Lesson 4  Air Quality


Skim or scan the heading, boldfaced words, and pictures in the lesson. Identify or predict three facts you will learn from the lesson. Discuss your thoughts with a classmate.

Main Idea

Sources of Air Pollution

Identify the 2 general sources of air pollution, and give an example of each.

1. ________________________________
   ________________________________
   ________________________________

2. ________________________________
   ________________________________
   ________________________________

Causes and Effects of Air Pollution

I found this on page __________.

NGSSS Check

How do humans impact air quality? HE.6.C.1.3

Analyse the causes and effects of air pollution.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid precipitation</td>
<td>1. damages plant and animal tissue</td>
</tr>
<tr>
<td></td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
</tr>
</tbody>
</table>

Particulate Pollution

I found this on page __________.

Define particulate matter. Then list three ways in which particulates can harm humans.

Particulate matter: ________________________________

1. ________________________________
2. ________________________________
3. ________________________________
Lesson 4 | Air Quality (continued)

**Main Idea**

**Movement of Air Pollution**
*I found this on page ________.*

**Details**

**Identify** the problems of wind moving or not moving air pollution.

When the wind blows, it ________________________________________.
When the wind does not blow, ____________________________________.

**Describe** two aspects of the Clean Air Act.

1. The Clean Air Act gives the U.S. government ____________________
   _______________________________________________________________.
2. The standards require states to _____________________________
   _______________________________________________________________.

**Complete** the statement to explain how monitoring air quality helps people.

If air pollution levels are too high . . .

...then the public is notified of danger and ____________________________

**Air Quality Trends**
*I found this on page ________.*

**Identify** four sources of indoor air pollution.

1. ______________________  3. ______________________
2. ______________________  4. ______________________

**Synthesize It** Suppose that a doctor has just diagnosed you with a respiratory problem. She has suggested that you remove sources of air pollution from your living space. What could you do?

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
Use this checklist to help you study.

- Complete your Foldables® Chapter Project.
- Study this chapter in your Notebook.
- Study the definitions of vocabulary words.
- Reread the chapter, and review the charts, graphs, and illustrations.
- Review the Understanding Key Concepts at the end of each lesson.
- Look over the Chapter Review at the end of the chapter.

**THINK ABOUT IT!**

**Summarize It**
Reread the Think About It question and the lesson Key Concepts. Explain how Earth’s atmosphere affects life on Earth.

**Challenge**
What is being done in your community to improve air quality? What could you do to promote the effort?
Radiant Energy Absorption

Ultimately, the Sun is the source of energy for Earth. Energy from the Sun moves through the atmosphere and is absorbed and reflected from different surfaces on Earth. Light surfaces reflect energy, and dark surfaces absorb energy. Both land and sea surfaces absorb energy from the Sun, and air that is in contact with these surfaces is warmed through conduction.

Ask a Question
Which surfaces on Earth absorb the most energy from the Sun?

Materials
thermometer  potting soil
lamp  500-mL beaker
spoon  paper towels
sand  clay
stopwatch

Safety 🌚 🌞 🌈

Make Observations
1. Read and complete a lab safety form.
2. Make a data table below to record your observations of energy transfer. Include columns for Type of Surface, Temperature Before Heating, and Temperature After Heating.
Big Idea Lab continued

3. Half-fill a 500-mL beaker with sand. Place a thermometer in the sand and carefully add enough sand to cover the thermometer bulb—about 2 cm deep. Keep the bulb under the sand for 1 minute. Record the temperature in the data table.

4. Place the beaker under the light source. Record the temperature after 10 minutes.

5. Repeat steps 3 and 4 using soil and water.

Form a Hypothesis

6. Use the data in your table to form a hypothesis stating which surfaces on Earth, such as forests, wheat fields, lakes, snowy mountaintops, and deserts, will absorb the most radiant energy.

Test Your Hypothesis

7. Decide which materials could be used to mimic the surfaces on Earth from your hypothesis.

8. Repeat the experiment with materials approved by the teacher to test your hypothesis.

9. Examine your data. Was your hypothesis supported? Why or why not?

Analyze and Conclude

10. Infer which types of areas on Earth absorb the most energy from the Sun.

11. Think Critically When areas of Earth are changed so they become more likely to reflect or absorb energy from the Sun, how might these changes affect conduction and convection in the atmosphere?
Big Idea Lab continued

12. The Big Idea Explain how thermal energy from the Sun being received by and reflected from Earth’s surface is related to the role of the atmosphere in maintaining conditions suitable for life.

Communicate Your Results
Display data from your initial observations to compare your findings with your classmates’ findings. Explain your hypothesis, experiment results, and conclusions to the class.

Inquiry Extension

What could you add to this investigation to show how cloud cover changes the amount of radiation that will reach Earth’s surfaces? Design a study that could test the effect of cloud cover on radiation passing through Earth’s atmosphere. How could you include a way to show that clouds also reflect radiant energy from the Sun?

Lab Tips
• If possible, use leaves, straw, shaved ice, and other natural materials to test your hypothesis.
Study Guide

Use Vocabulary
*Use the vocabulary from the chapter to complete the sentences below.*

1. Radio waves travel long distances by bouncing off electrically charged particles in the _________________.
2. The Sun's thermal energy is transferred to Earth through space by ________________.
3. Rising currents of warm air transfer energy from Earth to the atmosphere through ________________.
4. A narrow band of winds located near the top of the troposphere is a(n) ________________.
5. ________________ are steady winds that flow from east to west between 30°N latitude and 30°S latitude.
6. In large urban areas, ________________ forms when pollutants in the air interact with sunlight.
7. A mixture of dust, acids, and other chemicals that can be hazardous to human health is called ________________.

Link Vocabulary and Key Concepts
*Use vocabulary terms from the chapter to complete the concept map below.*

8. smog
9. Air pollution
10. nonpoint-source
11. point-source
12. polar easterlies
13. Wind patterns
14. global
15. local
16. conduction
17. latent heat

Earth's Atmosphere
Understand Key Concepts

Circle the correct answer below.

1. Air pressure is greatest SC.6.E.7.9
   A. at a mountain base.
   B. on a mountain top.
   C. in the stratosphere.
   D. in the ionosphere.

2. In which layer of the atmosphere is the ozone layer found? SC.6.E.7.9
   A. troposphere
   B. stratosphere
   C. mesosphere
   D. thermosphere

3. This diagram represents the atmosphere's SC.6.E.7.5
   A. air masses.
   B. global wind belts.
   C. inversions.
   D. particulate motion.

4. The Sun’s energy SC.6.E.7.5
   A. is completely absorbed by the atmosphere.
   B. is completely reflected by the atmosphere.
   C. is in the form of latent heat.
   D. is transferred to the atmosphere after warming Earth.

5. Which type of energy is emitted from Earth to the atmosphere? SC.6.E.7.5
   A. ultraviolet radiation
   B. visible radiation
   C. infrared radiation
   D. aurora borealis

6. Which is a narrow band of high winds located near the top of the troposphere? SC.6.E.7.3
   A. polar easterly
   B. a jet stream
   C. a sea breeze
   D. a trade wind

7. Which helps protect people, animals, plants, and buildings from the harmful effects of air pollution? HE.6.C.1.3
   A. primary pollutants
   B. secondary pollutants
   C. ozone layer
   D. air quality standards

8. The photo shows a potential source of HE.6.C.1.3
   A. ultraviolet radiation.
   B. indoor air pollution.
   C. radon.
   D. smog.
Chapter 4 Review continued

Critical Thinking
Use the lines below to respond to the following questions.

9. **Predict** how atmospheric carbon dioxide levels might change if more trees were planted on Earth. Explain your prediction.  *SC.6.E.7.9*

10. **Compare** visible and infrared radiation.  *SC.6.E.7.9*

11. **Assess** whether your home is heated by conduction or convection.  *SC.6.E.7.1*

12. **Sequence** how the unequal heating of Earth’s surface leads to the formation of wind.  *SC.6.E.7.5*
Chapter 4 Review continued

Critical Thinking
Use the lines below to respond to the following questions.

13. Evaluate whether a sea breeze could occur at night. **SC.6.E.7.5**

14. Interpret Graphics  What are the top three sources of particulate matter in the atmosphere? What could you do to reduce particulate matter from any of the sources shown here?  **LA.6.2.2.3**

![Source of Particulate Matter, 2002](chart)

15. Diagram how acid precipitation forms. Include possible sources of sulfur dioxide and nitrogen oxide and organisms that can be affected by acid precipitation. **HE.6.C.1.3**
Chapter 4 Review continued

Writing in Science

16. Write a paragraph explaining whether you think it would be possible to permanently pollute the atmosphere with particulate matter. **LA.6.2.2.3**
Chapter 4 Review continued

Review the Big Idea

17. Review the title of each lesson in the chapter. List all of the characteristics and components of the troposphere and the stratosphere that affect life on Earth. Describe how life is impacted by each one. SC.6.E.7.9

18. Discuss how energy is transferred from the Sun throughout Earth’s atmosphere. SC.6.E.7.5

Math Skills

Use Graphs

19. What was the percent change in energy usage between 1996 and 1999?

20. What happened to energy usage between 1999 and 2000?

21. What was the total percentage change between vehicle miles traveled and air pollution from 1970 to 2000?
Multiple Choice

1. What causes the phenomenon known as a mountain wave? SC.6.E.7.5
   A. radiation imbalance
   B. rising and sinking air
   C. temperature inversion
   D. the greenhouse effect

2. What phenomenon does the diagram above illustrate? SC.6.E.7.5
   F. radiation balance
   G. temperature inversion
   H. the Coriolis effect
   I. the greenhouse effect

3. What type of energy transfer occurs when the heat in the sand transfers to a person’s feet? SC.6.E.7.1
   A. convection
   B. conduction
   C. radiation
   D. absorption

4. In which direction does moving air appear to turn in the Northern Hemisphere? SC.6.E.7.5
   F. down
   G. up
   H. right
   I. left

5. Which layer of the atmosphere has the widest range of temperatures? SC.6.E.7.5
   A. mesosphere
   B. stratosphere
   C. thermosphere
   D. troposphere

6. Plants and animals thrived on Earth after the ozone layer was formed. What does the ozone protect the Earth from? SC.6.E.7.9
   F. solar radiation
   G. meteor showers
   H. acid rain
   I. volcanic gas
7 Which is the primary cause of the global wind patterns on Earth? **SC.6.E.7.5**
- A ice cap melting
- B uneven heating
- C weather changing
- D waves breaking

Use the diagram below to answer question 8.

**Energy Transfer Methods**

8 In the diagram above, which transfers thermal energy in the same way the Sun’s energy is transferred to Earth? **SC.6.E.7.1**
- F the boiling water
- G the burner flame
- H the hot handle
- I the rising steam

9 Which substance in the air of U.S. cities has decreased least since the Clean Air Act began? **HE.6.C.1.3**
- A carbon monoxide
- B ground-level ozone
- C particulate matter
- D sulfur dioxide

10 Which heat-transfer process can be described as currents of warm air rising from Earth’s surface as currents of cool air descend? **SC.6.E.7.1**
- F conduction
- G convection
- H latent heat
- I radiation

11 Which atmospheric layer absorbs the Sun’s harmful ultraviolet rays? **SC.7.E.7.9**
- A mesosphere
- B stratosphere
- C thermosphere
- D troposphere

Use the table below to answer question 12.

<table>
<thead>
<tr>
<th>Heat Transfer</th>
<th>Type of Transfer</th>
<th>How It Transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation</td>
<td>with rays of waves</td>
<td></td>
</tr>
<tr>
<td>Conduction</td>
<td>contact of material</td>
<td></td>
</tr>
<tr>
<td>Convection</td>
<td>flow of material</td>
<td></td>
</tr>
</tbody>
</table>

12 Heat can be transferred in several ways. The table describes types of heat transfer. Which is an example of conduction? **SC.6.E.7.1**
- F sunlight shining on a metal chair
- G fire heating a room
- H a metal pan burning a hand
- I hair dryer blowing hair
Multiple Choice Bubble the correct answer.

1. Look at the image above. In which layer of the atmosphere are the warmest air temperatures found? **SC.6.E.7.9**
   - A exosphere
   - B stratosphere
   - C thermosphere
   - D troposphere

2. In which layer of the atmosphere do most people spend their entire lives? **SC.6.E.7.9**
   - F exosphere
   - G mesosphere
   - H stratosphere
   - I troposphere

3. Which image shows solid particles that have been put into the atmosphere by human processes? **SC.6.E.7.9**
   - A
   - B
   - C
   - D

Extend Your Learning
Turn the page to Learn Out Loud
Think, Discuss, Share

From My Teacher
Multiple Choice Bubble the correct answer.

1. In the image above, what percentage of radiation is reflected back into the atmosphere by clouds and other particles? **SC.6.E.7.1**
   - A 20 percent
   - B 25 percent
   - C 50 percent
   - D 55 percent

2. Which gas is NOT an efficient greenhouse gas? **SC.6.E.7.9**
   - F helium
   - G methane
   - H carbon dioxide
   - I water vapor

3. In the image above, which type of heat transfer is represented by the number 1? **SC.6.E.7.1**
   - A conduction
   - B convection
   - C latent heat
   - D radiation

4. In what form does most solar radiation reach Earth? **SC.6.E.7.5**
   - F infrared light
   - G microwaves
   - H ultraviolet light
   - I visible light

**Extend Your Learning**
Turn the page to Learn Out Loud
Multiple Choice  Bubble the correct answer.

1. Look at the images above. What is the name of the nighttime circulation shown?  SC.6.E.7.3  
   A cold land  
   B land breeze  
   C sea breeze  
   D warm water

2. What is the difference between the trade winds and the prevailing westerlies?  SC.6.E.7.5  
   F Only the prevailing westerlies are driven by the Coriolis effect.  
   G Trade winds flow away from the equator; westerlies are steady and flow toward the equator.  
   H Trade winds flow from west to east, and westerlies flow from east to west.  
   I Unlike the trade winds, westerlies are not a result of a convection cell.

3. In the illustration above, between which latitudes is the first convection cell located?  SC.6.E.7.3  
   A at 0°  
   B between 0° and 30°  
   C between 30° and 60°  
   D between 60° and the pole
Think, Discuss, Share

From My Teacher
Multiple Choice  Bubble the correct answer.

1. Which image shows an example of nonpoint-source pollution?  **SC.6.E.7.9**

   A
   
   B
   
   C
   
   D

2. Which type of pollution is a mixture of dust, acids, and other chemicals?  **HE.6.C.1.3**
   
   F  acid precipitation
   
   G  ground-level ozone
   
   H  particulate matter
   
   I  photochemical smog

3. Which list is an example of indoor air pollutants?  **HE.6.C.1.3**
   
   A  carpets, furniture upholstery, radon
   
   B  cleaning products, insects, rugs
   
   C  fireplaces, foam insulation, trees
   
   D  pesticides, grass, tobacco smoke

Extend Your Learning  
Turn the page to Learn Out Loud
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From My Teacher