Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

3164804016

PHYSICS **0972/51**

Paper 5 Practical Test **May/June 2023**

1 hour 15 minutes

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.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- 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 **12** pages. Any blank pages are indicated.

1 In this experiment, you will investigate the balancing of a metre ruler.

Carry out the following instructions, referring to Fig. 1.1.

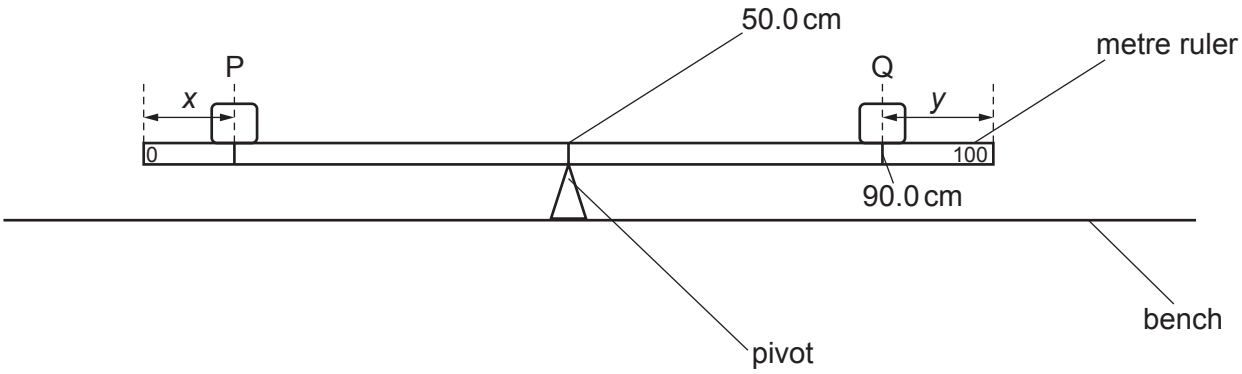


Fig. 1.1

(a) • Place the metre ruler on the pivot at the 50.0 cm mark with its scale facing upwards.
• Place the object Q with its centre on the metre ruler at the 90.0 cm mark.

Record the distance *y* from the centre of Q to the 100.0 cm end of the ruler.

y = ... cm [1]

(b) • Place a load P of weight *P* = 2.0 N on the metre ruler.
• Adjust the position of P so that the metre ruler is as near as possible to being balanced.

(i) Measure, and record in Table 1.1, the distance *x* from the centre of P to the zero end of the ruler. Record the weight *P*. [1]

(ii) Repeat the steps above, using loads of weight *P* = 3.0 N, 4.0 N, 5.0 N and 6.0 N.

Record all the values of *P* and *x* in Table 1.1. Ensure that the position of object Q on the metre ruler does **not** change.

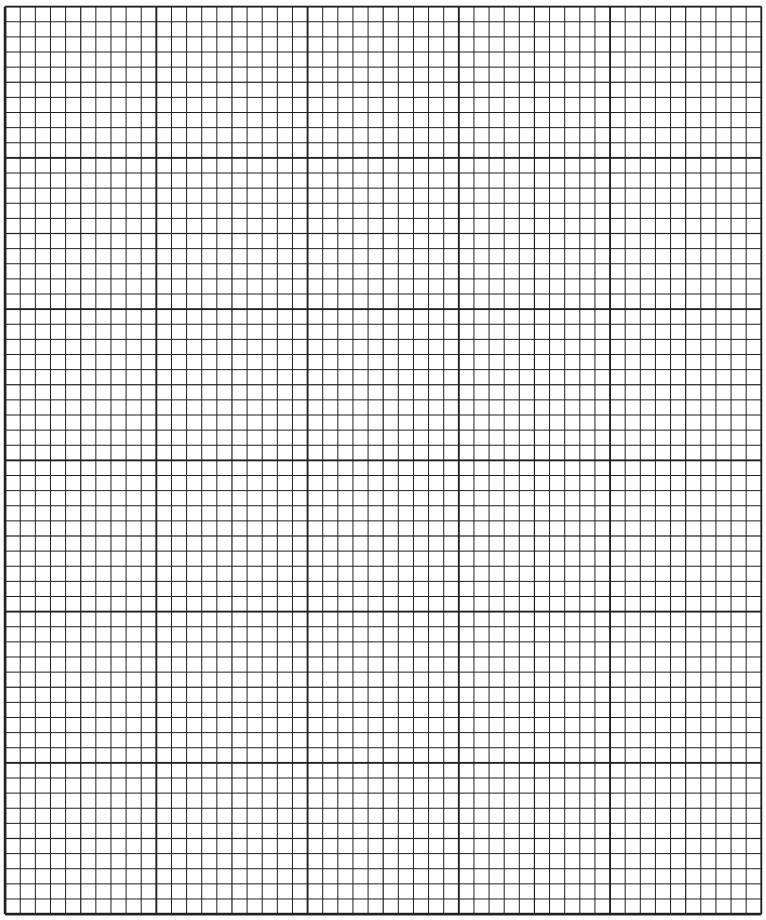
Table 1.1

P / N	*x* / cm

[3]

(c) Plot a graph of P / N (y-axis) against x / cm (x-axis).

Draw the best-fit line.



[4]

(d) Use the graph to find the value of x required to balance the ruler when $P = 3.5$ N.

Show clearly on the graph how you determined the value of x.

x = ... cm [2]

[Total: 11]

2 In this experiment, you will investigate the cooling of water.

Carry out the following instructions, referring to Fig. 2.1.

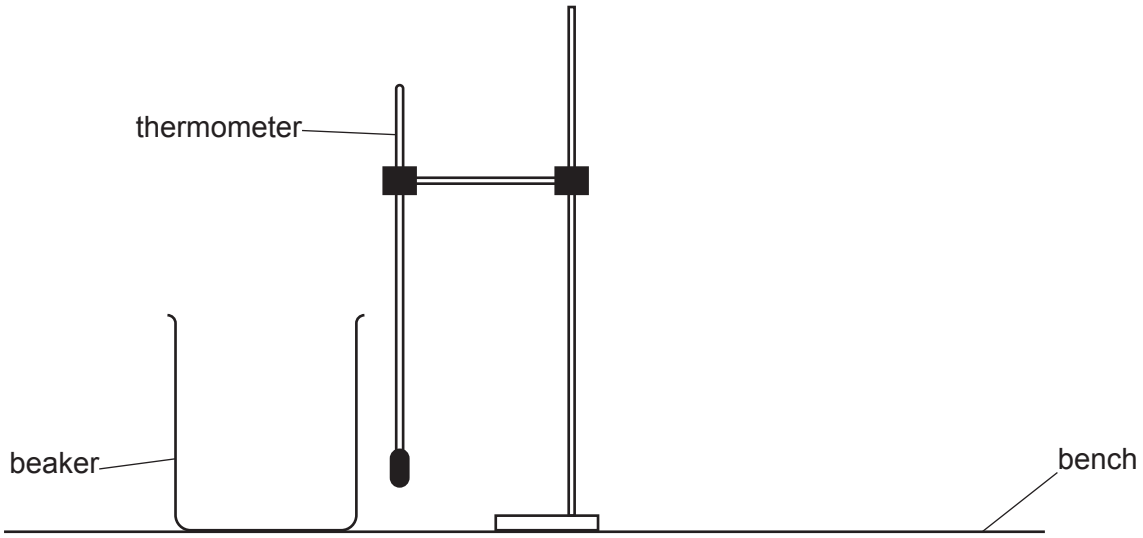


Fig. 2.1

(a) Use the thermometer to measure the room temperature θ_R.

θ_R = ... [1]

(b) (i) Pour 200 cm^3 of hot water into the beaker. Place the thermometer in the hot water in the beaker.

Record in Table 2.1 the temperature θ of the hot water at time t = 0. Immediately start the stop-watch.

Continue recording the temperature in Table 2.1 at 30 s intervals until you have seven sets of readings. [2]

(ii) Complete the column headings in Table 2.1.

Table 2.1

t/	θ/
0	
30	
60	
90	
120	
150	
180	

[1]

(c) **(i)** Calculate the decrease in temperature $\Delta\theta$ between $t = 0$ and $t = 180$ s.

$\Delta\theta =$ ..... [1]

(ii) Calculate the average rate of cooling R of the water using the equation $R = \frac{\Delta\theta}{\Delta t}$, where $\Delta t = 180$ s. Include the unit.

$R =$ ..... [2]

(d) A student states that the average rate of cooling of the water decreases as the temperature comes nearer to room temperature.

(i) Suggest **one** change to the experiment that you could make to test the statement.

.....

..... [1]

(ii) Suggest how to display the results to make it easier to see the trend in the rate of cooling.

.....

.....

..... [2]

(e) Explain briefly why it is good practice to read the thermometer scale at right angles.

.....

..... [1]

[Total: 11]

3 In this experiment, you will investigate the refraction of light using a semicircular transparent block.

Carry out the following instructions using the separate ray-trace sheet provided. You may refer to Fig. 3.1 and Fig. 3.2 for guidance.

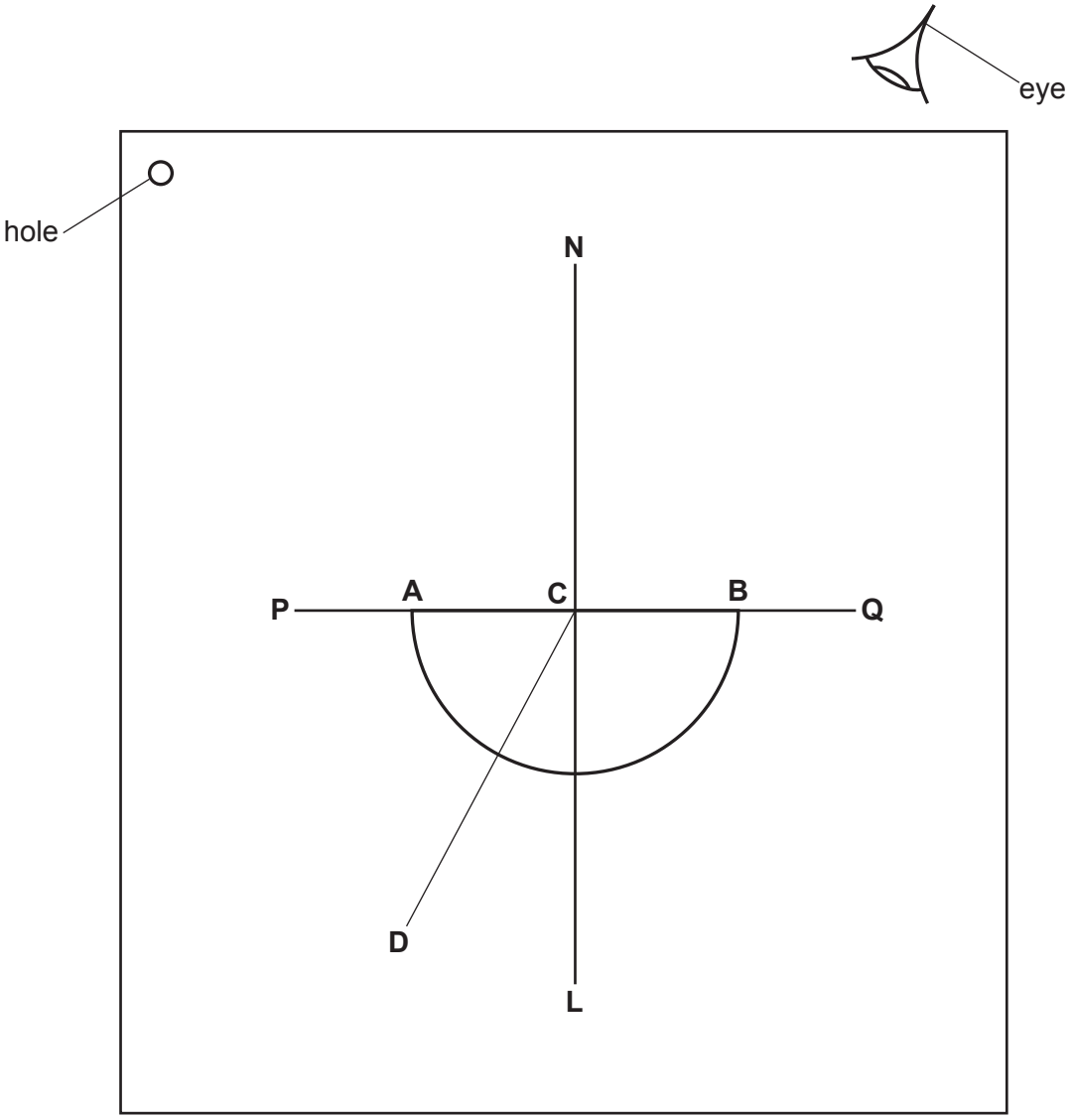


Fig. 3.1

(a)
- Draw a line across the ray-trace sheet supplied, approximately in the middle. Label the line **PQ**.
- Place the transparent block, largest face down, with the straight side on the line **PQ** and the curved side below the line.
- Draw round the outline of the block. Label the ends of the straight side of the block **A** and **B**.
- Remove the block and draw the normal **NL** through the centre of **AB**. Continue the normal so that it passes through the curved side of the block.
- Label the point **C** where the normal **NL** crosses **AB**.

[1]

(b)
- Draw the line **DC** at an angle $i = 30°$ to the normal, as shown in Fig. 3.1.
- Place the paper on the pin board.
- Place two pins, P_1 and P_2, on line **DC** at a suitable distance apart for this experiment.
- Replace the block and look from the position of the eye shown in Fig. 3.1 to observe the images of P_1 and P_2 through side **AB** of the block. Adjust your line of sight until the images of P_1 and P_2 appear one behind the other.
- Place two pins, P_3 and P_4, between your eye and the block so that P_3, P_4, and the images of P_1 and P_2 seen through the block, appear one behind the other.
- Label the positions of P_1, P_2, P_3 and P_4.
- Remove the block and the pins.
- Draw a line joining the positions of P_3 and P_4. Continue the line to **AB**.
- Label **E**, the end of the line furthest from **AB**.

[3]

(c) Measure the acute angle θ between the line **NL** and the line **CE**. (An acute angle is less than 90°.)

θ = ...° [2]

(d) State **one** precaution that you take to produce an accurate ray trace.

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..... [1]

(e) Place the transparent block on the ray-trace sheet in the position shown in Fig. 3.2.

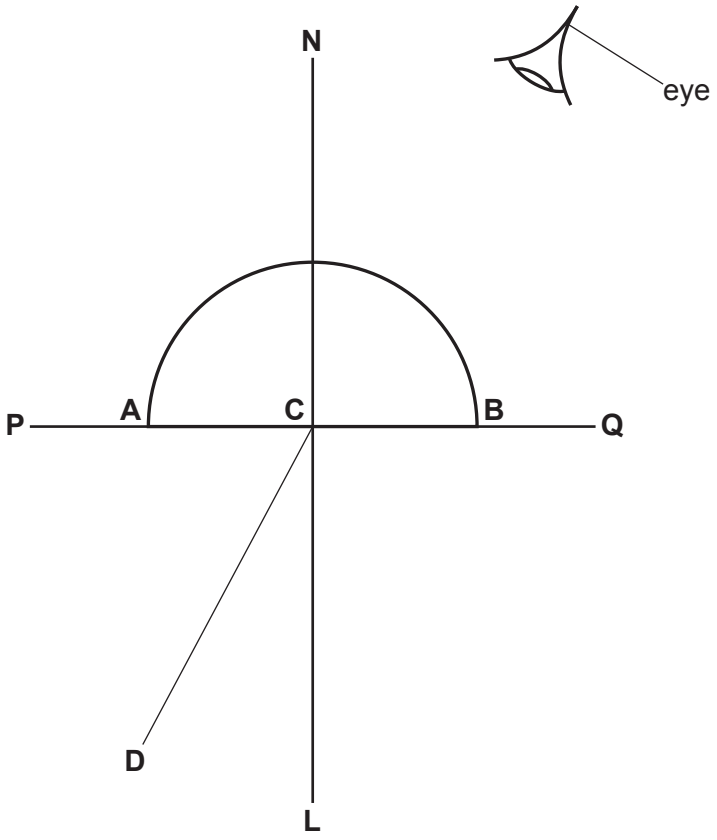

Fig. 3.2

- Replace pins P_1 and P_2 on line **DC** in the same positions used in **(b)**.
- Observe the images of P_1 and P_2 through the curved side of the block. Adjust your line of sight until the images of P_1 and P_2 appear one behind the other.
- Place two pins, P_5 and P_6, between your eye and the block so that P_5, P_6, and the images of P_1 and P_2 seen through the block, appear one behind the other.
- Label the positions of P_5 and P_6.
- Remove the block and the pins.
- Draw a line joining the positions of P_5 and P_6. Continue the line to **AB**.
- Label **F**, the end of the line furthest from **AB**.

[2]

(f) Measure the acute angle θ between the line **NL** and the line **CF**. (An acute angle is less than 90°.)

θ = ... ° [2]

[Total: 11]

Tie your ray-trace sheet into this question booklet between pages 8 and 9.

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4 A student investigates the change in resistance of a lamp filament when the current in the lamp is increased.

The following apparatus is available:

- a power supply
- a low-voltage filament lamp
- an ammeter
- a voltmeter
- connecting wires.

Other apparatus normally found in a school laboratory is also available.

Plan an experiment to investigate the change in resistance of the lamp filament when the current in the lamp is increased.

Resistance R is given by the equation $R = \frac{V}{I}$, where V is the potential difference (p.d.) across the lamp and I is the current in the lamp.

You are **not** required to do this investigation.

You should:

- draw a diagram of the circuit used
- explain briefly how to do the investigation, including how to change the current
- draw a table, or tables, with column headings, to show how to display your readings (you are **not** required to enter any readings in the table)
- explain how to use your readings to reach a conclusion.

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