Pearson Edexcel

Mark Scheme (Results)

January 2022

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

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer		Mark
1(a)	• Measure length of card **Or** use a card of known length • Velocity = length of card / time taken	(1) (1)	**2**
1(b)(i)	• Mean v = 1.98 (m s^{-1}) • Use of half range **Or** use of maximum difference from the mean • %U = 7 % rounded to 1 or 2 s.f. <u>Example Calculation</u> Mean v = (2.07 + 1.84 + 1.91 + 2.10) / 4 = 1.98 m s^{-1} U = (2.10 − 1.84) / 2 = 0.13 m s^{-1} %U = (0.13 / 1.98) × 100 = 6.6 %	(1) (1) (1)	**3**
1(b)(ii)	• Use of $v^2 = u^2 + 2as$ • a = 1.31 (m s^{-2}) Allow ecf for v from (b)(i) <u>Example Calculation</u> $1.98^2 = 0^2 + (2 \times a \times 1.50)$ $a = 1.98^2 / (2 \times 1.50)$ a = 1.31 m s^{-2}	(1) (1)	**2**
1(b)(iii)	• The second student carried out the same experiment	(1)	**1**
	Total for question 1		**8**

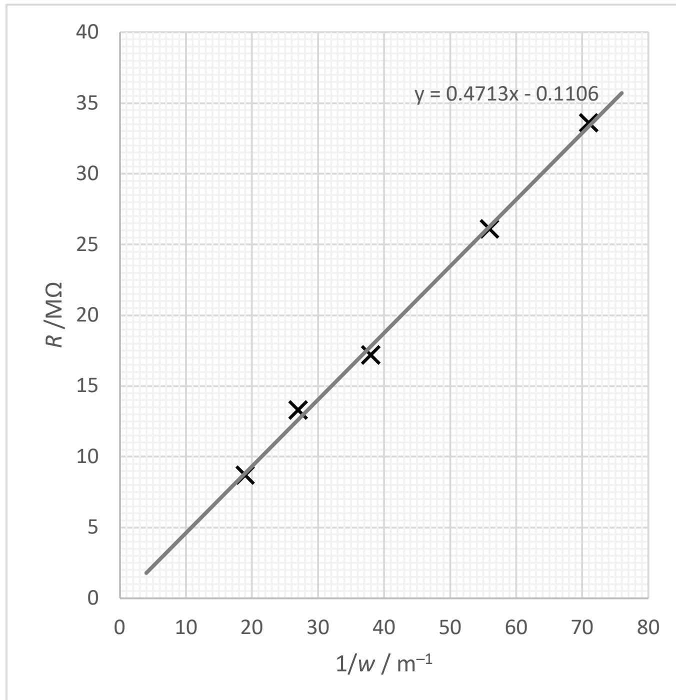
Question Number	Answer		Mark
2(a)	• Circuit with a means of varying the p.d. across the bulb (e.g., variable resistor, variable power supply) • Ammeter connected in series and voltmeter connect in parallel with the bulb	(1) (1)	**2**
2(b)	• Calculate power using $P = VI$ • Repeat experiment and calculate mean • Vary p.d. to obtain at least five sets of data • Describes method to control background light **Or** describes controlling distance from LDR to light source	(1) (1) (1) (1)	**4**
2(c)	• Resistance is negligible (compared to resistance of LDR)	(1)	**1**
	Total for question 2		**7**

Question Number	Answer		Mark
3(a)	• Measure **two** of sides AB, BC or AC • Calculate θ using: $\theta = \sin^{-1}$ (BC / AB) **Or** $\theta = \cos^{-1}$ (AC / AB) **Or** $\theta = \tan^{-1}$ (BC / AC)	(1) (1)	**2**
3(b)	• Measure the distance to the floor in two places using the metre rule **Or** place a spirit level along the bracket **Or** place a set square between the wall and the bracket **Or** place a protractor along the wall at the hinge **Or** correct description of applying Pythagoras theorem to the 3 measured lengths	(1)	**1**
3(c)	• Original/repeat measurements are not recorded • Inconsistent significant figures for F • x only recorded to nearest cm	(1) (1) (1)	**3**
3(d)(i)	• Intercept value between 0.7 and 0.9 N • Use of y-axis intercept $= \frac{W}{2sin\theta}$ • W value between 0.9 and 1.2 N <u>Example Calculation</u> $0.8\text{ N} = \frac{W}{2sin42°}$ W = 1.1 N	(1) (1) (1)	**3**
3(d)(ii)	• Percentage difference = 1.7% • Percentage difference is small, so method is accurate [MP2 dependent on MP1] <u>Example Calculation</u> Percentage difference = $\frac{(9.81 - 9.64)}{9.81} \times 100\%$ Percentage difference = 1.7 %	(1) (1)	**2**
	Total for question 3		**11**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>4(a)(i)</td><td>

- Correct $1/w$ values rounded to 2 s.f. (1)
- Labels axes with quantities and units (1)
- Sensible scales (1)
- Plotting (2)
- Line of best fit (1)

<table>
<tr><th>w / mm</th><th>R / MΩ</th><th>1/w / m^{−1}</th></tr>
<tr><td>14</td><td>33.6</td><td>71</td></tr>
<tr><td>18</td><td>26.1</td><td>56</td></tr>
<tr><td>26</td><td>17.2</td><td>38</td></tr>
<tr><td>37</td><td>13.3</td><td>27</td></tr>
<tr><td>53</td><td>8.7</td><td>19</td></tr>
</table>



</td><td>6</td></tr>
<tr><td>4(a)(ii)</td><td>

- Calculates gradient using large triangle (1)
- Use of gradient = $\rho l/t$ (1)
- t value between 0.81 mm – 0.87 mm (1)

<u>Example Calculation</u>
gradient = $28.5 \times 10^6\ \Omega$ / 60 m^{-1} = $4.75 \times 10^5\ \Omega$ m
$t = (4.0 \times 10^3\ \Omega\ m \times 0.1\ m) / 4.75 \times 10^5\ \Omega\ m = 8.42 \times 10^{-4}$ m

</td><td>3</td></tr>
<tr><td>4(b)(i)</td><td>

- Micrometer has high resolution so low uncertainty
Or Micrometer has a resolution of 0.01 mm so low uncertainty (1)
- <u>Percentage</u> uncertainty is reduced by measuring several thicknesses together
Or The uncertainty of the measurement is divided by the number of slices, so <u>percentage</u> uncertainty is reduced (1)

</td><td>2</td></tr>
<tr><td>4(b)(ii)</td><td>

- Calculates upper limit of 2% uncertainty for stated value of t (1)
- t determined from graph is above upper limit, so results not consistent (1)

Allow ecf for t from (a)(ii),
Accept calculation and comparison with the lower limit (0.78) if $t < 0.80$ mm

<u>Example Calculation</u>
Upper limit = 0.80 ×1.02 = 0.82 mm
0.85 mm > 0.82 mm

</td><td>2</td></tr>
<tr><td></td><td>Total for question 4</td><td>13</td></tr>
</table>

Question Number	Answer		Mark
5(a)(i)	• Number N of divisions between 7.1 and 7.3 • Use of $t = N \times$ time per division • Use of $s = ut$ • u value between 342 and 352 (m s^{-1}) Do not accept use of $v = f\lambda$ for MP3 & MP4 <u>Example of Calculation</u> $t = 7.2 \times 0.5 \times 10^{-3}$ s $= 3.6 \times 10^{-3}$ s u = 1.25 m / 3.6×10^{-3} s = 347 m s^{-1}	(1) (1) (1) (1)	**4**
5(a)(ii)	• Use of $s = ut$ to find time between peaks • Use of time per division to calculate maximum time that could be shown on the oscilloscope screen **Or** use of screen width to calculate time per division required to show both peaks on the oscilloscope screen **Or** use of time per division to calculate how many divisions would be required to show both peaks on the oscilloscope screen • Concludes that time displayed on the screen would be too short **Or** identifies the correct setting (50μs) Do not accept use of $v = f\lambda$ for MP1 <u>Example Calculation</u> time between peaks = 1.25 / 4000 = 3.1×10^{-4} s = 310 μs 20 μs × 8 = 160 μs So, time on display is too short to show both peaks	(1) (1) (1)	**3**
5(b)	• Peaks would be wider • It would be more difficult to judge the position/time of the peaks, so time between peaks would be less accurate	(1) (1)	**2**
5(c)	• Percentage uncertainty of E = 4% • So, the Young modulus is the more significant source of uncertainty (allow a conclusion consistent with comparison using incorrectly calculated $\%U_E$) <u>Example of Calculation</u> $\%U_E$ = (0.5 GPa / 11.2 GPa) × 100 = 4.46% 4% > 3%	(1) (1)	**2**
	Total for question 5		**11**

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