



2026 Sec 3 Physics
Answers to AS 3.1 - 3.3

AS 3.1

Reminders on presentation:

- State the formula/equation first!
- Insert units in the first step of substitution
- Final answer:
 - In decimal, not fraction
 - In 2 or 3 s.f. in general
- Vectors (displacement, velocity & acceleration) have both magnitude & direction

- 1 (a) $120 + 400 = 520$ m
(b) $120 - 400 = 280$ m West
(c) $520 \div (80+30+25) = 520 \div 135 = 3.85$ m s⁻¹
(d) $280 \div 135 = 2.07$ m s⁻¹ West

2 If downstream is given a positive sign convention,

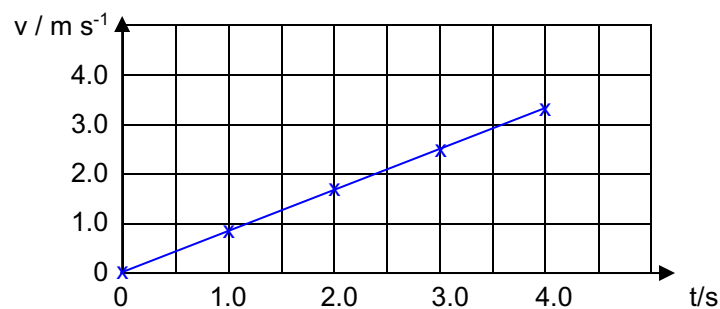
- (a) resultant velocity = $5.0 - 20.0 = -15.0$ km h⁻¹
15.0 km h⁻¹ upstream
(b) resultant velocity = $5 + 20.0 = 25.0$ km h⁻¹
25.0 km h⁻¹ downstream

3 (a) Frequency, $f = 60$ Hz

$$\text{average speed} = \text{distance} / \text{time} = \frac{10.0}{\left(\frac{8}{60}\right)} = 75 \text{ cm s}^{-1} \quad [1]$$

(b) The speed of the trolley is decreasing.

4 (a)



(b) The gradient of the v-t graph is constant.

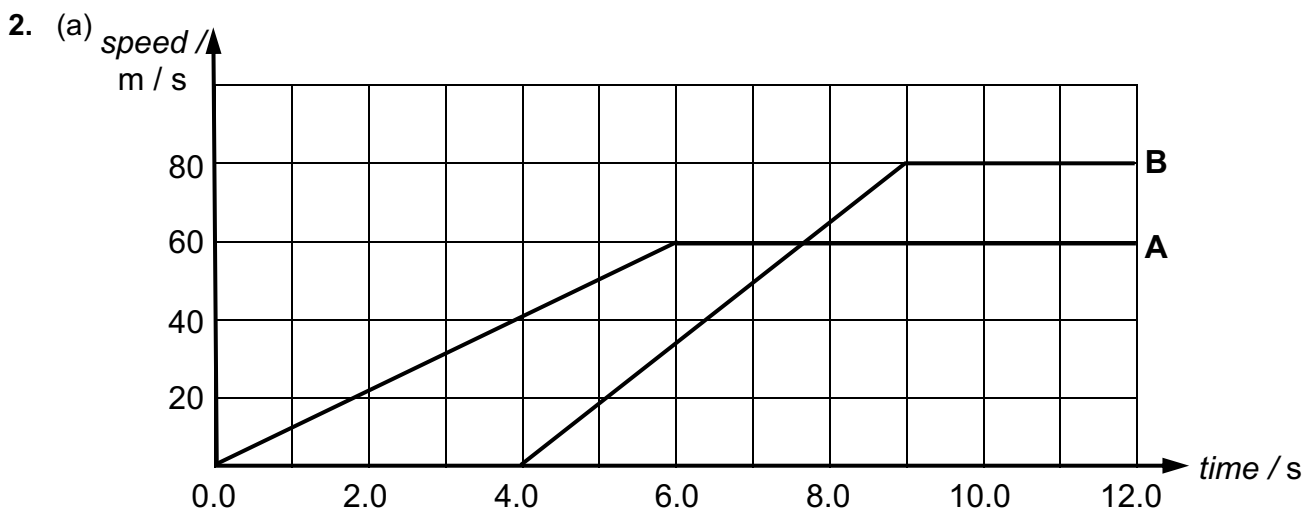
(c) $a = (v-u) / t = (3.2 - 0.0) / 4.0 = 0.80$ m s⁻²

AS 3.2

1. A : constant deceleration or velocity decreasing at a constant rate
 B : constant velocity or zero acceleration
 C : constant acceleration or velocity increasing at a constant rate
 D : decreasing acceleration or velocity increasing at an decreasing rate
 E : increasing deceleration or velocity decreasing at an increasing rate

Note:

- Describe motion in terms of “v” or “a” (preferably not both)
- Describe “v” with “rate of change”, but “a” without.



(b) average speed = total distance / total time = $[(\frac{1}{2} \times 60 \times 6.0) + (60 \times 6.0)] / 12.0$
 $= 45 \text{ m s}^{-1}$

(c) Let t be the time taken for the cars to reach the finishing line.

$$\begin{aligned} \text{distance travelled by car A} &= \text{distance travelled by car B} \\ (\frac{1}{2} \times 60 \times 6.0) + (t - 6.0)(60) &= (\frac{1}{2} \times 80 \times 5.0) + (t - 9.0)(80) \\ t &= 340 / 20 \\ t &= 17 \text{ s} \end{aligned}$$

3 (a) downwards positive

(b)(i) distance traveled = $\frac{1}{2} \times 1.2 \times 12.0 = 7.2 \text{ m}$

(b)(ii) acceleration = $0 - (-12.0) / 1.2$ or $16.0 - (-12.0) / 2.8 = 10 \text{ m s}^{-2}$

(c)(i) Ball will end up **lower** [1]. The distance moved downwards is greater than the distance moved upwards as shown by the areas under the graph.
 (up: -7.2 m, down: 12.8 m)

(c)(ii) displacement = $\frac{1}{2} (12.0 + 16.0) (2.8 - 2.4) = 5.6 \text{ m}$

or $s = \text{average } v \times \text{time}$

AS 3.3

1 (a) Sign convention: A towards B is positive
 $v = u + at$
 $25.0 = u + (0.670)(12.0)$
 $u = 16.96 \text{ m s}^{-1} = \mathbf{17.0 \text{ m s}^{-1} \text{ (to 3 s.f.)}}$

(b) $s = ut + \frac{1}{2} at^2$
 $s = (16.96)(12.0) + \frac{1}{2} (0.670)(12.0)^2$
 $s = 251.76 = \mathbf{252 \text{ m (to 3 s.f.)}}$

2 (a) Sign convention: downhill is positive
 $s = ut + \frac{1}{2} at^2$
 $s = (3.0)(8.0) + \frac{1}{2} (1.5)(8.0)^2 = \mathbf{72 \text{ m (to 2 s.f.)}}$

(b) $v^2 = u^2 + 2as$
 $7.0^2 = 3.0^2 + 2(1.5)(s)$
 $s = 13.33 = \mathbf{13 \text{ m (to 2 s.f.)}}$

3

Note: Good to sketch a diagram to illustrate the known and unknown quantities.

(a) Sign convention: A towards B is positive
 $s = ut + \frac{1}{2} at^2$
 $30 = (14)(2.5) + \frac{1}{2} (a)(2.5)^2$
 $a = \mathbf{-1.6 \text{ m s}^{-2}}$

(b) $v = u + at$
 $v = 14 + (-1.6)(2.5) = \mathbf{10 \text{ m s}^{-1} \text{ (to 2 s.f.)}}$

(c) $v = u + at$
 $0 = 14 + (-1.6)(t)$
 $t = 8.75 = \mathbf{8.8 \text{ s (to 2 s.f.)}}$

4 (a) Sign convention: upwards is positive
 $v^2 = u^2 + 2as$
 $0 = 40^2 + 2(-10)(s)$
 $s = \mathbf{80 \text{ m (to 2 s.f.)}}$

height = 80 m

(b) $s = ut + \frac{1}{2} at^2$
 $0 = (40)t + \frac{1}{2}(-10)t^2$
 $t = \mathbf{8.0 \text{ s}}$

5 Sign convention: downwards is positive

(a) $s = ut + \frac{1}{2} at^2$
 $80 = (0)t + \frac{1}{2} (10)t^2$
 $t = \mathbf{4.0 \text{ s}}$

(b) $v = u + at$
 $v = 0 + 10(4.0)$
 $v = \mathbf{40 \text{ m s}^{-1}}$

(c) (i) $v^2 = u^2 + 2as$
 $v^2 = 40^2 + 2(-20)(30)$
 $v = \mathbf{20 \text{ m s}^{-1}}$
(reject negative answer since motion is downwards, and downwards is taken as positive)

$$(ii) \quad v = u + at$$

$$20 = 40 + (-20)t$$

$$t = 1.0 \text{ s}$$

alternatively,

$$s = ut + \frac{1}{2}at^2$$

$$30 = (40)t + \frac{1}{2}(-20)t^2$$

$t = 1.0 \text{ s}$ (reject $t = 3.0 \text{ s}$ as acceleration is -20 m s^{-2} only before hitting the seabed)

$$(iii) \quad v = u + at$$

$$v = 40 + (-20)(1.0)$$

$$v = 20 \text{ m s}^{-1}$$

