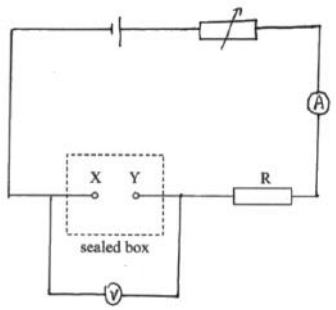
Mark Scheme (Results)

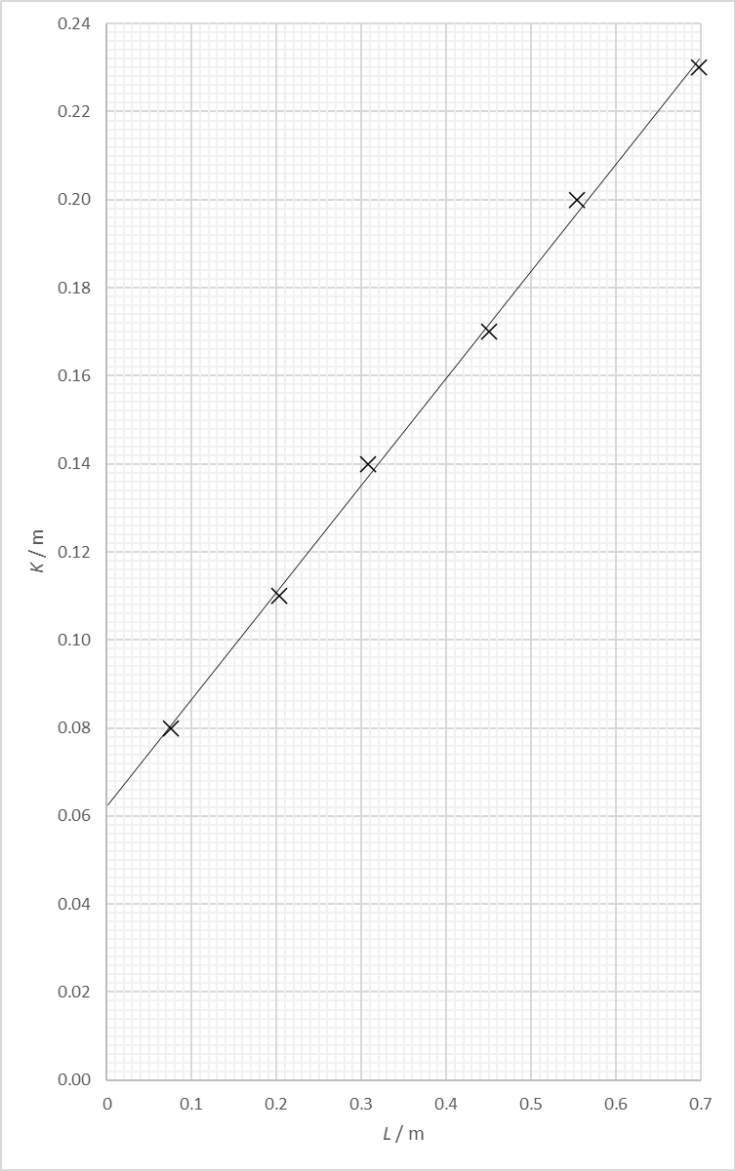
October 2024

Pearson Edexcel International Advanced Subsidiary Level In Physics (WPH13) Paper 01 Practical Skills in Physics I

Question Number	Answer		Mark
1(a)(i)	Uses percentage uncertainty = half resolution / measurement (× 100%) Percentage uncertainty = 0.4% Accept 0.39%, 0.394% Example of calculation Percentage uncertainty = $\frac{0.05\text{ mm}}{12.7\text{ mm}} \times 100 = 0.394\%$	**(1)** **(1)**	**2**
1(a)(ii)	Check (and correct for) zero error To eliminate systematic error MP2 dependent on MP1	**(1)** **(1)**	**2**
1(a)(iii)	Use a (mass) balance to obtain the mass Divide d by two (to obtain the radius) and calculate the volume using $\frac{4}{3}\pi r^3$ Calculate density using $\rho = \frac{m}{V}$	**(1)** **(1)** **(1)**	**3**
1(b)	Use a metre rule to measure distance (travelled by the sphere) Record distance **Or** time for two regions between the rubber bands Start and stop the stopwatch when the same point of the steel sphere passes the band **Or** Ensure measurement (of time) is taken in line with the sphere **Or** Use the lap timer on stopwatch **Or** Repeat with the sphere at the same initial position **Or** Record the motion between the rubber bands **and** view in slow motion Relate measurements to terminal velocity, e.g. travels equal distance in equal time, or velocity is equal in each region	**(1)** **(1)** **(1)** **(1)**	**4**
1(c)	**EITHER** Lower limit = 0.68 (Pa s) Correct conclusion comparing calculated lower limit to quoted viscosity of castor oil Example of calculation Lower limit = 0.72 Pa s × (1 − 0.06) = 0.68 (Pa s) The lower limit is greater than 0.65 (Pa s) so the liquid is not castor oil **OR** Percentage difference = 11% [Accept 10%] Correct conclusion comparing calculated %D to 6%	**(1)** **(1)** **(1)** **(1)**	**2**
	Total for question 1		**13**

Question Number	Answer		Mark
2(a)(i)	Circuit containing power supply, voltmeter, ammeter, variable resistor Ammeter in series, voltmeter in parallel with sealed box Example of circuit  	**(1)** **(1)**	**2**
2(a)(ii)	The fixed resistor is needed to limit the (maximum) current in the circuit **Or** The fixed resistor is needed to prevent a short circuit Because when the direction of current/potential difference is reversed The diode has a low resistance (and the current in the circuit will be very high)	**(1)** **(1)** **(1)**	**3**
2(a)(iii)	Use of $R = \frac{V}{I}$ $R = 27\ \Omega$ **Or** $I = 0.161$ A **or** 0.294 A Use of $P = \frac{V^2}{R}$ **Or** Use of $P = I^2R$ **Or** Use of $P = V \times I$ Conclusion stating resistor D with comparisons to minimum resistance of 27 Ω and correct value calculated from a power formula **Or** Conclusion stating resistor D with comparisons to $I = 0.161$ A **or** 0.294 A and correct value calculated from a power formula Example of calculation $R = \frac{V}{I} = \frac{(6 - 0.7)\ \text{V}}{200 \times 10^{-3}\ \text{A}} = 27\ \Omega$ $P = \frac{V^2}{R} = \frac{(5.3\text{V})^2}{33\ \Omega} = 0.85$ W	**(1)** **(1)** **(1)** **(1)**	**4**
2(b)	The graph shows current readings when the potential difference is negative Therefore the resistor and diode are in parallel MP2 dependent on MP1	**(1)** **(1)**	**2**
	Total for question 2		**11**

Question Number	Answer		Mark
3(a)	Clamp the metre rule in position **Or** Ensure the metre rule is vertical using a set square	**(1)**	
	Place metre rule is close to the beaker	**(1)**	
	Use a set square to judge scale reading **Or** Read perpendicular to the scale	**(1)**	**3**
3(b)	Any **THREE** from:		
	The values are not recorded to consistent decimal places	**(1)**	
	No evidence of repeat readings	**(1)**	
	Four data points is not enough (to plot a reliable graph)	**(1)**	
	Final value of h_2 should be 45.1 **Or** Final value of h_2 does not fit the trend	**(1)**	**3**
	Ignore references to intervals and range		
3(c)(i)	Calculation of mean	**(1)**	
	Mean n = 1.35 2 d.p. only, no unit	**(1)**	**2**
	<u>Example of calculation</u> Mean value of $n = \frac{(1.38 + 1.41 + 1.33 + 1.29)}{4} = 1.353$		
3(c)(ii)	Uses half range for uncertainty Accept furthest from the mean	**(1)**	
	Percentage uncertainty = 4% e.c.f. 3(c)(i)	**(1)**	**2**
	<u>Example of calculation</u> Uncertainty = half range $= \frac{1.41 - 1.29}{2} = 0.06$ Percentage uncertainty $= \frac{0.06}{1.35} \times 100 = 4.44\%$		
	Total for question 3		**10**

Question Number	Answer		Mark
4(a)	$K = \left(\frac{M_B}{M_A}\right) L + \frac{0.2M_R}{M_A}$ compares to $y = mx + c$ **and** $\frac{0.2M_R}{M_A}$ is the y-intercept	**(1)**	
	So $M_R = \frac{y\text{−intercept} \times M_A}{0.2}$		
	Or So $M_R = 5 \times y$-intercept $\times M_A$	**(1)**	**2**
4(b)(i)	Axis labels: y as K / m and x as L / m	**(1)**	
	Sensible scales	**(1)**	
	Accurate plotting	**(2)**	
	Line of best fit	**(1)**	**5**
			

4(b)(ii)	Calculates gradient using large triangle **(1)** Gradient in range 0.237 to 0.249 **(1)** Calculated gradient given to 2 or 3 s.f, positive, no unit **(1)** <u>Example of calculation</u> gradient = $\frac{0.220 - 0.086}{0.65 - 0.10} = 0.244$	**3**
4(b)(iii)	Uses gradient = $\frac{M_B}{M_A}$ **(1)** Correct value of M_B given to the nearest gram e.c.f. (b)(ii) **(1)** <u>Example of calculation</u> M_B = gradient × M_A = 0.244 × 0.400 kg = 0.097 kg	**2**
4(b)(iv)	Correct *y*-intercept determined from graph **Or** Correct *y*-intercept determined using gradient and data point from best fit line **(1)** Uses *y*-intercept = $\frac{0.2M_R}{M_A}$ **(1)** Correct value of M_R e.c.f. 4(b)(ii) **(1)** Value of M_R given to the nearest gram with correct unit **(1)** <u>Example of calculation</u> *y*-intercept = 0.062 $M_R = \frac{y\text{−intercept} \times M_A}{0.2} = \frac{0.062 \times 0.400\ \text{kg}}{0.2} = 0.124$ kg	**4**
	Total for question 4	**16**