

# Bouncing Ball Physics

Grade Level: 3-5

Duration: 30-45 minutes

Classification: Classroom AND/OR STEM Spark

Subject(s): physics, science

Categories (STEM): Science

Keywords: physics, elasticity, newton's third law

## Introduction

- Summary: Students will study the concepts of elasticity and Newton's Third Law by testing the bounce height of three different types of balls.
- Description:
  - Students will break up into groups of 3 to 4 kids.
  - Each group will test three different types of balls at different heights.
  - The class will calculate the averages from their trials and compare their results with their hypothesis.

**Online Resource:** <https://www.education.com/science-fair/article/ball-bounce-higher-dropped-greater-height/#:~:text=Explanation%3A,returns%20to%20its%20original%20shape.>

## Vocabulary

- Elasticity = an object's ability to return to its original shape after being stretched or squeezed
- Newton's Third Law = for every action (force) in nature there is an equal and opposite reaction

## Materials

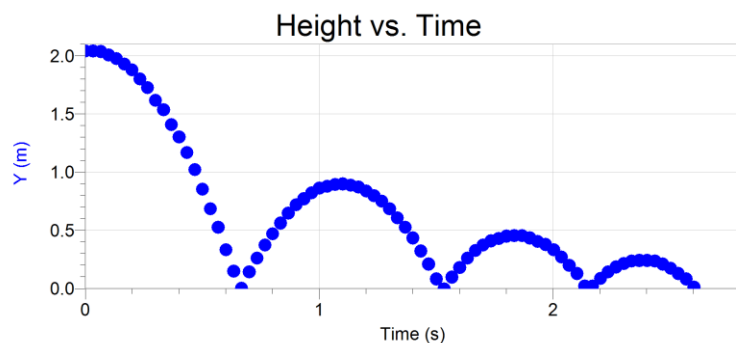
Materials	Quantity	Reusable?
Meter stick	1 per 3-4 kids	Yes
Data collection sheets	1 per kid	No
Rubber ball	1 per 3-4 kids	Yes
Ping pong ball	1 per 3-4 kids	Yes
Marble	1 per 3-4 kids	Yes

## Directions

1. Introduce the topic. What makes a ball bouncy? Why do some balls bounce higher than other balls? The answer has all to do with a ball's **elasticity**.
  - a. Elasticity is an object's ability to return to its original shape after being stretched or squeezed. Today we will see how this property helps balls to bounce higher.
2. We have 3 different types of balls to test: a rubber ball, a ping pong ball, and a marble. Which of these has the most elasticity? We are going to do an experiment to find out!
3. Make your hypothesis. Ask the class which ball they think will bounce the highest and which will bounce the lowest. Write their hypothesis on the board.
4. Break up the class into groups of 3-4 kids per group. Pass out activity sheets, meter sticks, and balls to each group.
5. Allow the kids time to perform their experiment with each different ball at different heights. Have each kid take a turn being the ball dropper. Make sure the kids are recording their results on their activity sheet.
6. After everyone has completed all their trials, help the class calculate their average bounce heights. If there's time, combine all results into one class results.
  - a. Average = sum of trials/number of trials
  - b. Which ball bounces the highest each time? (it should be the rubber ball)
  - c. Do our results agree with our hypothesis?
7. Lead closing discussion.

## Activity Extension

Graph the results to visualize the results.



What happens if you bounce the ball on different materials (carpet vs tile vs desk vs activity tub)? Students will find that some surfaces absorb more energy from the ball than others, causing them to bounce less.

Newton's First Law = items of different mass will hit the ground at the same time if they are dropped from the same height. Show this by dropping the largest ball and the smallest ball at the same time and seeing them hit the ground at the same time.

## **Discussion Questions**

- Which ball bounces the highest each time?
  - Most likely will be the rubber ball, which has the highest elasticity.
- Do our results agree with our hypothesis?
- What was the importance of making a hypothesis before we started testing? Is it a bad thing if our results don't agree with our hypothesis?
  - Our hypothesis states what we are trying to prove in our experiment. If we are wrong in our hypothesis, it means we have the opportunity to discover something new and learn why the experiment didn't go the way we expected.
- Why do the balls not bounce all the way back to their original height?
  - Friction
  - Energy absorbed into ground

## **What is happening?**

- When the ball hits the ground it gets compressed, or squished, and if it is very elastic, it quickly returns to its original shape. When it does this, it pushes back on the ground and shoots back up into the air.
- The marble, which is the hardest out of the three balls, has the least elasticity, so it does not bounce as high. It doesn't get squished when it lands, so it has a harder time changing its direction from down to up.

## **Applications:**

- Majors
  - Physics
  - Mechanical Engineering
- Jobs
  - Physicist
  - Engineer
- Hobbies
  - Sports - basketball, tennis, ping pong, etc
- Real-World applications
  - Bungee jumping
  - Slingshot



**PROGRAM FOR WOMEN  
IN SCIENCE AND ENGINEERING**

This activity was last updated in fall 2020 by Student Role Models.