Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9822822418

PHYSICS **5054/31**

Paper 3 Practical Test **October/November 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
For each of the questions in Section A, you will be allowed to work with the apparatus for a maximum of 20 minutes. For the question in Section B, you will be allowed to work with the apparatus for a maximum of 1 hour.

You are expected to record all your observations as soon as these observations are made.
An account of the method of carrying out the experiments is **not** required.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
Total	

This document consists of **13** printed pages and **3** blank pages.

© UCLES 2019

Cambridge Assessment International Education

Section A

Answer **all** the questions in this section.

1 *In this experiment, you will investigate the oscillation of a mass on a spring.*

You are provided with:

- a 100 g mass hanger and two 100 g masses
- an arrangement of 5 springs attached together end to end
- a stopwatch
- a stand, clamp, boss and G-clamp or weight
- a piece of card with a hole at the centre.

The supervisor has set up the apparatus as shown in Fig. 1.1.

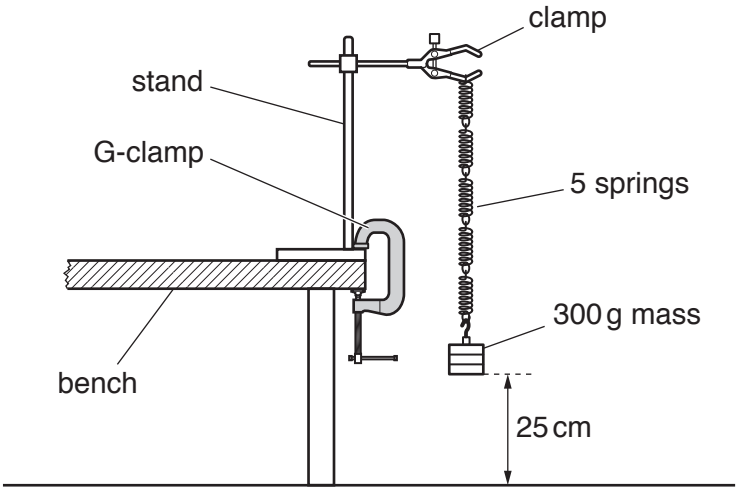


Fig. 1.1

(a) Pull down on the mass so that the springs extend and the bottom of the mass touches the floor.

Release the mass and observe it move up and then down again. One oscillation is the movement of the mass from its lowest position to its highest position and back to its lowest position.

(i) Determine an accurate value of the time t_1 for 30 oscillations of the mass.

t_1 = ... [1]

(ii) Describe what happens to the amplitude of the oscillations during time t_1.

.....

..... [1]

(b) Remove the mass hanger and masses from the spring.

Remove the two 100 g masses from the mass hanger.

Pass the hook of the mass hanger through the hole in the centre of the card. Slide the card down the stem of the mass hanger until it rests on the bottom.

Replace the two 100 g masses on top of the card, as shown in Fig. 1.2.

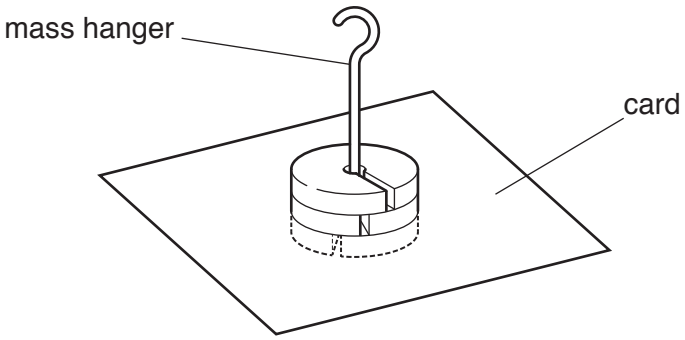


Fig. 1.2

Attach the mass hanger to the bottom of the spring.

(i) Pull down on the mass so that the springs extend and the bottom of the mass touches the floor. Release the mass and start the stopwatch.

Determine the time t_2 for 30 oscillations of the mass and card.

t_2 = ... [1]

(ii) Compare your observations of the change in amplitude of the mass with and without the card.

.....

..... [1]

(iii) Suggest an explanation for the differences observed.

.....

..... [1]

[Total: 5]

2 *In this experiment, you will investigate how the angle of an L-shaped beam varies with mass.*

You are provided with:

- an L-shaped beam
- a stand, clamp and two bosses
- a rod to act as a pivot
- two wire hooks
- a 100 g mass and a 300 g mass
- a protractor
- a metre rule
- a set square.

The supervisor has set up the apparatus, as shown in Fig. 2.1.

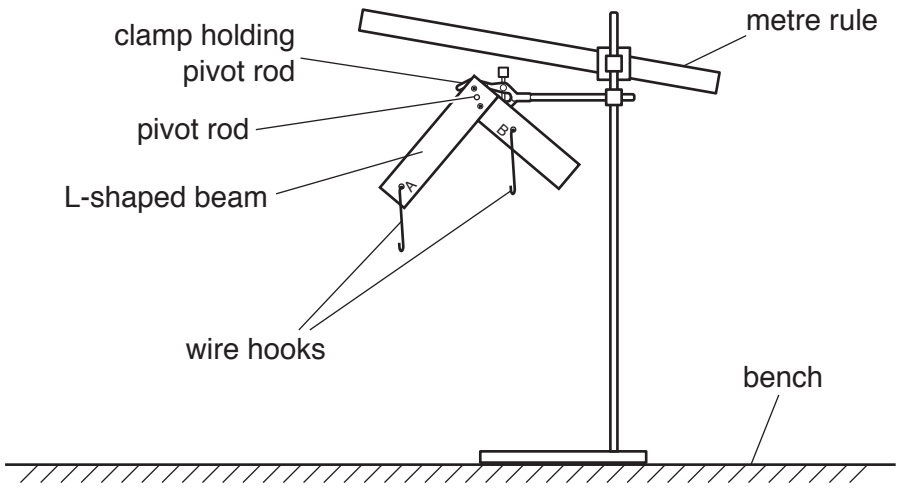


Fig. 2.1

Fig. 2.1 shows an L-shaped beam pivoted on a rod attached to a clamp.

Holes in the beam are marked A and B. Wire hooks are attached to these holes.

A metre rule is also attached to the stand.

(a) Adjust the position of the metre rule so that it is horizontal and its lower edge is behind the L-shaped beam and resting on the rod.

Explain how you ensure that the metre rule is horizontal.

.....

..... [1]

(b) Attach the 100 g mass to the wire hook at hole A.

Attach the 300 g mass to the wire hook at hole B.

The angle θ between the rule and the side of the L-shaped beam with the hole labelled A is shown in Fig. 2.2.

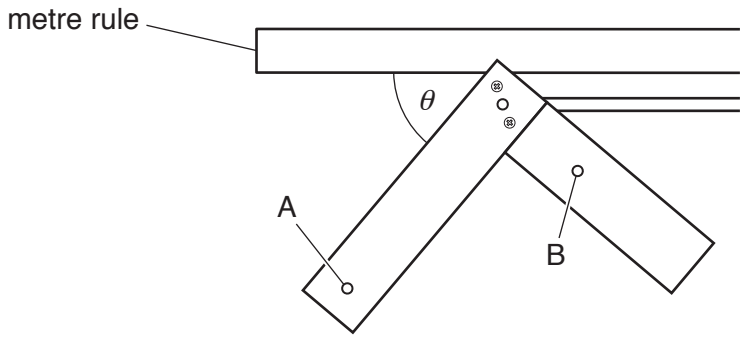


Fig. 2.2

(i) Measure angle θ.

θ = ... [1]

(ii) Describe how to investigate the relationship between value of the mass at hole A and the angle θ.

.....

.....

.....

..... [2]

(c) On Fig. 2.3, use your results to sketch a graph of the expected relationship between the value of the mass at hole A and the angle θ.

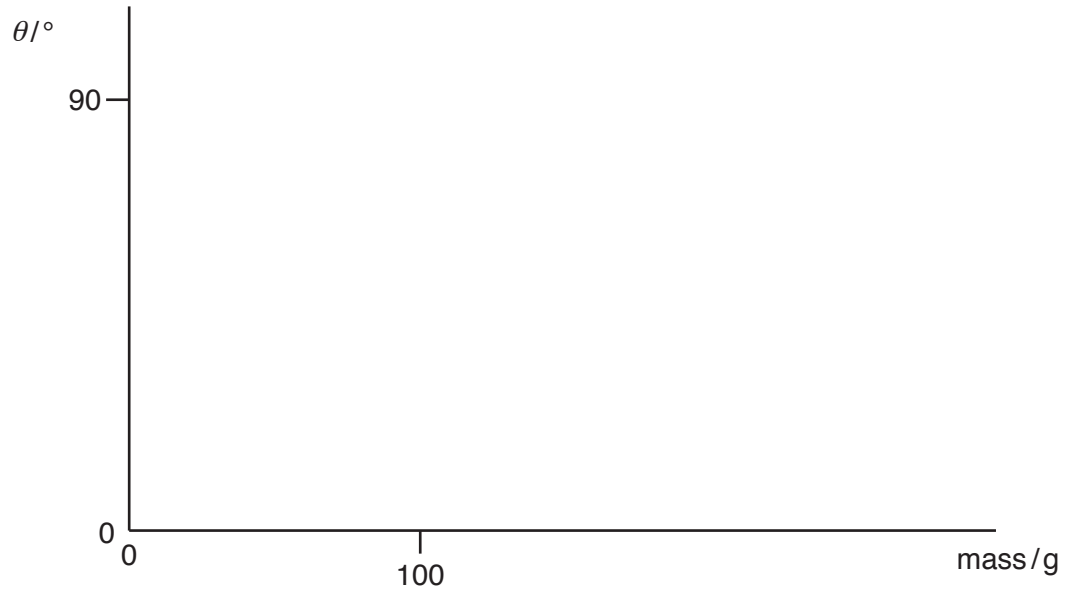


Fig. 2.3 [1]

[Total: 5]

3 *In this experiment, you will investigate the refraction of light.*

You are provided with:

- a lamp
- a slit plate
- a rectangular transparent block
- a protractor.

The supervisor has set up the lamp as shown in Fig. 3.1.

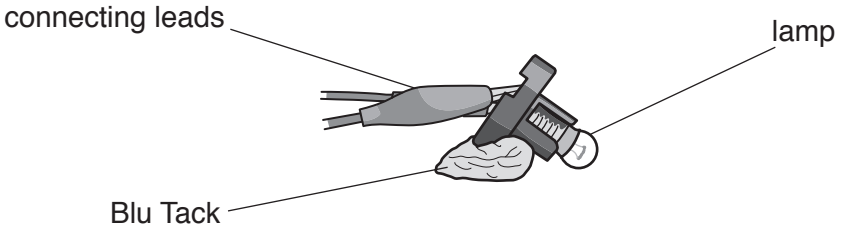


Fig. 3.1

Fig. 3.2 shows how you will set up the other apparatus.

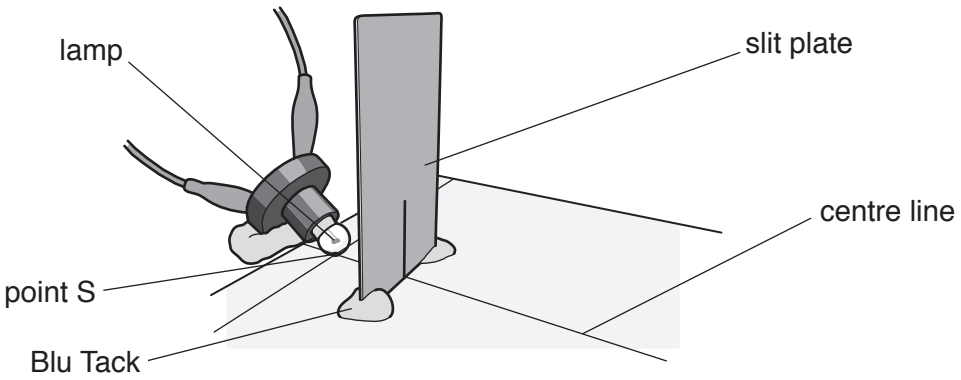


Fig. 3.2

Align the centre of the lamp with the point S marked on Fig. 3.3 on the facing page. Switch on the lamp.

Place the slit plate along the line PP. Adjust the position of the slit plate so that the ray emerging from the slit is aligned with the centre line marked on Fig. 3.3.

Place the block in the area shown on Fig. 3.3. One corner of the block is placed at point C with the long side along the line QQ. The size of your block may differ from the outline shown in Fig. 3.3.

(a) On Fig. 3.3 mark the point where the refracted ray emerges from the glass block. Label this point U. Switch off the lamp.

Remove the glass block and draw a straight line from point T to point U.
The line NN is the normal to the block at point T.
Mark the angle of refraction at point T. Label this angle *r*. [2]

(b) The angle of incidence *i* is labelled on Fig. 3.3.
Measure angles *i* and *r*.

i = ...

r = ... [2]

© UCLES 2019

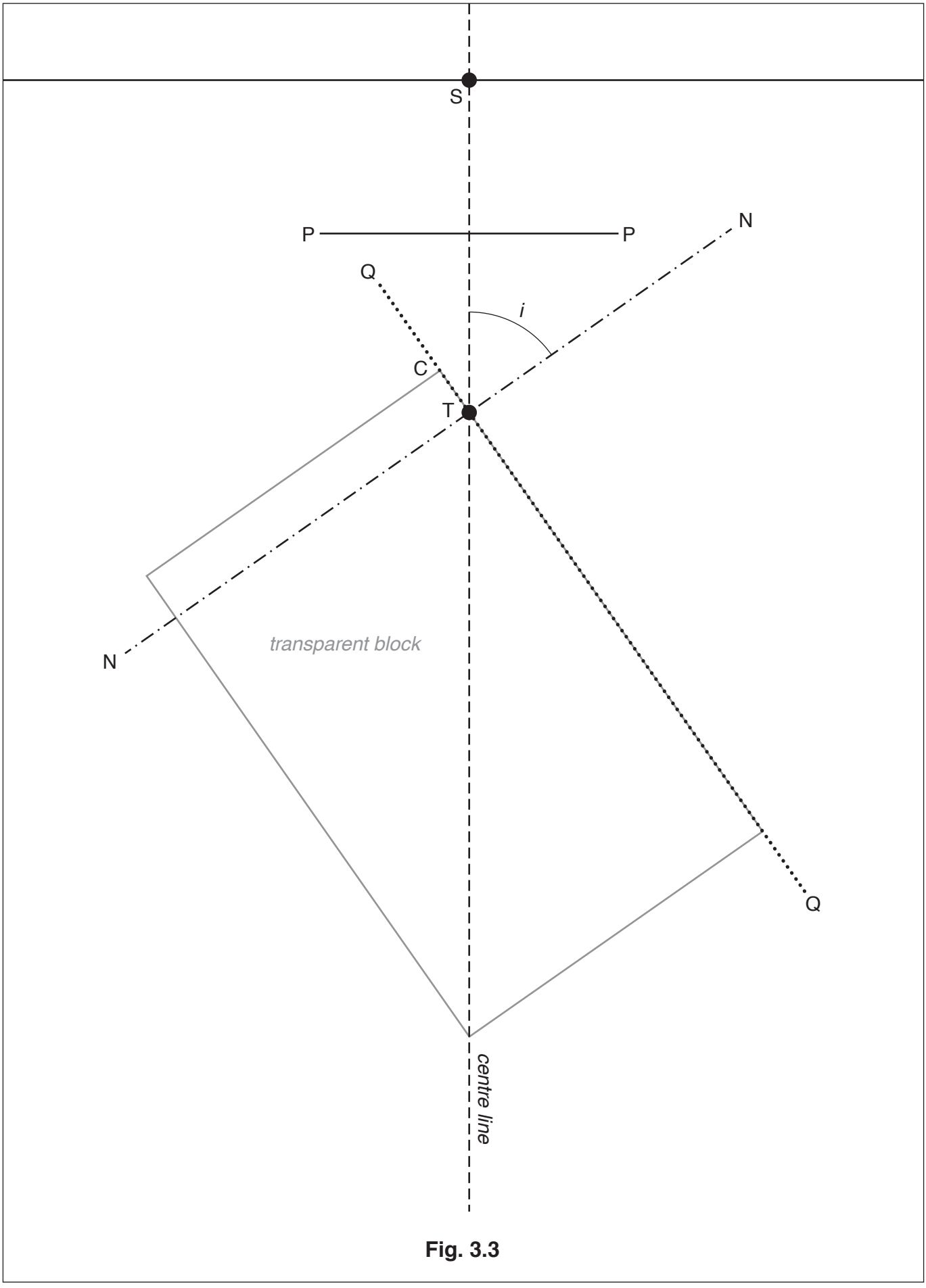


Fig. 3.3

(c) Calculate n, the refractive index of the glass.

Use the equation:

$$n = \frac{\sin i}{\sin r}$$

You **must** show your working.

n = ... [1]

[Total: 5]

SECTION B BEGINS ON PAGE 10

Section B

4 *In this experiment, you will investigate the resistance of a thermistor.*

You are provided with:

- an arrangement of a heater and a thermistor held inside a ball of Blu Tack
- a heat resistant mat
- a power supply
- a resistor of resistance 100 Ω
- switches labelled S and T
- a stopwatch
- Blu Tack.

You are also provided with a voltmeter and connecting leads.

The supervisor has set up the circuit, as shown in Fig. 4.1. Switches S and T are open.

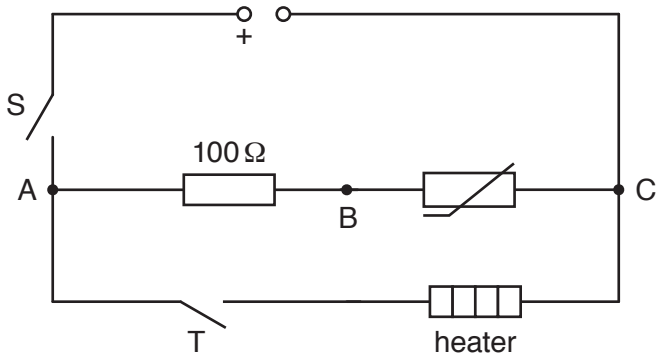


Fig. 4.1

The heater and the thermistor have been placed inside a ball of Blu Tack placed on a heat resistant mat. Do **not** remove the heater or thermistor from the ball of Blu Tack.

(a) (i) Connect the voltmeter between points A and C.
Ensure that the positive terminal of the voltmeter is connected to A.
Close switches S and T. Record the voltmeter reading V_{AC}.

V_{AC} = ... [1]

(ii) Switch off S and T. Describe how you ensured your value for V_{AC} is accurate.

.....

..... [1]

(b) (i) Disconnect the voltmeter lead from C and reconnect it at B.
Record the voltmeter reading V_{AB}.
Close switches S and T.

V_{AB} = ... [1]

Open switch S.

(ii) Calculate the current in the resistor.

Use the equation: $I = \frac{V_{AB}}{100}$

I = ... [1]

(iii) Calculate the resistance R_T of the thermistor.

Use the equation: $R_T = \frac{V_{AC} - V_{AB}}{I}$

R_T = ... [1]

(c) Record, for time $t = 0$, V_{AB}, I and R_T in the **second** row of Table 4.1 on page 12.

Complete the headings in the top row. [1]

(d) The heater operates when switch T is closed. The rise in temperature causes the resistance of the thermistor to change.

(i)
- Close switch S.
- Close switch T and start the stopwatch.
- In Table 4.1 on page 12, record V_{AB} every minute from $t = 1$ to $t = 5$ minutes.
- When you have finished your measurements, open switch S and open switch T. [2]

(ii) The supply voltage V_{AC} does not change and is the value recorded in **(a)(i)**.
Repeat the calculations in **(b)(ii)** and **(b)(iii)** for each set of readings.

Complete Table 4.1 on page 12. [2]

© UCLES 2019

[Turn over

Table 4.1

t / min	V_{AB} /....	...../....	...../....
0			
1			
2			
3			
4			
5			

(e) (i) On the grid opposite, plot a graph of the resistance R_T of the thermistor on the *y*-axis against time *t* on the *x*-axis.

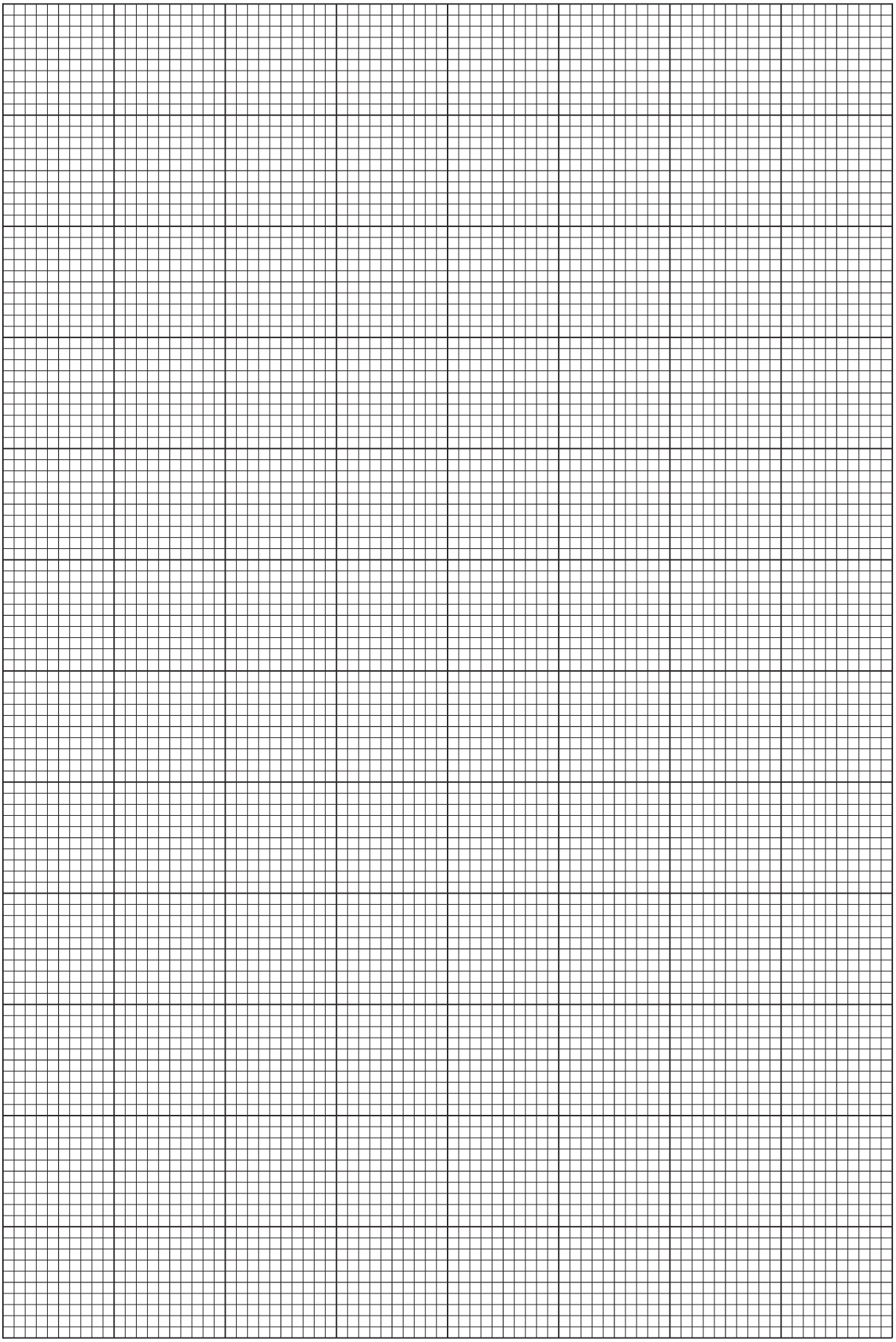
Draw the curve of best fit. [4]

(ii) Use your graph to determine the resistance of the thermistor at 2.5 minutes.

resistance = ... [1]

[Total: 15]

© UCLES 2019



© UCLES 2019

BLANK PAGE

BLANK PAGE

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

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.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

© UCLES 2019