Question number	Answer	Accept	Reject	Marks
1 (a) (i)	Work done = force x distance (in direction of force);	W = F x d d = W / F F = W / d		1
(ii)	Substitution (in correct equation); Answer; e.g.: W = 1.7 x 0.46 = 0.78 (J);;	 0.782		2
(iii)	Response must match 7a(ii) ; e.g. 0.78	Accept word answer e.g. "the same"		1
(b) (i)	KE is zero /less / decreased;	No KE The KE is transferred (to other forms)		1
(ii)	Centre of gravity is lower;	Centre of mass is lower Height is lower <u>and</u> reference to mgh		1

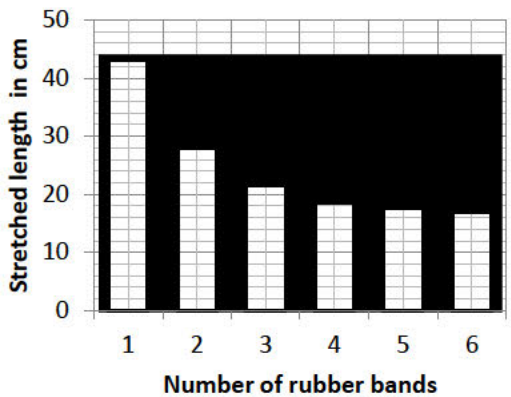
Total 6 marks

Question number	Answer	Notes	Marks
2 (a)	B – force;		1
(b)	B – energy;		1
(c)	A - gravitational potential energy;		1
(d)	D – the vertical forces on it are balanced;		1

Total 4 marks

Question number	Answer	Notes	Marks
3 (a) (i)	18.7 ± 0.5 (cm);	accept any value between 18.2 and 19.2	1
(ii)	Any two of - MP1 Mention of parallax error; MP2 Idea of zero error; MP3 End of ruler is worn; MP4 Hook is curved; MP5 Hook stretches bands to different lengths; MP6 Bands are not close to ruler; MP7Bands are not parallel to ruler; MP8 Bands are twisted;	Ignore human error Ignore inaccurate scale Ignore anomaly, no average, references to Hooke's law	2
(b)	Idea of a controlled variable; e.g. force kept constant temperature kept constant	Allow properties of bands, e.g. type, brand, material, thickness, elasticity, original length Ignore idea of consistent technique, e.g. using same equipment	1

Question number	Answer	Notes	Marks
3 (c) (i)	Discrete/discontinuous; OR Independent;	Allow non-continuous, categoric	1
(ii)	Axes labelled - quantities and distance unit; Suitable scale chosen - longest bar occupies at least half the grid; All 5 bars for given data correctly plotted;;	Ignore orientation Ignore the 4 band value Bar length plotted to nearest small square. Deduct one mark for each plotting error (max -2) Data plotted correctly, but only as floating "x's" gets maximum of one mark for plotting Reject both plotting marks if a line graph is drawn (only scale and axes marks are available in this case)	4
(iii)	MP1 Idea of inverse relationship; MP2 Idea of non linearity;	Allow: pattern statements negative correlation Accept ecf "curved line"	2

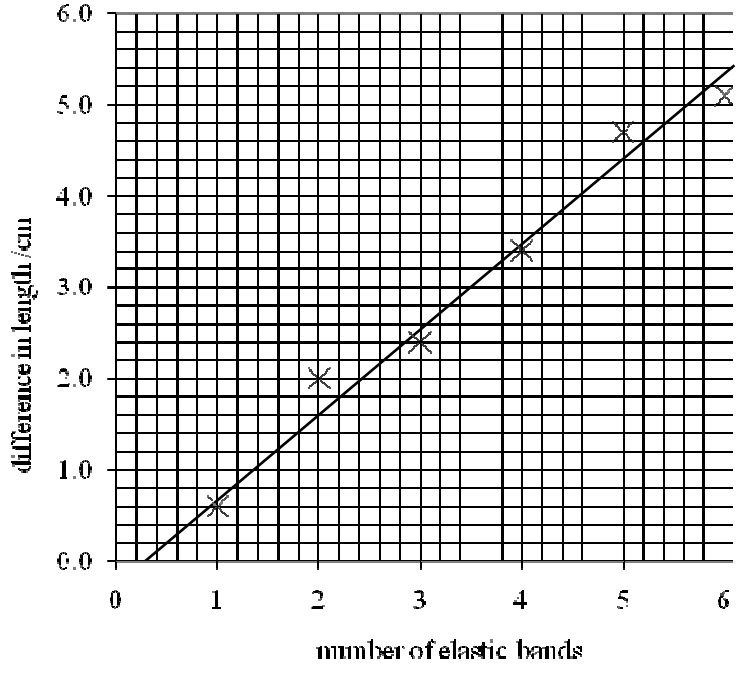


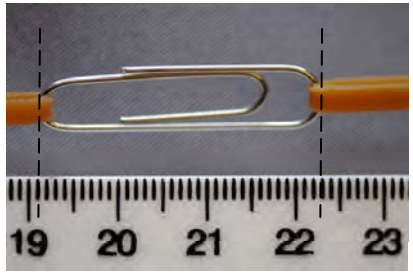
Number of rubber bands	Stretched length in cm
1	43.2
2	28.0
3	21.5
4	(Ignore)
5	17.6
6	17.0

Total 11 marks

Question number	Answer	Notes	Marks
4 (a)	weight of (the) plank		1
(b) (i)	moment = force x (perpendicular) distance (from pivot)		1
(ii)	substitution; final value; e. 1200 x 0.75 900 (Nm)		2
(c)	principle of moments (stated or implied); correct calculation of distance from hand to pivot; calculation of total anticlockwise moment; final value; e. (F x 2.25) + (200 x 0.75) = (1200 x 0.75) F = 330 (N)	Allow ecf from (b) 2.25 (m) seen in working (F x 2.25) + (200 x 0.75) Allow 333 N	4

Total 8 marks

Question number			Answer	Accept	Reject	Marks
5	a)	(i)	5.1			1
		(ii)	Suitable scale chosen (>50% of grid used); Axes labelled with quantities and units; Plotting to nearest half square (minus one for each plotting / error);; Line of best fit acceptable; Sample graph:  	Ignore 6 bands point Line below points 2,5 and above points 1,3,4 Ecf from (a)(i) e.g. an appropriate curve Orientation of axes unimportant 1 0. 2 2. 3 2. 4 3. 5 4. 6 (5.1		5

Question number			Answer	Accept	Reject	Marks
5	(a)	(iii)	Any two of It is a straight line; Gradient / slope / correlation is <u>positive</u>; Line does / doesn't pass through origin; Idea of correlated variables, e.g. direct / indirect proportionality [depending on projection to the origin], length increases with number of bands;	Ecf from (a)(i)/(ii) Related statement e.g. curve, line forced through origin or mention of "anomaly"		2
	(b)		3.2 ± 0.1 (cm) ; ; Sample working:  	Allow evidence of two readings from scale for one mark, e.g. subtraction (22.3 - 9.1) or appropriate drawing on the photograph	Direct measurement of photograph with a ruler	2

Question Number			Answer	A	Reject	Marks
5	(c)		Responses may refer to measuring the length of either object (the chain or the single paperclip from photographs A and B) Any two of: Either object - parallel with scale; closer to scale; use fiducial mark e.g. a set square; take parallax into account; Minimise effect of friction on stretched chain; Remove paperclip from chain for measurement;	Ignore: repetition, measuring <u>paperclip</u> from zero Allow sensible equipment changes, e.g. more precise scale, using stiffer paperclips / links		2
					Total	**12**