

Rigorous Curriculum Design Unit Planning Organizer

Subject(s)	Science
Grade/Course	6 th /Science
Unit of Study	Structures and Functions of Living Organisms
Pacing	6 weeks

Priority Essential Standards

- 6.L.1.1 Understand the structures, processes and behaviors of plants that enable them to survive and reproduce.
- 6.L.1.2 Explain the significance of the processes of photosynthesis, respiration and transpiration to the survival of green plants and other organisms.
- 6.L.2.1 Summarize how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain or food web (terrestrial and aquatic) from producers to consumers to decomposers.
- 6.L.2.2 Explain how plants respond to external stimuli (including dormancy and forms of tropism) to enhance survival in an environment.
- 6.L.2.3 Summarize how the abiotic factors (such as temperature, water, sunlight, and soil quality) of biomes (freshwater, marine, forest, grasslands, desert, Tundra) affect the ability of organisms to grow, survive and/or create their own food through photosynthesis

“UNWRAPPED” Priority Standards

L.1.1 Animals and plants have a great variety of body plans and internal structures that contribute to their being able to make or find food and reproduce. The process of sexual reproduction in flowering plants takes place in the flower, which is a complex structure made up of several parts. Some parts of the flower are directly involved in fertilization and seed production. Other flower parts have functions in pollination.

A flower is made up of six parts: petals-are leaf like, usually colorful structures arranged in a circle around the top of a flower stem. Sepals are modified leaves that encase the developing flower. They are sterile floral parts and may be either green or leaf like or composed of petal like tissue. Inside the circle of petals are the stamens. A stamen is the male reproductive structure of a flower. At the tip of the stamen is the anther. The anther produces pollen that contains sperm. At the center of the flower, attached to the top of the flower stem lie one or more pistils. The pistil is the female structure of the flower. The bottom portion of the pistil enlarges to form the ovary, a structure with one or more ovules, each containing one egg. When fertilization occurs the ovary grows into the fruit or vegetable. The length of night or dark period controls flowering.

L.1.2 One of the most general distinctions among organisms is between plants, which use sunlight to make their own food (photosynthesis) and animals, which consume energy-rich foods. Photosynthesis and cellular respiration are complementary processes. Plants carry on photosynthesis and cellular respiration where food is broken down into energy. The requirements of one process are the products of the other. Leaves have an epidermis with a waxy cuticle and stomata that help prevent water loss. Guard cells that

surround and control the size of the opening in stomata. The loss of water through the stomata is called transpiration. The opening and closing of guard cells regulate transpiration.

Photosynthesis	Cellular Respiration
Food accumulated	Food broken down
Energy from sun stored in glucose	Energy of glucose released
Carbon dioxide taken in	Carbon dioxide given off
Oxygen given off	Oxygen taken in
Produces glucose	Produces carbon dioxide and water
Goes on only in light	Goes on day and night
Occurs only in the presence of chlorophyll	Occurs in all living cells

6.L.2.1 Food provides molecules that serve as fuel and building material for all organisms. Plants use the energy from light to make sugars from carbon dioxide and water. Green plants are the producers of food that is used directly or indirectly by consumers. Plants can use the food they make immediately or store it for later use. Energy flows through ecosystems in one direction, from the sun through producers to consumers to decomposers. Matter is transferred from one organism to another and between organisms and their environments. Water, nitrogen, carbon dioxide, and oxygen are substances cycled between the living and non-living environments. Investigate how decomposers return nutrients to the environment—such as fungi on fallen logs, mold on bread. Explore the importance and role of bacteria in the guts of animals and plant roots at it relates to the recycling of matter.

6.L.2.2 Changes in environmental conditions can affect the survival of individual organisms and entire species. Dormancy is a period of inactivity in a mature seed prior to germination; seed remains dormant until conditions are favorable for growth and development of the new plant. Plants have mechanisms that enable them to respond to their environment. Plants grow, reproduce, and shift the position of their roots, stems and leaves in response to environmental conditions such as gravity, sunlight, temperature and day length. Tropism is a plant's turning or bending movement of an organism toward or away from an external stimulus such as light, heat or gravity. If the tropism is positive, the plant grows toward the stimulus. If the tropism is negative, the plant grows away from the stimulus. This enhances the survival rate for that plant in a given environment.

6.L.2.3 The world contains a wide diversity of physical conditions, which creates a wide variety of environments: freshwater, marine, forest, desert, grasslands, mountain, and others. In any particular environment, the growth and survival of organisms depend on the physical conditions. Environmental factors that affect an organism's ability to survive in its environment, such as food availability, predators, and temperature, are limiting factors. A limiting factor is any biotic or abiotic factor that restricts the existence, number, reproduction, or distribution of organisms. For example, at high elevations, temperatures are too low, winds too strong and the soil too thin to support the growth of large trees. Vegetation is limited to small, shallow-rooted plants, mosses, ferns and lichen. Factors that limit one population in a community may also have an indirect effect on another population. For example, a lack of water could limit the growth of grass in a grassland, reducing the number of seeds produced. The population of rabbits dependent on those seed for food will also be reduced and the hawks depending on the rabbits will be reduced too as a result of a decrease in their food supply. Another factor for survive is the ability of an organism to withstand fluctuations in biotic and abiotic environmental factors. The limits of an organism's tolerance are reached when the organism receives too much or too little of some environmental factor. Organisms become fewer as conditions move toward either extreme of the range of tolerance (too much or too little).

“Unwrapped” Concepts (students need to know)	“Unwrapped” Skills (students need to be able to do)	Bloom's Taxonomy
---	--	---------------------

Engaging Learning Experiences

		Levels
<ul style="list-style-type: none"> • Parts and functions of a flower. • Fertilization process. • Plant features required for survival. • Ingredients required for photosynthesis. • Products of photosynthesis. 	Dissect and identify parts of a flower.	Apply
	Classify plants based on how the plant pollinates.	Analyze
	Explain the relationship between photosynthesis, respiration and transpiration.	Analyze

Essential Questions

- How are fruits and vegetables replenished?
- Identify the structures and functions of flowering plants.
- How do plants make their own food?
- How do plants use the food they make during photosynthesis?
- How do plants change carbon dioxide to oxygen?

Informal Progress Monitoring Checks

- Ticket out the door sample questions: draw and label parts of a flowering plant; what's the function of the stamen, pistil, sepal, anther etc.
- Quick-write: Explain the role of the pistil in plant reproduction.
- Four Corners or Middle of the road: Have students to separate into groups based on their level of understanding of the topic.

Learning Activities Using Text or Program

L.1.1

Technology

http://www.bbc.co.uk/schools/scienceclips/ages/9_10/life_cycles.shtml<http://www.middle-schoolscience.com/flower.pdf>

Instructional Resource

L.1.1

<http://www.discoveryeducation.com/teachers/free-lesson-plans/all-about-plants.cfm>

L.2.2

<http://www.discoveryeducation.com/teachers/free-lesson-plans/the-importance-of-tropisms.cfm>

[Plants respond to stimuli](#)

L.2.1 & L.2.3

www.teachingboxes.org

Unit name: Feeding Frenzy—see Lesson 1 & 2

Additional ideas and resources:

Web Resources

[NCDPIWIKI-unit 5](#)

[Planting pollinators](#) –stewardship

Activity:

[Plant dissection](#)

[4-H project ideas](#)

Optional resource (does cost)

Carolina Biological Twig Videos

Sample Lesson Plan

Importance of Tropism

Adapted from: Assignment Discovery Online Curriculum

Duration:

Two to three class periods. Students will set up the experiment during the first period and observe the seeds over the next two periods.

Standard:

6.L.2.2 Explain how plants respond to external stimuli (including dormancy and forms of tropism) to enhance survival in an environment.

Student Learning Target(s)

1. I can identify different types of tropism
2. I can explain the importance of tropism in a plants survival.

Materials:*For the class:*

- Computers with Internet access (optional but very helpful)
- Reference materials: books and encyclopedias

For groups of three students:

- One petri dish
- Four soaked corn seeds
- One piece of filter paper
- One graduated cylinder
- Water (If there is not a sink in the classroom, water needs to be brought to class in a bucket.)
- Cotton
- Cellophane tape
- Grease pencil
- Scissors

For each student:

Pencils and paper

Note: You must prepare for the experiment by soaking four corn seeds per group of three students the night before you would like to do this activity. The seeds must soak for 24 hours.

Procedures:

1. Discuss with the class an interesting characteristic of plants: They can change their growth in response to their environment. These changes are called tropisms. Plants can exhibit the following kinds of tropisms:

- Phototropism—the way a plant grows or bends in response to light
- Geotropism—the way a plant grows or bends in response to gravity
- Hydrotropism—the way a plant grows or bends in response to water
- Thigmotropism—the way a plant grows or bends in response to touch

2. Explain that tropic responses can be positive or negative. A positive response is when the plant moves toward or in the direction of the stimulus. A negative response is when a plant moves away from the stimulus. For example, roots respond positively to gravity by growing down into the soil. The trunk and branches respond negatively to gravity by growing up toward the sky. (You may also want to note that the trunk and

branches respond positively to light.)

3. Divide students into groups of three. Tell them that they are going to perform an experiment to test geotropism, a root's response to gravity. Have students follow the steps below:

- a. Take four corn seeds that have been soaked overnight. Place them flat in the bottom of a petri dish with the seeds' pointed ends facing inward. Think of them as "hands on a clock" at 12, 3, 6, and 9.
- b. Cut a piece of filter paper so that it just fits in the petri dish. Place the filter paper into the petri dish, covering the seeds. (Be careful not to disturb the positioning of the seeds.)
- c. Without moving the petri dish, pour 15 milliliters of tap water on the filter paper. Then place enough cotton over the filter paper so that when the cover of the petri dish is put on, the paper and the seeds will not be able to move. The cotton should absorb any excess water.
- d. Once you've placed the cover on the petri dish, tape it shut. Turn the petri dish over. You should be able to see the seeds in the bottom of the dish, in the same position they were originally placed.
- e. With a grease pencil, write the name of your group on the side of the petri dish.
- f. Tape the petri dish containing seeds to the wall of a cupboard, with the bottom of the dish (showing the seeds) facing out. Close the cupboard door so that no light is exposed to the seeds for the next few days.*

**The dishes are kept in a dark cupboard so that the only variable being tested is the seeds' response to gravity. Their response to light is not being tested. Students should find that the roots grow downward, illustrating the effects of geotropism.*

4. After students have finished setting up and storing their petri dishes, have each student predict the results of the experiment by drawing how they think the roots will grow from each of the four seeds. Have students write their predictions in their science notebooks. Students will need to create a data chart in which to record their daily results.
5. Each day, students should make an observation and record the data on their sheets. Have them record the date and draw how the roots from each seed are growing. Have students record their observations for three days. As students are collecting data, have them look in reference books and on the Web to learn more about tropisms.
6. Students construct a response addressing the following questions; Did the root growth match the predicted sketch? What do these results show about how roots grow?
7. Tropisms in Your Neighborhood. Students collect information over a two-week period. Then have students bring in their data and share information with the class.

How many tropisms did they observe? Was one kind of tropism more prominent than others? Did the tropisms vary from neighborhood to neighborhood within the community?

Making Connections and extending understanding:

Have students design their own experiments to test one other plant tropism, such as light, water, or touch. Experiments must include a control and test only one variable at a time. For example, if students would like to test phototropism, they could put a control group upright under lights and an experimental group on its side under lights. To determine whether the plants are growing toward the light, students could use a protractor to measure the angle of the plant stems every 30 minutes for 2 hours. To record their results, students should design a data sheet. At the end of the experiment, have them present the experimental design and data to the class.

Questions: (include in science notebook)

1. How does the response of a root to gravity help a plant?
2. Consider plant roots and stems. Explain which tropisms affect both these plant organs. Do any tropisms affect both plant organs? Consider both positive and negative tropic responses.
3. Rain forests are unique and diverse plant habitats. Discuss tropisms that plants need to survive at various levels in the forest. Include the canopy, the understory, and the forest floor in your discussion.
4. Observe flowers growing in your neighborhood. Do they change the way they grow depending on where the light is? If so, how does this help the plant survive?
5. What do you think would happen if you place a light source below the plant? How would the stem grow?
6. Which do you think has a stronger influence on a plant—geotropism or phototropism? How could you design an experiment to test this?

Task Assessment

Use the following three-point rubric to evaluate students' work during this lesson. Students should be able to work in groups to set up the experiment, make a hypothesis about the way the roots will grow, observe the seeds over a period of time, record their observations, and draw conclusions from the experiment.

Three points: students were able to work successfully in their groups to set up the experiment and develop a hypothesis about the way the roots will grow; students could keep complete records of their observations, including sketches, and could write a clear, concise constructed response.

Two points: students worked somewhat successfully in their groups to set up the experiment and develop a hypothesis about the way the roots will grow; students were able to record most of their observations, including some sketches, and wrote a short constructed response.

One point: students worked in their groups to set up the experiment and develop a hypothesis about how the roots will grow; students were able to make some

observations, but they did not include sketches with each observation; students wrote a partial response.

Extensions and additional activities:

Light in a Shoebox

At one end of a shoebox, cut out a small opening that will allow sunlight in. The rest of the box should remain covered and dark. Put a small plant in the shoebox, and place the box near a light source. Make daily observations by carefully lifting off the cover of the box. Have students measure the length of growth each day and make a map of the direction of growth.

Invent a Tropism

Have students select an environment, such as the desert or the grasslands, and invent and name a tropism that would be advantageous to a plant's growth in that environment. Then have students build a model of the plant and its environment illustrating how the tropism works. For example, if the tropism is response to fertilizer placed deep in the ground, show how the plants grow downward in search of these nutrient.

Vocabulary:

geotropism

Context: The effect of geotropism on plants is tremendous, causing both the roots and the stems and leaves to grow in a certain way.

Definition: Growing or bending in response to gravity.

gravity

Pronunciation: grav i te

Context: Gravity causes the roots of plants to grow down so that the plant is anchored in the ground and has enough water to grow and thrive.

Definition: Force drawing objects to the center of Earth.

hydrotropism

Context: One of the reasons that roots grow down is in search of water, exhibiting most plants' tendency toward positive hydrotropism.

Definition: Growing or bending in response to water.

photoperiodism

Pronunciation: fo to pir e e diz em

Context: Sunflowers are known for their photoperiodism, or their ability to open and close in response to the changing position of the sun throughout the day.

Definition: The response of an organism to naturally occurring changes in light during a 24-hour period.

phototropism

Context: The stems and leaves of a geranium plant growing on the windowsill always turn toward the light, an example of phototropism.

Definition: Growing or bending in response to light.

thigmotropism

Context: Some people notice that their houseplants respond to thigmotropism, growing better when they touch them and pay attention to them.

Definition: Growing or bending in response to touch.

tropism

Pronunciation: tro piz em

Context: Tropisms are a unique characteristic of plants that enable them to adapt to different features of their environment—gravity, light, water, and touch—so that they can flourish.

Definition: The movement of an organism in response to an external stimulus.