

# What Do Plants Need?

## OBJECTIVES

Students grow plants in a variety of conditions to learn what plants need to stay healthy.

### The students

- ▶ plant grass seed
- ▶ monitor plant growth in a variety of growing conditions
- ▶ determine that plants need sunlight and a moderate amount of water to stay healthy

## SCHEDULE

**Session I** About 30 minutes, followed by regular maintenance for 1 week or until the grass shoots are about 8 cm (about 3.2 in.) tall

**Session II** About 15 minutes, followed by daily observations for 2 more weeks

**Session III** About 20 minutes, 2 weeks after Session II

## MATERIALS

### For each student

- 1 Activity Sheet 5

### For each team (6 teams total)

- 1 flowerpot
- 1 tray, plastic

### For the class

- 1 pkg grass seed
- 2 bags gravel, large newspaper\*
- 1 roll paper towels\*

- 1 plastic sheet, large
- 2 bags soil, potting
- 1 spoon, measuring (Tbsp)\*
- 6 sprinkler bottles
- 1 roll tape, masking water, tap\*

\*provided by the teacher

## PREPARATION

### Session I

- 1 Set up a distribution station with the following items: six flowerpots, six plastic trays, six sprinkler bottles filled with water, one bag of grass seed, two bags of large gravel, two bags of potting soil, a measuring spoon, and a roll of masking tape. You may want to cover the table with newspaper first for easy cleanup. Have paper towels on hand for spills and hand washing.
- 2 Find a warm, sunny spot where students can keep their flowerpots while the grass seeds sprout (about a week).
- 3 You will need a sheet of plastic to cover the pots with during germination.

### Session II

- 1 Make a copy of Activity Sheet 5 for each student.
- 2 Find a dark place where Teams 4, 5, and 6 can keep their flowerpots for the next 2 weeks. Keep in mind that students will need access to the pots every day.
- 3 Each team will need their flowerpot from Session I. All teams except 3 and 6 will need sprinkler bottles of water.

### Session III

Each student will need his or her activity sheet from Session II. Each team will need its flowerpot of grass. Set up an observation table in the classroom where students can observe all six pots of plants side by side.

## BACKGROUND INFORMATION

There are hundreds of thousands of plant species on Earth, thriving in a variety of growing conditions. All plants, regardless of where they grow, need sunlight, water, nutrients, and air (oxygen and carbon dioxide, among other gases). Without these basic elements, plants cannot survive.

In this activity, students observe the effects of variations in sunlight and water on the health of plants. They discover, for example, that plants that are deprived of sunlight become pale and spindly. Plants contain a chemical in their leaves and stems called chlorophyll. Chlorophyll is a pigment that gives plants their green color. When activated by sunlight, chlorophyll enables the plant to make its own food. (This process, called photosynthesis, will be discussed in more detail in Activity 8.) Without sunlight, a plant literally “starves.”

A plant that is deprived of water is not much better off. Plant cells, like all cells, need water to carry out their functions. Also, without water, a plant cannot absorb nutrients from the soil and transport them to the leaves. Depriving a plant of water deprives it of nutrients too. Without water or nutrients, a plant cannot make food. In addition, the absence of water makes the tubes of vascular plants collapse, causing the plant to wilt. Once that happens, the plant quickly dies.

Too much water, on the other hand, can drown a plant. Overwatering causes the soil around the roots to form into a solid mass. Packed, waterlogged soil does not allow air to circulate among its particles and reach the

roots. When that happens, the plant roots cannot breathe, and eventually will rot.

Over millions of years, plant species have adapted to the conditions in which they now grow. Any change in growing conditions can slow or stunt the growth of a plant. It can also weaken the plant, making it susceptible to disease. However, those plants that are not weakened continue to thrive and reproduce new generations of hardy plants.

### ▼ Activity Sheet 5

#### What Do Plants Need?

Team	Light	Water	How Plants Look (Before)	How Plants Look (After)
1	sunlight	daily	healthy	Short, healthy
2	sunlight	once a week	healthy	healthy
3	sunlight	no water	healthy	wilted
4	darkness	daily	healthy	Unhealthy
5	darkness	once a week	healthy	Unhealthy
6	darkness	no water	healthy	Unhealthy

1. Which plants do you think will grow best? Which do you think will grow worst?

Predictions will vary.

2. Which plants look best? Which look worst? Were your predictions correct?

Plant 2 looks the best. Plant 6 looks the worst.

3. What do plants need in order to grow and stay healthy?

Sunlight and some water

## Guiding the Activity

### Session I

- 1 Discuss possible reasons why any seeds in previous activities did not germinate or plants failed to thrive.

Tell students that in this activity they are going to grow some grass to learn more about what plants need to stay healthy.

- 2 Divide the class into six teams and assign each team a number from 1 to 6. Give each team a plastic flowerpot and a piece of masking tape to label their pot with their names and team number. Then have them gather around the distribution station. Supervise students as they work together to plant the grass seed, as follows (see Figure 5-1):

1. Put a thin layer of large gravel at the bottom of the pot.
2. Fill the pot with potting soil to within 3 cm (1.2 in.) of the top.
3. Sprinkle 2 tablespoons of grass seed evenly over the surface of the soil.
4. Sprinkle a final, thin layer of soil over the seeds.
5. Pat the surface of the soil gently.
6. Place the pot on a plastic tray.
7. Water the soil generously.
8. Place the pot of soil in a warm, sunny spot.

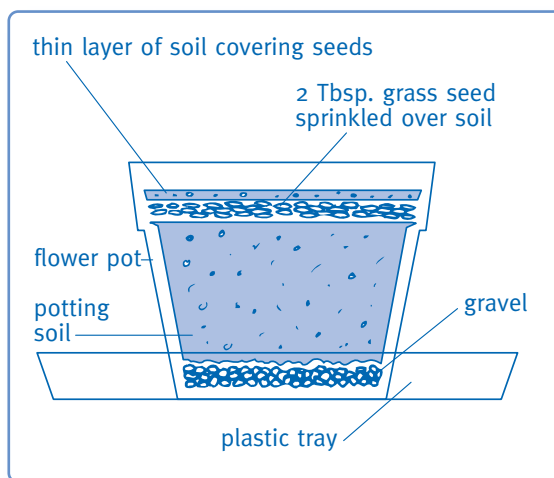
Cover all six pots with a sheet of plastic. Have a different student volunteer lightly water all of the pots every day. Within 3 or 4 days, the surface of the soil will swell and crack. A day or two later, green grass shoots will poke through. Remove the plastic at that time. In about a week or so, the shoots will be about 8 cm (about 3.2 in.) tall. Then begin Session II.

Clean up the distribution station. Discard the newspaper. Seal the bags of leftover gravel, soil, and grass seed and return them to the kit. Have students wash their hands.

### Additional Information

*Answers may include too much or too little light or water, cold temperatures, compacted soil, damaged seeds, and so on. Accept all reasonable answers.*

*To increase student participation, have each member of the team be responsible for one of the planting steps while the rest of the team gives help as needed.*



▲ Figure 5-1. Planting grass seed.

## Guiding the Activity

### Session II

- 3 Have each team retrieve its pot of grass. Have students examine the plants. Ask, **What do plants need in order to grow?**

Write the term *growing conditions* on the board and read it aloud to students. Tell students the amount of light and water a plant receives, the type of soil it is planted in, the temperature of the air, and other factors that affect plant growth are called *growing conditions*—the conditions in which the plant grows.

Ask, **How can you tell if a plant is receiving the right amount of light and water?**

Tell students that each group is going to grow their pot of grass in slightly different growing conditions to learn what the plants need to stay healthy.

- 4 Distribute a copy of **Activity Sheet 5** to each student and review the chart (see Figure 5-2) together. (You may want to reproduce this chart on the board and leave it there for the activity.)

Have students observe the appearance of the plants in each pot and record the information in the column labeled *Appearance of Plants (Before)*. Then have Teams 1, 2, and 3 place their pots in a sunny spot. Have Teams 4, 5, and 6 place their pots in a dark place. Tell Teams 1 and 4 that they will give their plants 8 ounces of water—or one full sprinkler bottle—every day. Tell Teams 2 and 5 that they will give their plants 8 ounces of water once a week. Tell Teams 3 and 6 that they will not water their plants at all.

Tell students that each team will be responsible for maintaining its own pot of plants. Students are to observe their plants every day.

### Additional Information

*Accept all reasonable responses.*

*You could change the amount of light and water it receives—change its growing conditions—and see what happens to the plant.*

**Note:** One sprinkler bottle holds 8 ounces.

Team	Light	Water
1	1	8 oz daily
2	2	8 oz once a week
3	3	no water at all
4	4	8 oz daily
5	5	8 oz once a week
6	6	no water at all

▲ Figure 5-2. Light conditions and watering schedules.

## Guiding the Activity

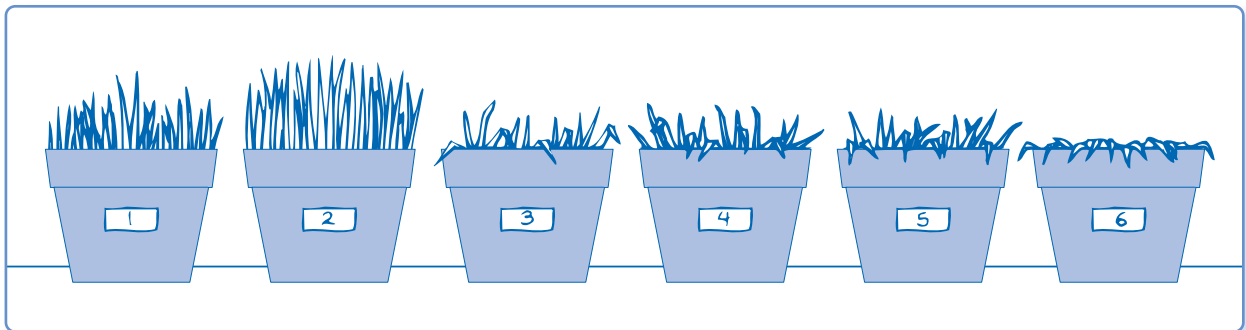
Ask students to predict which pots will fare the best and which will fare the worst, and why. Tell them to record their predictions on the activity sheet.

## Additional Information

### Session III

5

After 2 weeks, have students review the condition of the plants. Place the plants on a table where all students can see them. Have students compare the appearance of the plants and record their observations in the column labeled *Appearance of Plants (After)* on Activity Sheet 5. (See Figure 5-3 for possible results.)



▲ Figure 5-3. Comparing the health of plants grown in a variety of conditions.

Ask students, **Which plants are healthiest? Which plants are weakest? Were your predictions accurate?**

Have students answer the second question on their activity sheets. Record students' responses in a chart on the board as well. Then ask, **Which growing conditions are best for these plants?**

Have students answer the last question at the bottom of the activity sheet.

Tell students that in the next activity they are going to begin studying the parts of a plant, beginning with the roots.

*Those plants that received sunlight and 8 oz of water once a week grew the best. Those plants that received no sunlight and either too much water or no water at all fared worst.*

*Students should conclude that plants need sunlight and a moderate amount of water to be healthy.*

## REINFORCEMENT

Have students repeat the activity, using light and water conditions of their own choosing. They might want to discover, for example, whether plants in partial sunlight need less water than plants in full sunlight.

## SCIENCE JOURNALS

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

## CLEANUP

Have students correct the sunlight and water conditions of the pots so that the plants do not die. You may want to save the pots of grass for further experimentation. To “mow” the grass, simply trim the leaves with scissors. Discard the cuttings outdoors.

## SCIENCE AT HOME

Encourage students to volunteer to care for houseplants at home. Do all the plants in their homes need the same amounts of water or sunlight? What other activities do they do to take care of houseplants? (remove dead leaves or flowers, repot when a plant gets large, add plant food) They could also take two plants of the same kind, grow them in different conditions, and compare the results.

## Connections

### Science Challenge

Tell students that different kinds of plants need different amounts of water. To show this, set up three houseplants that need different amounts of water: for example, a fern or coleus, which needs evenly moist soil plus occasional misting; a pothos or geranium, which can be allowed to dry out before rewatering; and a cactus or other succulent, which needs only infrequent watering in small amounts. Let students take turns watering the three plants so they can see how much each requires and when.

### Science Extension

Students could grow plants in sand watered with fertilizer to see that it is the nutrients in soil, not the “dirt” itself, that supply plants with what they need. Instruct teams as follows: Plant 2 to 3 bean seeds in each of three numbered cups filled with sand, and leave them in a sunny place. Water Cup 1 with plain water, Cup 2 with a weak fertilizer solution, and Cup 3 with a strong solution. (Mix the solutions yourself and make them available in labeled pitchers.) When the seeds sprout, have students examine the plants each day and compare their appearance. Also have them measure the height of the tallest plant in each cup every few days. In addition to varying heights, students may notice that the plants differ in the number and color of their leaves. (Also see the first Science and Math Connection.)

### Science and Math

- ▶ As a follow-up to the Science Extension above, help each team make three histograms showing the heights they recorded for the tallest plant in each cup. If students do not yet know how to measure with a ruler and make a histogram, let them simply measure with string and then tape the strings on a sheet of paper in order from the first measurement to the last.

- ▶ Show the class some fresh spinach, and explain that spinach and other plants are made mostly of water. Use a kitchen scale to measure out 1 pound of the spinach, put it in an uncovered baking dish, and heat it in an oven at 212°F (or the lowest oven setting) for 1 hour. When the spinach has cooled, let students examine it to see how its appearance has changed. Then reweigh the spinach. Students will see that the spinach is much lighter now than it was before. Explain that when the spinach was cooked, the water in it evaporated, making it lighter. (Spinach is about 90 percent water; after baking, the spinach will probably weigh 1–2 oz.)

### Science and Health

As a follow-up to the second Science and Math activity below, tell students that their own bodies are made up mostly of water. Explain that when your body does not get enough water, you can become very sick, so you need to drink plenty of water and other liquids every day, especially when you are exercising or when the weather is very hot. (The recommended amount for adults is 6–8 glasses of water and other liquids per day.) Ask students to keep track of how many glasses of water and other liquids they drink each day for a week. Make a class chart showing the amounts that students report.

### Science, Technology, and Society

The following activity is appropriate for students with good reading skills. Provide (or ask students to bring from home) labels from different types of plant fertilizers. Have students examine the labels and read aloud the names of the nutrients contained in each one. Help students pronounce the names, if necessary. Ask volunteers to create a master list of all the different plant nutrients the class found.