



Cambridge International AS & A Level

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PHYSICS

9702/52

Paper 5 Planning, Analysis and Evaluation

February/March 2025

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 30.
- The number of marks for each question or part question is shown in brackets [].

This document has 8 pages.

- 1 Fig. 1.1 shows two identical cylindrical metal conductors P and Q, each of length L and cross-sectional area A .

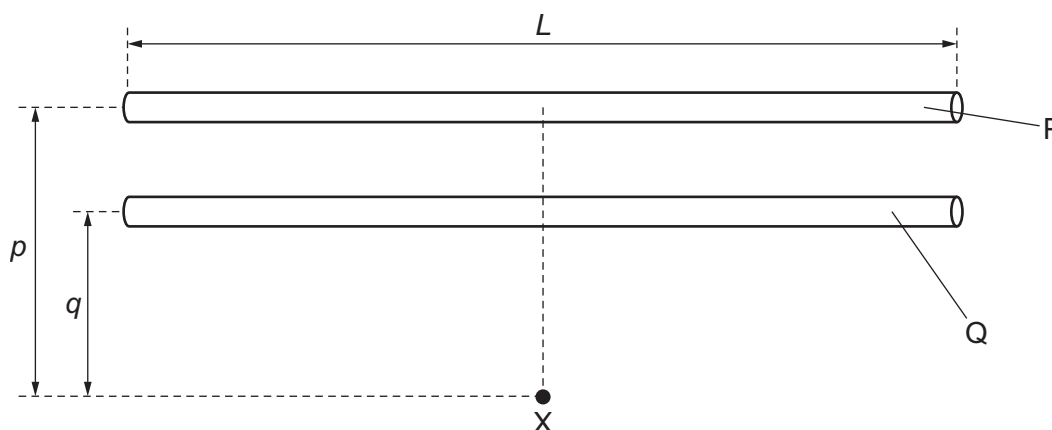


Fig. 1.1

The conductors are placed parallel to each other. The perpendicular distance from the midpoint of P to point X is p . The perpendicular distance from the midpoint of Q to point X is q .

The two conductors are electrically connected in parallel. This parallel combination is connected in series to a power supply and a resistor. The potential difference V between the ends of P is the same as the potential difference between the ends of Q.

The magnetic flux density at X due to the currents in the conductors is B .

It is suggested that B is related to p by the relationship

$$B = \frac{YAV}{Lp} + \frac{YZAV}{Lq}$$

where Y and Z are constants.

Plan a laboratory experiment to test the relationship between B and p .

Draw a diagram showing the arrangement of your equipment.

Explain how the results could be used to determine values for Y and Z .

In your plan you should include:

- the procedure to be followed
- the measurements to be taken
- the control of variables
- the analysis of the data
- any safety precautions to be taken.





Diagram

This image shows a full page of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page, providing a template for handwriting practice or general writing. There are no margins, text, or other markings on the page.

..... [15]

- 2 A student investigates the cooling of a liquid in a beaker.

The temperature θ_R of the laboratory is measured using a thermometer.

Hot water is added to an insulated beaker, as shown in Fig. 2.1.

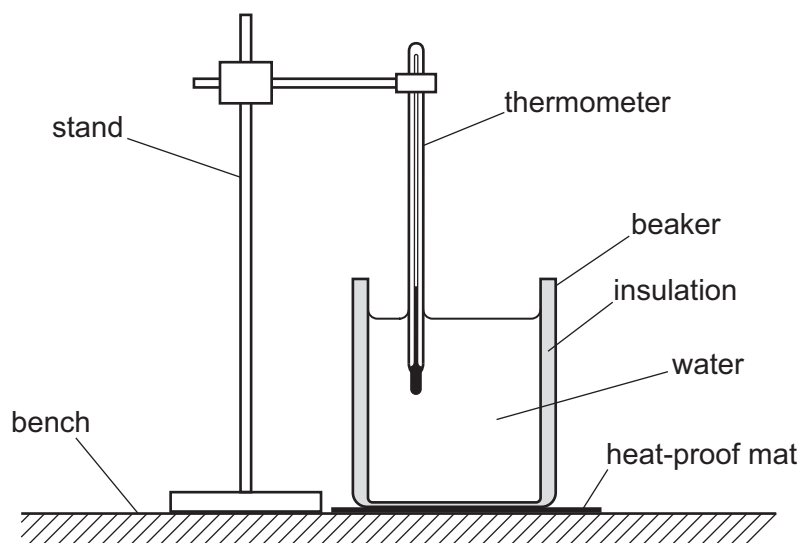


Fig. 2.1

The thermometer measures the temperature of the water. At time t the temperature of the water is θ .

A series of readings of t and θ are taken.

It is suggested that θ and t are related by the equation

$$\theta = \theta_R + (\theta_0 - \theta_R)e^{-\left(\frac{t}{K}\right)}$$

where θ_0 is the temperature at $t = 0$ and K is a constant.

- (a) A graph is plotted of $\ln(\theta - \theta_R)$ on the y-axis against t on the x-axis.

Determine expressions for the gradient and y-intercept.

gradient =

y-intercept =

[1]





(b) Values of t and θ are given in Table 2.1.

Table 2.1

t/min	$\theta/^\circ\text{C}$	$(\theta - \theta_R)/^\circ\text{C}$	$\ln((\theta - \theta_R)/^\circ\text{C})$
6.0	75.0 ± 0.5		
12.0	64.5 ± 0.5		
18.0	57.0 ± 0.5		
24.0	50.0 ± 0.5		
30.0	44.5 ± 0.5		
36.0	41.0 ± 0.5		

The value of θ_R is $(18.5 \pm 0.5)^\circ\text{C}$.

Calculate and record values of $(\theta - \theta_R)/^\circ\text{C}$ and $\ln((\theta - \theta_R)/^\circ\text{C})$ in Table 2.1.

Include the absolute uncertainties in $(\theta - \theta_R)$ and $\ln((\theta - \theta_R)/^\circ\text{C})$. [2]

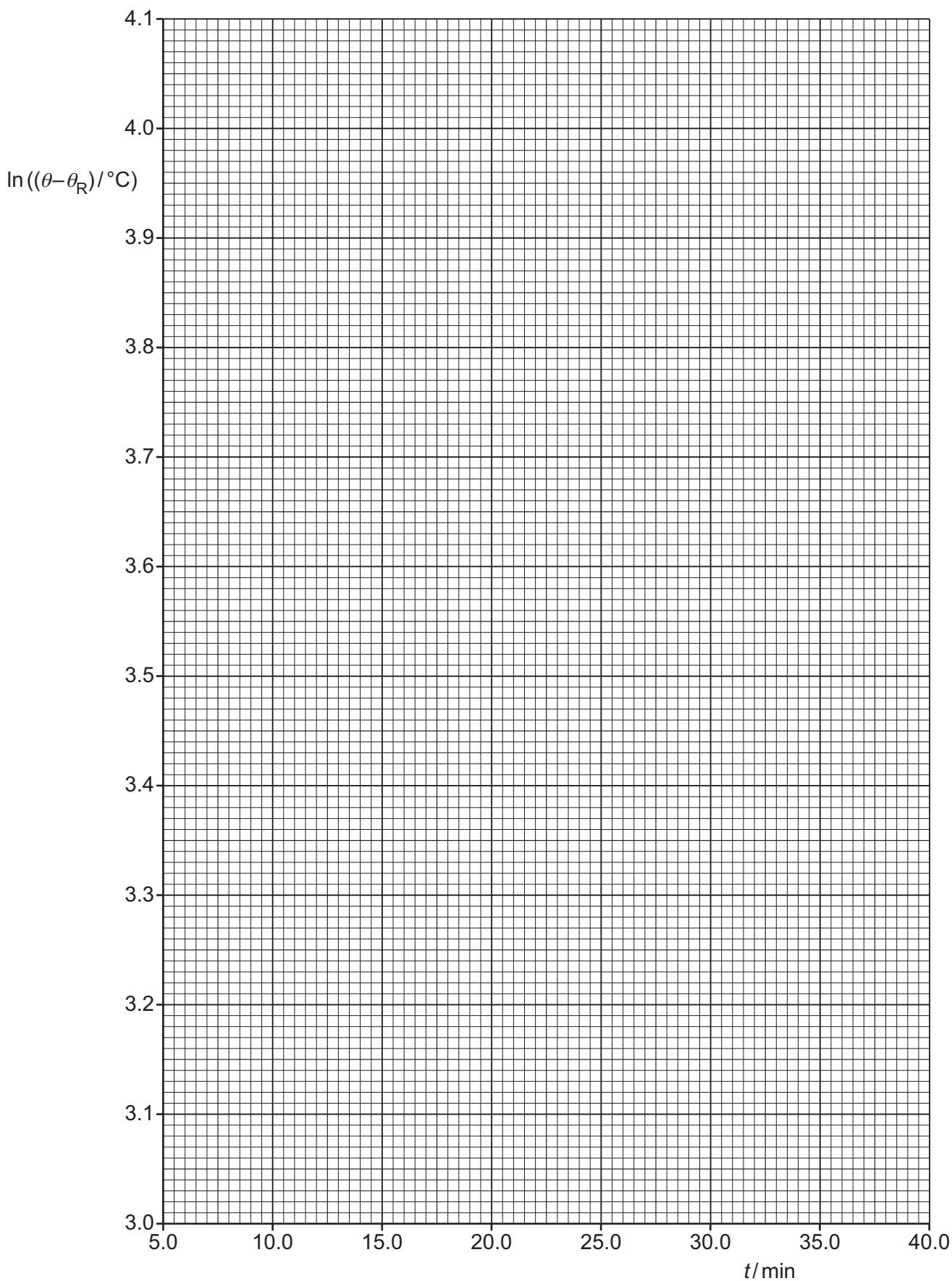
(c) (i) Plot a graph of $\ln((\theta - \theta_R)/^\circ\text{C})$ against t/min . Include error bars for $\ln((\theta - \theta_R)/^\circ\text{C})$. [2]

(ii) Draw the straight line of best fit and a worst acceptable straight line on your graph. Label both lines. [2]

(iii) Determine the gradient of the line of best fit. Include the absolute uncertainty in your answer.

gradient = [2]







- (iv) Determine the y -intercept of the line of best fit. Include the absolute uncertainty in your answer.

y -intercept = [2]

- (d) (i) Using your answers to (a), (c)(iii) and (c)(iv), determine the values of K and θ_0 . Include appropriate units.

K =

θ_0 = [2]

- (ii) Determine the absolute uncertainty in your value of θ_0 .

absolute uncertainty = [1]

- (e) Determine the time t for the temperature to reach 25.0°C .

t = min [1]

[Total: 15]

