

## Photo Description



A clear plastic bottle lies on its side, filled with dark soil and water. A small plant with green leaves is growing from the bottle opening, showing how seeds can sprout and grow even in unusual containers. This setup demonstrates how plants can adapt and grow in different environments when they have the basic needs of water, soil, and light.

## Scientific Phenomena

This image represents the Anchoring Phenomenon of plant germination and growth in a modified environment. The scientific process occurring is seed germination followed by early plant development. When a seed has adequate moisture, warmth, and eventually light, it begins to sprout by absorbing water, which activates enzymes that break down stored nutrients in the seed. The emerging plant (seedling) then uses photosynthesis to create its own food as it continues growing toward the light source. This bottle ecosystem creates a mini greenhouse effect, maintaining moisture and warmth that support plant growth.

## Core Science Concepts

1. Plant Life Cycles and Growth Requirements: Plants need water, nutrients, air, space, and light to survive and grow. This bottle provides a controlled environment meeting these basic needs.
2. Seed Germination Process: Seeds contain embryonic plants and stored food that activate when conditions are right, beginning the growth process from seed to mature plant.
3. Photosynthesis and Plant Nutrition: Once leaves develop, plants use sunlight, carbon dioxide, and water to make their own food through photosynthesis.
4. Adaptation and Survival: Plants can grow in various environments as long as their basic needs are met, demonstrating their ability to adapt to different conditions.

### Pedagogical Tip:

Use this image to launch a "Notice and Wonder" activity where students observe closely and generate questions before diving into explanations. This builds scientific thinking skills and student ownership of learning.

### UDL Suggestions:

Provide multiple ways for students to document observations - drawing, verbal descriptions, or digital photos with voice recordings. This supports diverse learners and communication styles while maintaining scientific rigor.

### Zoom In / Zoom Out

**Zoom In:** At the cellular level, root cells are actively dividing and elongating to push through the soil, while leaf cells contain chloroplasts that capture light energy and convert carbon dioxide and water into glucose through photosynthesis. Water molecules move through the plant's vascular system from roots to leaves.

**Zoom Out:** This small plant ecosystem connects to larger environmental cycles - the water cycle, carbon cycle, and food webs. Plants like this one contribute oxygen to our atmosphere, provide food for other organisms, and help cycle nutrients through ecosystems worldwide.

### Discussion Questions

1. What evidence do you see that this plant is getting what it needs to survive? (Bloom's: Analyze | DOK: 2)
2. How might this plant's growth compare to the same type of plant growing in a garden, and what factors could cause differences? (Bloom's: Evaluate | DOK: 3)
3. What do you predict would happen if we moved this bottle to a dark closet for a week? (Bloom's: Apply | DOK: 2)
4. How could we design an investigation to test whether plants need soil to grow? (Bloom's: Create | DOK: 4)

### Potential Student Misconceptions

1. Misconception: Plants get their food from soil.  
Clarification: Plants make their own food through photosynthesis using sunlight, water, and carbon dioxide. Soil provides water, minerals, and support, but not food.
2. Misconception: Seeds need soil to germinate.  
Clarification: Seeds primarily need moisture and warmth to germinate. They can sprout on wet paper towels, in water, or other moist environments because they contain stored food.
3. Misconception: Plants only grow upward.  
Clarification: Plant roots grow downward (gravitropism) while shoots grow toward light (phototropism), showing plants respond to environmental cues in different directions.

### Cross-Curricular Ideas

1. Mathematics - Measurement and Data: Students can measure the plant's growth over time (height, number of leaves) and create graphs or charts to display their data. This connects to 5.MD standards for measuring and representing data visually.
2. English Language Arts - Narrative and Informative Writing: Students can write a "life story" from the perspective of the seed, describing its journey from germination to seedling. Alternatively, they can write informative pieces explaining the steps of seed germination to younger students, practicing clear explanations.
3. Social Studies - Human Needs and Community: Connect this to how farmers and gardeners grow food to feed communities. Students can research local farming practices, visit a community garden, or learn about food production in different regions and how climate affects what plants can grow.
4. Art - Mixed Media and Observation Drawing: Students can create detailed scientific drawings of the plant at different growth stages, using colored pencils or watercolor to show the progression. They can also design and decorate their own bottle planters, exploring how artistic design and function work together.

### STEM Career Connection

1. Botanist - A botanist is a scientist who studies plants - how they grow, what they need, and how they help our world. Botanists might work in gardens, laboratories, or forests to learn new things about plants. Some botanists help create new types of plants that grow better in different climates or help solve problems like hunger. Average Annual Salary: \$65,000
2. Horticulturist - A horticulturist is someone who grows plants and takes care of gardens, farms, and greenhouses. They know exactly how to make plants healthy and strong, and they might grow food, flowers, or plants for landscaping. Horticulturists use science to decide when to water plants, what soil to use, and how much sunlight they need. Average Annual Salary: \$58,000
3. Environmental Scientist - An environmental scientist studies how living things interact with their surroundings, including plants, water, air, and soil. They might design systems to grow food sustainably, clean up polluted areas, or help protect forests and natural spaces. These scientists help solve big problems to keep our planet healthy. Average Annual Salary: \$73,000

### NGSS Connections

- Performance Expectation: 5-LS1-1: Support an argument that plants get the materials they need for growth chiefly from air and water
- Disciplinary Core Ideas: 5-LS1.C Organization for Matter and Energy Flow in Organisms
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- Crosscutting Concepts: Systems and System Models
- Crosscutting Concepts: Energy and Matter
- Science and Engineering Practices: Engaging in Argument from Evidence

### Science Vocabulary

- \* Germination: The process when a seed begins to sprout and grow into a new plant.
- \* Photosynthesis: The process plants use to make food from sunlight, water, and carbon dioxide.
- \* Seedling: A young plant that has just started growing from a seed.
- \* Nutrients: Substances that living things need to grow and stay healthy.
- \* Environment: All the conditions and surroundings where a living thing exists.
- \* Adaptation: How living things change or adjust to survive in their environment.

### External Resources

Children's Books:

- From Seed to Plant by Gail Gibbons
- The Tiny Seed by Eric Carle
- A Seed Is Sleepy by Dianna Hutts Aston