

# Activity 5: Space Garden Engineering Challenge

In this activity, learners will design and build a garden habitat to grow plants in space. They will identify what challenges need to be overcome, design possible solutions, and build a model of their idea. *\*Background information can be found at the end of this activity guide\**

## Activity

Growing food on Mars or The Moon will be extremely challenging. Engineers at NASA are constantly thinking about ways to provide plants with the things they will need to survive. They might use greenhouses, hydroponics, or something never thought of before. Someone will have to come up with a solution, so why not give it a shot! To put creativity to the test, our project ends with a challenge to design and build a space garden!

1. Gather your learners and the materials needed!
2. Begin with a discussion, using some of the questions below:
  - a. *Do you think it will be possible to grow plants in space? How?*
  - b. *What makes it challenging for plants to grow in space?*
3. With your learners, design and sketch an idea for a “garden habitat” in space. You can choose to design it for The Moon or Mars. Your garden habitat must provide the resources necessary for plant survival (air, water, and light), and conserve as much of those resources as possible for astronauts. You do not have to actually plant food in your garden, you can use your imagination for this activity! Use some of the following questions to guide your design:
  - a. *What do plants need to survive?*
  - b. *What might be missing on The Moon or Mars that a plant would need?*
  - c. *How could we provide the plant with soil, water, air, etc. if there is none?*
  - d. *What can we invent, or build to help plants grow in space?*



## Suggested Materials

- [Data Sheet \(printable version\)](#)
- Crayons, markers, or colored pencils
- Foil
- Paper towel or toilet paper rolls
- Small cardboard boxes such as shoe boxes
- Plastic cups
- Straws
- Rubber bands
- Cardstock, construction paper, or scratch paper
- Pipe cleaners
- Craft sticks
- Scissors
- Glue or hot glue

### **\*Safety\***

Adult supervision is recommended throughout this experiment. Building might require use of sharp tools. Small pieces are easy to swallow.

4. Once you are done sketching, use the suggested materials to build a model of your design.
5. Test your model to see if it fits the criteria needed for plants to grow in space. Use the following questions to check:
  - a. Does the garden provide the resources necessary for plant survival (air, water, sunlight, optional: soil)?
  - b. Does the garden protect against the dangers of The Moon? Or Mars?
  - c. Does the garden conserve any vital resources, such as water or air?
  - d. How would you change your model to increase the plants' chances of survival?
6. Rebuild any parts of your model that could be improved, then check again!
7. Once you are done, congratulate your learners on a great invention and snap a pic! Share it on social media with us at Chabot Space & Science Center! [Facebook](#), [Twitter](#), [YouTube](#), [Instagram](#)

Ensuring that astronauts will be able to grow food is a necessary step for their survival. Studying and experimenting with plants will help scientists prepare them for space and the challenges that come with it. Missions to The Moon and Mars have still yet to launch. The plan for growing food in space is still not finalized. Your ideas and innovations might be the exact solutions needed to help them along. Will it be possible to grow food in space? You tell us.

## Background

### **What is a habitat?**

A habitat is a home for a living thing, including people, plants, and animals. A habitat should have everything needed for that organism to survive. Engineers are already planning habitats for human life on Mars, including special rooms dedicated to growing crops and plants.

### **What is a greenhouse? Or hydroponics?**

A greenhouse is a glass-walled house that plants are grown in. They provide protection from the outside environment, including extreme weather conditions. Greenhouses could be important for keeping plants warm in space. Temperatures can reach  $-80^{\circ}\text{F}$  Mars and  $-280^{\circ}\text{F}$  on The Moon.

Hydroponics is the process of growing plants in water. Nutrients are added into the water to be absorbed by the plant, therefore eliminating the need for soil. Neither The Moon nor Mars has healthy enough soil for plants to grow in, so this technology may be useful to grow plants in space.

### **How are astronauts growing plants in space already?**

On the International Space Station, astronauts are successfully growing plants under the conditions of space by using two different habitats; "Veggie" and the "Advanced Plant Habitat" (APH). Their research has discovered a few solutions, such as using LED lights to encourage upward plant growth, and planting them in clay pillows full of fertilizer rather than soil.

To date, "Veggie" has successfully grown three different types of lettuce, Chinese cabbage, zinnia flowers, and more. Read more about Veggie, APH, and other experiments being done on the ISS on their [webpage](#).

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Choose to design a Space Garden on (circle one):

**The Moon** or **Mars**

What might be missing on The Moon or Mars that a plant would need?

What are the challenges?

**I think...**



**Sketch your design ideas for a Space Garden Habitat:**

Do you think your model could survive on The Moon or Mars? Why or why not?

**I think...**

How would you change your model to increase the plants' chances of survival?

**I think...**

