

TAKE A LITTLE, GIVE A LITTLE



BENCHMARK and TASK

SC.G.1.2.3 The student knows that green plants use carbon dioxide, water, and sunlight energy to turn minerals and nutrients into food for growth, maintenance, and reproduction.

- The student explains how green plants use carbon dioxide, water, and sunlight energy to turn minerals and nutrients into food for growth, maintenance, and reproduction.

KEY QUESTION

How is the environment affected by transpiration?

BACKGROUND INFORMATION

A plant's roots absorb moisture from the soil. The water passes through the plant's stem or trunk through branches to the leaves. Inside the leaves, the plant uses some of the water to make food for growth during **photosynthesis**, but there is more water in the leaves than the plant needs. The extra water **evaporates** into the air from the surface of the leaves in a process called transpiration. As the water evaporates, it **changes state** from a **liquid** to a **gas**. The change from liquid to gas uses up heat energy in the air, so the air becomes cooler. Stomata cells are located on the underside of leaves, the sides facing away from the sun. These are the cells that regulate evaporation. Air and water move in and out of leaf cells through the stomata cells. More than 99 percent of the water drawn up into a tree is transpired out through the leaves.

MATERIALS

Per pair of students

1 gallon-size plastic bag with twist tie
1 small rock
1 graduated cylinder
1 leaf
1 microscope or Magiscope
twig covered with leaves

Per student

science journal

TEACHING TIP

If you have a limited number of microscopes, set up one or more in various parts of the room and allow student pairs to rotate to the stations at different times.

ENGAGE

Have students tear a leaf in half and use a microscope to observe along the tear. Have students sketch and describe what they see. Explain that the tiny openings on the underside of the leaf are called stomata. Plants breathe through the stomata.

EXPLORE

1. Find a healthy tree or shrub.
2. Inflate a dry, plastic bag to make sure it doesn't have any holes. Place the bag over a small twig covered with leaves; count the number of leaves enclosed in the bag. Place a small rock inside the bag so that the bag hangs down. Use a twist tie to securely close the plastic bag around the base of the twig.
3. Examine the bag after 24 hours.
4. Carefully pour the water from the plastic bag into a graduated cylinder and measure the amount of water that has transpired.

EXPLAIN

Did you find any water in the bag? Why do you think water accumulated in the bag? (Plants give off water through the stomata cells on the leaves, the water evaporates into the atmosphere and becomes water vapor, and the water vapor condenses inside the plastic bag. This process is called transpiration.)

How much water was in the bag? (Amounts will vary.)

Did every pair find the same amount of water in their bag? Why do you think the amounts differed? (The amount of water will vary based on the number of leaves, the type of leaves, and how securely the bag was sealed.)

How does plant transpiration affect our environment? (As the water evaporates, it changes from a liquid to a gas. The change from liquid to gas uses up heat energy in the air, so the air becomes cooler.)

EXTEND/APPLY

Discuss: How would transpiration affect the temperature and humidity in a forest area? (When water evaporates, it changes from a liquid to a gas. The changes require heat energy from the surrounding air, so the air becomes cooler. The forest, with so many trees, would be cooler than an area with fewer trees.)

EXTENSIONS

1. Compare the amounts of water transpired during the daylight hours and during the night.
2. Compare the amounts of water transpired on a cloudy day and a sunny day.

ASSESSMENT

Have students respond to the Key Question in their science journals: How is the environment affected by transpiration?