AUDIENCE WITH AN ASTRONAUT
SPACE FOUNDATION

STEM ACTIVITY LESSON

FLUIDS IN SPACE

Explore the fascinating concept of fluid redistribution in space, uncovering how the absence of gravity affects the human body and delving into the unique physiological challenges faced by astronauts during their missions beyond Earth's confines.

Grade Level

3rd - 12th

Focus

Life Science, Physics, Space Science, Engineering

Standards

MS-LS1-3, MS-PS2-4

BACKGROUND
INFORMATION

Fluid redistribution in space is a crucial aspect of astronaut health. In the microgravity of space, bodily fluids, including blood and water, shift towards the upper body, leading to effects like facial puffiness and congestion. This phenomenon is vital to understand for long-duration space missions and informs the design of spacecraft, spacesuits, and medical countermeasures. It showcases the interdisciplinary nature of science, physics, and engineering in solving real-world problems in space exploration.

STUDENT REAL-LIFE
CONNECTIONS

- Have you ever experienced discomfort during a long car or plane journey? How might this relate to the way fluids shift in microgravity during space travel?
- When you're sick, do you notice changes like congestion or facial puffiness? How could this relate to how astronauts' bodies react to microgravity in space?
- Have you ever been to a swimming pool or a beach? How does your body feel lighter in the water? How is this sensation connected to the feeling of weightlessness experienced by astronauts in space?

LESSON
OBJECTIVES

- Describe the concept of fluid redistribution in a microgravity environment and explain how it differs from fluid distribution under Earth's gravity.
- Relate the observed changes in the straw and water levels during the activity to the challenges astronauts face in space, such as facial puffiness and altered fluid balance.

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MATERIALS

LIST

- Clear, flexible tubing (approximately 3 feet per group)
- Two clear plastic cups per group
- Food coloring (optional)
- Drinking straws
- Modeling clay or Play-Doh
- Rulers
- Timers or stopwatches

ACTIVITY

DIRECTIONS

Engage

- Begin the lesson by showing an image or video of astronauts in space or a spacecraft.
- Ask the students open-ended questions like, "What do you think happens to astronauts' bodies in space?" and "How does the lack of gravity affect the human body?"
- Encourage students to share their ideas and thoughts. This will spark their interest and curiosity about the topic.

Explore

- Divide the class into pairs or small groups.
- Provide each group with two clear plastic cups, water (colored with food coloring, if desired), a drinking straw, modeling clay or Play-Doh, a ruler, and a timer.
- Fill one cup with water, leaving it about 2/3 full.
- Instruct one student from each group to dip one end of the drinking straw into the water, ensuring it's wet.
- Have the other student seal the top of the straw with modeling clay or Play-Doh to create an airtight seal.
- Ask the students to gently tilt the cup with the sealed straw at an angle, representing microgravity conditions.
- Allow students to observe and record any changes in the water level inside the straw.

Explain

- Discuss the observations made during the activity. Guide students in drawing connections between the activity and how it simulates fluid redistribution in space.
- Explain the concept of fluid redistribution in space, such as how it can lead to facial puffiness and other physiological changes in astronauts.
- Encourage students to discuss the implications of these changes for long-duration space missions and the need for countermeasures.
- Provide a comprehensive explanation of fluid redistribution in space. Discuss why it happens and how it affects the human body.
- Highlight the role of gravity in fluid dynamics and the consequences of its absence in microgravity.
- Explain how fluid redistribution leads to physiological changes, such as facial puffiness, and its relevance to astronauts and space missions.

ACTIVITY

DIRECTIONS (CONT.)

Elaborate

- After understanding the concept of fluid redistribution, challenge the students to design and conduct a modification of the initial experiment.
- Instruct them to explore how different angles of tilt affect fluid movement in the straw or to investigate the effects of changing the diameter of the straw's opening.

Evaluate

- Assess students' understanding by having them share their observations and conclusions from the extension activity. Then, engage in a class discussion to review the lesson. Evaluate students' understanding by asking questions such as:
  - How did changing the angle or diameter in your extension experiment affect the movement of water in the straw?
  - What are the practical implications of understanding fluid redistribution in space?
  - How might engineers use this knowledge to design better spacesuits and spacecraft?
  - Can you think of any other factors that might impact fluid redistribution in space?