2225 – 6720M

Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2025

Physics

Higher level

Paper 1B

8 pages

Subject Details: Physics HL Paper 1B Markscheme

Mark Allocation

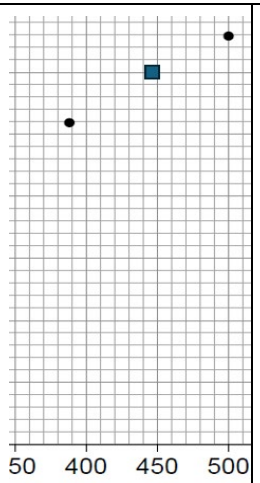
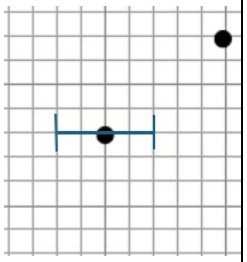
Candidates are required to answer ALL questions. Maximum total = [20 marks].

1. Each row in the "Question" column relates to the smallest subpart of the question.
2. The maximum mark for each question subpart is indicated in the "Total" column.
3. Each marking point in the "Answers" column is shown by means of a tick (✓) at the end of the marking point.
4. A question subpart may have more marking points than the total allows. This will be indicated by "max" written after the mark in the "Total" column. The related rubric, if necessary, will be outlined in the "Notes" column.
5. For numerical answers, a correct answer with no working is awarded full marks UNLESS stated otherwise in the "Notes". For correct numerical answers with working the working must be checked. If the working contains minor omissions or errors full marks are awarded. If the working contains wrong Physics or wrong method the correct answer obtained will be the result of numerical coincidence. In that case the answer is penalized.
6. An alternative wording is indicated in the "Answers" column by a slash (/). Either wording can be accepted.
7. An alternative answer is indicated in the "Answers" column by "OR" between the alternatives. Either answer can be accepted.
8. Words in angled brackets « » in the "Answers" column are not necessary to gain the mark.
9. The order of marking points does not have to be as in the "Answers" column, unless stated otherwise in the "Notes" column.
10. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the "Answers" column then award the mark.
11. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
12. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in a marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then error carried forward (ECF) marks should be awarded. When marking, indicate this by adding ECF on the script. When ECF is not to be applied "Do not allow ECF" will be displayed in the "Notes" column.
13. Do not penalize candidates for errors in units or significant figures, unless it is specifically referred to in the "Notes" column.
14. Allow alternative formats such as c for rad or use of E for scientific notation.

Question			Answers	Notes	Total
1.	a		Rule placed perpendicular/vertical to wood surface ***OR*** Ruler placed near/parallel/aligned to nail ***OR*** Compensating/allowing for zero error of the ruler ✓		1
1.	b	i	Diameter/mass/length/type/sharpness/surface of nail ***OR*** Type/material/density/stability/surface of wood ***OR*** Rate/time which pressure is applied✓	*Do not award MP for references to temperature, atmospheric pressure or changes to piston*	1
1.	b	ii	Measure the length of the nail and subtract length above surface of wood ✓	*Allow use of symbols if they are clearly identified*	1
1.	b	iii	«Addition of absolute uncertainties ±»2 mm ✓	Units not required Accept 0.002	1

1.	**b**	**iv**	***Alternative 1*** Determining one value of *k* ✓ Finding a second, **non-adjacent** value of *k* **and** conclusion that they are different ✓ ***Alternative 2*** Correct gradient/ratio or variable difference between two sets of points determined ✓ Finding a second gradient/ratio or variable difference, **and** conclusion that they are different ***OR*** Using a point to show a straight line does not pass through origin ✓	*For Alternative 1 allow reciprocal values of k* *Sufficient to use ≠ sign between values as a conclusion*	**2**

P	d	$k = \frac{P}{d}$
50	15	3.3
100	21	4.8
150	26	5.8
200	30	6.7
250	33	7.6
300	37	8.1

1.	**c**	**i**	Correctly plotted $(447 \pm 3, 30)$	*Award MP if centre of plotted point is located on perimeter or within the box* 	**1**
1.	**c**	**ii**	***Alternative 1*** «Uncertainty in $\sqrt{P}$ is» $\frac{1}{2} \times 0.08 = \pm 4\%$ ✓ $\pm 4\% \times 500 = \pm 20$ ✓ Uncertainty bar plotted correctly ✓ ***Alternative 2*** $0.08 \times 250000 = 20000$ ✓ $\frac{\sqrt{250000+20000} - \sqrt{250000-20000}}{2} = \pm 20$ ✓ Uncertainty bar plotted correctly ✓	*Allow ECF for MP2 and MP3* *For MP3 apply tolerance of* ± 5 *on each end of plotted error bar* 	**3**
1.	**c**	**iii**	$x = \frac{3}{2}$ ✓ $y = 1$ ✓		**2**

1.	**d**		«One/less trial(s)» does not consider «random» uncertainty/error/accuracy ***OR*** «One/less trial(s)» does not consider outliers/irregularities/inconsistencies/variations/differences «in wood or nails» ✓ ***OR*** Collecting/averaging multiple trials can evaluate/reduce the uncertainty/error		**1**

Question			Answers	Notes	Total
2.	a		Measure distance between multiple constructive/maxima fringes ✓ Divide this distance by the number of fringes «subtract 1» OR Divide this distance by the number of minima✓	*Do **no**t accept answers that refer to changing the ruler to other measuring devices*	**2**
2.	b		«A smaller d will» increase fringe separation s ✓ «Relative» uncertainty in s will decrease ✓	*Do not award MP2 without correct MP1 except when applying ECF from MP1*	**2**
2.	c	i	$\frac{1}{d}$ ✓	*Allow* $\frac{D}{d}$	**1**
2.	c	ii	Uncertainty $\pm 30\ nm$ ✓ Rounding $\lambda = 610 \pm 30\ nm$ ✓	*MP1 for obtaining uncertainty to any number of s.f.* *Allow ECF from MP1 for an answer written to correct s.f.* *Award [2] for BCA*	**2**