

HOW DO PLANTS RESPOND TO THEIR ENVIRONMENT?

Unit 2: Changing Landscapes (Plants)

Lesson 6 — Grade 6

INSTRUCTIONS



Overview

In this lesson students will germinate seeds and observe the direction the stem and roots grow. After the roots have started to grow they will change the orientation of the plants and observe the response of the stem and roots to the change.

Objectives

On successful completion of this unit, students will be able to:

- germinate plants; and
- observe the effect of gravity on the roots and stem of a plant.

Alaska Standards

Alaska Science Standards / Grade Level Expectations

- [6] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
- [6] SA1.2 The student demonstrates an understanding of the processes of science by collaborating to design and conduct simple repeatable investigations.
- [6] SC1.2 The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by recognizing that species survive by adapting to changes in their environment.

Alaska Cultural Standards

- [E] Culturally- knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. Students who meet this cultural standard are able to:
- [E.2] understand the ecology and geography of the bioregion they inhabit.

Bering Strait School District Scope & Sequence

M.S. Sequence: 6.8 Plant Structure, Function, and Life Cycles

- A. Name what characteristics allow a plant to live successfully on land.

M.S. Sequence 8.6 Forces and Motion

- C. Explains the Theory of Gravity including knowing that every object exerts gravitational force on every other object.



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Materials

- Seeds (radish, marigold, or other fast germinating seed)
- Plastic baggies (3 for each group)
- Paper towels
- Rulers (cm)
- Tape or thumbtacks
- Permanent marker
- Cardboard
- STUDENT WORKSHEET: Geotropism

Additional Resources

Glencoe Life Science Ch 9-10

Glencoe Physical Science Ch 1-2

Activity Preparations

1. Depending on time and student abilities it may be easier to cut the paper towels before students start the activity.
2. Set up a location where the bags can be allowed to germinate.

Whole Picture

Plants respond to their environment in a variety of ways. The response of an organism, usually a plant, to an environmental stimulus is called a tropism. Some common plant stimuli include light, gravity, water, movement of the sun, and touch. The naming of the tropism is associated with the stimulus. For example, the movement of plant roots towards water is called hydrotropism. See the vocabulary list for more examples. The movement away from a stimulus is called a negative response, and the movement towards the stimulus is a positive response. For example, roots exhibit a positive response to gravity, while stems exhibit a negative response.

It is important that plants are anchored in soil to absorb water and nutrients. When a plant has been disturbed by an animal, or flipped over by the wind, researchers have determined that the roots and stems of a plant can respond within one minute. Additionally, researchers have determined that plants can distinguish between gravitational and mechanical disturbances.



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Vocabulary

tropism	plant growth toward or away from a stimulus.
phototropism	the response of a plant to light; stems bend toward the light, roots move away from the light
geotropism	the response of the plant to gravity
hydrotropism	the bending of a plant's roots toward water
thigmotropism	the response of a plant to touch; Some plants have leaves that close when they are touched. Afterwards they will return to their original position.
heliotropism	the movement of plant leaves and flowers in the direction of the sun

Activity Procedure

1. Ask students what effect light has on plants. Do plants always grow towards light? Ask what other stimulus plants react to. Define tropism and describe how tropisms are named for the stimulus.
2. Introduce the activity and demonstrate how to set up the germination bags.
3. Divide the class into groups of three students each.
4. Allow time for students to make the germination bags. Be sure they label them and put their names on the bags.
5. Students will need to attach the bags to a surface with tape, or with thumbtacks to cardboard. To eliminate the stimulus of light, and control that variable on the plants, the bags could be put in a box or dark room.
6. Students should write their hypothesis of what they think the seeds will look like in the germination bag in 5 days.
7. Students will need to check the bags every couple of days. They should complete the Observation Table each time they check the bags.
8. When the roots have grown 1cm they should rotate the bags 90 degrees.
9. When the roots have grown 2cm they should dispose of the bags and complete the questions on the Student Worksheet.
10. Discuss the results of the activity with the class when finished.



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STUDENT WORK



Extension Activities

- Have students try the activity with different types of seeds.
- Have some groups let the seeds germinate in light and have other groups place their bags in a box, or dark room for comparison as the seeds germinate.
- Have students design and conduct experiments to test other tropisms.

Answers

1. Answers will vary.
2. The roots should grow down, towards the pull of gravity.
3. The stems grow up, away from the pull of gravity.
4. The stems will grow away from gravity and the roots will grow toward gravity.
5. The roots and stems responded to the force of gravity.
6. The direction of growth would be random because of the weightless environment.
7. The roots would grow horizontally along the bottom surface.

References

http://www.ncsu.edu/news/press_releases/04_10/271.htm



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STUDENT WORK



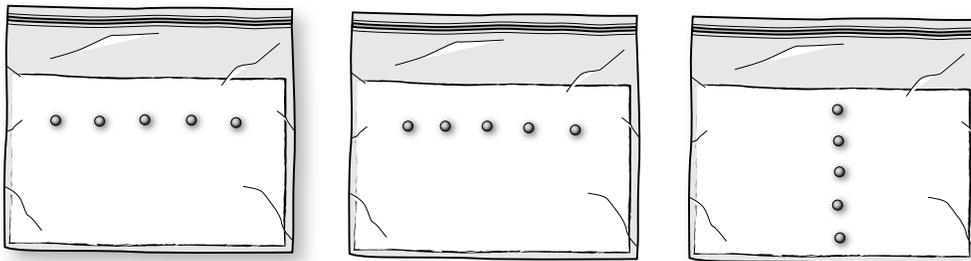
Student Worksheet: Geotropism

Name _____

We can easily observe that plant stems grow up and roots grow down, but what would happen to the stems and roots of a growing plant if we change the direction of “up” and “down”. In this activity the affect of changing directions will be tested.

Procedure

1. A total of three germination bags will be needed for each group. For each bag fold a paper towel once. Cut the paper towel so that it will fit inside the bag and extend approximately $\frac{3}{4}$ of the way up the bag. The fold should be at the bottom of the bag.
2. With a marker, label each bag A, B, or C and place a L (left) and R (right) on them.
3. Wet each of the paper towels with a small amount of water. Place 5 seeds on the inside of the folded paper towel as shown in the diagram.



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4. Place the paper towels with the seeds in the baggies. If there is extra water carefully pour it off. The paper towels only need to be damp.
5. Blow a little air in the bag and seal the top.
6. Use tape or thumbtacks to attach the bags to the surface your teacher has provided.
7. Complete the hypothesis section by describing and drawing what the seeds will look like in 5 days.
8. Check the bags every 2 days and record observations on the Observation Table. When the roots are approximately 1 cm long turn them 90 degrees so the "L" side is up.
9. Continue to monitor the plants and observe the direction the roots and stem are growing in until the roots are 2cm in length.
10. After the roots are 2cm long dispose of the bags and complete the questions.

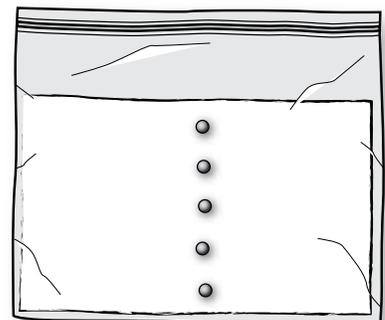
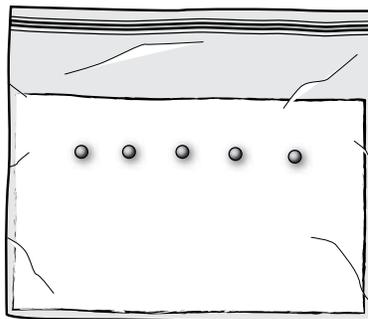
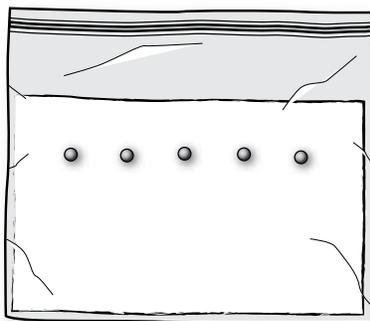
Hypothesis

Describe and draw what the seeds in each germination bag will look like in 5 days.

A _____

B _____

C _____



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Check the bags every 2 days and complete the observation data table below.

Observation Table

Date	Observation	Drawing



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Questions

1. How many days did it take before the root was visible?
2. Did the roots from all the seeds grow in the same direction?
3. Did the stems from all the seeds grow in the same direction?
4. Describe what happened to the direction the roots and stems grew when the bags were turned 90 degrees.
5. What caused the roots and stems to change the direction they were growing?
6. If this experiment was done on the Space Station what direction do you think the roots and stems grow? Why?
7. What do you think would happen to the roots if another germination bag was made and placed horizontal on a flat surface?

