



Lesson: Micro-Gravity and Forces in Space

Grade level: K-5

Lesson duration: 30 minutes

Kit materials:

Gloves

Puzzles

Jacobs ladders

Slinkys

Yo-yos

Basketball hoop and foam ball

Microgravity spinner

Images of floating astronauts

Jar with lid

"Toys in Space" DVD program (on the *Exploring Science...As Only NASA Can* DVD)

Lesson objectives:

- Students will learn that accomplishing regular tasks can be difficult when there is no gravity
- Students will understand that gravity is missing both outside and inside a space shuttle or space station
- Students will understand what friction is, and that lack of friction in outer space makes it difficult to stop an object that is already moving

Lesson preparation:

- Set up stations around the room, with one toy per station

Lesson procedure:

1. **Tell the students that in space, astronauts live in a world without gravity. Show the group pictures of astronauts floating in the space station to enforce this idea. Tell the group that when astronauts work on the ship or do repairs, simple tasks can become quite difficult.**
2. Gravity is a universal force on Earth and affects everything. If you drop a cup of pudding on Earth, it falls to the floor. Without gravity, objects would float off into space. If an astronaut drops a cup of pudding in the Space Shuttle or the International Space Station, it falls too, but doesn't look like it's falling. That's because the pudding, the astronauts, and the spacecraft are all falling together at the same rate, while at the same time traveling around the Earth.

Since they're all falling, objects appear to floating a state of "microgravity" in which the effects of gravity seem reduced to almost nothing. Gravity tries to pull the spacecraft to the Earth, but it is traveling so fast that it falls around the Earth, in a path we call an "orbit."

Items such as food, science experiments, and exercise equipment must all be attached to the spacecraft so they don't float around in the cabins. Astronauts float too. When they want to stay still enough to eat, work, exercise, or sleep, astronauts hold onto one of the many handles or attach themselves to the spacecraft.

3. **Demonstrate how to sit on the anti-gravity spinner. Have the students wear large gloves to simulate what a space suit would feel like. Each child will get the chance to try to unscrew a lid as they sit and spin! Explain that this is what it would be like to do this task on the Moon.**
4. **Ask students why they think it was harder to do this task than it would have been on Earth. Which new factors do astronauts need to think about in space?**
5. **Explain to students that one force that we deal with on Earth that is not a problem in space is friction.** Friction is the force that makes it difficult for one object to slide over another. Friction occurs when a surface has even the smallest hills and valleys. All surfaces have some type of bumps or grooves; there is no totally smooth surface.

When two surfaces touch, each of their hills and valleys rub against those of the other and cause friction. The rougher the surface, the more friction the object will create.

In space, there is no friction. This can pose a problem when astronauts are moving large objects. On Earth, when we push an object, the friction will slow it down until it eventually stops. In a microgravity environment, if you push an object, even nudge it a

little, the object continues to move, and is difficult to stop or even to change its direction.

- 6. Demonstrate friction to students by rolling one of the foam balls across the floor. After the ball has stopped on its own, ask them to think about what sports would be like if a ball just kept going and never stopped! Ask if they can think of a good way to test this.**
- 7. Tell students that you are going to play with some different toys, and think about how that toy might be different in space. Divide the class into five groups, and assign each of them to a station. Each group should brainstorm how their toy would function differently in outer space. If possible, show the parts of the “Toys in Space” DVD that correspond with that toy.**

Students may complete this activity with or without the heavy gloves on.