere** (pages 454–456)

13. Circle the letter of each sentence that is true about the thermosphere.

- a. It is the outermost layer of the atmosphere.
- b. Its air is very thin.
- c. It has no definite outer limit.
- d. It starts at 320 kilometers above sea level.

14. Why is the thermosphere so hot? Energy from the sun strikes the thermosphere first, and nitrogen and oxygen molecules in the air convert the energy into heat.

15. Why would an ordinary thermometer show a low temperature in the thermosphere? There are not enough air molecules in the thermosphere to collide with an ordinary thermometer and warm it very much.

16. Complete the table.

Layers of the Thermosphere	
Layer	Distance Above Sea Level
Ionosphere	80–550 kilometers
Exosphere	Above 550 kilometers

17. Brilliant light displays that occur in the ionosphere are called the aurora borealis.

18. Is the following sentence true or false? Satellites orbit Earth in the exosphere. true

CHAPTER 13, Earth's Atmosphere (continued)

WordWise

Match each definition in the left column with the correct term in the right column. Then write the number of each term in the appropriate box below. When you have filled all the boxes, add up the numbers in each column, row, and two diagonals. All the sums should be the same.

Definitions

- A. Mixture of gases that surrounds Earth
- B. Form of oxygen with three atoms instead of two
- C. Harmful substance in the air, water, or soil
- D. Amount of mass in a given space
- E. Amount of force pushing on an area
- F. Elevation above sea level
- G. Second-lowest layer of Earth's atmosphere
- H. Outermost layer of Earth's atmosphere
- I. Outer layer of the thermosphere

Terms

- 1. thermosphere
- 2. atmosphere
- 3. altitude
- 4. pollutant
- 5. pressure
- 6. stratosphere
- 7. density
- 8. exosphere
- 9. ozone

A <u>2</u>	B <u>9</u>	C <u>4</u>		= <u>15</u>
D <u>7</u>	E <u>5</u>	F <u>3</u>	=	<u>15</u>
G <u>6</u>	H <u>1</u>	I <u>8</u>	=	<u>15</u>
=	=	=	=	<u>15</u>
<u>15</u>	<u>15</u>	<u>15</u>		

CHAPTER 14

WEATHER FACTORS

SECTION **Energy in the Atmosphere**
14-1 (pages 462-465)

This section explains how the atmosphere, or the air around Earth, is heated.

► **Energy from the Sun** (pages 462-463)

1. Is the following sentence true or false? About half the energy in Earth’s atmosphere comes from the sun. false
2. Energy from the sun travels to Earth as electromagnetic waves .
3. Is the following sentence true or false? Electromagnetic waves are classified according to wavelength, or the distance between waves.
 true
4. The direct transfer of energy by electromagnetic waves is called radiation .

Match the type of radiation with its description.

	Type of Radiation	Description
<u> a </u>	5. visible light	a. It is a mixture of all the colors of the rainbow.
<u> c </u>	6. infrared radiation	b. It has wavelengths that are shorter than violet light.
<u> b </u>	7. ultraviolet radiation	c. It has wavelengths that are longer than red light.

8. What causes the different colors of visible light? The different colors are the result of different wavelengths.

CHAPTER 14, Weather Factors (continued)

9. Is the following sentence true or false? Red light has a shorter wavelength than blue light. false

10. Circle the letter of each sentence that is true about infrared radiation.

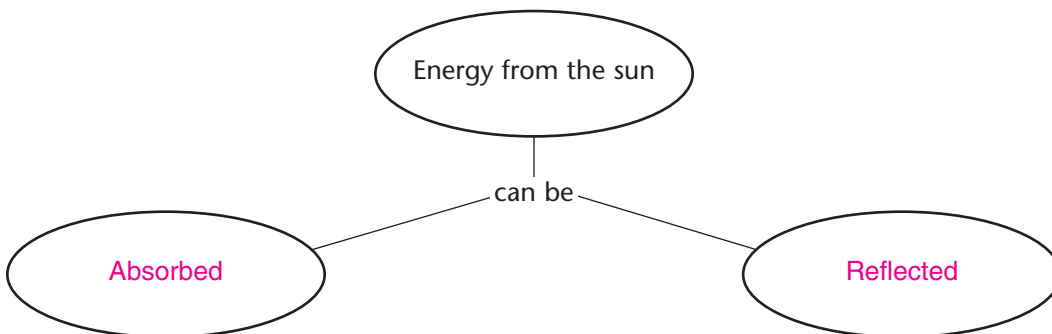
- a. It is invisible.
- b. It can be felt as heat.
- c. It has longer wavelengths than red light.
- d. It causes sunburn.

11. Circle the letter of each sentence that is true about ultraviolet radiation.

- a. It makes up most of the energy from the sun that reaches Earth.
- b. It can cause skin cancer and eye damage.
- c. It has longer wavelengths than violet light.
- d. It is used in heat lamps.

► Energy in the Atmosphere (pages 463–464)

12. Complete the concept map.



13. What absorbs or reflects energy from the sun in the atmosphere?

 Clouds, dust particles, and molecules of gases in the atmosphere absorb or reflect energy from the sun.

14. Reflection of light in all directions is called scattering .

15. Circle the letter of each sentence that is true about scattering.

- a. Short wavelengths of visible light scatter less than long wavelengths.
- b. Blue light scatters less than red light.
- c. Scattered light is bluer than ordinary sunlight.
- d. Scattering explains why the daytime sky looks blue.

16. What happens to energy from the sun that is neither reflected nor absorbed by the atmosphere? The energy is either reflected or absorbed by Earth's surface.

► **Energy at Earth's Surface** (page 465)

17. Energy that is absorbed by the land and water is changed into heat.

18. Is the following sentence true or false? When Earth's surface is heated, it radiates some of the energy back into the atmosphere as ultraviolet radiation. false

19. What absorbs the energy that is radiated from Earth's surface? Water vapor, carbon dioxide, and other gases in the atmosphere absorb the energy that is radiated from Earth's surface.

20. The process by which gases hold heat in the air is called the greenhouse effect.

21. Is the following sentence true or false? The greenhouse effect is a natural process. true

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SECTION **Heat Transfer**
14-2 (pages 468-471)

This section explains what temperature measures and how temperature is related to heat. The section also describes three ways that heat can be transferred from a hotter object to a cooler one.

► **Energy and Temperature** (pages 468-469)

1. Is the following sentence true or false? The faster the molecules of a gas are moving, the more energy they have. true

CHAPTER 14, Weather Factors (continued)

2. The total energy of motion in the molecules of a substance is called thermal energy.
3. The average amount of energy of motion of the molecules of a substance is called temperature.
4. Is the following sentence true or false? Temperature is a measure of how hot or cold a substance is. true

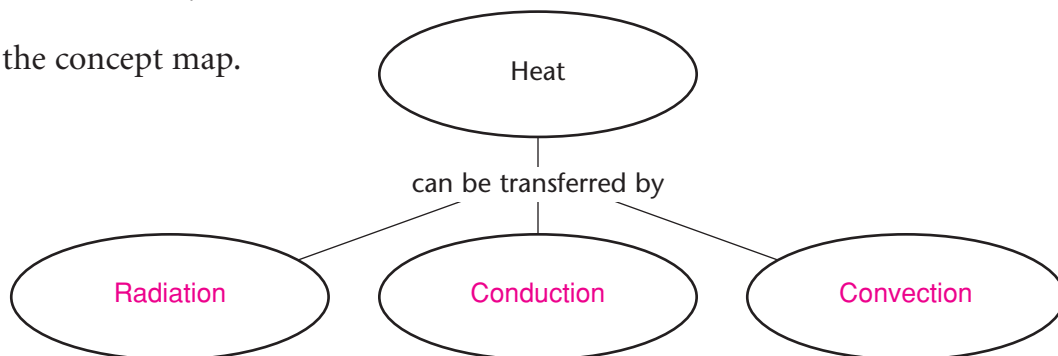
► **Measuring Temperature** (page 469)

5. Air temperature is usually measured with a(n) thermometer.
6. How does a thermometer work? When the temperature increases, the liquid in the bulb expands and rises up the column. When the temperature decreases, the liquid contracts and moves down.
7. Complete the compare/contrast table.

Temperature Scales		
Scale	Freezing Point of Water	Boiling Point of Water
Celsius	0°C	100°C
Fahrenheit	32°F	212°F

► **How Heat Is Transferred** (pages 469–470)

8. The energy transferred from a hotter object to a cooler one is referred to as heat.
9. Complete the concept map.



10. Is the following sentence true or false? Radiation is the direct transfer of energy by electromagnetic waves. true

11. The direct transfer of heat from one substance to another substance that it is touching is called conduction.

12. Circle the letter of each sentence that is true about conduction.

- a. It works well in some solids. b. It works well in metals.
 c. It works best in liquids. d. It works very well in air.

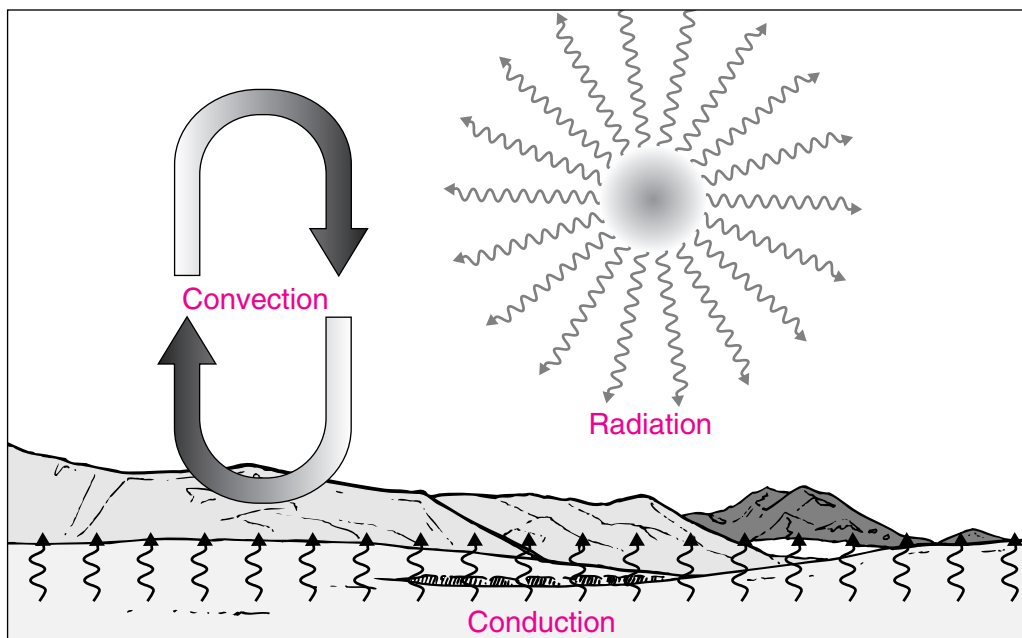
13. The transfer of heat by the movement of a fluid is called convection.

Match the type of heat transfer with its example.

Heat Transfer	Example
<u> c </u> 14. radiation	a. Drying your boots over a hot-air vent
<u> b </u> 15. conduction	b. Burning your bare feet on hot sand
<u> a </u> 16. convection	c. Feeling the sun's warmth on your face

► **Heat Transfer in the Troposphere** (pages 470–471)

17. In the drawing, label each of the ways that heat is transferred in the troposphere.



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CHAPTER 14, Weather Factors (continued)

18. Most of the heating of the troposphere is caused by convection.
19. The upward movement of warm air and the downward movement of cool air form convection currents.

SECTION **Winds**
14-3 (pages 472-480)

This section explains what causes winds and how winds are measured. The section also describes different types of winds that blow across Earth’s surface.

► **What Causes Winds?** (pages 472-473)

1. The horizontal movement of air from an area of high pressure to an area of lower pressure is referred to as wind.
2. Is the following sentence true or false? All winds are caused by differences in air pressure. true
3. Differences in air pressure are caused by unequal heating of the atmosphere.

► **Measuring Wind** (page 473)

Match the instrument with what it measures.

Instrument	What It Measures
<u> b </u> 4. wind vane	a. wind speed
<u> a </u> 5. anemometer	b. wind direction

6. Is the following sentence true or false? A south wind blows toward the south. false
7. The increased cooling that a wind can cause is called the wind-chill factor.

8. Why does the wind blowing over your skin make you feel colder?

The wind makes you feel colder because it removes body heat.

► **Local Winds** (pages 474–476)

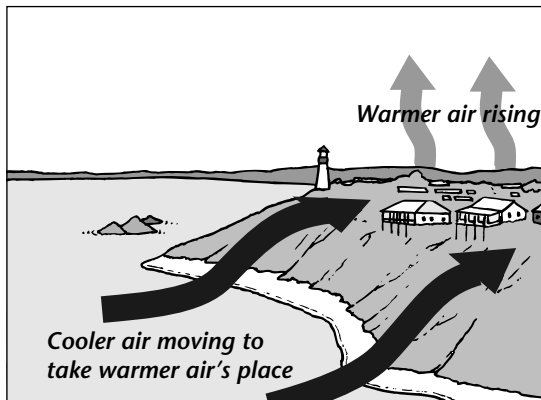
9. Winds that blow over short distances are called local winds.

10. What causes local winds? Local winds are caused by unequal heating of Earth's surface within a small area.

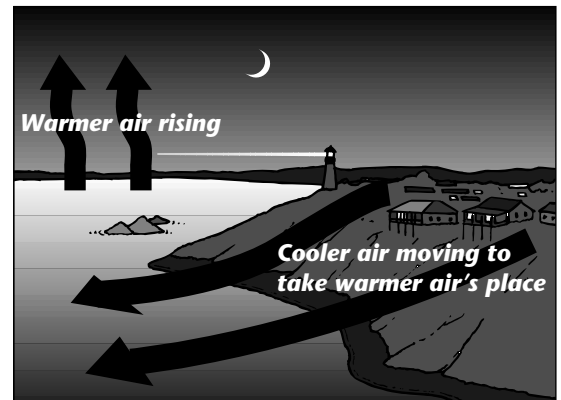
11. Circle the letter of each sentence that is true about the unequal heating of land and water.

- a. Land warms up faster than water.
- b. During the day, air over water is warmer than air over land.
- c. Water cools more quickly than land.
- d. At night, air over water is cooler than air over land.

12. Label the drawings to indicate which drawing shows a sea breeze and which drawing shows a land breeze.



Sea breeze



Land breeze

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► **Monsoons** (page 476)

13. Circle the letter of each sentence that is true about monsoons.

- a. They are caused by unequal heating of land and water.
- b. They occur in the South Atlantic.
- c. They always blow in the same direction.
- d. They supply the rains needed by crops.

CHAPTER 14, Weather Factors (continued)

► **Global Winds** (page 477)

14. Winds that blow steadily from specific directions over long distances are called global winds.

15. Circle the letter of each sentence that is true about global winds.

- a. They are created by unequal heating of Earth’s surface.
- b. They are produced by the movement of air between the equator and the poles.
- c. They blow in a straight line from the poles toward the equator.
- d. They curve because of Earth’s rotation.

16. As Earth rotates, the Coriolis effect causes winds in the Northern Hemisphere to turn toward the right.

► **Global Wind Belts** (pages 478–480)

17. The calm areas around Earth include the doldrums and the horse latitudes.

18. Complete the compare/contrast table.

Directions of Global Wind Belts	
Wind Belt	Direction It Blows
Trade winds	Toward the equator
Prevailing westerlies	Toward the poles
Polar easterlies	Away from the poles

► **Jet Streams** (page 480)

19. Circle the letter of each sentence that is true about jet streams.

- a. They are about 100 kilometers above Earth’s surface.
- b. They are hundreds of kilometers wide.
- c. They blow from east to west.
- d. They blow at speeds of 200 to 400 kilometers per hour.

SECTION
14-4 **Water in the Atmosphere**
(pages 481-486)

This section explains what humidity is and how it is measured. The section also explains how clouds form and describes different types of clouds.

► **Introduction (page 481)**

1. The process by which water molecules in liquid water escape into the air as water vapor is called evaporation.
2. What is the water cycle? The water cycle is the movement of water between the atmosphere and Earth's surface.

► **Humidity (page 482)**

3. A measure of the amount of water vapor in the air is humidity.
4. What is relative humidity? It is the percentage of water vapor in the air compared to the maximum amount the air could hold.
5. Circle the letter of each sentence that is true about relative humidity.
 - a. It is a percentage.
 - b. It is all the water vapor the air can hold.
 - c. It depends on air temperature.
 - d. It measures how hot it feels.
6. How does evaporation of moisture from your skin help keep you comfortable on a hot day? Evaporation of moisture from your skin removes heat and helps to keep your body's temperature comfortable.

► **Measuring Relative Humidity (pages 482-483)**

7. Relative humidity can be measured with a(n) psychrometer.

CHAPTER 14, Weather Factors *(continued)*

8. Circle the letter of each sentence that is true about how a psychrometer works.
- a. The dry-bulb thermometer is cooled by evaporation when the wind blows.
 - b. The higher the humidity, the faster water evaporates from the bulb.
 - c. The wet-bulb thermometer reading is always higher than the dry-bulb reading.
 - d.** When relative humidity is high, there is not much difference between thermometer readings.

► **How Clouds Form** (pages 482–483)

9. Is the following sentence true or false? Clouds form when water vapor in the air becomes liquid water or ice crystals. true

Match the term with its definition.

Term	Definition
<u> d </u> 10. condensation	a. Ice that has been deposited directly from the air onto a cold surface
<u> c </u> 11. dew point	b. Water that condenses from the air onto a cold surface
<u> b </u> 12. dew	c. Temperature at which condensation begins
<u> a </u> 13. frost	d. Process by which molecules of water vapor become liquid water

14. Circle the letter of each sentence that is true about condensation of water vapor.
- a. It occurs when air gets warmer.
 - b.** It can occur on cold surfaces.
 - c.** It is why clouds form.
 - d. It occurs when air sinks.
15. What causes the clouds to form on the windward side of the mountain?

 The cooling of humid air as it rises up over the mountain causes condensation and cloud formation.

► **Types of Clouds (pages 484–486)**

Match the type of cloud with its height.

- | Type of Cloud | Height |
|--------------------------|---|
| <u> a </u> 16. cumulus | a. About 2 to 18 kilometers above the surface |
| <u> d </u> 17. stratus | b. More than 6 kilometers above the surface |
| <u> b </u> 18. cirrus | c. At or near the surface |
| <u> c </u> 19. fog | d. 2 to 6 kilometers above the surface |

20. Complete the table.

Types of Clouds	
Type of Cloud	Description
Cumulus	Looks like fluffy piles of cotton
Stratus	Forms in flat layers
Cirrus	Looks wispy and feathery

21. Circle the letter of each sentence that is true about cloud types.

- a. Cumulus clouds are usually a sign that a storm is approaching.
- b.** Cumulonimbus and nimbostratus clouds produce rain or snow.
- c. Altostratus clouds are lower than regular stratus clouds.
- d.** Cirrus clouds are made up of ice crystals.

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Reading Skill Practice

When you read a section with a lot of details, writing an outline can help you organize and remember the material. Outline Section 14-4 by first writing the section headings as major topics in the order in which they appear in the book. Then, beneath each major topic, list important details about it. Title your outline *Water in the Atmosphere*. Do your work on a separate sheet of paper.

Students should use as their major topics *Humidity, Measuring Relative Humidity, How Clouds Form, and Types of Clouds*. Under each topic, they should list enough details to make the topic clear and informative.

CHAPTER 14, Weather Factors (continued)

SECTION **Precipitation**
14-5 (pages 487-490)

This section explains how rain, snow, and other common types of precipitation occur and how they are measured. The section also describes how scientists try to produce rain from clouds.

► **Introduction** (page 487)

1. What is precipitation? Precipitation is any form of water that falls from clouds and reaches Earth's surface.
2. Is the following sentence true or false? All clouds produce precipitation.
false

► **Types of Precipitation** (pages 487-489)

3. Complete the compare/contrast table.

Types of Precipitation	
Type of Precipitation	Description
Rain	Drops of water at least 0.5 mm in diameter
Sleet	Ice particles smaller than 5 mm in diameter
Hail	Ice pellets larger than 5 mm in diameter
Snow	Ice crystals

4. Is the following sentence true or false? The most common kind of precipitation is snow. false
5. How do mist and drizzle differ from rain? Mist and drizzle are made up of smaller drops of water than rain.

6. Why do ice storms cause power failures? Ice builds up on tree branches, which break onto power lines, causing power failures.
-

Match the type of precipitation with how it forms

Precipitation	How It Forms
<u> d </u> 7. sleet	a. Water vapor in a cloud is converted directly into ice crystals.
<u> c </u> 8. freezing rain	b. Ice pellets add layers of ice as they are carried up and down in a storm cloud.
<u> b </u> 9. hail	c. Raindrops freeze after they hit the ground and other surfaces.
<u> a </u> 10. snow	d. Raindrops freeze into tiny particles of ice as they fall through the air.

11. What damage can large hailstones do? Large hailstones can cause tremendous damage to crops, buildings, and vehicles.
-

► **Measuring Precipitation (page 489)**

12. Meteorologists measure rainfall with a(n) rain gauge.
13. Is the following sentence true or false? On average, 10 centimeters of snow contains about the same amount of water as 5 centimeters of rain. false

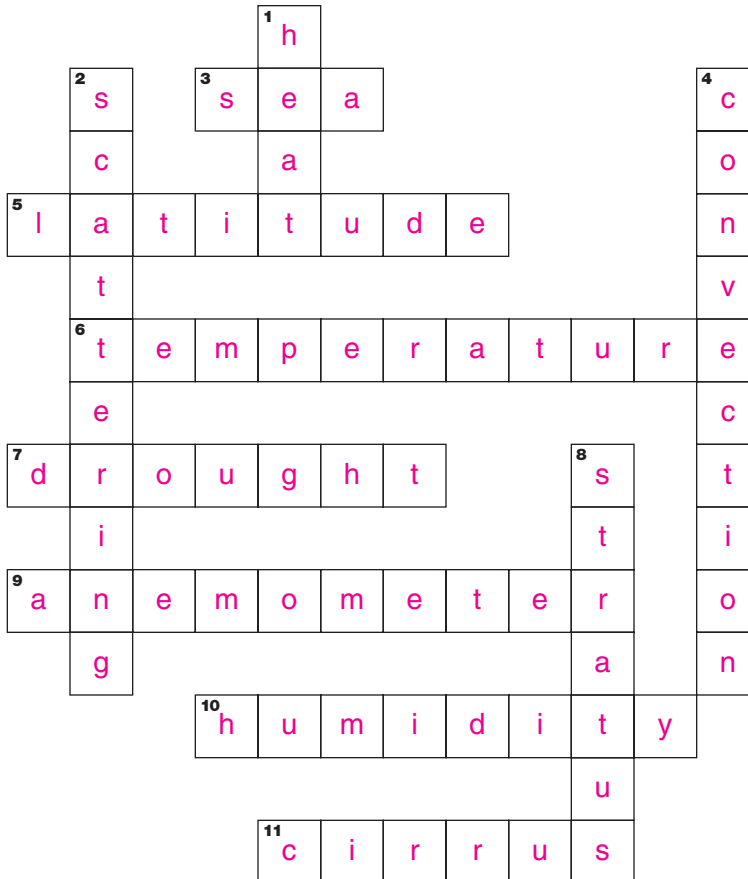
► **Controlling Precipitation (page 490)**

14. Long periods of unusually low precipitation are called droughts.
15. Circle the letter of each sentence that is true about cloud seeding.
- a. It is the most common way to produce rain from clouds.
 - b. It adds water vapor to the air so clouds will form.
 - c. It adds particles to clouds so water vapor can condense.
 - d. It has been used to clear fog from airports.

CHAPTER 14, Weather Factors (continued)

WordWise

Test your knowledge of key terms from Chapter 14 by solving the crossword puzzle.



Clues down

1. The energy transferred from a hotter object to a cooler one
2. Reflection of light in all directions
4. Transfer of heat by movements of a fluid
8. Clouds that form in flat layers

Clues across

3. Type of breeze that blows from an ocean or lake to the land
5. Distance north or south from the equator measured in degrees
6. Average amount of energy of motion in the molecules of a substance
7. Water shortage caused by long periods of low precipitation
9. Instrument used to measure wind speed
10. Measure of the amount of water vapor in the air
11. Clouds made mostly of ice crystals that form high above Earth

CHAPTER 15

WEATHER PATTERNS

SECTION **Air Masses and Fronts**
15-1 (pages 496-502)

This section describes huge bodies of air, called air masses, and explains how they move. The section also explains how the meeting of different air masses affects weather.

► **Introduction** (page 496)

1. What is an air mass? An air mass is a huge body of air that has similar temperature, humidity, and air pressure throughout it.

► **Types of Air Masses** (pages 496-498)

2. Scientists classify air masses according to temperature and humidity.
3. Is the following sentence true or false? Polar air masses have low air pressure. false
4. Complete the compare/contrast table.

Types of Air Masses and Their Characteristics	
Type of Air Mass	Characteristics
Maritime tropical	Warm and humid
Maritime polar	Cool and humid
Continental tropical	Hot and dry
Continental polar	Cool and dry

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► **Cyclones and Anticyclones** (pages 501–502)

12. A swirling center of low air pressure is called a(n) cyclone.

13. Is the following sentence true or false? Winds spiral inward toward the center of a cyclone. true

14. What type of weather is associated with cyclones? Storms and precipitation are associated with cyclones.

15. Is the following sentence true or false? Winds in an anticyclone spin clockwise in the Northern Hemisphere. true

16. What type of weather is associated with anticyclones? Dry, clear weather is associated with anticyclones.

.....

SECTION **Storms**
15-2 (pages 503–511)

This section explains how thunderstorms, tornadoes, hurricanes, and snow storms form. The section also describes how people can stay safe in the different types of storms.

► **Introduction** (page 503)

1. What is a storm? A storm is a violent disturbance in the atmosphere.

► **Thunderstorms** (pages 504–505)

2. Circle the letter of the type of clouds in which thunderstorms form.

a. cumulus

b. nimbus

c. nimbostratus

d. cumulonimbus

3. A sudden energy discharge between parts of a cloud or between the cloud and the ground is called lightning.

CHAPTER 15, Weather Patterns (continued)

4. Circle the letter of each sentence that is true about thunder.

- a. It is the sound of an explosion.
- b. It occurs after lightning.
- c. It occurs because lightning heats the air.
- d. It occurs because light travels faster than sound.

5. Circle the letter of each sentence that is a way to stay safe in a thunderstorm.

- a. Avoid touching metal objects.
- b. Get out of the water.
- c. Don't use the telephone.
- d. Get out of your car and go under a tree.

► Tornadoes (pages 505–508)

6. What is a tornado? A tornado is a rapidly whirling, funnel-shaped cloud that reaches down from a storm cloud to touch Earth's surface.

7. Is the following sentence true or false? Tornadoes develop in the same clouds that bring thunderstorms. true

8. Circle the letter of each sentence that is true about where and when tornadoes occur.

- a. Tornadoes are most likely in late summer and early fall.
- b. Tornadoes occur often in the Great Plains.
- c. Tornadoes occur more often in the United States than in any other country.
- d. Tornadoes occur in just a few parts of the United States.

9. Where is the safest place to be during a tornado? The safest place to be is in the basement of a well-built building.

► **Hurricanes (pages 508–510)**

10. Circle the letter of each sentence that is true about a hurricane.

- a. It is a tropical storm.
- b. It has winds of at least 159 kilometers per hour.
- c. It is typically about 60 kilometers across.
- d. It forms over water.

11. The quiet center of a hurricane is called the eye.

12. Is the following sentence true or false? Hurricanes do not last as long as other storms. false

13. A “dome” of water that sweeps across the coast where the hurricane lands is called a(n) storm surge.

14. Is the following sentence true or false? If you hear a hurricane warning and are told to evacuate, you should leave the area immediately.
true

► **Winter Storms (pages 510–511)**

15. When does snow fall? Snow falls when humid air cools below 0°C.

16. Circle the letter of each sentence that is true about lake-effect snow.

- a. It occurs in Detroit and Chicago.
- b. It occurs because land cools more rapidly than water.
- c. It occurs on the south and west sides of the Great Lakes.
- d. It occurs when humid air rises and cools over land.

17. What should you do if you are caught in a snowstorm? You should try to find shelter from the wind, cover exposed parts of your body, and try to stay dry. If you are in a car, the driver should keep the engine running only if the exhaust pipe is clear of snow.

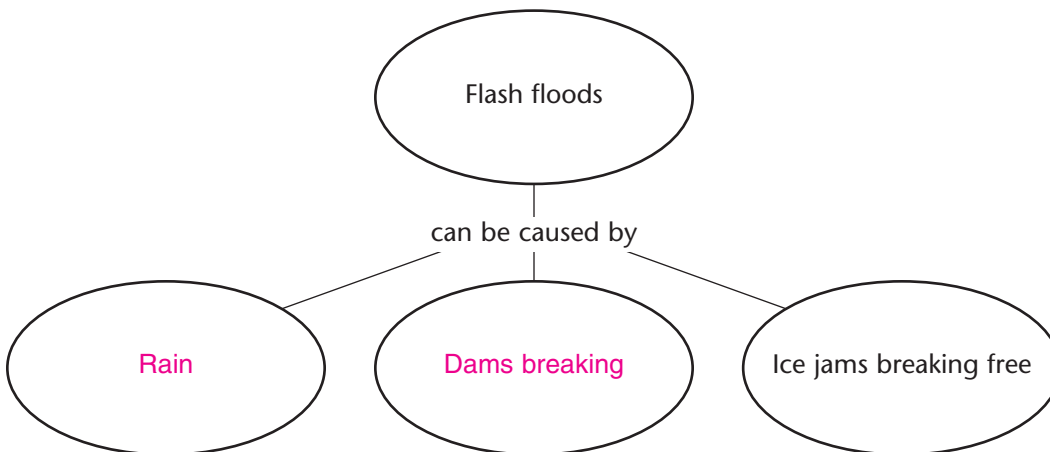
CHAPTER 15, Weather Patterns (continued)

SECTION 15-3 Floods (pages 515-518)

This section explains why floods occur and describes how to stay safe in floods.

► Flash Floods (page 516)

1. Is the following sentence true or false? Floods are the most dangerous weather-related events in the United States. true
2. A sudden, violent flood that occurs within a few hours, or even minutes, of a storm is called a(n) flash flood.
3. Complete the concept map.



► Flood Safety Measures (pages 516-518)

4. Why is it important to be able to predict floods? Advance warning can help reduce flood damage and loss of life.
5. An announcement describing the area in which flooding is possible is a(n) flood watch.
6. An announcement that floods have already been reported or are about to occur is a(n) flood warning.

7. What is the first rule of flood safety? The first rule of flood safety is to
move to higher ground and stay away from flood waters.

8. Circle the letter of each choice that is a flood hazard.

- a. power outages
- b. landslides
- c. polluted drinking water
- d. interruption of emergency services



Reading Skill Practice

As you read, identifying the sentence that best expresses the main topic under each heading can help you focus on the most important points. For each heading in Section 15-3, identify and copy the sentence that best expresses the main topic under that heading. Do your work on a separate sheet of paper.

The boldfaced sentences are good choices for topic sentences under the two headings.

.....

SECTION **Predicting the Weather**
15-4 (pages 519-525)

This section explains how scientists predict the weather in the future and why it is difficult to predict the weather accurately. The section also explains how to read weather maps.

► **Weather Forecasting** (page 520)

1. Scientists who study the causes of weather and try to predict it are called meteorologists.
2. Meteorologists get weather information from which of the following sources?
 - a. radar
 - b. seismographs
 - c. instruments carried by balloons
 - d. satellites

CHAPTER 15, Weather Patterns (continued)

► Weather Technology (page 521)

3. In what two areas have changes in technology occurred in weather forecasting? Gathering weather data and using computers to make forecasts
-
4. Is the following sentence true or false? Weather forecasts for over three days into the future are never reliable. false
5. Circle the letter of each sentence that is true about weather balloons or weather satellites.
- a. Weather balloons carry instruments into the stratosphere.
 - b. Weather balloons carry computers to analyze weather data.
 - c. The first weather satellite was launched in 1940.
 - d. Weather satellites take pictures of Earth from the exosphere.
6. Circle the letter of each sentence that is true about computer forecasts of the weather.
- a. Computers are rarely used to help forecast weather.
 - b. Computer forecasts are based on weather conditions from many weather stations.
 - c. Computers only make long-term forecasts of a week or more.
 - d. When new weather data come in, computers revise their forecasts.

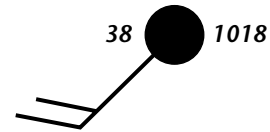
► El Niño (page 522)

7. A warm-water event that occurs periodically in the Pacific Ocean is called El Niño.
8. Circle the letter of each sentence that is true about El Niño.
- a. When it occurs, warm surface water is pushed toward South America.
 - b. It prevents cold water from rising to the surface near the coast of South America.
 - c. It occurs once every five to ten years.
 - d. It can affect weather patterns in places as far away as Florida.

► **Reading Weather Maps** (pages 522–525)

9. What data are shown on a weather map? Weather maps show amount of cloud cover, atmospheric pressure, wind direction, wind speed, and temperature for individual weather stations. Weather maps also show the location of air masses and fronts.

10. What are the temperature, air pressure, and wind direction at the weather station represented by the symbol shown here? The temperature is 38°F, the air pressure is 1018 millibars, and the wind is from the southwest.



Match the term with its definition.

Term	Definition
<u> b </u> 11. isobars	a. Lines on a weather map joining places that have the same temperature
<u> a </u> 12. isotherms	b. Lines on a weather map joining places that have the same air pressure

► **The Butterfly Effect** (page 524)

13. Why is weather forecasting tricky, even with current technology?
The main reason weather forecasting is tricky is that weather patterns do not follow an orderly, step-by-step process.

14. Is the following sentence true or false? The butterfly effect refers to the fact that a small change in the weather today can mean a larger change in the weather a week later. true

CHAPTER 15, Weather Patterns (continued)

WordWise

Solve the clues by filling in the blanks with key terms from Chapter 15. Then write the numbered letters in the correct order to find the hidden message.

Clues

Key Terms

Violent disturbance in the atmosphere

s t o r m
1 2

Type of air mass that forms north of 50° north latitude or south of 50° south latitude

p o l a r
3 4

Type of air mass that forms over oceans

m a r i t i m e
5

Lines on a map joining places that have the same air pressure

i s o b a r s
6 7 8

Type of front in which a warm air mass is cut off from the ground by cool air beneath it

o c c l u d e d
9 10

Type of air mass that forms in the tropics

t r o p i c a l
11

A sudden spark when electrical charges jump between parts of a cloud or between a cloud and the ground

l i g h t n i n g
12 13

Lines on a map joining places that have the same temperature

i s o t h e r m s
14 15

Rapidly whirling, funnel-shaped cloud that reaches down from a storm cloud to touch Earth's surface

t o r n a d o
16

Tropical storm with winds of 119 kilometers per hour or higher

h u r r i c a n e
17

Scientist who studies the causes of weather and tries to predict it

m e t e o r o l o g i s t
18

Hidden Message

S t o r m s a r e d a n g e r o u s
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

CHAPTER 16**COMPONENTS OF THE SOLAR SYSTEM****SECTION**
16-1 **Describing the Solar System**
(pages 532-537)

This section describes the history of ideas about the solar system. It also explains the two factors that keep the planets in orbit around the sun.

► Wandering Stars (page 533)

1. What did the Romans name the five points of light that the Greeks called planets? Mercury, Venus, Mars, Jupiter, and Saturn
- _____

► Greek Ideas: Earth at the Center (page 533)

2. In a geocentric system, what is the arrangement of planets? Earth is at the center of the revolving planets.
- _____
3. What was Ptolemy's explanation for why the planets seemed to move at different speeds? He thought the planets moved on little circles that moved on bigger circles.
- _____

► Copernicus's Idea: Sun at the Center (page 534)

4. A description of the solar system in which all the planets revolve around the sun is called a(n) heliocentric system.
5. In the 1500s, who developed a heliocentric explanation for the motion of the planets? Polish astronomer Copernicus
- _____

CHAPTER 16, Components of the Solar System *(continued)*

► **Galileo’s Observations** (page 534)

6. What were two observations that Galileo made through his telescope that supported the heliocentric model? He saw four moons revolving around Jupiter and he discovered that Venus goes through phases similar to the moon’s phases.

7. Circle the letter of whose ideas about the solar system are accepted today.
 a. Copernicus b. the Greeks c. Ptolemy d. the Romans

► **Brahe and Kepler** (pages 534–535)

8. What is an ellipse? An ellipse is an elongated circle, or oval shape.

9. Complete the table about Brahe and Kepler.

Brahe and Kepler			
Observer	Time	Identification	Accomplishment
Tycho Brahe	late 1500s	Danish astronomer	Observed the positions of the planets for almost 20 years
Johannes Kepler	1600	German mathematician	Discovered that the orbit of each planet is an ellipse

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► **Inertia and Gravity** (pages 535–536)

10. What were the two factors Isaac Newton concluded that combined to keep the planets in orbit?

a. gravity

b. inertia

11. What is inertia? Inertia is the tendency of a moving object to continue in a straight line or a stationary object to remain in place.

12. Circle the letter of each statement that Newton made about the moon's orbit around Earth.

- a. Earth pulls the moon toward it.
- b. The moon keeps moving ahead because of gravity.
- c. Earth curves away as the moon falls toward it.
- d. Inertia keeps the moon moving ahead.

13. What does Figure 5 on page 536 show would happen if the force of gravity didn't pull the planet toward the sun? The planet would travel in a straight line away from the sun.

14. Why are the planets in orbit around the sun? The sun's gravity pulls on them while their inertia keeps them moving ahead.

► Smaller Systems Inside (page 536)

15. Astronomers still use telescopes to study the solar system. How have they made even closer observations of the planets? They have made close-up observations of the planets from space probes sent far into the solar system.

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Reading Skill Practice

Writing a summary can help you remember the information you have read. When you write a summary, write only the most important points. On a separate sheet of paper, write a summary of the information in Section 16–1. Your summary should be shorter than the text on which it is based.

Students' summaries should be a short history of ideas about the solar system, including the ideas and discoveries of Ptolemy, Copernicus, Galileo, Brahe, Kepler, and Newton.

CHAPTER 16, Components of the Solar System *(continued)*

SECTION **Characteristics of the Sun**
16-2 (pages 538-542)

This section describes the sun's interior and its atmosphere. It also describes features on and above the sun's surface.

► **The Sun's Interior** (pages 538-539)

- The sun's energy comes from the process called nuclear fusion.
- What occurs in nuclear fusion? Hydrogen atoms join together to form helium atoms.
- Where does nuclear fusion occur on the sun? It occurs in the sun's center, or core.
- What are three products of the nuclear fusion that occurs on the sun?
 a. helium b. light c. heat

► **The Sun's Atmosphere** (pages 539-540)

- Complete the table about the layers of the sun's atmosphere.

The Sun's Atmosphere		
Layer	Description	When Is It Visible?
Photosphere	The inner layer	When you look at an image or photograph of the sun
Chromosphere	The middle layer	At the beginning or end of a total eclipse
Corona	The outer layer	During eclipses or with special telescopes

- The corona sends out a stream of electrically charged particles called solar wind.

► **Features on the Sun** (pages 540–542)

7. What are three features on or above the sun’s surface?

- a. sunspots b. prominences c. solar flares

8. Complete the table about features on the sun.

Features on the Sun	
Feature	Description
Sunspots	Areas of gas on the sun that are cooler than the gases around them
Prominences	Reddish loops of gas that connect different parts of sunspot regions
Solar flares	Explosions of hydrogen gas out into space

9. Short-term changes in climate on Earth may be related to

sunspot cycles.

10. When solar flares increase solar wind from the corona, what do they

cause in Earth’s upper atmosphere? magnetic storms

SECTION **Characteristics of the Inner Planets**
16-3 (pages 544–551)

This section describes the main characteristics of the four planets closest to the sun.

► **Introduction** (page 544)

1. Which planets are often called the terrestrial planets? The inner planets—Mercury, Venus, Earth, and Mars

2. What are two similarities among the inner planets? They are small and have rocky surfaces.

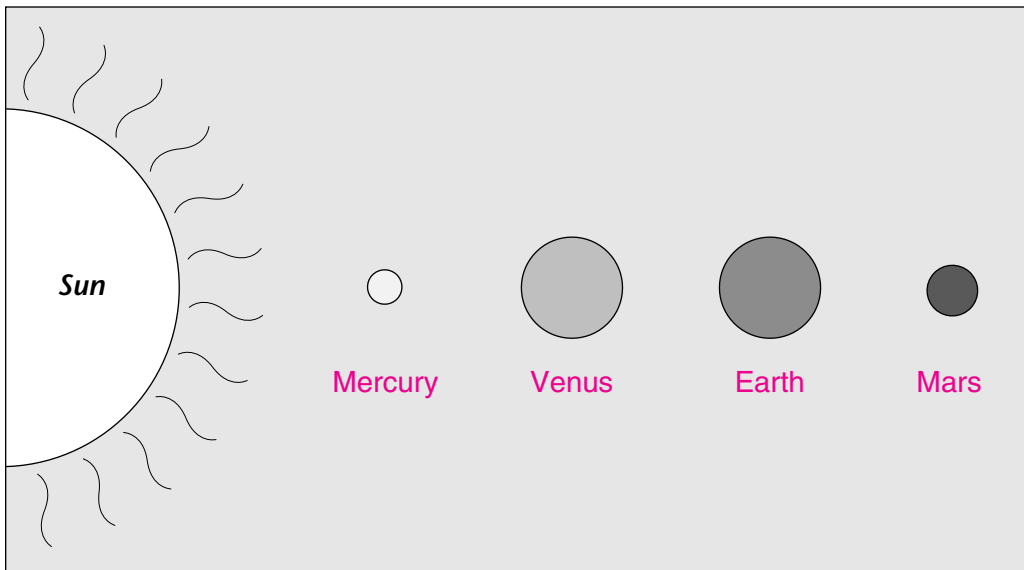
CHAPTER 16, Components of the Solar System *(continued)*

3. Look at the table in Figure 10 on page 545. Rank the inner planets according to diameter. Rank the planet with the greatest diameter as 1.

4 Mercury 2 Venus 1 Earth 3 Mars

4. Which planet rotates on its axis in about the same amount of time as Earth does? Mars

5. The drawing below shows the sun and the four inner planets. Label the inner planets according to their place in the solar system.



► **Earth** (pages 544–545)

6. Circle the letter of each sentence that is true about Earth.

- a. About 70 percent of its surface is covered with water.
- b. Its atmosphere extends about 1 kilometer above its surface.
- c. Most of the atmosphere is composed of oxygen gas.
- d. No other planet in the solar system has oceans like it.

7. What are the three main layers of Earth?

a. crust b. mantle c. core

8. What is Earth’s dense inner core made of? iron and nickel

9. How can studying Earth help scientists understand other planets?

They use what they know about Earth to make inferences about other planets.

► **Mercury (page 546)**

10. Is the following sentence true or false? Most of the gases Mercury once had in its atmosphere apparently escaped into space. true

11. Circle the letter of each sentence that is true about Mercury.

- a. Mercury's surface has many craters.
- b. Mercury has no moons.
- c. The interior of Mercury is composed mostly of the element mercury.
- d. Mercury is the planet closest to the sun.

12. Why does Mercury have a greater range of temperatures than any other planet? It is so close to the sun that it gets very hot during the day. But because it has almost no atmosphere, most of the heat escapes into space at night, and the temperature becomes very cold.

► **Venus (pages 547–549)**

13. Because Venus is often a bright object in the west after sunset, it is known as the evening star.

14. Why is Venus sometimes called “Earth’s twin”? Venus is about the same size as Earth.

15. Circle the letter of the gas that makes up most of the atmosphere of the planet Venus.

- a. oxygen
- b. nitrogen
- c. sulfuric acid
- d. carbon dioxide

CHAPTER 16, Components of the Solar System (continued)

16. Why is the rotation of Venus called retrograde rotation? Venus rotates from east to west, the opposite of the other planets.

17. Is the following sentence true or false? The atmosphere of Venus is so thick that it never has a sunny day. true

18. The trapping of heat by the atmosphere of Venus is called the greenhouse effect.

► **Mars** (pages 549–551)

19. Why is Mars called the “red planet”? It has a slightly reddish tinge when you see it in the sky.

20. The atmosphere on Mars is mostly carbon dioxide.

21. Is the following sentence true or false? There are no canals on Mars. true

22. Why do some regions on Mars look darker than others? Wind storms arise and blow the dust around on the surface of Mars. The darker regions are where the dust has been blown away.

23. Circle the letter of each sentence that is true about Mars.

- a. The rocks on Mars are covered with a rusty dust.
- b. Mars has seasons because it is tilted on its axis.
- c. Mars has many large oceans on its surface.
- d. Mars has giant volcanoes on its surface.

24. What are the two moons of Mars?

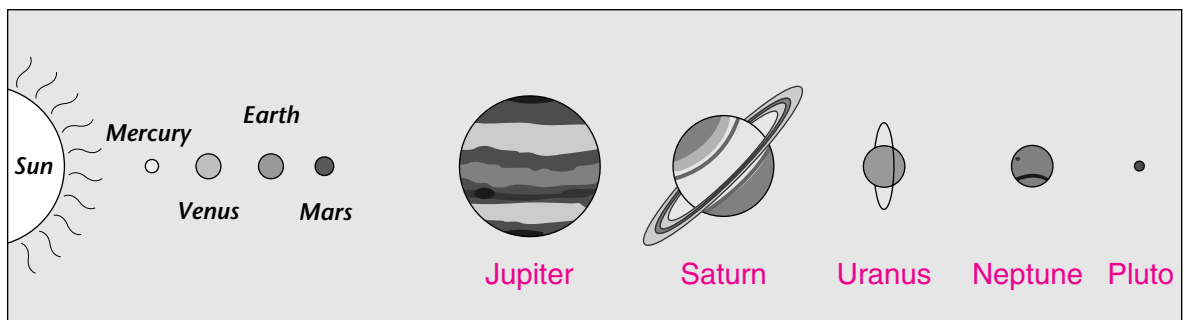
- a. Phobos
- b. Deimos

SECTION
16-4 **Characteristics of the Outer Planets**
(pages 552-559)

This section describes the main characteristics of the five planets farthest from the sun. It also explains how Pluto is different from the other planets.

► Characteristics of the Gas Giants (pages 552-553)

1. The first four outer planets do not have solid surfaces.
2. Which four planets are known as the gas giants? Jupiter, Saturn, Uranus, and Neptune
3. What is the composition of the atmospheres of the gas giants? Their atmospheres are, on average, about 75 percent hydrogen, 24 percent helium, and 1 percent other elements.
4. Is the following sentence true or false? None of the gas giants has a solid surface, but all have a solid core. true
5. The drawing below shows the sun, the four inner planets, and the five outer planets. Label the outer planets according to their place in the solar system.



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6. Why don't astronomers know much about the cores of the gas giants?
The cores are buried so deep inside the gas giants that it has been hard to find out much about them.

CHAPTER 16, Components of the Solar System *(continued)*

► **Jupiter** (pages 554–555)

7. Is the following sentence true or false? Jupiter’s atmosphere is made up mainly of hydrogen and helium. true
8. What is the Great Red Spot on Jupiter? It is a giant area in Jupiter’s atmosphere with swirling clouds many times bigger than Earth. It appears to be an ongoing storm similar to a hurricane on Earth.
9. Circle the letter of each sentence that is true about Jupiter.
- a. Jupiter’s atmosphere contains many colorful bands.
- b. Jupiter’s atmosphere is extremely thin.
- c. Jupiter has many moons revolving around it.
- d. Jupiter is the most massive planet in the solar system.
10. What are Jupiter’s four largest moons?
- a. Ganymede b. Callisto
- c. Io d. Europa
11. Jupiter’s moon Io is covered with volcanoes .

► **Saturn** (pages 555–556)

12. What are Saturn’s rings made of? They are made of chunks of ice and rock, each traveling in its own orbit around Saturn.
13. Is the following sentence true or false? Saturn has only 10 rings, although it looks like there are more. false
14. The largest of Saturn’s 19 moons is called Titan .

► **Uranus** (page 557)

15. Why does Uranus look bluish? It looks bluish because there are traces of methane in its atmosphere.

16. What made astronomer William Herschel famous in 1781? He discovered the planet Uranus, the first planet discovered since ancient times.
17. How much larger is Uranus than Earth? Uranus is about four times the diameter of Earth.
18. How is the rotation of Uranus unlike that of most of the other planets? Uranus rotates from top to bottom instead of from side to side, the way most of the other planets do.
19. What are Uranus's five largest moons like? They have icy, cratered surfaces. They also have lava flows on their surfaces.

► **Neptune (page 558)**

20. In the 1800s, why did astronomers predict that the planet Neptune would be discovered well before anyone had seen it? Uranus was not quite following the orbit astronomers thought it should. They hypothesized that the gravity of another planet was affecting Uranus's orbit.
21. Circle the letter of the sentence that explains how the Great Dark Spot was like the Great Red Spot.
- a. Both formed from volcanoes. b. Both formed on rings.
c. Both were probably storms. d. Neither lasted long.
22. Is the following sentence true or false? Neptune's atmosphere is blue and nearly featureless. false
23. Which is the largest of Neptune's eight moons? Triton

CHAPTER 16, Components of the Solar System (continued)

► Pluto and Charon (page 559)

24. Is the following sentence true or false? Pluto is less than two thirds the size of Earth's moon. true
25. Why don't astronomers know much about Pluto and Charon? They are so far away that astronomers haven't been able to learn much about them.
26. Circle the letter of each sentence that is true about Pluto.
- a. Its moon is more than half Pluto's size.
 - b. Both Pluto and Charon have gaseous surfaces.
 - c. Astronomers often consider Pluto and Charon a double planet.
 - d. The American astronomer Clyde Tombaugh discovered Pluto in 1930.
27. Why do some astronomers think Pluto should not be called a planet?
It is so small that it may just be the largest of thousands of objects revolving around the sun out beyond Neptune.



SECTION 16-5 **Comets, Asteroids, and Meteors** (pages 562-565)

This section describes the other objects in the solar system, including comets, asteroids, and meteors.

► Comet Systems (pages 562-563)

1. What are comets? Comets are large chunks of ice and dust whose orbits can be very long, narrow ellipses.
2. What are the three main parts of a comet system?
a. nucleus b. coma c. tail

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3. How does a comet's tail form? Solar wind pushes the gas from a comet away from the sun. Gas and dust form the comet's tail.

4. Is the following sentence true or false? A comet's tail can be hundreds of millions of kilometers long. true

5. Who predicted that a comet would reappear in 1758? English astronomer Edmond Halley

► **Asteroids (page 564)**

6. Objects revolving around the sun that are too small and too numerous to be called planets are called asteroids.

7. Where is the asteroid belt? The asteroid belt lies between the orbits of Mars and Jupiter.

8. What happened when an asteroid collided with Earth 65 million years ago? Debris from the explosion probably started huge fires that destroyed much of Earth's forests and grass. As a result, many species became extinct, including the dinosaurs.

► **Meteors (pages 564–565)**

Match the term with its definition.

Term	Definition
<u> b </u> 9. meteoroid	a. A meteoroid that has passed through the atmosphere and hit Earth's surface
<u> c </u> 10. meteor	b. A chunk of rock or dust in space
<u> a </u> 11. meteorite	c. A streak of light caused by the burning up of a meteoroid in the atmosphere

CHAPTER 16, Components of the Solar System (continued)

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SECTION **Traveling in Space**
16-6 (pages 566-569)

This section explains how rockets travel in space and describes what satellites and space stations are used for.

► **Transportation in Space** (page 566)

1. Why does a rocket move forward? A rocket moves forward when gases expelled from the rear of the rocket push it in the opposite direction.

2. For every force, or action, there is an equal and opposite force, or reaction.

3. How many stages do multistage rockets have? three

4. What happens to each stage when it uses up its fuel? The empty fuel container drops off.

5. What did the development of multistage rockets make possible? Their development made it possible to send rockets to the moon and farther into space.

► **Artificial Satellites** (pages 567-568)

6. What is a satellite? A satellite is any natural or artificial object that revolves around an object in space.

7. Circle the letter of the first artificial satellite launched into space.

- a. Skylab b. Explorer 1 **c. Sputnik 1** d. Mir

8. What are four uses of satellites and space stations?

- a. communications
- b. navigation
- c. collecting weather data
- d. research

9. What does it mean when a satellite is in a geosynchronous orbit? The satellite revolves around Earth at the same rate that Earth rotates.

10. Circle the letter of each sentence that is true about geosynchronous orbits.

- a. They seem to hover over a given point on Earth.
- b. People can live on them for long periods.
- c. They are used to map weather patterns.
- d. People can find them on Earth's surface.

11. A large satellite in which people can live for long periods is called a(n) space station.

12. What are the United States, Russia, and many other countries cooperating to build in space? the International Space Station

► **Equipment Needed in Space (page 569)**

13. An astronaut's space suit adjusts air pressure and oxygen levels for the astronaut.

14. List three components' included in a space suit.

- a. helmet
- b. communication system
- c. parachute

15. Is the following sentence true or false? When astronauts leave the shuttle to work in space, they must take along a life-supporting environment. true

CHAPTER 16, Components of the Solar System *(continued)***WordWise**

Answer the questions by writing the correct key terms in the blanks. Use the circled letters to find the hidden key term. Then write a definition for the hidden key term.

Clues

What is the middle layer of the sun's atmosphere?

p h o t o s p h e r e

What is an elongated circle, or oval shape, called?

e l l i p s e

What are the objects called that orbit the sun in a belt between Mars and Jupiter?

a s t e r o i d s

What is the spinning rotation of a planet from east to west called?

r e t r o g r a d e r o t a t i o n

What is a description of the solar system in which all the planets revolve around Earth?

g e o c e n t r i c

What is a chunk of rock or dust in space called?

m e t e o r o i d

What are reddish loops of gas that connect different parts of sunspot regions?

p r o m i n e n c e s

What are areas of gas on the sun that are cooler than the gases around them?

s u n s p o t s

What is a stream of electrically charged particles sent out by the corona called?

s o l a r w i n d

What is the outer layer of the sun's atmosphere?

c o r o n a

Key Term: h e l i o c e n t r i c

Definition: A description of the solar system in which all of the planets revolve around the sun

