

How fast and how quickly speeding up

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

Name: _____ Date: _____ Class: _____

These problems practise the language and equations of motion. You will separate scalars from vectors, calculate average speed and displacement, convert km/h to m/s and use $a = (v - u) \div t$ in one and two steps.

They suit GCSE and IGCSE students, O Level and Class 9-10 learners, moving from recall to multi-stage journeys and error spotting.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** IGCSE 1.2, HS-PS2-1

Problem 1 Scalar or vector (easy)

Classify each quantity as a scalar or a vector.

1. distance
2. displacement
3. speed
4. velocity
5. acceleration
6. time

Problem 2 A minibus journey (easy)

A minibus in Nairobi travels 90 km in 1.5 h.

1. Calculate its average speed in km/h.
2. Convert the speed to m/s.

Problem 3 Distance from speed (easy)

A cyclist rides at a steady 6.0 m/s for 2.0 minutes.

1. Convert the time to seconds.
2. Calculate the distance covered.

Problem 4 Time for a sound to arrive (easy)

Sound travels at 330 m/s. Chiamaka in Lagos hears a firework burst 1650 m away.

1. Rearrange $v = s \div t$ to make t the subject.
2. Calculate the time for the sound to reach her.

Problem 5 First acceleration (easy)

A motorbike starts from rest and reaches 10 m/s in 4.0 s.

1. State the starting velocity.
2. Calculate the acceleration.

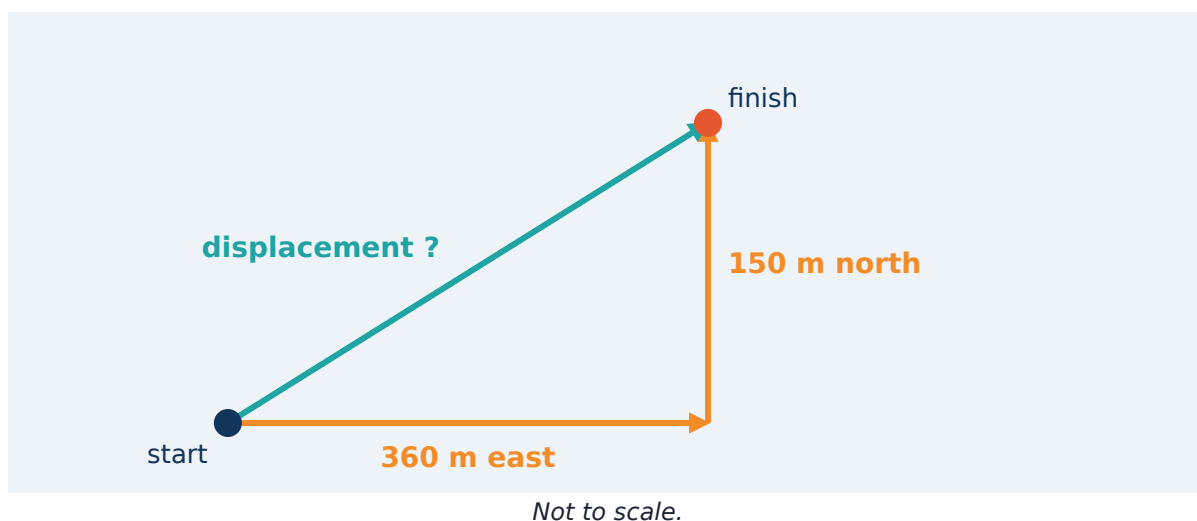
Problem 6 Changing km/h and m/s (easy)

1. Convert 36 km/h to m/s.
2. Convert 15 m/s to km/h.
3. Convert 108 km/h to m/s.

Problem 7 Distance and displacement (medium)

Diego in Texas walks 150 m north and then 360 m east, as shown.

1. Calculate the total distance.
2. Calculate the magnitude of the displacement using Pythagoras.
3. Explain why the two answers differ.

**Problem 8 Two-stage average speed** (medium)

A car travels 40 km at 80 km/h and then 60 km at 60 km/h.

1. Calculate the time for each stage.
2. Calculate the total distance and total time.
3. Calculate the average speed for the whole journey.

Problem 9 Negative velocity (medium)

Take east as positive. Emma in Leeds walks along a straight path from $x = +12$ m to $x = -8$ m in 5.0 s.

1. Calculate her displacement.
2. Calculate her average velocity.

3. State her average speed.

Problem 10 A train slows (medium)

A train slows from 30 m/s to 12 m/s in 9.0 s.

1. Calculate its acceleration.
2. Explain the sign of your answer.

Problem 11 Final speed (medium)

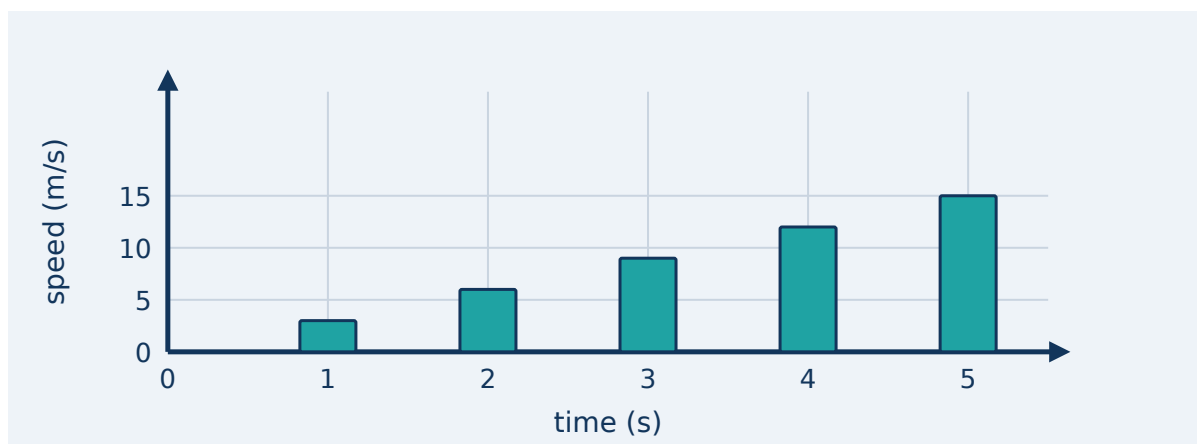
A scooter in Lahore is moving at 3.0 m/s and accelerates at 1.5 m/s^2 for 8.0 s.

1. Write the equation for v in terms of u , a and t .
2. Calculate the final speed.
3. Convert it to km/h.

Problem 12 Speed readings of a motorbike (medium)

The chart shows a motorbike's speed every second.

1. Read the speed at 4 s.
2. Calculate the acceleration between 1 s and 4 s.
3. State whether the acceleration is constant and why.



Speed of a motorbike every second.

Problem 13 Which is fastest (medium)

Rank these from slowest to fastest: 1.4 m/s, 18 km/h, 330 m/s, 90 km/h.

Problem 14 Harbour ferry (medium)

A ferry in Mumbai harbour crosses 4.5 km at a steady 7.5 m/s.

1. Calculate the crossing time in seconds.
2. Convert the time to minutes.
3. Convert the ferry's speed to km/h.

Problem 15 Market round trip (hard)

Aarav cycles 2.4 km to a market at 6.0 m/s and returns along the same route at 4.0 m/s.

1. Calculate the time for each leg.
2. Calculate the average speed for the whole trip.
3. State the average velocity for the whole trip and explain.

Problem 16 Cyclists approaching (hard)

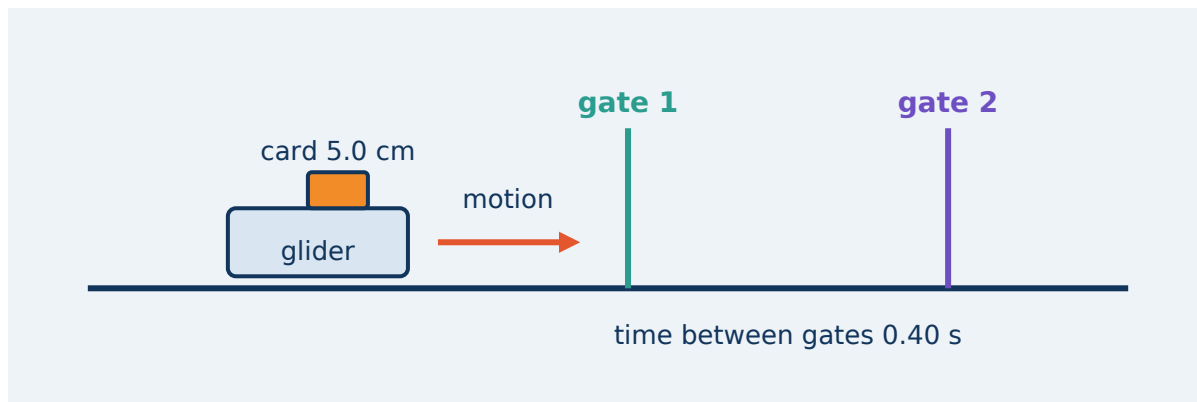
Two cyclists start 900 m apart on a straight road and ride towards each other at 5.0 m/s and 4.0 m/s.

1. Calculate how quickly the gap closes.
2. Calculate the time until they meet.
3. Calculate how far the faster cyclist has travelled.

Problem 17 Light gates (hard)

A card 5.0 cm long on a glider passes gate 1 in 0.050 s and gate 2 in 0.025 s. The glider takes 0.40 s to travel from gate 1 to gate 2.

1. Convert the card length to metres.
2. Calculate the speed at each gate.
3. Calculate the acceleration.



Glider with a card passing two gates.

Problem 18 Braking car (hard)

A car moving at 20 m/s brakes with an acceleration of -5.0 m/s^2 .

1. Calculate the time to stop.
2. Calculate the average speed while braking.
3. Calculate the braking distance.

Problem 19 Spot the errors (hard)

A student says: "A car going round a roundabout at a steady 10 m/s has zero acceleration."

Another says: "Cycling half a route at 20 km/h and half at 40 km/h gives an average of 30

km/h.”

1. Explain the error in the first statement.
2. Take a route of 2.0 km and calculate the true average speed for the second.

Problem 20 Speed trap (hard)

A speed-check system measures a car passing two sensors 20 m apart, 0.80 s apart. The limit is 80 km/h.

1. Calculate the speed in m/s.
2. Convert it to km/h.
3. State whether the car is over the limit, and by how much.