

Reading journeys from motion graphs

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab answers

The model answers use the sample table. Your own results will differ a little, but run A should give a straight line and run B an upward-curving line with rising interval speeds.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** IGCSE 1.2

Question 1 Shape of the two graphs

Run A: a **straight line** sloping up through the origin (constant speed). Run B: a **curve that gets steeper**, so the gradient increases (speeding up).

Question 2 Speed in run A

Gradient = $(10.0 - 0) \div (13.2 - 0) = 0.7576$, so **0.76 m/s**.

Question 3 Speeds in run B

Interval times are 4.0, 2.5, 1.8, 1.4 and 1.1 s. Speeds: $2.0 \div 4.0 = \mathbf{0.50 \text{ m/s}}$; $2.0 \div 2.5 = \mathbf{0.80 \text{ m/s}}$; $2.0 \div 1.8 = \mathbf{1.11 \text{ m/s}}$; $2.0 \div 1.4 = \mathbf{1.43 \text{ m/s}}$; $2.0 \div 1.1 = \mathbf{1.82 \text{ m/s}}$.

Question 4 Interpreting run B

The speeds **rise** from 0.50 m/s to 1.82 m/s, so the walker is accelerating. The gradient of the distance-time graph grows, which is why the line curves upwards.

Question 5 Estimating acceleration

$a = (1.82 - 0.50) \div (10.25 - 2.0) = 1.32 \div 8.25 = \mathbf{0.16 \text{ m/s}^2}$.

Question 6 Reliability of the timing

$0.2 \div 13.2 \times 100 = \mathbf{1.5 \%}$.

Question 7 Improving the lab

1. Use **light gates** or a phone filming in slow motion to remove reaction time.
2. Use more marks and repeat each run three times, then average the times to cut random error.