

# Greenhouse

## STEM Design Challenge

*A lesson from the New Jersey Agricultural Society  
Learning Through Gardening program*

**OVERVIEW:** Students work in small groups to design a small greenhouse for a plant and observe the plant's growth in the greenhouse compared to a plant without greenhouse protection.



**OBJECTIVES:** The student will be able to:

- Design a mini-greenhouse based on criteria provided.
- Compare multiple greenhouse designs and with a group design a mini-greenhouse based on criteria provided.
- Build the greenhouse with a group based on the design.
- Evaluate the group's greenhouse based on the criteria provided.

**GRADES:** K-5

*To modify the challenge for younger grades, plant the seeds in a container with a flat bottom, such as cut-down milk cartons, and omit the criteria about stabilizing the plant. Write the criteria on the board and explain the rules. At the end of the challenge, give each student a How Did We Do? challenge sheet. Read the sentences to younger students and ask them to circle the answers "yes" or "no."*

**BACKGROUND:** A *greenhouse* is a building where plants such as flowers and vegetables are grown. It usually has a glass or see-through plastic roof. Many greenhouses also have glass or plastic walls. The plants stay warm as the sun shines through the roof and walls during the day.

Plants are grown in greenhouses in late winter and early spring, when it is too cold to grow plants outside. The plants are moved or *transplanted* into the soil outside as the weather warms up. In New Jersey, most tomatoes and sweet peppers get their start in a greenhouse and then are moved into fields.

Growing plants in greenhouses is different from growing plants outside. No rain can get inside a greenhouse, so gardeners must water the plants. Greenhouses can also get very hot from the sun's heat, so gardeners must make sure the temperature does not get too hot for the plants. Greenhouses usually have vents that can be opened to let excess heat out.

**PREPARATION:**

Poke holes for drainage in the bottom of the cups or milk cartons for planting. If the students are too young to do this, the teacher should make the holes ahead of time.

## PROCEDURE:

Divide the students into groups of four. For K-2 students, write the criteria on the board or on a large paper. For 3-5 students, distribute the design challenge rubric sheets. Explain and review the criteria with the class and answer questions. Explain and review the challenge rules. Explain and review the time schedule. Tell students that you will be observing their progress and reminding them to stick to the challenge criteria, rules, and time requirements.

## CRITERIA:

- Plant your seeds in a plastic cup and water them lightly.
- Your mini-greenhouse must be big enough to hold the cup your plant is planted in.
- The greenhouse walls cannot touch the plant.
- The greenhouse must be opened easily to water the plant and release heat if necessary.

## MATERIALS:

Potting soil	Craft sticks	Straws	Ziplock bags
Plastic wrap	Paper plates	Tape	Glue

Plastic cups OR milk cartons, for younger students (both with holes in the bottom)  
Seeds (If you are doing this challenge in late winter or early spring, plant seeds of hot weather plants such as tomatoes, sweet peppers, cucumbers, or corn.)

K-2: A *Greenhouse Design Challenge, How Did We Do?* sheet for each student

3-5: A *Greenhouse Challenge Rubric* sheet for each student.

## CHALLENGE RULES:

- Listen carefully to ideas from everyone on your team. Decide on the best design before you begin to build.
- You may only use the materials provided. You do not have to use all the materials provided.
- You must build your greenhouse in the time provided.
- You may use additional tools such as scissors and rulers.

## TIME SCHEDULE:

Teacher will set a timer and notify students when to move on to the next step.

- 5 minutes for each student to sketch his/her own design.
- 5 minutes to brainstorm ideas as a group.
- 10 minutes to plan out the design.
- 20 minutes to create the product (the greenhouse).
- 10 minutes to reflect. How can we improve the design? What worked well? What did not work well?

## EXTEND THE EXPERIMENT:

Have each group plant another plastic cup with seeds. Then place both the plant in the greenhouse and the exposed plant outside in a sunny area where they will not be blown by the wind. Visit the plants every other day to water them and to check on their growth. In the same small groups, have the students measure the growth of both the exposed plant and the plant in the greenhouse and keep a record of the growth by date. Choose an end date for your experiment – two weeks or a month – and then ask the students to graph the growth pattern for each plant. Discuss the results. Did the greenhouse protect the plant and allow it to grow faster?

## New Jersey Learning Standards:

*Science: K-2: ETS1.A,B,C 3-5: ETS1.A,B,C*

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## GREENHOUSE DESIGN CHALLENGE RUBRIC Grades 3-5

Today your challenge is to design and construct a greenhouse for seeds planted in a plastic cup. You will have only 40 minutes to build your greenhouse. After your greenhouse is completed, we will take it outside and see how your seeds grow in your greenhouse compared to seeds planted without a greenhouse.

### BEFORE YOU BEGIN:

- Plant seeds in two plastic cups and water them lightly.

### CRITERIA:

- Your mini greenhouse must be big enough to hold the plastic cup.
- The greenhouse walls cannot touch the plant.
- The plant must be supported so that the plastic cup does not tip over.
- The greenhouse must be opened easily to water the plant and release heat if necessary.

### CHALLENGE RULES:

- Listen carefully to ideas from everyone on your team. Decide on the best design before you begin to build.
- You may only use the materials provided.
- You must build your greenhouse in the time provided.
- You may use additional tools such as scissors and rulers.

*To evaluate your greenhouse, circle how you met each specification below.*

<b>CRITERIA</b>	<b>3</b>	<b>2</b>	<b>1</b>
Greenhouse big enough to hold plant	Yes!	Almost	Not really
Greenhouse walls do not touch plant	Yes!	They barely touch	Not really
Plastic cup does not tip over	Yes!	A little unsteady	Not really
Greenhouse opens easily for watering	Yes!	A little tricky	Not really
Original and creative	Impressive design	Unique design	Interesting design
Used materials on list only	Yes!	Some	Used a material not on the list

NAME \_\_\_\_\_

## GREENHOUSE DESIGN CHALLENGE

How Did We Do?

Grades K-2

Our greenhouse is big enough  
to hold our plant.

YES

NO

The walls of our greenhouse  
do not touch plant.

YES

NO

We can easily open our  
greenhouse to water  
our plant.

YES

NO

We only used the materials  
on the table.

YES

NO

We worked together and  
listened to each other.

YES

NO

We are proud of our greenhouse  
design.

YES

We can do better  
next time.