



Station Spacewalk Game

Educator Answer Key

This activity meets the National Science Education Standards written by the National Research Council and addresses the Science and Technology standards for grades 5-8 for: Understandings about Science and Technology.

To complement their experience with Station Spacewalk Game, students can learn more about Extra Vehicular Activities at the following sites. Questions 1–6 draw on this supplemental material.

http://www.nasa.gov/mission_pages/shuttle/shuttlemissions/sts119/119_overview.html

http://www.nasa.gov/audience/forstudents/5-8/features/F_What_Goes_Up_5-8.html

<http://www.nasa.gov/audience/forstudents/5-8/features/what-is-the-iss-58.html>

Students can learn more about how people on Earth communicate with things in space by visiting

http://solc.gsfc.nasa.gov/M1_Training/solc1.html. Questions 7–9 draw on this material.

1. What is the purpose of the International Space Station?

The space station has made it possible for people to have an ongoing presence in space. Human beings have been living in space every day since the first crew arrived in 2000. The space station's laboratories allow crew members to do research that could not be done anywhere else. Scientists also study what happens to the body when people live in microgravity for a long time. NASA and its partners have learned how to keep a spacecraft working well. All of these lessons will be important for future space exploration. NASA will use lessons it learns on the space station to build an outpost on the moon and for future explorations to Mars.

<http://www.nasa.gov/audience/forstudents/5-8/features/what-is-the-iss-58.html>

2. What are some of the hazards of spacewalking?

A primary reason spacewalks are dangerous is collision with space debris. An object as small as 1 millimeter in length can cause damage to a spacecraft since it is travelling at speeds up to 7.8 km/sec. Ultraviolet radiation and extreme temperatures of -100 degrees Celsius up to 120 degrees Celsius also pose significant challenges during spacewalks.

http://www.nasa.gov/audience/forstudents/5-8/features/F_What_Goes_Up_5-8.html

3. What is the role of an airlock?

An airlock is an airtight room with two entrances that allows an astronaut to go on a spacewalk without letting the air out of the spacecraft.

<http://www.nasa.gov/audience/forstudents/5-8/features/what-is-the-iss-58.html>

4. What do the solar arrays do?

Solar arrays collect energy from the sun to provide electrical power. The set of solar arrays that the STS-119 crew delivered included two solar array wings, each of which has two 115-foot-long arrays. Equipment connects the two halves and allows the arrays to twist as they track the sun. The total wingspan measures 240 feet. Altogether, the four sets of arrays can generate 84 to 120 kilowatts of electricity – enough to provide power for more than 40 average homes.

http://www.nasa.gov/mission_pages/shuttle/shuttlemissions/sts119/119_overview.html
<http://www.nasa.gov/audience/forstudents/5-8/features/what-is-the-iss-58.html>

5. What is the benefit of installing the S6 truss?

The S6 truss holds the final set of solar arrays for the space station. The set of solar arrays that the STS-119 crew delivered included two solar array wings. Since the three existing arrays can handle the majority of the station's day-to-day operational and life support needs, the newest solar array will double the amount of power available for scientific research.

http://www.nasa.gov/mission_pages/shuttle/shuttlemissions/sts119/119_overview.html

6. Now that you've played the game, what do you think of the challenges that an astronaut faces?

Answers will vary.

7. What kinds of information might need to be exchanged between satellites and the ground?

Many satellites transfer pictures they have taken. The International Space Station sends audio, video, experiment data, internet, and more.

Supporting quotations:

www.nasa.gov

"Many satellites take pictures of our earth, some for weather forecasting, some for determining the health of crops, others to track pollution. Some satellites take pictures of space, studying planets galaxies and our sun."

"Voice communications and video from the Space Shuttle and International Space Station are now possible without interruption during critical mission phases."

8. The International Space Station is a low-earth-orbiter (LEO), making it an ideal client of the Space Network's Tracking and Data Relay Satellite (TDRS) system. What are the benefits of sending communication through TDRS satellites instead of directly to the ground?

When satellites want to communicate directly with the ground, they can only transmit information when they're directly over a ground station. Because two thirds of the Earth is covered in water, there's no way to track a satellite along its full orbit using this method. Using the Space Network, however, NASA can communicate with the International Space Station during all points in its orbit.

Supporting quotations:

"A satellite can only send the information it has gathered to earth when it is in view of a ground station."

"To overcome the limited view-time imposed by ground stations for low-earth-orbiters, NASA developed a satellite that tracks other satellites: the Tracking and Data Relay Satellite, or TDRS..."

"Now, communications can be maintained over the entire orbit of a LEO satellite. This is particularly important when the information to be sent to Earth cannot be recorded for later playback. Voice communications and video from the Space Shuttle and International Space Station are now possible without interruption during critical mission phases."

9. The data from the SPHERES experiment will have to be sent back to Earth for analysis. Using what you have learned, describe the path that the signal will take to get back to Earth.

The signal will be sent from the ISS to a TDRS, and then from the TDRS to an antenna on Earth.