



Follow the Bouncing Ball

Overview

Children predict whether a ball on Earth or a ball on the Moon bounces higher when dropped (or thrown at the floor) and why. They simulate the experiment by dropping high- and regular-bounce balls from their shoulder height.

Activity Time

5 minutes

Type of Program

- Facilitated hands-on experience
- Station, presented in combination with related activities
- Passive program
- Demonstration by facilitator

Intended Audience

Families or other mixed-age groups, including children as young as 4 years old *with assistance from an older child, teen, or adult*
School-aged children ages 5–7 and 8–9
Tweens up to about age 13

What's the Point?

- Astronauts — and kids! — need to rest, relax, and have fun.
- Astronauts experienced less gravity on the Moon, so dropping a ball on the Moon would cause it to bounce much higher than on Earth.

Facility Needs

- 1 or more tables OR A small container or bag to hold the activity materials

Materials

For the Facilitator

- Follow the Bouncing Ball Facilitator Background Information* (below)
- Explore! Health in Space Discussion Guide* (below)

- Health in Space Correlations to National Standards***
www.lpi.usra.edu/explore/space_health/space_stations/standards.shtml

For Each Group of 1–3 Children

- 1 high-bounce ball
- 1 jacks ball or other low-bounce ball
- 1 permanent marker
- Follow the Bouncing Ball Children's Guide*

Not all high-bounce balls actually *are*. Test them to make sure! You may substitute other pairs of balls for high-bounce and jacks balls, as long as they bounce at noticeably different heights.

Preparation

Six months before the activity

- Determine the setup of your program, including any complementary activities or extensions that you'd like to combine with this activity. This activity may be offered as a brief learning experience on its own, as part of a longer facilitator-led program, or as a station in combination with other health- and space-related activities. For passive programs, plan to provide the materials at a table that can be visited by small groups or individuals. For facilitated programs, consider using an "icebreaker" activity to help the children get to know each other. If stations are set up, it is recommended that an adult or older child is present at each station to serve as a host and to prompt the children's thinking. Station hosts may also demonstrate and/or assist younger children in completing the activity.
- Prepare and distribute publicity materials for programs based on this activity. If possible, build on the children's knowledge by offering multiple science, technology, engineering, art, and mathematics (STEAM) programs.
- Pull supporting resources out of circulation to feature during the program. If possible, integrate online videos and website resources into the program. See the *Health in Space* resource lists at www.lpi.usra.edu/explore/space_health/resources for ideas!
- Review the *Beans in Space Facilitator Background Information* and *Explore! Health in Space Discussion Guide*.
- With a permanent marker, label the low-bounce ball "Earth" and the high-bounce ball "Moon."

The day before the activity

- Provide the balls and *Follow the Bouncing Ball Children's Guide* in a bag or bin, or place them at a table so that participants can access them.

Activity

1. Share ideas and knowledge.

- Introduce yourself. Help the children learn each other's names (if they don't know each other already).
- Use the *Explore! Health in Space Discussion Guide* to draw participants into the activity and frame the activity with the main message: Astronauts — and kids! — need to rest, relax, and have fun.
- Encourage the participants to first predict which ball would bounce higher: a ball dropped on the Earth or on the Moon.

2. Test how a ball bounces on the Moon compared with on the Earth. Explain that the Earth ball will *simulate* how a ball bounces on Earth and the other will *simulate* how a ball bounces on the Moon. Invite each participant to drop (or *gently* throw) the “Earth” and “Moon” balls from shoulder height and observe what happens.

3. Compare observations and connect them to the “real world.” Prompt the children to use their experiences bouncing the balls to decide whether Olympic athletes would be able to jump higher or not as high on the Moon as on Earth.

5. Conclude. Summarize that the Moon ball bounced higher and for longer than the Earth ball. This simulates Earth's greater force of gravity pulling on the ball more than the Moon's smaller force of gravity. The Moon's smaller force of gravity offers opportunities for fun!

(These steps are also described in the *Children's Guide*.)

Extensions

How Much Would you Weigh on Distant Planets?

<http://btc.montana.edu/ceres/html/Weight/weight1.htm>

Use movies of astronauts walking on the Moon, throwing a discus, jumping, and more from “Activity I - Exploration: Is there any gravity on the Moon?” as conversation-starters about whether or not there is gravity on the Moon.



Follow the Bouncing Ball

Facilitator Background Information

Astronauts have tried this experiment in space! When they drop a bouncy ball it doesn't go anywhere — it just hangs in space. But when they throw the ball at the floor, it bounces back at them and keeps going until it hits the wall of the Space Station! Then it bounces back and forth and back and forth. Very, very gradually it loses a little bit of energy each time it hits a wall. If the wall of the Space Station were not there for the ball to bounce off, the ball would keep going in space!

On Earth, that same bouncy ball, when dropped, would fall to the ground because gravity pulls it toward the center of the Earth. The same thing would happen on the Moon. On Earth, the ball would bounce back up to almost the height from which it was dropped, and then it would continue to bounce, each time a little less high until it stops. The ball loses a bit of energy with each bounce. On the Moon, with gravity 1/6th that of Earth, the ball would bounce higher, but more slowly and for longer.

So should future Olympics be hosted at the International Space Station or on the Moon? On the Moon, astronauts can jump higher than on Earth because of the lower gravity. On the Space Station, with little effort or use of energy, astronauts could jump infinitely high — unless they are stopped by a tether or the walls of the station!



Health in Space

Brief Discussion Guide

Draw participants into the activity and frame the activity with the main message:

Astronauts — and kids! — need to exercise to stay healthy. Use discussion to help them start to think about prior experiences and build new understandings about health and the importance of exercise —both on Earth and in space. Some conversation-starters are:

- Invite the children to tell another child or family member one thing that they do to stay healthy and one thing that an astronaut would do to stay healthy.
- Suggest that they think of the things they do every single day, starting with the minute they wake up to the very last thing they do at night. Ask which of those things, if they didn't *do* or *have* them on a regular basis, would *sooner* or *later* make them either physically sick — or just plain miserable. Answers will vary, but probably will include things like breathing, eating, sleeping, bathing, brushing your teeth, exercising and playing.
- Both kids and astronauts have to...
 - *Keep clean.* Cleanliness is an important factor for maintaining a healthy life! Bacteria can thrive in space as well as on Earth, particularly on unclean surfaces, and that includes your body! Colds can spread in space, just like they can on Earth; it is necessary for astronauts to stay clean to stay healthy. Being clean also makes you feel good! There are no showers or baths in space, so astronauts use wipes to keep their bodies clean.
 - *Sleep.* Children, particularly teenagers, need at least 8 hours of sleep each night. Astronauts also need to get enough sleep because, without sleep, it is difficult to think clearly.
 - *Have fun.* No matter what your age or location, fun — and relaxation — is important for good mental health. All people need time out — to rest, relax, and have fun. Astronauts and kids share a lot of fun things in common, like playing Frisbee, cards, guitar, juggling, tossing food and catching it in their mouths (or trying!), watching movies, listening to music, reading books, and sending e-mails to family and friends!
 - *Eat a well-balanced diet.* Meals should follow a schedule and be nutritious and well balanced. They should be rich in vitamins, minerals, and other nutrients, and should be balanced for calories/energy. Calcium, in particular, is an important mineral for both kids and astronauts to build and maintain bone mass. Another vital ingredient for health is drinking plenty of water. Without a healthy diet, we would not have the energy to work and play and we would be more susceptible to diseases.
 - *Eat foods that are rich in calcium and help healthy bones to grow and stay healthy.* Dairy foods, like cheese and yogurt, as well as broccoli and brussel sprouts have lots of calcium.
 - *Exercise.* Exercise keeps bones and muscles strong and keeps our heart — and brain! — healthy. Exercise helps keep astronauts' bones and muscles from weakening while they are in the reduced gravity conditions of space. You may want to mention to the children that "exercise" and "play" are not necessarily the same

- things. There can be overlap, but activities like video games could be considered play; doing jumping jacks for 30 minutes would be exercise.
- Protect ourselves from ultraviolet radiation. Too much exposure to UV radiation results in sunburn and skin diseases. A little UV radiation is needed by all humans, but we need to limit our exposure by using sun block, covering up with clothing and space suits, and wearing protective sunglasses and visors on our space helmets.