Pearson Edexcel

Mark Scheme (Results)

January 2025

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

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January 2025
Question Paper Log Number P78477A
Publications Code WPH13_01_2501_MS

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.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:

- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.

( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.

Phrases/words underlined indicate that the meaning of the phrase or the actual word is essential to the answer.

ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Graphs

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

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 of the available space and is not an awkward scale e.g., multiples of 3, 7 etc.

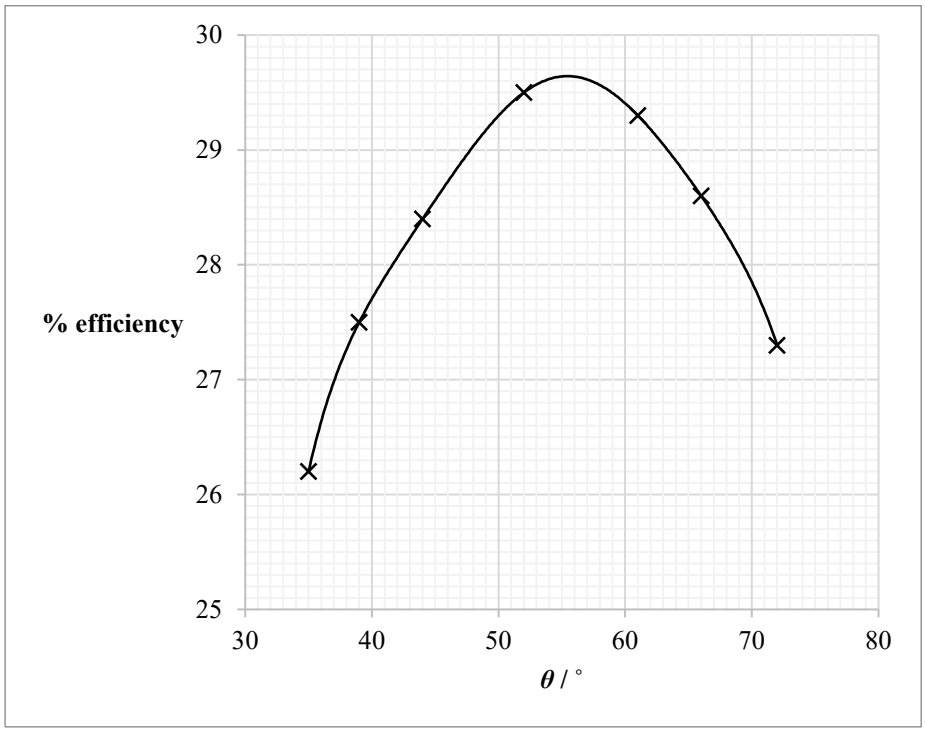
For WPH13 there are two marks available for plotting data points. Points should be plotted to within 1 mm.

- If all are within 1 mm, award 2 marks.
- If one point is 1+ mm out, award 1 mark.
- If two or more points are 1+ mm out, award 0 marks.

For a line mark there must be a thin continuous line which is the best-fit line for the candidate's results.

Question Number	Answer	Mark
1(a)	Use of uncertainty = (half) the resolution **(1)** Percentage uncertainty in l = 0.07 (%) **(1)** <u>Example calculation</u> Resolution of digital calipers = 0.1 mm Percentage uncertainty in t = (0.05 mm / 75.6 mm) × 100% = 0.066%	**2**
1(b)(i)	Calculates mean using all 5 values **(1)** Mean t = 44.8 ms rounded to 3 s.f. **(1)** Max 1 mark for correct calculation of a mean t using 4 values <u>Example calculation</u> Mean t = (44.7 + 44.6 + 44.9 + 45.2 + 44.5)/5 Mean t = 44.78 ms	**2**
1(b)(ii)	Use of uncertainty = ½ the range **Or** use of uncertainty = maximum difference from the mean **(1)** Percentage uncertainty in t = 0.8 (%) **(1)** (0.9% if max difference method used) Allow ecf for range and mean from 1(b)(i) for both marks <u>Example calculation</u> Range of repeats = 45.2 – 44.5 = 0.7 ms Uncertainty in t = 0.7 ms / 2 = 0.35 ms Percentage uncertainty in t = (0.35 ms / 44.8 ms) × 100% = 0.78%	**2**
1(c)	Measure s the distance (between the starting point and the light gate) with a metre rule **(1)** Calculate the speed of the car (through the light gate) using $v = l$ / (mean) t **(1)** Use $v^2 = (u^2 +) 2as$ to calculate the acceleration **(1)**	**3**
	Total for question 1	**9**

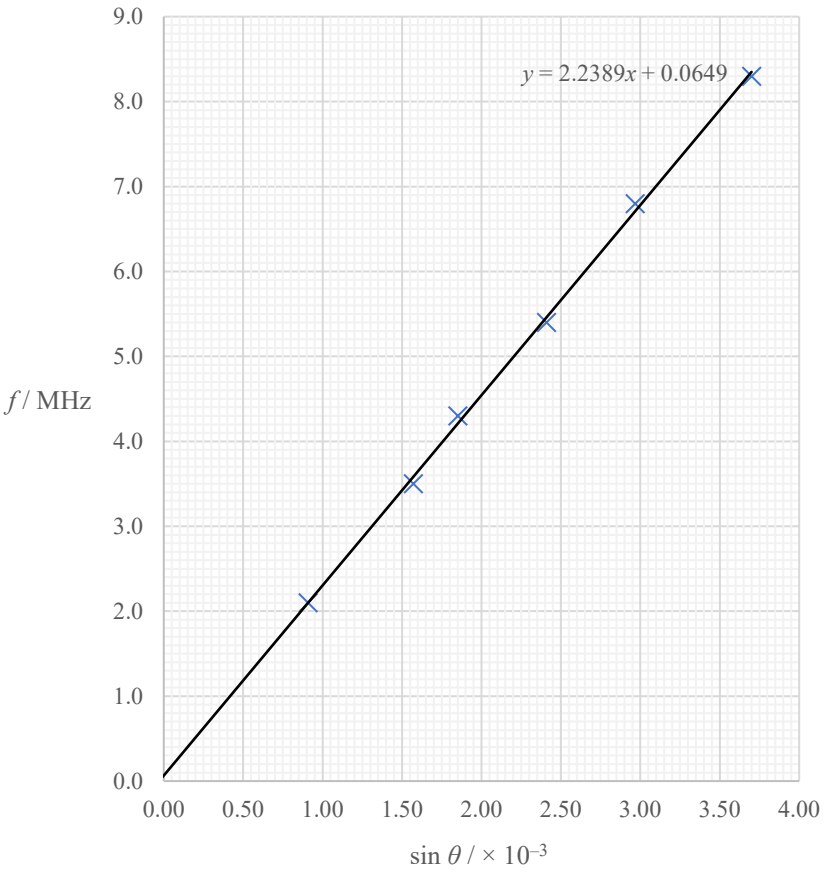
Question Number	Answer		Mark
2(a)(i)	Place mass on the beam (in the middle) Increase the mass until the beam breaks/cracks Calculate the maximum force on the beam at breaking using $W = mg$ **Or** use a force meter to measure the weight of the mass added Repeat with other beams and calculate the mean maximum force at breaking **Or** repeat with smaller masses when beam is close to breaking	**(1)** **(1)** **(1)** **(1)**	**4**
2(a)(ii)	**Mark this holistically with 2(a)(i) – students may include this as details in their plan.** **EITHER** Masses/beam could fall and injure feet/legs/hands Place a box/cushion underneath the experiment **Or** ensure feet/legs/hands are not below the experiment **Or** wear (safety) boots/shoes to protect feet **Or** clamp the supports to stop them rolling **OR** The beam could shatter and pieces enter the eye Wear goggles to protect eyes **OR** The beam could be sharp/rough after breaking, damaging hands Wear gloves to protect hands	 **(1)** **(1)** **(1)** **(1)** **(1)**	**2**
2(b)(i)	No evidence of repeats Inconsistent number of s.f. for maximum force	**(1)** **(1)**	**2**
2(b)(ii)	**EITHER** Calculate the increase/change in maximum force **and** plot a graph of this against mass Graph should produce a straight line through the origin **OR** Calculate the increase/change in maximum force **and** divide this by mass Repeats this for a different mass of fibre **and** show the ratios are similar MP2 dependent on MP1	 **(1)** **(1)** **(1)** **(1)**	**2**
	Total for question 2		**10**

Question Number	Answer	Mark
3(a)(i)	Carry out the investigation in a darkroom **Or** close all curtains in the room **Or** cover the whole apparatus with a box **(1)**	**1**
3(a)(ii)	**Max 2 of** Power/intensity of the lamp **(1)** Power of the power supply **(1)** Distance between the lamp and the solar cell **(1)**	**2**
3(b)(i)	Use of $P = VI$ **(1)** P_{out} = 11.9 (mW) rounded to 3 s.f. **(1)** Use of $\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}}$ **(1)** Efficiency = 25.8 (%) **(1)** (accept 25.9% for P=11.92 mW used in efficiency calculation) <u>Example calculation</u> $P = VI = 0.536\ \text{V} \times 22.24\ \text{mA} = 11.9\ \text{mW}$ $\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}} = \frac{11.9\ \text{mW}}{46.1\ \text{mW}} \times 100\% = 25.8\%$	**4**
3(b)(ii)	Attempts to draw a single curved line of best fit **(1)** Maximum efficiency between 29.6 and 29.8 (%) **(1)** θ_{max} between 55 and 57 (°) **(1)** Ignore plotting of data from (b)(i)  	**3**

Question Number	Answer		Mark
3(c)	Take (*V* and *I*) measurements for smaller angle increments	**(1)**	
	...for angles between 52° and 61° **Or** ...for angles around 55° **Or** ...around the peak of the curve/graph	**(1)**	
	So a more accurate curve/line of best fit can be drawn **Or** the peak of the curve can be determined more accurately	**(1)**	**3**
3(d)(i)	The light should be incident at 90° to the panel **Or** the light should be incident perpendicular to the panel	**(1)**	**1**
3(d)(ii)	The panel could move to follow the sun's position in the sky **Or** the panel could move to face the sun as it moves across the sky	**(1)**	
	...to ensure the light was always incident at the best angle to the panel	**(1)**	
	So the panel was always generating maximum power/energy **Or** so the power generated was increased **Or** so the system was always working at maximum/increased efficiency	**(1)**	**3**
	MP3 dependent on MP1 **or** MP2 being awarded		
	Total for question 3		**17**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>4(a)(i)</td><td>Correct values of sin θ (1)
...rounded to 3 s.f. (1)

<table>
<tr><th>f / MHz</th><th>θ / °</th><th>sin θ</th><th>sin θ / × 10^{-3}</th></tr>
<tr><td>2.1</td><td>0.052</td><td>0.000908</td><td>0.908</td></tr>
<tr><td>3.5</td><td>0.090</td><td>0.00157</td><td>1.57</td></tr>
<tr><td>4.3</td><td>0.106</td><td>0.00185</td><td>1.85</td></tr>
<tr><td>5.4</td><td>0.138</td><td>0.00241</td><td>2.41</td></tr>
<tr><td>6.8</td><td>0.170</td><td>0.00297</td><td>2.97</td></tr>
<tr><td>8.3</td><td>0.212</td><td>0.00370</td><td>3.70</td></tr>
</table></td><td>2</td></tr>
<tr><td>4(a)(ii)</td><td>Labels axes with quantities and units (1)
Sensible scales (1)
Plotting (2)
Line of best fit (1)

 
</td><td>5</td></tr>
<tr><td>4(b)</td><td>Re-arranges equation to $f = \frac{v}{\lambda}\sin\theta$ and compares to $y = mx$ (+ c) (1)

States that gradient $= \frac{v}{\lambda}$
Or states that $v =$ gradient $\times \lambda$ (1)</td><td>2</td></tr>
</table>

Question Number	Answer	Mark
4(c)(i)	**EITHER** Calculates gradient using large triangle **(1)** Use of gradient $= \frac{v}{\lambda}$ **(1)** v between 1400 and 1500 m s^{-1} **(1)** **OR** Reads coordinate for sin θ and f from their line **(1)** Use of $\lambda = \frac{v}{f}\sin\theta$ with $\lambda = 650$ nm **(1)** v between 1400 and 1500 m s^{-1} **(1)** Example calculation Gradient = ((7.9 – 1.2) × 10^{6} Hz) / ((3.5 – 0.5) × 10^{-3}) = 2.2 × 10^{9} Hz v = 2.2 × 10^{9} Hz × 650 × 10^{-9}m = 1430 m s^{-1}	**3**
4(c)(ii)	**EITHER** Calculates 5% uncertainty range in calculated v from (c)(i) **(1)** Compares this range to table values **and** concludes that (only) castor oil has a v within the range **(1)** **OR** Calculates the percentage difference between v from (c)(i) **and** the table value for all three liquids **(1)** Only castor oil has a percentage difference < 5% **(1)** MP2 is dependent on MP1 for this approach Allow ecf for the use of their value of v from (c)(i) to deduce their choice of liquid Example calculation 1430 m s^{-1} × 1.05 = 1502 m s^{-1} 1430 m s^{-1} × 0.95 = 1359 m s^{-1} 1474 m s^{-1} is within range, so liquid is castor oil	**2**
	Total for question 4	**14**

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