

Phototactic

Overview: A plant's need to survive can be very complex. Use this visual experiment with your students as a great way to provide background knowledge on plant growth. It will be phototactic!

Procedure:

- 1) Give students the following writing prompt: *What do plants need to live?* After students have written their responses, encourage them to share their ideas with the class.
- 2) Discuss what plants need to survive (soil, air, water, and sunlight).
- 3) Ask students, "Could a plant survive without one of these needs?"
- 4) Show students the materials for the experiment and explain that they will be testing if a plant can survive without one of the declared needs.
- 5) Set up each plant with the class, as written below.

Control plant: Place a plant in a container with soil, air, daily water, and sunlight.

Plant without soil: Set up a plant in a container with air, daily water, and sunlight.

Plant without sunlight: Plant a plant in a container with soil, air, daily water, but in a dark cupboard.

Plant without water: Place a plant in a container with soil, air, sunlight, but do not water the plant.

Plant without air: Plant a plant in a bag with soil, water, and sunlight. Push the air out of the bag, roll up the bag carefully, and set in sunlight. This last plant will hold water longer, but you may need to unroll it to give it water and push the air back out.

- 6) Have students make predictions/hypotheses on which plant(s) will survive.
- 7) Keep a log of how long each plant survives.
- 8) Make a graph of your results and draw conclusions.

ASOLs Covered in this Activity:

SCIENCE

5S-LPS 1: The student will investigate and understand basic plant anatomy and life processes. Key concepts include

- c) photosynthesis;
- d) adaptations allow plants to satisfy life needs and respond to the environment.

5S-LPS 2 a: The student will investigate and understand how plants and animals, including humans, in an ecosystem interact with one another with the nonliving components in the ecosystem. Key concepts include plant and animal adaptation.

8S-ECO 2a: The student will investigate and understand that organisms within an ecosystem are dependent on one another and on nonliving components of the environment. Key concepts include the carbon, water, and nitrogen cycles.

8S-ECO 6a: The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic, change over time, and respond to daily seasonal, and long-term changes in their environment. Key concepts include phototropism, hibernation, and dormancy.

8S-LS 4: The student will investigate and understand the basic physical and chemical processes of photosynthesis and it's important to plant and animal life. Key concepts include

- a) Energy transfer between sunlight and chlorophyll;
- b) Transformation of water and carbon dioxide into sugar and oxygen.

Extension Idea:

This activity allows students to investigate and understand basic plant needs. Extend this activity by using it as background knowledge for teaching photosynthesis and plant adaptations.

5S-LPS 1: The student will investigate and understand basic plant anatomy and life processes. Key concepts include.

- a) The structures of typical plants and the function of each structure;
- b) Processes and structures involved with plant reproduction.

5S-LPS 4 a: The student will investigate and understand that organisms are made of one or more cells and have distinguishing characteristics that play a vital role in the organism's ability to survive and thrive in its environment key concepts include basic cell structure and functions.

8S-LS 1: The student will investigate and understand that all living things are composed of cells. Key concepts include

- a) cell structure and organelles;
- b) similarities and differences between plant and animal cells.

Extension Idea:

Use the plants in this experiment to teach the parts and functions of a plant, plant reproduction, and plant cells.

5S-LPS 3 b: The student will investigate and understand important Virginia natural resources. Key concepts include animals and plants.

8S-ECO 7 a: The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include food production and harvest.

Extension Idea:

Increase the meaning of this activity by relating the experiment to plants we produce for food. Express the importance of understanding plants and the need for food production and harvest.

5S-SI 1: The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

- a) distinctions are made among observations, conclusions, inferences, and predictions;
- b) objects or events are classified and arranged according to characteristics or properties;
- c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;
- e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;
- f) independent and dependent variables are identified;

- g) constants in an experimental situation are identified;
- h) hypotheses are developed as cause and effect relationships;
- i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;
- k) data are communicated with simple graphs, pictures, written statements, and numbers;

5S-SI 2: The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigation in which

- b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools;
- d) hypotheses are formed from testable questions;
- e) independent and dependent variables are identified;
- f) constants in an experimental situation are identified;
- g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements;
- h) predictions are made using patterns from data collected, and simple graphical data are generated;
- i) inferences are made and conclusions are drawn;

8S-SI 1: The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations which

- a) observations are made involving fine discrimination between similar objects and organisms;
- b) precise and approximate measurements are recorded;
- d) hypotheses are stated in ways that identify the independent and dependent variables
- e) a method is devised to test the validity of predictions and inferences;
- g) data are collected, recorded, analyzed, and reported using metric measurements and tools;
- h) data are analyzed and communicated through graphical representation.

8S-SI 2: The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

- f) dependent variables, independent variables, and constants are identified;
- g) variables are controlled to test hypotheses, and trials are repeated;
- h) data are organized, communicated through graphical representation, interpreted, and used to make predictions;

8S-SI 3: The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

- f) independent and dependent variables, constants, controls, and repeated trials are identified.
- g) data tables showing the independent and dependent variables, derived quantities, and the number of trials are constructed and interpreted;
- h) data tables for descriptive statistics showing specific measures of central tendency's, the range of the data set, and the number of repeated trials are constructed and interpreted;
- j) valid conclusions are made after analyzing data;

k) research methods are used to investigate practical problems and questions;

l) experimental results are presented in appropriate written form.

HSS-SI 2 The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include

a) science explains and predicts the interactions and dynamics of complex Earth systems;

b) evidence is required to evaluate hypotheses and explanations;

c) observation and logic are essential for reaching a conclusion;

d) evidence is evaluated for scientific theories.

Extension Idea:

These standards can be addressed through the course of this activity's scientific process.

READING & WRITING

3E-RW 2a: The student will use newly acquired vocabulary drawn from reading and other content areas.

3E-CN 1g: The student will sequence at least two steps in a procedure or ideas/incidents in an event.

4E-RW 1c: The student will use newly acquired vocabulary drawn from reading and other content areas.

5E-RW 1f: The student will demonstrate understanding of content-specific words.

7E-RW 1e: The student will demonstrate an understanding of word relationships by using synonyms and antonyms.

7E-CN 1e: The student will use content words and phrases from a nonfiction text.

8E-RW 1e: The student will acquire and use content words and phrases.

8E-WP 1a: The student will write to convey ideas and information including facts, details, and other information.

b: The students will write about a personal experience by introducing the event or experience, at least one character, and two or more events in sequence.

d: The student will use content specific vocabulary when writing about a topic.

8E-WP 3b: The student will write to convey ideas and information including facts, details, and other information as well as graphics and multimedia as needed.

8E-WP 5a: The student will write an argument to support a claim with one clear reason or piece of evidence.

HSE-WP 1b: The student will write to convey ideas and information using clear organization and including facts, details, and other information as well as graphics and multimedia as needed.

c: The student will write about an event or personal experience by introducing the event or experience, at least one character, and describing multiple events in sequence.

HSE-RW 2c: The student will acquire and use content words and phrases.

Extension Idea:

Upon completion of this experiment, students will write a how-to text teaching peers how to take care of plants. This can be a fun way for the students to demonstrate what they have learned. Particular attention may be given to content

words and sequence of events. Encourage students to include illustrations, tables, graphs, and digital photographs. Texts might take the form of a PowerPoint presentation, book, journal entry, newsletter, or blog.

MATH

3M-PSPFA 1b: The student will use picture or bar graphs to answer questions.

c: The student will insert data into a pre-constructed bar graph template.

d: The student will interpret data from a variety of graphs to answer questions.

5M-PSPFA 1a: The student will compare two sets of data within a single data display such as a picture graph, line plot, or bar graph.

6M-PSPFA 1a: The student will display data on a graph or table that shows variability in the data.

b: The student will summarize data distributions on a graph or table.

c: The student will answer a question related to the collected data from an experiment, given a model of data, or from data collected by the student.

8M-PSPFA 1b: The student will describe how a graph represents a relationship between two quantities.

HSM-FS 2a: The student will indicate general trends on a graph or chart.

HSM-FS 3a: The student will, given data, construct a simple graph and answer questions about the data.

Extension Idea:

Students will use data to create a bar graph that displays the length of time each plant survived. Ask students to interpret the data on the graph and confirm or edit their original hypothesis.

3M-NSCE 1a: The student will identify and write numerals 0 to 30;

b: identify the place value of tens on a number line between the numbers 0 to 30.

3M-NSCE 4a: The student will add to solve single-step story problems from 0-30.

4M-NSCE 1b: The student will compare whole numbers (<,>, =).

4M-NSCE 4b: The student will add and subtract double-digit whole numbers.

Extension Idea:

Students can answer questions related to the graph in which they compare and contrast whole numbers and/or add and subtract double-digits.

History:

HS-H 7: The student will identify and compare changes in community life over time in terms of buildings, jobs, transportation, and population.

HS-G 7: The student will read and construct maps, tables, graphs, and or charts.

HS-G 8e: The student will demonstrate knowledge of the physical geography and native peoples, past and present, of Virginia by describing how American Indians related to the climate and their environment to secure food, clothing, and shelter.

Extension Idea:

Use the plant experiment to express importance of understanding farming in community life. Discuss how farming has changed over time relates to the needs of plants displayed in this experiment. Students can read and construct maps, tables, graphs, and/or charts to describe the plants grown in different locations or time periods.

Materials Needed:

- 5 plants that are the same type and similar size
- soil
- 5 containers for the plants
- plant log
- water
- graph paper

Instructional Setting:

This activity requires access to sunlight and a dark cupboard.

Community Connections and/or Peer Interaction:

Students can work together in small groups with peers.
Have a farmer come to visit to explain the growth of his crops.

Functional Activity/Routine:

This activity encourages functional skills such as following instructions, gardening, cleaning up, and job skills. Each day assign students jobs to take care of the plants. These jobs could contain checking on the plants health and watering the plants properly.

Strategies to Collect Evidence:

For collection of evidence, be sure that each student records a hypothesis, data, and conclusion individually.

Specific Options for Differentiating this Activity:

- For students with poor fine motor skills give assistance when helping potting and watering plants. A variety of AT devices can be used for students with motor challenges: a switch adapted pour cup for mixing soil or watering plants or use a power link to attach a water pic to water plants.
- Allow students to use their preferred “pencil” when writing. This may include writing utensil, keyboard, alternative pencil, or dictating to a scribe.
- Prepare, as necessary, for each student to make choices and communicate with their preferred method. This may include using augmentative communication.