

The Nonliving Environment

section 2 Cycles in Nature

What You'll Learn

- why Earth's water cycle is important
- about the carbon cycle
- how nitrogen affects life on Earth

● Before You Read

What happens when you boil water in a covered pot? What do you see on the lid of the pot when you remove it?

Study Coach

Outline As you read, make an outline to summarize the information in the section. Use the main headings in the section as the main headings in the outline. Complete the outline with the information under each heading in the section.

● Read to Learn

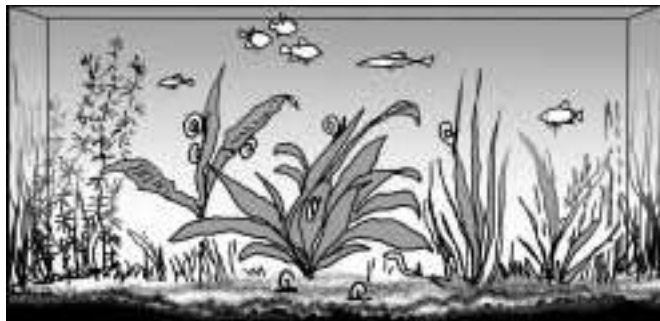
The Cycles of Matter

Imagine an aquarium with water, fish, snails, plants, algae, and bacteria. The tank is sealed so that only light can enter. How can the organisms survive without adding food, water, and air? The plants and algae produce their own food through photosynthesis. They also supply oxygen to the tank. The fish and snails eat the plants and algae and take in the oxygen. The wastes from the fish and snails fertilize the plants and algae. Bacteria decompose those organisms that die. The organisms in this closed environment can survive because the materials are recycled.

The environment in the aquarium is similar to Earth's biosphere. Earth only has a certain amount of water, carbon, nitrogen, oxygen, and other materials needed for life. These materials are constantly being recycled.

Picture This

1. **Explain** to a partner how the fish in the tank survive without anyone adding food, water, and air.



The Water Cycle

When you leave a glass of water on a sunny windowsill, the water evaporates. **Evaporation** takes place when liquid water changes into a gas, called water vapor, and enters the atmosphere. Water evaporates from the surfaces of lakes, streams, and oceans. It enters the atmosphere from plants in a process known as transpiration (trans puh RAY shun). Animals release water vapor as they exhale. Water is returned to the environment from animal wastes.

What is condensation?

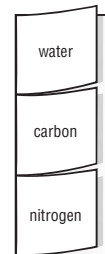
After water vapor enters the atmosphere, eventually it will come into contact with colder air. The temperature of the water vapor drops. Over time, the water vapor becomes cool enough to change back into liquid water. The process of changing from a gas to a liquid is called **condensation**.

The water vapor condenses on particles of dust in the air and forms tiny droplets. The droplets join together to form clouds. When the droplets become large and heavy enough, they fall to the ground as rain or other precipitation.

As the figure below shows, the **water cycle** is a model that describes how water moves from the surface of Earth to the atmosphere and back to the surface again.

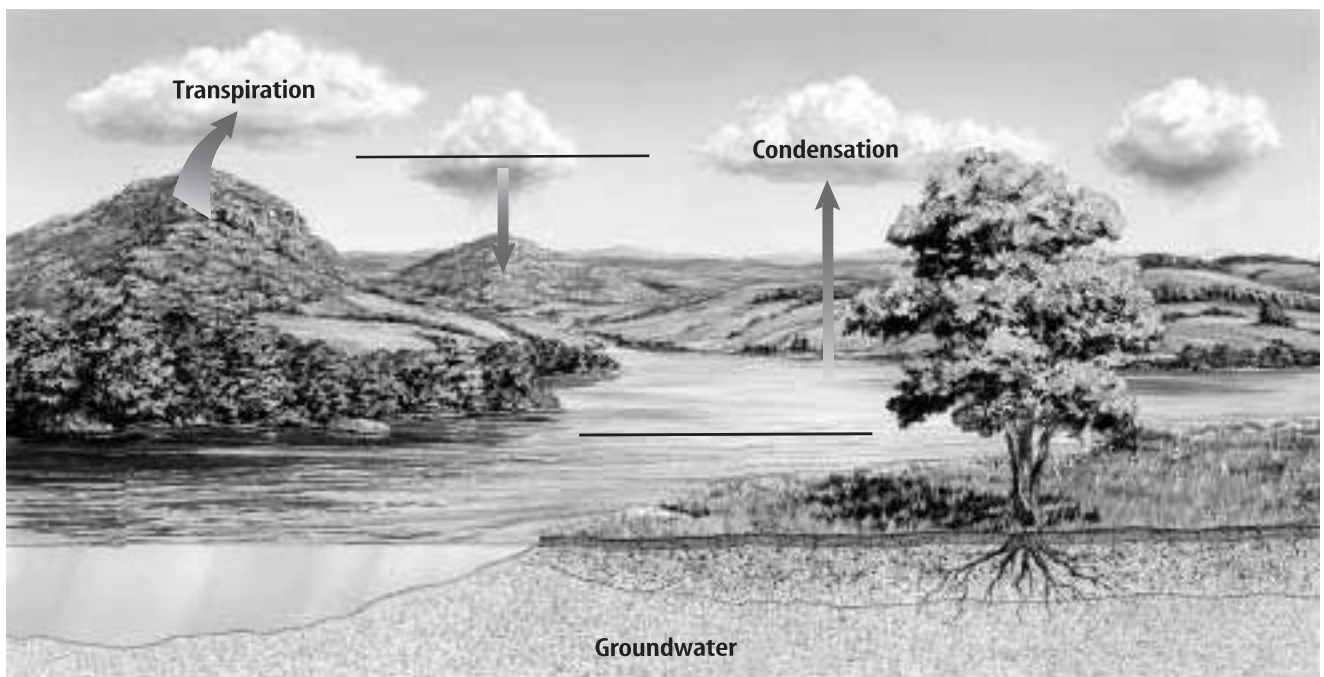
FOLDABLES™

A Describe Make a three-tab book Foldable, as shown below. Use the Foldable to describe the water, carbon, and nitrogen cycles.



Picture This

2. Identify Complete the figure by labeling the missing steps in the water cycle.



Think it Over

3. **Analyze** List some of the ways you use water.

Picture This

4. **Discuss** What is one role animals play in the nitrogen cycle?

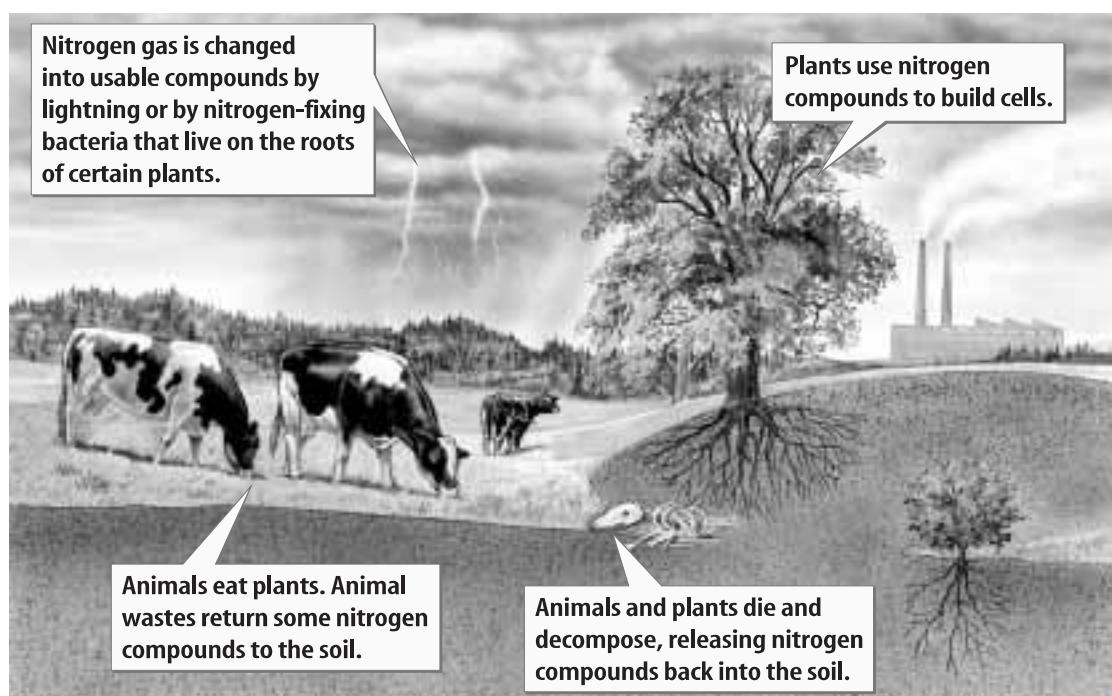
How do humans affect the water cycle?

Humans take water from reservoirs, rivers, and lakes to use in their homes, businesses, and farms. Using this water can reduce the amount of water that evaporates into the atmosphere. Humans also influence how much water returns to the atmosphere by limiting the amount of water available to plants and animals.

The Nitrogen Cycle

Nitrogen is important to all living things. It is a necessary part of proteins. Proteins are needed for the life processes that take place in the cells of all organisms. Nitrogen is the most plentiful gas in the atmosphere. However, most organisms cannot use nitrogen directly from the air.

Plants need nitrogen that has been combined with other elements to form nitrogen compounds. Through a process called **nitrogen fixation**, some types of soil bacteria form the nitrogen compounds that plants need. Plants take in these nitrogen compounds through their roots. Animals get the nitrogen they need by eating plants or other animals. When dead organisms decay, the nitrogen in their bodies returns to the soil or the atmosphere. This transfer of nitrogen from the atmosphere to the soil, to living organisms, and back to the atmosphere is called the **nitrogen cycle**. The nitrogen cycle is shown in the figure below.



How do human activities affect soil nitrogen?

Humans can affect the part of the nitrogen cycle that takes place in the soil. After crops are harvested, farmers often remove the rest of the plant material. The plants are not left in the field to decay and return their nitrogen compounds to the soil. If the nitrogen compounds are not replaced, the soil could become infertile. Fertilizers can be used to replace soil nitrogen. Compost and animal manure also contain nitrogen compounds that plants can use. They can be added to soil to make it more fertile. ✓

Another way to replace soil nitrogen is by growing nitrogen-fixing crops. Most nitrogen-fixing bacteria live on or in the roots of certain plants. Some plants, such as peas, have roots with nodules that contain nitrogen-fixing bacteria. These bacteria supply nitrogen compounds to the plants and add nitrogen compounds to the soil.

The Carbon Cycle

Carbon atoms are found in the molecules of living organisms. Carbon is part of soil humus and is found in the atmosphere as carbon dioxide gas (CO₂). The **carbon cycle** describes how carbon molecules move between the living and nonliving world.

The cycle begins when producers take CO₂ from the air during photosynthesis. They use CO₂, water, and sunlight to make energy-rich sugar molecules. Energy is released from these molecules during respiration—the chemical process that provides energy for cells. Respiration uses oxygen and releases CO₂. Photosynthesis uses CO₂ and releases oxygen. The two processes help recycle carbon on Earth. ✓

Human activities also release CO₂ into the atmosphere. For example, when fossil fuels are burned, CO₂ is released into the atmosphere as a waste product. People also use wood for building and for fuel. Trees that are cut down for these purposes cannot remove CO₂ from the atmosphere during photosynthesis. The amount of CO₂ in the atmosphere is increasing. The extra CO₂ could trap more heat from the Sun and cause average temperatures on Earth to rise.

✓ Reading Check

5. Identify two ways to add nitrogen to soil.

✓ Reading Check

6. Explain What two processes recycle carbon on Earth?

● After You Read

Mini Glossary

carbon cycle: a model that describes how carbon molecules move between the living and nonliving world

condensation: process that occurs when a gas changes to a liquid

evaporation: process that occurs when liquid water changes into water vapor and enters the atmosphere

nitrogen cycle: the transfer of nitrogen from the atmosphere to the soil, to living organisms, and back to the atmosphere

nitrogen fixation: process in which some types of soil bacteria form the nitrogen compounds that plants need

water cycle: a model that describes how water moves from the surface of Earth to the atmosphere and back to the surface again

1. Review the terms and their definitions in the Mini Glossary. Write a sentence that explains the difference between condensation and evaporation.

2. In the chart, list the steps in the nitrogen cycle.

Steps in the Nitrogen Cycle	
1.	<hr/> <hr/>
2.	<hr/> <hr/>
3.	<hr/> <hr/>
4.	<hr/> <hr/>



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