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

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Name of the Student:____
Max. Marks : 19 Marks **Time : 19 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)	• Use a micrometer to measure y and/or z **(1)** • Use Vernier/digital calipers to measure x and/or **(1)** • Mass of slide(s) measured using (top pan) balance/scales **(1)** • Repeat and determine mean for at least one measurement **(1)**	**(Part (a) and (b) to be marked holistically** **MP1** accept digital calipers for a single slide Accept Vernier calipers if it is clear that the thickness of a number of slides is being measured. To award both MP1 & 2, *x*, *y* & *z* must all be referred to. MP4 can be awarded for a reference to averaging any of the measurements.	**4**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)	Check zero error on micrometer/callipers/balance **Or** measure *x*/*y*/*z* of slide in different places **Or** measure thickness/mass of multiple slides **(1)**	Accept 'tare' for zero error check on balance	**1**

Q2.

Question Number	Acceptable Answers		Additional Guidance	Mark
(i)	• drag + weight = upthrust	(1)	Example of calculation: drag + weight = upthrust drag = upthrust - weight $6\pi\eta rv = 4\pi r^3\rho_{stout}g/3 - 4\pi r^3\rho_{gas}g/3$ $v = 2(\rho_{stout} - \rho_{gas})r^2g/9\eta$	
	• use of $\rho = m/V$ **and** $W = mg$	(1)		
	• use of $F = 6\pi\eta rv$ **and** $V = 4/3\pi r^3$	(1)		**(3)**

Question Number	Acceptable Answers	Additional Guidance	Mark
(ii)	• low speed OR laminar flow OR not turbulent flow		**(1)**

Question Number	Acceptable Answers		Additional Guidance	Mark
(iii)	• use of $v = 2(\rho_{stout} - \rho_{gas})r^2g/9\eta$	(1)	Example of calculation: $v = 2\,(1.007 \times 10^3\text{ kg m}^{-3} - 1.223\text{ kg m}^{-3}) \times (61 \times 10^{-6}\text{ m})^2 \times 9.81\text{ N kg}^{-1} / 9 \times 2.06 \times 10^{-3}\text{ Pa s}$ $= 3.96 \times 10^{-3}\text{ m s}^{-1}$ $t = 0.115\text{ m} / 3.96 \times 10^{-3}\text{ m s}^{-1}$ $= 29\text{ s}$ Actual time much less than the manufacturers time therefore not a valid statement OR reference time to reach terminal velocity OR there is turbulent flow	
	• use of $v = s/t$	(1)		
	• time = 29 s	(1)		
	• comment on the difference with 120 seconds OR an attempt to account for the difference	(1)		**(4)**

Q3.

Question Number	Answer		Mark
(i)	(Stokes' law is only for) small (solid) spheres **Or**(Stokes' law is only for) laminar flow **Or** there is turbulent flow Additional/less drag due to the bubbles having a non-stationary surface **Or** Stokes' law cannot be applied to a gas bubble because they have a non-stationary surface **Or** sides of container too close to bubbles **Or** volume/shape changes as it rises	(1) (1)	2
* (ii)	(QWC – work must be clear and organised in a logical manner using technical terminology where appropriate) **Either: Resultant forces method 4 marks** Measure the diameter/radius of the sphere (from the photograph) Use of $4\pi r^3/3$ to find the volume of the sphere Use $V\rho g$ to find the upthrust / weight of the bubble Drag = upthrust – weight **Or: Stokes' law method 2 marks** Measure the diameter/radius of the sphere (from the photograph) Calculate the (terminal) velocity using $v = s/t$ **and** substitute into $F = 6\pi r\eta v$	 (1) (1) (1) (1) (1) (1)	4

Q4.

Question Number	Acceptable answers		Additional guidance	Mark
(i)	• Use of stress = F/A • Use of Young modulus = stress / strain • Use of strain = $\Delta x/x$ • Extension = 0.053 m	(1) (1) (1) (1)	<u>Example of calculation</u> stress = 93.4 N / 6.6 $\times 10^{-7}$ m^2 = 1.42 $\times 10^8$ N m^{-2} strain = 1.42 $\times 10^8$ N m^{-2} / 1.8 $\times 10^9$ N m^{-2} = 0.0786 extension = 0.0786 × 0.68 m = 0.053 m	4
(ii)	• Increase tension so increase wavespeed since $v = \sqrt{\frac{T}{\mu}}$ **Or** decrease μ so increase wavespeed since $v = \sqrt{\frac{T}{\mu}}$ • Since $v = f\lambda$ and wavelength unchanged, this increases frequency	(1) (1)		2