

SIEMENS STEM DAY ACTIVITY

LEAVES ARE THE PLACE TO BE

REAL-WORLD SCIENCE TOPICS

- An evaluation of the common physical characteristics of plants
- An evaluation of the relationship between plants' characteristics and their function
- An understanding that chemical processes breakdown substances to be used as energy in living organisms

ADDRESSES NGSS

LEVEL OF DIFFICULTY

1

GRADE RANGE:

3-5

OVERVIEW

In this activity, students will explore the structures within a leaf where the process of photosynthesis occurs. Students will work in groups to create a demonstration (human model) of one of the processes within a leaf. Each group will be given a vocabulary term or concept to act out explaining their process.

TOPIC

Plants and Energy

OBJECTIVE

Students will be able to demonstrate their understanding of the structure and function of leaf parts by modeling their function. Students will analyze how air and water are required for plant growth.

NGSS THREE-DIMENSIONS

| Science and Engineering Practices | Disciplinary Core Idea | Crosscutting Concepts |
|--|---|--|
| <p>Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Support an argument with evidence, data, or a model.</p> | <p>LS1.C: Organization for Matter and Energy Flow in Organisms Plants acquire their material for growth chiefly from air and water.</p> | <p>Energy and Matter Matter is transported into, out of, and within systems.</p> |

(Source: Next Generation Science Standards)

BACKGROUND INFORMATION

What do plants need to grow?

All plants are comprised of the same parts and require both air and water to grow. The roots of the plant are used to obtain nutrients from the soil and water. The leaves of the plant are used in the process of photosynthesis and absorb energy from the sun and carbon dioxide from the air in order to create food for the plant.

How does a plant transport its food?

Plants contain tube-like structures called the xylem and the phloem. The xylem carries water and nutrients up through the plant to the leaves. The phloem then returns the food created within the leaves down to the stem and roots of the plant. This process begins in the roots where water and nutrients are drawn in from the soil and transported up the stem into the leaves.

What happens in the leaves of a plant?

When a plant absorbs light energy from the sun, it is able to make its own food through a process called photosynthesis which takes place in the leaves of a plant. On the underside of a leaf there are tiny structures called stomata. These stomata, also known as guard cells, open and close enabling the plant to take in carbon dioxide and oxygen. The roots of the plant absorb water and nutrients and send to up into the leaves via the xylem. Once the water and nutrients from the roots reach the chloroplasts in the leaves, the plant is able to make its own food. The food called glucose (sugar) is transported back down into the plant via the phloem.

- During the day, the stoma releases the by-products from the process, which are oxygen and water vapor out of the plant. These delicate stomata are able to control the amounts of oxygen and water vapor that are being released in order to help the plant survive.
- At night, the process is reversed, plants release carbon dioxide and take in oxygen in a process called respiration (breathing)

What is transpiration?

Stomata are like tiny pores in the leaf that have the ability to open and close. They are similar to the pores you have in your skin. When you sweat your body is trying to lower its temperature by cooling you down your pores open to release moisture. Stomata have a similar function in a leaf. This process is called transpiration. As you know, water is transported up into the plant from the roots. During photosynthesis the water is used to make plant for the food and then released through the stomata as water vapor. Transpiration also enables a plant to control water loss. The plant needs to be able to control how much water it loses so it does not dry out and die. To conserve water, the stomata will close during periods of intense heat or drought.

KEY VOCABULARY

Chloroplasts: a green part of a plant cell where photosynthesis occurs

Phloem: tube-like structure in a plant that transports food down into the plant

Photosynthesis: the process of a plant taking in three substances: light, water, and carbon dioxide and changing them into sugar and oxygen. The sugar is then used by plants for its food and the oxygen is given off into the atmosphere.

Root: part of a plant that is underground and absorbs water and nutrients transporting them to the stem

Stomata: guard cells found on the leaves of plants that open and close

Transpiration: process in a plant that absorbs and releases water

Xylem: tube-like structure in a plant that transports water and nutrients up into the plant

MATERIALS NEEDED FOR ACTIVITY

- Scenario cards of a plant concept or idea
- Preprinted arrows in a variety of directions
- Tape
- Props/items available for students to use:
- Bags of sugar
- Balloons
- Flexible foam swim tubes
- Tissue paper or butcher paper
- Construction paper
- Toilet paper or paper towel tubes
- Boxes various sizes
- Bubble Wrap
- Bottled water
- Water sprayers
- Bottles of Bubbles
- Lamp
- Markers
- Open area for students to act out their concepts
- **Optional:** Large paper shape of a leaf (large enough for students to stand on or up against). The leaf shape can be put on the floor or wall. You could also just tape a shape onto the floor or wall.

TEACHER PREPARATION

Prepare scenarios and groups

Have a list of the terms/concepts displayed so students have a word bank to refer to. You could leave your review diagram displayed as a reference

Preprint arrows

Optional: Large paper leaf made in advance or floor taped to make the shape of a leaf.
Have all materials ready to use.

- 1. Warm-up Activity:** Have a discussion with the students about how we obtain energy. Lead the discussion towards our need for food, nutrients and oxygen. Ask students “How do we obtain our food?” followed by brief discussion and conclusion that we obtain our food and then eat it where it is then transformed into energy. Ask students “How do plants obtain their food?” followed by a brief discussion. Teacher should lead discussion towards the idea that unlike humans, plants are able to make their own food. A chemical process still occurs that transforms the food into energy to help a plant grow.
2. Teacher will review background information with students. During this review, the teacher is drawing a diagram of the important concepts and labeling them.
 - Photosynthesis [diagram](#)
 - Water cycle [diagram](#)

Leave these diagrams visible during the activity.

3. Teacher will explain “in today’s activity you will work in groups to create a skit of one of the plant’s processes we have been learning about. Your skit will be with actions, and you can use any of the props I have available. You won’t be able to use words in your skit. This will be similar to a game of charades” (Clarify the meaning of the word charades if needed).
4. Students will be put into groups. Size of group will vary depending on the concept they have been assigned.
5. Provide students with time to obtain materials for their skit and to practice how they will demonstrate their concept.
6. Begin the concept presentations one group at a time. The rest of the class should be observing the skits and seeing if they can guess the concept or activity being demonstrated. They can write their observations down or they can be shared verbally. At the end of each skit, the actors should ask what the concept was that they demonstrated.
7. Conclude the activity with analysis of how well the students were able to demonstrate their concept or idea. Ask the class:
 - “Why are air and water so important for a plant to grow?”
 - “How did the skits help you understand the concept?”

EXTENSION ACTIVITY

Teacher can provide students with opportunity to observe how these processes work in actual plants. Set up mini stations and as students progress around the stations, they write down their observations and analyze how water and air are crucial for plant growth.

- colored water to show how the xylem and phloem system works in celery, bok choy or carnations
- floating leaves in water
- growing a plant under cover with no air
- growing a plant in a dark environment
- showing plants growing in soil that has been watered and one that has dried out.

SOURCES

Dictionary Definitions You Can Understand – YourDictionary. N.p., n.d. Web. 7 Feb. 2016.

Next Generation Science Standards. N.p., n.d. Web. 7 Feb. 2016.

“Photosynthesis in Plants.” *Photosynthesis Education*. N.p., n.d. Web. 6 Feb. 2016.

“Photosynthesis Process for Kids.” *Buzzle*. N.p., n.d. Web. 6 Feb. 2016.

“Stomata.” *Encyclopedia of Earth*. N.p., n.d. Web. 7 Feb. 2016.

“Transpiration:transfer of Water from Plants to the Atmosphere.” *WW2010 (the Weather World 2010 Project)*:. N.p., n.d. Web. 7 Feb. 2016.

WEBSITES

http://www.biology4kids.com/files/plants_main.html

<http://www.dkfindout.com/us/animals-and-nature/plants/>

<http://photosynthesiseducation.com/photosynthesis-for-kids/>

SCENARIOS FOR GROUPS TO ACT OUT

Light energy—you will represent how light energy starts the process of photosynthesis.

Stoma (stomata)—you will represent how the stoma open and close.

Air—you will represent how carbon dioxide is taken in through the leaves during the day and how oxygen is taken in through the leaves at night.

Roots—you will represent how water and nutrients enter the roots and are transported to the stem of the plant

Xylem—you will represent how these tube-like structures transport water up the stem of the plant

Chloroplasts—you will represent how this part of the cell in the leaf takes in carbon dioxide and water from the stem of the plant and creates sugar (glucose)

Phloem—you will represent how food that is made by the plant, glucose, is transported down the tube-like structure into the plant.

Transpiration—you will represent how a plant is able to release water vapor and conserve water as needed