GradeMax

* 0000800000001 *

Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3260109492

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.

DC (PB/SG) 342333/2

© UCLES 2025

[Turn over

GradeMax

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

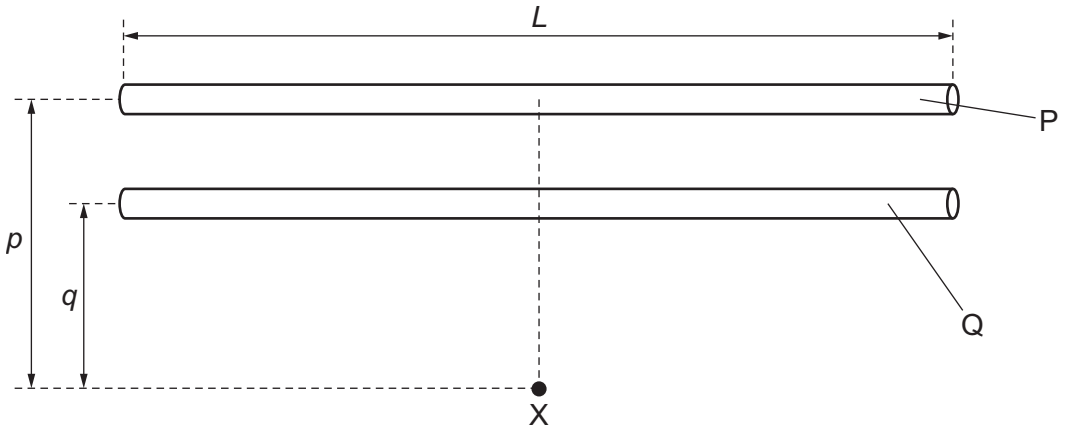


Fig. 1.1

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.

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

* 0000800000003 *

Diagram

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© UCLES 2025

GradeMax

.....

.....

.....

GradeMax

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.

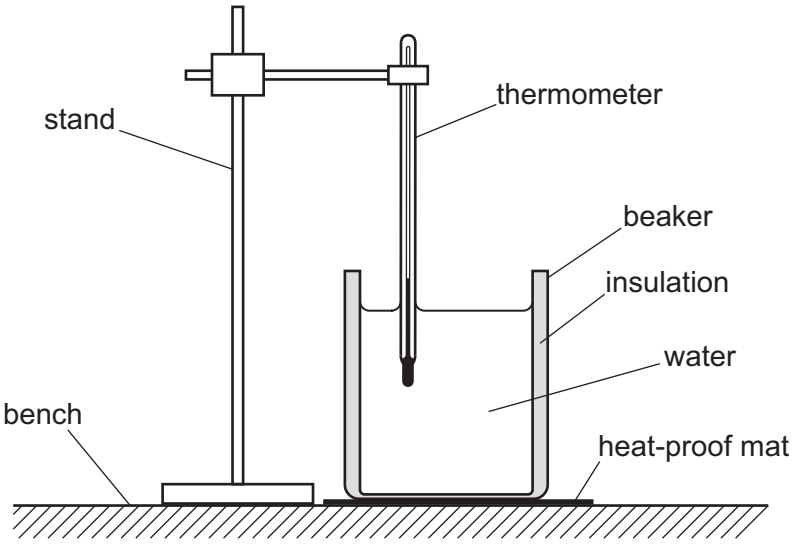


Fig. 2.1

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

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

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]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

GradeMax

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

Table 2.1

t/min	θ/°C	$(\theta - \theta_R)$/°C	ln(($\theta - \theta_R$)/°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 ± 0.5) °C.

Calculate and record values of $(\theta - \theta_R)$/°C and ln(($\theta - \theta_R$)/°C) in Table 2.1.
Include the absolute uncertainties in $(\theta - \theta_R)$ and ln(($\theta - \theta_R$)/°C). [2]

(c) **(i)** Plot a graph of ln(($\theta - \theta_R$)/°C) against t/min. Include error bars for ln(($\theta - \theta_R$)/°C). [2]

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

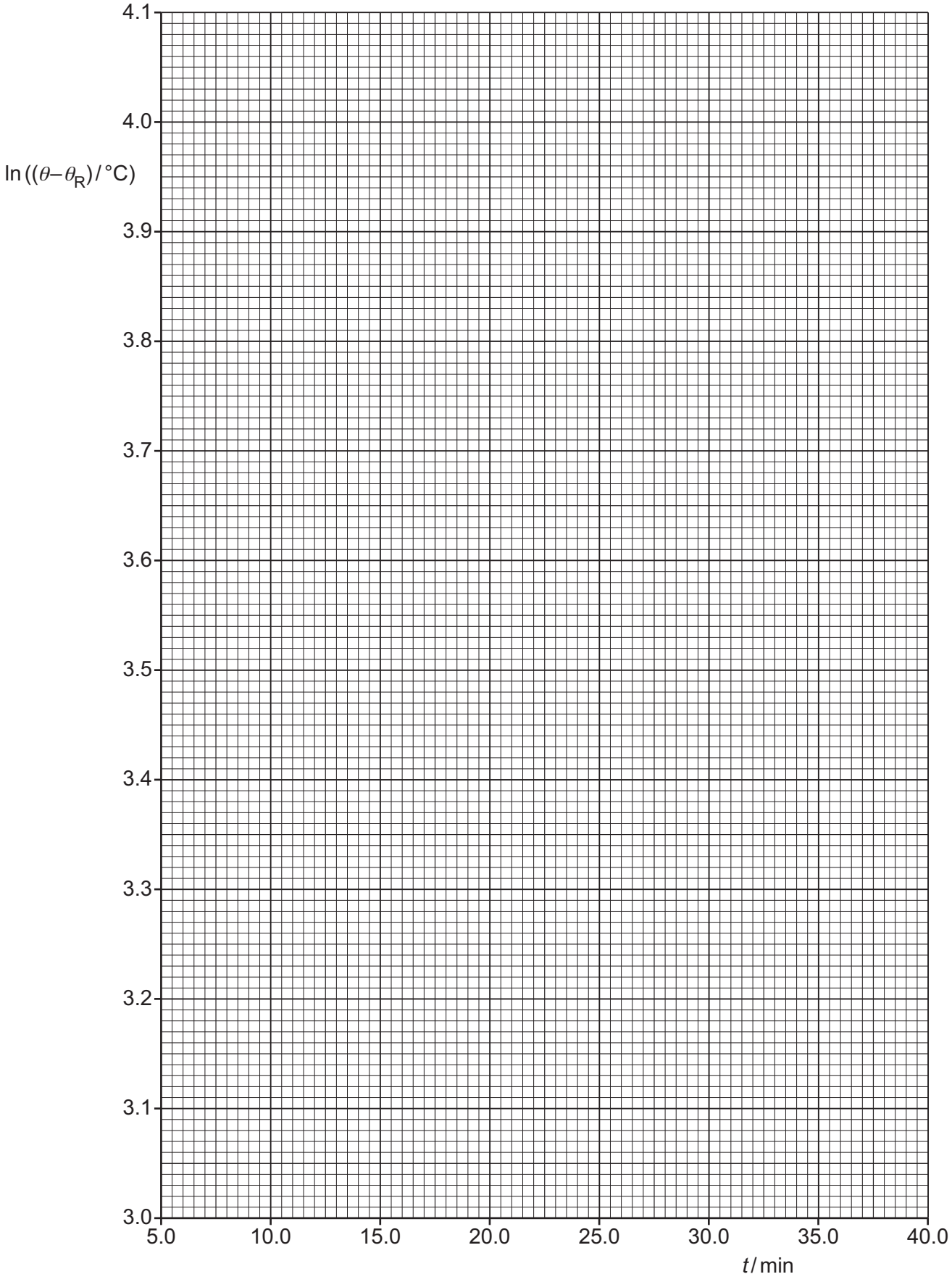
(iii) Determine the gradient of the line of best fit. Include the absolute uncertainty in your answer.

gradient = ... [2]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

GradeMax

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN



GradeMax

(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]

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

© UCLES 2025

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN