



# The Book Planter



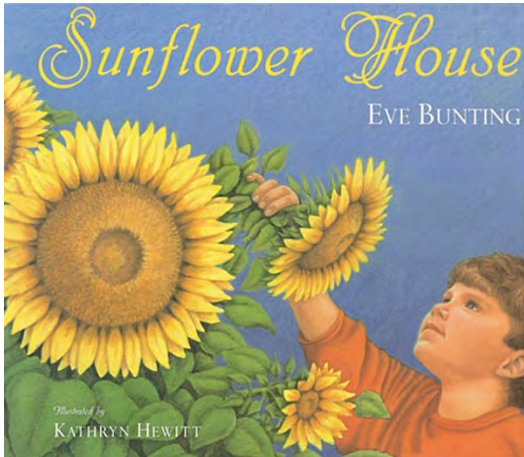
## Ag in the Classroom

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August 2022: *Sunflower House*

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Illustrated by: Kathryn Hewitt



Three children plant sunflower seeds in a large circle and care for them by weeding and watering the young plants. When the plants grow into large sunflowers the children have a playhouse to enjoy. At the end of the season the sunflowers drop their seeds which the children can plan next year. This book highlights the stages and life cycle of the sunflower.

### Did You Know?

- The average yield of sunflower seeds is 1,513 pounds per acre.<sup>1</sup>
- Sunflowers are in the genus *Helianthus*, which is a large group of more than 150 species of flowers mostly native to North America.<sup>2,3</sup>
- The Common Sunflower (*H. annuus*) is the sunflower we get edible seeds, birdseed, and sunflower oil from.<sup>3</sup>
- North Carolina has become a hub of sunflower **agritourism**, with many fields planted in parks, along highways and interstates, and on farms to attract visitors.

### Vocabulary<sup>1,4</sup>

**Agritourism:** viewing, touring, or visiting agricultural related places, such as farms, to participate in farm related activities or events.

**Life Cycle:** the stages a living thing goes through in its lifetime.

**Phototropism:** a plant's bending and growing towards a light source.

### Interest Approach – Engagement<sup>1</sup>

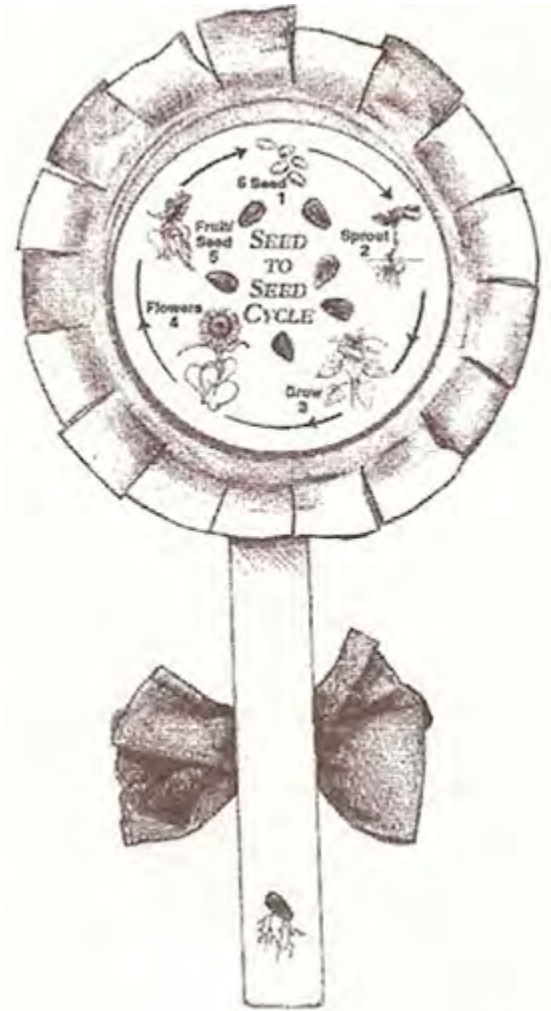
1. Tell students that you are going to give them some clues and that you want them to guess what kind of flower you are thinking of. Use all or some of these clues:
  - This flower has a green stem and leaves.
  - The petals of this flower are usually yellow.
  - This flower can be more than 10 feet tall when it's full grown.
  - This flower produces seeds that sometimes we like to eat.
2. "What flower is it?" (*A sunflower!*)

### Activity 1: Sunflower Lifecycle<sup>1</sup>

1. Read the book, *Sunflower House*, by Eve Bunting to the students. As you read, discuss with students the meaning of a “life cycle.” Point out the steps of the sunflower lifecycle as you read the story.
2. Show students the [Sunflower Growth Stages](#) pictures. Show the students an actual sunflower head with the seeds inside if you can, but if not, use the pictures provided with this lesson. Go through each step of the cycle. Place the pictures on the board with tape or a magnet and leave them for the next activity.

### Activity 2: Paper Plate Sunflowers<sup>1</sup>

1. Distribute the activity supplies.
2. Glue the [Seed to Seed Cycle](#) in the middle of the paper plate, and set aside.
3. Ask students what the first step in the Seed Cycle is (*seed*). Have students glue one sunflower seed about 1” up the craft stick, as if they were planting a seed in the ground and the stick is the stem that would grow from the seed.
4. Ask students what the next step in the cycle is (*sprout*). Talk with them about what is needed for a seed to germinate. Have students draw roots on their craft stick below the seed with the brown crayon.
5. Ask students what the next step is (*grow*). As the stems and leaves begin to grow, have students cut out leaves from the green paper and glue them to the stick above the seed.
6. Ask students what step 4 is (*flower*). Have them color the white paper plate around the *Seed to Seed Cycle*. Use scissors to snip the plate edges to the center circle to create flower petals.
7. Talk with students about step 5 (*fruit*). Students should glue sunflower seeds to the center of the *Seed to Seed Cycle*.
8. Tape or glue the paper plate flower to the craft stick.



### Activity 3: Tropism Twist<sup>4</sup>

#### Background Agricultural Connections

Although plants don't have the ability to move from their rooted position, they do have the ability to respond to stimuli such as temperature, animals, moisture, gravity, and light. Tropisms are plant growth movements toward or away from a specific stimulus in nature. They help plants achieve optimal growth. Tropism comes from the Greek word, “to turn.”

**Phototropism** (photo meaning light) is the growth of a plant toward light. For plants, this light source is the sun, but artificial alternatives can also stimulate phototropism. This ability is very useful for plants, enabling them to position their leaves and flowers to efficiently receive the light energy they need for photosynthesis.

Plants have special receptors made of chemical pigments known as phytochromes. When phytochromes absorb visible wavelengths of light they emit a chemical signal that produces a hormone known as auxin. Auxins cause the cells on the shaded side of a plant to elongate more than cells on the sunny side. The growth of cells on the light-receiving side of the plant is inhibited. As a result, plants bend and twist towards the light.

#### Materials:

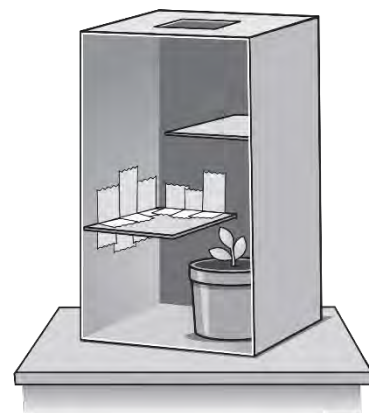
For the teacher

- Build an example of the phototropism box according to directions
- Utility knife

For each group

- Shoebox and/or cardboard milk cartons (have students bring these from home)
- Thick cardboard sections
- Duct tape
- Scissors
- Clear plastic cup (6 oz.)
- Potting soil or peat pots
- Two bean seeds

1. Summarize the lifecycle of a sunflower with students.
2. Show students the [Time Lapse: Sunflower Following the Sun](#) video. As students watch the video, ask them to watch the leaves and the bud of the sunflower. Can they guess what the sunflower bud and leaves are following? Explain that they are following the sun.
3. Define the word **phototropism**. Break the word down into smaller pieces, explaining that “photo” means “light” and “tropism” means “to turn.” Draw on prior knowledge and remind students that plants receive their energy from the sun. Some plants move so that the surface of their leaves receive the most sun rays.
4. Tell students that in this lesson, they will design an experiment so they can observe phototropism in action.
5. Distribute the [Tropism Twist](#) activity sheet to each student. Ask students to write a hypothesis for the testable question, “Does light affect the direction that a seedling will grow?” in the appropriate place on their worksheet.
6. Divide students into lab groups consisting of 3-4 students. Distribute shoebox, scissors, duct tape, and cardboard. Instruct students to write their names on the bottom of the shoebox.
7. Show students a completed tropism testing box and guide them through the steps of creating their own boxes. Use the diagrams to guide students through the construction process.
  - Carefully draw and cut out a two-inch square from the middle section of one end of the box. Students may need help from the teacher and the teacher’s utility knife. It is recommended that only the teacher be equipped with a utility knife.
  - Place the lid on the front of the box. Hold the box up to the light. Look through your two-inch hole and make certain that this hole is the only source for light to get into the box. Carefully duct tape over any other cracks or crevices that may be letting light in. Do not tape the box shut.



- Using paper to create a pattern, cut two pieces the height of the inside of the shoebox and half the width. Trace the pattern on stiff cardboard and cut them out. Tape them into the box as shown.
8. After tropism boxes are complete, instruct students to use the designated planting station to plant two bean seeds for their group experiment. The planting station should be supplied with newspaper, 6-ounce plastic cups, potting soil, bean seeds, water spray bottles, craft sticks, masking tape, and markers for labeling.
  9. Place planted seeds in a lighted area and wait for the seeds to germinate. When the seedlings are approximately two inches tall, place the watered seedlings into the shoebox as shown.
  10. Close the box, tape it, and place it by a sunny window so the square hole on the top can be exposed to the light.
  11. After five days, carefully shine a flashlight through the square hole to observe the plant growth. It is best not to disturb plants during this testing period. It can alter the final outcome.
  12. In another 3-5 days, check to see if the plant has grown enough to reach the top of the box. Remove the shoebox lid once the plant has reached the top of the shoebox. Have students record their observations and answer the questions on their *Tropism Twist* worksheet.
  13. Variations on this activity:
    - Have students plant the bean seeds, then build the tropism boxes on another day while you are waiting for seeds to germinate.
    - Using different kinds of seeds, test to see if different kinds of seedlings display phototropism more than others. Do some seedlings bend and twist the moment they germinate? Do other seedlings show no sign of phototropism? Compare and contrast growth rate and angle of growth rate between seedlings.

## Links

- Sunflower Growth Stages (pictures, **Activity 1**)  
[https://cdn.agclassroom.org/media/uploads/2015/04/13/Sunflower\\_Growth\\_Stages.pdf](https://cdn.agclassroom.org/media/uploads/2015/04/13/Sunflower_Growth_Stages.pdf)
- Seed to Seed Cycle (**Activity 2**)  
[https://cdn.agclassroom.org/media/uploads/2015/04/13/Seed\\_to\\_Seed\\_Cycle.pdf](https://cdn.agclassroom.org/media/uploads/2015/04/13/Seed_to_Seed_Cycle.pdf)
- Time Lapse: Sunflower Following the Sun (video, **Activity 3**)  
<https://youtu.be/w-adjH-xyk?t=42s>
- *Tropism Twist* activity sheet (**Activity 3**)  
[https://cdn.agclassroom.org/media/uploads/2015/10/06/Tropism\\_Twist\\_worksheet.pdf](https://cdn.agclassroom.org/media/uploads/2015/10/06/Tropism_Twist_worksheet.pdf)

## Sources

1. <https://agclassroom.org/matrix/lesson/175/>
2. <https://extensiongardener.ces.ncsu.edu/extgardener-sunflowers-live-up-to-their-namesake/>
3. <https://plants.ces.ncsu.edu/plants/helianthus/>
4. <https://agclassroom.org/matrix/lesson/352/>

## K-5 Subject Areas

Reading, Speaking and Listening, and Science

## NC Standard Course of Study

### Reading

- **RL.K.1** With prompting and support, ask and answer questions about key details in a text.
- **RL.K.3** With prompting and support, identify characters, settings, and major events in a story.
- **RL.K.9** With prompting and support, compare and contrast the adventures and experiences of characters in familiar stories.
- **RL.1.1** Ask and answer questions about key details in a text.
- **RL.1.2** Retell stories, including key details, and demonstrate understanding of their central message or lesson.
- **RL.1.3** Describe characters, settings, and major events in a story, using key details.



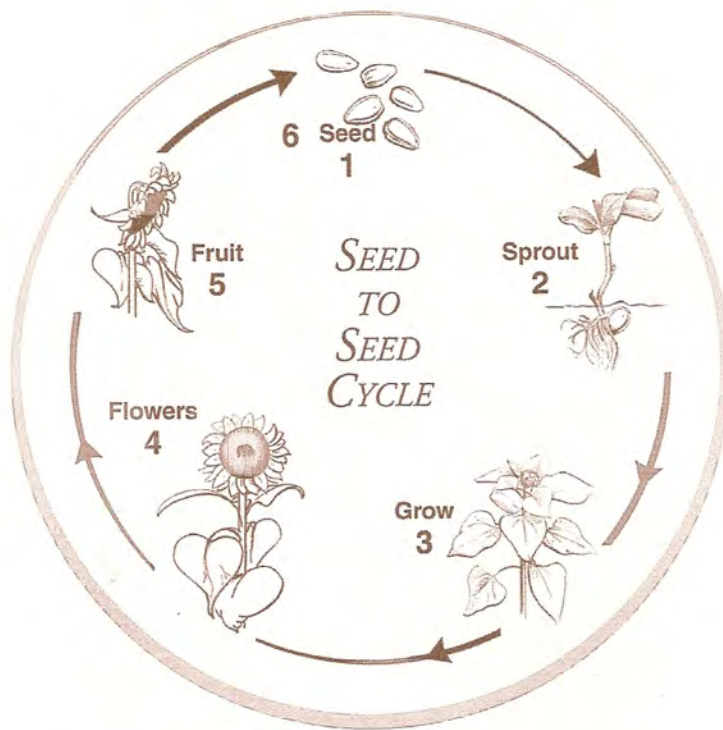
- **RL.1.9** Compare and contrast the adventures and experiences of characters in stories.
- **RL.3.1** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- **RI.K.1** With prompting and support, ask and answer questions about key details in a text.
- **RI.K.2** With prompting and support, identify the main topic and retell key details of a text.
- **RI.1.1** Ask and answer questions about key details in a text.
- **RI.1.2** Identify the main topic and retell key details of a text.

#### **Speaking and Listening**

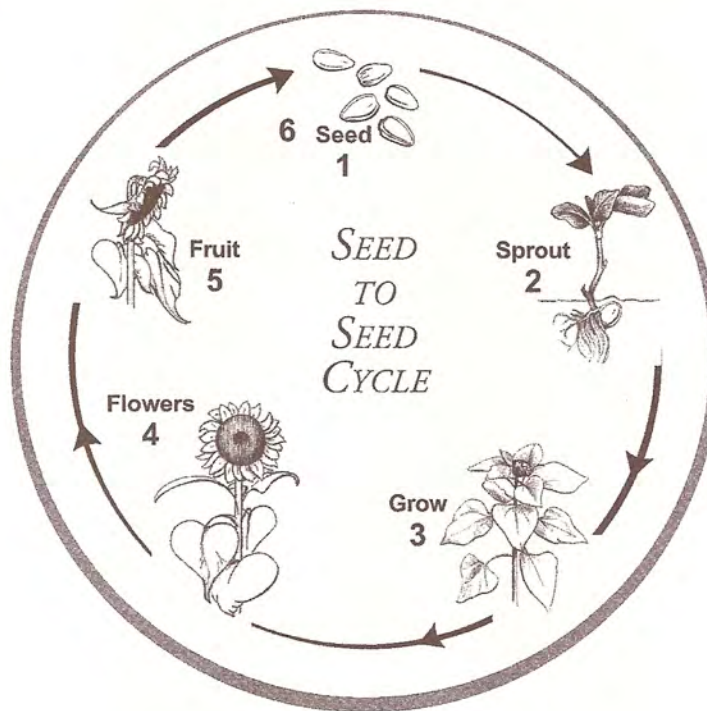
- **SL.K.1** Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
- **SL.K.2** Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
- **SL.K.3.** Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
- **SL.K.4.** Speak audibly and express thoughts, feelings, and ideas clearly.
- **SL.K.5** Add drawings or other visual displays to descriptions as desired to provide additional detail.
- **SL.1.1** Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
- **SL.1.2** Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
- **SL.1.5** Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
- **SL.2.1** Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
- **SL.2.2** Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
- **SL.2.4** Tell a story or recount an experience with appropriate facts and relevant, descriptive details, speaking audibly in coherent and complete sentences.
- **SL.3.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
- **SL.3.2** Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- **SL.3.3** Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.
- **SL.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly in complete sentences at an understandable pace
- **SL.4.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
- **SL.4.4** Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; adjust speech as appropriate to formal and informal discourse.
- **SL.5.2** Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

#### **Science**

- **K.E.1.1** Infer that change is something that happens to many things in the environment based on observations made using one or more of their senses.
- **K.L.1.2** Compare characteristics of living and nonliving things in terms of their structure, growth, changes, movement, basic needs.
- **1.L.1.1** Recognize that plants and animals need air, water, light (plants only), space, food, and shelter and that these may be found in their environment.
- **1.L.1.2** Give examples of how the needs of different plants and animals can be met by their environments in North Carolina or different places throughout the world.
- **1.L.2.1** Summarize the basic needs of a variety of different plants (including air, water, nutrients, and light) for energy and growth.
- **2.E.1.1** Summarize how energy from the sun serves as a source of light that warms the land, air, and water.
- **2.L.1** Identify ways in which many plants and animals closely resemble their parents in observed appearance and ways they are different.
- **3.L.2.1** Remember the function of the following structures as it relates to the survival of plants in their environments: roots (absorb nutrients), stems (provide support), leaves (synthesize food), and flowers (attract pollinators and produce seeds for reproduction).
- **3.L.2.2** Explain how environmental conditions determine how well plants survive and grow.
- **3.L.2.3** Summarize the distinct stages of the life cycle of seed plants.
- **4.P.3.1** Recognize the basic forms of energy (light, sound, heat, electrical, and magnetic) as the ability to cause motion or create change.
- **4.P.3.2** Recognize that light travels in a straight line until it strikes an object or travels from one medium to another, and that light can be reflected, refracted, and absorbed.
- **4.L.1.1** Give examples of changes in an organism's environment that are beneficial to it and some that are harmful.
- **5.L.3.1** Explain why organisms differ from or are similar to their parents based on the characteristics of the organism.



SUNFLOWER SEED TO SEED CYCLE



SUNFLOWER SEED TO SEED CYCLE

# Seed



Sunflower seeds are usually black  
with white stripes

# Sprouts

Sunflower  
seeds need  
water, soil, and  
warmth from  
the sun to begin  
growing.





# Growth



Sunflowers grow a very tall stem and leaves.



# Flower



The head of the flower can be  
15" in diameter or more!

# Wilting

The petals fall off and the weight of the seeds make the flower droop.





# Seeds



The seeds are harvested.



# Tropism Twist

Name: \_\_\_\_\_

**Testable Question:** Does light affect the direction that a seedling will grow? Write your hypothesis for the testable question below. Remember, a hypothesis is an intelligent guess and is usually written as one complete sentence.

**Hypothesis:** \_\_\_\_\_

\_\_\_\_\_

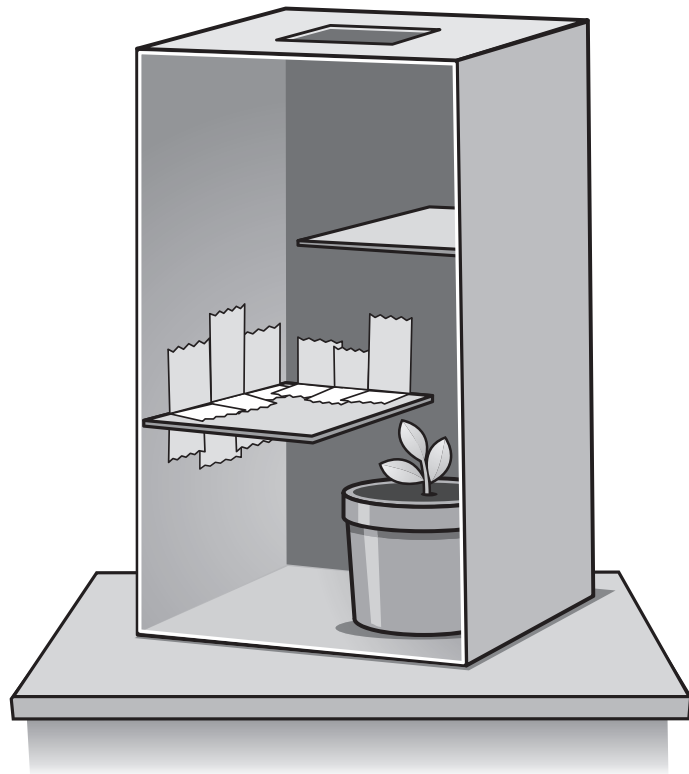
## Materials

*For your group:*

- ▶ 6 oz. clear plastic cup
- ▶ Potting soil
- ▶ Scissors
- ▶ Shoebox or milk carton
- ▶ Water spray bottle
- ▶ Craft stick
- ▶ Duct tape
- ▶ 2 bean seeds
- ▶ Permanent marker
- ▶ Thick cardboard

## Procedure

Follow the directions to make a phototropism box like the one pictured:



## **Tropism Twist** *(continued)*

1. Carefully draw and cut out a two-inch square from the middle section of one end of the shoe box.
2. Place the lid on the front of the box. Hold the box up to the light. Look through your two-inch hole and make certain that this hole is the only source for light to get into the box. Carefully duct tape over any other cracks or crevices that may be letting light in. *Do not tape the box shut.*
3. Using paper to create a pattern, cut two pieces the height of the inside of the shoebox and half the width. Trace the pattern on stiff cardboard and cut them out. Tape them into the box as shown.
4. After tropism boxes are complete, use the designated planting station to plant two bean seeds for your group experiment.
5. Place planted seeds in a lighted area and wait for the seeds to germinate. When the seedlings are approximately two inches tall, place the watered seedlings into the shoebox as shown.
6. Close the box, tape it, and place it by a sunny window so the square hole on the top can be exposed to the light.
7. After five days, carefully shine a flashlight through the square hole to observe the plant growth. It is best not to disturb plants during this testing period. It can alter the final outcome.
8. In another 3-5 days, check to see if the plant has grown enough to reach the top of the box. Remove the shoebox lid once the plant has reached the top of the shoebox. Record your observations and answer the questions on your worksheet.

## **Results and Conclusion**

1. With the lid removed, draw the inside of your tropism box along with the bean plants' growth progress in the shoebox.

## **Tropism Twist** *(continued)*

2. Did the experiment prove or disprove your hypothesis? \_\_\_\_\_

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3. Explain how your plant grew in the phototropism box. \_\_\_\_\_

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4. Why is phototropism important for plants? \_\_\_\_\_

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