
SPACE STATION
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DESIGN A SPACE STATION

The International Space Station was was assembled in space and many segments were built in different countries. It has fourteen pressurized modules plus a truss, huge solar panels, and two robotic arms. It contains two bathrooms, six sleep stations, and areas for exercising and preparing food. It also has many workspaces for maintaining the station's systems and doing science experiments.

YOUR MISSION

Use the engineering design process to create one or more space station modules with the materials provided. Work as a team to assemble everyone's modules into a complete space station.

MATERIALS

- **Clean, empty 2-liter bottles**
- **Utility knife**
- **Tape**
- **Aluminum foil**
- **Pieces of cardboard or foam core**
- **PVC pipe fittings (such as elbows, T-fittings, and 4-way fittings)**
- **Miscellaneous materials (modeling clay, craft foam, tongue depressors, pipe cleaners, etc.)**

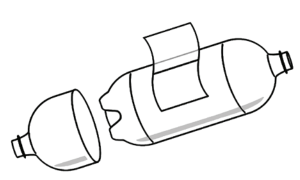
Safety Note: Adult supervision and assistance is required when using utility knife

IMAGINE AND DESIGN

After learning about the ISS (visit SpaceStationExplorers.org for great ISS content), brainstorm and write down your ideas. What does a space station need to keep humans alive? What is it like to live, work, eat and sleep in space? Would you need chairs, tables or beds? How would you exercise? Where would your electricity and water supply come from?

BUILD

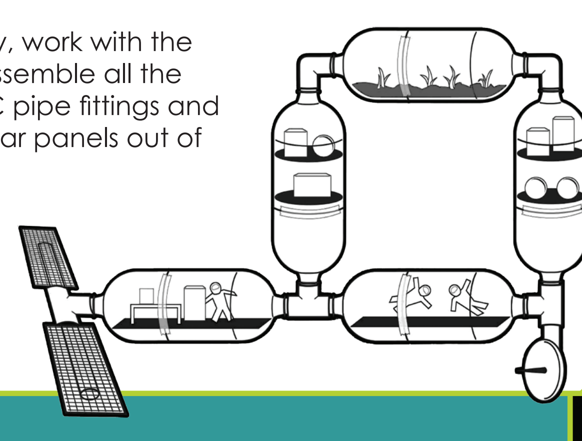
Cut a window in the side of each bottle to access the inside. As you create the interior of your module, you can use all the materials provided or choose only some of them.



TEST AND REDESIGN

Pick up and rotate your module. Remember that in microgravity there is no sense of up or down and loose items can float freely and get lost. Do you need to modify your module for microgravity?

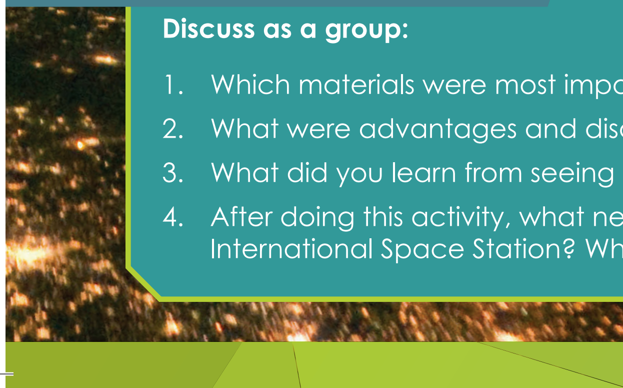
When you're ready, work with the other builders to assemble all the modules using PVC pipe fittings and tape. Make the solar panels out of cardboard and aluminum foil.



ANALYSIS AND REFLECTION

Discuss as a group:

1. Which materials were most important in your Space Station design?
2. What were advantages and disadvantages to designing and building as a team?
3. What did you learn from seeing the others' creations?
4. After doing this activity, what new questions do you have about the International Space Station? Where will you look for the answers?



WELCOME
TO THE
INTERNATIONAL SPACE STATION

The World's Orbital Laboratory

The International Space Station (ISS) is one of humanity's greatest achievements in engineering and cooperation. It orbits about 400 km (250 miles) above Earth's surface at 28,000 km (17,500 miles) per hour.

In 2005, Congress designated the U.S. segment of the ISS as the newest national laboratory. There are many areas of science being explored on the ISS National Lab including life sciences, physical sciences, Earth observation, materials science, technology development, and human research.

In the microgravity environment of the ISS, fires burn differently, liquids crystallize differently, and living cells (including the cells in astronauts' bodies) change their behavior. On the station's exterior, experiments can be exposed to conditions including vacuum, increased radiation, and extreme temperature changes. Research in this unique setting has led to improvements in medicine, technology, and other applications that benefit people here on Earth!

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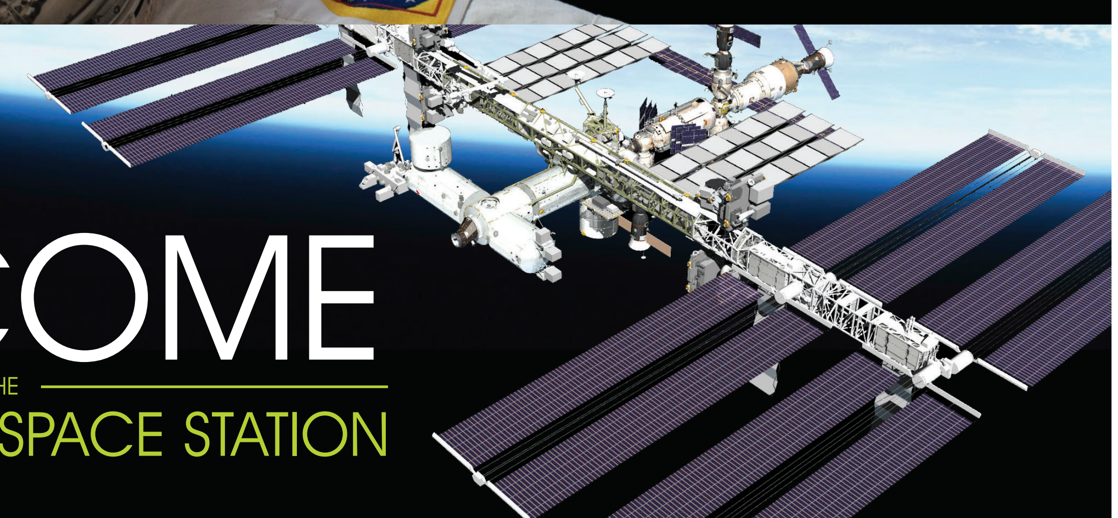
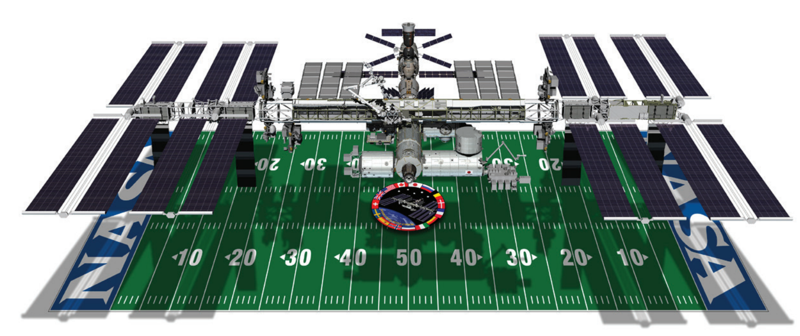


SPACE STATION FACTS

- Assembling the International Space Station took 35 Space Shuttle missions and over 150 spacewalks between 1998 and 2011.
- The space station, including its large solar arrays, spans the area of a U.S. football field.
- The mass of the ISS is over 419,600 kilograms, equivalent to 925,000 pounds or more than 320 cars!
- The distance that the ISS travels in one day is equivalent to flying to the Moon and back!
- The ISS completes one orbit around Earth every 92 minutes, letting astronauts see about 15 sunrises and sunsets every 24 hours.
- The ISS has been continuously inhabited since 2000, usually with six people aboard.
- Since 2011, all crews have traveled to and from the ISS on Soyuz capsules, which fit three people. It takes about 4000 kilograms (8800 pounds) of supplies to support three astronauts for a typical six-month stay.
- As of January 2017, 226 astronauts from 8 countries have spent time on the space station.

Discover more about the space station through the activities on these pages!

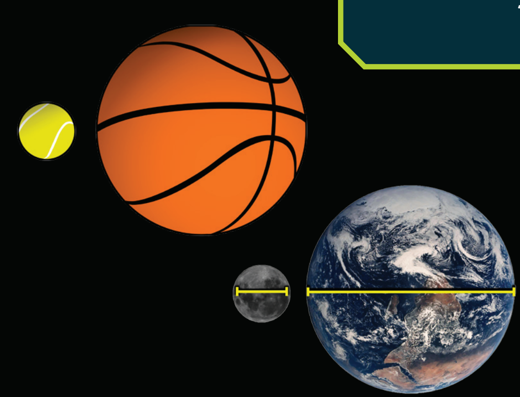


HUMANS IN SPACE

Measuring Distances to Space Destinations

Space agencies have sent robotic spacecraft to explore many regions within our solar system, but humans have only ventured to a few destinations: the International Space Station (ISS), the Moon, and soon, Mars!

The ISS is an ideal platform for humans to prepare for long-duration space missions, like the journey to Mars. Sending humans to Mars and back will be the next chapter in human spaceflight. Let's compare the distances between the space destinations that humans have ventured to and where we're headed.

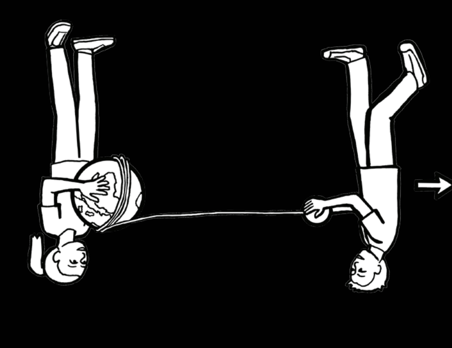


MATERIALS

- **Spheres representing Earth and the Moon. The Moon's diameter should be about 1/4 of the Earth's diameter. A good pairing is a basketball for Earth with a tennis ball for the Moon.**
- **Pin, paper cutout, or other small object representing the ISS**
- **String**

PROCEDURE

1. Give the Earth to one volunteer and the Moon to another. Ask them to move to positions that they think show the distance between the Earth and the Moon.
2. Ask the Earth volunteer to wrap the string around the planet 9.5 times to approximate the distance between Earth and the Moon. Tape the Earth model to that place on the string.
3. Give the end of the string to the Moon volunteer and ask the volunteers to move apart until the string is extended. The distance is probably farther than they expect!
4. Give another volunteer the object representing the Space Station and ask how close it should be to the Earth model. If Earth is a basketball, the ISS is just 8 millimeters away!



EXTENSION

1. Add a red ball to represent Mars! Its diameter should be about half of Earth's. Give Mars to another volunteer and ask where Mars should be in relation to the Earth and Moon. If Earth is a basketball, the average distance to Mars would be 4.2 km (2.6 miles)! The volunteer doesn't need to walk that far.

Space Station Explorers

Space Station Explorers is a community of educational partners and programs that use the International Space Station (ISS) as a platform to inspire and engage learners in science, technology, engineering, and math (STEM). Students can talk with astronauts, plant seeds that flew in space, participate in Earth observations, follow along with science experiments on the ISS, and even design and launch their own experiments to space! Visit SpaceStationExplorers.org to access our partner programs as well as news, videos, lesson plans, and activities about the ISS.

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