

Inside the Space Station: Teacher's Guide

Grade Level: 6-8

Curriculum Focus: Astronomy/Space

Lesson Duration: Two class periods

Program Description

Meet the scientists, astronauts, and diplomats behind the largest satellite in the sky today. The International Space Station is a testament to making the impossible a reality. It's also the story of 16 nations that put aside cultural differences to accomplish incredible technological feats no one nation could do alone.

Onscreen Questions and Activities

Segment 1, Inside the Space Station: Part One

- Pre-viewing questions:
 - What do you already know about space travel from television, radio, and books?
 - As you watch, think about the risks and benefits of living and working in space.
 - Note how the space station is truly an international effort.
 - Why is it important for humans to have an active space exploration program?
- Post-viewing questions:
 - Living in zero gravity presents certain challenges to the human body. Discuss how living in space can affect muscles and bone density.
 - How can these limitations be dealt with during long missions?
- Activity: Scientific research is a daily activity aboard and outside the space station. Write a proposal for research to be conducted on the space station. What scientific question about space do you hope to answer?

Segment 2, Inside the Space Station: Part Two

- Pre-viewing questions:
 - Explorers throughout history have had to face unknown dangers and risks. Discuss some of the reasons why humans are willing to risk their lives for discovery.
 - As you watch the program, note the steps that are taken to protect the lives of astronauts living aboard the space station.

- Post-viewing question: For most of its history, space travel was conducted by only a few nations. Discuss how you think the world will or will not benefit when space travel becomes a multinational and multicultural endeavor.
 - Activity: List and describe the challenges for human beings living in space. Design a training program to prepare a person to live in space for several months at a time.
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Lesson Plan

Student Objectives

Students will understand:

- An environment with almost no gravity challenges humans living in space. Humans must adjust their diets, sanitation, and sleep patterns; wear space suits; and conduct specially designed experiments.
- ISS inhabitants perform the daily functions of life in space using special products and procedures.

Materials

- *Inside the Space Station* video and VCR, or DVD and DVD player
- Computers with Internet access
- Additional reference materials on the ISS

Procedures

1. Begin the lesson by asking students what they already know about the International Space Station (ISS). As they brainstorm facts, write them on the board. Next, review basic facts about the ISS:
 - The ISS will orbit the Earth, allowing humans to live and work in space for long periods of time.
 - Scientists will be able to study the long-term effects of microgravity (the weightless environment of the ISS) on humans, as well as chemical, physical, and biological processes. These studies should lead to advances in medicine, technology, industrial materials, and in other practical areas.
 - The ISS also serves as a stepping-stone to the solar system because to undertake such missions, we must first understand how humans can survive in space for such long journeys.
 - Sixteen countries are working together to build the ISS: the United States, Russia, Canada, Japan, Brazil, and the nations of the European Space Agency (Belgium, Britain, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, and Switzerland).



- The ISS is being assembled piece by piece in space. Enormous and heavy, it can only be built in microgravity.
 - The first component of the ISS was Zarya, the control module built by Russia. It was launched into orbit in November 1999 and was followed a few weeks later by the U.S. module Unity. The two modules were connected in space—beginning an assembly that will include over 70 more components and take at least six more years to complete.
2. Have students locate the 16 nations that are working together to build the ISS on a world map.
 3. If students have other questions about the ISS, challenge them find answers at the following Web sites:
 - DiscoverySchool.com: Space-Age Living
<http://school.discovery.com/schooladventures/spacestation/>
 - NASA: International Space Station
<http://spaceflight.nasa.gov/station/index.html>
 - Living in Space
<http://spaceflight.nasa.gov/living/index.html>
 - International Space Station
http://www.shuttlepresskit.com/ISS_OVR/
 4. Next, ask students what they think it is like to live in space. Begin with a brief discussion of microgravity, the weightless environment of the ISS. Have them consider everyday activities, like eating, taking a shower, and using the bathroom. What might be some challenges of living on the ISS? Tell the class that they will be working in groups and using the Internet or other resource materials to answer questions about living in space.
 5. Divide the class into five groups and explain that each group will explore one aspect of daily living in space, such as food, clothing, and sleep. Assign each group to one of the topics below and give each group the research questions and Web resources. Explain that each group will use the Web resources provided to answer questions. The Web sites listed above may also be helpful in their research.

Group 1: Food

Research Questions

- How has the food that astronauts eat changed over the last 50 years?
- What kinds of foods do astronauts eat in space today?
- What methods are used to prevent food from spoiling?
- If you lived in space for a month, what foods do you think you would miss the most? Why?

Web Resources

- Space Food
<http://spaceflight.nasa.gov/living/spacefood/index.html>



- Eating in Space
http://www.pbs.org/spacestation/station/living_eating.htm
- Top 5 Foods Astronauts Request
<http://www.timeforkids.com/TFK/magazines/story/0,6277,55034,00.html>

Group 2: Space Suits

Research Questions

- What are the main parts of a space suit? How do they work?
- Do astronauts have to wear the space suits all the time? Why or why not?
- What are some safety measures that are built into space suits?
- Do you think space suits are comfortable? Why or why not?

Web Resources

- Space Wear
<http://spaceflight.nasa.gov/living/spacewear/index.html>
- Space Suits
http://www.pbs.org/spacestation/station/living_spacesuit.htm
- The Space Suit (history)
<http://www.hq.nasa.gov/office/pao/History/SP-4026/noord47.html>

Group 3: Extraterrestrial Experiments

Research Questions

- What are some examples of experiments that are conducted on the ISS?
- What do scientists hope to learn about life in space?
- How do scientists conduct controlled experiments in space?
- Name two findings that have emerged from experiments done in space.

Web Resources

- Space Work
<http://spaceflight.nasa.gov/living/spacework/index.html>
- Space Station Science
<http://spaceflight.nasa.gov/station/science/index.html>
- Space Research: Research on Station
http://spaceresearch.nasa.gov/research_projects/ros/ros.html
- Space Station User's Guide: Science and Utilization
<http://www.spaceref.com/iss/science.html>

Group 4: Sanitation in Space

Research Questions

- How do astronauts shower and use the bathroom in space?
- Do they have to wash dishes or laundry?
- How do they keep their living quarters clean?
- What special sanitation issues do astronauts face that those of us on Earth don't worry about?

Web Resources

- Sanitation
http://www.pbs.org/spacestation/station/living_sanitation.htm
- Life in Space (click Hygiene)
<http://spaceflight.nasa.gov/living/index.html>
- Housekeeping on the ISS
<http://spaceflight.nasa.gov/living/factsheets/housekeeping.html>

Group 5: Sleep and Relaxation

Research Questions

- Do astronauts require more or less sleep than normal when they are in space?
- How many hours of sleep do astronauts usually get each night?
- How do astronauts relax in space?
- Do astronauts sleep in a bed? If they do not, how do they sleep?

Web Resources

- Recreation and Sleeping
http://www.pbs.org/spacestation/station/living_sleeping.htm
- Space Sleep
<http://spaceflight.nasa.gov/living/spacesleep/index.html>
- Space Fun
<http://spaceflight.nasa.gov/living/spacefun/index.html>

6. After completing the research and answering all their research questions, have each group present its findings to the class. Encourage students to take notes on every aspect of space age living as they listen to the other groups' presentations.
7. As a follow-up homework assignment, ask students to use what they learned from the presentations to complete the following essay: Imagine that you were the first kid selected to spend a week in space. Write a short story about what you think your experience would be like. Include information about the food you would eat, the clothes you would wear, the way you would sleep, how you would use the bathroom, and what you might do for fun. What would



happen if you got into an argument with another astronaut? How would you settle differences? You may want to include a discussion of the preparation and training you received before launching.

Discussion Questions

1. What are some of the challenges astronauts face living in a microgravity environment?
2. Why must the ISS be constructed in space rather than on the surface of a planet?
3. What was the space race? What factors led to the United States and Russia collaborating on the ISS?
4. Who first suggested the idea of creating the ISS? Has it always been called the "International Space Station?" If not, what was its former name?
5. If astronauts traveled to Mars, they would be away from Earth for more than a year. What problems do you think being in space for a year would cause? For example, would the astronauts face health problems, and would the equipment be able to remain in space for so long without maintenance? What could be done to address these and other problems?
6. The cost of completing the ISS will exceed \$60 billion. Do you think that the benefits of this project justify this astronomical cost? If not, how would you recommend this money be spent?

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- 3 points: Students worked effectively in their groups, researched all their questions thoroughly and accurately; presented their findings to the class in an interesting and creative way; and wrote convincing, accurate essays about a week in space.
- 2 points: Students worked somewhat effectively in their groups, researched most of their questions thoroughly and accurately, presented their findings to the class in a satisfactory way, and wrote a satisfactory essay about a week in space.
- 1 point: Students did not work very effectively in their groups, researched one question thoroughly and accurately, presented some information to the class, and wrote a few sentences about a week in space.

Vocabulary

cosmonaut

Definition: A Russian astronaut.

Context: On April 12, 1961, cosmonaut Yuri A. Gagarin of the Soviet Union became the first person to travel in space.

gravity

Definition: The force of attraction between objects.



Context: The farther away an object, such as a spacecraft, gets from Earth, the less effect the Earth's gravity has on it.

microgravity

Definition: A very low gravity environment, which causes people and objects to be practically weightless.

Context: During the first few days on the ISS, the effects of microgravity caused some astronauts to feel nauseous.

space shuttle

Definition: Spaceships that take off and land like airplanes and are designed to be used for up to 100 missions.

Context: In 1993, a crew from the space shuttle *Endeavour* repaired the orbiting Hubble space telescope.

Academic Standards

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/compendium/browse.asp>.

This lesson plan addresses the following national standards:

- Technology: Understands the relationships among science, technology, society, and the individual.
- Technology: Understands the nature of technological design.

National Academy of Sciences

The National Academy of Sciences provides guidelines for teaching science in grades K-12 to promote scientific literacy. To view the standards, visit this Web site: <http://books.nap.edu/html/nses/html/overview.html#content>.

This lesson plan addresses the following national standards:

- Earth Science: Earth in the solar system
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>
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