

Describing movement and average speed

Grade 6 science (Year 7 · Class 6) · Worksheet answers

Each answer shows the formula, the substitution and the final result with its unit in bold.
Compare your method as well as your result, and check that you converted minutes into hours or hours into seconds wherever needed.

Level: Grade 6 science (Year 7 · Class 6) · **Curriculum:** MS-PS2-2

Problem 1 Moving or at rest?

1. Relative to the seat she is **at rest**.
2. Relative to the tree she is **moving**.
3. Whether an object moves depends on the reference object: her position does not change compared with the seat, but it changes compared with the tree.

Problem 2 Speed formula and units

1. Average speed = distance ÷ time, so **$v = d \div t$** .
2. The SI unit is **metre per second (m/s)**.
3. Kilometre per hour (km/h) is common on roads (miles per hour is used in the UK and USA).

Problem 3 A 100 m run

$$v = d \div t = 100 \text{ m} \div 20 \text{ s} = \mathbf{5 \text{ m/s}}$$

Problem 4 A long drive

$$v = 150 \text{ km} \div 3 \text{ h} = \mathbf{50 \text{ km/h}}$$

Problem 5 Reading dotted tracks

1. A is a **straight line**, B is a **circle** and C is a **curve** (an arc).
2. The tip of a second hand moves in a circle, so **track B**.
3. Equal distances in equal times means the speed is **constant**.

Problem 6 Distance of a scooter

$$d = v \times t = 12 \text{ m/s} \times 30 \text{ s} = \mathbf{360 \text{ m}}$$

Problem 7 Time for a bus journey

$$1. t = d \div v = 200 \div 80 = \mathbf{2.5 \text{ h}}$$

2. $0.5 \text{ h} = 30 \text{ min}$, so the journey takes **2 h 30 min**.

Problem 8 Converting units

- $54 \div 3.6 = \mathbf{15 \text{ m/s}}$.
- $8 \times 3.6 = \mathbf{28.8 \text{ km/h}}$.
- $29 \times 3.6 = 104.4 \text{ km/h}$, which is **more than 100 km/h**.

Problem 9 Cycling to the market

- $20 \text{ min} = 20 \div 60 = 1/3 \text{ h}$.
- $v = 6 \div (1/3) = \mathbf{18 \text{ km/h}}$.
- $v = 6000 \text{ m} \div 1200 \text{ s} = \mathbf{5 \text{ m/s}}$ (check: $18 \div 3.6 = 5$).

Problem 10 Reading a graph

- After 20 s the walker has covered **30 m**.
- 45 m is reached after **30 s**.
- $v = 60 \text{ m} \div 40 \text{ s} = \mathbf{1.5 \text{ m/s}}$.

Problem 11 Who is faster?

- Aarav: $400 \div 80 = 5 \text{ m/s}$. Hina: $2700 \text{ m} \div 600 \text{ s} = \mathbf{4.5 \text{ m/s}}$.
- Aarav** is faster because 5 m/s is greater than 4.5 m/s.

Problem 12 Journey with a stop

- $v = 90 \div 2 = \mathbf{45 \text{ km/h}}$.
- Moving time = $2 \text{ h} - 0.5 \text{ h} = 1.5 \text{ h}$, so $v = 90 \div 1.5 = \mathbf{60 \text{ km/h}}$.
- The stop counts in the total time but adds no distance, so the average over the whole journey is lower.

Problem 13 Spot the error

- The time was left in minutes while the speed was wanted in km/h, so the result is wrong (and far too small for a car).
- $90 \text{ min} = 1.5 \text{ h}$, so $v = 150 \div 1.5 = \mathbf{100 \text{ km/h}}$.

Problem 14 Toy car data

- 0-2 s: $4 \div 2 = 2 \text{ m/s}$. 2-4 s: $8 \div 2 = 4 \text{ m/s}$. 4-6 s: $4 \div 2 = 2 \text{ m/s}$. 6-8 s: 0 m/s .
- The car was at rest **between 6 s and 8 s**.
- $v = 16 \div 8 = \mathbf{2 \text{ m/s}}$.

Problem 15 A sprint in two units

1. $v = 100 \div 9.8 = 10.204... = \mathbf{10.2 \text{ m/s}}$.
2. $10.204 \times 3.6 = 36.73... = \mathbf{36.7 \text{ km/h}}$.

Problem 16 Two parts of a trip

1. First part: $60 \div 40 = 1.5 \text{ h}$. Second part: $100 \div 80 = 1.25 \text{ h}$.
2. Total distance 160 km, total time 2.75 h, so $v = 160 \div 2.75 = \mathbf{58.2 \text{ km/h}}$.
3. The mean of 40 and 80 is 60 km/h, which is different, because more time was spent at the lower speed.

Problem 17 Cyclists meeting

1. The gap shrinks at $12 + 15 = \mathbf{27 \text{ km/h}}$.
2. $t = 27 \div 27 = \mathbf{1 \text{ h}}$.
3. $d = 12 \times 1 = \mathbf{12 \text{ km}}$ (Diego has covered 15 km, and $12 + 15 = 27 \text{ km}$).

Problem 18 Two runners on a graph

1. A: $100 \div 20 = \mathbf{5 \text{ m/s}}$. B: $(80 - 20) \div 20 = \mathbf{3 \text{ m/s}}$.
2. B starts $\mathbf{20 \text{ m ahead}}$.
3. The lines cross where $5t = 20 + 3t$, so $2t = 20$ and $t = \mathbf{10 \text{ s}}$. Then $d = 5 \times 10 = \mathbf{50 \text{ m}}$ from the start.

Problem 19 Catching the school bus

1. $t = 18 \div 40 = 0.45 \text{ h} = 0.45 \times 60 = \mathbf{27 \text{ min}}$.
2. 07:45 minus 27 min = $\mathbf{07:18}$.

Problem 20 Laps of a track

1. $d = 3 \times 400 = \mathbf{1200 \text{ m}}$.
2. $t = 270 \text{ s}$, so $v = 1200 \div 270 = 4.44... = \mathbf{4.4 \text{ m/s}}$; $4.444 \times 3.6 = \mathbf{16 \text{ km/h}}$.
3. Average speed uses the total distance travelled along the trajectory, not the straight-line gap between start and finish, so it is not zero.