

WJEC Physics GCSE
Topic 2.1: Distance, speed
and acceleration
Mark Schemes for
Questions by topic

1.

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

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 ²] 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) Either mark can be awarded on its own but only award 2 marks if they are linked.	2
			Question total	[6]	

3.

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/s² 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/s².</p> <p>5 – 6 marks 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>3 – 4 marks 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>1 – 2 marks 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>0 marks 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 must 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) \times 20 (1) = 400 [m] (1) Repeated multiplications e.g. 20 x 20, 20 x 40, 20 x 5 [1 only]</p> <p>Question total</p>	3 [12]

4.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	1	<u>Braking distance</u>	<u>Breaking distance</u>		
(b) i	2	Thinking distance increases with speed (1) in proportion / uniformly / steadily (1)	As speed doubles thinking distance doubles (2) Speed increases with thinking distance (1)		Linear Constantly
ii	1	Less steep straight line through origin \pm 1 small square division			Any curves at all
(c) i	1	C			
ii	1	A			
Total	6				

5.

Question	Answer / Explanatory Notes	Marks Available
3.	<p>Indicative content: The advantage is that the time taken for the given journey is reduced from 4 h to 3.5 h with the increase in speed. The disadvantage is that in the event of an emergency stop being necessary, the total stopping distance is increased from 96 m to 121.5 m, increasing risk of serious injury or death. Relevant factors clearly explained, e.g. tiredness, related to time or speed / separation from vehicle in front. Increased momentum at higher speed related to increased force on vehicle and occupants in the event of a collision.</p> <p>5 - 6 marks 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>3 – 4 marks 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>1 – 2 marks 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>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>	6
	Question total	[6]

6.

Mark	Answer	Accept	Neutral answer	Do not accept
6	<p>Indicative content: If the vehicle is travelling faster then the thinking distance is increased and the braking distance is also increased. This means that the overall stopping distance is greater (or the converse for a vehicle travelling more slowly). If the brakes are worn (or poor road surface conditions) the thinking distance is unaffected but the braking distance is increased. This again leads to an increased stopping distance (or the converse for new brakes). If the driver has drunk alcohol or is tired the reaction time is bigger and so the thinking distance is greater. Although the braking distance is unaffected the overall stopping distance is greater.</p> <p>5-6 marks 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>3-4 marks 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>1-2 marks 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>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>			

7.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	15			
	(ii)	1	36 [m]			
	(iii)	2	Increases [distance] (1) because it travels further in the <u>same time</u> (1) The 1st mark must be linked to the 2nd mark.	Thinking <u>time is the same</u> (1) so distance increases (1) / Thinking distance and overall stopping distance increase (1)		Takes you longer to think / Thinking distance and overall braking distance increase
(b)		2	<u>Thinking</u> distance increases (1) <u>braking</u> distance unchanged (1)	Both distances increase / The data increases (1)	Stopping distance References to time Ignore any reasoning References to overall stopping distance	
(c)		3	$2 \times 40 = 80$ (1) $\frac{80\text{ecf}}{31}$ (1) $= 2.58$ [s] or 2.6 [s] (1)	$\frac{40}{31} = 1.29$ (2) $\frac{80}{70}$ (1) [=1.14] Any number divided by 31 award 1 mark only 2.5 [s] on its own award 2 marks		$\frac{40}{70} = 0.57$
(d)		2	Overall stopping distance is <u>96 m</u> (1) which is <u>more than</u> 80 m / 16 m <u>more</u> / <u>more than</u> 2 gaps (1) The 1st mark must be linked to the 2nd mark.	which is more than 40 m / more than a gap (1)	Reference to braking distance	
Total		11				