

Reading motion graphs and acceleration

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

Each answer shows the graph reading, the formula and the substitution before the result with its unit. When you read a graph, state the axes first and then whether you are using a gradient or an area.

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

Problem 1 Axes and meaning

1. Time is on the horizontal axis and **distance** on the vertical axis.
2. The object is **stationary**.
3. A **higher speed**.

Problem 2 Read Aarav's walk

1. **20 m**.
2. From 10 s to 20 s: **10 s**.
3. **60 m**.

Problem 3 Speed from a distance

1. speed = distance ÷ time.
2. $150 \div 30 = \mathbf{5.0 \text{ m/s}}$.

Problem 4 Acceleration of a car

1. $a = (v - u) \div t$.
2. $a = (12 - 0) \div 4.0 = \mathbf{3.0 \text{ m/s}^2}$.

Problem 5 Match the shapes

1. Graph **B**.
2. Graph **A**.
3. Graph **C**.

Problem 6 Change of units

1. $72 \div 3.6 = \mathbf{20 \text{ m/s}}$.
2. $15 \times 3.6 = \mathbf{54 \text{ km/h}}$.

Problem 7 Gradient of a line

1. $90 \div 12 = \mathbf{7.5 \text{ m/s}}$.
2. The **speed** of the object.

Problem 8 Out and back

1. $60 \div 15 = \mathbf{4.0 \text{ m/s}}$.
2. From 15 s to 25 s: **10 s**.
3. 60 m in 20 s = **3.0 m/s**.
4. Total distance = $60 + 60 = 120 \text{ m}$. $120 \div 45 = \mathbf{2.7 \text{ m/s}}$.

Problem 9 A train speeds up

1. $a = (25 - 10) \div 30 = 15 \div 30 = \mathbf{0.50 \text{ m/s}^2}$.

Problem 10 Find the final speed

1. $v = u + a \times t$.
2. $v = 2.0 + 1.5 \times 8.0 = 2.0 + 12 = \mathbf{14 \text{ m/s}}$.

Problem 11 Scooter journey

1. $a = 12 \div 6 = \mathbf{2.0 \text{ m/s}^2}$.
2. From 6 s to 16 s: **10 s**.
3. $a = (0 - 12) \div 4 = \mathbf{-3.0 \text{ m/s}^2}$, a deceleration of 3.0 m/s^2 .

Problem 12 Who is faster?

1. Diego: $100 \div 16.0 = \mathbf{6.25 \text{ m/s}}$. Emma: $100 \div 12.5 = \mathbf{8.0 \text{ m/s}}$.
2. $8.0 - 6.25 = \mathbf{1.75 \text{ m/s}}$.

Problem 13 A curved graph

1. The car is **speeding up**.
2. The gradient of a distance-time graph is the speed, and the gradient is getting bigger.
3. A straight sloping line rising from the origin (constant acceleration).

Problem 14 Table of distances

1. $80 \div 20 = \mathbf{4.0 \text{ m/s}}$.
2. It is **stationary**, because the distance stays at 80 m.
3. $(120 - 80) \div 10 = \mathbf{4.0 \text{ m/s}}$.

Problem 15 A long walk

1. Distance = $3.0 + 6.0 = 9.0$ km. Time = 60 min = 1.0 h.
2. $9.0 \div 1.0 = \mathbf{9.0 \text{ km/h}}$.
3. $9.0 \div 3.6 = \mathbf{2.5 \text{ m/s}}$.

Problem 16 Area under a graph

1. $a = 16 \div 8 = \mathbf{2.0 \text{ m/s}^2}$.
2. Stage 1: $\frac{1}{2} \times 8 \times 16 = 64$ m. Stage 2: $16 \times 12 = 192$ m. Stage 3: $\frac{1}{2} \times 6 \times 16 = 48$ m. Total = **304 m**.
3. $304 \div 26 = \mathbf{11.7 \text{ m/s}}$.

Problem 17 Spot the errors

1. A flat line means the object is **stationary**.
2. A steeper line on a speed-time graph means a **larger acceleration**, not a larger speed.
3. Negative acceleration means the velocity is **decreasing**; the object may still move forward while slowing down.

Problem 18 A falling ball

1. $v = 9.8 \times t$: **9.8 m/s, 19.6 m/s, 29.4 m/s**.
2. A straight line from the origin with a gradient of 9.8 m/s^2 .
3. Area of a triangle = $\frac{1}{2} \times 3.0 \times 29.4 = \mathbf{44.1 \text{ m}}$.

Problem 19 Chasing cars

1. $t = 20 \div 4.0 = \mathbf{5.0 \text{ s}}$.
2. Car A: $20 \times 5.0 = 100$ m. Car B: $\frac{1}{2} \times 5.0 \times 20 = 50$ m.
3. A is **50 m ahead**. After that both cars travel at 20 m/s, so the gap does not change.

Problem 20 A tram journey

1. $a = 15 \div 10 = \mathbf{1.5 \text{ m/s}^2}$. Deceleration = $15 \div 5 = \mathbf{3.0 \text{ m/s}^2}$.
2. Distances: $\frac{1}{2} \times 10 \times 15 = 75$ m; $15 \times 40 = 600$ m; $\frac{1}{2} \times 5 \times 15 = 37.5$ m. Total = **712.5 m**.
3. $712.5 \div 55 = \mathbf{13 \text{ m/s}}$ (12.95...).