



# Greenhouse Challenge

## Virtual Classroom Extension

### **Objective**

This activity is designed to help your at-home student(s) recognize themselves as scientists and think critically about problem-solving. The goal is to help students practice critical thinking, problem-solving, and design skills. As with all lessons provided, please feel free to adapt them according to your students' abilities. Take these ideas, make them your own and your at-home students will have a greater chance at success.

### **Materials**

Paper, writing utensil, ruler, 6 plant seeds of your choice, potting soil, 6 small plant pots or 16 oz water bottles, water, scissors, duct tape or clear packaging tape, thermometer for measuring air temperature, hot glue gun, building materials which may include clear plastic wrap, plastic baggies, popsicle sticks, empty plastic 2 liter bottles or milk jugs, dowel rods.

### **Background Information**

Plants, like all living things, require water, space, and food to survive. Plants use their roots to take up water and nutrients from the soil. They also use the energy from the sun to create their own food through a process called photosynthesis.

Many types of plants that people use for food or put in their gardens do not do well in very cold temperatures. Because of this, people sometimes grow plants in greenhouses. A greenhouse is an enclosed structure that allows plants to grow year-round. They usually have a glass or clear plastic ceiling and walls. This allows heat from the sun to get into the greenhouse and warm the air. However, the warm air is then trapped by walls and cannot escape. This helps greenhouses stay warm all year round. In order to prevent it from getting too hot for the plants, greenhouses also have vents to allow heat to escape.

### **Procedures**

1. Explain to your students that they are going to grow plants from seeds. If you do not have a small pot to plant the seeds in, you can make one by cutting a 16 oz water bottle in half (or other bottle or carton of your choice). Recycle the top half as you will only be

using the bottom half. The edges will be sharp, so you should cover the edge with duct tape so that your students do not cut themselves. Poke holes in the bottom to allow water to escape. Use a permanent marker to label the pots 1-6. Have your students add soil to the bottom of the pots and plant one seed in each pot according to the directions on the seed packet. Spray water so that the soil is damp but there is no standing water. It is important that you do not over water the seeds.

2. Next, discuss the concept of greenhouses with your student. Explain that many plants cannot survive the cold winters of Ohio. Tell them that you are challenging them to create their own tabletop greenhouse so that they can keep their plants alive all year long.
3. Give them time to think through how they would design a greenhouse. It should be large enough to hold three of the six plants. You can allow them to look up greenhouses online if they need some ideas. Remind them that they will need to access the plants to water them and measure their growth, so your students will need to design the greenhouse in a way that allows them to do this.
4. As your students plan their greenhouse, they should draw out their design and how they would build it. They should also record what materials they would need to build it.
5. Once your students have a plan, help them gather their materials. If they planned to use a material that you do not have access to, help them to think through how they might modify their plan with the materials that are handy. Materials listed at the top of this lesson plans are some suggestions of things that can be used. Feel free to add your own materials based on what you have available. Remember that the materials will need to be waterproof as the greenhouse will accumulate moisture.
6. After your students have gathered their materials, they should construct their greenhouse. Younger students may require more assistance, especially when cutting materials or using a hot glue gun.
7. Once their greenhouse is constructed, your students need to test it to make sure it works. Have them place plants one-three in the greenhouse and put the greenhouse near a window that receives sunlight.
8. Place plants four-six in the sun next to the greenhouse.
9. Place the thermometer near the plants next to the greenhouse. Wait five minutes and record the temperature outside of the greenhouse.
10. Place the thermometer in the greenhouse. Wait five minutes and record the temperature inside the greenhouse.
11. Tell your students to make a prediction as to which group of plants will grow better, inside the greenhouse or outside of the greenhouse.
12. For the next two-three weeks, your students should record the temperature inside the greenhouse and outside the greenhouse at the same time every day, using the methods from step nine and ten.
13. Continue to water the plants as they grow. Your students should record which day each plant emerges from the soil. After the plants emerge from the soil, they should use a

ruler to measure the plant growth each day. The attached data collection sheet can be used to record this information.

14. After two-three weeks, have your students graph the growth of each plant over the course of the research period. On a separate graph, they should plot the temperature inside the greenhouse and outside the greenhouse each day.
15. For older students, they can find the average of the growth of the three plants inside the greenhouse each day and the average of the growth of the plants outside the greenhouse each day.
16. Discuss the results with your students. Some questions to help lead the discussion may include:
  - a. Which plant was tallest at the end of the experiment?
  - b. Which plant had the most leaves at the end of the experiment?
  - c. What did you notice about the temperature inside the greenhouse versus outside the greenhouse?
  - d. What other observations did you make about the plants or the greenhouse?
  - e. What was surprising to you about your results?
  - f. Could there have been anything else that affected your results? (If your students cannot think of anything, you could have them think about things like the amount of water or the amount of soil).
  - g. If any of the seeds never grew or died during the experiment, what could have caused this?
  - h. Do your results suggest a need to change your greenhouse in anyway? If so, what would you change?

### ***Ohio's Learning Standards***

<b>Technology Content Standards</b>
Grade 3-5 Design and Technology Topic: Identify a problem and use an engineering design process to solve the problem <b>3-5.DT.2.b.</b> Plan and implement a design process: identify a problem, think about ways to solve the problem, develop possible solutions, test and evaluate solution(s), present a possible solution, and redesign to improve the solution.



# Greenhouse Challenge

Week 1: Height of Plant							
Plant Number	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
1							
2							
3							
4							
5							
6							

Week 2: Height of Plant							
Plant Number	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
1							
2							
3							
4							
5							
6							

Week 3: Height of Plant							
Plant Number	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21
1							
2							
3							
4							
5							
6							

Week 1: Number of Leaves							
Plant Number	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
1							
2							
3							
4							
5							
6							

Week 2: Number of Leaves							
Plant Number	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
1							
2							
3							
4							
5							
6							
Week 3: Number of Leaves							
Plant Number	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21
1							
2							
3							
4							
5							
6							

Day	Temperature inside the greenhouse	Temperature outside the greenhouse
1		
2		

Day	Temperature inside the greenhouse	Temperature outside the greenhouse
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		



