

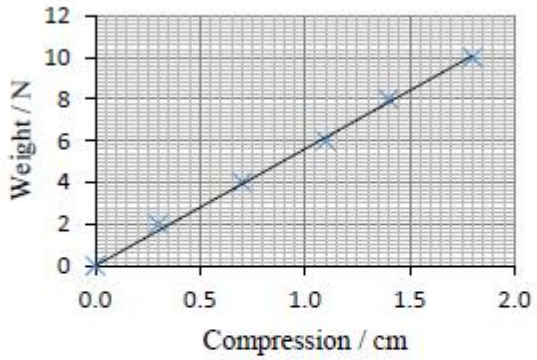
Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark														
(a)(i)	Processing of data to calculate change in length (1) Axes with labels & units (accept force for weight) (1) Scales (1) Plots (1) Line of best fit (1)	 <p>MP2: only award for a graph of weight against compression. Units may be in m or cm for compression. Allow paper to be landscape</p> <p>MP3: scales only in 1,2,4,5 and must cover at least half of paper</p> <p>MP4: a 2 mm square tolerance, check all points</p>	5														
	<table border="1"> <thead> <tr> <th>Weight/ N</th> <th>Compression/ cm</th> </tr> </thead> <tbody> <tr> <td>0.00</td> <td>0.0</td> </tr> <tr> <td>2.00</td> <td>0.3</td> </tr> <tr> <td>4.00</td> <td>0.7</td> </tr> <tr> <td>6.00</td> <td>1.1</td> </tr> <tr> <td>8.00</td> <td>1.4</td> </tr> <tr> <td>10.00</td> <td>1.8</td> </tr> </tbody> </table>	Weight/ N	Compression/ cm	0.00	0.0	2.00	0.3	4.00	0.7	6.00	1.1	8.00	1.4	10.00	1.8		
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(a)(ii)	<ul style="list-style-type: none"> States that best fit line is through the origin (1) So it fits Hooke's law because extension is proportional to force (1) Uses corresponding values from best fit line from (a)(i) to determine gradient (1) Spring constant = $10.0 \text{ N} / 0.0176 \text{ m} = 568 \text{ (N m}^{-1}\text{)}$ (which, 1 s.f., is the stated answer) (1) 	If plunger position plotted in (a)(i) then only MP2 may be awarded for attempt at gradient MP3: values selected from at least half way along line or a triangle using over half the line is used MP4: conditional on MP3 and allow any value that rounds to 1 sf as 600	4														

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(b)	<ul style="list-style-type: none"> • Use of $\Delta F = k\Delta x$ (1) • Use of $\Delta E_{el} = \frac{1}{2} F\Delta x$ (1) • Use of $E_k = \frac{1}{2} mv^2$ (1) • $v = 6.7 \text{ m s}^{-1}$ to 6.8 m s^{-1} (1) 	<p><u>Example of calculation</u></p> <p>$\Delta F = k\Delta x = 610 \text{ N m}^{-1} \times 0.054 \text{ m} = 32.94 \text{ N}$ $\Delta E_{el} = \frac{1}{2} F\Delta x = \frac{1}{2} \times 32.94 \text{ N} \times 0.054 \text{ m} = 0.90 \text{ J}$ $E_k = \frac{1}{2} mv^2$ so $0.90 \text{ J} = \frac{1}{2} \times (0.0041 + 0.0354) \text{ kg} \times v^2$ $v = 6.75 \text{ m s}^{-1}$</p>	4

Question Number	Acceptable answers	Additional guidance	Mark
(c)	<p>Work may be done against friction (by the spring/marble) Or KE is gained by the spring Or GPE gained by the piston and marble Or the light gate must be above the launch position so the marble is already accelerating downwards Or statement of friction between two specified parts in launch system (1)</p>		1

Q2.

Question Number	Acceptable Answers	Additional guidance	Mark								
	<p>This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning.</p> <p>Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.</p> <p>Indicative Content</p> <ul style="list-style-type: none"> • Band does not obey Hooke's law (1) Or there is a non-linear relationship between force and extension • (The band is elastic so) the extension returns to zero when the force is removed or size/shape is unchanged (1) • For a given force the extension when loading is less than when unloading or for the same extension more force required when loading (1) • Area under the loading curve is greater than the unloading curve Or Loading increases the elastic strain energy (of the band) (1) • The band absorbs more energy when being loaded than it releases when unloaded Or Unloading: some strain energy transferred by heating (1) • Energy released by heating represented by the area between the lines (1) 	<p>The following table shows how the marks should be awarded for structure and lines of reasoning</p> <table border="1"> <thead> <tr> <th></th> <th>Number of marks awarded for structure of answer and sustained line of reasoning</th> </tr> </thead> <tbody> <tr> <td>Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout</td> <td>2</td> </tr> <tr> <td>Answer is partially structured with some linkages and lines of reasoning</td> <td>1</td> </tr> <tr> <td>Answer has no linkages between points and is unstructured</td> <td>0</td> </tr> </tbody> </table>		Number of marks awarded for structure of answer and sustained line of reasoning	Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout	2	Answer is partially structured with some linkages and lines of reasoning	1	Answer has no linkages between points and is unstructured	0	6
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