

PH2HP

Question 1

question	answers	extra information	mark
1(a)(i)	B C	either order	1
1(a)(ii)	elastic <u>potential</u> (energy)	accept strain for elastic	1
1(b)(i)	measured / recorded the length of the spring (and not extension)	mark both parts together accept measured A–C (and not B–C) accept did not work out/measure the extension	1
	extension does not equal zero when force = 0	accept line should pass through the origin	1
1(b)(ii)	point marked at 5.5 (N)	accept anywhere between 5.0 and 5.6 inclusive	1
	up to that point force and extension are (directly) proportional	accept at the end of the straight part (of the graph line) accept past that point force and extension are no longer (directly) proportional accept the line starts to curve	1
1(c)	1.8	allow 1 mark for correct substitution, ie 25×0.072 provided no subsequent step shown an answer 1800 gains 1 mark an incorrect conversion from mm to m with a subsequent correct calculation gains 1 mark	2
Total			8

Question	Answers	Extra information	Mark	AO spec ref
4(a)	3800	allow 1 mark for 2000 allow 1 mark for 1800 if neither of above scored, allow correct substitution for 1 mark $(800 \times 2.5) + (600 \times 3)$ if moments have been calculated incorrectly, allow 1 mark for adding their two moment values correctly	3	AO1 AO2 3.2.2b
	newton metres or Nm	do not allow nm or NM	1	
4(b)	as the girl increases her distance (from the pivot) the clockwise moment increases		1	AO3 3.2.2b, c
	(F must increase) as the anticlockwise moment must increase		1	
	so (the anticlockwise moment) is equalled / balanced by the clockwise moment or so resultant / overall moment (on the board) is zero	accept to balance / equal the moments to balance the board is insufficient	1	
Total			7	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	starting / stopping the stopwatch or timing over the smaller distances	human error is insufficient reaction time is insufficient accept not timing accurately do not accept references to measuring distance incorrectly	1	AO3 2.1
1(b)(i)	before		1	AO3 2.1
1(b)(ii)	increasing	accept accelerating it is not constant is insufficient it is less than after four seconds is insufficient it reaches a constant speed negates	1	AO3 2.1.2b
1(b)(iii)	calculate the gradient of the straight/steepest/constant section	accept gradient of any section after 5.5 seconds/30 cm	1	AO1 2.1.2b
1(b)(iv)	drag (force) increases (as the ball bearing gets faster) (until) drag (force) = weight or (until) resultant force is zero	accept frictional/upward force for drag accept upward force = downward force accept till forces are balanced	1 1	AO1 2.1.4b

1(c)	less than ball bearing increases speed at a greater rate or ball bearing has a greater acceleration or terminal velocity has not been reached so resultant force must be greater or as weight is the same (the drag must be less)	accept it travels the same distance in less time accept the ball bearing is going faster accept warmer oil has a lower density/viscosity for 1 mark if neither of the two reason marks score	1 1 1	AO3 2.1.4a/b
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	elastic potential		1	AO1 2.1.5b 2.2.1c
5(b)(i)	line is straight	accept line does not curve	1	AO1 2.1.5c
5(b)(ii)	400	allow 1 mark for correct substitution of any pair of numbers correctly taken from the graph e.g. $160 = k \times 0.40$	2	AO2 2.1.5d
	newtons per metre or N/m	if symbols are used they must be correct	1	AO1 2.1.5d
5(b)(iii)	300	allow 1 mark for correctly obtaining force on 1 spring = 100N	2	AO3 2.3.2l
5(c)	52	allow 2 marks for calculating change in gpe for 1 chin-up as 260 (J) or for 12 chin-ups as 3120 (J) an answer 4.3 gains 2 marks allow 1 mark for correct substitution into gpe equation ie $\text{gpe} = 65 \times 10 \times 0.4 (\times 12)$ or correct use of power equation with an incorrect value for energy transferred	3	AO2 2.2.1e
Total			10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	turning effect	accept force multiplied by perpendicular distance from the line of action of the force to the pivot	1	AO1 3.2.2a
5(a)(ii)	moments are equal (in size) and opposite (in direction)	both parts are required allow clockwise moment = anticlockwise moment	1	AO1 3.2.2c
5(a)(iii)	0.9 (N)	allow 2 marks for $F=0.18 \div 0.2$ provided no subsequent steps allow 1 mark for (anticlockwise moment) = 0.18 (Nm) allow 1 mark for correct substitution i.e. $1.5 \times 0.12 = F \times 0.20$	3	AO2 3.2.2e
5(b)	a longer drumstick lever gives a quieter sound a longer drumstick lever allows a greater range of volumes	 a greater force gives a louder sound is insufficient	1 1	AO3 3.2.2e
Total			7	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	The distance the lorry travels during the driver's reaction time.		1	AO1 2.1.3c
4(a)(ii)	the greater the speed (of the lorry) the greater the (thinking) distance or they are directly proportional		1	AO1 2.1.3b
4(b)(i)	24 (m)	allow 1 mark for $\frac{1}{2} \times 12 \times 4$ an answer of 30 gains 1 mark	2	AO2 2.1.2h
4(b)(ii)	15000 (N) or $360\,000 \div$ their (b)(i) correctly calculated	allow 1 mark for correct substitution ie $360\,000 = F \times 24$ or their (b)(i) an answer 15 with the unit changed to kN gains 2 marks an answer 15 gains 1 mark $360 \div$ their b(i) correctly calculated gains 1 mark	2	AO2 2.2.1b
4(c)(i)	any one from: <ul style="list-style-type: none"> height (of the ramp) speed of the trolley at the bottom (of the ramp) angle (of the ramp) start point (on the ramp) 	the following are insufficient length of ramp or string same trolley or same ramp	1	AO2 HSW
4(c)(ii)	(measure maximum) distance the weight is lifted from the floor		1	AO3 HSW

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(c)(iii)	increase accuracy (in measurement of braking distance)	accept results would be more reliable ignore reference to validity	1	AO3 HSW
	by allowing a mean/average to be calculated or by allowing anomalous results to be discarded	accept by allowing anomalous results to be identified accept shows results are repeatable reproducible is insufficient	1	
4(c)(iv)	As (braking) force increases (braking) distance decreases	accept weight (lifted) for braking force	1	AO3 HSW
	justification by correct numerical example eg increasing the force from 2 to 8 you can decrease the braking distance from 80 to 20 cm	An answer of (braking) distance is inversely proportional to (braking) force gains 2 marks	1	
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	momentum before (firing) = momentum after (firing)	accept momentum (of the cannon and ball) is conserved if no other marks are awarded answers only in terms of equal and opposite forces gain a maximum of 1 mark	1	AO1 2.2.2b
	before firing momentum (of cannon and ball) is zero		1	
	after (firing) the ball has momentum (forwards) so the cannon must have (equal) momentum (backwards)		1	
7(b)	1000 (kg m/s)	allow 2 marks for correctly calculating (final) velocity as 125 (m/s) allow 1 mark for correct substitution ie $2500 = \frac{v(-u)}{0.05}$ award 1 mark for an incorrectly calculated value of v correctly substituted and calculated in the equation momentum = m x v	3	AO2 2.1.2e 2.2.2a
Total			6	

22	(a)	The momentum at the start and at the end will be equal as long as no external forces act / AW (1)	1	1.1	
	(b)	$(90 \times 2) + (60 \times \text{velocity}) = 0$ (1) Velocity = $(-)$ 3 (m/s) (1)	2	2 x 2.1	