

The Water Cycle

Have you ever made sand castles at the beach? When you dig a trench around the castle you may get a surprise (see **Figure 1**). The trench fills with water that comes from below the surface.

Water Beneath the Soil

There are two sources of fresh water: ground water and surface water. Precipitation that collects above the ground is called surface water. Lakes, ponds, and rivers are surface water. Surface water filters down into the layers of soil and rock. Eventually it reaches a level where the soil or rock is saturated with water. This level is called the water table. Water at and below the water table is ground water.

As water seeps downward it carries dissolved chemicals from the upper to the lower layers of the soil. This process is called **leaching**. The removal of these chemicals from the upper layers of the soil could be a serious problem for plants, which require the chemicals for growth and development. They respond by sending long, branching roots deep into soil. These help draw the chemicals back from the lower levels of the soil to the surface.

Figure 1

Water in the moat around this sand castle provides evidence that water continuously moves between the lake and the soil.

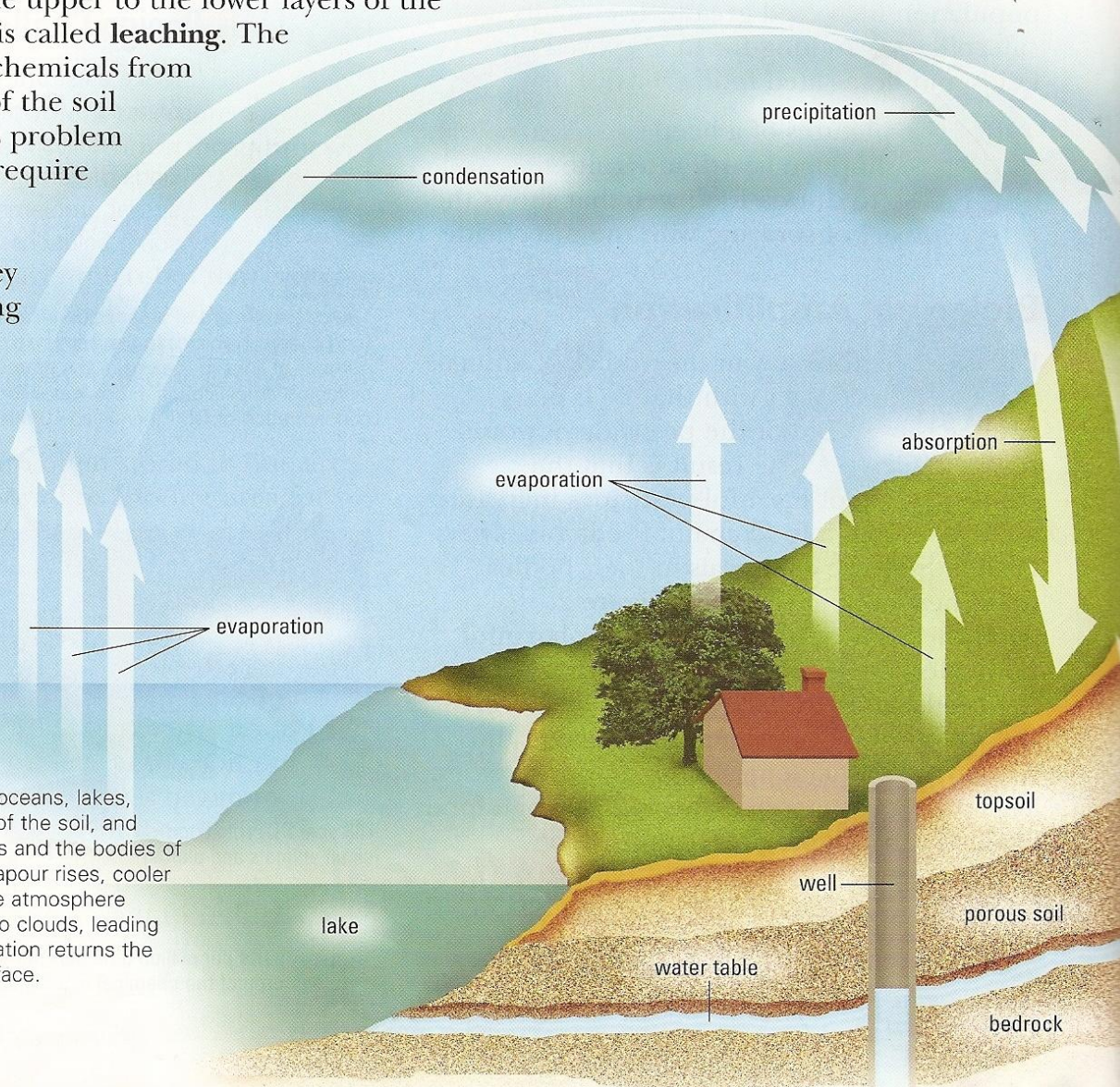


Figure 2

Water evaporates from oceans, lakes, rivers, the upper layers of the soil, and from the leaves of plants and the bodies of animals. As the water vapour rises, cooler temperatures high in the atmosphere cause it to condense into clouds, leading to precipitation. Precipitation returns the water to the Earth's surface.

The Water Cycle

Water moves through ecosystems in a cycle. As shown in **Figure 2**, the **water cycle** collects, purifies, and distributes Earth's water. When the Sun's rays warm the Earth's surface, water evaporates and enters the atmosphere as vapour. As water enters the atmosphere, it leaves behind any chemicals that were dissolved in the water. Even the salt dissolved in ocean water remains in the ocean. Only fresh water enters the atmosphere by evaporation. Water removed from the oceans, lakes, and soil by evaporation is returned to Earth in the form of rain, snow, sleet, and hail.

Understanding Concepts

1. What is the water table?
2. Explain in your own words how the water cycle purifies water.
3. Why do minerals leach from the soil?
4. How do the roots of plants help prevent the leaching of important minerals?

Making Connections

5. List and describe two factors that would alter the amount of ground water in an area.
6. What dangers might be created by digging a hole for an outhouse at a beach cottage?

Design Challenge

How could a landfill site contaminate ground water? How might you prevent contamination?



Try This Measuring Water Cycling ^{6B}

How much water goes from plants to the atmosphere? You can find out.

- Put a small plastic bag around a leaf of a deciduous tree and around a small branch of a tree with needle leaves (**Figure 3**).
- Gently tie off the bag so the mouth of the bag is snug to the branch but not tight, and collect water overnight.
- Pour the water you collect into a graduated cylinder.

1. Which type of leaf cycled the greatest amount of water?
2. Create a hypothesis to explain the difference. ^{2C}

Figure 3

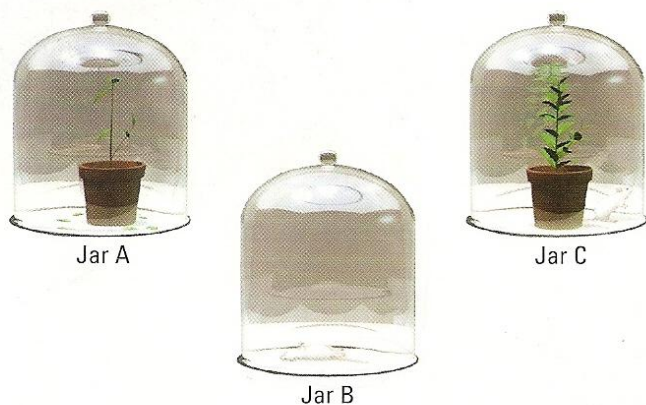


The Carbon Cycle

Nearly 200 years ago, Joseph Priestley conducted an experiment that demonstrated that animals depend on plants. Priestley used three heavy glass jars. One of the jars was placed over a mint plant. The second was placed over a mouse. The third was placed over a mint plant and a mouse together, as shown in **Figure 1**. The mouse in jar B died. When living together, however, the mouse and plant seemed to thrive. Plants and animals need each other—but why?

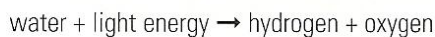
Figure 1

Priestley's experiment showed that plants and animals help each other.



Photosynthesis

Plants convert light energy into chemical energy (food). However, the conversion is not a single-step process (see **Figure 2**). During the first part of the reaction, light energy is absorbed by chlorophyll in the plant's leaves. The light energy is used to split water molecules into hydrogen and oxygen. The oxygen is released into the atmosphere.



During the second phase, carbon dioxide from the air is combined with the hydrogen that was removed from water molecules. The product is glucose, a sugar.

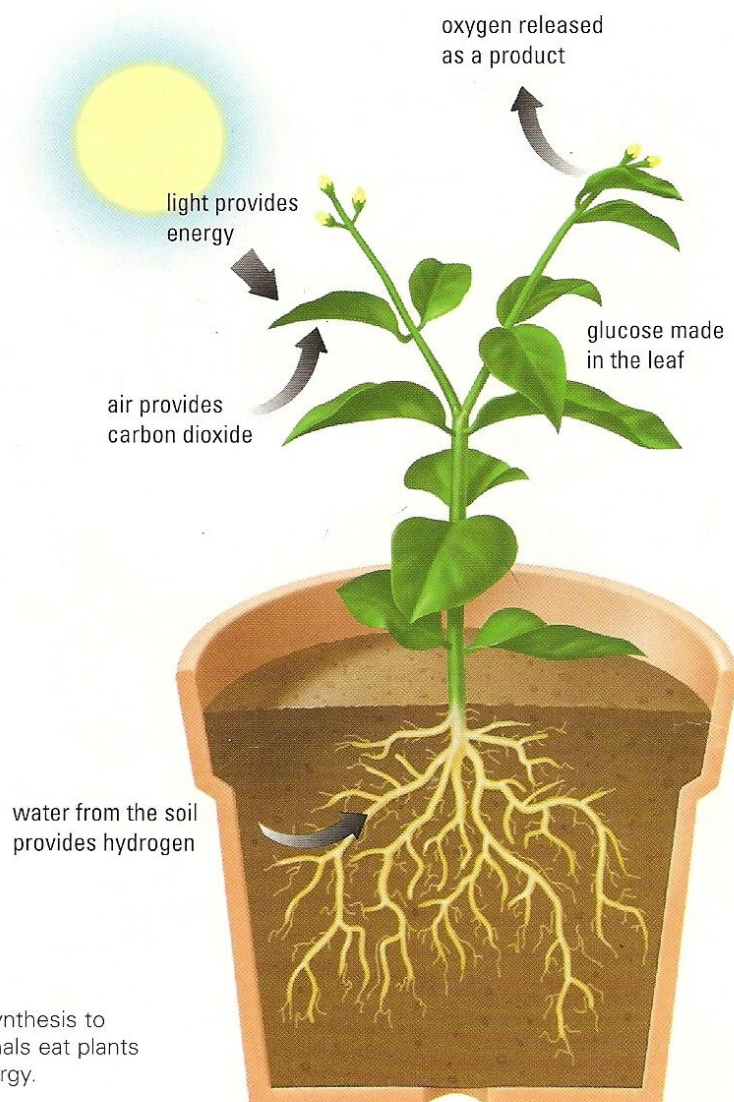
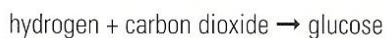


Figure 2

Plants use photosynthesis to store energy. Animals eat plants for that stored energy.

Respiration

You need energy to move. Your heart needs energy to pump blood through your body. You need energy to make new molecules for growth and to fight off disease. You need energy to breathe and to think. There is no time of the day that you don't need energy.

Your body gets its energy from food molecules, such as the sugar glucose. In your cells, oxygen is used to break down sugar molecules and release energy. This process is known as **respiration**. As sugar is broken down, carbon dioxide and water are released.



Both plants and animals use respiration to release energy (see **Figure 3**).

Figure 3

Plants also respire. During the day, photosynthesis is working faster in plants, so they release much more oxygen than they do carbon dioxide. At night, just like animals, plants use up oxygen and release carbon dioxide as they break down sugar for energy.

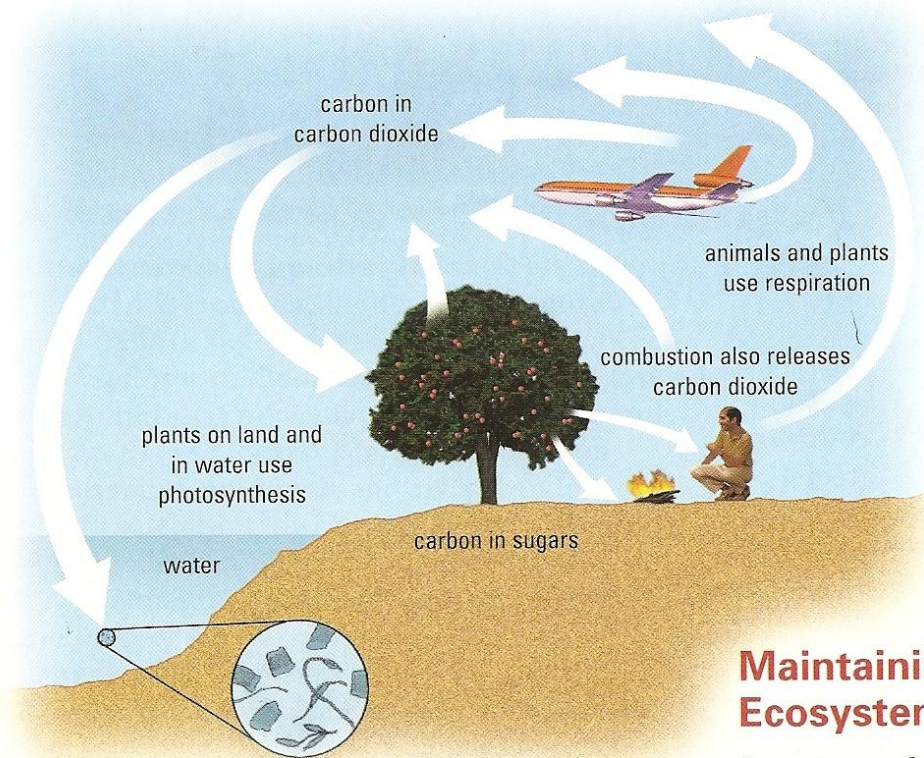
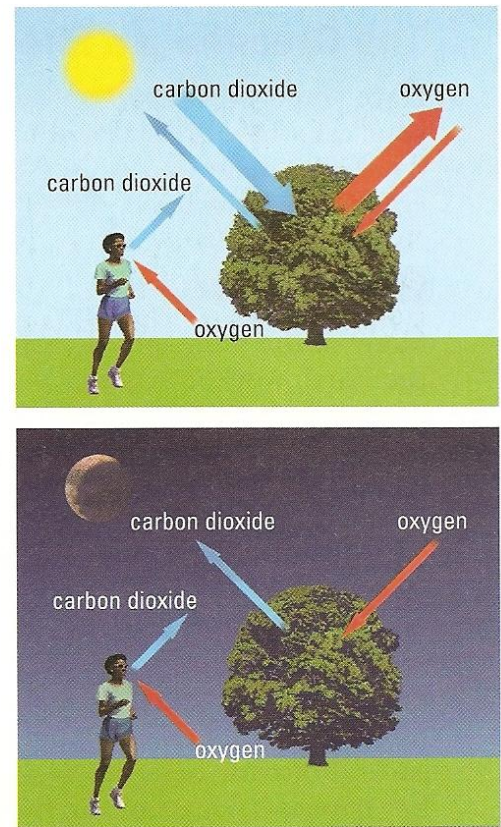


Figure 4

The carbon cycle. Carbon in carbon dioxide from the atmosphere is used to make sugars. The sugars are used by plants and animals for energy. The carbon from the broken-down sugars is then released to the atmosphere as carbon dioxide.

Maintaining a Balance in Ecosystems

In nature a balance of oxygen and carbon dioxide is maintained. The plants provide oxygen and sugars for the ecosystem, while animals provide carbon dioxide and water for the ecosystem. The processes of photosynthesis and respiration support one another. The flow of carbon through photosynthesis and respiration is called the **carbon cycle**, as shown in **Figure 4**.