Solutions

Each answer shows the steps, then the **result**.

2.1

- $v = s/t$

$$v = \frac{100 \text{ m}}{12.5 \text{ s}} = \mathbf{8.0} \text{ m/s}$$

2.2

- the distance travelled

2.3

- $a = \Delta v/\Delta t$

$$a = \frac{6.0 \text{ m/s} - 18 \text{ m/s}}{4.0 \text{ s}} = \mathbf{-3.0} \text{ m/s}^\mathbf{2}$$

- the minus sign means the car is decelerating, so the acceleration is opposite to the motion

2.4

- find the area under the line (between the line and the time axis)

3.1 B

- a flat line on a distance–time graph means the distance is not changing — at rest

3.2

(a) $a = \Delta v/\Delta t$

$$a = \frac{24 \text{ m/s} - 0}{8.0 \text{ s}} = \mathbf{3.0} \text{ m/s}^\mathbf{2}$$

(b) distance = area of the triangle

$$s = \tfrac{1}{2}(8.0 \text{ s})(24 \text{ m/s}) = \mathbf{96} \text{ m}$$

3.3

- as the diver speeds up, air resistance increases
- when air resistance equals the weight, the resultant force is zero
- so there is no acceleration and the speed stays constant (terminal velocity)

3.4

(a) between 2.9 and 3.5 min: constant speed

- between 3.5 and 4.5 min: constant (uniform) deceleration to rest

(b) time $= (2.9 - 0.90) \times 60 \text{ s} = 120 \text{ s}$

- $a = \Delta v/\Delta t$

$$a = \frac{7.5 \text{ m/s} - 0}{120 \text{ s}} = \mathbf{0.063} \text{ m/s}^\mathbf{2}$$

(c) distance = area of the speeding-up triangle

$$s = \tfrac{1}{2}(120\text{ s})(7.5\text{ m/s}) = \mathbf{450}\text{ m}$$

- for the first 72 s of it the area is 270 m

(d) time = 60 s; $a = \Delta v/\Delta t$

$$a = \frac{0 - 7.5\text{ m/s}}{60\text{ s}} = -\mathbf{0.13}\text{ m/s}^{\mathbf{2}}$$

- the minus sign means the bus is slowing down, so the resultant force is opposite to the motion

(e) at first the acceleration is g, because only the weight acts

- as the stone speeds up, air resistance grows and the resultant force falls, so the acceleration decreases
- when air resistance equals the weight the resultant force and the acceleration are zero and the speed is constant