2225 – 6714M

Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2025

Physics

Higher level

Paper 1B

7 pages

Subject Details: Physics HL Paper 1B Markscheme

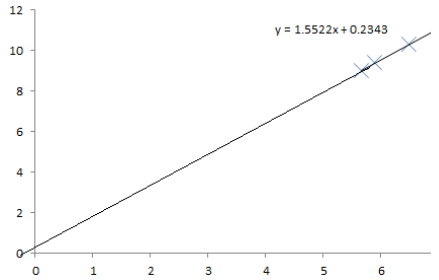
Mark Allocation

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.

Q			Answers	Notes	Total
1	a		to reduce effect of random errors/random uncertainties / to calculate average ***OR*** check on uniformity **«** of wire/diameter/thickness/cross section **»** ✓		1
1	b	i	**«**Half-**»**Metre ruler ***OR*** measuring tape with millimetre graduations ✓	Ruler is not enough, some indication of the length of the ruler at least 50 cm is required. Allow meter stick, metre-stick, long ruler.	1
1	b	ii	micrometer / screw gauge ***OR*** **«**Vernier**»** caliper ✓		1
1	c	i	discards 0.26 ✓ correct calculation of mean from five ***OR*** six readings✓	Allow full marks, if two answers are provided, with and without 0.26.	2
1	c	ii	**«**range in d = 0.04 mm so**»** absolute uncertainty is = 0.02 mm ✓ Fractional uncertainty = $\frac{0.02}{0.20} = 0.1$ ***OR*** 10%✓	Do not award mark for BCA. Ignore calcluation of relative uncertainty of screw gauge/caliper.	2

1	c	iii	0.004 ***OR*** 0.4 %✓		1
1	d		$\rho = 9 \times 10^{-7}\ \Omega$ m ✓ Attempts to use $\left(\frac{\Delta R}{R}\right)+2\left(\frac{\Delta d}{d}\right)+\left(\frac{\Delta l}{l}\right)$ ✓ «to give $\frac{\Delta\rho}{\rho}=(0.015+2(0.1)+0.004)=0.22$ » « $\Delta\rho=(9\times10^{-7})\times0.22=2.02\times10^{-7}$ » $(9 \pm 2) \times 10^{-7}\ \Omega$ m ✓	Accept answers in Ωmm. Do not allow omission of the factor 2 in MP2.	3

Q				Notes	Total
2	a	i	Plots missing point correctly on graph to within half a square (6.5×10^4, 10.3×10^4)✓		1
2	a	ii	Clear, straight single line, drawn with ruler, points balanced about line ✓		1
2	a	iii	**ALTERNATIVE 1** Evaluate *PV* for each data point ***OR*** any statement to that effect ✓ these should be same ✓ Could be roughly the same / within experimental error / some consistent comment about variation of data ✓ **ALTERNATIVE 2** Graph is a straight line / slope is constant / relationship is linear✓ Use data to produce value for intercept ✓ This should be at / close to origin for relationship to be correct ✓ **ALTERNATIVE 3** Graph is a straight line / slope is constant / relationship is linear ✓ Replot graph on larger axes ✓ To see if graph goes through / is close to origin ✓	The question does not require calculation, but accept explanation through calculations. Accept Alternative 3 in the form of graph. 	3

2	b	i	Use two points <u>on line</u> to determine the slope ***OR*** Attempts to evaluates *PV* for each data point and then average ***OR*** Uses minimum of two data point <u>on line</u> and evaluates *PV* for each with average ✓ 1.56 J ✓		2
2	b	ii	Joule / J / kgm^2s^{-2} / Pam^3 / Nm ✓		1
2	c		« $N = \frac{K}{k_B T} = \frac{1.59}{1.38 \times 10^{-23} \times 291}$ so» *N* = 3.96 x 10^{20} ✓	Allow use of $N = \frac{PV}{k_B T}$, where P and V are taken from graph.	1