

Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Mark Schemes

Q1.

Question Number	Answers	Additional guidance	Mark
	- Use a micrometer Or vernier callipers Or digital callipers (1) - Measure diameter/width of ball at more than one orientation/position (1) - Calculate the mean of the diameter and divide by 2 (1)		3

Q2.

Question Number	Answer	Mark
(a)	Use of $\Delta x = (1.12 \times \text{diameter} - \text{diameter})$ e.g. $\Delta x = 1.27 \times 10^{-11} \text{ m}$ (1) Use of $F = k\Delta x$ (1) $F = 1.4 \times 10^{-8} \text{ N}$ (1) <u>Example of calculation</u> $\Delta x = 0.12 \times 1.06 \times 10^{-10} \text{ m} = 1.27 \times 10^{-11} \text{ m}$ $F = 1130 \text{ N m}^{-1} \times 1.27 \times 10^{-11} \text{ N}$ $F = 1.44 \times 10^{-8} \text{ N}$	3
(b)(i)	Max 3 For positive force/extension the spring is in tension/stretched/extended (accept after/right of origin) (1) For negative force/extension the spring is in compression/squashed (accept before/left of origin) (1) From $-0.7 (\pm 0.1) \text{ N}$ to $1.5 (\pm 0.1) \text{ N}$ the spring obeys Hooke's law (1) At $1.5 (\pm 0.1) \text{ N}$ the spring has reached its elastic limit (allow limit of proportionality, yield point) Or at $-0.9 (\pm 0.1) \text{ N}$ the spring is fully compressed (allow coils touching) (1) (answers may be given in terms of extension $1.5 \text{ N} \rightarrow 7.6 (\pm 0.4) \text{ cm}$, $-0.9 \text{ N} \rightarrow -4.0 (\pm 0.4) \text{ cm}$ and $-0.7 \text{ N} \rightarrow -3.6 (\pm 0.4) \text{ cm}$)	3

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(b)(ii)	Use of gradient Or pairs of points from the graph within the linear region (1) $k = 20 \text{ N m}^{-1}$ Or 0.20 N cm^{-1} (allow 19 to 21 N m^{-1}) (1) <u>Example of calculation</u> $\text{gradient} = \frac{7.4 \times 10^{-4} \text{ m}}{1.5 \text{ N}} = 0.0493 \text{ m N}^{-1}$ $k = \frac{1}{\text{gradient}} = \frac{1}{0.0493} = 20.3 \text{ N m}^{-1}$	2
*(c)	(QWC – work must be clear and organised in a logical manner using technical terminology where appropriate) MP1 and 2 are for atom separation decreasing When pushed together the repulsive force is the greater force (1) (because) the repulsive graph is steeper (at smaller separations) Or repulsive force increases more rapidly (1) MP3 is for atom separation increasing. When pulled apart the repulsive force is the smaller force Or repulsive force is zero but attractive force is still present (1)	3
Total for question		11

Q3.

Question Number	Answer	Additional Guidance	Mark																																
*	This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning. Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning. The following table shows how the marks should be awarded for indicative content. • There is an upthrust on the rock (as the rock displaces water) • Hence the net downward force on the rock is reduced • F decreases to a minimum once the rock is fully submerged • The rock pushes downwards on the water • So there is an extra force on the balance • Hence R increases to a maximum once the rock is fully submerged	<table border="1"> <thead> <tr> <th>IC points</th><th>IC mark</th><th>Max linkage mark available</th><th>Max final mark</th></tr> </thead> <tbody> <tr> <td>6</td><td>4</td><td>2</td><td>6</td></tr> <tr> <td>5</td><td>3</td><td>2</td><td>5</td></tr> <tr> <td>4</td><td>3</td><td>1</td><td>4</td></tr> <tr> <td>3</td><td>2</td><td>1</td><td>3</td></tr> <tr> <td>2</td><td>2</td><td>0</td><td>2</td></tr> <tr> <td>1</td><td>1</td><td>0</td><td>1</td></tr> <tr> <td>0</td><td>0</td><td>0</td><td>0</td></tr> </tbody> </table>	IC points	IC mark	Max linkage mark available	Max final mark	6	4	2	6	5	3	2	5	4	3	1	4	3	2	1	3	2	2	0	2	1	1	0	1	0	0	0	0	6
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