

Reading motion graphs and acceleration

Grade 8 science (Year 9 · Class 8) · Lab answers

Model answers use the sample table. Your own times will differ a little, but you should still find a curved distance-time graph and an acceleration of roughly half a metre per second squared for a gentle ramp.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-PS2-2

Question 1 Section speeds

0–20 cm: $0.20 \div 0.90 = 0.22$ m/s

20–40 cm: $0.20 \div 0.37 = 0.54$ m/s

40–60 cm: $0.20 \div 0.28 = 0.71$ m/s

60–80 cm: $0.20 \div 0.24 = 0.83$ m/s

80–100 cm: $0.20 \div 0.22 = \mathbf{0.91}$ m/s

Question 2 Distance-time graph

The points make a **curve that gets steeper**, so the speed of the ball is increasing as it moves down the ramp.

Question 3 Estimating acceleration

$a = \text{change in speed} \div \text{change in time} = (0.91 - 0.22) \div (1.90 - 0.45) = 0.69 \div 1.45 = \mathbf{0.48 \text{ m/s}^2}$.

Question 4 Final speed

Average speed = $1.00 \div 2.01 = 0.50$ m/s. Final speed = $2 \times 0.50 = 1.0$ m/s. $a = 1.0 \div 2.01 = \mathbf{0.50 \text{ m/s}^2}$, close to the estimate in the previous question.

Question 5 Reaction time

$0.1 \div 0.90 = \mathbf{11\%}$. The short early times are affected most, so the early section speeds are the least reliable.

Question 6 Steeper ramp

The curve is **steeper** and the times are shorter, because a steeper ramp gives a larger acceleration, so the ball gains speed faster.

Question 7 Improvements

Use a phone video with a frame counter, or light gates, to time the ball, and repeat each time more than three times to find a mean. **Any two sensible improvements** earn full credit.