

11-1 What is air?

Objectives

Describe air as matter. Identify and describe the main gases in air.

Key Terms

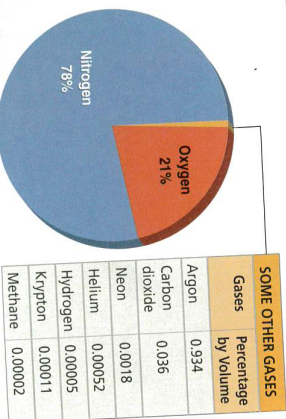
matter: anything that has mass and volume
atmosphere (At-muh-s-feer): envelope of gases that surrounds Earth
cellular respiration (seh-puh-RAH-shuhn): process by which a cell releases energy from food molecules

A Mixture of Gases Air is a colorless, tasteless, odorless mixture of gases. Air is matter. **Matter** is anything that has mass and takes up space, or has volume.



◀ **Figure 11-2**
Air has mass and volume.

The **atmosphere**, or air, is the envelope of gases that surrounds Earth. Air is made up mostly of nitrogen and oxygen. Air is also made up of other gases. Figure 11-3 shows the approximate percentages of the gases that make up air.



▶ **Figure 11-3** Gases in the air

1 **ANALYZE:** What percentage of air is made up of helium, neon, and krypton?

Nitrogen About 78 percent of the atmosphere is nitrogen. All organisms need nitrogen. However, most living things cannot use nitrogen gas from the air.

Bacteria are microscopic organisms that live in soil, in water, and in the air. Some bacteria can change the nitrogen gas in the air into nitrogen compounds. Plants get the nitrogen they need by absorbing the nitrogen compounds made by these bacteria. Animals get the nitrogen they need by eating plants.

2 **DEFINE:** What are bacteria?

Oxygen About 21 percent of air is oxygen. Living things need oxygen to carry on cellular respiration. **Cellular respiration** is the process by which a cell releases energy from food molecules. The energy comes from the food made, eaten, or absorbed by an organism. Plants make their own food. Most animals must eat food. Some other organisms absorb food from their environment. Most living things get the oxygen they need from air.

3 **INFER:** How do people get the oxygen they need to carry on respiration?

Carbon Dioxide About 0.04 percent of air is made up of carbon dioxide. Carbon dioxide is released when things burn. Respiration produces carbon dioxide as a byproduct. You get rid of this carbon dioxide when you breathe out. Plants need carbon dioxide to make their own food.

4 **STATE:** How does carbon dioxide get into air?

Other Components in Air Most of the time, air looks and feels dry to us. However, it is never really completely dry. In addition to the gases mentioned above, air contains water vapor. Water vapor is water in the form of a gas. Steam is heated water vapor. Sometimes steam contains tiny droplets of water, which is what you see. The water vapor itself is invisible. The amount of water vapor in the air varies greatly from place to place and over time. In rain forests, up to 5 percent of the air may be water vapor.

Water vapor plays an important role in weather. Clouds form as water vapor condenses out of air that has cooled. It forms tiny drops of liquid water or crystals of ice. If these drops or crystals grow large enough, they can fall as rain or snow.

In addition to the gases that make it up, air contains tiny particles of dust, smoke, salt, and other chemicals. You can see some of these particles. They are not part of the air itself. They float in the air, and sometimes they make the air unhealthy to breathe.

5 **LIST:** What is in air besides the gases?

CHECKING CONCEPTS

1. What two main gases make up air?
2. What is matter?

3. Why do living things need oxygen?
4. How does water vapor affect the weather?
5. What are two non-gaseous particles in air?

THINKING CRITICALLY

6 **CONTRAST:** How is water vapor different from other gases that make up air?

INTERPRETING VISUALS

Use Figure 11-3 to answer the following questions.

7. **ESTIMATE:** What gas makes up most of air?
8. **CALCULATE:** What percentage of air is made up of methane, krypton, and hydrogen?
9. **IDENTIFY:** What gases make up the 1 percent of air not composed of nitrogen and oxygen?



Real-Life Science BRONCHIAL ASTHMA

We all need air to live. For people who suffer from bronchial asthma, getting that air into their lungs can be a struggle. There are more than 14 million asthma sufferers in the United States alone.

An asthma attack usually starts with a swelling in the passages that carry air into our lungs when we breathe. One of the most common signs of an asthma attack is wheezing. Wheezing is the high-pitched noise caused by air moving through a narrowed air passage.

What causes an asthma attack? Usually, the air passages become irritated by tiny particles floating in the air. Often, these particles are things that a person with asthma is allergic to, such as pollen or animal fur. Household cleaners and cigarette smoke can also cause asthma attacks. The body's immune system releases a substance called histamine to fight the "invaders." It is the histamine that causes the swelling. Asthma cannot be cured. Its symptoms can be controlled, though, with treatment.

Thinking Critically How can the condition of asthma be triggered by particles suspended in air?



▶ **Figure 11-4** Three types of pollen grains