

The Atmosphere ▪ Guided Reading and Study

**The Air Around You** (pp. 392-397)

This section describes Earth's atmosphere, or the layer of gases that surrounds the planet.

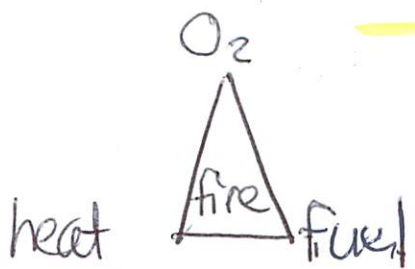
**Use Target Reading Skills**

As you preview the section headings, write what you know about the atmosphere in the box What You Know. As you read the section, complete the What You Learned box. Accept all logical answers.

What You Know
1. The atmosphere contains oxygen.
2. Animals breathe oxygen.
3.

What You Learned
1. The atmosphere contains mostly nitrogen.
2. Ozone is a form of oxygen.
3.

Density =  $\frac{\text{Mass}}{\text{Volume}}$



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The Air Around You (continued)

Introduction (p. 392)

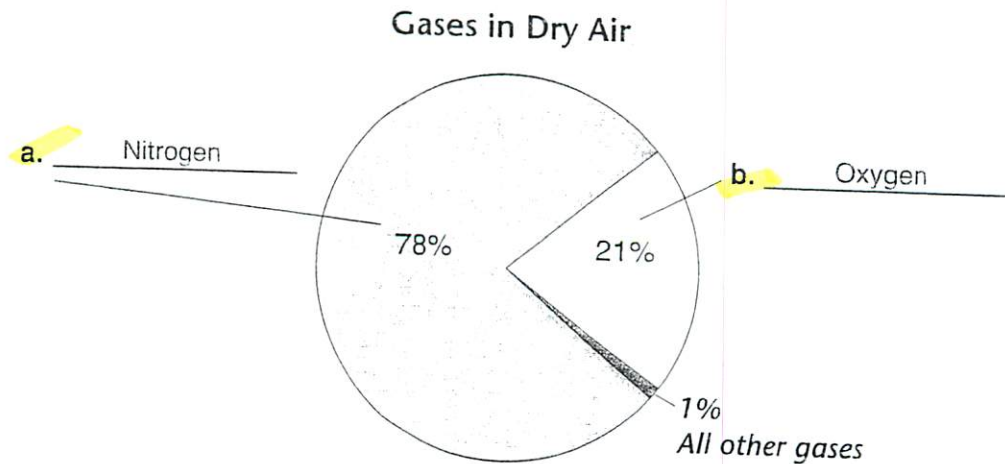
1. The condition of Earth's atmosphere at a particular time and place is called \_\_\_\_\_ weather \_\_\_\_\_.

2. What is Earth's atmosphere?

Earth's atmosphere is the envelope of gases that surrounds the planet.

Composition of the Atmosphere (pp. 393–394)

3. Label the two larger pieces of the graph with the gases they represent.



c. Use the graph to estimate how many times more nitrogen than oxygen makes up air. \_\_\_\_\_ almost four \_\_\_\_\_

d. What percentage of air is made of nitrogen and oxygen together? \_\_\_\_\_ 99% \_\_\_\_\_

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

- a. Humans do not breathe in nitrogen.
- b. A nitrogen molecule has two nitrogen atoms.
- c. Nitrogen is a gas.
- d. Nitrogen makes up more of the air than any other gas.

5. Circle the letter of each sentence that is true about oxygen.

- a. It is needed by plants.
- b. It is needed to burn any fuel.
- c. It is the most common gas in the atmosphere.
- d. Ozone is a form of oxygen that has three oxygen atoms in each molecule.

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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 plants and 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~~ <sup>and other gases</sup> 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 heavy enough.

11. What types of particles does air contain?

Air contains tiny solid and liquid particles of dust, smoke, salt, and other chemicals.

### Importance of the Atmosphere (p. 395)

12. 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 being hit by objects from outer space.

### Air Quality (pp. 395–396)

13. Harmful substances in the air, water, or soil are known as \_\_\_\_\_ pollutants \_\_\_\_\_.

14. Circle the letter of each sentence that is true about the causes of air pollution.

- a. Some air pollution occurs naturally.
- b. Some air pollution is caused by human activities.
- c. Motor vehicles cause almost half of the air pollution from human activities.
- d. Farming is not a cause of air pollution.

15. What are some natural sources of particles in the atmosphere?

Natural sources include molds, plant pollen, forest fires, soil erosion, dust storms, and erupting volcanoes.



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The Air Around You (continued)

16. The brown haze that forms over sunny cities like Los Angeles is called photochemical smog.

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

- (a.) It is caused by the action of sunlight on chemicals in the air.
- b. It forms when particles in smoke combine with water droplets in air.
- (c.) It forms a mixture of ozone and other pollutants.
- d. It is harmless to living things.

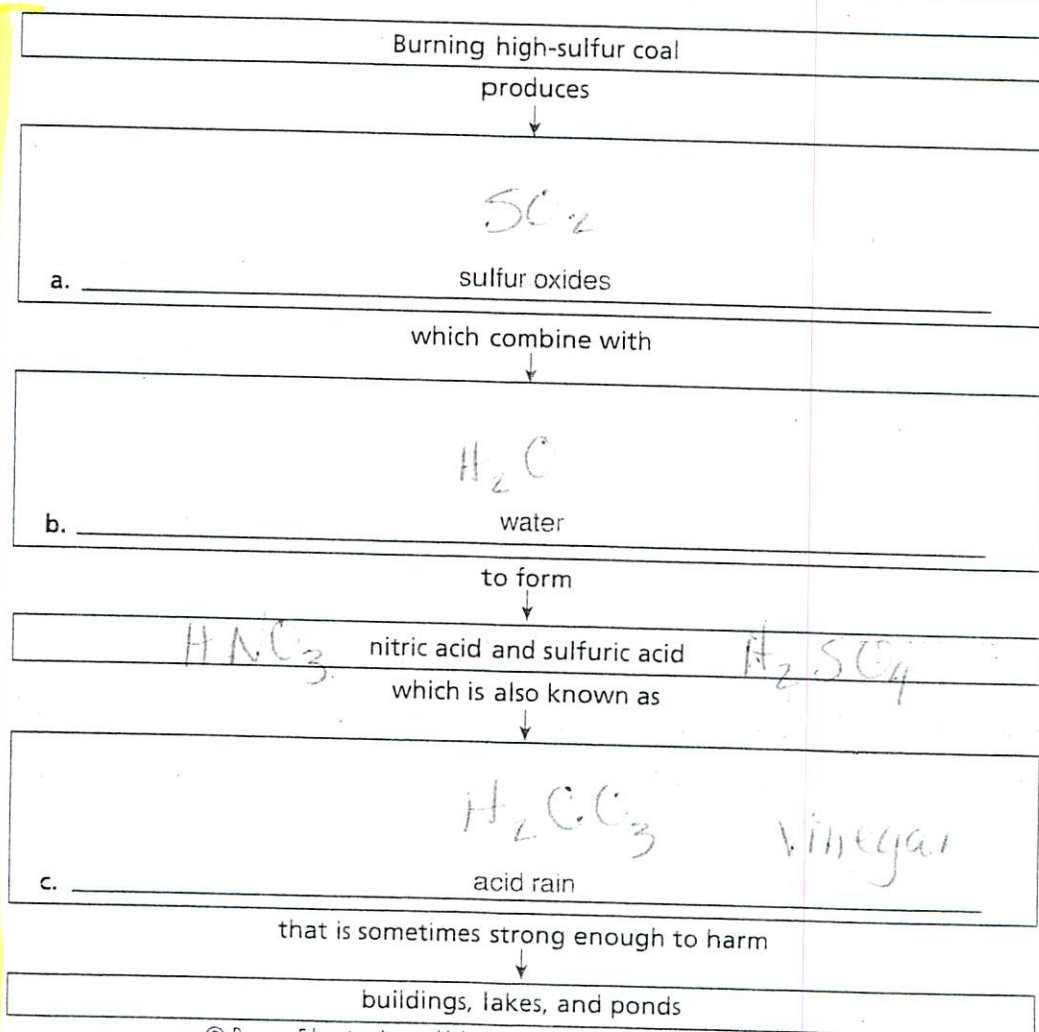
18. What effects does smog have on people and things?

Smog can irritate the eyes, throat, and lungs. It can also harm plants and other living things and damage certain materials.

19. Is the following sentence true or false? One result of air pollution is acid rain.

true

20. Complete the flowchart to show causes, results, and effects related to acid rain.



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- d. Identify the cause of sulfur oxides.  
Burning high-sulfur coal causes sulfur oxide.  
\_\_\_\_\_
  - e. How is sulfuric acid both a result and a cause?  
It is a result of sulfur oxide combining with water. It is a cause of acid rain.  
\_\_\_\_\_
  - f. What is the end effect of burning high-sulfur coal?  
Trees and other living things are harmed by acid rain.  
\_\_\_\_\_
21. Is the following sentence true or false? Rain is ~~not~~ naturally acidic.  
\_\_\_\_\_ false \_\_\_\_\_
22. Rain that contains more acid than normal is known as  
\_\_\_\_\_ acid rain \_\_\_\_\_.
23. How can acid rain affect trees such as pines and spruce?  
It may make tree needles turn brown or fall off.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
24. 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** (p. 397)

25. Is the following sentence true or false? Air quality in this country has generally ~~worsened~~ over the past 30 years.  
improved ~~false~~ true
26. Is the following sentence true or false? The air in many American cities is still polluted.  
\_\_\_\_\_ true \_\_\_\_\_

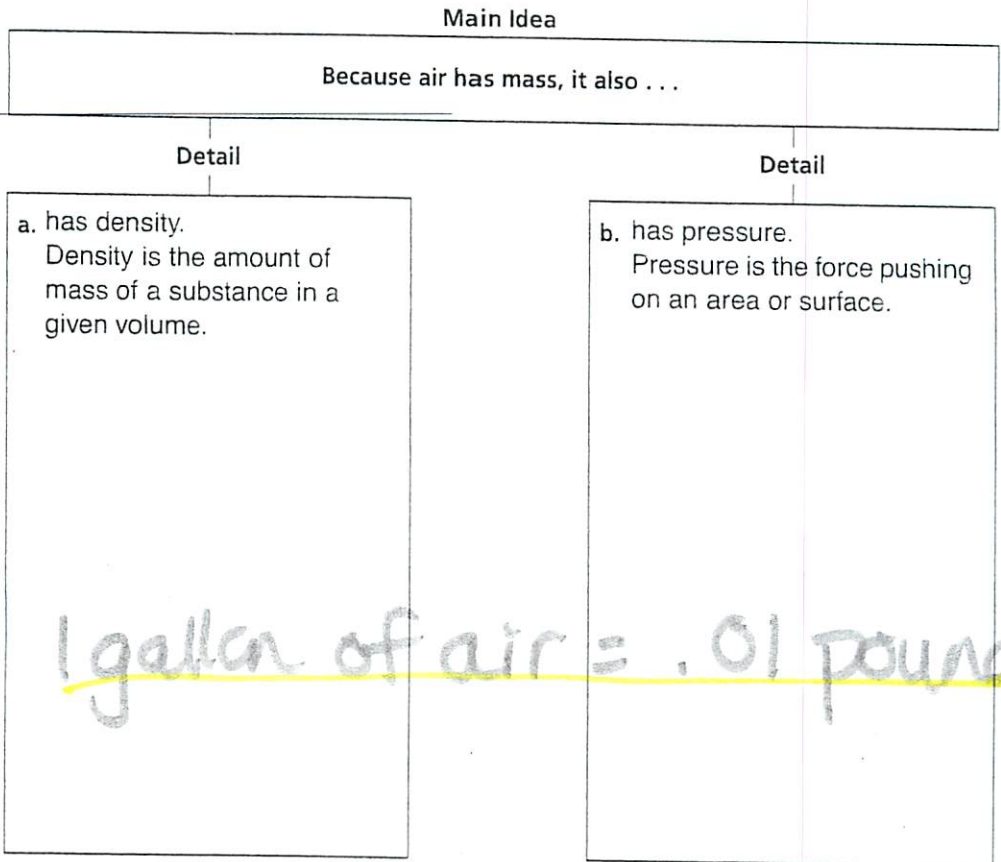
**The Atmosphere** ▪ *Guided Reading and Study*

**Air Pressure** (pp. 398–402)

*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.*

**Use Target Reading Skills**

*As you read about the properties of air, fill in the detail boxes that explain the main idea in the graphic organizer below. Accept all logical answers.*



**Introduction** (p. 398)

1. Suppose that you are not carrying anything on your back. Why do your shoulders still have pressure on them?  
The weight of the atmosphere itself is constantly pressing on your body.

**Properties of Air** (p. 399)

2. Circle the letter of each sentence that is true about air.
  - (a) Air has mass because it is composed of atoms and molecules.
  - (b) Because air has mass, it has density and pressure.
  - (c) The more molecules in a given volume of air, the greater its density.
  - d. The greater the density of air, the less pressure it exerts.

Air mass exerts a force per unit called air pressure



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3. Complete the cause-and-effect table to show the relationship among mass, volume, and density.

CAUSE		EFFECT
If mass	and volume	then density
increases	stays the same,	a. increases.
b. decreases	stays the same,	decreases.
stays the same	decreases,	c. increases.
stays the same	d. increases,	decreases.

- e. Use the information in the table to write one or two sentences about the relationship among mass, volume, and density.

~~Possible answer:~~ If volume stays the same, density increases as mass increases and decreases when mass decreases. If mass stays the same, density increases when volume decreases and decreases when volume increases.

**Measuring Air Pressure** (pp. 400–401)

4. An instrument that is used to measure air pressure is a(n) \_\_\_\_\_ barometer.

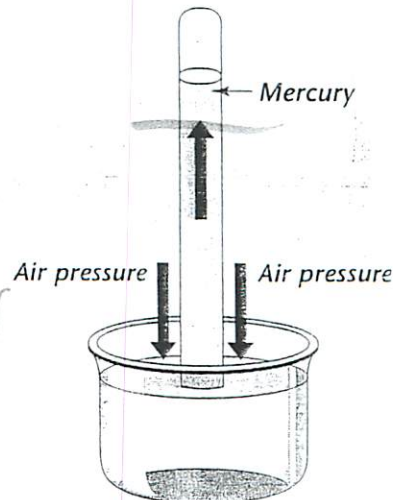
5. What is the difference between how air pressure is indicated in a mercury barometer and an aneroid barometer?

A mercury barometer contains liquid mercury that is forced up a column when air pressure increases. An aneroid barometer has no liquid. The thin walls of its airtight metal chamber bulge when air pressure increases.

6. Draw a line on the glass tube to show where the level of the mercury might be if the air pressure fell.

~~Student's lines may be anywhere below the level of mercury shown in the figure.~~

*mercury barometer*



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Air Pressure (continued)

- 7. Two different units used to measure air pressure are inches of mercury and millibars.
- 8. If the air pressure is 30 inches, how many millibars of air pressure are there?  
There are about 1.016 millibars.

lower air pressure

At high elevations air is less dense

At sea level air is more dense

Altitude and the Properties of Air (pp. 401-402)

- 9. Another word for elevation, or distance above sea level, is altitude.
- 10. Is the following sentence true or false? Air pressure increases as altitude increases. de- false true
- 11. Is the following sentence true or false? As air pressure decreases, so does air density. true
- 12. Why is air pressure greater at sea level than at the top of a mountain?  
Air pressure is greater at sea level because sea-level air has the weight of the whole atmosphere pressing down on it.
- 13. Is the following sentence true or false? As altitude increases, ~~so does~~ air density. decreases false true
- 14. Explain why mountain climbers sometimes bring tanks of oxygen along with them on their climbs.  
At high elevations, the air is less dense and less oxygen is taken in with each breath. Mountain climbers would quickly get out of breath at high altitudes if oxygen tanks were not available.
- 15. 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.



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**Layers of the Atmosphere** (pp. 403–407)

*This section describes the four main layers of the atmosphere.*

**Use Target Reading Skills**

*As you preview Figure 12 in your textbook, write questions in the appropriate spaces in the graphic organizer. As you read, fill in the answers under the questions.*

Accept all logical answers.

**Layers of the Atmosphere**

Q. Where is the ozone layer?
A. In the middle portion of the stratosphere
Q. Is the thermosphere cold?
A. No; it is very hot, up to 1,800°C.

**Introduction** (p. 403)

- The four main layers of the atmosphere are classified according to changes in \_\_\_\_\_ temperature \_\_\_\_\_.

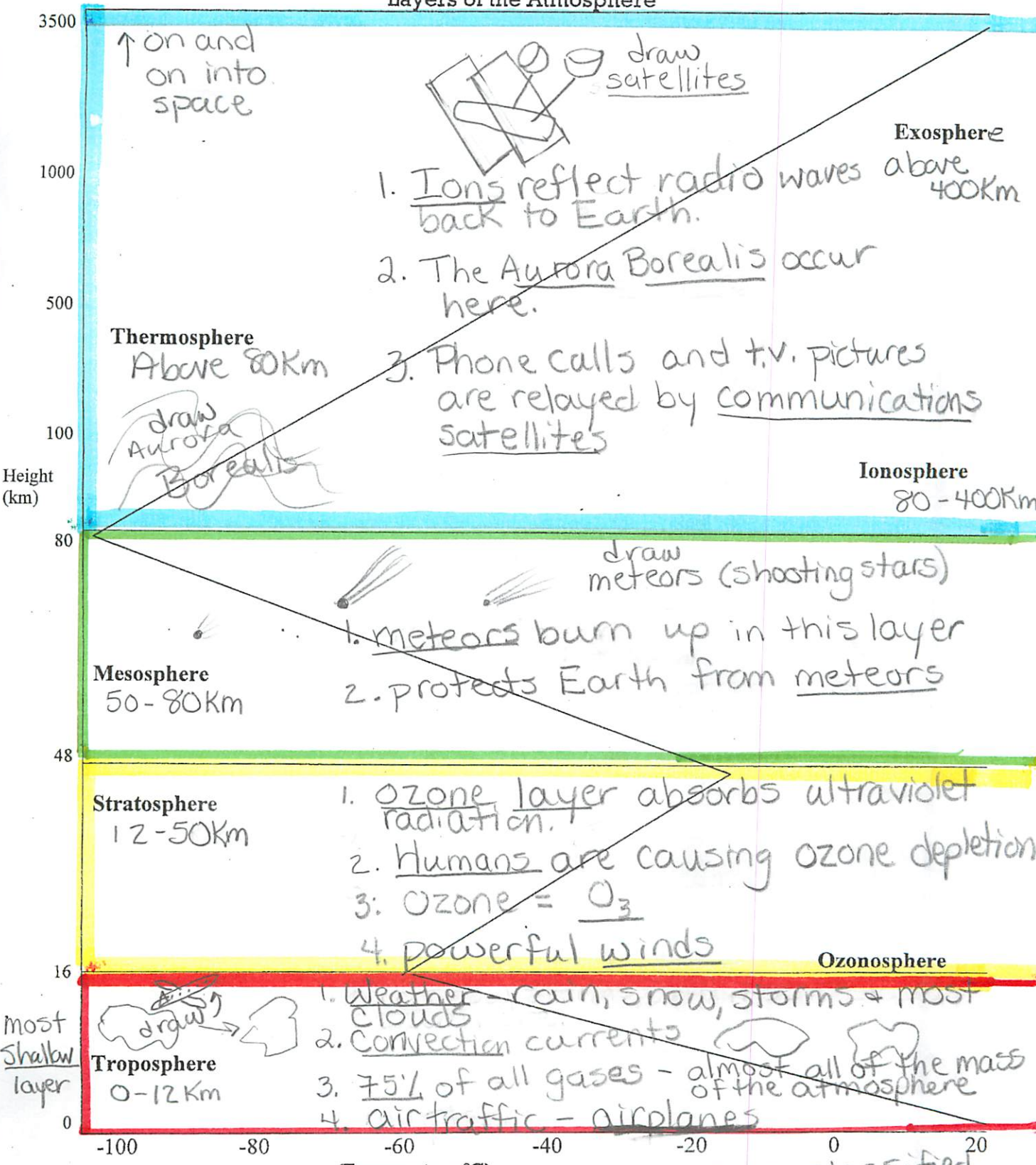
**The Troposphere** (p. 404)

- Circle the letter of each sentence that is true about the troposphere.
  - It is the lowest layer of Earth's atmosphere.
  - It has less variable conditions than other layers.
  - It is where Earth's weather occurs.
  - 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 \_\_\_\_\_

*decreases*

MacGregor

### Layers of the Atmosphere



The layers of the atmosphere are classified according to changes in temperature





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**The Thermosphere** (pp. 406–407)

11. 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.

12. 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.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

13. Why would an ordinary thermometer show a low temperature in the thermosphere?

The thermosphere does not contain enough air molecules to collide with and warm an  
ordinary thermometer very much.

\_\_\_\_\_

\_\_\_\_\_

14. List the layers of the thermosphere, and describe where each begins above Earth's surface.

a. The ionosphere begins 80 kilometers above the surface.

b. The exosphere begins about 400 kilometers above the surface.

15. Brilliant light displays that occur in the ionosphere are called the  
auroras

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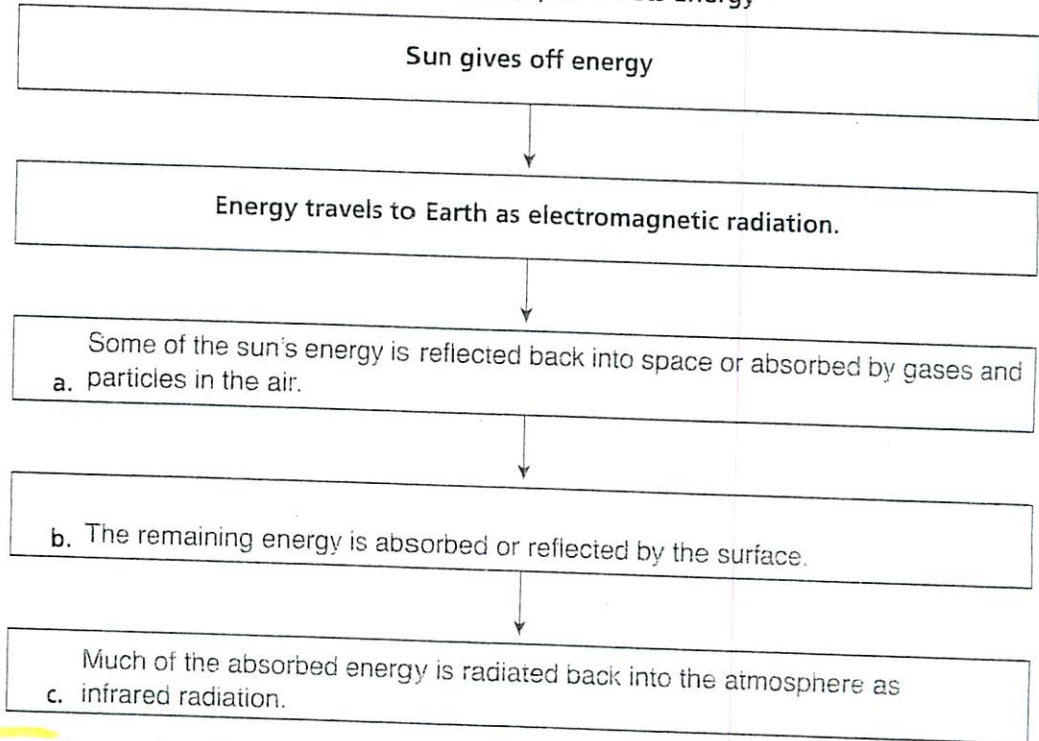
**Energy in Earth's Atmosphere** (pp. 408–411)

This section explains how the atmosphere, or the air around Earth, is heated.

**Use Target Reading Skills**

As you read about how the sun's energy reaches Earth's surface, fill in the flowchart to show the sequence of events. Accept all logical answers.

How Earth's Atmosphere Gets Energy



About 50%

**Energy from the Sun** (pp. 408–409)

1. Is the following sentence true or false? Nearly <sup>all</sup> ~~half~~ of the energy in Earth's atmosphere comes from the sun. false ~~true~~
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 of the colors of the rainbow.
<u>c</u> 6. infrared radiation	b. It has wavelengths that are shorter than those of violet light.
<u>b</u> 7. ultraviolet radiation	c. It has wavelengths that are longer than those of red light.

shorter than visible light

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8. What causes the different colors of visible light?

The different colors are the result of different wavelengths.

9. Is the following sentence true or false? Red light has a <sup>longer</sup> 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 has.
- 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 has.
- d. It can cause sunburns.

### Energy in the Atmosphere (p. 410)

12. What happens to energy from the sun that is neither reflected nor absorbed by the atmosphere?

It passes through the atmosphere to the surface.

13. What absorbs energy from the sun in the atmosphere?

Water vapor, carbon dioxide, clouds, dust, and other gases absorb energy from the sun in the atmosphere.

14. What reflects energy from the sun in the atmosphere?

Clouds, dust particles, and gases reflect energy from the sun.

15. Reflection of light in all directions is called scattering.

16. 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.



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Energy in Earth's Atmosphere (continued)

Energy at Earth's Surface (p. 411)

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 most of the energy back into the atmosphere as ultraviolet radiation.           ~~false~~ true                     infrared
19. What absorbs most of the energy that is radiated from Earth's surface?  
Water vapor, carbon dioxide, methane, and other gases in the air absorb most of 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

**The Atmosphere** • *Guided Reading and Study*

**Heat Transfer** (pp. 414–417)

*This section explains what temperature measures and how temperature is related to heat. The section also describes three ways by which heat can be transferred from a hotter object to a cooler one.*

**Use Target Reading Skills**

*As you read about heat transfer, complete the outline to show the relationship among the headings.*

<b>Heat Transfer</b>	
I. Thermal Energy and Temperature	
A. Measuring Temperature	_____
B. Temperature Scales	_____
II. How Heat Is Transferred	_____
A. Radiation	_____
B. Conduction	_____
C. Convection	_____
D. Heating the Troposphere	_____

**Thermal Energy and Temperature** (p. 415)

1. Is the following sentence true or false? The faster the particles of a substance are moving, the more energy they have.                     true
2. The total energy of motion in the particles of a substance is called                     thermal energy                    .
3. The average amount of energy of motion of each particle 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
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 in the column. When  
the temperature decreases, the liquid contracts and moves down the column.  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

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Heat Transfer (continued)

7. Complete the compare/contrast table to show the difference between two temperature scales.

Temperature Scales		
Scale	Freezing Point of Water	Boiling Point of Water
Celsius	a. 0°	b. 100°
Fahrenheit	c. 32°	d. 212°

- e. Is 50° hotter on a Celsius or on a Fahrenheit scale? Explain your answer by comparing the numbers in the table.  
It is hotter on a Celsius scale. On a Celsius scale, 50° is midway between 0° and 100°. On a Fahrenheit scale, 50° is much closer to 32° than 212°.

How Heat Is Transferred (pp. 416–417)

8. The energy transferred from a hotter object to a cooler one is referred to as heat.
9. Is the following sentence true or false? Radiation is the direct transfer of energy by electromagnetic waves. true
10. The direct transfer of heat from one substance to another substance that it is touching is called conduction.
11. 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.
12. The transfer of heat by the movement of a fluid is called convection.

Match the type of heat transfer with its example.

Heat Transfer

- c 13. radiation  
b 14. conduction  
a 15. convection

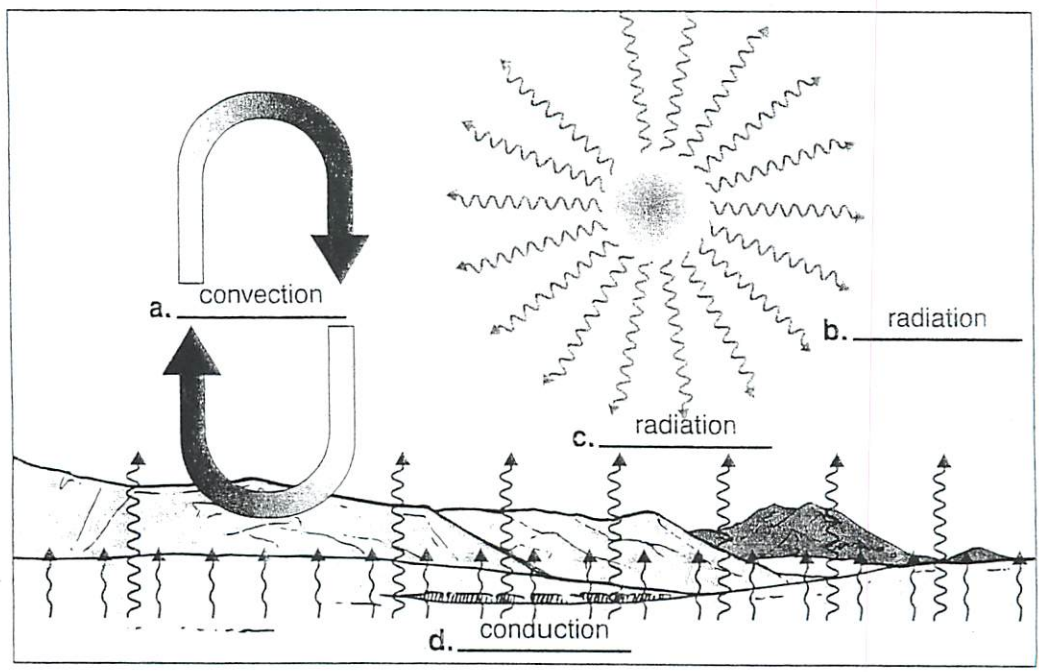
Example

- a. Warm water rising in a pot on a stove  
 b. Burning your bare feet on hot sand  
 c. Feeling the sun's warmth on your face



**The Atmosphere** ▪ *Guided Reading and Study*

16. In the drawing, label each of the ways by which heat is transferred in the troposphere.



17. The troposphere is heated mainly by \_\_\_\_\_ convection \_\_\_\_\_.

18. The upward movement of warm air and the downward movement of cool air form \_\_\_\_\_ convection currents \_\_\_\_\_.

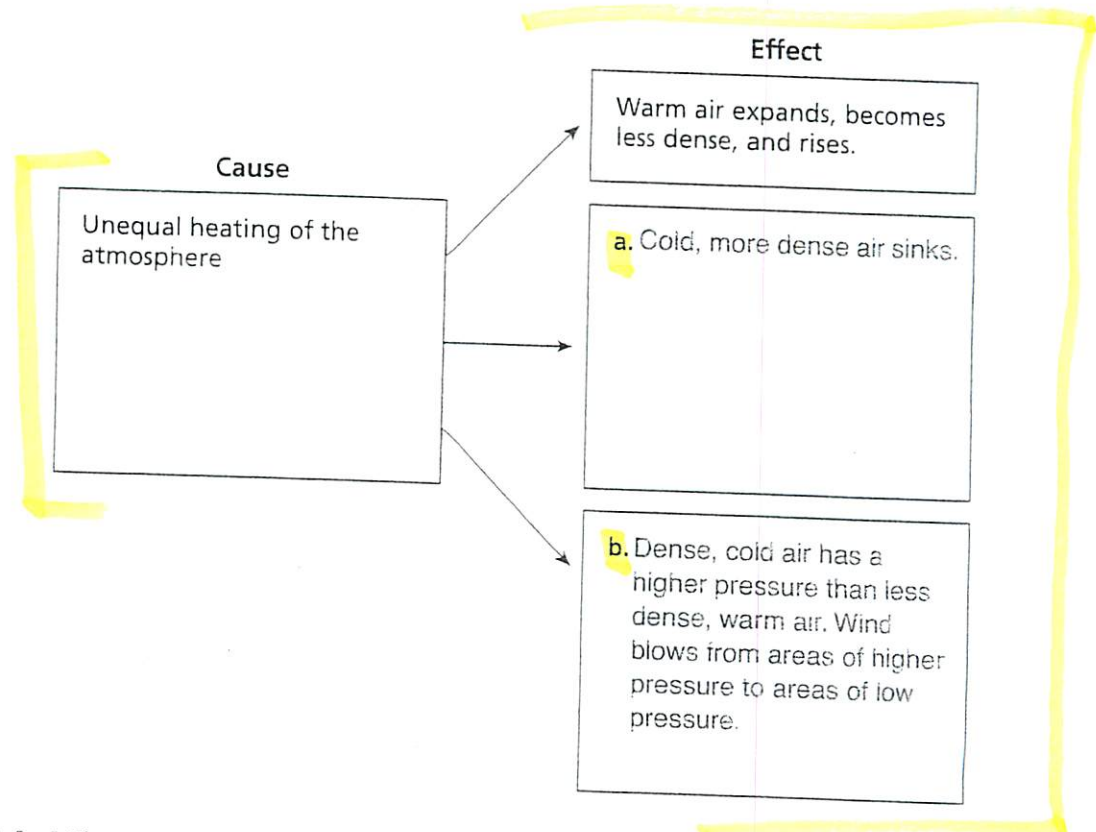
The Atmosphere • Guided Reading and Study

**Winds** (pp. 418–424)

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.

**Use Target Reading Skills**

As you read about unequal heating of the atmosphere, fill in the graphic organizer with its effects. Accept all logical answers.



**What is Wind?** (p. 419)

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? Winds are caused by differences in air pressure. \_\_\_\_\_ true

Match the instrument with what it measures.

Instrument	What It Measures
<u>b</u> 3. wind vane	a. wind speed
<u>a</u> 4. anemometer	b. wind direction

5. Is the following sentence true or false? A south wind blows <sup>from</sup> toward the south. \_\_\_\_\_ ~~false~~ true

6. The increased cooling that a wind can cause is called the \_\_\_\_\_ wind-chill factor.  
 Winds are named by the direction they come from.

**The Atmosphere** ▪ *Guided Reading and Study*

7. 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** (p. 420)

8. Winds that blow over short distances are called \_\_\_\_\_ local winds \_\_\_\_\_.

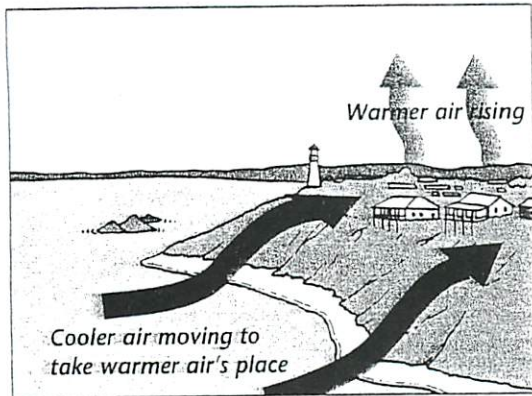
9. What causes local winds?

Local winds are caused by unequal heating of Earth's surface within a small area.

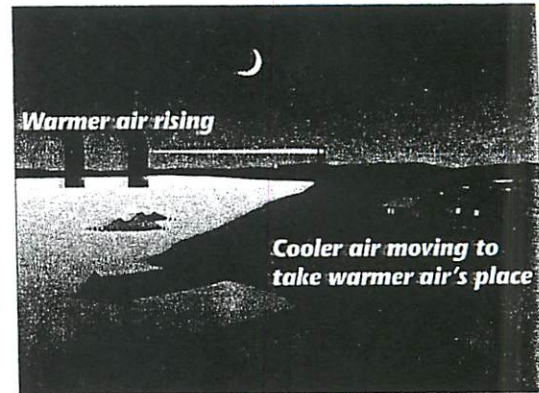
10. Circle the letter of each sentence that is true about the unequal heating of land and water.

- 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.

11. Label the drawings to indicate which drawing shows a sea breeze and which drawing shows a land breeze.



a. \_\_\_\_\_ sea breeze \_\_\_\_\_



b. \_\_\_\_\_ land breeze \_\_\_\_\_

**Global Winds** (p. 421)

12. Winds that blow steadily from specific directions over long distances are called \_\_\_\_\_ global winds \_\_\_\_\_.

13. 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. *Coriolis effect*



**The Atmosphere** ▪ *Guided Reading and Study*

**Winds** (continued)

14. As Earth rotates, the Coriolis effect causes winds in the Northern Hemisphere to turn toward the \_\_\_\_\_ right \_\_\_\_\_.

**Global Wind Belts** (pp. 422–424)

15. The calm areas around Earth include the \_\_\_\_\_ doldrums \_\_\_\_\_ and the \_\_\_\_\_ horse latitudes \_\_\_\_\_.
16. Complete the compare / contrast table to show the differences among the major wind belts.

Direction of Global Wind Belts	
Wind Belt	Direction It Blows
Trade winds	a. From the northeast in the Northern Hemisphere and southeast in the Southern Hemisphere
Prevailing westerlies	b. From the southwest in the Northern Hemisphere and northwest in the Southern Hemisphere
Polar easterlies	c. Away from the poles.

- d. Suppose you were sailing from Central America to Asia just above the equator. Which winds would help speed you on your way?  
\_\_\_\_\_ trade winds \_\_\_\_\_
17. 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.

The Atmosphere • Key Terms

## Key Terms

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 of the boxes, add up the numbers in each column, row, and two diagonals. All of the sums should be the same.

Definitions	Terms
A. Envelope of gases that surrounds Earth	1. thermosphere
B. Form of oxygen with three atoms instead of two	2. atmosphere
C. Harmful substance in the air, water, or soil	3. altitude
D. Amount of mass in a given volume	4. pollutant
E. Force pushing on an area	5. pressure
F. Distance above sea level	6. stratosphere
G. Second-lowest layer of Earth's atmosphere	7. density
H. Outermost layer of Earth's atmosphere	8. exosphere
I. Outer layer of the thermosphere	9. ozone

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