

How moving and lifted objects store energy

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

These model answers use the sample table. Your own measurements will differ a little, but the pattern should be the same: a greater release height gives a longer push.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS3-1, MS-PS3-2

Question 1 Variables

1. The **release height** of the ball.
2. The **distance the cup is pushed**.
3. For example the mass of the ball, the slope of the ramp, the cup and the surface it slides on.

Question 2 Energy at the top

$GPE = 0.016 \times 9.8 \times h = 0.1568 \times h$ (h in m).

5 cm: $0.1568 \times 0.05 = 0.00784 \text{ J} = \mathbf{7.8 \text{ mJ}}$. 10 cm: **15.7 mJ**. 15 cm: **23.5 mJ**. 20 cm: **31.4 mJ**. 25 cm: **39.2 mJ**.

Question 3 Draw the graph

The points lie close to a straight line through the origin. **The push distance is directly proportional to the release height:** doubling the height roughly doubles the distance.

Question 4 Gradient

Gradient = $10.2 \div 25 = \mathbf{0.41}$ (no unit, because both axes are in centimetres).

It means the cup moves about 0.41 cm for every 1 cm of release height.

Question 5 Prediction

Using a gradient of about 0.4: $0.4 \times 30 = \mathbf{\text{about } 12 \text{ cm}}$.

It is reasonably reliable because it is only just outside the measured range, but it assumes the straight line continues.

Question 6 Why distance shows energy

The ball hits the cup with a certain kinetic energy. Friction between the cup and the table then removes this energy as the cup slides. A **larger kinetic energy lets the cup slide further**, so the distance is a measure of the energy.

Question 7 Energy losses

Some energy is transferred to the surroundings as thermal energy by friction on the ramp and between ball and cup, and some is carried away as sound in the collision. **Friction and sound** are the main losses; the ball also keeps some kinetic energy after the collision.

Question 8 Improving the lab

The pushes range from 10.0 to 10.4 cm, so the range is **0.4 cm** (about ± 0.2 cm).

Improvement: repeat more times, use a ruler fixed to the table, or film the cup from above to read the distance more precisely.