

Reading journeys from motion graphs

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

Name: _____ Date: _____ Class: _____

A graph is only useful if you can draw it from real measurements. In this lab you time a walker over marked distances, plot distance against time, and use the gradients to tell steady motion from speeding up.

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

Aim

To plot distance-time graphs for a steady walk and a walk that speeds up, and to use their gradients to find speed and acceleration.

Equipment

- Corridor or playground at least 12 m long
- Tape measure and masking tape or chalk
- Two stopwatches or phones
- Graph paper and ruler

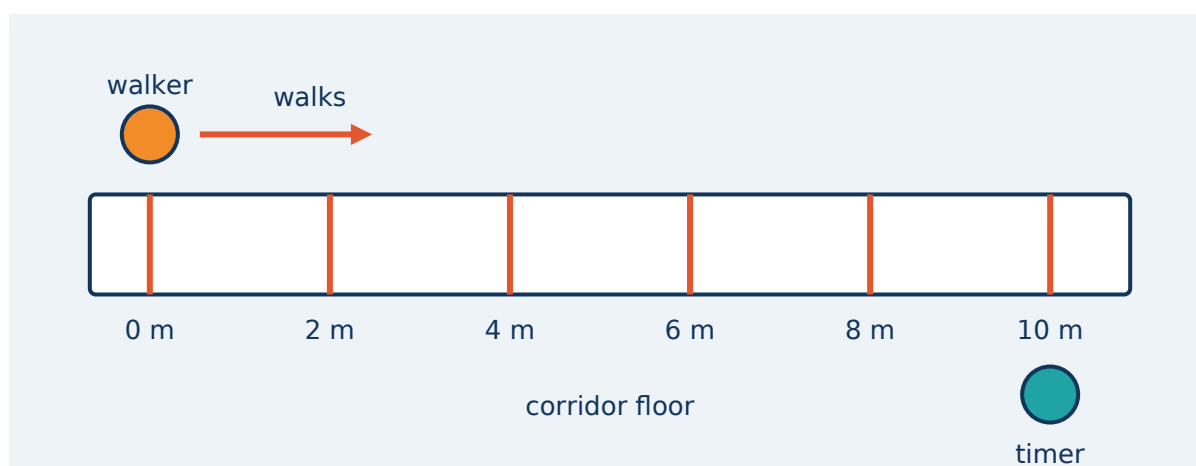
Safety

Safety

Walk, do not run. Check that the floor is dry and clear of bags, and stay away from doors that could open into the walker.

Method

1. Mark the start line and then every 2.0 m up to 10 m.
2. Run A: the walker walks as steadily as possible. Timers note the time as the walker passes each mark.
3. Run B: the walker starts very slowly and walks faster and faster along the corridor, passing the last mark at about the same time.
4. Record both sets of times and plot distance (y-axis) against time (x-axis) for both runs.



Results

Times recorded by one group:

Distance (m)	Time, run A (s)	Time, run B (s)
0	0	0
2.0	2.6	4.0
4.0	5.3	6.5
6.0	7.9	8.3
8.0	10.6	9.7
10.0	13.2	10.8

Analysis questions

Question 1 Shape of the two graphs

Describe the shape of the distance-time graph you expect for run A and for run B.

Question 2 Speed in run A

Calculate the gradient of the run A graph using the points at 0 m and 10.0 m.

Question 3 Speeds in run B

Calculate the speed over each 2.0 m interval of run B, to 2 decimal places.

Question 4 Interpreting run B

Explain what the speeds from the previous question show about run B.

Question 5 Estimating acceleration

The mid-time of the first interval is 2.0 s and of the last interval 10.25 s. Estimate the average acceleration of the walker in run B.

Question 6 Reliability of the timing

The timing by hand has an uncertainty of about ± 0.2 s. Calculate the percentage uncertainty in the total time for run A.

Question 7 Improving the lab

Suggest two changes that would make the results more precise.