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

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Name of the Student:____

Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
	• Use of $F = k\,\Delta x$ **(1)** • $k = 14.4\ \text{N m}^{-1}$ **(1)** • Use of $T = 2\pi\sqrt{\frac{m}{k}}$ **(1)** • Use of $f = 1/T$ **(1)** • $f = 2.4$ Hz **(1)**	Example of calculation: $k = mg/\Delta x = 66\times 10^{-3}\ \text{kg} \times 9.81\text{m s}^{-2})/4.5 \times 10^{-2}\ \text{m} = 14.4\ \text{N m}^{-1}$ $T = 2\pi(0.066/14.4.0)^{1/2} = 0.425$ s $f=1/T = 1/0.425 = 2.35$ Hz	**5**

Q2.

Question Number	Acceptable answers	Additional guidance	Mark
(i)	• Use of $s = ut + \frac{1}{2}at^2$ with $a = 0$ **(1)** • Use of $F = 6\pi\eta rv$ **(1)** • 0.037 N **(1)**	Example of calculation $v = \frac{0.75\ \text{m}}{3.4\ \text{s}} = 0.22\ \text{m s}^{-1}$ $F = 6\pi \times 1.8\ \text{Pa s} \times 5 \times 10^{-3}\ \text{m} \times 0.22\ \text{m s}^{-1}$ $= 0.037$ N	**3**

(ii)	• Viscous drag force + upthrust = weight (1) • Upthrust and weight are unchanged (with temperature) (1) • (So at terminal velocity) viscous drag force is unchanged so the student is incorrect **Or** For viscous drag to be constant, if the viscosity decreases then the terminal velocity will increase so the student is incorrect $(F = 6\pi\eta r v)$ (1)		3

Q3.

Question Number	Acceptable answers	Additional guidance	Mark
(a)	• Weight and drag force are equal for terminal velocity stated or implied (1) • Quotes $F = 6\pi\eta rv$ and $mg = 4(\pi r^3)\rho g/3$ and suitable working to obtain $v = \frac{2g\rho r^2}{9\eta}$ (1)		2

Question Number	Acceptable answers	Additional guidance	Mark
(b)	• Use of $v = \frac{2g\rho r^2}{9\eta}$ (1) • $v = 760$ (m s^{-1}) (1)	<u>Example of calculation</u> $v = 2 \times 9.81$ N $kg^{-1} \times 1.0 \times 10^3$ kg m^{-3} $\times (2.5 \times 10^{-3}$ m$)^2 / 9 \times 1.8 \times 10^{-5}$ Pa s $v = 757$ m s^{-1}	2

Question Number	Acceptable answers	Additional guidance	Mark
(c)	• Measured value much less than calculated value (1) **Max 2 from** • The raindrop is moving very fast so Stokes' law does not apply (1) • Flow is not laminar so Stokes' law does not apply (1) • Raindrops not small so Stokes' law does not apply (1) • Raindrops not spherical so Stokes' law does not apply (1) • Argument based on increased upward force if upthrust taken into account so it doesn't apply (1)		3