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First Secondary
English Language
Lesson title: Life in Space: International Space Station
Grade level: 1st secondary class
Duration: 3 class periods
Objectives:
Students will understand the following:
1. 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.
2. ISS inhabitants perform the daily functions of life in space using special products and procedures.
Materials:
For the class:
• Computers with Internet access (optional but very helpful)
• Additional reference materials on the ISS
Each group of three or four students will need the following:
• Large sheets of paper
• Construction paper
• Colored markers
Each student will need the following:
• Pencils
• Paper
• One copy of Classroom Activity Sheet: How Do Astronauts Live in Space?
• One copy of Take-Home Sheet: A Week in Space
This lesson can be enhanced by purchasing a copy of the documentary *The International Space Station* from our School Store.
Procedures:.2
1. Begin the lesson by asking students what they already know about the IS 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. If students have other questions about the ISS, have them find answers in the following http://www.shuttlepresskit.com/ISS
3. 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.
4. Divide the class into five groups and give each group a set of questions outlined below. Each group will use the Web resources provided to answer questions. All the questions relate to the daily life of astronauts and cosmonauts in space. Students should record their findings on the Classroom Activity Sheet: How Do Astronauts Live in Space?

Group 1: Food

• 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?.3
• If you lived in space for a month, what foods do you think you would miss the most? Why?

Web Resources

Frankfurters in Orbit
http://www.spacekids.com/missions/food_sts106_000828
Top 5 Foods Astronauts Request
http://www.timeforkids.com/TFK/magazines/story/0,6277,55034,00
Eating in Space
http://www.pbs.org/spacestation/station/living_eating

Group 2: Space Suits

• 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 Suit: How it Works
http://www.utc.com/discover/hiw-emu
Space Suits
http://www.pbs.org/spacestation/station/living_spacesuit
The Space Suit (history)
http://www.hq.nasa.gov/office/pao/History/SP-4026/noord47
What is It Like to Wear a Space Suit?
http://www.itss.raytheon.com/cafe/qadir/q2470

Group 3: Extraterrestrial Experiments

• 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

Home in the Sky: International Space Station
http://www.discovery.com/stories/science/spacestation/spacestation
NASA Watch
http://www.nasawatch.com/station.news

Group 4: Sanitation in Space

• 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?
•
about?

Web Resources

Three Bedrooms, One Bath, Great Neighborhood (article)
http://www.spacekids.com/missions/ISS_next_000828
Sanitation
http://www.pbs.org/spacestation/station/living_sanitation

Group 5: Sleep and Relaxation

• 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

4. After completing the research and filling out the classroom sheet, have each group present its findings to the class. Students should use their Classroom Activity Sheet to take notes. As a follow-up homework assignment, assign the Take-Home Activity Sheet: A Week in Space. Students should use what they learned from the presentations to complete their essays.

Books about the ISS

The International Space Station
Franklyn Mansfield Branley. HarperCollins, 2000.
The International Space Station
Wolfgang Englehardt. Tessloff Publishers, 1998.
Space Station Science
Marianne J. Dyson. Scholastic Inc., 1999..5

Web Sites on the ISS

If students need additional resources, they may be interested in visiting the following Web sites:

What is ISS?
http://www.spacekids.com/spacenews/ISS_overview_000419
NASA International Space Station
http://spaceflight.nasa.gov/station/index
Our Base in Space
http://www.timeforkids.com/TFK/magazines/story/0,6277,55023,00
City in Space: International Space Station
http://www.cnn.com/SPECIALS/space/station/briefing
Earth from Space: An Astronauts View of the Planet
http://earth.jsc.nasa.gov
NASA Spacelink: An Aeronautics & Space Resource for Education

http://spacelink.nasa.gov/.index
NASA Spacelink on the International Space Station
http://spacelink.nasa.gov/NASA.Projects/Human.Exploration.and.Development.of.Space/Human Space.Flight/International.Space.Station/.index
Lesson Plan on the Space Shuttle
http://school.discovery.com/lessonplans/programs/thespaceshuttle
100 th Space Shuttle Mission a Success
http://www.timeforkids.com/TFK/news/related/0,6418,58563,00

Adaptation for older students:

Forty years ago, during the space race between the United States and the Soviet Union, no one could imagine that in the 1990s Russians and Americans would be collaborating on a space station. Have high school students research the history of the space age, focusing on the relationship between the United States and the Soviet Union. Make sure students discuss the role of competition between the two countries. In what ways did this competition improve space technology? How did the competition interfere with progress? Students can write a research paper on their findings or make a presentation to the class..6

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

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?

Evaluation:

Students should be able to work cooperatively in groups; research their questions thoroughly and accurately; make an interesting presentation to the class; and write accurate, lively essays about a week in space. Use the following three-point rubric to evaluate s
this lesson: Three 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.
Two 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.
One 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.

Extensions:

Check It Out!

The
population can see it. As it passes overhead, it looks like a bright, slowly moving star. It takes 3 to 4 minutes to cross the sky, traveling west to east. To find out more about the ISS,

students can access the following Web site, which gives real-
location:
http://spaceflight.nasa.gov/realdata/tracking/index.html>..7
Also, encourage students to look for the ISS as it flies over your area by visiting this Web site, which gives city-by-city information about ISS sightings:
http://spaceflight.nasa.gov/realdata/sightings/SSapplications/Post/SightingData/sighting_index

Space Spin-offs

Tools developed by NASA for its space missions often have applications on Earth. For example, cordless drills were developed for the Apollo missions. Another more whimsical example of technology transfer is space pens, which are sold in educational science stores. These pens are able to write when held upside-down, underwater, and in extreme temperatures, which make them useful to astronauts. Have students research other spin-offs from the space program. This Web site is a good place to learn more:
http://www.thespaceplace.com/nasa/spinoffs

Suggested Readings (If possible):

Space Station Science: Life in Free Fall

Marianne J. Dyson, Scholastic, 1999.

For some lucky individuals, the International Space Station may soon be both their home and their work address. This book describes what their lives will be like in the station - how they'll get there, the types of work they'll be doing, and even how they'll accomplish simple things like eating and sleeping while weightless. This book is filled with photographs of past space missions, interviews with astronauts, and experiments you can do on earth.

Off the Planet: Surviving Five Perilous Months Aboard the Space Station Mir

Jerry M. Linenger, McGraw-Hill, 2000.

This is an amazing true-life adventure, or perhaps horror story, told by a U.S. astronaut who spent five incredibly perilous months on the Russian space station, Mir. The crew survived failing equipment, power outages, a near collision, and even a fire. It's a fast-paced story told in a personal way by a man who lived through one of the most dangerous missions ever..8

Web Links:

Enter the Space Station

Take a 360-degree virtual tour of the International Space Station's Zvezda Servie Module and the Zarya Module at Discovery Online's multimedia web site.
http://www.discovery.com/stories/science/iss/enterstation

Track the Space Station

Discovery Online provides up-to-the-minute information on where the Space Station is in its orbit, with maps and a tracking system that lets you know when and where to look for the ISS as it passes over your own backyard.
http://www.discovery.com/stories/science/iss/trackstation

ISS Interactives

Suit up and take a virtual walk in space, see exclusive video from the ISS, and learn how the international community came together to make the ISS at this highly interactive web site from Discovery Online.
http://www.discovery.com/stories/science/iss/interactives

Life In Space: The International Space Station

Discovery Online treats you to a fully interactive multimedia web site with everything you ever wanted to know about the International Space Station. This is your first stop for info on the ISS!
http://www.discovery.com/stories/science/iss/iss

To download the model of the International Space Station!

Download templates and cut out parts for assembling your very own colorful 3-D model of the International Space Station.
http://www.marscenter.it/iss/download_iss