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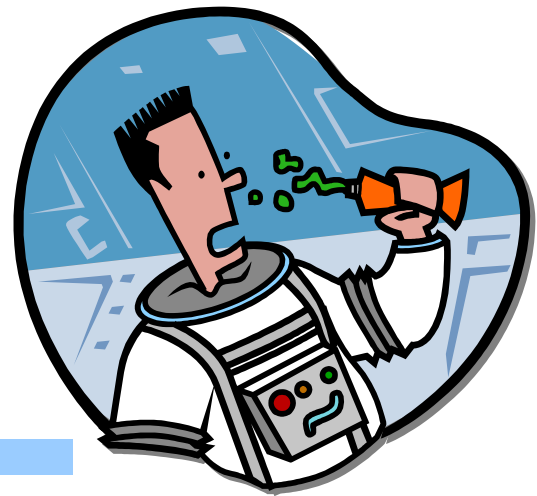
LIVING IN SPACE/ NEWTON IN SPACE

LANDMARK MEDIA

1998

Grade Levels: 5-8

23 minutes



DESCRIPTION

In the first segment, a shuttle astronaut compares eating, sleeping, bathing, and working and relaxing in space with life on earth. The second segment focuses on Newton's three laws of motion as the astronaut demonstrates them with cans of pudding.

ACADEMIC STANDARDS

Subject Area: Science: Physical Sciences

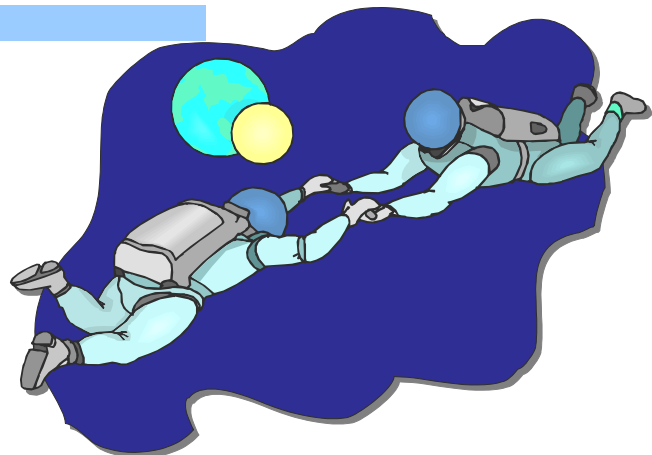
- Standard: Understands forces and motion
 - Benchmark: Knows that the Earth's gravity pulls any object toward it without touching it
 - Benchmark: Knows that when a force is applied to an object, the object either speeds up, slows down, or goes in a different direction
 - Benchmark: Knows the relationship between the strength of a force and its effect on an object (e.g., the greater the force, the greater the change in motion; the more massive the object, the smaller the effect of a given force)

INSTRUCTIONAL GOALS

1. To show the effects of gravity in space.
2. To examine how life in space compares with everyday routine on Earth.
3. To demonstrate how Newton's three laws of motion affect space travel.

VOCABULARY

1. convection oven
2. disposed
3. personal needs
4. retrieve
5. macadamia nut
6. free-fall orbit
7. exerted
8. mass
9. compelled
10. acceleration
11. formula



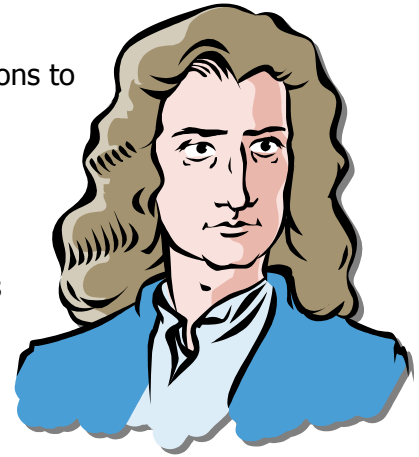
BEFORE SHOWING

Living in Space

1. Display pictures of famous astronauts and space events. Discuss their importance in history.
2. Display examples of various kinds of common foods and beverages. Discuss which are appropriate for eating in space and which are not.

Newton in Space

1. Show a picture of Sir Isaac Newton. Briefly explain his contributions to science by using a time line.
2. Discuss examples that apply to Newton's three laws of motion.
 - a. Roll a ball on the floor. What happens to the ball?
 - b. Push an empty wagon and an identical wagon that is full of books with the same force. Which wagon moves faster?
 - c. Jump off a skateboard while it is still moving. What happens to the skateboard?



DURING SHOWING

Living in Space

Discussion Items and Questions

1. View the video more than once, with one showing uninterrupted.
2. Pause at the section showing the boy dropping the ball as he jumps on the trampoline. Discuss how this implies to space travel.
3. Pause after each scene showing routine activities on Earth. Predict how these activities are performed in outer space. What adaptations need to be made?

Newton in Space


1. View the video more than once, with one showing uninterrupted.
2. Pause after the section showing a lengthy explanation of the first law of motion. Write a simpler explanation.
3. Pause at the scene showing the equations used to explain the acceleration rates of the two cans of pudding.
 - a. Use capital letters to show the larger mass and faster acceleration.
 - b. Use lowercase letters to show the smaller mass and slower acceleration.
 - c. Use the same-size letter to show that the forces applied were equal.

AFTER SHOWING

Living in Space

Discussion Items and Questions

1. How do the astronauts warm their food?
2. Where do the astronauts keep their belongings and other objects in the spacecraft so they won't float away?
3. What do the astronauts call the toilet on the spacecraft?
4. How does waste stay on the bottom of the toilet until it can be disposed?
5. How is urine collected?

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6. Why can't astronauts take showers in space?
 7. How do they take a bath?
 8. How do they wash their hair without water?
 9. What kinds of foods might the astronauts have for breakfast?
 10. What are some typical jobs that might need to be performed on a shuttle?
 11. Why is exercise very important for astronauts traveling in space?
 12. What kinds of activities are performed for relaxation in space?

Applications and Activities

1. Keep a diary or journal of an imaginary 6-day space flight.
2. Research some of the adverse effects of weightlessness on astronauts and how they are treated.
3. Report on food preparation and planning for space flights.
4. In the video, the astronaut's faces look puffy.
 - a. Research the effect of weightlessness on body fluids.
 - b. Make illustrations to show the placement of body fluids before and during the space flight.
5. Make a list of activities that would be appropriate for relaxation during a space flight.
6. The amount of space inside the spacecraft is very limited.
 - a. Investigate to find the approximate dimensions of a common spacecraft.
 - b. Rope off the same area in the classroom and set up an imaginary work station.
 - c. Set up jobs for seven people to do inside the small area.
 - d. Observe the activities and take notes of problems seen. Suggest ways for doing these jobs more efficiently.
7. Weightlessness makes some jobs on the space shuttle difficult. List other jobs that are made easier by weightlessness.
8. Make space food by placing pudding in a self-sealing sandwich bag.
 - a. Punch a hole in the bag and eat the pudding through the hole.
 - b. Record the time it takes to eat pudding.

Newton in Space

Discussion Items and Questions

1. How do the weights of the can of pudding and the macadamia nut compare on Earth?
2. How much less do the can of pudding and the macadamia nut weigh on the moon?
3. Why do they weigh less on the moon than they do on Earth?
4. How much do the can of pudding and the nut weigh in space?
5. What is *mass*?
6. Is the mass of an object the same no matter where it is?
7. Why did the can of pudding hit the astronaut with more force than the nut?
8. How many years ago did Sir Isaac Newton come up with a formula to explain motion?
9. What is the *first law of motion*?
10. What example is used in the video to explain the first law of motion?
11. What is the *second law of motion*?
12. What is *force*?
13. What is *acceleration*?
14. What example did the astronaut use to explain the second law of motion?
15. How does mass affect acceleration?

16. When force was applied to the two cans of pudding, one moved faster than the other. Why?
17. What is the *third law of motion*?
18. How did the astronauts demonstrate the third law of motion?

Applications and Activities

1. Using conversion formulas, change the following to miles and miles per hour.
2. We are 260 kilometers above the Earth.
3. We are traveling at 8 kilometers per hour.
4. Make a list of common activities that demonstrate each of the three laws of motion. Demonstrate each activity and tell to which law it applies.
5. Produce a slide show presentation on the life of Sir Isaac Newton and his contributions to science.
6. Research and report on the gravitational pull of the other planets. Will objects weigh more or less on them?
7. Make a wall-size poster illustrating each of the laws of motion.

RELATED RESOURCES



Captioned Media Program

- Let's Move It: Newton's Laws of Motion #2405
- Promise You'll Take Me With... #2103
- Sir Isaac Newton: The Gravity of Genius #8355
- Space Basics #9286



World Wide Web

The following Web sites complement the contents of this guide; they were selected by professionals who have experience in teaching deaf and hard of hearing students. Every effort was made to select accurate, educationally relevant, and "kid safe" sites. However, teachers should preview them before use. The U.S. Department of Education, the National Association of the Deaf, and the Captioned Media Program do not endorse the sites and are not responsible for their content.

• LIFTOFF TO SPACE EXPLORATION

<http://liftoff.msfc.nasa.gov/>

Contains a section on the human journey which includes information about eating, sleeping, and exercising in space.

• LIVING IN SPACE

http://www.abhisheksood.50megs.com/living_in_space.htm

Includes information such as protecting against the danger of space, microgravity, meeting basic needs, and working in space.

• NEWTON'S THIRD LAW OF MOTION

<http://www.iit.edu/~smile/ph9608.html>

Contains a lab activity designed for grades 4-6 that demonstrates the action-reaction concept of Newton's third law.