



Under Pressure: Ball Bouncing Dynamics

Areas of Science	Sports Science (http://www.sciencebuddies.org/science-fair-projects/project-ideas/sports-science)
Difficulty	
Time Required	Very Short (\leq 1 day)
Prerequisites	None
Material Availability	Readily available
Cost	Very Low (under \$20)
Safety	No issues

Abstract

Many sports use a ball in some way or another. We throw them, dribble them, hit them, kick them, and they always bounce back! In this experiment you can investigate the effect of air pressure on ball bouncing.

Objective

In this experiment you will test if air pressure will affect the dynamics of ball bouncing.

Credits

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Cite This Page

General citation information is provided here. Be sure to check the formatting, including capitalization, for the method you are using and update it as needed.

MLA Style

Science Buddies Staff. "Under Pressure: Ball Bouncing Dynamics." *Science Buddies*, 12 Jan. 2020, https://www.sciencebuddies.org/ideas/Sports_p007/sports-science/ball-bouncing-dynamics. Accessed 6 Mar. 2020.

APA Style

Science Buddies Staff. (2020, January 12). *Under Pressure: Ball Bouncing Dynamics*. Retrieved from https://www.sciencebuddies.org/ideas/Sports_p007/sports-science/ball-bouncing-dynamics

Last edit date: 2020-01-12

Introduction

Bouncing is what makes playing with a ball so much fun. But what makes a ball bounce? If you were to see a ball drop to the ground, its shape would change dramatically. When it hits the ground, the bottom of the ball becomes flat against the floor. Then when it bounces, its shape changes again. These changes in shape are due to a balance of forces and energy:

"When you drop a ball, gravity pulls it toward the floor. The ball gains energy of motion, known as kinetic energy. When the ball hits the floor, the energy has to go somewhere. The energy goes into deforming the ball-- from its original round shape to a squashed shape. The molecules are stretched apart in some places and squeezed together in others. As they are pushed about, the molecules rub against each other." (Doherty, 1991)

In this experiment you will use a ball filled with air. When it is dropped, the air molecules will squish together and then spring apart. A ball with an air pressure gauge is used to test if changing the bounciness of the ball.

Terms and Concepts

- air pressure
- forces
- energy
- motion
- gravity

Questions

- How high will a ball bounce?
- Will the air pressure change the bounciness of a ball?
- How can you measure the height a ball bounces?

Bibliography

- Doherty, P., 1991. "That's The Way The Ball Bounces," The Exploratorium Museum, San Francisco, CA. [accessed August 2018] http://www.exploratorium.edu/sports/ball_bounces/index.html (http://www.exploratorium.edu/sports/ball_bounces/index.html)
- Here is another activity that tests temperature and bounce using golf balls and baseballs:
Exploratorium Staff, 1998. "Science Activity: Bouncing Balls," The Exploratorium Museum, San Francisco, CA. [accessed August 2018] http://www.exploratorium.edu/baseball/bouncing_balls.html (http://www.exploratorium.edu/baseball/bouncing_balls.html)
- There are many other great ball projects in this fun book:
Goodstein, M., 1999. *Sports Science Projects: The Physics of Balls in Motion*. Berkeley Heights, NJ: Enslow Publishers.

Materials and Equipment

- ball air pump
- ball pressure gauge (available at a sporting goods store)
- basketball or soccer ball
- stepladder
- video camera with a tripod
- paint
- tape measure (preferably metric)
- large roll of paper
- volunteer



Under Pressure: Ball Bouncing Dynamics

https://www.sciencebuddies.org/science-fair-projects/project-ideas/Sports_p007/sports-science/ball-bouncing-dynamics
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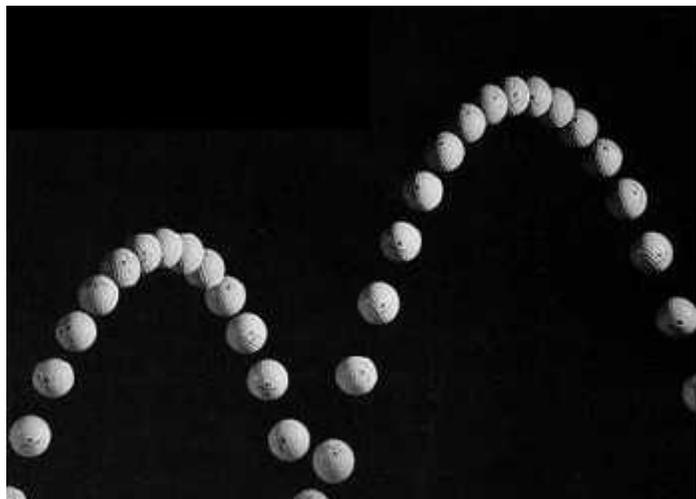
PDF date: 2020-03-06

Experimental Procedure

1. First, you will need to draw the background for your experiment, which will act as a large ruler for measuring your bounces. Measure to make a series of lines on your roll of paper. It should be tall enough to hang up behind your ladder, about 5 feet where you will drop the ball from, so that it will be the same for each test. Then make a series of lines every 5 centimeters every 3 inches (1/4 of a foot) if you are using English measurements.
2. Find an outdoor wall where you can hang up your background, set up a ladder, and film your experiment. It should be on a flat surface. Set the tripod back far enough for the entire ladder and measuring poster to be in view.
3. Fully pump up the basketball and check the pressure with the pressure gauge. Write the pressure in the data table:

Air Pressure in PSI (Lbs)	Height of Bounce (cm)

4. Have your volunteer get the video camera ready. Carefully climb the ladder with the ball. After your partner starts recording from the same height each time. It is important to let the ball fall out of your hands, and not to push it down with your hand.
5. Let the ball bounce until it stops, and then stop recording.
6. Use the pressure gauge to release some of the air pressure from the ball. Record the new pressure reading in your data table.
7. Keep releasing pressure and repeating the experiment until the ball no longer bounces.
8. Now, take your video and watch it to gather your data. You will need to be able to stop the video to make your measurements at the first bounce. Write each measurement in the data table.



A ball bounces in an arc, so measure the height at the top of the arc of the first bounce. (Image by Harriet)

9. Make a line graph of your data. Set up the graph by putting a scale of the air pressure on the bottom of the graph (X-axis) side of the graph (Y-axis). Now use your data table to plot points on the graph. Then draw a line to connect the dots. Is it a What do you think this means about your results?

If you like this project, you might enjoy exploring these related careers:



(<http://www.sciencebuddies.org/science-engineering-careers/earth-physical-sciences/physicist>)

Physicist (<http://www.sciencebuddies.org/science-engineering-careers/earth-physical-sciences/physicist>)

Physicists have a big goal in mind—to understand the nature of the entire universe *and* everything and measure natural events seen on Earth and in the universe, and then develop theories, using phenomena occur. Physicists take on the challenge of explaining events that happen on the ground happen at the level of the smallest atomic particles. Their theories are then applied to human-sci technologies, like computers, lasers, and fusion energy. [Read more](http://www.sciencebuddies.org/science-engineering-careers/earth-physical-sciences/physicist) (<http://www.sciencebuddies.org/science-engineering-careers/earth-physical-sciences/physicist>)



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Our universe is full of matter and energy, and how that matter and energy moves and interacts with physics. Physics teachers spend their days showing and explaining the marvels of physics, which subjects, including biology, chemistry, Earth and space science. Their work serves to develop the engineers, including all healthcare professionals. They also help all students better understand their everyday lives, as well as how to become better citizens by understanding the process of:

(<http://www.sciencebuddies.org/science-engineering-careers/earth-physical-sciences/physics-teacher>)

Variations

- Does height make a difference? Try the experiment again, but this time change how high the ball is dropped instead of the
- Do different kinds of balls bounce differently? Try bouncing different kinds of balls to test this question. Some balls to try are tennis, or handball.
- Check out this Project Idea [Playing the Angles: The Physics of Balls Bouncing Off of Surfaces](http://www.sciencebuddies.org/science-engineering-careers/earth-physical-sciences/physics-ball-bounce) (<http://www.sciencebuddies.org/science-engineering-careers/earth-physical-sciences/physics-ball-bounce>).
- Does the weather make a difference? Try your bounce test in different weather conditions. Try comparing a hot day to a cold different atmospheric pressure. You can check the weather stats at <http://www.weatherunderground.com> (<http://www.weatherunderground.com>)
- There are many other great ball projects in this fun book by Madeline P. Goodstein, *Sports Science Projects: The Physics* Publishers. Check it out from your local library!

Ask an Expert