

Variation and Heredity

Objectives

You will be able to

- Determine how different environmental conditions affect plant growth rate.
- Plan and conduct an experiment about environmental effects on plant growth.
- Use data to construct an explanation about how the environment and genetics influence plant growth.
- Discuss and plan procedures.
- Write a lab report.



How do the environment and genetics affect who we are and how we are similar or different?

Evaluation and Feedback

To evaluate your work, you will

- Use the "Carrying Out Investigations" row of the Science and Engineering Practices Rubric.
- Use the "Analyzing and Interpreting Data" row of the Science and Engineering Practices Rubric.
- Use the "Constructing Explanations and Designing Solutions" row of the Science and Engineering Practices Rubric.
- Use other criteria determined by your teacher.

Task 1: Effects of the Environment on Plant Growth

As a group:

- Observe the variation of traits in beans.
- Design an experiment to see the environmental effects on plant growth.
- Conduct the plant growth experiment.
- Record data and make a graph of your data.
- Observe and analyze patterns in the results of your experiment.
- Explain what effects the environment had on your plants.

Vocabulary

- control group
- environmental conditions
- experiment
- experimental group
- organism
- prediction
- standard factor (fair test)
- variable

Connect to the Culminating Project

Plan and organize your children's book in your Individual Project Organizer:

- Draw a scene that shows how the environment affects the main character.
- Write a short narrative that explains how the environment affects the main character.



Introduction

In the last task, you identified different traits and thought about the ways human beings are similar and different. Now it's time to think about why. Why are we similar? Why are we different? Is it because of genetics or environment? Today you will design an experiment that tests whether the environment affects traits of living organisms.

• Think about what you already know. Based on your prior knowledge of how plants and animals grow, do you think the environment can have an effect on organisms' similarities and differences? How?

Part I • Variation of Beans

Characteristic	Bean 1	Bean 2	Bean 3	Bean 4
Length (mm)				

1. Pick four beans out of the bowl. Make observations about each bean.

Put your beans back in the bowl. Mix the beans up. Pour the beans out on the table.
 See if you can find the beans you described!



3. Use evidence and reasoning to support the claim provided.

Claim

Beans have many different traits.

Evidence

Use evidence from your observations to support the claim.

Reasoning

Use a scientific concept to explain why your evidence supports the claim.



Part II • Design an Experiment to Analyze How the Environment Affects Physical Traits of a Plant

A. Experimental Question

The question you will answer in your experiment: How does the environment affect a plant's growth rate?

B. Brainstorm Your Experimental Design

- 1. Think about what you already know about what plants need to grow. Then brainstorm and list different **environmental conditions** that might be responsible for variations in plant growth.
- 2. Decide on one environmental condition (variable) your group will test to see the effect it has on plant growth.

Teacher initials: _____

- 3. Decide how many seeds your group will use in your experimental group and the control group.
- 4. **Measurements:** Together as a class decide on what and how you will will measure:
 - a. Look at the Bean Anatomy reference sheet at the end of this task and decide what you will measure.
 - b. How will you measure?
 - c. What units will you use?
 - d. How often will you measure?



Effects of the Environment on Plant Growth

5. Draw your experimental and control setups.

Draw and label your experimental setup. Include amounts of materials.	Draw and label your control setup. Include amounts of materials.
Teacher initials:	Teacher initials:

6. Standard Factors (Fair Test)

What conditions will you keep the same for both your experimental setup and your control setup?

7. Prediction

Cause and Effect: What do you think will happen in your experiment? Why?



C. Record Your Experimental Design

8. Write a formal description of your experiment in your science notebook, as shown below.



Section	Details Included in Each Section			
Experimental Question	• Write the question you want to answer.			
Procedure	 Write step by step procedures. Include amounts of materials. Include times to do steps. Describe both your experimental setup and your control setup. Include details about measuring or gathering data. 			
Materials	Make a list of the materials.			
Prediction of the Results	 Predict and give reasons for the predicted results in the experiment. 			
Data Table	 Make a data table. Give your data table a title. Label all your columns. Identify units of measurement. 			

D. Conduct Your Experiment

- 9. Conduct your experiment.
- 10. Fill in your data table each day to record your results.

E. Graph Your Data

11. After collecting all your data, graph the data on the graph paper provided by your teacher.

F. Analyze Your Data and Make Conclusions

- 12. Discuss the following:
 - Examine your seed growth data and identify patterns you see.
 - Compare your results with your prediction. Were you correct in your prediction? Why or why not?



13. Cause and Effect

Use your evidence and the patterns you noticed in the data to explain what effect, if any, the environmental factor had on the growth of your seeds.

- a. Write a **claim** about what affect the environmental factor had on the growth of your seeds.
- b. Use **evidence** from your experiment to support the claim.
- c. Use a scientific concept to **justify** that your evidence supports your claim.

Claim	
vidence	
Reasoning	



G. Communicate Your Findings

14. Share your data, analysis, and conclusion with the class.



REFLECT

At the beginning of this task, you were asked if you thought environment could have an effect on organisms' similarities and differences. Look back at your response. Do you still agree with what you initially thought? How could you add to or change your answer after what you have learned from this task?

Part III • Connect to the Culminating Project and Assessment

Complete the Individual Project Organizer for this task.





Effects of the Environment on Plant Growth

