

3RD GRADE

THE EFFECT OF GRAVITY ON BOUNCY BALLS

Summary: Gravity is a force that pulls objects towards earth. In this lab, students compare balls of different mass, circumference, and material. Students predict which balls will bounce back the highest after dropped from a height of 1 meter. A graph helps students evaluate their data and see if they notice any trends in bounce back height for the three parameters that are being studied.

Intended Learning Outcomes for 3rd Grade:

- 1a. Observe simple objects and patterns and report their observations.
- 1c. Make simple predictions and inferences based upon observations.
- 1d. Compare things and events.
- 1e. Use instruments to measure length, temperature, volume, and weight using appropriate units.
- 1f. Conduct a simple investigation when given directions.
- 1h. Use observations to construct a reasonable explanation.
- 3a. Know science information specified for their grade level.
- 4a. Record data accurately when given the appropriate form and format.

Utah State Core Curriculum Tie:

Standard III Objective 2:

- a. Predict and observe what happens when a force is applied to an object.
- b. Compare and chart the relative effects of a force of the same strength on objects of different weight.

Standard IV Objective 1:

- a. Demonstrate that a force is required to overcome gravity.
- b. Use measurement to demonstrate that heavier objects require more force than lighter ones to overcome gravity.

Standard IV Objective 2:

- b. Observe, record, and compare the effect of gravity on several objects in motion.
- c. Pose questions about gravity and forces.

Preparation time: 30 min

Lesson time: 50 min

Small group size: works best with one adult for every 5 students

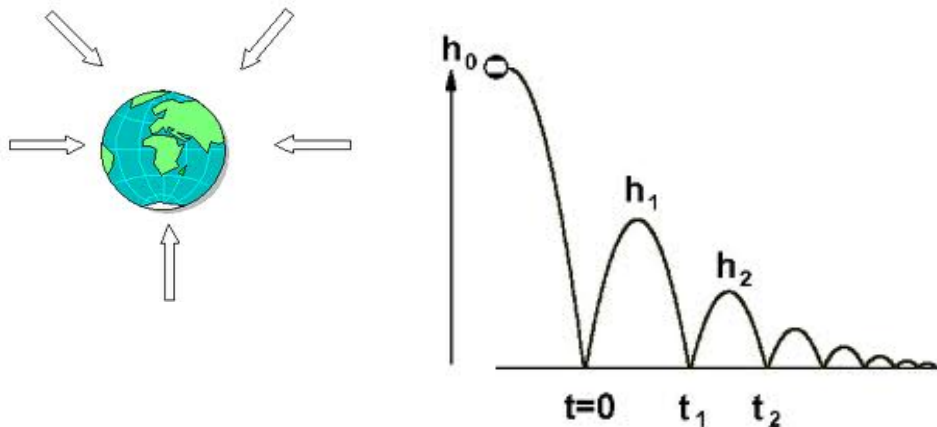
Materials:

- 1. bouncy balls: three sizes of the same type of ball per group (Zurcher's 48 ct bouncy balls for \$10.97)
- 2. balls from other materials: two per group such as ping pong balls, Styrofoam balls, marbles etc. Try and get some that are the same size as the bouncy balls so you can compare mass, size and material.

3. one balance per group with gram mass cubes (Gram mass cubes can be ordered from enasco.com TB16755M Set of 500 for \$12.50.)
4. one meter stick per group
5. graph paper and the student table

Background information:

Gravity is a pull force. Gravity is due to the Earth's rotation. The rotation causes an inward pull directed towards Earth's center. All objects are pulled to the center of our earth. Gravity exists between any two objects. The larger the objects the larger the effect seen by gravity. Earth is pulled by gravity towards the sun because the Sun has a larger mass. This pull causes the Earth to revolve around the Sun. We are pulled by gravity towards the Earth because the Earth has the larger mass.



We will drop balls from a standard height and observe which one bounces back the highest. None of the balls will bounce back to the starting height because gravity will counteract some of the force of the drop and pull the balls toward earth as they bounce back. In theory, the heavier the ball, the larger the force and the greater the bounce back. However, the material the ball is made of and the circumference of the ball also have an affect.

Pre-lab discussion: Ask the students what they know about gravity. Have them predict what happens when a Ping-Pong ball is dropped on the table. Drop the ball and discuss how the bounce gets smaller after each hit on the table. Eventually the ball stops bouncing because it runs out of energy. Discuss gravity and explain to the students that they are going to test which ball in their group can bounce back the highest.

Instructional procedure: If students are working in groups, it works well to have one student assigned to each ball. Each group should have the three different sized rubber balls and one or two non-rubber balls.

I. Measuring mass

1. For each of the balls write down their types and the material they are made of in the table.
2. Use the balance and write down the mass (in grams) of each of the balls.
3. Record this information on the data table.

II. Measuring the bounce back of the balls

1. Take one of the balls and use a meter stick to hold it 1 meter above the ground. Let it drop. **Why didn't the ball bounce back as high as it was dropped?** Gravity was pulling the ball towards the earth and that had an effect on how high the ball bounced back.
2. Have students predict which ball they think will bounce back the highest and explain why they think it will. Write their prediction on the chart. Drop each of the balls from 1 meter and write in the chart the height each ball came to when it bounced back up. You may need to practice this once or twice before you right down the final number. Add this information to the data table.
3. Ask the students the importance of starting each ball at the same height, deciding the height of the bounce back in the same way each time, and why they have to drop the ball and not push it down. Any other things that need to be controlled?
4. Make a graph that compares the mass to bounce back height. Place the mass on the x-axis and the bounce back height on the y-axis.
5. Look at the trend in the graph. Discuss the differences in the bounce backs with the rubber balls compared to the non-rubber ball. **Did the non-rubber ball follow the same rubber ball trend or was it different?**
6. **What is the force in this experiment?** The height from which the ball is dropped and its mass causes the force. The higher the height and heavier the ball, the stronger the force.
7. **Did heavier balls bounce back less high than lighter balls?** The higher the balls bounce back indicates an easier time and more force to overcome gravity.
8. **All balls had the same force applied because they were dropped from the same height. How come they didn't all bounce back the same?**