Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 4_Materials

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Name of the Student:_______________________________________

Max. Marks : 23 Marks **Time : 23 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable Answer		Additional Guidance	Mark
	Use of $V = \pi r^2 t$	(1)	<u>Example of calculation</u> $V = \pi r^2 t = \pi \left(\frac{1.3\times10^{-2}\text{ m}}{2}\right)^2 \times 2\times10^{-3}\text{m}$ $\therefore V = 2.65\times10^{-7}\text{m}^3$ $m = \rho V = 7900\text{ kg m}^{-3}\times2.65\times10^{-7}\text{m}^3$ $\therefore m = 2.10\times10^{-3}\text{kg}$ $\frac{0.1\text{ g}}{M} = 0.5\%$ $\therefore M = \frac{0.1\text{ g}}{0.5/100} = 20\text{ g}$ $\therefore$ number of discs$= \frac{20\text{ g}}{2.10\text{ g}} = 9.5$	4
	Use of $\rho = \frac{m}{V}$ to find m	(1)		
	Use of 0.5% to find total mass needed	(1)		
	Number of discs = 10	(1)		

Q2.

Question Number	Acceptable Answer		Additional Guidance	Mark
(a)(i)	• reference point so that reliable timings can be made	(1)		
	• end of metre rule will be travelling fastest at its equilibrium position (so uncertainty is determining when rule is at this position is least)	(1)		**(2)**

(a)(ii)	• calculate average time period for each ruler [T_1 = 0.962 s, T_2 = 1.072 s] (1) • use of $T^2 \propto \frac{ML^3}{E}$ (1) • $\frac{E_2}{E_1} = 0.80$ (1)	<u>Example of calculation:</u> $T_1 = \frac{19.3\text{s} + 19.1\text{s} + 19.3\text{s}}{60} = 0.962\text{s}$ $T_2 = \frac{21.3\text{s} + 21.5\text{s} + 21.5\text{s}}{60} = 1.07\text{s}$ $T^2 \propto \frac{ML^3}{E} \therefore \frac{E_1}{E_2} = \frac{T_2^2}{T_1^2}$ $\frac{E_2}{E_1} = \frac{T_1^2}{T_2^2} = \left(\frac{0.962\text{s}}{1.07\text{s}}\right)^2 = 0.804$	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)(i)	T^2 on y-axis and L^3on x-axis (or vice versa)		**(1)**
(b)(ii)	An explanation that makes reference to the following: • $T^2 = \frac{KML^3}{E}$, so gradient will be $\frac{KM}{E}$(if T^2 plotted against L^3) (1) • $\therefore E = \frac{KM}{\text{gradient}}$, if *K* is known *E* can be determined (1)	If axes reversed in (b)(i), gradient = *E*/*KM* for full credit	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(c)	An explanation that makes reference to the following: • time a larger number of oscillations (1) • as the greater the total time the smaller the % uncertainty (1)		**(2)**

Q3.

Question Number	Acceptable Answers	Additional Guidance	Mark
(a)	A description that makes reference to **two** of the following: • No need for further calculation **Or** gives a value for resistance without calculation (1) • No need for an additional power supply (1) • Uncertainties caused by two devices is (possibly) greater than that caused by one device (1)	Do not accept more precise **or** no parallax **or** quicker	2

Question Number	Acceptable Answers	Additional Guidance	Mark
(b)(i)	• (As applied force increases) the length (l) (of wire) increases/stretches **Or** the wire is longer (1) • the resistance increases with reference to $R = \frac{\rho l}{A}$ (1)	Reference to formula may be in terms of proportionality or direct quote of equation Do not accept change in resistivity	2

Question Number	Acceptable Answers	Additional Guidance	Mark
(b)(ii)	• Use of $GF = \frac{\Delta R}{\epsilon R}$ (1) • Substitution of $\epsilon = \frac{\Delta w}{w}$ into GF equation (1) • $\Delta w = 2.5 \times 10^{-5}$ m (1)	(x may seen in place of w) <u>Example of calculation:</u> $GF = \frac{\Delta R}{\epsilon R}$ $2 = \frac{0.001}{\Delta w / (5 \times 10^{-2})}$ $\Delta w = 2.5 \times 10^{-5}$ m Accept 2.5×10^{-3} cm / 2.5×10^{-2} mm	3

Question Number	Acceptable Answers	Additional Guidance	Mark
(c)	An explanation that makes reference to the following: • As small changes (in w) are multiplied many times **Or** can use a longer wire (on a small gauge) **Or** to achieve a greater change in the length (1) • (So) greater sensitivity **Or** larger changes in R (for a given change in width) (1)		2