

Markscheme

May 2025

Physics

Higher level

Paper 1

© International Baccalaureate Organization 2025

All rights reserved. No part of this product may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without the prior written permission from the IB. Additionally, the license tied with this product prohibits use of any selected files or extracts from this product. Use by third parties, including but not limited to publishers, private teachers, tutoring or study services, preparatory schools, vendors operating curriculum mapping services or teacher resource digital platforms and app developers, whether fee-covered or not, is prohibited and is a criminal offense.

More information on how to request written permission in the form of a license can be obtained from <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organisation du Baccalauréat International 2025

Tous droits réservés. Aucune partie de ce produit ne peut être reproduite sous quelque forme ni par quelque moyen que ce soit, électronique ou mécanique, y compris des systèmes de stockage et de récupération d'informations, sans l'autorisation écrite préalable de l'IB. De plus, la licence associée à ce produit interdit toute utilisation de tout fichier ou extrait sélectionné dans ce produit. L'utilisation par des tiers, y compris, sans toutefois s'y limiter, des éditeurs, des professeurs particuliers, des services de tutorat ou d'aide aux études, des établissements de préparation à l'enseignement supérieur, des fournisseurs de services de planification des programmes d'études, des gestionnaires de plateformes pédagogiques en ligne, et des développeurs d'applications, moyennant paiement ou non, est interdite et constitue une infraction pénale.

Pour plus d'informations sur la procédure à suivre pour obtenir une autorisation écrite sous la forme d'une licence, rendez-vous à l'adresse <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organización del Bachillerato Internacional, 2025

Todos los derechos reservados. No se podrá reproducir ninguna parte de este producto de ninguna forma ni por ningún medio electrónico o mecánico, incluidos los sistemas de almacenamiento y recuperación de información, sin la previa autorización por escrito del IB. Además, la licencia vinculada a este producto prohíbe el uso de todo archivo o fragmento seleccionado de este producto. El uso por parte de terceros —lo que incluye, a título enunciativo, editoriales, profesores particulares, servicios de apoyo académico o ayuda para el estudio, colegios preparatorios, desarrolladores de aplicaciones y entidades que presten servicios de planificación curricular u ofrezcan recursos para docentes mediante plataformas digitales—, ya sea incluido en tasas o no, está prohibido y constituye un delito.

En este enlace encontrará más información sobre cómo solicitar una autorización por escrito en forma de licencia: <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

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		Read the volume at the bottom of the meniscus OR placed on a horizontal surface so that the cylinder is vertical OR eyes levelled with the reading ✓	Do not award vague statements such as “horizontal reading” or repeat measurements or improving precision or parallax error without a way to improve it	[1]
1	b	i	$\rho = \ll \frac{10.82}{10.6} \gg = 1.02 \checkmark$ $\frac{\Delta \rho}{\rho} = \frac{0.2}{10.6} + \frac{0.01}{10.82} = 0.0198 \text{ so } \Delta \rho = 0.02 \checkmark$	Award MP2 if they use the fractional uncertainty in volume only AND state that the fractional / absolute uncertainty in mass can be neglected. Allow 1020 kg m^{-3} and $\Delta p = 20$ DO NOT penalize for SF.	[2]
1	b	ii	$\rho = 1020 \pm 20 \checkmark$	Watch for ECF from bi) For ECF, density must be in kgm^{-3} AND correct corresponding uncertainty. The density should have 3SF, and corresponding precision in the uncertainty.	[1]
1	c		reads $994 (\pm 1) \text{ «kg m}^{-3}\text{»}$ at $T = 35^\circ\text{C} \checkmark$ value outside the range $\text{«}1020 \pm 20\text{»}$ so sample is not pure ✓	Watch for ECF from bii) Allow 1020 ± 20 does not include the value of a pure sample at 35°C so it is not pure for MP2	[2]

Question			Answers	Notes	Total
2.	a		measure P to be at the centre of the flat edge/side so that incident rays are aimed at P /go through radial lines OR check that the incident angle is 0° at every point of incidence ✓		[1]
2	b	i	$\theta_r = 49^\circ$ ✓	Accept correct answer only	[1]
2	b	ii	0.755 ✓	Accept only 0.755. Answer must be quoted to 3 sf.	[1]
2	c	i	use two points from the line that use more than half the line of best fit ✓ gradient = 1.5 ✓	Allow (implicit) use of the origin. Look for $\Delta x \geq 0.3$	[2]
2	c	ii	draw max from lower end of lower error bar to upper end of upper error bar ✓		[1]
2	c	iii	States gradient gives the value of the refractive index OR $n = 1.5$ ✓ $n = 1.5 \pm 0.2$ ✓	MP1 can be shown as an equation Candidates may calculate the uncertainty by using the gradient of the line found in cii) or finding the average of the max and min lines of best fit. Look for working leading to $0.1 \leq \Delta n \leq 0.2$	[2]

Question			Answers	Notes	Total
3.	a		r ✓ because it gives the most uniform field in space between coils/across the magnet OR $2r$ gives a lower magnitude of the field OR $0.5r$ gives a greater magnitude of the field but not uniform across magnet ✓		[2]
3	b		B_H will be perpendicular to B_{coils} ✓ the deflection of the magnet will allow for the determination of B_H ✓ gives the maximum possible deflection of the magnet ✓	MP2 can be given for use of deflection to measure B_H .	[2] max
3	c		$\tan 24^\circ = B_H/B_{\text{coils}}$ ✓ $B_H = \llcorner 7.5 \times 10^{-5} \text{ T} \times \tan 24^\circ = \gg 3.3 \times 10^{-5} \text{ T}$ ✓	Watch for ECF from a). For MP2: for $2r$, $B_H = 1.3 \times 10^{-5} \text{ T}$ for $0.5r$, $B_H = 4.5 \times 10^{-5} \text{ T}$	[2]