Goldie at Home Activity: Space! The Final Frontier

Activity Overview: Turn your eyes to the sky to explore the secrets of space with Goldie! Although many Iowans have studied astronomy (stars, planets, comets and galaxies) in the past, very few have actually spent time rocketing into space. This Goldie at Home activity looks at the impact exploring space can have on the human body. Due to gravity - or a lack thereof - environments are different between standing on the ground on Earth and performing a space walk on the moon. You will try different physical tests to see how a body changes and adapts due to reduced pressure and gravity - just like an astronaut.

Connection to Iowa History

Did you know that an Iowan currently holds the U.S. record for the most days in space? Peggy Whitson, born and raised on a farm in Beaconsfield, Iowa, spent a total of 665 days in space, and she placed eighth on the all-time space endurance list. Whitson studied biology and chemistry and she finally, after 10 years of applying, she was accepted into National Aeronautics and Space Administration's (NASA) astronaut program. Whitson would go on to serve as the first female commander of the International Space Station and complete 10 space walks, among many other accomplishments. From 2009 to 2012, she also was the chief of the Astronaut Office, which oversees all NASA astronaut activities, including crew selection and training. She was the first woman and the first civilian to hold that position. Whitson retired from NASA in 2018.

Instructions

This activity will need at least two people. One person will be the test subject and the other will be the record keeper.

1. Before beginning this activity, use the provided worksheet to write down your predictions about what happens to the human body while in space.
2. Select one person to be the test subject. On the test subject's leg, make three marks in different places either with washable marker or masking tape; one mark needs to be at the calf. In the next steps, you will be measuring around the test subject's leg, or the circumference of the leg at the marked points.
3. Measure the distance around the subject's leg at the marked locations with measuring tape or string and note the measurements on the worksheet. This is the control number, or what the other numbers will be measured against.
4. Next, the test subject needs to lie on their back with their legs and feet extended toward the ceiling at a 90-degree angle for 10 minutes. It may help to prop the test subject's legs against a piece of furniture or against a wall. Write down predictions about what will happen to their leg measurements after being elevated on the worksheet.

Instructions continued on the next page

Materials

- Measuring tape or string
- Ruler, if using string
- Washable marker or masking tape
- Timer

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Instructions continued

5. At the end of the 10 minutes, the subject should remain in the same position. The record keeper will measure all three marked places on the leg again. Record the new measurements on the worksheet.

6. Repeat steps 2-5 with your partner, who switches into the test subject role.

7. After you have gathered the leg measurements, compare your results and discuss your findings.

8. **Questions to Spark Learning**

Peggy Whitson's Flight Suit

- This flight suit is made from nylon and elastic (cord, tape or fabric, woven with strips of rubber, which returns to its original length or shape after being stretched). Why do you think it is made from this material?
- Looking at the flight suit, why do you think it has so many pockets? Why might that be important for an astronaut?
- Why do you think astronauts need a flight suit? Why do you think they cannot wear everyday clothes while in space?

9. **Peggy Whitson's Flight Patch/Insignia**

- What do you notice about the patch? What is significant about the what you see?
- Why do you think the patch is written in both English and Russian?
- Why would wearing a patch like this be important while working on the International Space Station?

10. **Further Research**

If you have more time to explore more about Peggy Whitson, space exploration and the impact it has on the human body, try these additional resources:

- To discover other resources about Peggy Whitson, check out the State Historical Society of Iowa's **Primary Source Set - Iowa's Connection to the World**.
- Look through the **"Finding Our Place in the Cosmos: From Galileo to Sagan and Beyond"** primary source collection from the Library of Congress. This collection explores changing models of the universe through time, ideas of life on other words and Carl Sagan's place in the tradition of science. It features manuscripts, rare books, celestial atlases, newspaper articles, sheet music and movie posters.
- Check out **NASA's Kids Club** to discover space-based games for children pre-K through 4th grade. **NASA's Space Place website** will inspire and enrich upper-elementary-aged kids' learning of space and Earth science online through fun games, hands-on activities, informative articles and engaging short videos.
- Space has an intriguing impact on the human body. Use **NASA's Human Research Program** to explore the ways humans are impacted by spending time in space.

Goldie at Home: Space! The Final Frontier Worksheet

Prepare for takeoff as you explore the impact space has on the astronauts who dare to explore it. You will perform an experiment at home to observe the impact gravity has on the human body.

Pre-Activity Questions

- How do you think a human body changes when leaving Earth and heading into space?

- Why do you think there would be differences between Earth and space?

First Leg Measurements (Test Subject Control)

Location #1 (Calf)	Location #2	Location #3

First Prediction

- How do you think the leg will change after being elevated for 10 minutes?

Second Leg Measurements (While still elevated, at end of time)

Location #1 (Calf)	Location #2	Location #3

Goldie at Home: Space! The Final Frontier Worksheet

Difference Between First and Second Leg Measurements

Location #1 (Calf)	Location #2	Location #3

Final Thoughts

- Were your first predictions correct? Why or why not?

- What do you think would happen if you added more time to the experiment?