

The Air Around You

Reading Preview

Key Concepts

- What is the composition of Earth's atmosphere?
- How is the atmosphere important to living things?

Key Terms

- weather
- atmosphere
- ozone
- water vapor

Target Reading Skill

Using Prior Knowledge Before you read, look at the section headings and visuals to see what this section is about. Then write what you know about the atmosphere in a graphic organizer like the one below. As you read, write what you learn.

What You Know

1. The atmosphere contains oxygen.
- 2.

What You Learned

- 1.
- 2.

Lab
zone

Discover Activity

How Long Will the Candle Burn?

1. Put on your goggles.
2.  Stick a small piece of modeling clay onto an aluminum pie pan. Push a short candle into the clay. Carefully light the candle.
3.  Hold a small glass jar by the bottom. Lower the mouth of the jar over the candle until the jar rests on the pie pan. As you do this, start a stopwatch or note where the second hand is on a clock.
4. Watch the candle carefully. How long does the flame burn?
5.  Wearing an oven mitt, remove the jar. Relight the candle and then repeat Steps 3 and 4 with a larger jar.



Think It Over

Inferring How would you explain any differences between your results in Steps 4 and 5?

The sky is full of thick, dark clouds. In the distance you see a bright flash. Thirty seconds later, you hear a crack of thunder. You begin to run and reach your home just as the downpour begins. That was close! From your window you look out to watch the storm.

Does the weather where you live change often, or is it fairly constant from day to day? **Weather** is the condition of Earth's atmosphere at a particular time and place. But what is the atmosphere? Earth's **atmosphere** (AT muh sfeer) is the envelope of gases that surrounds the planet. To understand the relative size of the atmosphere, imagine that Earth is the size of an apple. If you breathe on the apple, a thin film of water droplets will form on its surface. Earth's atmosphere is like that water on the apple—a thin layer of gases on Earth's surface.

◀ From space, Earth's atmosphere appears as a thin layer near the horizon.

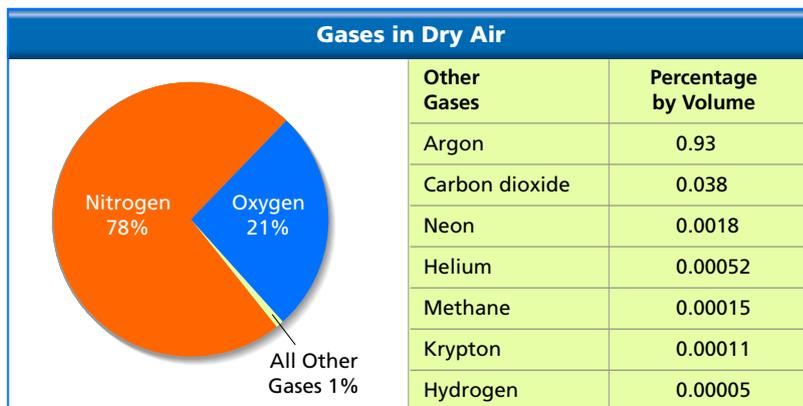


FIGURE 1
 Dry air in the lower atmosphere generally has about the same composition of gases.
Interpreting Data
What two gases make up most of the air?

Composition of the Atmosphere

The atmosphere is made up of a mixture of atoms and molecules of different kinds. An atom is the smallest unit of a chemical element that can exist by itself. Molecules are made up of two or more atoms. **Earth's atmosphere is made up of nitrogen, oxygen, carbon dioxide, water vapor, and many other gases, as well as particles of liquids and solids.**

Nitrogen As you can see in Figure 1, nitrogen is the most abundant gas in the atmosphere. It makes up a little more than three fourths of the air we breathe. Each nitrogen molecule consists of two nitrogen atoms.

Oxygen Even though oxygen is the second most abundant gas in the atmosphere, it makes up less than one fourth of the volume. Plants and animals take oxygen directly from the air and use it to release energy from their food.

Oxygen is also involved in many other important processes. Any fuel you can think of, from the gasoline in a car to the candles on a birthday cake, uses oxygen as it burns. Without oxygen, a fire will go out. Burning uses oxygen rapidly. During other processes, oxygen is used slowly. For example, steel in cars and other objects reacts slowly with oxygen to form iron oxide, or rust.

Most oxygen molecules have two oxygen atoms.

Ozone is a form of oxygen that has three oxygen atoms in each molecule instead of the usual two. Have you ever noticed a pungent smell in the air after a thunderstorm? This is the odor of ozone, which forms when lightning interacts with oxygen in the air.

FIGURE 2
Burning Uses Oxygen
 Oxygen is necessary in order for the wood to burn.



What is ozone?

FIGURE 3

Water Vapor in the Air

There is very little water vapor in the air over the desert where this lizard lives. In the tropical rain forest (right), where the frog lives, as much as four percent of the air may be water vapor.



Lab Zone Try This Activity

Breathe In, Breathe Out

How can you detect carbon dioxide in the air you exhale?

1. Put on your goggles.
2. Fill a glass or beaker halfway with limewater.
3.  Using a straw, slowly blow air through the limewater for about a minute. **CAUTION:** Do not suck on the straw or drink the limewater.
4. What happens to the limewater?

Developing Hypotheses

What do you think would happen if you did the same experiment after jogging for 10 minutes? What would your results tell you about exercise and carbon dioxide?

Carbon Dioxide Each molecule of carbon dioxide has one atom of carbon and two atoms of oxygen. Carbon dioxide is essential to life. Plants must have carbon dioxide to produce food. When the cells of plants and animals break down food to produce energy, they give off carbon dioxide as a waste product.

When fuels such as coal and gasoline are burned, they release carbon dioxide. Burning these fuels increases the amount of carbon dioxide in the atmosphere.

Other Gases Oxygen and nitrogen together make up 99 percent of dry air. Argon and carbon dioxide make up most of the other one percent. The remaining gases are called trace gases because only small amounts of them are present.

Water Vapor So far, we have discussed the composition of dry air. In reality, air is not dry because it contains water vapor. **Water vapor** is water in the form of a gas. Water vapor is invisible. It is not the same thing as steam, which is made up of tiny droplets of liquid water. Each water molecule contains two atoms of hydrogen and one atom of oxygen.

The amount of water vapor in the air varies greatly from place to place and from time to time. Water vapor plays an important role in Earth's weather. Clouds form when water vapor condenses out of the air to form tiny droplets of liquid water or crystals of ice. If these droplets or crystals become heavy enough, they can fall as rain or snow.

Particles Pure air contains only gases. But pure air exists only in laboratories. In the real world, air also contains tiny solid and liquid particles of dust, smoke, salt, and other chemicals. You can see some of these particles in the air around you, but most of them are too small to see.



What is water vapor?



Importance of the Atmosphere

Earth's atmosphere makes conditions on Earth suitable for living things. The atmosphere contains oxygen and other gases that you and other living things need to survive. In turn, living things affect the atmosphere. The atmosphere is constantly changing, with gases moving in and out of living things, the land, and the water.

Living things need warmth and liquid water. By trapping energy from the sun, the atmosphere keeps most of Earth's surface warm enough for water to exist as a liquid. In addition, Earth's atmosphere protects living things from dangerous radiation from the sun. The atmosphere also prevents Earth's surface from being hit by most meteoroids, or rocks from outer space.

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Section 1 Assessment

 **Target Reading Skill Using Prior Knowledge**
Review your graphic organizer and revise it based on what you just learned in the section.

Reviewing Key Concepts

- Defining** What is the atmosphere?
 - Listing** What are the four most common gases in dry air?
 - Explaining** Why are the amounts of gases in the atmosphere usually shown as percentages of dry air?
- Describing** What are three ways in which the atmosphere is important to life on Earth?
 - Predicting** How would the amount of carbon dioxide in the atmosphere change if there were no plants?
 - Developing Hypotheses** How would Earth be different without the atmosphere?

Writing in Science

Summary Write a paragraph that summarizes in your own words how oxygen from the atmosphere is important. Include its importance to living things and in other processes.