

Motion Graphs

GCSE Physics · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

A runner covers 400 m in 50 s. Calculate her average speed. (2 marks)

Step 1 · Write the equation

distance travelled = speed $\times$ time, $s = v t$, so $v = s \div t$

Step 2 · Calculate

$$v = 400 \div 50 = 8.0 \text{ m/s}$$

Answer: 8.0 m/s

Check: Faster than typical running (about 3 m/s): she is sprinting.

2. Now try one with the steps

A car travels at 72 km/h. Convert this to m/s and find how long it takes to travel 1.5 km. (4 marks)

Step 1 · Convert km/h to m/s

Step 2 · Convert distance

Step 3 · Time

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Explain the difference between distance and displacement. [2]

2. A car travels 150 m in 10 s. Calculate its average speed in m/s. [2]

3. State a typical walking speed in m/s. [1]

4. State what the gradient of a distance–time graph represents. [1]

5. Describe the motion shown by a horizontal line on a distance–time graph. [1]
-
-
6. Use the example journey graph to calculate Amira's speed during the first 120 s, in m/s. [2]
-
-
7. A train travels at 45 m/s for 2.0 minutes. Calculate the distance it travels. [2]
-
-
8. Calculate the time taken to cycle 3.0 km at 6.0 m/s. [3]
-
-
-
9. Thunder is heard 3.0 s after the lightning flash. The speed of sound in air is 330 m/s. Calculate the distance to the lightning. [2]
-
-
10. Describe the motion shown by a distance–time graph that curves upwards, getting steeper. [1]
-
-
11. Use the example journey graph to calculate Amira's average speed for the whole journey, in m/s. [2]
-
-
12. Explain why an object moving in a circle at constant speed has a changing velocity. [2]
-
-
13. A tangent to a curved distance–time graph passes through (2 s, 0 m) and (6 s, 20 m). Calculate the speed at that point, in m/s. [2]
-
-
14. A runner completes one 400 m lap of a track in 80 s, finishing where she started. State her displacement and calculate her average speed. [3]
-
-
-

4. Before you hand it in

Reading the speed straight off a distance–time graph's y-axis

Speed is the gradient: change in distance $\div$ change in time.

Using km and s together: $3 \div 6 = 0.5$ s

Convert km to m (3.0 km = 3000 m) before using $s = v t$.

"Speed and velocity are the same."

Velocity is speed in a given direction. A car going round a roundabout at a steady speed has a changing velocity.

Forgetting the stops when finding average speed

Average speed = total distance $\div$ total time, including any time spent stationary.