Distance–time graphs: walking and waiting

Student activity • observation and reasoning

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The question

How does a walk with a pause appear on a distance–time graph?

Measure a short walk, then use your graph to distinguish travelling from waiting. Walking is optional: timing, plotting and the supplied practice example are equivalent participation routes.

Equipment

- Student booklet, graph paper, pencil and ruler
- One clear 8 m lane, five flat markers and a measuring tape
- Four stopwatches for the active group

Walk only on a clear, level, dry lane. Do not race, obstruct exits or leave loose tape across the route. Observers stand to the side. Anyone can choose a timing or plotting role without walking.

Course coverage: Shared Physics / Double Award: 1.1, 1.3, 1.4. Distance–time graphs and average speed.

Plan, model or apparatus sketch

Draw a labelled setup or force diagram; include the measured quantities.

Method and reasoning

Read the whole sequence before starting

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1. Use a staff-approved level 8 m lane with markers at 0, 2, 4, 6 and 8 m. Keep a clear stopping space beyond the last marker. Work in five groups of six, with one group using the lane at a time.

2. Assign a walker, a starter/recorder and four timekeepers. Each timekeeper starts on the same signal and stops when the walker reaches their assigned marker. Walk comfortably; do not race.

3. Record cumulative times at each distance. Repeat twice more with the same walker and method. Record each complete walk separately rather than joining readings from different trials.

4. Make one further walk with a deliberate five-second pause at 4 m. Record arrival and departure times there. Observe the pause rather than substituting a made-up measured time.

5. Plot cumulative distance travelled against elapsed time for one uninterrupted walk and the paused walk. Calculate average speed over the full journey, including the pause.

6. Use gradients to describe intervals. Discuss reaction-time uncertainty and why a steeper straight segment represents greater speed. Label any supplied example as practice data.

Cleanup

- Collect markers and tape, return stopwatches and leave the route clear.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Practice data, not measurements: time / s = 0, 2, 4, 9, 11, 13; cumulative distance / m = 0, 2, 4, 4, 6, 8. Total distance travelled cannot decrease. A graph of distance from the start can fall on a return journey; label that different quantity explicitly.

Distance / m	Time 1 / s	Time 2 / s	Time 3 / s
0			
2			
4			
6			
8			

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. What does a horizontal segment mean?

2. Calculate the practice journey's average speed.

3. Why is the average speed lower when waiting is included?

4. Can total distance travelled decrease on a return walk?

5. Why use several timekeepers with the same start signal?

6. What uncertainty remains with stopwatch timing?