About This Module

Overview	Youth will consider what it would take to travel to and explore space. They will discuss the basic human needs and consider how to adapt their space travel plans to account for these. Youth will design structures and technologies that will support life in space to display at a final culminating event.
Guiding Questions*	• What is life in space like? • How are environmental conditions in space different from those on Earth? • What systems and structures must humans design to survive in space?
Culminating Activities	Youth will display what they created throughout the week, answer guests' questions about space travel and discuss their plans to provide for basic human needs in order to colonize terrestrial planets in our solar system.
Session 1	**Surveying the Solar System** Youth will be able to analyze planet characteristics to determine whether a planet may be suitable for human life.
Session 2	**Water in Space** Youth will be able to describe how the International Space Station provides water to astronauts and test different water filtration systems.
Session 3	**Food in Space** Youth will be able to describe how astronauts are supplied with food and create a menu for astronauts based on their knowledge of space food.
Session 4	**Radiation in Space** Youth will describe radiation and its effects in space. Youth will also test various materials to discover how to protect against radiation.
Session 5	**Space Communities** Youth will be able to apply information about space to develop a space community that meets human needs. Youth will present their space community to others.

*Guiding questions are not specifically asked in the sessions themselves; they're meant to guide your preparation and facilitation of the unit. Keep these questions in mind so you can help youth make connections and capture key take aways relating to the topic.

Key Terms

Word	Definition
Terrestrial planet	Earth-like planets (e.g., Mercury, Venus, Earth, Mars) with a hard surface made of rocks or metal.
Gas giant	Large planets (e.g., Jupiter, Saturn) consisting of hydrogen and helium gases that get denser and more like liquid toward their small core of ice and rock.
Ice giant	Smaller planets (e.g., Uranus, Neptune) made of heavier elements like oxygen, carbon, nitrogen and sulfur. They have gas on the outside that gets denser and more liquid-like toward their core, which is larger and has more ice and rock than gas giants.
International Space Station	A large spacecraft orbiting the Earth used for research and exploration.
Atmosphere	The layer of air or gases that surround a planet.
Water cycle	The constant process on Earth where water evaporates from its surface; forms clouds; falls back to earth; drains into rivers, lakes and oceans where it evaporates again.
Freeze-dry	A process that freezes food at extremely low temperatures and then gradually warms it back up. As it warms back up, the remaining moisture is removed so that only about three percent of the moisture remains.
Dehydrated	The moisture is removed from something.
Rehydrated	The moisture is added back into something.
Irradiated	Sterilized (made clean) by radiation.
Thermostabilzed	Sterilized by heat.
Compact	Small in size.
Subatomic particle	One of the three components of an atom: a proton, a neutron or an electron.
Shelf-stable	Food that doesn't spoil or go bad, even over long periods of time at room temperature.
Solar energetic particles (SEPs)	Fast-moving subatomic particles caused by explosions on the sun that radiate outward in solar storms.
Chemical element	The basic types of matter in the universe that can't be broken down into simpler forms by chemical reactions. The periodic table features 118 chemical elements including hydrogen, oxygen, iron and zinc.
Atom	The smallest component of an element and a building block for everything in the universe.
Galactic cosmic radiation (GCR)	Subatomic particles generated by stars outside the solar system that travel through space in a constant stream. They are heavier and faster than SEPs, which makes them more damaging.
Central nervous system	The brain and spinal cord, which control all thoughts, feelings, movement and other bodily functions.

Supplies

Facilitator Needs	1	Device with internet connection
	1	Projector
	1	Whiteboard or flipchart paper and marker
	1 roll	Toilet paper
	1	Marker or pen
	1	Scissor
	1 package	Cheesecloth
	1 set	Metric liquid measuring cups
	1	Hole puncher
	1 package	Rubber bands
	1 pack	Paper
	1	Permanent marker
	1 package	Litmus testing strips
	1 bottle	Vinegar
	1 bottle	Italian dressing
	1 package	Aquarium gravel
	1 package	Activated carbon/activated charcoal (can be found with aquarium supplies)
	2 cups	Play sand
	1 package	Marbles
	1 package	Cotton balls
	1 package	Coffee filters
	1 package	Packing materials (Styrofoam “peanuts”)
	1	Cardboard box or other container (medium-sized)
	1	Hot glue gun (optional)
	1	Jenga or equivalent game
	1 pack	Colored construction paper
	1 roll	Scotch tape or masking tape
		Plastic spoons (enough for each attendee) (optional)

Supplies (contd.)

Facilitator Needs		Assorted freeze-dried meals (enough meals so that each participant and visitor can have a small taste) (optional)
		Sample-size containers (enough of each sample for each attendee) (optional)
		Capri Sun fruit drink pouch (per participant and attendee) (optional)
		Paper napkins (enough for each attendee) (optional)
Each Group Needs	1	Device with internet connection
	1	Calculator or calculator app
	3	Paper bowls
	1	Mesh bag or panty hose
	1	2-liter bottle
	4	Clear plastic cups
	1 liter	Tap water with a pH between 6.5 and 7.5 (or bottled water)
	1 set	Markers or crayons
	1	Scissor
	1	School glue
	1 roll	Tape (cellophane, masking, etc.)
	1	Ruler
	Assorted	Building materials (e.g., balsa wood, construction paper, toothpicks, popsicle sticks, white paper, string, aluminum foil, paperclips, Styrofoam, foam core and film canisters)
	3	16-ounce water bottles
	1 sheet	White construction paper
	1 sheet	Black construction paper
	1	Thermometer
	Assorted	Arts and crafts supplies (optional)
	3	Pencils or pens
	1	Adhesive tape
	8	Popsicle sticks
	2 sheets	Paper
		Random items to represent space tools (e.g., toys, tools, items from kitchen or office)

Extension Activities

- **National Geographic Passport to Space** (kids.nationalgeographic.com/space)
  - Allow youth to explore this resource and discover space facts, photos, books and games all about space.
- **NASA's International Space Station** page (nasa.gov/international-space-station/)
  - Allow youth to learn more about the ISS by exploring images, videos and media from this site.
- **Deep Space Food Challenge** (deepspacefoodchallenge.org)
  - Invite your youth to accept the Deep Space Food Challenge and design food for astronauts.
- **NASA's What Is the Weather Like on Other Planets?** (spaceplace.nasa.gov/weather-on-other-planets/en/)
  - Take a weather tour of the solar system by visiting NASA's Space Place.

Career Connections

In this module, youth will participate in hands-on activities that allow them to explore careers related to space travel. While many of the activities focus on astronauts, sustaining human life in space depends on many people in many different careers. When discussing astronaut food and designing packaging for it, youth will confront some of the same challenges as food scientists and engineers who design packaging and delivery methods. Other engineering fields concentrate on delivering clean water and breathable air to astronauts, while disposing of or recycling waste by-products. Still other engineers and technicians design the spacesuits and space capsules to protect astronauts from dangerous radiation and space debris.

Notes to Facilitator

Many of the concepts in this module are complex. There are Facilitator Notes throughout to explain some of the more advanced concepts and help answer questions that may arise. Review the modules in advance and be prepared to look up any terms or concepts you are not familiar with. If questions do arise that you do not feel equipped to answer, just assure youth that you will do some research and get back to them.

This module references many videos to help illustrate the concepts. Please prepare a place and a way to display selected videos for your participants.

If inviting parents, caregivers, special guests or others from the community to join the final session and listen to the groups present their space community, draft a list of people to invite and send out invitations as early as possible.