

Lesson Plan 3 How does gravity affect plant growth on Earth and in space?

Length: 30 minutes for 7 days

NGSS Standards

- Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-5),(HS-LS1-7)
- Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS-LS2-5)

Essential Questions:

How can we model a low gravity environment to study plant growth?

What is gravitropism's role in plant growth?

Objectives:

Students will be able to model low gravity environment by using a rotating CD with the tomosphere seed inside.

Students will be able explain gravitropism and write claims on how gravitropism affects plant's growth.


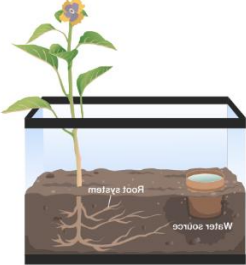
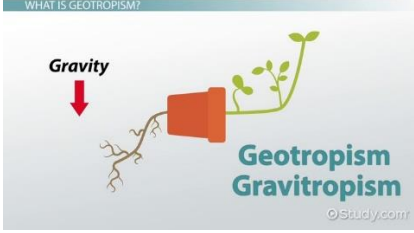

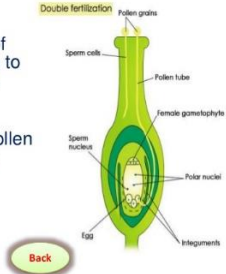
Students will be able to simulate a model depicting low gravity in space.

Materials:

- 5 “tropisms” matching sheet
- CD cases – transparent, thick-style case (1 cm depth) - 2 per small group of 3-4 students
- Felt – 1 square per CD case, cut to the size of the CD case. Darker colors of felt, such as brown or green, are preferable for observing the emerging roots and shoots
- Paper towels (good quality) – 1 per CD case
- Tomato seeds – 4 seeds per CD case; use seeds collected from tomatoes at home or purchased from a gardening center; the type or variety of tomato does not matter
- Access to fresh water
- Magnifying glasses or stand magnifiers
- Masking tape and marker
- Plastic pipettes or medicine droppers for watering
- Materials for recording (e.g., colored pencils, cameras, video cameras, etc.)

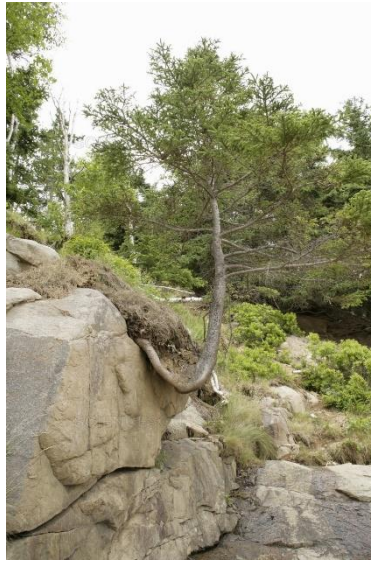
Engage

A “tropism” refers to a plants biological ability to respond to various forms of stimuli. A plant responds positively (toward the stimuli) or negatively (away from stimuli). Students discuss the 5 main types of tropism below. Afterward, students cut and match the different types of tropism with a partner to test their knowledge.

<p>Phototropism: plants respond to light stimuli</p>	
<p>Hydrotropism: plants respond to water stimuli</p>	
<p>Geotropism or gravitropism: plants respond to gravity stimuli</p>	
<p>Thigmotropism: plants respond to touch stimuli</p>	
<p>Chemotropism: plants respond to a chemical stimuli</p>	<p>Chemotropism</p> <p>It is movement of plant in response to chemical stimuli.</p> <p>Eg:- Growth of pollen tube towards the ovule.</p> 

Explore

After students become familiar with the different types of tropisms, the teacher will show students this picture of the tree. Student will write a claim as to which tropism is being represented and why. They will discuss their answers as a class.



<https://www.sciencesource.com/archive/Geotropism-SS2746536.html>

Explain

Plants have adapted throughout time to survive various types of environments. Plants use a strategy called “tropism.” Tropism is Greek meaning “to turn.”

Gravitropism plays a major role in plant growth on Earth. Plants can recognize the force of gravity. This picture depicts the roots growing downward towards gravity while the leaves grow upwards.

Scientists are currently studying how microgravity in space affects gravity receptors in plants.

Teacher asks the students how they think microgravity affects plant growth in space. Students share their thoughts with the class or in their observation journal.

Next, the teacher will explain that students will build a model representing microgravity in space to measure how gravitropism affects plant growth.

Elaborate

Students will perform the following investigation to model how microgravity in space affects gravitropism in plants.

1. Distribute 2 transparent CD cases, two pre-cut felt pieces and two pieces of paper towel to each group.
2. Wet the paper towel and felt until moist.
3. Place the paper towel in CD case then the felt on top of the paper towel.
4. Distribute 4 tomato seeds to each group for students to place evenly across the middle of each felt.
5. Label one CD case with masking tape “Top”); Label the other CD case “Rotating”
6. Stand the CD cases on their short ends with the word “Top” facing up.
7. Keep CD cases in a warm, well lit area in the classroom.
8. One of the CD cases will remain still (static-normal gravity conditions) and the other CD will be rotated 90 degrees clockwise on its short side each day (rotated-space conditions).
9. Each day, students can use a pipette or dropper to water the edges of the CD cases to keep the seeds moist. DO NOT open the CD cases to add water.

<http://tomatosphere.letstalkscience.ca/Resources/library/ArticleId/5767/how-do-plants-know-which-way-to-grow-in-space.aspx>

Each day, students should spend 10-15 minutes to make observations and measurements (see Additional Resources: **Observation Sheet**). They can use magnifying glasses to help them. Students could take photos each day or make a time lapse video as another way to record their observations. Students can use their observation sheet to draw the progress. Students should make observations until the seeds grow small leaves (cotyledons) and roots (radicle).



Figure 2: Tomato seedling with green cotyledons after two weeks

Source: Let's Talk Science

Evaluate

Students will end their investigation shortly after the leaves and roots begin to appear. The students will use a Venn Diagram to write the similarities and differences between gravitropism on Earth and space. They will include any measurements and data they collected.

