Pearson Edexcel

Mark Scheme (Results)

June 2024

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

Question Number	Answer		Mark
1(a)(i)	The stand may topple over	(1)	
	Clamp (the base of the stand) to the bench **Or** Place a heavy mass on the (base of the) stand **Or** Turn the base (of the stand) round (by 180°)	(1)	
	The (rubber) band may hit the student in the eye/face **Or** The (rubber) band may damage the eye	(1)	
	Wear eye protection	(1)	4
1(a)(ii)	Add masses (gradually) until the (rubber) band breaks	(1)	
	Calculate the force using $F = mg$ Accept W	(1)	2
1(b)	(Repeating the measurement) reduces (the effect of) <u>random error</u>	(1)	
	(Caused by) variations in the temperature of the rubber bands	(1)	2
	MP1 do not accept systematic error		
	Total for question 1		**8**

Question Number	Answer		Mark
2(a)(i)	Height (of the initial position) of the ball **Or** The initial velocity of the ball Accept ball is stationary when released	**(1)**	**1**
2(a)(ii)	Height affects the gravitational potential energy of the ball **Or** Height affects how long the ball accelerates for **Or** Initial velocity affects the initial kinetic energy of the ball	**(1)**	
	(So) The (impact) velocity of the ball may vary **Or** The (impact) kinetic energy may vary	**(1)**	**2**
	MP1 must be linked to the control variable stated		
2(b)	Any **THREE** from		
	The values (of x and θ) are not recorded to consistent decimal places	**(1)**	
	There is no evidence of repeats	**(1)**	
	There are not enough sets of data (to draw a reliable graph)	**(1)**	
	The reading of x at 20.5° does not follow the trend	**(1)**	**3**
2(c)	**EITHER**		
	Use a camera to record the motion	**(1)**	
	Which can be viewed in slow motion (to find the exact point where the ball landed)	**(1)**	
	OR		
	Place a tray of sand on the bench for the ball to land in	**(1)**	
	So that the ball remains stationary when it lands **Or** so the ball leaves an indentation where it lands	**(1)**	**2**
	Total for question 2		**8**

Question Number	Answer		Mark
3(a)	Clamp the metre rule in position **Or** Ensure the metre rule is vertical using a set square [allow spirit level] **Or** Place metre rule close to the tube Check the zero of the metre rule is level with the bottom of the transducer **Or** Check the zero of the metre rule is level with the surface of the water **Or** Measure to the surface of the water and to the bottom of the transducer and subtract the values Accept any valid method to determine *s* View (the metre rule) perpendicularly **Or** Use a set square to take the measurement from the metre rule	**(1)** **(1)** **(1)**	**3**
3(b)	Calculates time t = number of divisions × time per division Use of $v = \frac{s}{t}$ Do not accept use of $v = f\lambda$ Uses 2 × s **Or** Uses ½ × t v = 331 (m s^{-1}) Bald answer scores 0 <u>Example of calculation</u> t = 6 divisions × 0.5 ms per division = 3 ms $v = \frac{s}{t} = \frac{2 \times 0.497\text{ m}}{3 \times 10^{-3}\text{ s}}$ = 331.3 m s^{-1}	**(1)** **(1)** **(1)** **(1)**	**4**
3(c)(i)	Calculation of mean Mean v = 341 m s^{-1} 3 sig fig only <u>Example of calculation</u> Mean value of $v = \frac{(335 + 347 + 339 + 342)\text{ m s}^{-1}}{4} = \frac{1363\text{ m s}^{-1}}{4}$ = 340.8 = 341 m s^{-1}	**(1)** **(1)**	**2**
3(c)(ii)	Calculates half range for uncertainty Accept furthest from the mean Correct value of percentage uncertainty using calculated mean (e.c.f. 3(c)(i)) <u>Example of calculation</u> Uncertainty = half range = $\frac{(347 - 335)\text{ m s}^{-1}}{2}$ = 6 m s^{-1} Percentage uncertainty = $\frac{6\text{ m s}^{-1}}{341\text{ m s}^{-1}} \times 100$ = 1.8%	**(1)** **(1)**	**2**

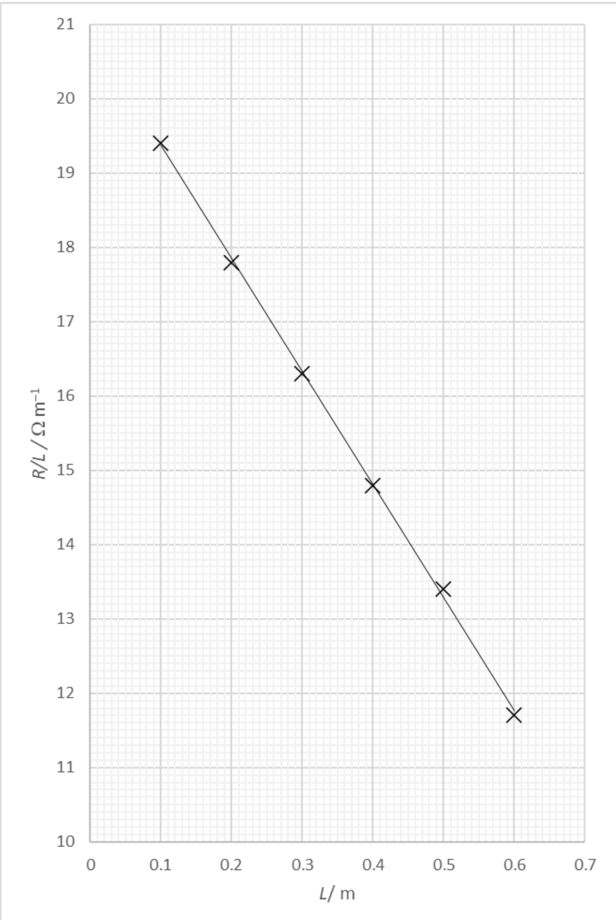
3(d)	**EITHER** Upper limit = 1502 ($m\ s^{-1}$) **(1)** Conclusion consistent with comparing calculated limit and given value **(1)** <u>Example of calculation</u> Upper limit = $1444\ m\ s^{-1} \times 1.04 = 1502\ (m\ s^{-1})$ The upper limit is above $1481\ m\ s^{-1}$ so the student's value is consistent **OR** Percentage difference = 2.5 % **(1)** Conclusion consistent with comparing calculated percentage difference with 4% **(1)**	**2**
	Total for question 3	**13**

Question Number	Answer	Mark
4(a)(i)	Calculates percentage uncertainty = half resolution / measurement × 100% **(1)** Percentage uncertainty = 2 % Accept 1.9 % **(1)** <u>Example of calculation</u> Percentage uncertainty = $\frac{0.005\ \text{mm}}{0.27\ \text{mm}} \times 100 = 1.85\ \% = 2\ \%$	**2**
4(a)(ii)	**EITHER** Check (and correct) for zero error **(1)** To eliminate <u>systematic error</u> **(1)** MP2 dependent on MP1 **OR** Use the ratchet (to prevent overtightening) **(1)** To reduce (the effect of) <u>random error</u> **(1)** MP2 dependent on MP1	**2**
4(b)	The fixed resistor limits the (maximum) current in the circuit **(1)** So the wire/circuit does not overheat **Or** so there is not a short circuit **Or** so the ammeter/battery is not damaged **(1)**	**2**

4(c)(i)	($\frac{R}{L} = -kL + \frac{\rho}{A}$) compares to $y = mx + c$ where $\frac{\rho}{A}$ is the y-intercept So ρ can be calculated from the y-intercept multiplied by A.	**(1)** **(1)**	**2**
4(c)(ii)	Correct values of $\frac{R}{L}$ units not required in table heading Values consistent to 3 sig figs	**(1)** **(1)**	**2**

L / m	I / A	V / V	$\frac{R}{L}$ / Ω m^{-1}
0.100	0.720	1.40	19.4
0.200	0.390	1.39	17.8
0.300	0.290	1.42	16.3
0.400	0.250	1.48	14.8
0.500	0.220	1.47	13.4
0.600	0.210	1.47	11.7

4(c)(iii)	Axis labels: y as $\frac{R}{L}$ / Ω m^{-1} and x as L / m Sensible scales Accurate plotting Line of best fit	**(1)** **(1)** **(2)** **(1)**	**5**



4(c)(iv)	Calculates gradient using large triangle k = in range (–)14.4 to (–)15.6 k given to 2 or 3 s.f., positive, units $\Omega\ m^{-2}$ <u>Example of calculation</u> $k = -\text{gradient} = -\frac{19.4 - 13.3}{0.1 - 0.5} = 15.3$	**(1)** **(1)** **(1)**	**3**
4(c)(v)	y-intercept determined from graph **Or** Calculation of y-intercept using gradient and data point from best fit line Uses $A = \frac{\pi d^2}{4}$ Correct value of ρ given to 2 or 3 s.f. with units Ω m (e.c.f. 4(c)(iv)) <u>Example of calculation</u> y-intercept = $20.9\ \Omega\ m^{-1}$ $A = \frac{\pi d^2}{4} = \frac{\pi(0.27 \times 10^{-3}\ m)^2}{4} = 5.73 \times 10^{-8}\ m^2$ $\rho = 20.9\ \Omega\ m^{-1} \times 5.73 \times 10^{-8}\ m^2 = 1.2 \times 10^{-6}\ \Omega\ m$	**(1)** **(1)** **(1)**	**3**
	Total for question 4		**21**