Pearson

Mark Scheme (Results)

Summer 2026

Pearson Edexcel International Advanced Level In Physics
WPH16/01A

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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.

Mark scheme notes

Underlying principle
The mark scheme will clearly indicate the concept that is being rewarded, backed up by examples. **It is not a set of model answers.**

1. Mark scheme format
1.1 You will not see 'wtte' (words to that effect). Alternative correct wording should be credited in every answer unless the MS has specified specific words that must be present. Such words will be indicated by underlining e.g. 'resonance'
1.2 Bold lower case will be used for emphasis e.g. '**and**' when two pieces of information are needed for 1 mark.
1.3 Round brackets ( ) indicate words that are not essential e.g. "(hence) distance is increased".
1.4 Square brackets [ ] indicate advice to examiners or examples e.g. [Do not accept gravity] [ecf].

2. Unit error penalties
2.1 A separate mark is not usually given for a unit but a missing or incorrect unit will normally mean that the final calculation mark will not be awarded.
2.2 This does not apply in 'show that' questions or in any other question where the units to be used have been given, for example in a spreadsheet.
2.3 The mark will not be awarded for the same missing or incorrect unit only once within one clip in epen.
2.4 Occasionally, it may be decided not to insist on a unit e.g the candidate may be calculating the gradient of a graph, resulting in a unit that is not one that should be known and is complex.
2.5 The mark scheme will indicate if no unit error is to be applied by placing brackets around the unit.

3. Significant figures
3.1 Use of too many significant figures in the theory questions will not prevent a mark being awarded if the answer given rounds to the answer in the MS.
3.2 Too few significant figures will mean that the final mark cannot be awarded in 'show that' questions where one more significant figure than the value in the question is needed for the candidate to demonstrate the validity of the given answer.
3.3 The use of one significant figure might be inappropriate in the context of the question e.g. reading a value off a graph. If this is the case, there will be a clear indication in the MS.
3.4 The use of $g = 10\ \text{m s}^{-2}$ or $10\ \text{N kg}^{-1}$ instead of $9.81\ \text{m s}^{-2}$ or $9.81\ \text{N kg}^{-1}$ will be penalised by one mark (but not more than once per clip). Accept $9.8\ \text{m s}^{-2}$ or $9.8\ \text{N kg}^{-1}$
3.5 In questions assessing practical skills, a specific number of significant figures will be required e.g. determining a constant from the gradient of a graph or in uncertainty calculations. The MS will clearly identify the number of significant figures required.

4. Calculations

4.1 **use of** the formula means that the candidate demonstrates substitution of physically correct values, although there may be conversion errors e.g. power of 10 error.

4.2 If a 'show that' question is worth 2 marks, then both marks will be available for a reverse working. If the question is worth 3 marks then only 2 marks will be available.

4.3 The mark scheme will show a correctly worked answer for illustration only.

5. Quality of Written Expression

5.1 Questions that asses the ability to show a coherent and logically structured answer are marked with an asterisk.

5.2 Marks are awarded for indicative content and for how the answer is structured.

5.3 Linkage between ideas, and fully-sustained reasoning is expected.

6. Graphs

6.1 A mark given for axes requires both axes to be labelled with quantities and units, and drawn the correct way round.

6.2 Sometimes a separate mark will be given for units or for each axis if the units are complex. This will be indicated on the mark scheme.

6.3 A mark given for choosing a scale requires that the chosen scale allows all points to be plotted, spreads plotted points over more than half of each axis and is not an awkward scale e.g. multiples of 3, 7 etc.

6.4 Points should be plotted to within 1 mm. Check all the points - If any is more than 1mm out do not award mark. For a line mark there must be a thin continuous line which is the best-fit line for the candidate's results.

Question Number	Acceptable Answer	Additional Guidance	Mark
1(a)(i)	A description that makes reference to the following points: • Clamp the metre rule and check it is vertical with a set square **Or** Clamp the metre ruler close to the light sensor **(1)** • Align the zero with the surface of the light sensor **Or** Take the readings at the surface of the light sensor and the lower edge of the filament bulb, and subtract the measurements **(1)** • (Use a set square to) view the scale perpendicularly **(1)**	Accept use of plumb-line or spirit level Accept clamp the metre rule close to the bulb	**3**
1(a)(ii)	A description that makes reference to the following points: • The resolution (of the metre rule) is 1 mm **(1)** • The uncertainty in a single measurement is half the resolution (of the rule) **Or** The uncertainty in each measurement is 0.5 mm **(1)** • As there are two judgments/measurements the uncertainties are added **Or** As (there are two judgments/measurements) 0.5 (mm) + 0.5 (mm) = 1 (mm) **(1)**	Do not accept precision/accuracy for resolution. MP3 dependent on MP2	**3**
1(b)	• There are not enough data points **(1)** • The range of data is too small **(1)** • There may be systematic/random error (in V or in h) **Or** No evidence of repeat readings **(1)** • So an accurate best-fit line cannot be drawn **Or** The graph may not be linear **(1)**	Ignore references to significant figures, inconsistent intervals.	**4**

(Total for Question 1 = 10 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
2(a)	• Determines no. of divisions for minimum of 2 waves **(1)** • Uses no. of divisions × 0.5 ms **(1)** • Use of $T = \frac{1}{f}$ **(1)** • f in the range 667 - 690 (Hz) [at least 2 sf] **(1)**	Example of Calculation $3T = 8.8$ divisions $\times 0.5\times10^{-3}$ s $= 4.4\times10^{-3}$ s $T = \frac{4.4\times10^{-3}\text{ s}}{3} = 1.47\times10^{-3}$ s $f = \frac{1}{T} = \frac{1}{1.47\times10^{-3}\text{s}} = 682$ Hz	**4**
2(b)	A description that makes reference to the following points: • Vary the frequency gradually until the maximum current is shown on the ammeter **Or** Repeat the process of finding maximum current **(1)** • Determine the time period from the oscilloscope **(1)** • Calculate $f = \frac{1}{T}$ **(1)** • Record f for different values of C **(1)** • Record 5 sets of data **(1)** • Plot a graph of f^2 against $\frac{1}{C}$ and determine the gradient for X **Or** Plot a graph of log f against log C and determine the y-intercept for X **(1)**		**6**

(Total for Question 2 = 10 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
3(a)	An answer that makes reference to two of the following points: • Handle the source with tongs **(1)** • Use the source for as short a time as possible **(1)** • Stand away from the source **(1)** • Ensure the lid is tightly on the bottle **(1)**	Ignore references to PPE Ignore references to storage of source before/after experiment	**2**
3(b)	An answer that makes reference to the following points: • Record a background count rate **(1)** • Subtract from all readings **(1)**		**2**
3(c)(i)	An explanation that makes reference to the following points: **EITHER** • $\ln C = \ln C_0 - \lambda t$ **(1)** • Compares to $y = c + mx$ where the gradient is $-\lambda$ (which is constant) **(1)** **OR** • $\ln C = -\lambda t + \ln C_0$ **(1)** • Compares to $y = mx + c$ where the gradient is $-\lambda$ (which is constant) **(1)**	MP2 dependent on MP1 MP2 dependent on MP1	**2**
3(c)(ii)	• Values of ln C correct and consistent to 3 d.p. [Accept correct and consistent to 2 d.p.] **(1)** • Axes labelled: y as ln (C / s^{-1}) and x as t / s **(1)** • Appropriate scales chosen **(1)**		

t / s	C / s^{-1}	ln (C / s^{-1})	ln (C / s^{-1})
0	118	4.771	4.77

<table>
<tr>
<td></td>
<td>
• Processed values plotted accurately (1)
[ALL points plotted to ±1 mm]

• Best fit line drawn (1)
</td>
<td>
<table>
<tr><td>30</td><td>89</td><td>4.489</td><td>4.49</td></tr>
<tr><td>60</td><td>66</td><td>4.190</td><td>4.19</td></tr>
<tr><td>90</td><td>49</td><td>3.892</td><td>3.89</td></tr>
<tr><td>120</td><td>39</td><td>3.664</td><td>3.66</td></tr>
</table>
</td>
<td>5</td>
</tr>
<tr>
<td>3(c)(iii)</td>
<td>
• Uses large triangle to calculate gradient (1)
[data from table must be on best fit line]

• Value of λ in range 0.0092 – 0.0098 (1)

• Value of λ given to 2 or 3 s.f., positive, unit s^{-1} (1)
</td>
<td>
<u>Example of calculation</u>

$-\lambda = \text{gradient} = \frac{4.76-3.60}{0-124} = \frac{1.16}{-124} = -9.35 \times 10^{-3}$
$\lambda = 9.35 \times 10^{-3}\ s^{-1}$

Bald answer can score MP2 only
</td>
<td>3</td>
</tr>
<tr>
<td>3(c)(iv)</td>
<td>
An answer that makes reference to the following points:

• Half-life is inversely proportional to the decay constant (1)

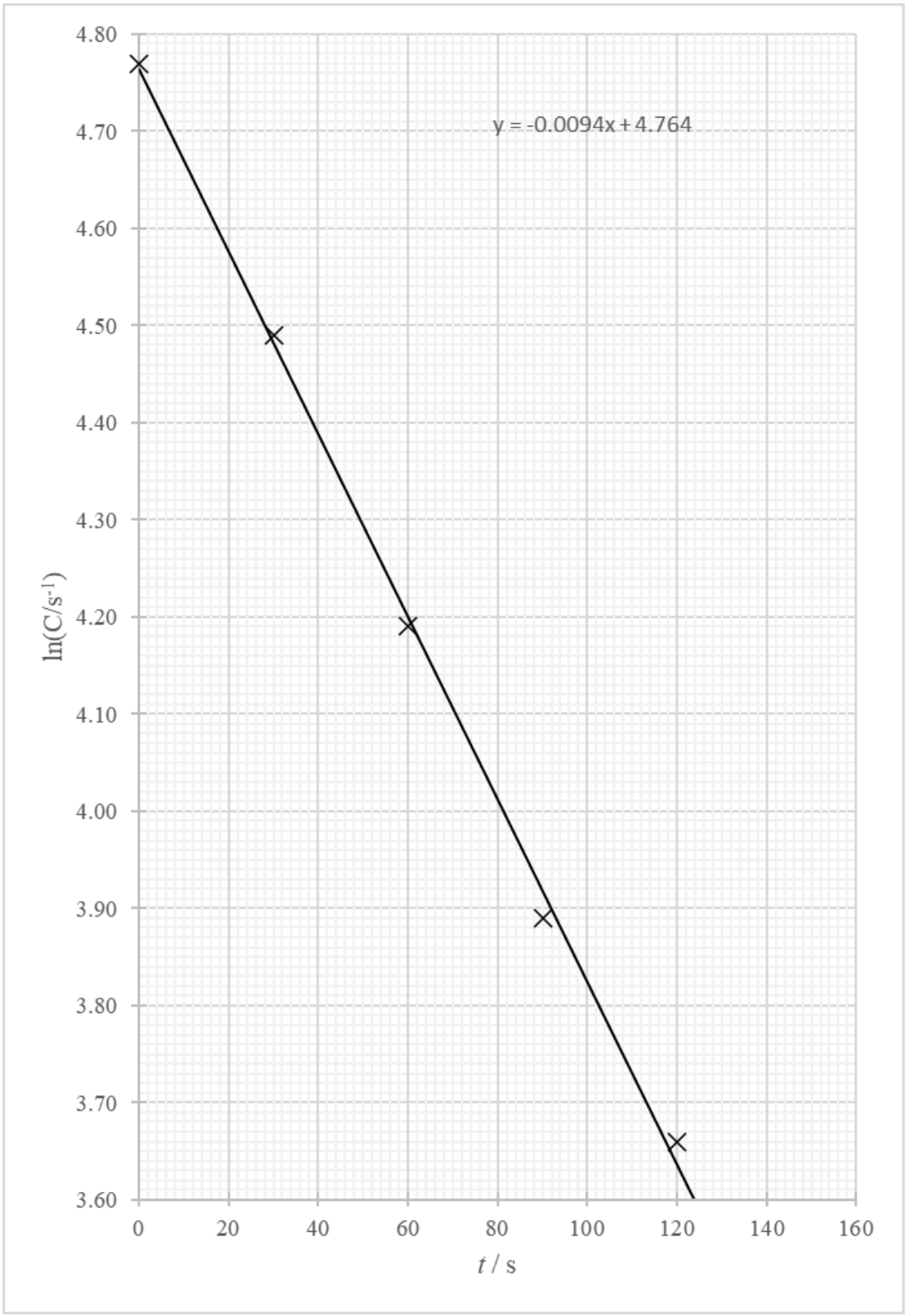
• So a shorter half-life increases the decay constant (1)

• Therefore the (gradient of the) graph will be steeper (1)
</td>
<td>
Accept reference to equation $\lambda = \ln 2 / t_{1/2}$

Accept a shorter half-life would mean the source decays more quickly

Accept graph has a more negative gradient
</td>
<td>3</td>
</tr>
</table>

(Total for Question 3 = 17 marks)


y = -0.0094x + 4.764
ln(C/s-1)
4.80
4.70
4.60
4.50
4.40
4.30
4.20
4.10
4.00
3.90
3.80
3.70
3.60
0
20
40
60
80
100
120
140
160
t / s

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)(i)	• Uses half resolution **Or** (Value on micrometer is) 2.34 (mm) **(1)** • %U = 0.2 (%) Accept 0.21 (%) **(1)**	Example of calculation Half resolution = 0.5 × 0.01 mm = 0.005 mm %U = $\frac{0.005\ \text{mm}}{2.34\ \text{mm}} \times 100 = 0.21\ \%$	**2**
4(a)(ii)	An explanation that makes reference to the following points: • Repeat at different orientations and calculate a mean **(1)** • To reduce (the effect of) random error **(1)**	ONE mark only for "repeat and calculate a mean to reduce (the effect of) random error" Do not allow eliminate/avoid. MP2 dependent on MP1	**2**
4(b)(i)	• Calculates mean value of d **(1)** • Uses $G = \frac{32mglx^2}{\pi y d^4}$ **(1)** • $G = 7.9 \times 10^{10}$ (Pa) **(1)**	Example of calculation Mean $d = \frac{(2.34+2.35+2.37+2.33)\text{mm}}{4} = 2.35$ mm $G = \frac{32mglx^2}{\pi y d^4} = \frac{32\times 0.1\text{kg}\times 9.81\text{Nkg}^{-1}\times 0.589\text{m}\times (0.103\text{m})^2}{\pi\times 26\times 10^{-3}\text{m}\times (2.35\times 10^{-3}\text{m})^4}$ $= \frac{0.196\text{Nm}^3}{2.49\times 10^{-12}\ \text{m}^5} = 7.87 \times 10^{10}$ (Pa)	**3**
4(b)(ii)	**EITHER** • Uses half range for uncertainty in d **(1)** • Uses %U in l **or** x **or** y Accept fractional uncertainty **(1)** • Uses $2\times$%U in x **and** $4\times$%U in d Accept $2 \times \frac{\Delta x}{x}$ and $4 \times \frac{\Delta d}{d}$ **(1)** • %U = 9.4 (%) given to minimum 2 s.f. **(1)** **OR**	Example of calculation Half range = $\frac{(2.37-2.33)\text{mm}}{2} = 0.02$ mm %U in $d = \frac{0.02\ \text{mm}}{2.35\ \text{mm}} \times 100 = 0.851\%$ %U in $l = \frac{0.1\ \text{cm}}{58.9\ \text{cm}} \times 100 = 0.170\%$ %U in $x = \frac{0.1\ \text{cm}}{10.3\ \text{cm}} \times 100 = 0.971\%$ %U in $y = \frac{1\ \text{mm}}{26\ \text{mm}} \times 100 = 3.846\%$ %U in G = %U in l + 2×%U in x + %U in y + 4×%U in d = 0.170% + 2×0.971% + 3.846% + 4×0.851% = 0.170% + 1.942% + 3.846% + 3.404%	

	• Uses maximum and minimum values of d **(1)** • Use of uncertainties to calculate maximum or minimum G **(1)** • Calculation of half range shown **(1)** • %U = 9.4 (%) given to minimum 2 s.f. **(1)** [Only credit if both maximum and minimum are correct and half range calculated]		= 9.36% Example of calculation Max $G = \frac{32mglx^2}{\pi yd^4} = \frac{32\times0.1\text{kg}\times9.81\text{Nkg}^{-1}\times0.590\text{m}\times(0.104\text{m})^2}{\pi\times25\times10^{-3}\text{m}\times(2.33\times10^{-3}\text{m})^4}$ $= 8.654\times10^{10}$ Pa Min $G = \frac{32mglx^2}{\pi yd^4} = \frac{32\times0.1\text{kg}\times9.81\text{Nkg}^{-1}\times0.588\text{m}\times(0.102\text{m})^2}{\pi\times27\times10^{-3}\text{m}\times(2.37\times10^{-3}\text{m})^4}$ $= 7.176\times10^{10}$ Pa U in $G = \frac{8.654-7.176}{2} \times 10^{10}$ Pa $= 0.739 \times 10^{10}$ Pa %U in $G = \frac{0.739\times10^{10}\text{ Pa}}{7.87\times10^{10}\text{ Pa}} \times 100 = 9.39$ %	**4**
4(b)(iii)	**EITHER** • Lower limit G = 7.13×10^{10} Pa **(1)** [show that values give 7.28×10^{10} Pa] [Use of 7.9 x 10^{10} Pa with 9.37% will give 7.16×10^{10} Pa] • Valid conclusion based on comparison of calculated limit with 7.70×10^{10} Pa **(1)** **OR** • %D = 2% using 7.70×10^{10} Pa in denominator [show that values give 3.9%] **(1)** • Valid conclusion based on comparison calculated %D with 9% **(1)**		Example of calculation Lower limit = 7.87×10^{10} Pa × (1 – 0.094) = 7.13×10^{10} Pa Accept correct calculations using their values from i and ii. As 7.13×10^{10} Pa is less than 7.70×10^{10} Pa the rod could be made from carbon steel Must see value being compared to Example of calculation %D = $\frac{(7.87-7.70)\times10^{10}\text{Pa}}{7.70\times10^{10}\text{Pa}} \times 100 = 2.2\%$ As 2.2% is less than 9% the rod could be made from carbon steel Must see value being compared to	**2**

(Total for Question 4 = 13 marks)
TOTAL FOR PAPER = 50 MARKS