

Space Living and Research

Lesson Overview

In this activity, students will investigate the life of an astronaut living in space and conducting research on the International Space Station (ISS). Students will conduct in-depth research about one specific aspect of the ISS, choosing one of: the main structural parts and functions of the ISS, the astronauts who currently live there, preparations for space exploration, traveling conditions on a space shuttle, living conditions on the ISS, and current scientific research studies taking place on the ISS. Students will create multimedia presentations about their chosen topic.

Objectives

- Learn how the ISS is used for space living and research
- Using multiple sources, conduct in-depth research about one specific aspect of the ISS: the main structural parts and functions of the ISS, the astronauts who currently live there, preparations for space exploration, traveling conditions on a space shuttle, living conditions on the ISS, and current scientific research studies taking place on the ISS
- Create multimedia presentations about one aspect of the ISS

Standards

For state specific standards visit edu.zspace.com

Next Generation Science Standards

Earth and Space Science - Earth's Place in the Universe

- MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

Common Core Connections

- Language Arts
 - RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
 - RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
 - SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

Grade level: 4-6

Lesson Time: 150 minutes

Key Terms:

Artificial
Dock
Galley
Habitation modules
International Space Station
Microgravity
Module
Satellite
Shuttle
Solar array
Thermal control panels

Resources:

Space Living and Research worksheet
Answer Key

Materials needed:

Research materials
Presentation materials
(poster boards, PowerPoint, chart paper, model supplies, etc.)

Differentiation (Δ)

- Allow students to provide answers that are handwritten, typed, or verbal
- Give students a variety of presentation styles to choose from (using charts/graphs, PowerPoint, making 3D presentations, creating videos/movies, making posters)

Introduction

The teacher will ask the students to imagine that they are astronauts living in space and conducting research on the International Space Station. The teacher will pose several questions: What preparations would you need to make before traveling? How would you get there and how long would it take? What would your living conditions be like? How would living in space differ from living here on Earth? What kinds of scientific research would you conduct in space?

Activity

Space Living and Research

This section will be completed in Studio along with the Space Living and Research worksheet.

Scene 1

Astronauts live in space on the International Space Station, or ISS. This habitable satellite was launched in 1998 with the primary goal to conduct research regarding the feasibility of humans living in space.

Scene 2

Let's first take a closer look at where the ISS resides in our atmosphere.

- Use the Dissect stylus mode to slowly remove the layers of the Earth's atmosphere.
- In which layer does the ISS reside?

Scene 3

Astronauts used to take a space shuttle like this one to the ISS.

- Use the Dissect stylus mode to analyze the parts of the space shuttle.
- How do astronauts get to the ISS now?

Scene 4

Now let's take a closer look at the ISS.

- Analyze the main parts of the ISS.
- Use the Straight Ruler tool to measure the dimensions of the ISS. Take a screenshot of the length and width of the ISS.

Hint 1: The length of the ISS is the longest distance across the truss, or backbone, of the ISS.

Hint 2: The width of the ISS is the distance from the top of one array to the bottom of another (when the solar arrays are laying parallel to the modules).

Scene 5

Imagine what it would be like to live on the ISS for an extended period of time. To date, the longest mission duration on the ISS has been 7 months and 3 days.

- Add an astronaut model to the scene.
- Click on the Show/Hide Scale icon and select the Relative Size icon. This gives you an idea of how large the ISS really is.
- Could you be the next astronaut in this photo?

Small Group Research and Presentations

Students will work in small groups to conduct in-depth research about one aspect of the ISS: the main structural parts and functions of the ISS, the astronauts who currently live there, preparations for space exploration, traveling conditions on a space shuttle, living conditions on the ISS, or current scientific research studies taking place on the ISS. Students will create multimedia presentations using Studio, PowerPoint, or similar application, and add visual displays such as posters, charts, diagrams, photos, videos, and models to clarify information, strengthen claims and evidence, and add interest. Students will share these presentations the the rest of the class.

Closing

After listening to the group presentations, students will share what they like about other group presentations. Students will also share what they learned about the ISS.

Questions for Discussion

1. What are some things that you learned about the International Space Station?

Answers will vary. Sample Answer: I learned that the astronauts on the ISS conduct lots of scientific research about the feasibility of living in space.

2. How is living in space different from living on Earth?

Answers will vary. Sample Answer: When you live in space, you are affected by microgravity, or weightlessness. On Earth, we are affected by gravity.

3. What factors would be the hardest for you about living in space? Why?

Answers will vary. Sample Answer: The hardest part for me about living in space would be being away from my family for such a long period of time. I would miss them a lot.

4. Based on your research, do you think that you would enjoy being an astronaut living and researching in space on the ISS? Why or why not?

Answers will vary. Sample Answer: I would enjoy being an astronaut living and researching in space because I would be able to make ground-breaking discoveries in science. It would be a once-in-a-lifetime experience that would give me a new perspective on the Earth and our place in the universe.

Δ Investigate Further

Extension Activity: Students could build scale models of the ISS and present their models to the class.

Extension Activity: Student could complete various engineering activities related to living in space, such as designing a lunar thermos, building a solar oven, and designing a device to eat food in microgravity.

Answer Key

Activity Questions Provided in Studio

1. In which layer of the Earth's atmosphere does the ISS reside? Why does the ISS orbit Earth and not float away into outer space?

Answers will vary. Sample Answer: The ISS resides in the thermosphere. The Earth's gravity keeps the ISS orbiting approximately 360-475 km above the Earth's surface.

2. Name some of the major structures of the space shuttle. What do you think are their functions?

Answers will vary. Sample Answer: The space shuttle consists of three main structures: the orbiter vehicle, a pair of solid rocket boosters, and an external tank. The orbiter vehicle is the reusable space plane that carries astronauts and payloads into space and back to the Earth. The solid rocket boosters are used during the first two minutes of flight and provide 83% of liftoff thrust for the space shuttle. The external tank provides the liquid hydrogen fuel and liquid oxygen oxidizer necessary for liftoff and ascent.

3. Currently, how do astronauts travel to the ISS?

Answers will vary. Sample Answer: Astronauts now travel to the ISS in rockets.

4. What kind of preparations do you think astronauts need to make before taking off?

Answers will vary. Sample Answer: Astronauts need to prepare and train for space missions by undergoing medical testing, physical training, procedural training, and much more. They need to know about the special conditions and environments that they will encounter during space travel and living.

5. Do you think the traveling conditions in a space shuttle or rocket are the same or different from an airplane? How?

Answers will vary. Sample Answer: The traveling conditions in a space shuttle or rocket would be very different from an airplane for many reasons. Their liftoff and speeds are very different. Airplanes take off relatively slowly and reach speeds of approximately 500 mph. Shuttles and rockets take off quickly using their rocket boosters for liftoff and reach speeds of approximately 17,500 mph. Also, astronauts traveling through space would experience microgravity (weightlessness), a condition which doesn't occur on regular airplanes.

6. Name some of the major structures of the ISS. What do you think are their functions?

Answers will vary. Sample Answer: Habitation modules are the main living quarters which include a galley, toilet, shower, bed, and medical facilities. Research modules are where the astronauts conduct research. Solar arrays provide electrical power to the ISS from the sun. Thermal control panels maintain the correct temperature equilibrium onboard the ISS. The docking compartment is a port for visiting spacecraft to attach to the ISS and create a tight airlock for people and cargo to travel safely through.

7. What is the approximate length and width of the ISS? Hint: The length is the longest distance across the truss, or backbone, of the ISS. The width is the distance from the top of one array to the bottom of another.

Answers will vary. Sample Answer: The length of the ISS is approximately 108.5 m. The width is

approximately 72.8 m.

8. What science topics could you research in space that you wouldn't be able to do here on Earth?

Answers will vary. Sample Answer: The ISS provides astronauts with an environment to research the long term effects of microgravity. Astronauts are currently conducting research in the areas of astronomy, astrobiology, meteorology, life science, physical science, materials science, space weather, and space medicine.

Name _____ Date _____

Space Living and Research

Complete this worksheet as you view the Space Living and Research tour in Studio.

In which layer of the Earth's atmosphere does the ISS reside?

Name some of the major structures of the space shuttle. What do you think are their functions?

Currently, how do astronauts travel to the ISS?

What kind of preparations do you think astronauts need to make before taking off?

Do you think the traveling conditions in a space shuttle or rocket are the same or different from an airplane? How?

Name some of the major structures of the ISS. What do you think are their functions?

What is the approximate length and width of the ISS? Hint: The length is the longest distance across the truss, or backbone, of the ISS. The width is the distance from the top of one array to the bottom of another.

What science topics could you research in space that you wouldn't be able to do here on Earth?