ACTIVITIES 34&35

What Do Plants Need?
(Sessions I and II)

BROWARD COUNTY ELEMENTARY SCIENCE BENCHMARK PLAN

Grade 5—Quarter 4
Activities 34 & 35

SC.F.1.2.3
The student knows that living things are different but share similar structures.

SC.H.1.2.1
The student knows that it is important to keep accurate records and descriptions to provide information and clues on causes of discrepancies in repeated experiments.

SC.H.1.2.2
The student knows that a successful method to explore the natural world is to observe and record, and then analyze and communicate the results.

SC.H.1.2.3
The student knows that to work collaboratively, all team members should be free to reach, explain, and justify their own individual conclusions.

SC.H.1.2.4
The student knows that to compare and contrast observations and results is an essential skill in science.

SC.H.2.2.1
The student knows that natural events are often predictable and logical.

SC.H.3.2.2
The student knows that data are collected and interpreted in order to explain an event or concept.

ACTIVITY ASSESSMENT OPPORTUNITIES

The following suggestions are intended to help identify major concepts covered in the activity that may need extra reinforcement. The goal is to provide opportunities to assess student progress without creating the need for a separate, formal assessment session (or activity) for each of the 39 hands-on activities at your grade.

1. **Session I—Activity 34:** Tell students to imagine that they have planted corn, cactus, maple tree, and spruce tree seedlings on May 15. Ask, *If you did nothing to help the seedlings grow after they were planted, what do you predict they would look like on July 30, September 30, December 30, and May 15, a year later?* (Accept all reasonable answers. The cactus seedling would require the least care because it needs less water than the

other plants during the growing season. The two tree seedlings might survive for longer because they do not grow during colder months and need fewer nutrients then. The corn would do least well because it needs the right amount of water to produce seeds.)

2. **Session II—Activity 35:** Ask, *Would any of the plants used in your investigations survive on Mars? Why or why not?* (The Martian environment has extreme temperature ranges in which almost all Earth plants would find it difficult to survive; it is drier on Mars than on any place on Earth.)

3. Use the Activity Sheet(s) to assess student understanding of the major concepts in the activity.

In addition to the above assessment suggestions, the questions in bold and tasks that students perform throughout the activity provide opportunities to identify areas that may require additional review before proceeding further with the activity.

ACTIVITIES 34&35

What Do Plants Need?

OBJECTIVES

Students identify the two most basic needs of plants in order to grow through a variety of experimental setups.

The students

- compare the growth of seedlings in light and dark conditions
- compare the growth of seedlings receiving various amounts of water
- observe that plants require light and water to grow
- observe the growth of stems toward light

SCHEDULE

Session I—Activity 34 About 30 minutes

Session II—Activity 35 About 30 minutes, 7 to 10 days after Session I

VOCABULARY

phototropism

MATERIALS

For each student

1	Activity Sheet 34
1 pr	safety goggles*

For the class

32	flower pots
1	light source, artificial*
1 cont	seeds, mung bean
2 bags	soil, potting
1 roll	tape, masking
4	trays, plastic, white
	water, tap*
	DSR *Plants in Our World*

*provided by the teacher

PREPARATION

Session I—Activity 34

1. Make a copy of Activity Sheet 34 for each student.
2. About one to two weeks before conducting this activity, you will need to plant the bean seeds. Fill each flower pot about three quarters full with potting soil. Plant two seeds in each pot, pressing them down into the soil until they are 0.5 cm (about 0.25 in.) below the surface.
3. Place all of the pots on plastic trays (eight pots per tray). Water them by pouring water into the trays and letting it soak up into the soil through the bottom of the pots. Place the pots in a warm, sunny spot or underneath a grow light. Water them regularly. When the seedlings sprout their first set of true leaves, begin the activity.
4. Remove the pots from the plastic trays. Use masking tape to number and label the trays as follows: 1) light, with water; 2) light, without water; 3) dark, with water; and 4) light, such as a desk lamp, to one side, with water.
5. Each team of four will need four flower pots containing bean seedlings and four strips of masking tape.
6. Select a dark place where one tray of seedlings can be left to grow for a week or more.

Session II—Activity 35

Each team will need its four pots of bean seedlings from Session I.

BACKGROUND INFORMATION

The word ***phototropism*** comes from the Greek roots *photo,* meaning "light," and *tropos,* meaning "turning." When light falls on one side of a plant, auxin, a plant growth hormone, collects in the growth centers of the plant on the side facing away from the light. The auxin stimulates the growth of the cells there. These cells then grow longer than the cells on the side of the plant facing toward the light, causing the plant stem to bend toward the light (see Figure 34-1).

Plants bend toward the light source because they need light in order to photosynthesize and grow. A plant grown in the light will have healthy green leaves. A plant grown without light typically will have unusually long stems and very small leaves, and will lack chlorophyll and thus appear yellowish rather than green.

▼ Activity Sheet 34

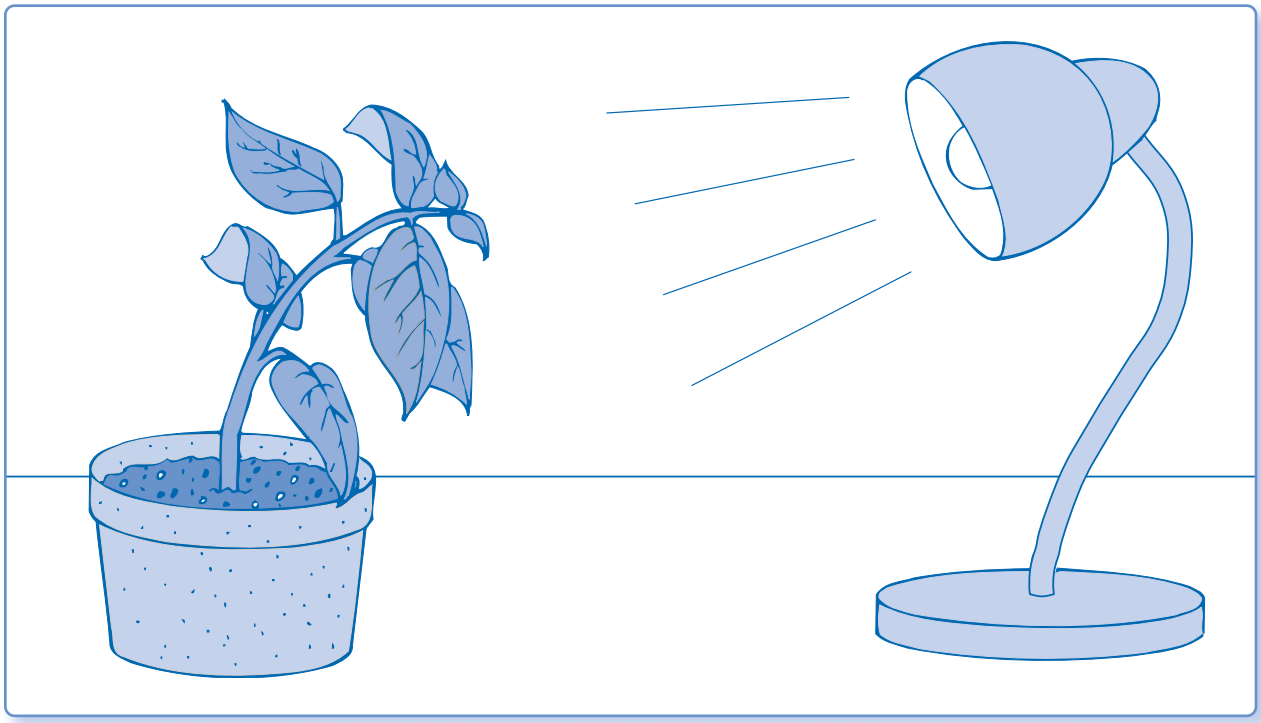
What Do Plants Need?

1. What do you predict will happen to plants grown in each of the four conditions listed below?
   - a. In light, with water: will grow normally
   - b. In light, without water: will shrivel and die
   - c. In darkness, with water: will grow spindly or not at all
   - d. Light to one side, with water: will grow toward light

Effects of Light and Water on Bean Seedlings

Observations	Conditions of Growth							
	a. In light, with water		b. In light, without water		c. In darkness, with water		d. Light to one side, with water	
	Before	After	Before	After	Before	After	Before	After
Color of leaves	Green	Green	Green	Green	Green	Yellow	Green	Green
Appearance of leaves	Healthy	Healthy	Healthy	Dried and shriveled	Healthy	New leaves are small	Healthy	Healthy
Other observations						Tall and spindly		Plant faces light
Drawing of plant	Before		Before		Before		Before	
	After		After		After		After	

2. Review your predictions. Were they correct?
   Answers will vary.



▲ ***Figure 34-1.*** *A plant grown next to a desk lamp will bend toward the light.*

Guiding the Activity

Session I—Activity 34

Guiding the Activity	Additional Information
1 Ask, **What do you think plants need to grow?**	*Students may know from previous experience that nearly all plants require water and light in order to grow.*
Tell the students that they will grow bean seedlings to test the reactions of plants to water and light. Ask, **Under what conditions would you grow seedlings in order to find out if they need light and water?**	*Students may give various responses.*
List all of the students' responses on the board. Among them should be the following three conditions: in light, with water; in light without water; and in darkness, with water. You may want to suggest, as a fourth condition, placing a light source to one side of a plant and giving the plant the usual amount of water.	*If students did not come up with these conditions, prompt them by asking questions based on the responses they did give. For example, if a student mentions that a plant needs to be near a window, relate that being near a window indicates a need for light.*
Circle or otherwise identify these four growing conditions on the board. Ask, **What will be demonstrated by plants grown under each of these conditions?**	*The pot in light, with water, will serve as the control, since the assumption is that plants need both water and light to survive. The pot in light, without water, will show whether plants need water. The pot in the dark, with water, will show whether plants need light. The pot with a light source to one side will demonstrate the response of a plant to directed light.*
As appropriate, read or review pages 3–6 from the Delta Science Reader *Plants in Our World*.	
2 Give each student a copy of **Activity Sheet 34.** Have the students predict what will happen to the seedlings under each growing condition, and tell them to record their predictions in the spaces provided.	

Guiding the Activity

	Additional Information
3 Divide the class into teams of four and distribute four pots containing bean seedlings and four strips of tape to each team. Tell the students to label their pots 1 through 4, according to the four conditions listed on the activity sheet. They should also label the pots with their team's name.	*Some pots may have more than one seedling growing in them. Since both seedlings should respond in the same way to their environment, students can leave them in place and note any changes to them collectively.*
Have the students record in the table on the activity sheet the appearance of the seedlings in each pot.	*Make sure the students record their observations in the "Before" column for all four conditions.*
4 Identify for the students the four numbered trays and the conditions each represents. Have the students place their numbered pots in the corresponding trays.	
Place trays 1 and 2 in light, and tray 3 in the dark. Set up a light source (such as a desk lamp) to one side of tray 4. Every few days have the students check their pots on the trays that are being watered (trays 1, 3, and 4) and give the seedlings additional water, if necessary. The second tray of pots will not receive any water.	*The tray that is exposed to side lighting should be placed in a dimly lit corner of the classroom, but need not be placed in the dark to produce results. Be careful that the students do not overwater the seedlings. Do not leave standing water in the tray constantly.*
Session II—Activity 35	
5 Seven to ten days after Session I, have the students retrieve their pots and observe the plants. Tell them to record their observations in the table on the activity sheet.	*Make sure the students record their observations in the "After" column for all four conditions.*
6 Instruct the students to examine their data and answer the question in Step 2 of the activity sheet. Ask, **What happens to a plant that does not receive enough water?**	*It shrivels up and dies.*
Ask, **What happens to a plant that does not receive enough light?**	*It grows long and spindly and loses its color.*
Ask, **What can you conclude from these observations?**	*Plants need light and water in order to grow.*
7 Ask, **How does a plant react when the light source is to one side?**	*It bends and grows toward the light.*

Guiding the Activity

Write the word *phototropism* on the board. Tell the students that **phototropism** refers to a plant's growth toward a light source, which they observed in tray 4. Ask, **Why do you think plants demonstrate this type of growth?**

Ask, **In what other situations have you observed phototropism?**

Additional Information

Plants need light in order to grow. The more light they receive, the more they will grow. They increase the amount of light they receive by bending and growing toward the light.

Students' answers will vary.

Reinforcement

After the activity has been completed, switch the light source for tray 4 to the opposite side. Leave the pots for several days until the plants exhibit growth in the opposite direction.

Science Notebooks

Have students place their completed activity sheets in their science notebooks.

Cleanup

Students may want to try to revive some of the ailing seedlings by restoring the conditions needed for plant health: watering those that have gone without water, and exposing to light those that have been kept in the dark. Once the students have finished experimenting with the seedlings, have them empty out the pots, clean them, and return them, along with the plastic trays, to the kit.

Connections

Science Challenge

Students might enjoy investigating geotropism, the turning of a plant in response to gravity so the stem always grows up and the roots down. A simple way to show this is to invert a potted plant or tip it on its side, and then leave it for a few weeks to observe its growth. For a more intriguing investigation of geotropism, students can attach several foam-plastic cups planted with bean seedlings to a record turntable and then leave the turntable running 24 hours a day for up to a week, stopping it only briefly to water the seedlings as needed. As the seedlings grow, they bend toward the center of the turntable. Students also could remove the seedlings from their pots and examine the roots, which will have grown toward the outside of the turntable. Ask students to try to explain this response. (The centripetal force of the rotating turntable creates a "false gravity" to which the seedlings respond.)

Science Extension

- Suggest that students investigate plants' need for nutrients as well as water and light. Using the activity sheet experimental design as a model, students can test the effects on plant growth of varying amounts of plant fertilizer dissolved in water. Remind students to keep all other variables constant—the amount of water given to each plant, the number of times each week the plants are watered, and their placement in sunlight. Also make sure students include a control, a plant watered with plain water. Help students construct a data table for recording their results. (Also see Science and Math below.) In a summarizing discussion, ask students to describe the effects of various amounts of fertilizer on plant growth. Did any plant(s) receive too much fertilizer? How can students tell?
- Many science activity books available in libraries contain instructions for building a maze that a potted plant or a potato sprout will follow as it grows toward a light source. Have students locate such instructions and build a phototropic maze.

Science and Language Arts

Ask students to look up the derivation of *phototropism.* (from the Greek *photo,* "light," and *tropos,* "turn") Have them add this term to the class vocabulary list they began in Activity 1. If students have done the Science Challenge activity above and the Social Studies activity below, also have them find the derivations of *geotropism* and *thigmotropism* and add those terms to the list. (from the Greek *geo,* "earth, land" and *thigma,* "touch")

Science and Math

Using the plant heights they recorded in the first Science Extension above, students can construct a bar graph showing the effects of different amounts of fertilizer on plant growth. Tell students to label the vertical axis "Height of Plants (cm)" and the horizontal axis "Amount of Fertilizer."

Science and Social Studies

Although Charles Darwin is best known for his theory of evolution through natural selection, he also researched plant tropisms and was the first to suggest that plant hormones are responsible for tropisms. Ask interested students to research and report on Darwin's investigations on plant tropisms, particularly his studies of thigmotropism—the motion of climbing plants as they "search for" a support.