PQ 2b Q and A

Speed and EoM

Q1

A car is travelling at a speed of 60 km/h. How many metres will it travel per second?

1 m/s = 3.6 km/h, so here the speed needs to be **divided** by 3.6 to convert back to m/s.

60/3.6 = 16.7

17 m

Q2

- Mr Mac's DB 9 can accelerate from 0 to 100 km/h in 2.5 seconds. This is an acceleration of?

100 km/h is around 28 m/s (dividing by 3.6). This change in speed needs to be divided by the time to calculate the acceleration.

$$a = \frac{v-u}{t} = \frac{28\ \text{m/s}}{2.5\ \text{s}} = 11\ \text{m/s}^2$$

Q3

- A car accelerates at a constant rate from 0 to 15 m/s over a period of 10 seconds. What is the distance covered during that time?

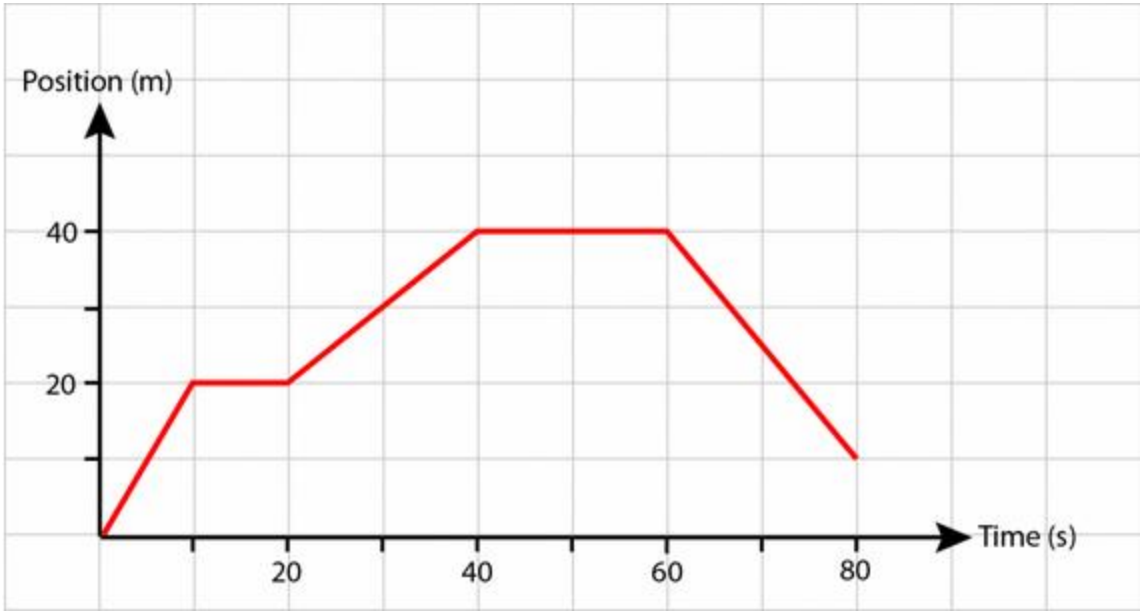
$$= \frac{1}{2}(u+v)t$$

$$= \frac{1}{2}(0+15m/s) \times 10s$$

$$= 75m$$

Q4

- The graph below shows the position of a walker up and down a street.



- Which of the following statements about the walk is incorrect?

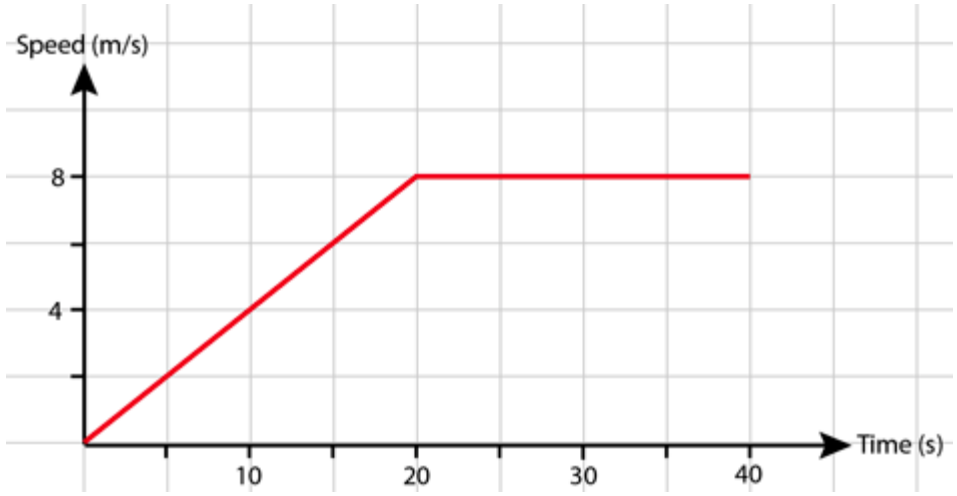
Q4 continued

- The walker averages 1 m/s for the the first 40 seconds.
- The walk back towards the starting point is the fastest part of the motion.
- The walker is stationary for a total of 30 seconds.
- At 30 seconds, the walker is 30 m from the starting point.

The gradient of the position time graph gives the velocity. The steepest section of the graph is actually the first 10 seconds, when 20 metres of distance was covered (averaging 2 m/s).

Q5

- The graph below shows the speed of a cyclist over a period of 40 seconds.



- What was the average speed of the cyclist during the 40 seconds?

Q5 continued

Average speed is calculated by dividing the distance travelled by the time period. Distance is found from the area under the graph.

$$\text{Distance} = \frac{1}{2}(0+8m/s)\times(20s)+(8m/s)\times(20s)=240m$$

$$\text{Average speed} = \frac{240m}{40s}=6m/s$$

Q6

- A stone is dropped 30 metres to the ground below. How long does it take to hit the ground?

Q6 continued

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

$$= \frac{1}{2}at^2 \ (u = 0)$$

$$t = \sqrt{\frac{2x}{a}} = \sqrt{\frac{2 \times -30m}{-10m/s^2}} = \sqrt{6} = 2.4m/s$$

Q7

- A stone is dropped 30 metres to the ground below. How fast is will it be travelling when it hits the ground?

$u = 0\ m/s$

$v = ??$

$a = -10\ m/s^2$

$x = -30\ m$

$v^2 = u^2 + 2ax$

$v = \sqrt{0^2 + 2 \times -10 \times -30}$

$v = 24\ m/s$

Q8

- The student driver of a car travelling at 72 km/h sees an obstacle on the road and manages to come to a stop in 4.0 s. What distance has the car covered while braking?
- (72km/h = 20m/s)

$$= \frac{1}{2}(u+v)t$$

$$= \frac{1}{2}(20m/s+0m/s)\times 4s$$

$$= 40m$$

Q9

- A ball is thrown up into the air and falls back down to the starting height after 3.0 s. What speed was the ball thrown at?
- (DWD!)

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

$$0 = u(3s) + \frac{1}{2}(-10m/s^2)(3s)^2$$

$$3u = 45$$

$$u = 15m/s$$

Q10

- A car is travelling on road at 108 km/h and the driver sees an obstacle 50m down the road. The combination of tyres and road surface allow a deceleration of 7 m/s2.
- At what speed will the car hit the obstacle?
- 108 km/h (30 m/s)

$$u = 30m/s \quad v = ?? \quad a = -7m/s^2 \quad x = 50m$$

$$v^2 - u^2 = 2ax \rightarrow v = \sqrt{u^2 + 2ax}$$

$$v = \sqrt{(30m/s)^2 + 2 \times (-7m/s^2) \times (50m)}$$

$$v = \sqrt{200}m/s$$

$$v = 14m/s$$