

Following energy through devices and chains

Grade 7 science (Year 8 · Class 7) · Lab

Name: _____ Date: _____ Class: _____

How much of a ball's stored energy survives a bounce? This lab measures drop and bounce heights to calculate the gravitational potential energy before and after, the wasted energy and the efficiency of the bounce.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS3-5

Aim

To find what fraction of its gravitational potential energy a tennis ball keeps after one bounce, and to calculate the energy wasted.

Equipment

- A tennis ball of mass 57 g (0.057 kg)
- A metre rule fixed upright against a wall, or a long tape measure
- A phone to film each bounce in slow motion
- A hard, flat floor

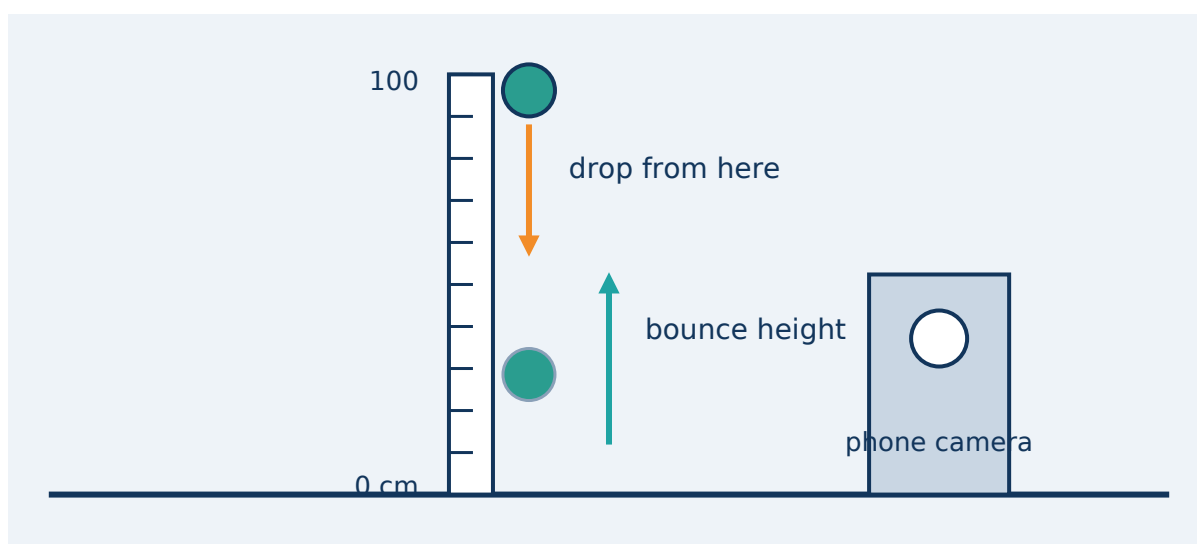
Safety

Safety

Keep the floor clear of bags and cables so nobody trips. Retrieve the ball straight away after each drop and keep your head away from the ball when it comes back up.

Method

1. Hold the bottom of the ball level with the 40 cm mark and release it without pushing.
2. Film the drop with the phone level with the rule. Play the film back frame by frame and read the highest point reached after the first bounce (bottom of the ball).
3. Repeat three times and calculate the mean bounce height.
4. Repeat for drop heights of 60, 80, 100 and 120 cm.



The ball is dropped from a measured height and filmed so that the bounce height can be read from the rule.

Results

Sample measurements from one group are shown below.

Drop height (m)	Bounce 1 (m)	Bounce 2 (m)	Bounce 3 (m)	Mean bounce (m)
0.40	0.24	0.25	0.23	0.24
0.60	0.35	0.37	0.36	0.36
0.80	0.48	0.50	0.49	0.49
1.00	0.60	0.62	0.61	0.61
1.20	0.71	0.73	0.72	0.72

Analysis questions

Question 1 Variables

1. State the independent variable.
2. State the dependent variable.
3. Explain why the ball is dropped, not thrown.

Question 2 Energy before and after

Use $g = 9.8 \text{ N/kg}$. For the 1.00 m drop, calculate the gravitational potential energy (a) at the release point and (b) at the top of the bounce.

Question 3 Wasted energy

Calculate how much energy was wasted in the 1.00 m drop and name where it went.

Question 4 Efficiency of the bounce

Calculate the efficiency of the bounce for each drop height, taking the bounce energy as useful. Give each answer to the nearest whole number.

Question 5 Graph

Plot bounce height (y-axis) against drop height (x-axis). Describe the graph and calculate its gradient using the point (1.20, 0.72).

Question 6 Prediction

Predict the mean bounce height for a drop from 1.50 m and calculate the energy wasted in that bounce.

Question 7 Reliability

Look at the three bounces from 0.80 m. State the range and suggest two ways to improve the accuracy.

Question 8 Different balls

Predict how the efficiency would change for a softer ball that does not bounce well. Explain using energy transfers.