Question number	Answer	Additional guidance	Mark
1(a)	An answer that combines the following points of understanding to provide a logical description: • measurement of time	allow stopwatch, light gates	
	 between(or at) two positions using suitable timing equipment (1) measurement of suitable distance 	minimum is 0.5 m metal tape measure	
	 along the runway with metre rule (1) measurement of vertical height to starting position (1) repeats AND averages AND use of a correct 	average speed = distance/time OR average speed = (speed at A - speed at B)/2	
	equation (1)		(4)

Question number	Answer	Additional guidance	Mark
1(b)(i)	Substitution of correct data from graph and mass conversion (1) $0.5 \times 0.65 \times (0.61)^2$ Answer (1) 0.12 (J)	maximum of 1 mark if mass in g used allow tolerance of ±0.2 for speed	(2)

Question number	Answer	Additional guidance	Mark
1(b)(ii)	 Tangent to the graph at h = 0.1 (1) Answer in the region 3.5 to 	either seen on graph or suitable pairs of values of Δv and Δh	
	3.6		(2)

Question	Answer	Mark
number		
1(b)(iii)	An answer that combines points of interpretation/evaluation	
	to provide a logical description:	
	 for each change in height, as the height increases the speed of the trolley increases 	
	the greatest change in speed is between the change in	(2)
	height from 0.04 m to 0.9 m	

Question number	Answer	Additional guidance	Mark
1(c)	 An answer that combines the following points to provide a logical description of the plan/method/experiment: identifies control variables (1) uses at least 3 different surfaces (1) calculates average speed for each surface and repeats (1) 	constant height, constant slope, constant starting points and same length of surface	(3)

Question Number	Answer	Acceptable answers	Mark
2(a)	Α		(1)

Question Number	Answer	Acceptable answers	Mark
2 (b)	distance travelled = area under graph (1)	distance = average speed x time	
	substitution (1) 1/2 x 20 x 2	= 10 × 2	
	evaluation (1) 20 (m)	20 (m) allow (distance) = speed × time or 20 x 2 for 1 mark	
		give full marks for correct answer, no working	(3)

Question Number	Answer	Acceptable answers	Mark
2 (c)	An explanation linking the following points		
	 velocity is a vector (1) 	velocity has magnitude and direction velocity has direction	
	 (whereas) speed is not (1) 	speed is a scalar speed has {no direction}/{magnitude only}	
		allow for 2 marks velocity is speed in a straight line velocity = <u>displacement</u>	
		time	
		momentum must still refer to vectors or direction to gain credit	(2)

Number An explanation linking some of the following GWC *2(d) An explanation linking some of the following • weight down • air resistance up (opposing motion) Forces during fall • weight constant • air resistance increases • with speed • resultant force = W - R Effect on shape of graph • at start, resultant force decreasing so acceleration large / gradient steep • mid resultant force decreasing so acceleration decreasing / gradient decreasing • terminal velocity, resultant force is zero so acceleration zero / gradient zero (6) Level O No rewardable content 1 1-2 • a limited explanation linking a few facts from the indicative content. E.g. at terminal velocity, forces are equal so constant speed. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy 2 3 -4 • a simple explanation linking some of the indicative content to the shape of the graph e.g At the start weight > air resistance so na acceleration. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy • the answer communicates ideas showing some evidence of clarity and organisation and	Questi	estion Indicative Content Mar		Mark		
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			 spelling, punctuation and grammar are used with few errors 			

Question Number	Answer	Acceptable answers	Mark
3 (a) (i)	16 (s) (1)	Sixteen/ sixteen seconds/ 16 s/ 16 seconds	(1)

Question Number	Answer		Acceptable answers	Mark
3 (a) (ii)	Downward arrow starting at centre of the block	(1)	Mark by eye ie ruler not required. Accept freehand lines and gaps between dot and line less than half the distance between dot and bottom of block by eye. Accept lines that are not quite vertical	(1)

Answer	Acceptable answers	Mark
D zero		(1)
	Answer D zero	Answer Acceptable answers D zero

Question Number	Answer		Acceptable answers	Mark
3 (a) (iv)	Substitution 3 / 2			
	Evaluation 1.5	(1) (1)		
	Unit m/s ²	(1)	ms ⁻² or m/s/s bald 1.5 x 10 ⁿ m/s ² gains 2 marks eg bald 150 = 1 mark (BOD for correct substitution) 150 m/s ² gains 2 marks give full marks for correct numerical answer, 1.5 m/s^2 even if no working	(3)

Question Number	Answer	Acceptable answers	Mark
3 (a) (v)	An explanation to include two of the following points		
	 (At first/in first 2 seconds Block is) accelerating (1) 	(block is) speeding up/increasing velocity	
	Which requires a (resultant) force (1)	there is an unbalanced force/ forces are not balanced	
	 In addition to the force needed to balance the weight of the block (1) 		(2)
	 (In next 4 seconds) forces are balanced (1) (Because) velocity is constant (1) 	(Because) speed is steady	

Question Number	Answer	Acceptable answers	Mark
3 (b)	An explanation to include	Ignore air resistance	
	Information taken from the graph (1)	(Overall) time is less OR velocity/speed is greater OR acceleration is greater OR bigger/faster change in velocity/speed	(2)
	A valid conclusion (1)	So (same amount of) work is done more quickly/energy is transferred faster	