

Reading motion graphs and acceleration

Grade 8 science (Year 9 · Class 8) · Worksheet

Name: _____ Date: _____ Class: _____

These problems train you to read distance-time and speed-time graphs, to find speed and acceleration from gradients and to find distance from areas. They also practise unit conversion and calculations with $a = (v - u) \div t$, from one-step recall to multi-stage journeys.

They suit Grade 8, Year 9 and Class 8 students, in line with middle school physical science (NGSS MS-PS2-2) and KS3 courses.

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

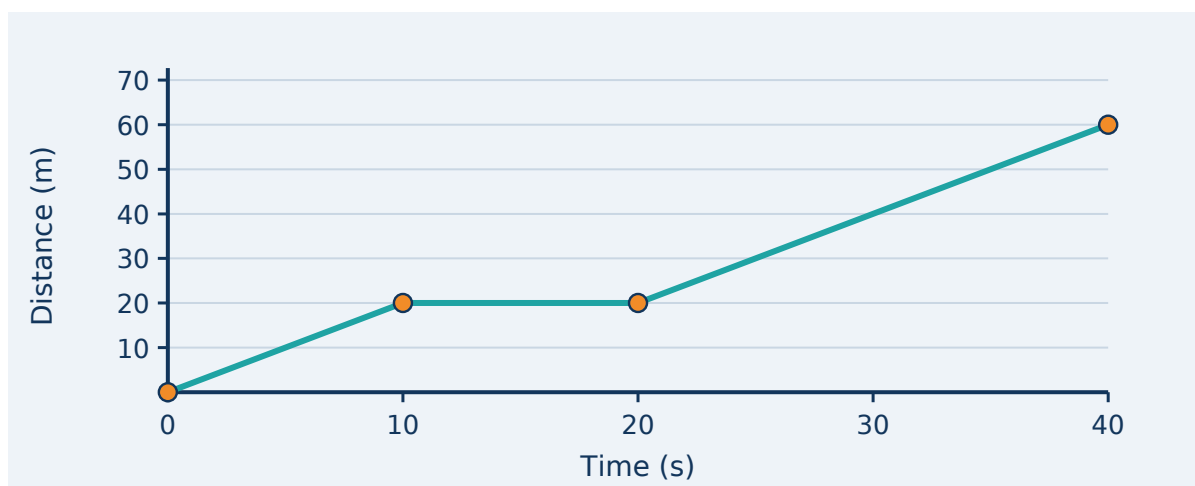
Problem 1 Axes and meaning (easy)

Look at a distance-time graph.

1. State what is plotted on the horizontal axis and on the vertical axis.
2. State what a horizontal line means.
3. State what a steeper line means.

Problem 2 Read Aarav's walk (easy)

Aarav in Pune walks to the school gate. Look at the graph.



Aarav's walk to the school gate.

1. State how far he is from the start after 10 s.
2. State how long he stands still.
3. State the total distance after 40 s.

Problem 3 Speed from a distance (easy)

Kofi in Accra jogs 150 m in 30 s.

1. Write the formula for speed.
2. Calculate his speed.

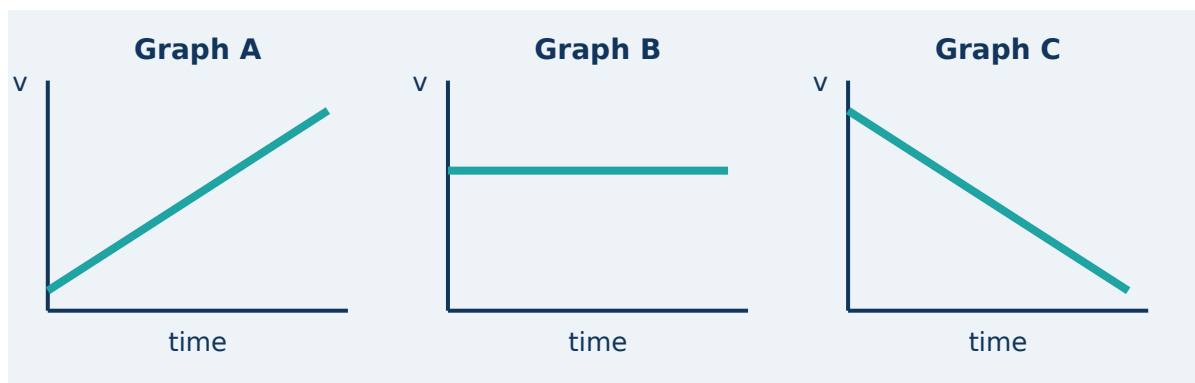
Problem 4 Acceleration of a car (easy)

A car speeds up from rest to 12 m/s in 4.0 s.

1. Write the formula for acceleration.
2. Calculate the acceleration.

Problem 5 Match the shapes (easy)

Look at the speed-time graphs for three vehicles.



Three speed-time graphs for three vehicles.

1. State which graph shows constant speed.
2. State which graph shows speeding up.
3. State which graph shows slowing down.

Problem 6 Change of units (easy)

Wanjiru in Nairobi reads the speed of a matatu.

1. Convert 72 km/h to m/s.
2. Convert 15 m/s to km/h.

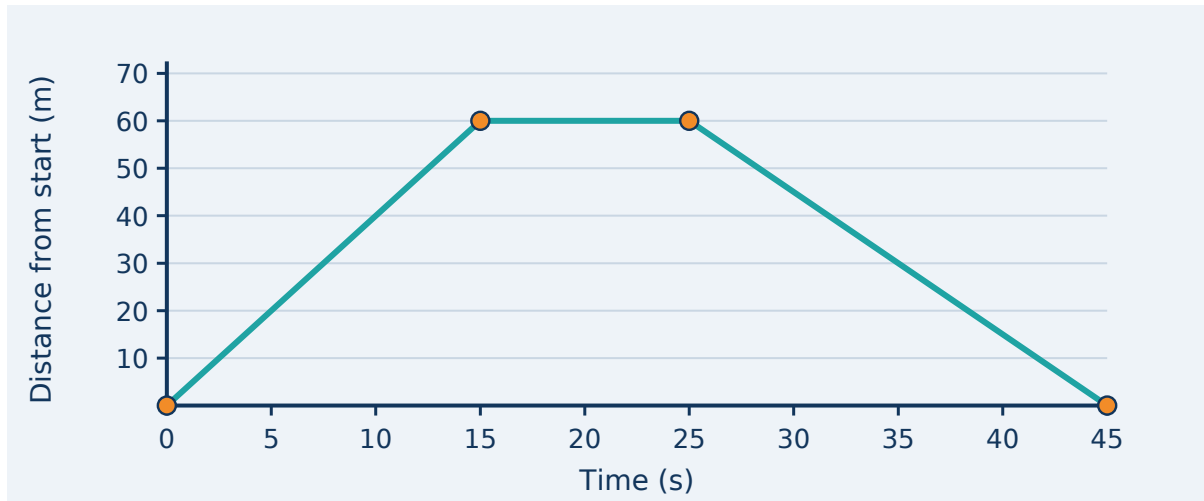
Problem 7 Gradient of a line (medium)

On a distance-time graph, a line passes through (0 s, 0 m) and (12 s, 90 m).

1. Calculate the gradient.
2. State what the gradient represents.

Problem 8 Out and back (medium)

A student walks to a bench and back.



A student's walk to a bench and back.

1. Calculate the speed on the way out.
2. State how long the student rests.
3. Calculate the speed on the way back.
4. Calculate the average speed for the whole 45 s.

Problem 9 A train speeds up (medium)

A train speeds up from 10 m/s to 25 m/s in 30 s.

1. Calculate its acceleration.

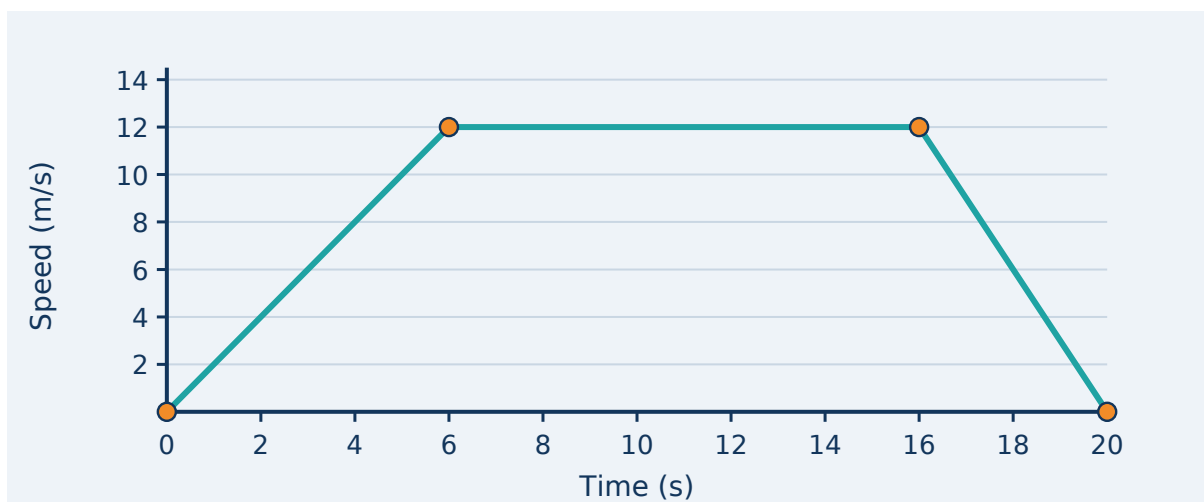
Problem 10 Find the final speed (medium)

A skateboard rolls downhill with an acceleration of 1.5 m/s^2 . It starts at 2.0 m/s .

1. Rearrange $a = (v - u) \div t$ to make v the subject.
2. Calculate the speed after 8.0 s.

Problem 11 Scooter journey (medium)

Mei in Singapore rides a scooter. Look at the speed-time graph.



A scooter ride along a straight road.

1. Calculate the acceleration during the first 6 s.
2. State for how long the scooter moves at constant speed.
3. Calculate the deceleration in the last 4 s.

Problem 12 Who is faster? (medium)

Diego in Texas and Emma in Leeds race over 100 m. Diego takes 16.0 s and Emma takes 12.5 s.

1. Calculate each average speed.
2. Find the difference between the speeds.

Problem 13 A curved graph (medium)

A distance-time graph for a car is a curve that gets steeper and steeper.

1. Describe how the speed of the car changes.
2. Explain how you can tell from the graph.
3. Sketch or describe the matching speed-time graph.

Problem 14 Table of distances (medium)

Chiamaka in Lagos records the distance of a toy car from a start line: 0 s: 0 m; 10 s: 40 m; 20 s: 80 m; 30 s: 80 m; 40 s: 120 m.

1. Calculate the speed from 0 s to 20 s.
2. State what the car does from 20 s to 30 s.
3. Calculate the speed from 30 s to 40 s.

Problem 15 A long walk (medium)

Bilal in Lahore walks 3.0 km in the first 20 minutes, then 6.0 km in the next 40 minutes.

1. Calculate the total distance and the total time in hours.
2. Calculate his average speed in km/h.
3. Convert the average speed to m/s.

Problem 16 Area under a graph (hard)

A truck's speed is 0 at 0 s, 16 m/s at 8 s, stays 16 m/s until 20 s, then falls to 0 at 26 s, with straight lines between.

1. Calculate the acceleration in the first 8 s.
2. Calculate the distance for each of the three stages using areas.
3. Calculate the average speed over the whole journey.

Problem 17 Spot the errors (hard)

A student writes three statements.

- (A) A flat line on a distance-time graph means constant speed.

(B) A steeper line on a speed-time graph means a faster object.

(C) Negative acceleration means the object moves backwards.

1. Correct (A).
2. Correct (B).
3. Correct (C).

Problem 18 A falling ball (hard)

A ball is dropped from a tall tower and falls with a constant acceleration of 9.8 m/s^2 (ignore air resistance).

1. Calculate its speed after 1.0 s, 2.0 s and 3.0 s.
2. Describe the speed-time graph.
3. Use the area under the graph to calculate the distance fallen in 3.0 s.

Problem 19 Chasing cars (hard)

Car A passes a junction at a steady 20 m/s just as Car B starts from rest at the same junction. Car B accelerates at 4.0 m/s^2 until it reaches 20 m/s, then stays at 20 m/s.

1. Calculate the time Car B takes to reach 20 m/s.
2. Calculate the distance each car has travelled by then.
3. Find how far ahead Car A is, and explain why the gap then stays the same.

Problem 20 A tram journey (hard)

A tram speeds up uniformly from 0 to 15 m/s in 10 s, runs at 15 m/s for 40 s, then slows uniformly to rest in 5 s.

1. Calculate the acceleration and the deceleration.
2. Calculate the total distance travelled.
3. Calculate the average speed for the whole 55 s.