Where Do Plants Get Their Food?

TEACHER INFORMATION

LEARNING OUTCOME
Where plants get there food and where plant matter comes from.

LESSON OVERVIEW
This lesson engages students in thinking about the development of the scientific method and understanding plant nutrition (photosynthesis).

Students are asked to design an experiment to determine if plants get their matter from the soil. They then critique each others procedures. Together with the instructor they settle on the called for procedure below.

GRADE-LEVEL APPROPRIATENESS
This Level III, Living Environment, interdisciplinary lesson is intended for use with students in grades 9–10.

MATERIALS

Potting soil	Water
Marking pens	Scissors
Index cards	Clear cellophane tape

Planting containers (8-oz. or 10-oz. plastic cups)
Large seeds (beans, peas, corn) or small plants (ivy, impatiens, coleus, etc.)
Electronic balance capable of reading to 0.01 grams

TEACHING THE LESSON

- All living things use the 4 same components as building blocks right?
    - Carbohydrates, lipids, nucleic acids, and proteins are all made mostly of Carbon.

      We and all living things are made mostly of carbon because of this. Where do you think plants get the carbon they need for energy and structure? In other words, where does the stuff that makes up a plant come from?

    - In groups of 3, Design an experiment to determine if the stuff that plants are made of comes from soil. (Scientific method may help guide you)

    - Discuss and critique your plan with another group. Then come to a final decision as a class. (Use the one below)

    - As individuals, carry out plant growth experiments.

* **Food** is a substance that provides an organism with **both nutrients** and **energy**.

* A **nutrient** is a **mineral** necessary for **maintaining good health**, but it **doesn't provide energy.** (i.e. calcium, nitrogen, phosphorous, and potassium).

- Steps:

(1) Dry soil by spreading it out on a paper towel and leaving it for a day or two.

(2) Find the mass of a plastic cup and record it. Then fill the cup three-fourths full with the dry soil. Find and record the combined mass of the cup and soil. Subtract the mass of the cup to find the mass of the soil placed in the cup.

(3) Moisten the soil with water.

(4) Find and record the mass of a large bean seed.

(5) Cover the pot, leaving only a hole for the bean plant to grow up through once the seed germinates.

(6) Keep the soil moist. Add nothing else.

(7) Wait for the bean plant to grow. Allow it to grow long enough so that it has several leaves.

(8) Remove the entire plant from the soil and record its mass.

(9) Dry the soil in the pot.

(10) Determine and record the mass of the soil. Compare the mass gained by the bean to the mass lost by the soil.

BACKGROUND INFORMATION

Students may ask if the tiny bit of weight lost by the soil in the experiment served as plant food. The weight difference of the soil was due to minerals that were absorbed through the willow tree's roots. Plants require small amounts of minerals for a variety of life functions; minerals are needed to make the enzymes that regulate photosynthesis, respiration, and other metabolic processes.

A few students might argue that the tree did get its food from the soil. Some will claim that the minerals served as food and others will claim that minerals have no weight but served as food. These students are not using the law of conservation of matter in their thinking. Point out to them that it is impossible for the increased mass of the tree to come from minerals in the soil that possess a tiny mass.

At some point, students should realize that the mass gained came largely from matter synthesized from carbon dioxide and water during photosynthesis. Thus follows the argument that many make: most of the weight of a tree comes from the carbon dioxide in the air.

(STUDENT HANDOUT SECTION FOLLOWS)

Name _____

Date _____

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Background Information

Imagine that you are asked to observe and record the activities of two organisms for five minutes. You are given a mouse (that is not asleep!) and a bean plant. Your list of the mouse's activities would probably be quite long. It would be difficult to accurately record everything it did during the five-minute observation period. The bean plant's activities would likely be very easy to record.

A data table comparing your observations of the mouse and the bean plant might look like Table 1: Plant and Animal Comparisons.

Table 1: Plant and Animal Comparisons

Type of Activity Observed	Animal (mouse) Examples	Plant (bean) Examples
Movement	walking and running	nothing
Eating	chews on seeds	nothing
Breathing	sides go in and out	nothing
Waste Elimination	small dark objects come out of its posterior	nothing
Response	mouse goes to food put in cage	nothing

In order for it to be alive, the bean plant must carry out the activities listed in the chart. Plants require energy, respire, eliminate wastes, and so on. Aristotle, a Greek scholar who lived from 384 to 322 B.C., observed plants. He is possibly one of the first to carefully record plant activities. He concluded that plants get everything they need from the soil through their roots. However, Aristotle wasn't sure what plants needed or how their roots obtained it. He did not conduct any experiments. What he did was discuss his observations with others. This is the way science was done at that time. Was Aristotle correct? What do you think? Plan an experiment to determine this.

Table 2: Materials	
Index cards	Scissors
Water	Large seeds (beans, peas, corn) or small plant
Potting soil	Clear cellophane tape
Marking pens	Planting containers (8-oz. or 10-oz. plastic cups)
Paper towels	Electronic balance capable of massing objects to 0.01g

- Steps:
  (1) Dry soil by spreading it out on a paper towel and leaving it for a day or two.
  (2) Find the mass of a plastic cup and record it. Then fill the cup three-fourths full with the dry soil. Find and record the combined mass of the cup and soil. Subtract the mass of the cup to find the mass of the soil placed in the cup.
  (3) Moisten the soil with water.
  (4) Find and record the mass of a large bean seed.
  (5) Cover the pot, leaving only a hole for the bean plant to grow up through once the seed germinates.
  (6) Keep the soil moist. Add nothing else.
  (7) Wait for the bean plant to grow. Allow it to grow long enough so that it has several leaves.
  (8) Remove the entire plant from the soil and record its mass.
  (9) Dry the soil in the pot.
  (10) Determine and record the mass of the soil. Compare the mass gained by the bean to the mass lost by the soil.