Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1

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

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

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Q2

Question Number	Acceptable answers	Additional guidance	Mark
	• measure distance from grating to screen l and from centre to dot x (1) • use $\tan\theta = x / l$ to determine θ (1)		2

Question Number	Acceptable answers	Additional guidance	Mark
	• Axes with labels (1) • scales (1) • plots (1) • line of best fit (1)	**MP2**: scales only in 1,2,4,5 and must cover at least half of paper **MP3**: a 2 mm square tolerance, check all points	4

Question Number	Acceptable answers	Additional guidance	Mark
	• calculation of a gradient (1) • use gradient = d/λ (1) • use d = 0.001 / 300 (1) • wavelength = 6.3×10^{-7} m (1)	<u>Example of calculation</u> $\text{gradient} = \frac{4.0}{0.76} = 5.26$ $\frac{0.001}{300} = 5.26 \times \lambda$ wavelength = 6.3×10^{-7} m	4

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