LESSON 8:
COLONIZING SPACE

SUPPLIES

LESSON KIT #8

- Box of Aluminum Foil (1)
- Popsicle Sticks (40)
- Pipe Cleaners (80)
- Plastic Wrap (1)
- Styrofoam Sphere Halves (10)
- Paper Plates (10)

HANDOUTS FOLDER

- Brainstorming Page (10)

PENCIL BOX

- Tape
- Glue Sticks
- Scissors
- Markers

OBJECTIVES

- ☑ Understand the basic elements of surviving in space.
- ☑ Students will develop problem-solving and engineering skills by designing and building a model space habitat

HOOK

3-5 min

Ask students to close their eyes and imagine they are astronauts on a mission to colonize a new planet. What would they need to survive? Prompt them to think about air, water, food, and protection from harsh environments. After a few minutes, have students share their ideas with the class.

INTRODUCTION

3-5 min

Life in space is vastly different from life on Earth. The absence of gravity affects how we move, sleep, and even eat. Space is a harsh environment with extreme temperatures and climate, high levels of radiation, and no readily available sources of drinkable water or food. To survive, astronauts rely on advanced space technology.

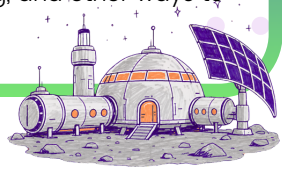
One project aimed at understanding long-term space habitation is the Mars One mission, which aims to establish a human settlement on Mars. Another critical initiative is the International Space Station (ISS), a space station that orbits the Earth. On the ISS, astronauts experiment with different ways to live in space. Scientists are studying how to create sustainable habitats that can support life on Mars, focusing on air and water recycling, food production, and protection from radiation.

In today's activity, you will work in teams to design and build a model space habitat on Mars using recyclable materials.

LET'S LEARN ABOUT SPACE COLONIZATION: RADIATION

Space colonization means creating places for humans to live beyond Earth, such as on the Moon or Mars. However, living in space comes with many challenges, and one of the biggest is **radiation**.

Radiation is energy that travels through space in the form of waves or particles. On Earth, our atmosphere and magnetic field protect us from much of the harmful radiation coming from the Sun and outer space. On the Moon and Mars, this protection is much weaker, leaving astronauts exposed to higher levels of radiation that can damage their cells and increase their risk of health problems. To live safely beyond Earth, scientists are developing protective habitats, special shielding, and other ways to keep astronauts safe.



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COLONIZING SPACE

TEACHER MODELING

10 min

To survive anywhere, whether on Earth or in space, humans need a few basic things: air, water, food, and shelter. In space, providing these necessities is much more challenging. Air must be generated and recycled, water must be conserved and purified, food must be grown in controlled environments, and habitats must protect people from extreme temperatures and radiation. Electricity can be generated using solar panels, which convert the solar energy in space into usable power for the habitat.

NASA Space Technology Photos

- Show students the NASA pictures of space technology.
- Discuss each piece of technology.
- Use the "Ideas" page to model some systems for students.

ACTIVITY DIRECTIONS

35 min

Brainstorming: (5 minutes)

- Divide students into small groups.
- Have students brainstorm materials they can use to represent each technology.
- Each group will brainstorm and sketch their space colony design on their brainstorming handout.
- Encourage detailed sketches, labeling each part and its function.

They should include:

- Air recycling system
- Water recycling and storage system
- Food production area
- Radiation shielding
- Electricity generation
- Living quarters

Building the Colony (30 minutes)

- Provide each group with the specified materials.
- Students will build their space colony based on their sketches and plans.
- Circulate and assist teams as needed, prompting them to think about the functionality of their designs.

TEACHER TIP

- Hands-On Practice: Let students practice building each component with guidance to build confidence before starting their projects.
- Answer Questions: Encourage questions, clear up confusion, and provide tips for using materials.
- Encourage Creativity: Provide a basic framework while allowing students to add unique ideas and think about how each system works.
- Simplify Materials: Pre-cut materials when needed and use child-friendly tools like safety scissors and non-toxic glue.

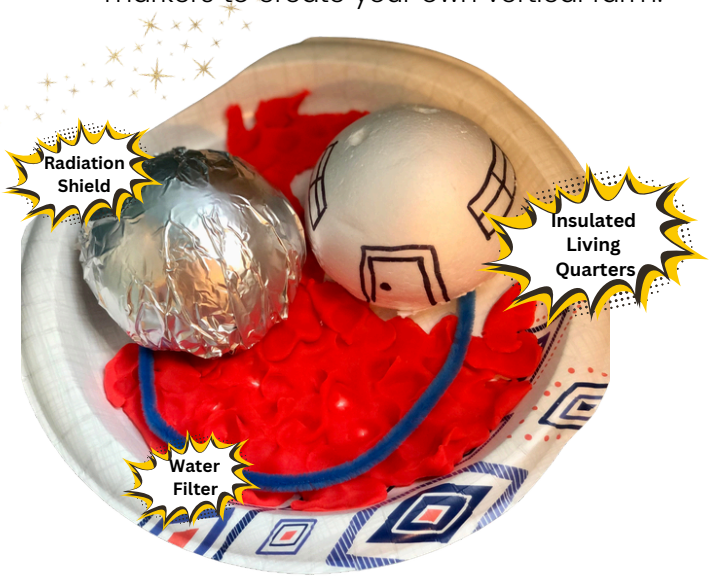


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IDEAS FOR SPACE SYSTEMS

Teacher Modeling 10 min

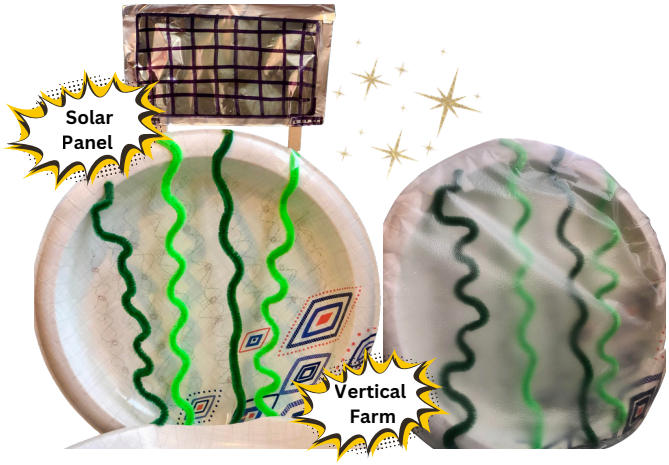
1. Air Recycling System
   - Plants and Algae: Use markers, Play-Doh and/or pipe cleaners to create plants.
   - Air Filters: Use pipe cleaners to create air filters.
2. Food Production Area
   - Greenhouse: Use clear plastic wrap for windows and Play-Doh, markers and pipe cleaners for plants.
   - Vertical Farming: Use pipe cleaners and markers to create your own vertical farm.



5. Electricity Generation
   - Solar Panels: Create solar panels with aluminum foil, using popcicle sticks for support

6. Living Quarters
   - Insulated Rooms: Build living quarters with halved styrofoam spheres. Use markers to add details like doors and windows.

7. Rough Terrain
   - Use Play Doh to create a rough planetary terrain around your space colony.



3. Water Recycling and Storage System
   - Water Collection: Use halved styrofoam spheres to create a water storage system.
   - Purification: Use pipe cleaners to simulate water filtration systems.

4. Radiation Shielding
   - Aluminum Foil Walls: Cover habitat walls with aluminum foil to provide radiation shielding.
   - Layered Protection: Add layers of colored Play-Doh for extra protection.



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COLONIZING SPACE

DISCUSSION

3-5 min

Facilitate a discussion about the space colonies:

- What was the hardest part of building your space colony? How did you solve that problem?
- Which part of your space colony did you build first, and why did you choose to start there?
- What materials did you use to build your space colony, and how did they help you?
- How did you make sure your space colony could help people live there for a long time?
- What creative ideas did you come up with to solve problems in your space colony?



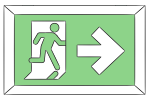
OBSERVE & EXPLAIN

3-5 min

Designing a space colony requires thinking about everything people need to live. First, a space colony needs a system to recycle air so that people always have fresh air to breathe. It also needs a system to recycle water, making sure there is enough clean water for drinking and washing.

To grow food, a space colony might use special gardens called hydroponics, which can grow plants without soil. Solar panels can be used to capture sunlight and turn it into electricity to power the colony.
The places where people live in the space colony need to be comfortable and safe. Would you live in your space colony?

Building a space colony takes careful planning and creative problem-solving. Each part of the colony has to work well with the others to create a place where people can live for a long time. By thinking about these human needs and coming up with new ideas, future space explorers can make sure their colonies are ready for life in space!



Exit Ticket



Ask each student one of the following questions as they walk out the door.

- Q: Why is living in space different from living on Earth?
  - A: Examples include no gravity, extreme temperatures, radiation exposure, no easy access to food and water
- Q: Why do astronauts need advanced space technology?
  - A: Examples include creating air, recycling water, growing food, protecting from radiation

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NASA SPACE TECHNOLOGY



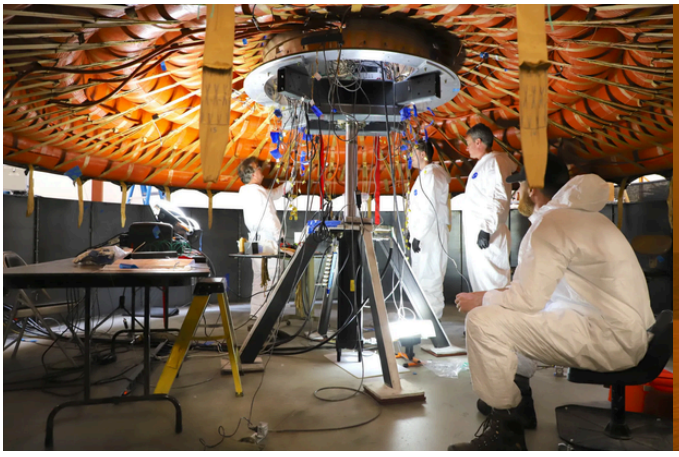
In this illustration, NASA astronauts drill into the Mars' subsurface to find ice.



Spacesuit insulation technologies protect the astronaut from extreme high and low temperatures of the space environment.



NASA's next-generation spacesuit is designed to help astronauts move easier on the Moon and Mars.



Engineers prepare a flexible heat shield on an inflatable structure. The view is from bottom side, and the heat shield is on top.

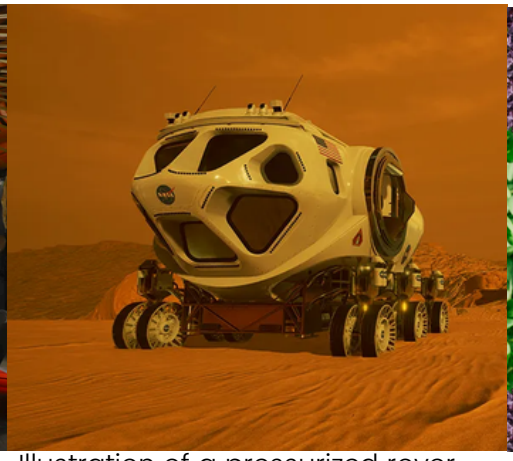


Illustration of a pressurized rover on Mars. This helps astronauts breathe and stay safe while traveling.



NASA researches vertical farming without sunlight or gravity.

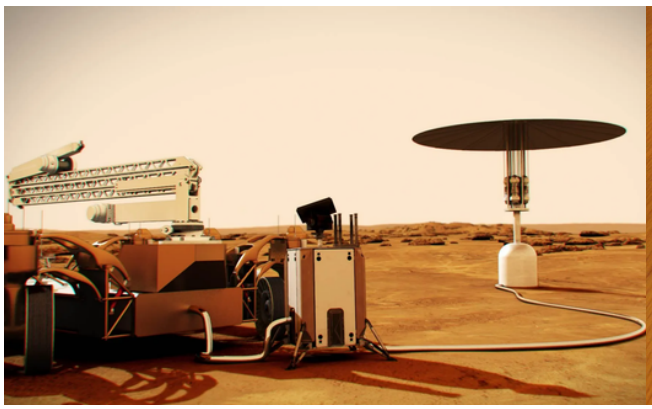
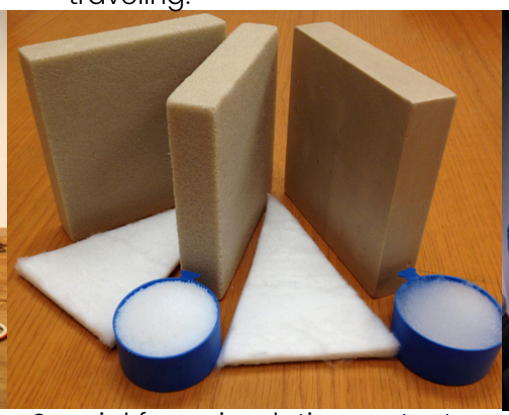


Illustration of a nuclear power system concept on Mars. This would provide electricity.



Special foam insulation protects from heat, cold, and sound.



Plantsgrow in a "pillow" filled with fertilizer. The pillows are important to help distribute water, nutrients and air in a healthy balance around the roots.

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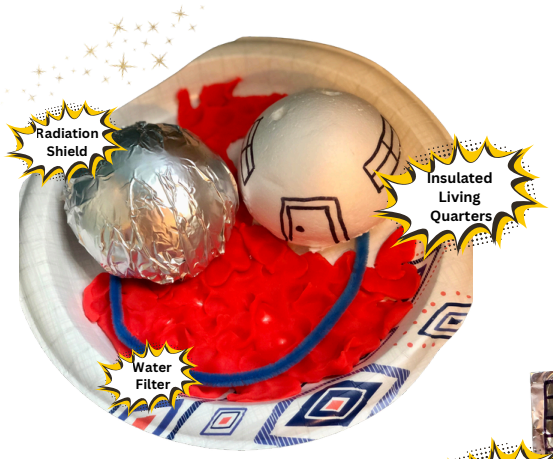
BRAINSTORMING PAGE

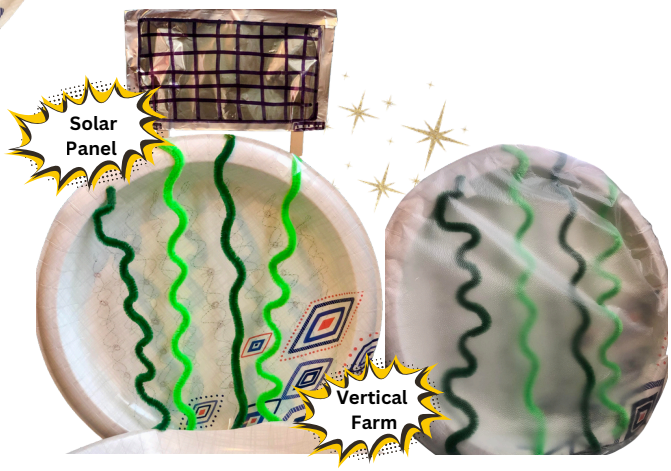
Directions: Brainstorm your ideas on this page. What kinds of ways can you build technology?

Air Recycling System	Food Production Area
Water Recycling/Storage	Radiation Shielding
Electricity Generation	Living Quarters
Other Ideas	Other Ideas

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COLONIZING SPACE : STUDENT EXAMPLES







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