Eduqas Physics GCSE
Topic 4.1: Motion concepts
Mark Schemes for Questions by topic

Marking Scheme

1.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		3	Substitution into $x = ut + \frac{1}{2}at^2$ (1) Conversion to 500 (1) t = 10 [s] (1) **Don't award 3rd mark if conversion to 500 is not applied**			
	(ii)		2	$65 = \frac{d}{10}$ **ecf** (1- subs) d = 650 [m] (1)			
(b)			2	X at ground level to the right of 0 on the scale (1) X drawn at 650 [m] **ecf** (1)			
TOTAL			7				

2.

Question				Marking details	Marks
1.	(a)	(i)		0.8 [s]	1
		(ii)		3.2 [s] (allow **ecf** from (i)) If answer is 3.2 in (i) then **don't accept** 0.8 as **ecf** in this part.	1
		(iii)		subs $\frac{15}{3.2(\text{ecf})}$ (1) = 4.69 or 4.7 or 4.6875 [m/s^2] (1) Ignore the signs. **Don't accept** 4.68 or 4.687. A common **ecf** is $\frac{15}{4.2}$ = 3.57 or 3.6	2
		(iv)		Horizontal line would be longer (1) because the reaction (or thinking) time (or distance) would be longer / would travel further [at constant speed] / slower reactions (1) **Don't accept** slower reaction time **To award both marks both statements must be linked.**	2
		(v)		Less steep graph / sloping line is longer (1) because braking distance (or time) increases / takes longer to stop / smaller deceleration / less friction or grip (1) **Don't accept** not as fast to mean a greater braking distance. **Accept** slippery road. **To award both marks both statements must be linked.**	2

3.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
	4	= 50 + 125 + 200 + 100 (1) = 475 [m] (1) Mean speed $= \frac{475\ \textbf{ecf}}{40}$ (1) = 11.875 [m/s] (1) **Alternative (using mean speeds):** = 5 + 12.5 + 20 + 10 (1) = 47.5 (1) Mean speed = $= \frac{47.5\ \textbf{ecf}}{4}$ (1) = 11.875 [m/s] (1)	12 [m/s] 11.9 [m/s] 11.88 [m/s]		11.8 [m/s]
TOTAL	4				

4.

Question			Marking details	Mark
2.		(i)	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^2 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^2. **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. **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. **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. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6
		(ii)	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.	3
		(iii)	20 (1) x 20 (1) = 400 [m] (1) Repeated multiplications e.g. **20** x 20, **20** x 40, **20** x 5 [1 only]	3
			Question total	**[12]**

5.

Question			Marking details	Mark
5.		(i)	Substitution into $v^2 = u^2 + 2ax$ (1) $u = 0$ (1) $v = 10$ m/s (1) **Alternative method:** t calculated first **OR another alternative method:** PE = $mgh = 0.2 \times 10 \times 5 = 10$ [J] (1) ½ $mv^2 = 10$ [J] (1) then $v = 10$ [m/s] (1)	3
		(ii)	Recognition that v^2 halves i.e. to 50 (1) Therefore new $v = \sqrt{50} = 7[.07]$ [m/s] (1) **Alternative method:** Initial KE = 10 [J] **ecf** so rebound KE = 5 [J] (1) Calculation of $v = 7[.07]$ [m/s] (1)	2
		(iii)	Substitution into $x = ½ (u+v)t$ (1) rearrange so $t = \frac{2.5}{3.5(\text{ecf})}$ (1) Answer = 0.7[1] s (1) Award same format of marks if $x = ut + \ldots$ is used	3
			Question total	**[8]**

6.

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]**

7.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	Substitution into $x = ut + \frac{1}{2}at^2$ i.e. $x = [0 +] (\frac{1}{2} \times 10 \times 2.8^2)$ (1) Answer = 39.2 [m] (1)	Combinations of equations of motion – find the mean speed (14 m/s) (1) and use of distance = speed × time = 39.2 [m] (1)		$2.8 \times 28 =$ 78.4 [m]
(c)	(i)		2	Substitution into KE = $\frac{1}{2}mv^2$ i.e. KE = $\frac{1}{2} \times 0.3 \times 14^2$ (1) Answer = 29.4 [J] (1)			KE = $\frac{1}{2} \times 0.3 \times 14$

8. (a) Size / magnitude (NOT distance) and direction B1

9. (a horizontal by eye M1
arrow to left A1
idea of airliner accelerating/changing direction AND caused by force in that direction o.w.t.t.e. OR centripetal force
OR force/acceleration towards centre of circle B1 [3]

(c) direction changing B1
(therefore) velocity changing or speed/magnitude constant B1 [2]