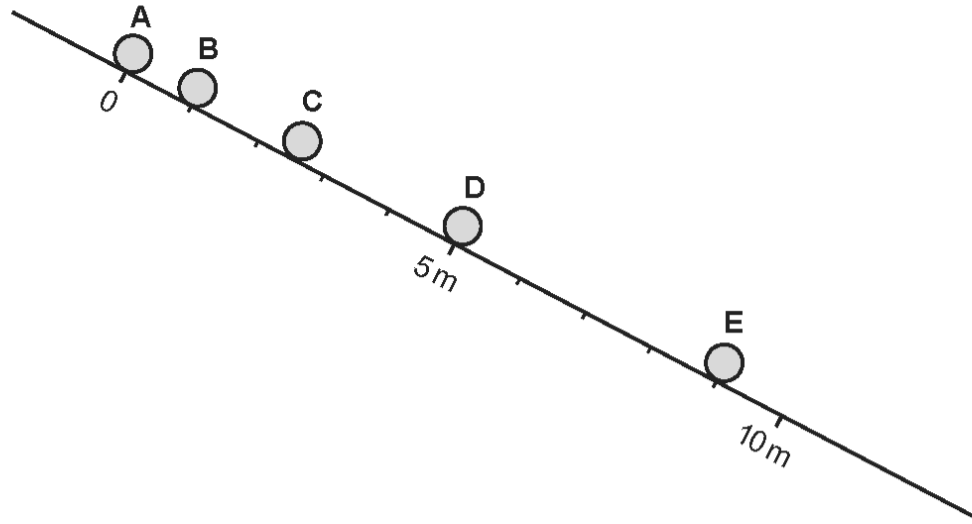


# **My Question Paper**

1.



The diagram shows the positions of a ball at 0.5s intervals as it rolls down a 10m track. It took 0.5s to roll from A to B, then another 0.5s to roll from B to C and so on.

(a) (i) Write down the distance travelled by the ball from A to E. [1]

distance = ..... m

(ii) Write down the time taken for the ball to travel from A to E. [1]

time = ..... s

(b) Use the equation:

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

to calculate the mean speed as the ball rolled from A to E. [1]

speed = ..... m/s

(c) State how the diagram shows that the ball is accelerating as it moves. [1]

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.....

(d) Describe how the positions of the ball would be different if the track was less steep. [1]

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5

2. A car is travelling at 15 m/s and decelerates to 0 m/s in 5 s on a dry road.

(i) Use an equation from page 2 to calculate the deceleration of the car. [2]

deceleration = ..... m/s<sup>2</sup>

(ii) (i) Use the equation:

$$\text{mean speed} = \frac{(\text{initial speed} + \text{final speed})}{2}$$

to calculate the mean speed of the car as it decelerates. [2]

mean speed = ..... m/s

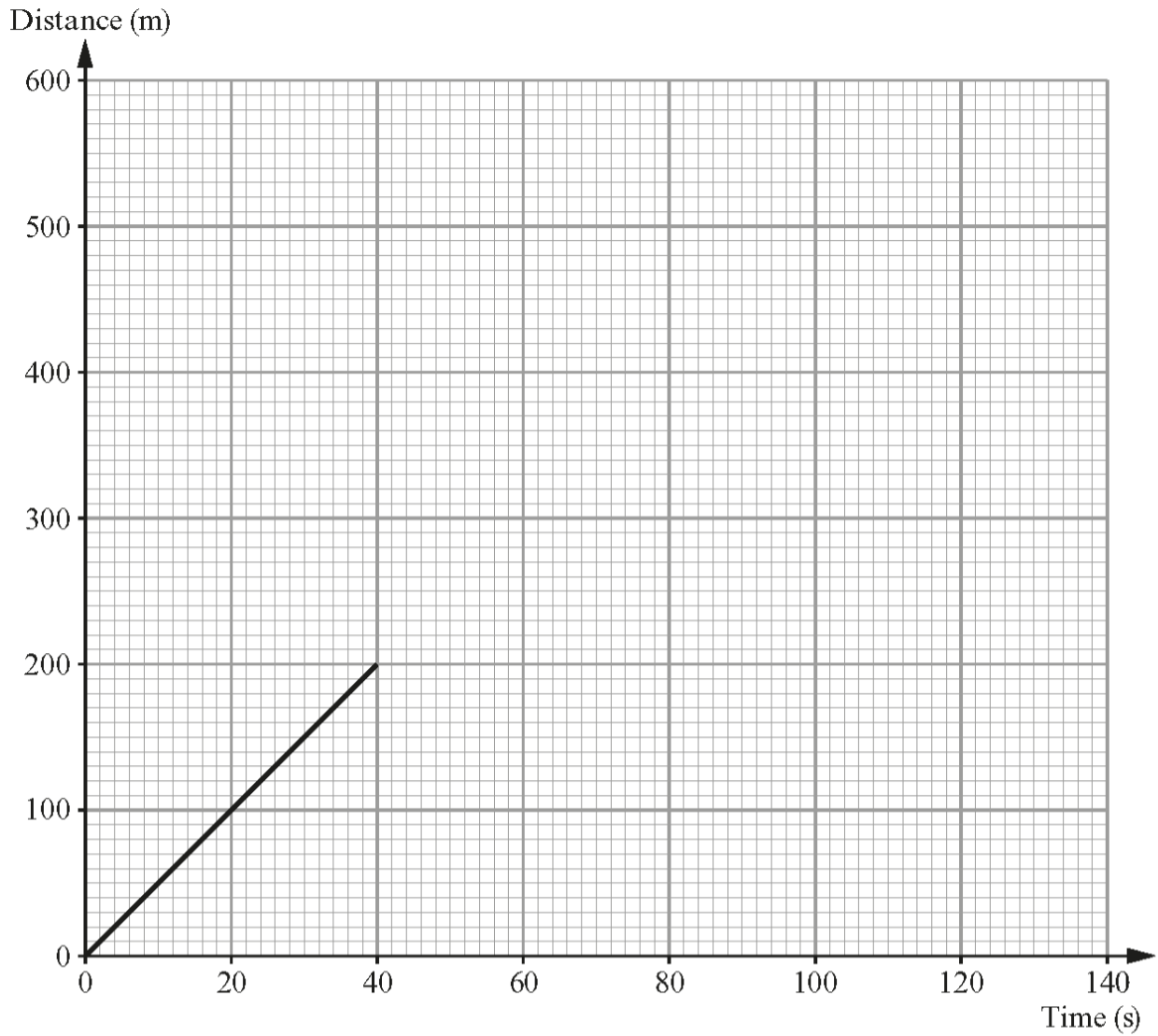
(ii) Explain how the mean speed of the decelerating car travelling at 15 m/s would have changed (if at all) if the road had been icy instead of dry. [2]

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6

3.

The distance-time graph shows part of a journey made by a cyclist.



(a) Complete the graph using the data in the table below. [3]

Time (s)	60	80	100	120	140
Distance (m)	200	200	200	400	600

(b) Use the graph to answer the following questions.

(i) Use an equation from page 2 to calculate the speed of the cyclist during the first 40 s. [3]

Speed = ..... m/s

(ii) For how long was the cyclist not moving? ..... s [1]

(c) (i) Compare the speed of the cyclist in the first 40 seconds and the last 40 seconds. [1]

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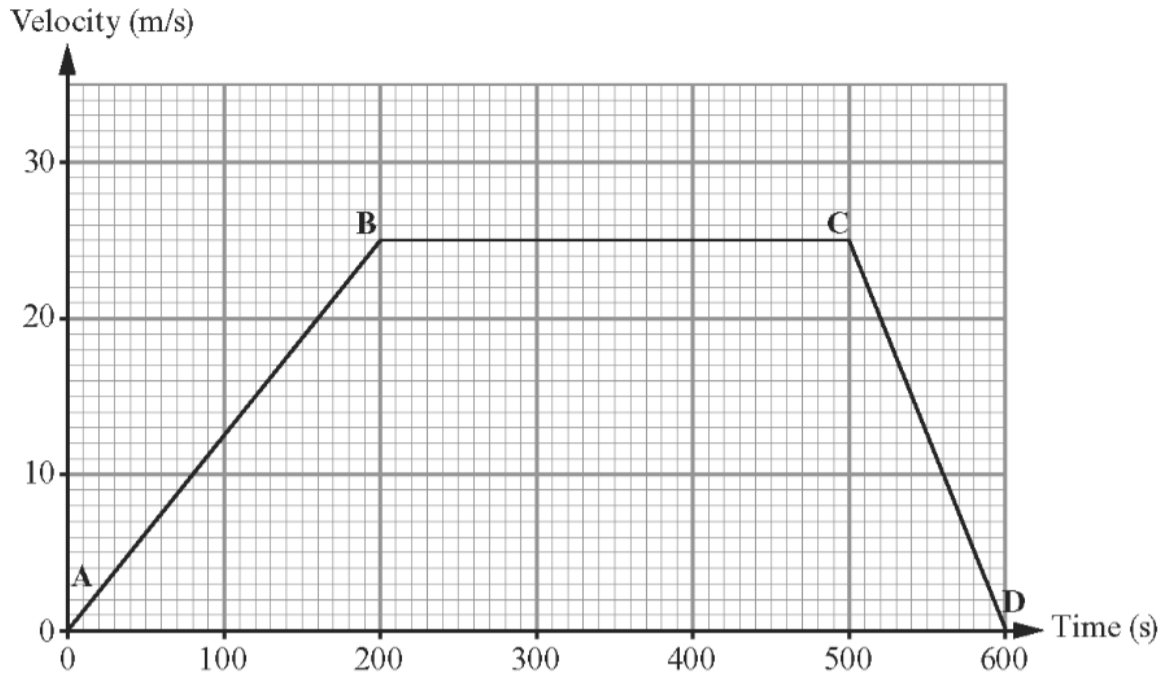
(ii) Give a reason for your answer. [1]

.....  
.....

9

4.

A train of mass 80 000 kg leaves a station **A** and arrives at another station **D**. Its journey is shown on the velocity-time graph below.



(a) Describe the motion from **A** to **D** giving as much detail as possible. [3]

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(b) (i) Use the graph and equations from page 2 to calculate the resultant force acting on the train when it was accelerating. [3]

Resultant force = ..... N

- (ii) Explain how the size of the resultant force acting on the train during its deceleration compares to your answer in (b)(i). [3]

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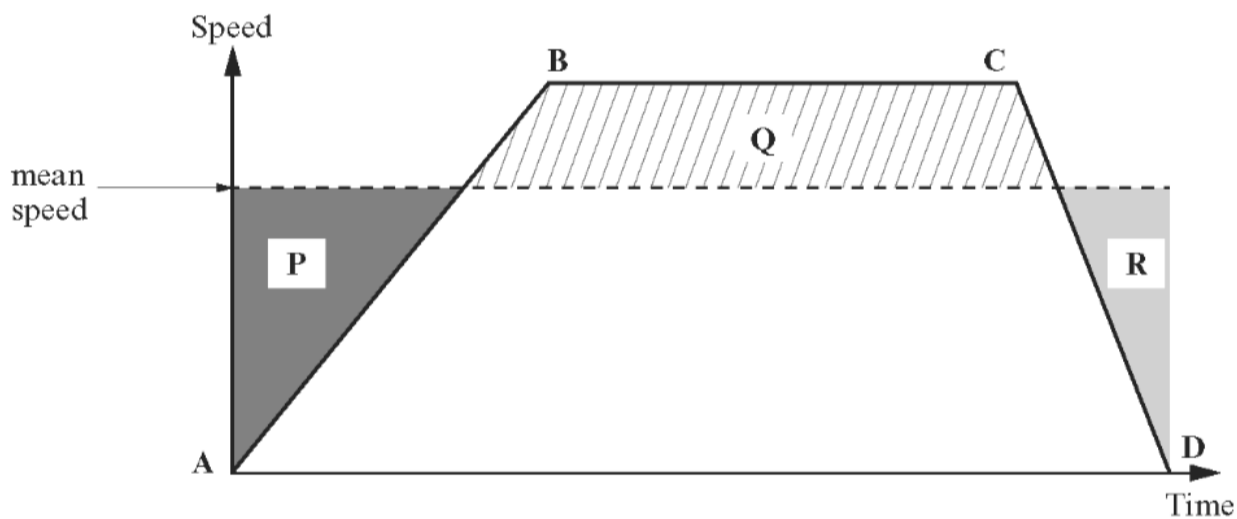
- (c) (i) Use the graph and equation from page 2 to calculate the distance from station A to station D. [3]

Distance from A to D = ..... m

- (ii) Use your answer to (c)(i) and an equation from page 2 to calculate the mean speed of the train. [2]

Mean speed = ..... m/s

- (iii) The mean speed for the journey is shown as a dotted line on the graph below.



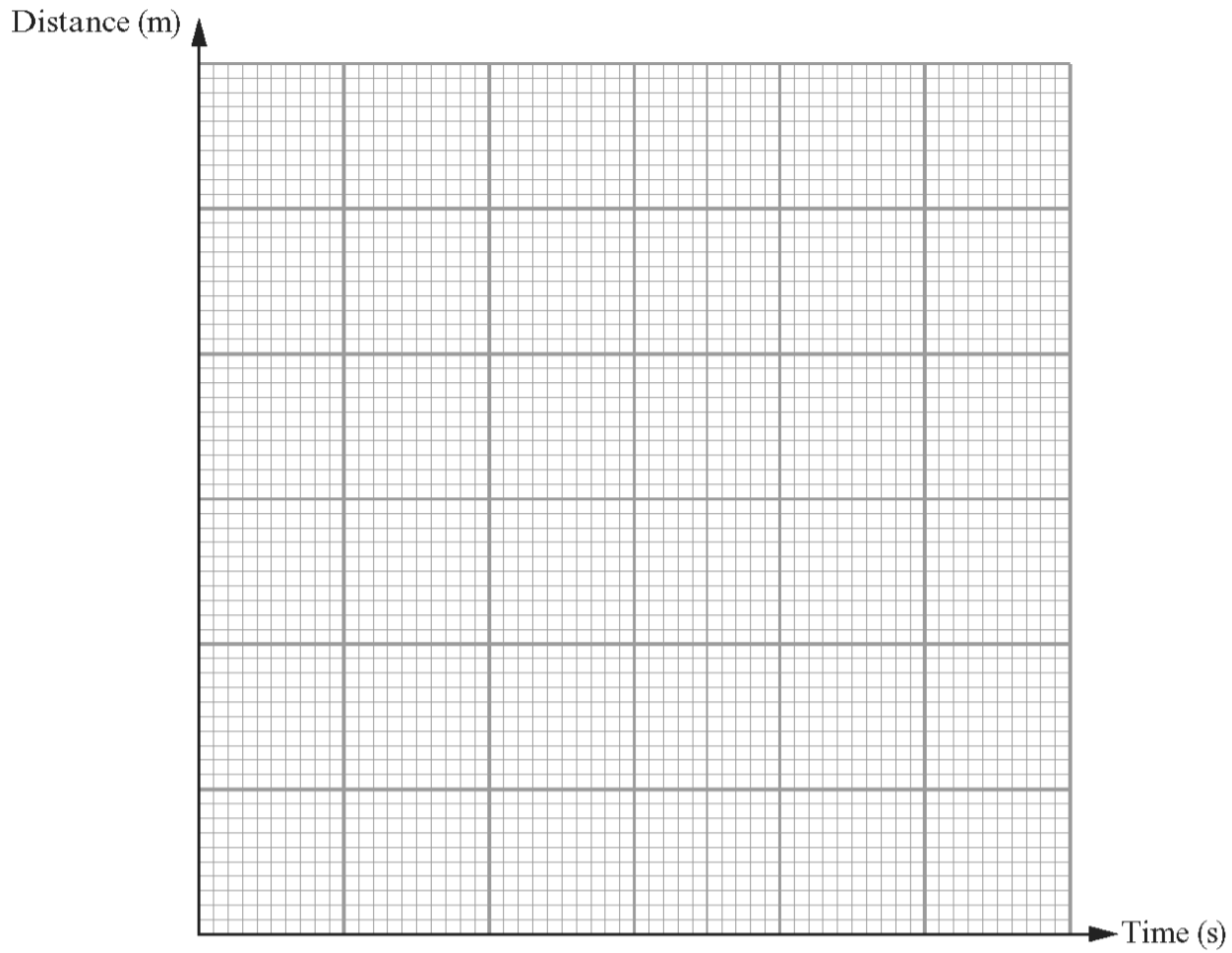
Write down how the three shaded areas P, Q and R are related mathematically. [1]

.....

.....



- (ii) During the first 10s, the bus travels 50m. Use this information to construct a distance-time graph for the **first 10s only** on the grid below. [3]



- (iii) Use the equation:

$$\text{distance} = \text{speed} \times \text{time}$$

to calculate the distance travelled by the bus between **A** and **B** on the graph opposite. [3]

Distance travelled = ..... m

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# Marking Scheme

1.

Question			Marking details	Marks
4.	(a)	(i)	9 [m]	1
		(ii)	2 [s]	1
	(b)	Speed = $\frac{9}{2} = 4.5$ ( <b>ecf</b> on (i) or (ii) above) [m/s] (1-ans)	1	
	(c)	The distances <u>get</u> / are bigger / balls get further apart. <b>Don't accept</b> further away.	1	
	(d)	Distances between the ball positions would be less / the balls would be closer together.	1	
<b>Question total</b>				<b>[5]</b>

2.

Question			Marking details	Marks	
1.		(i)	$a = \frac{(0-15)}{5}$ OR $a = \frac{(15-0)}{5}$ [1 – subs] = $-3$ [1 – ans] [m/s <sup>2</sup> ] Answer does not require a negative sign.	2	
		(ii)	(I)	Mean speed = $\frac{(15+0)}{2} = 7.5$ [1 – subs], [1 – ans] [m/s]	2
			(II)	EITHER: Mean speed would have remained the same (1) because it is the sum of two values that will not have changed (divided by two) (1). OR: The distance taken to stop would have increased but so would the time taken have increased (1) so it is difficult to conclude how the mean speed would have changed. (1) OR: Mean speed would remain the same (1) because distance and time increase. (1) <b>Either mark can be awarded on its own but only award 2 marks if they are linked.</b>	2
<b>Question total</b>				<b>[6]</b>	

3.

Question		Answer / Explanatory Notes	Marks Available
		<b>Question total</b>	<b>[7]</b>
2.	(a)	Plots $\pm \frac{1}{2}$ square (2) [-1 per error] Joined point to point (1) ecf for incorrect plots If line is correct assume points are correct even if they can't be seen. Ignore thickness of line but do not accept disjointed / wispy / double / curves	3
	(b)	(i) Use of 200 m from graph (1) Speed = $\frac{200}{40}(1 - \text{subst}) = 5$ [m/s] (1)  Correct working of gradient (matching points) = 3 marks e.g. $\frac{100}{20} = 5$	3
		(ii) 60 [s] ecf from graph	1
	(c)	(i) Faster speed in the <u>last 40</u> seconds or 5 m/s compared with 10m/s (ii) Steeper line / has a larger gradient / same time [interval] but travelled further or 5 m/s compared with 10m/s	1 1
		<b>Question total</b>	<b>[9]</b>

4.

Question		Answer / Explanatory Notes	Marks Available
5.	(a)	General description of 3 parts (1) Reference to all 3 times (1) Reference to 25 m/s value / value of acceleration (0.125) / deceleration (0.25) (1)	3
	(b)	(i) Either: $a = 0.125$ (1) and $F = ma = 80\,000(1) \times 0.125$ (ecf) = 10 000 [N](1) or $F = 80\,000(1) \times \left\{ \frac{(25-0)}{200} \right\}(1) = 10\,000$ [N](1) (ii) Force is bigger (1 mark only) but force is twice as big (2 marks only) because time is smaller / half as long / gradient is bigger or twice as big (1) (Calculated value for force of 20 000 N gets 2 marks but a statement the force is bigger because the time is halved (1) is still needed.)	3 3
	(c)	(i) $(300 + 600)(1) \times (0.5(1) \times 25)(1) = [11\,250 \text{ m}]$ N.B. no mark for answer OR Area = $(0.5 \times 200 \times 25)(1) + (300 \times 25)(1) + (0.5 \times 100 \times 25)(1)$ $= 2\,500 + 7\,500 + 1\,250 = [11\,250 \text{ m}]$ N.B. no mark for answer (ii) mean speed = $\frac{11250(\text{ecf})}{600} = 18.75$ [m/s] [1 for subs, 1 for answer] (iii) Area P + area R = area Q [1] accept P + R = Q	3 2 1
		<b>Question total</b>	<b>[15]</b>

## 5.

Question		Marking details	Mark
2.	(i)	<p>Indicative content: The initial velocity of the bus is 5 m/s. It continues at this velocity for 10 s. Then it accelerates at a constant rate of 1.5 m/s<sup>2</sup> for 10 s to 20 m/s. It travels at a constant velocity of 20 m/s for 20 s. At 40 s, it decelerates at a decreasing rate until it comes to a rest at 70 s. The mean deceleration is 0.67 m/s<sup>2</sup>.</p> <p><b>5 – 6 marks</b> The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p><b>3 – 4 marks</b> The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p><b>1 – 2 marks</b> The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p><b>0 marks</b> The candidate does not make any attempt or give a relevant answer worthy of credit.</p>	6
	(ii)	<p>Scales using at least half of each axis [at least one intermediate point required and a sensible scale] (1) point (10,50) [point may not be clear but award if line ends at this point. Ignore intermediate points]. (1) Straight(ish) line to that point and <b>must</b> be from (0,0) [Do not award this mark for an obvious curve] (1). Any line that goes past (10,50) is penalised 1 mark. Straight line to wrongly plotted point gets the line mark.</p>	3
	(iii)	<p>20 (1) <math>\times</math> 20 (1) = 400 [m] (1) Repeated multiplications e.g. <b>20</b> <math>\times</math> 20, <b>20</b> <math>\times</math> 40, <b>20</b> <math>\times</math> 5 [1 only]</p>	3
	<b>Question total</b>		