

Following energy through devices and chains

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

These model answers use the sample table. Your own values will differ slightly, but the efficiency should stay roughly constant at about 60 % and the wasted energy should be larger for higher drops.

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

Question 1 Variables

1. The **drop height**.
2. The **bounce height**.
3. A throw would give the ball extra kinetic energy at the start, so the energy at release would no longer depend only on the height.

Question 2 Energy before and after

GPE = $m \times g \times h$ with $m \times g = 0.057 \times 9.8 = 0.5586 \text{ N}$.

(a) $0.5586 \times 1.00 = \mathbf{0.56 \text{ J}}$.

(b) $0.5586 \times 0.61 = 0.3407 \text{ J} = \mathbf{0.34 \text{ J}}$.

Question 3 Wasted energy

Wasted = $0.5586 - 0.3407 = 0.2179 \text{ J} = \mathbf{0.22 \text{ J}}$.

It was transferred as thermal energy to the ball and floor and as sound when the ball hit the floor.

Question 4 Efficiency of the bounce

The mass and g cancel, so efficiency = bounce height $\div$ drop height $\times 100$.

0.40 m: $0.24 \div 0.40 = \mathbf{60 \%}$. 0.60 m: $0.36 \div 0.60 = \mathbf{60 \%}$. 0.80 m: $0.49 \div 0.80 = \mathbf{61 \%}$.

1.00 m: $\mathbf{61 \%}$. 1.20 m: $0.72 \div 1.20 = \mathbf{60 \%}$.

Question 5 Graph

The points lie on a straight line through the origin, so **bounce height is proportional to drop height**.

Gradient = $0.72 \div 1.20 = \mathbf{0.60}$. It equals the efficiency as a fraction.

Question 6 Prediction

Bounce height $\approx 0.60 \times 1.50 = \mathbf{0.90\ m}$.

Energy at the start = $0.5586 \times 1.50 = 0.838\ \text{J}$. Energy kept = $0.5586 \times 0.90 = 0.503\ \text{J}$.

Wasted = $0.838 - 0.503 = \mathbf{0.34\ J}$.

Question 7 Reliability

The range is $0.50 - 0.48 = \mathbf{0.02\ m}$.

Improvements: film at a high frame rate and read the highest frame, keep the camera level with the rule to avoid parallax, and repeat more times.

Question 8 Different balls

The efficiency would be **lower**. A soft ball deforms more at impact and transfers more energy as thermal energy and sound, so less is left as kinetic energy for the bounce.