Diploma Programme
Programme du diplôme
Programa del Diploma

Physics
Higher level
Paper 1B

29 April 2025

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

Candidate session number

2 hours [Paper 1A and Paper 1B]

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- A clean copy of the **physics data booklet** is required for this paper.
- The maximum mark for paper 1B is **[20 marks]**.
- The maximum mark for paper 1A and paper 1B is **[60 marks]**.

2225–6714

Answer **all** questions. Answers must be written within the answer boxes provided.

1. A student determines the resistivity ρ of a metal that is in the form of a cylindrical wire. The student makes the following measurements:

Length L of the wire = (462 ± 2) mm

Readings for the diameter d of the wire:

Reading	1	2	3	4	5	6
***d* / mm**	0.18	0.20	0.21	0.22	0.26	0.18

Resistance R of the wire = $(13.7 \pm 1.5\,\%)\,\Omega$

(a) Outline why the measurements of d were made at different places along the wire. [1]

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(b) Suggest suitable instruments for the measurement of

(i) L [1]

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(ii) d [1]

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(Question 1 continued)

(c) (i) Show that the mean diameter of the wire is about 0.2 mm. [2]

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(ii) Calculate the fractional uncertainty in the mean diameter of the wire. [2]

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(iii) Calculate the fractional uncertainty in the length of the wire. [1]

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(d) The resistivity of the wire is given by $\rho = \frac{RA}{L}$ where A is the cross-sectional area of the wire. Calculate the value of ρ and its absolute uncertainty. State your answers to an appropriate number of significant figures. [3]

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2. The equation $PV = Nk_BT$ describes the behaviour of an ideal gas.

A student tests a fixed mass of gas to confirm that, for a constant temperature,

$$PV = K$$

where K is a constant.

The student does this by making measurements of P and V.

Five sets of data for this experiment are shown in the table. Four processed values of $\frac{1}{V}$ are also shown.

P / kPa	V / 10^{-5} m^3	$\frac{1}{V}$ / 10^4 m^{-3}
117	1.37	7.30
110	1.42	7.04
103	1.54	
94	1.70	5.88
90	1.77	5.65

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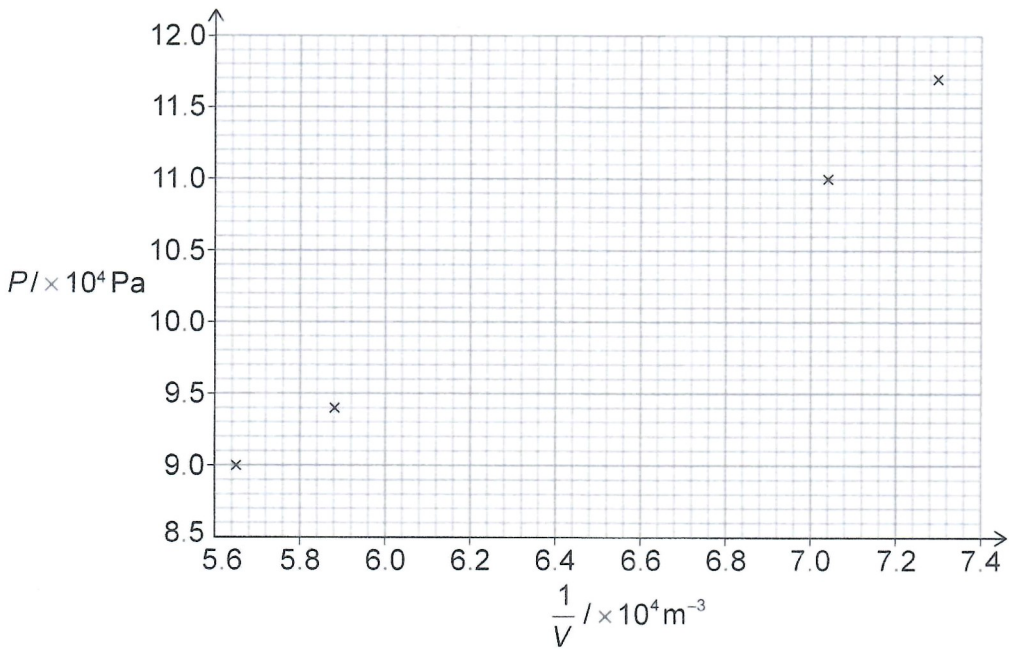
(Question 2 continued)

The variation of P with $\frac{1}{V}$ is shown for four data points.



(a) (i) Plot the missing data point on the graph. [1]

(ii) Draw the best-fit line on the graph. [1]

(iii) Explain how the student can use the graph to decide whether the data support the relationship $PV = K$. [3]

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(Question 2 continued)

(b) (i) Determine K. [2]

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(ii) State an appropriate SI unit for K. [1]

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(c) The laboratory is at a constant temperature of 291 K.

Determine the number of molecules in the fixed mass of gas. [1]

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