Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5433737023

PHYSICS **5054/32**

Paper 3 Practical Test **October/November 2021**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

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.
- 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 should record all your observations in the spaces provided in the question paper as soon as these observations are made.
- 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 [ ].

For Examiner's Use	
1	
2	
3	
4	
Total	

This document has **16** pages. Any blank pages are indicated.

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Section A

1 *In this experiment you will investigate angles of reflection.*

You are provided with:

- an illuminated slit (slit plate and small lamp) or ray box
- a pair of mirrors joined together with tape
- a small amount of adhesive putty
- a 30 cm ruler
- a protractor.

(a) Fig. 1.1 is on page 3 of your question paper.

Measure and record angle *a* on Fig. 1.1.

angle *a* = ...° [1]

(b) On Fig. 1.1:

- place the illuminated slit plate or the slit plate of the ray box on the line **PP**. If you are using the small lamp with the slit plate, you will need to turn the lamp upside down so that the glass is touching the paper next to the slit. Adjust the position of the slit plate so that, when the lamp or ray box is switched on, a single ray of light emerging from the slit lines up with the centre line marked on Fig. 1.1

- place the pair of mirrors so that the corner where they are joined together is at point **C** and one mirror lines up with the marked area (▭), as shown on Fig. 1.1. A small amount of adhesive putty may be used to fix the mirror in place. This mirror is mirror 1.

Switch on the lamp.

Observe the ray reflected from mirror 1. Without moving mirror 1, adjust the position of mirror 2 so that the ray also reflects from this mirror to cross the centre line between **X** and the slit.

The distance from **X** to the point where the reflected ray crosses the centre line is *d*.

Describe how you could investigate the relationship between angle *a* and the distance *d*.

.....

.....

..... [2]

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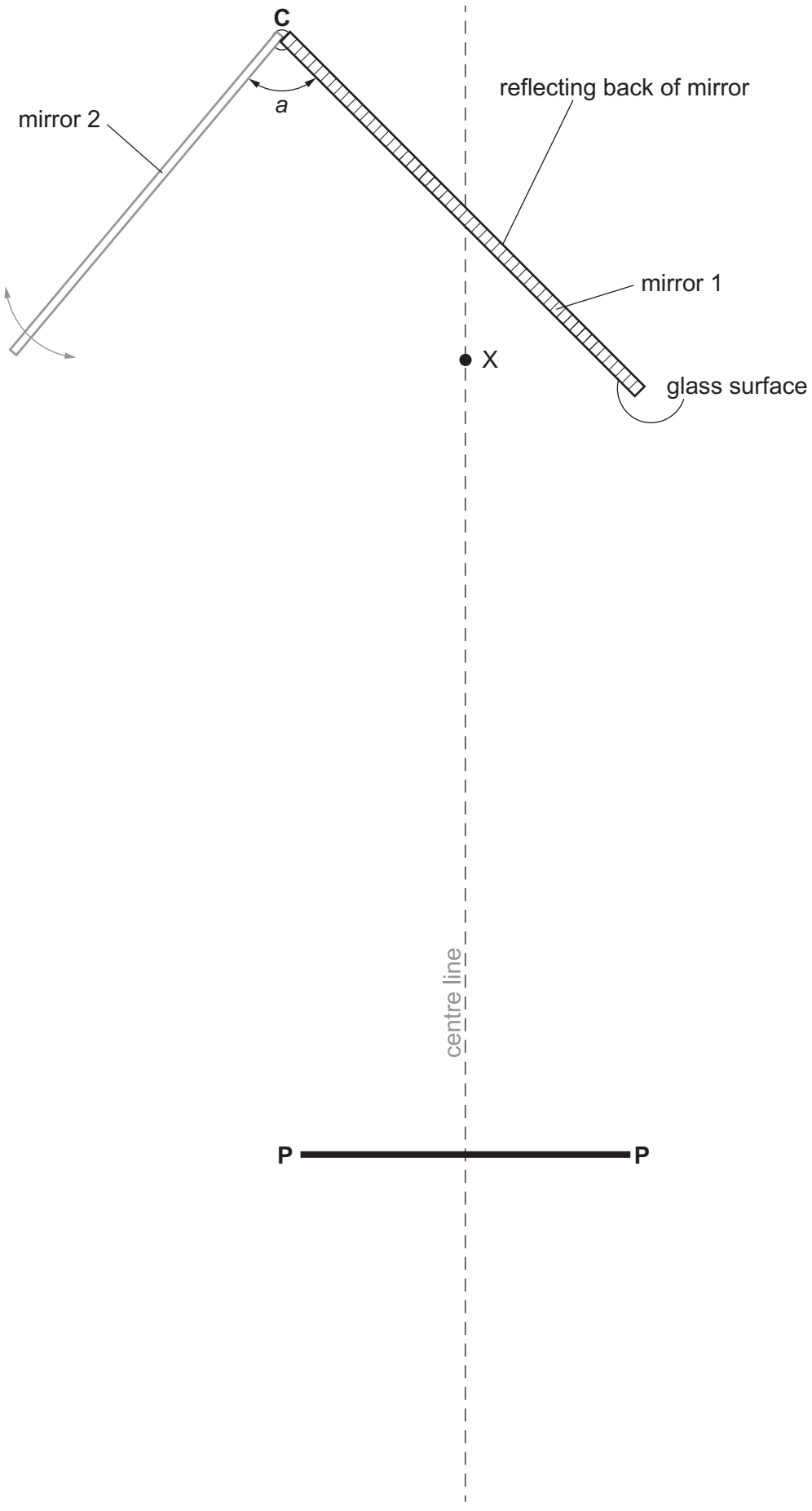

C
a
mirror 2
reflecting back of mirror
mirror 1
X
glass surface
centre line
P
P

Fig. 1.1

(c) On Fig. 1.2, sketch a graph of the relationship between the angle *a* and distance *d*.

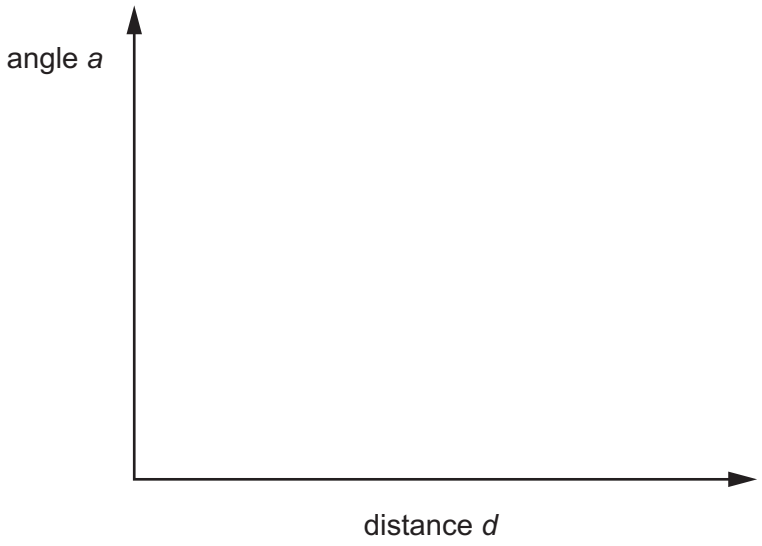


Fig. 1.2

[2]

[Total: 5]

Question 2 begins over the page

2 *In this experiment you will investigate an electrical circuit.*

You are provided with:

- components joined together in an electrical circuit
- a voltmeter connected into the circuit.

The supervisor has set up the circuit.

(a) Some electrical symbols are shown in Fig. 2.1.

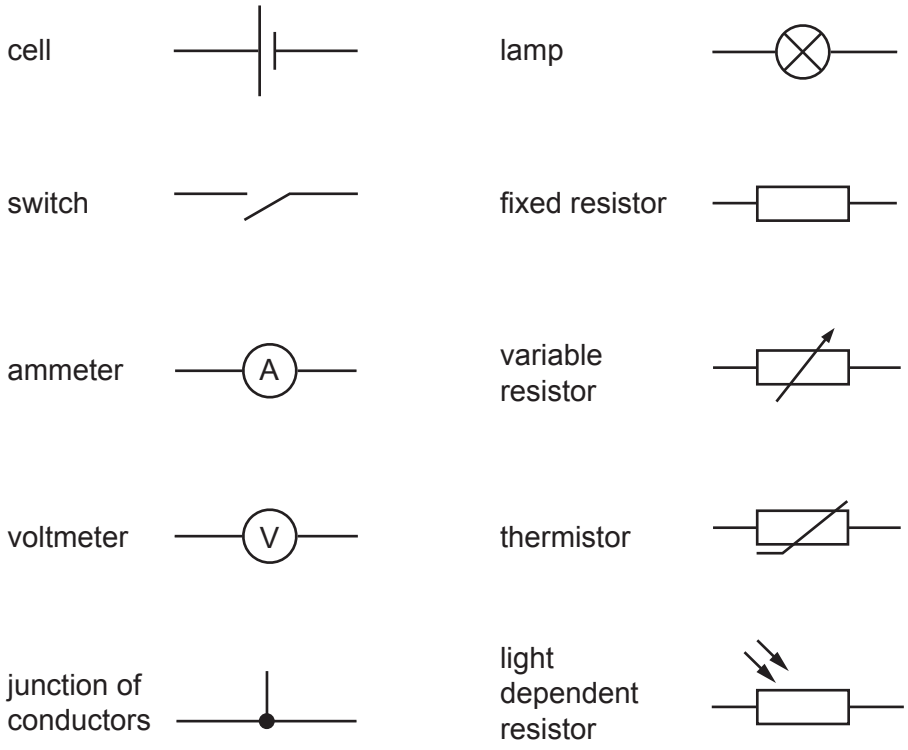


Fig. 2.1

Draw a diagram of the circuit.

[3]

(b) You are also provided with

- a beaker of iced water.

Check that the thermistor can be safely placed in the beaker of iced water. Carefully move the beaker closer to the circuit if necessary.

Take the thermistor out of the beaker and wait a minute to let it warm up to room temperature.

Close the switch.

Record the reading on the voltmeter when

- the thermistor is on the bench

voltmeter reading with thermistor on bench = ... V

- the thermistor is placed in the iced water.

voltmeter reading with thermistor in iced water = ... V
[1]

Open the switch.

(c) Describe the precaution you take to obtain a steady voltmeter reading when the thermistor is in iced water.

.....

..... [1]

[Total: 5]

3 *In this experiment you will investigate the speed of a falling mass.*

You are provided with:

- a pulley attached to a stand
- two 100 g mass hangers
- a length of string (twine)
- a metre rule
- set square
- a stop-watch
- heavy weight or G-clamp to stabilise stand.

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

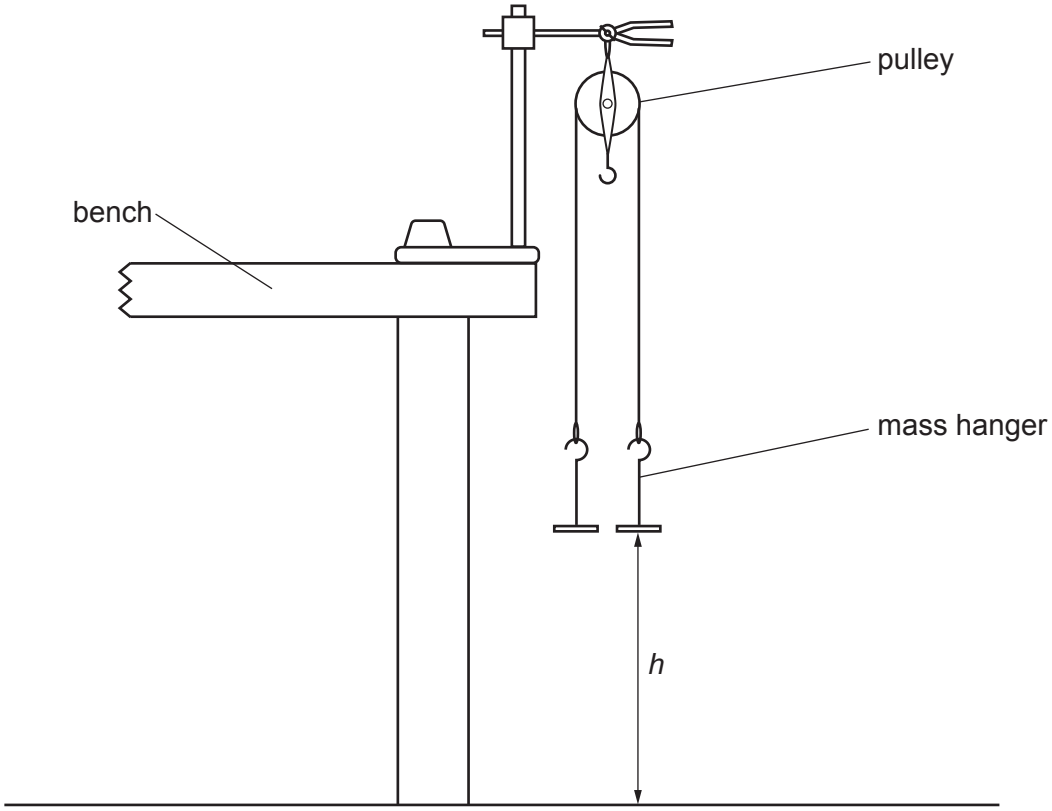


Fig. 3.1

Adjust the positions of the mass hangers so that the base of each hanger is at the same height *h* above the floor.

(a) (i) Measure and record *h* in centimetres to the nearest millimetre.

h = ... cm [1]

(ii) Describe **two** techniques you use to ensure an accurate measurement of *h*.

1 .....

.....

2 .....

.....

[2]

(b) You are also provided with a small piece of modelling clay or adhesive putty.

Carefully place the piece of modelling clay on **one** of the mass hangers and hold this mass hanger in position.

Release the mass hanger and start the stop-watch. (You may have to give the mass hanger a gentle push downwards to start the movement).

Measure and record an accurate value for the time *t* for the mass hanger to fall to the floor.

t = ... s [1]

(c) Calculate the average speed *v* of the falling mass using the equation:

$$v = \frac{h}{t}$$

v = ... cm / s [1]

[Total: 5]

Section B

4 *In this experiment you will investigate a pendulum.*

You are provided with:

- a mass attached to a metre rule
- a triangular block to act as a pivot.

(a) (i) The mass has been attached to the metre rule at the 80 cm mark. Place the metre rule with the mass attached on the pivot, as shown in Fig. 4.1.

Adjust the position of the rule on the pivot so that the metre rule is as near as possible to being balanced. The point on the metre rule underneath which the pivot is positioned is X.

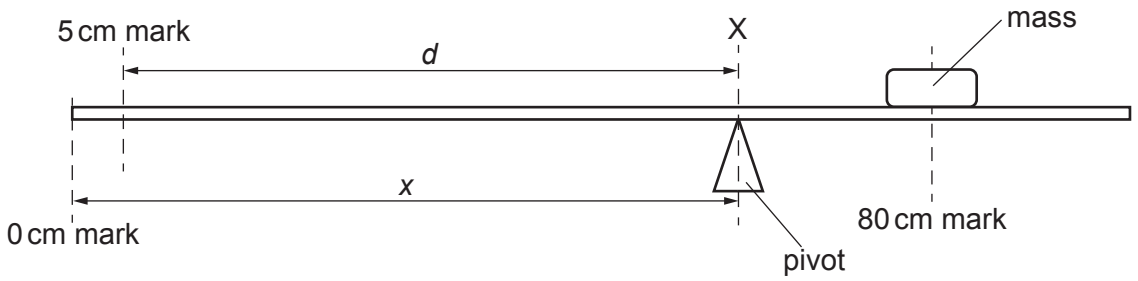


Fig. 4.1

Record the distance *x* between the 0 cm mark and point X to the nearest centimetre.

x = ... cm [1]

(ii) The metre rule has holes that are spaced 5 cm apart along its length.

Determine the distance *d* between the hole at the 5 cm mark and X to the nearest centimetre.

d = ... cm [1]

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(b) (i) You are also provided with:

- a stand and boss
- a metal rod to act as a pivot
- a stop-watch.

The metal rod has been attached to the boss on the stand. Remove the brightly coloured piece of paper from the tip of the rod. Do **not** remove the rod from the boss or the mass from the metre rule.

Pass the metal rod through the hole in the rule at the 5 cm mark and let the rule hang freely.

Rotate the bottom end of the rule a small distance to the left. Release the rule and observe it swing to the right and then swing back to its starting position. This is one oscillation.

Measure and record the time t_{10} for ten oscillations of the pendulum.

t_{10} = ... s

Calculate the time T for **one** oscillation of the pendulum.

T = ... s
[1]

(ii) Explain why the procedure used in **(b)(i)** gives a more accurate value for the time T than timing just one oscillation.

.....

..... [1]

(c) Record in Table 4.1 your measurements of d, t_{10} and T from **(a)(ii)** and **(b)(i)** for the rod position of 5 cm.

Add appropriate headings with units to each column.

Move the metal rod to the hole at 10 cm. This is rod position 10 cm. Determine the new value of d, t_{10} and T. Continue the procedure in **(b)(i)** for each rod position up to 60 cm.

You may need to adapt the procedure described in **(b)(i)** in order to complete all the measurements.

When you have completed your measurements, place the brightly coloured paper back on the tip of the metal rod.

Table 4.1

rod position / cm			
5			
10			
15			
20			
25			
30			
35			
40			
45			
50			
55			
60			

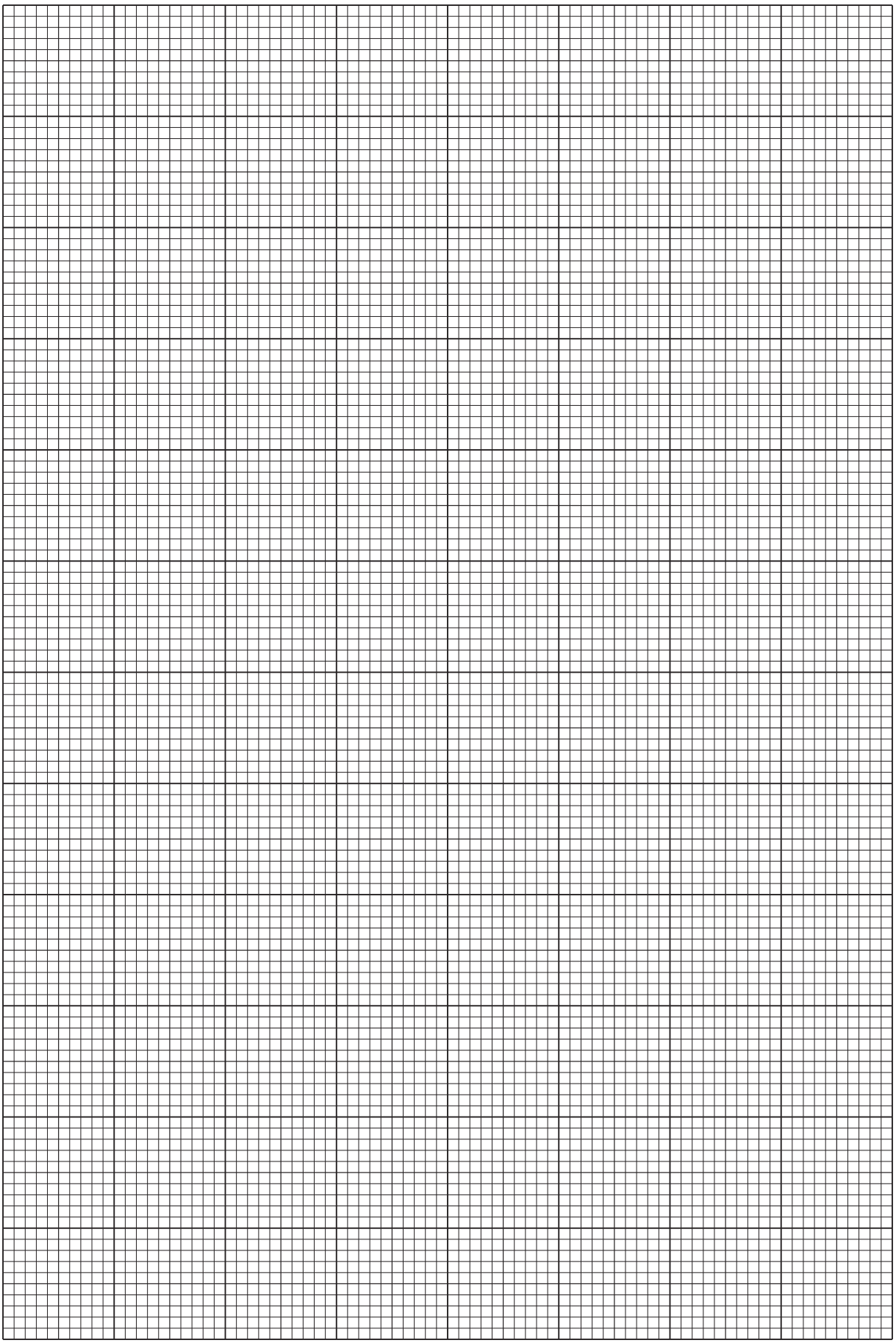
[4]

(d) Using the grid on page 13, plot a graph of T on the y-axis against d on the x-axis.

You do not need to start your graph from the origin (0, 0).

Draw the curved line of best fit. [4]

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(e) **(i)** Explain why it is more difficult to measure t_{10} when d is small.

.....

..... [1]

(ii) Explain how the procedure described in **(b)(i)** can be adapted to overcome this difficulty.

.....

..... [1]

(f) A student suggests that T is a minimum when $d = \frac{1}{2}(x - 5)$.

Use your graph and your value for x from **(a)(i)** to explain whether the student's suggestion is correct. You should draw lines on your graph to support your answer.

.....

..... [1]

[Total: 15]

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