

**GCSE Physics A (Gateway)**  
**J249/04 Physics A P5-P8 and P9 (Higher Tier)**

**Question Set 24**

$$\frac{d}{s} = t$$

$$0.375$$

$$0.75 \quad 1.5$$

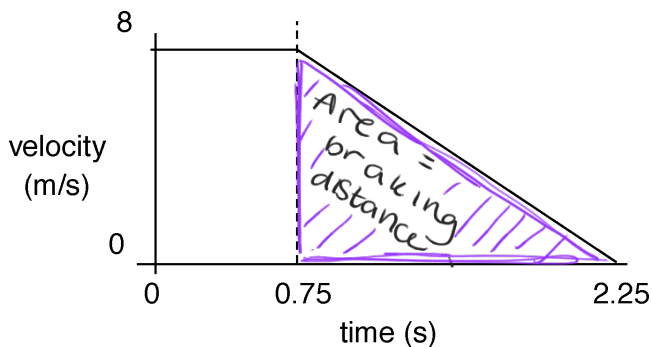
24

The table shows the stopping distances for a car.

Speed of car (m/s)	Thinking distance (m)	Braking distance (m)	Stopping distance (m)
4	3	1.5	4.5
8	6	6	12
16	12	24	36
32	24	96	120

- (a)  $\frac{1.5}{4} = 0.375$      $\frac{6}{8} = 0.75$      $\frac{24}{16} = 1.5$      $\frac{x}{32} = 3$
- Add the missing results to the table at a speed of 32 m/s. [2]
- (b) The car takes 6 m to brake when moving at 8 m/s.

Look at the graph of the car as it starts to brake and then stop.



Use the graph to show that the braking distance is 6 m.

$$(2.25 - 0.75) \times 8 \times \frac{1}{2}$$

$$1.5 \times 8 \times \frac{1}{2} = 6 \text{ m}$$

[2]

(c) The formula to work out kinetic energy is:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{velocity}^2)$$

A car has 30 000 J of energy and a mass of 1 tonne (1 tonne = 1 000 kg).

Calculate the velocity of the car and show your working.

$$KE = \frac{1}{2}mv^2$$

$$\sqrt{\frac{2KE}{m}} = v$$

$$\sqrt{\frac{2 \times 30,000}{1000}} = v = 2\sqrt{15} = 7.74596\dots = 7.7 \text{ m/s}$$

Answer = 7.7 m/s  
(2sf).

[2]

(d) Cars and lorries have different brakes.

- Brakes absorb the energy of the vehicle before it comes to rest.
- The brakes on lorries have larger brake discs and brake pads than cars.
- Brakes are designed to increased air flow.

Explain why increased air flow is more important for lorries than cars.

Lorries are heavier than cars  $\therefore$  have more kinetic energy ( $\frac{1}{2}mv^2$ , mass is larger). This means the brakes have to absorb more of the energy of the lorry. This means the brakes need to have any

[4]

**Total Marks for Question Set 24: 10**

increased air flow, for the lorry to have the same braking distance to a lighter car.  $\therefore$  increased air flow is more important for lorries than cars.

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