

# Earth's Atmosphere

## Air Quality

### ..... Before You Read .....


<b>What do you think?</b> Read the two statements below and decide whether you agree or disagree with them. Place an A in the Before column if you agree with the statement or a D if you disagree. After you've read this lesson, reread the statements to see if you have changed your mind.		
Before	Statement	After
	7. If no humans lived on Earth, there would be no air pollution.	
	8. Pollution levels in the air are not measured or monitored.	

### ..... Read to Learn .....

## Sources of Air Pollution

The contamination of air by harmful substances, including gases and smoke, is called **air pollution**. Air pollution is harmful to humans and other living things. Years of exposure to polluted air can weaken a human's immune system. Air pollution can cause respiratory diseases such as asthma.

Air pollution comes from many sources. Point-source pollution is pollution that comes from a single, identifiable source. Examples of point sources include smokestacks of large factories and electric power plants that burn fossil fuels for energy. They release tons of polluting gases and particles into the air each day. An example of natural point-source pollution is an erupting volcano.

Nonpoint-source pollution is pollution that comes from a widespread area. An example of nonpoint-source pollution is air pollution in a large city. This is called nonpoint-source pollution because the pollution cannot be traced back to one source. Some bacteria that live in swamps and marshes are examples of natural sources of nonpoint-source pollution. 

### Key Concepts

- How do humans impact air quality?
- Why do humans monitor air quality standards?

### Study Coach

**Asking Questions** Read each head and write down one question you have about that topic. Try to find answers to your questions as you read.

### Key Concept Check

1. **Compare** point-source and nonpoint-source pollution.

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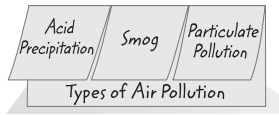


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Make a three-tab book to record information about the formation and effects of air pollution.



 **Reading Check**

**2. Identify** How does acid precipitation form? (Circle the correct answer.)

- a. when gases mix with moisture in the atmosphere
- b. when chemicals in the atmosphere react with sunlight
- c. when ground-level ozone rusts metal

 **Key Concept Check**

**3. Explain** How do humans impact air quality?

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## Causes and Effects of Air Pollution


The harmful effects of air pollution are not limited to human health. Some pollutants, including ground-level ozone, can harm plants. Air pollution can also damage human-made structures. Sulfur dioxide pollution can change the color of stone, rust metal, and damage paint.

### Acid Precipitation

When sulfur dioxide and nitrogen oxides combine with moisture in the atmosphere and form precipitation that has a pH lower than that of normal rainwater, it is called **acid precipitation**. Acid precipitation includes acid rain, snow, and fog. Acid precipitation affects the chemistry, or makeup, of water in lakes and rivers. This can harm the organisms living in the water. Acid precipitation also damages buildings and other structures made of stone.

Natural sources of sulfur dioxide include volcanoes and marshes. However, the most common sources of sulfur dioxide and nitrogen oxides are automobile exhausts and factory and power-plant smoke. 

### Smog

**Photochemical smog** is air pollution that forms from the interaction between chemicals in the air and sunlight. Smog forms when nitrogen dioxide, released in gasoline-engine exhausts, reacts with sunlight. A series of chemical reactions produces ozone and other compounds that form smog. Recall that ozone in the stratosphere helps protect organisms from the Sun's harmful rays. Ground-level ozone can damage the tissues of plants and animals. Ground-level ozone is the main part of smog. Smog in urban areas reduces visibility and makes it difficult for some people to breathe the air. 

### Particulate Pollution

Although you can't see them, over 10,000 solid or liquid particles are in every cubic centimeter of air. A cubic centimeter is about the size of a sugar cube. This type of pollutant is called **particulate matter**. **Particulate** (par TIH kyuh lut) **matter** is a mixture of dust, acids, and other chemicals that can be hazardous to human health. The smallest particles are the most harmful. They can be inhaled and then enter your lungs. They can cause asthma and bronchitis and can lead to heart attacks. Children and older adults are most likely to experience health problems due to particulate matter.

Particulate matter in the atmosphere absorbs and scatters sunlight. This can create haze. Haze particles scatter light, make things blurry, and reduce visibility.

## Movement of Air Pollution

Wind can influence the effects of air pollution. Because moving air carries pollution with it, some wind patterns cause more pollution problems than others. Weak winds or no wind prevents pollutants from mixing with the surrounding air. During weak wind conditions, pollution can grow to dangerous levels.

Temperature inversions can form during long winter nights when winds are weak and skies are clear. As land cools at night, the air above it also cools. Calm winds, however, prevent cool air from mixing with the warm air above it. Any pollution in the cool air stays close to Earth's surface and can cause problems.

Cool air, along with the pollution it contains, can be trapped in valleys. Cool air sinks down the sides of surrounding mountains into the valley preventing air layers from mixing. Pollution becomes trapped by the temperature inversion. ✓

## Maintaining Healthful Air Quality

Preserving the quality of Earth's atmosphere requires the cooperation of government officials, scientists, and the public. The Clean Air Act is an example of how government can help fight air pollution. The act was passed in 1970. Since then, steps have been taken to reduce pollution from automobile exhaust. Pollutant levels have decreased greatly in the United States. Unfortunately, serious problems still remain. The amount of ground-level ozone is still too high in many large cities. Also, acid precipitation continues to form and harm organisms in lakes, streams, and forests.

### Air Quality Standards

The Clean Air Act gives the United States government the power to set air-quality standards. The standards protect humans, animals, plants, and buildings from the effects of air pollution. All states must make sure pollutants do not exceed harmful levels. Some of the pollutants that are monitored include carbon monoxide, nitrogen oxides, particulate matter, ozone, and sulfur dioxide. ✓

### Monitoring Air Pollution

Pollution levels are continuously monitored by hundreds of instruments in all major cities in the United States. If levels are too high, authorities might advise people to limit outdoor activities.

#### ✓ Reading Check

#### 4. Cause and Effect

How is pollution trapped by a temperature inversion?

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#### ✓ Reading Check

5. Describe What is the Clean Air Act?

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**Key Concept Check**

**6. Cause and Effect** Why do humans monitor air quality standards?

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**Math Skills**

The graph here shows the percent change in four different pollution factors from 1970 through 2006. All values are based on the 0% amount in 1970. For example, from 1970 to 1990, the number of vehicle miles driven increased by 100%. In other words, the vehicle miles doubled. During the same period, the amount of air pollution decreased by 30%.

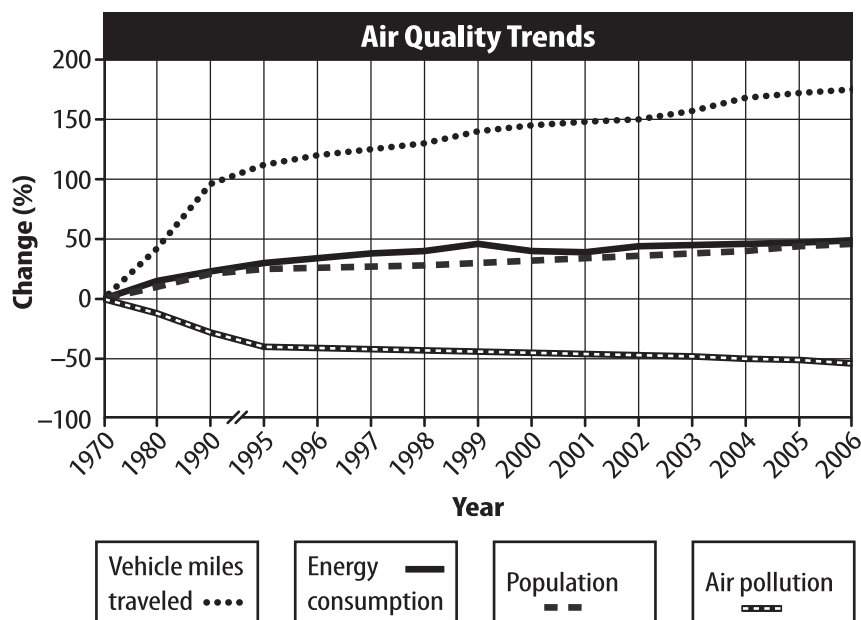
**7. Use Graphs** What was the percent change in population between 1970 and 2006? (Circle the correct answer.)

- a. 50 percent
- b. 75 percent
- c. 100 percent

## Air Quality Trends

Air quality in U.S. cities has improved over the last several decades, as shown in the graph below. Even though some pollution-producing processes have increased, such as burning fossil fuels and traveling in automobiles, levels of certain air pollutants have decreased. Levels of lead and carbon monoxide in the air have decreased the most. Levels of sulfur dioxide, nitrogen oxide, and particulate matter have also decreased.

Ground-level ozone has not decreased much. Recall that ozone can form from chemical reactions involving car exhaust. The large number of vehicles in use results in the level of ground-level ozone remaining high.



## Indoor Air Pollution

Not all air pollution is outdoors. The air inside homes and other buildings can be as much as 50 times more polluted than outdoor air! Air quality indoors can affect human health more than air quality outdoors.

Indoor air pollution comes from many sources. Tobacco smoke, cleaning products, pesticides, and fireplaces are some common sources of indoor air pollutants. Furniture upholstery, carpets, and foam insulation also add pollutants to indoor air. Another indoor air pollutant is radon. Radon is an odorless gas given off by some soil and rocks. Radon leaks through cracks in the foundations of buildings and sometimes builds up to harmful levels inside homes. Harmful effects of radon come from breathing its particles.

## After You Read

### Mini Glossary

**acid precipitation:** precipitation that results when sulfur dioxide and nitrogen oxides combine with moisture in the atmosphere

**air pollution:** the contamination of air by harmful substances, including gases and smoke

**particulate (par TIH kyuh lut) matter:** a mixture of dust, acids, and other chemicals that can be hazardous to human health

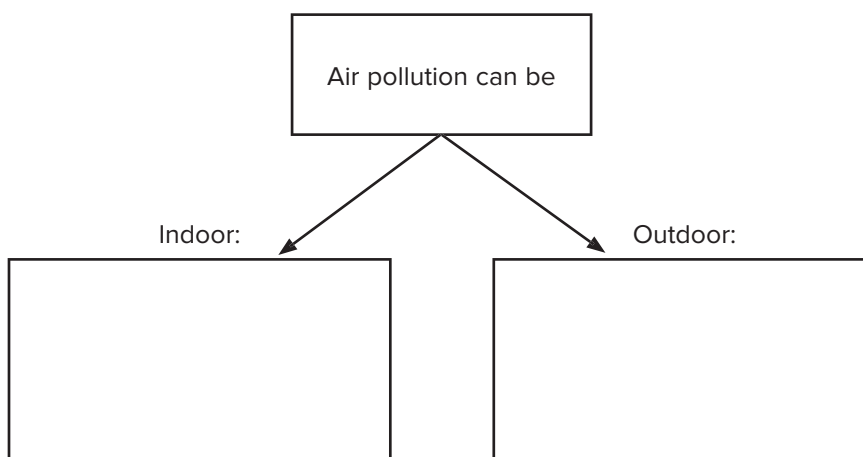
**photochemical smog:** air pollution that forms from the interaction between chemicals in the atmosphere and sunlight

1. Review the terms and their definitions in the Mini Glossary. Explain in one sentence what photochemical smog is.

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2. Complete the concept map to identify different sources of indoor and outdoor air pollution.



3. How did asking questions before you read the material help you better understand air quality?

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### What do you think

**NOW?**

Reread the statements at the beginning of the lesson. Fill in the After column with an A if you agree with the statement or a D if you disagree. Did you change your mind?



Log on to [ConnectED.mcgraw-hill.com](http://ConnectED.mcgraw-hill.com) and access your textbook to find this lesson's resources.

**END OF LESSON**

# Lesson 4 Air Quality

**Scan** Lesson 4. Read the lesson titles and bold words. Look at the pictures. Identify three facts that you discover about Earth's air quality. Write these facts in your Science Journal.

## Main Idea

### Sources of Air Pollution


### Causes and Effects of Air Pollution

I found this on page \_\_\_\_\_.


### Particulate Pollution

I found this on page \_\_\_\_\_.

## Details

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

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_

 **Analyze** the causes and effects of air pollution.

Cause	Effect
Acid precipitation	1. _____ 2. _____
	1. damages plant and animal tissue 2. _____ 3. _____

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

- Particulate matter: \_\_\_\_\_  
\_\_\_\_\_  
1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_

**Main Idea**

**Movement of Air Pollution**

I found this on page \_\_\_\_\_.

**Maintaining Healthful Air Quality**

I found this on page \_\_\_\_\_.

I found this on page \_\_\_\_\_.

**Air Quality Trends**

I found this on page \_\_\_\_\_.

**Details**

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


When the wind blows, it \_\_\_\_\_  
\_\_\_\_\_.

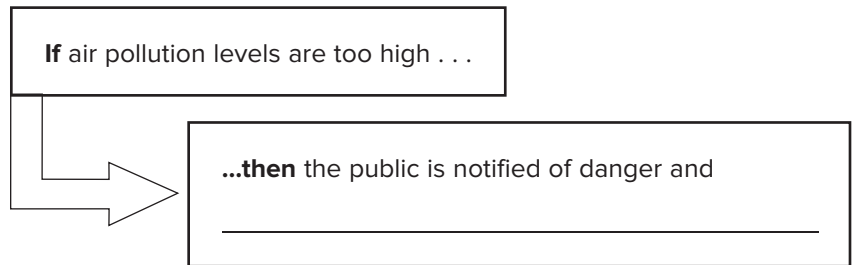
When the wind does not blow, \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.

 **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.



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

- 1.** \_\_\_\_\_
- 2.** \_\_\_\_\_
- 3.** \_\_\_\_\_
- 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?

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\_\_\_\_\_