Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable Answer	Additional Guidance	Mark
	• Upthrust on canister equals weight of air/fluid displaced. **(1)** • Volume of canister stays constant, so upthrust on canister remains constant (and student X is incorrect) **(1)** • Mass of helium gas (in canister) decreases **(1)** • Hence the weight will decrease (as helium is released) and student Y is correct		**4**

Q2.

Question Number	Acceptable answers		Additional guidance	Mark
(i)	• Use of $W = mg$	(1)	Example of calculation:	
	• Use of $F = kx$	(1)	$275\ \text{kg} \times 9.81\ \text{N kg}^{-1} = 2700\ \text{N}$ $2700\ \text{N} = k \times 0.152\ \text{m}$	
	• $k = 17700\ (\text{N m}^{-1})$	(1)	$k = 17\,748\ \text{N m}^{-1}$	3

(ii)	• Use of $T = 2\pi\sqrt{\frac{m}{k}}$ (1) • Use of $f = 1/T$ (1) • f = 1.3 Hz (ecf from (b)(i)) (1)	Example of calculation: $T = 2\pi\sqrt{\frac{1100\text{ kg}}{4 \times 17\,700\text{ N m}^{-1}}}$ f = 1 / 0.783 s f = 1.28 Hz	3

Q3.

Question Number	Acceptable answers	Additional guidance	Mark
(i)	• Substitutes stress $= \frac{F}{A}$ and strain $= \frac{\Delta x}{x}$ into $E = \frac{stress}{strain}$ (1) • Identifies gradient as $\frac{F}{\Delta x}$ (1)		2
(ii)	• Calculates gradient of straight section (1) • Use of $E = gradient \times \frac{x}{A}$ (1) • E = 1.2 to 1.3 $\times$ 10^{11} N m^{-2} (1) • Wire is made from copper because 117 GPa is closest to the calculated value **Or** Correct conclusion of the metal consistent with candidate's calculated value (1)	Example of calculation Gradient = $\frac{33}{7 \times 10^{-3}}$ = 4600 - 4900 E = 1.24 $\times$ 10^{11} N m^{-1} = 124 GPa copper	4
(iii)	• Use a smaller (maximum) force/load (1) • To avoid exceeding the limit of proportionality **Or** As the breaking force of a thinner wire is smaller (1) • Use small(er) increments in the force/load (1) • To obtain more readings (before the elastic limit is reached) **Or** to obtain enough readings (in the linear part of the graph) (1)		4