



Cambridge O Level

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PHYSICS

5054/31

Paper 3 Practical Test

May/June 2026

1 hour 30 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. Do **not** use correction fluid or tape.
- 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 You will investigate the density of modelling clay.

You are provided with:

- a piece of modelling clay rolled into the shape of a cylinder
- a 30cm ruler with a millimetre scale
- two small rectangular wooden blocks
- access to a top pan balance
- a ballpoint pen.

(a) The modelling clay provided is in the shape of a cylinder as shown in Figure 1.1.

You will need to be careful not to squash the modelling clay when handling the cylinder.

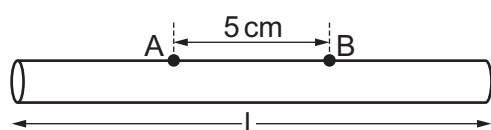


Figure 1.1

- (i) Measure the length l of the cylinder in cm to the nearest mm.

$l = \dots\dots\dots$ cm [1]

- (ii) Use the ballpoint pen to mark two points, A and B, on the modelling clay. The two points should be 5 cm apart as shown in Figure 1.1.

Place the two blocks around the cylinder of modelling clay so that point A is between them as shown in Figure 1.2.

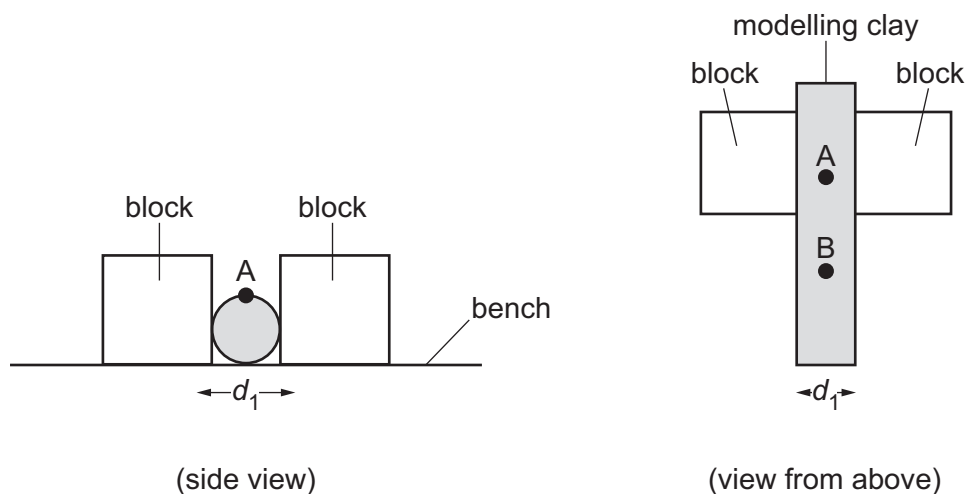


Figure 1.2

The diameter d_1 of the modelling clay is the distance between the two blocks at point A.

Measure d_1 in cm to the nearest mm.

$d_1 = \dots\dots\dots$ cm [1]



- (iii) Move the two blocks so that point B on the modelling clay is between them.

Measure the diameter d_2 of the modelling clay at point B.

$$d_2 = \dots\dots\dots \text{ cm [1]}$$

- (iv) The average diameter d of the modelling clay is given by the equation shown.

$$d = \frac{d_1 + d_2}{2}$$

Use your values from **1(a)(ii)** and **1(a)(iii)** to find d . Give your answer in cm to the nearest mm.

$$d = \dots\dots\dots \text{ cm [2]}$$

- (b) Place the cylinder on the top pan balance and record its mass m .

Record the mass m in g to the nearest 0.1 g.

$$m = \dots\dots\dots \text{ g [1]}$$

- (c) The density of the modelling clay is calculated using the equation shown.

$$\text{density} = 1.27 \times \frac{m}{d^2 l}$$

Use your answers in **1(a)(i)**, **1(a)(iv)** and **1(b)** to calculate the density of the modelling clay.

Give your answer to three significant figures, and state the unit of your answer.

$$\text{density} = \dots\dots\dots \text{ unit } \dots\dots\dots \text{ [3]}$$

- (d) Suggest why it is important to take measurements of the diameter at more than one place along the length of the cylinder.

.....
 [1]

[Total: 10]



2 You will investigate the resistance of a thermistor.

You are provided with:

- a d.c. power source
- a switch
- a thermistor
- a fixed resistor
- connecting wires used to assemble a circuit
- a voltmeter with two connecting wires attached
- a beaker of iced water
- paper towels to mop up any spillages.

(a) A circuit has been assembled for you by the supervisor.

(i) Draw a diagram of the circuit, using standard electrical symbols.

[3]

(ii) Close the switch.

Record the potential difference across the fixed resistor V_R on the answer line and in Table 2.1.

Open the switch.

$V_R = \dots\dots\dots$ V [1]

(iii) Disconnect the voltmeter from across the fixed resistor.

Connect the voltmeter across the thermistor.

Close the switch.

Record the potential difference across the thermistor V_T on the answer line and in Table 2.1.

Open the switch.

$V_T = \dots\dots\dots$ V [1]



- (iv) The resistance of the thermistor R_T is calculated using the equation shown.

$$R_T = \frac{470 \times V_T}{V_R}$$

Calculate R_T . Record your answer on the answer line and in Table 2.1.

$$R_T = \dots\dots\dots \Omega \quad [1]$$

- (b) Disconnect the voltmeter from across the thermistor and reconnect it across the fixed resistor.

Immerse the thermistor in the beaker of iced water as shown in Figure 2.1.

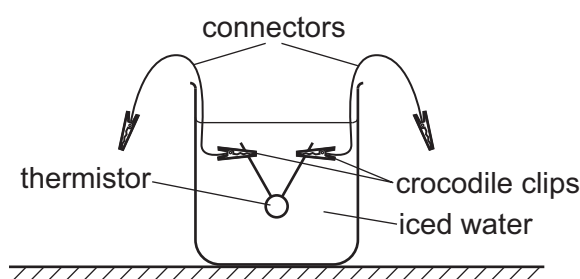


Figure 2.1

- (i) With the thermistor in the beaker of iced water, repeat the instructions in **2(a)(ii)**, **2(a)(iii)** and **2(a)(iv)**, recording your results in Table 2.1.

Remove the thermistor from the beaker of iced water.

Table 2.1

	V_R/V	V_T/V	R_T/Ω
at room temperature			
at temperature of iced water			

[2]

- (ii) Describe how the resistance of the thermistor changes as its temperature changes.

.....
 [1]

- (iii) Suggest a possible value for the resistance of the thermistor when it is placed in water heated to 50 °C.

.....
 [1]

[Total: 10]

- 3 You will investigate the effect of aluminium foil on the rate of cooling of a beaker of water.

You are provided with:

- a 100 cm³ glass beaker
- a piece of aluminium foil
- a stirring thermometer with a range of -10°C to $+110^{\circ}\text{C}$
- a clamp, boss and stand
- a stopwatch reading to 0.1 s
- a supply of paper towels to mop up any spillages.

- (a) (i) The thermometer has been placed in the clamp as shown in Figure 3.1.

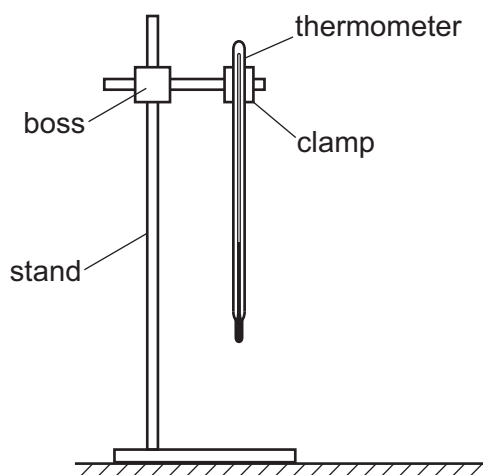


Figure 3.1

Record the temperature on the thermometer to the nearest 0.5°C . This is room temperature θ_R .

$\theta_R = \dots\dots\dots^{\circ}\text{C}$ [1]

- (ii) Explain how you avoid parallax error when reading the room temperature from the thermometer scale.

.....

..... [1]



(b) (i) procedure

Place the glass beaker below the thermometer.

Lower the thermometer by using the boss so that the thermometer bulb is in the middle of the beaker as shown in Figure 3.2.

Ask the supervisor to pour 100 cm^3 of hot water into the beaker.

Wait for the thermometer to reach its maximum value and then start the stopwatch.

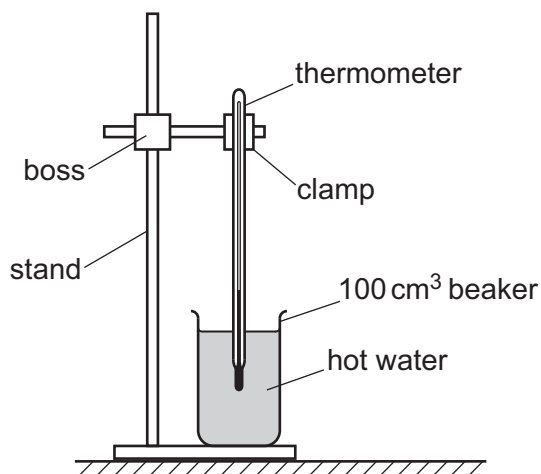


Figure 3.2

Take readings of the temperature θ_1 of the water every 1.0 minute for 5.0 minutes.

Stir the water gently before each reading.

Record your readings in Table 3.1 on page 8.

[2]



- (ii) Use the boss to raise the thermometer out of the water.

Pour the water in the beaker away.

Cover the sides and the bottom of the beaker with the aluminium foil provided.

Repeat the procedure in (b)(i) to obtain readings of the temperature θ_2 of the water in the beaker covered with aluminium foil.

Record your readings in Table 3.1.

[1]

Table 3.1

time/min	0.0	1.0	2.0	3.0	4.0	5.0
$\theta_1 / ^\circ\text{C}$						
$\theta_2 / ^\circ\text{C}$						

- (c) (i) On the grid provided in Figure 3.3, plot a graph of $\theta_1 / ^\circ\text{C}$ on the y-axis against time/min on the x-axis.

Start your x-axis at 0.

You do **not** have to start your y-axis at 0.

Draw the curve of best fit for the θ_1 results. Label this line θ_1 .

[4]

- (ii) On the same axes in Figure 3.3, plot a graph of $\theta_2 / ^\circ\text{C}$ on the y-axis against time/min on the x-axis.

Draw the curve of best fit for the θ_2 results. Label this line θ_2 .

[1]

- (iii) Use the data in Table 3.1 and your graphs in Figure 3.3 to compare the **rates** of cooling of the water in the beakers without and with the aluminium foil.

.....

 [1]



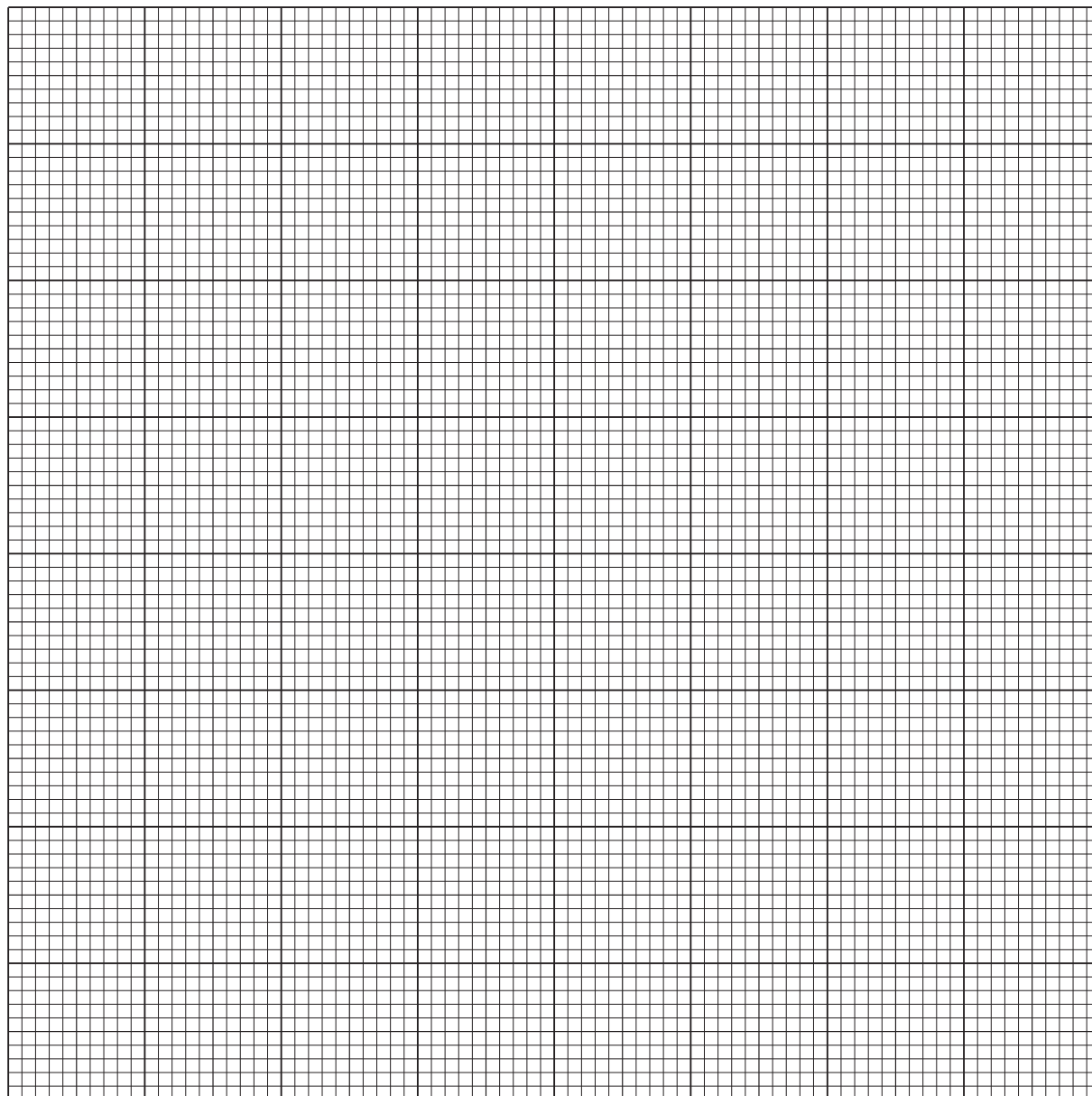


Figure 3.3

(d) (i) Explain why the thermometer bulb is placed in the middle of the beaker.

.....
 [1]

(ii) State **two** factors that are controlled in this experiment to ensure that a valid comparison can be made.

1
 2 [2]

[Total: 14]



- 4 Figure 4.1 shows an iron nail inside a coil of wire. The wire is connected into a circuit in series with a variable resistor.

When a current passes through the coil, the iron nail is magnetised and attracts paper clips as shown in Figure 4.1.

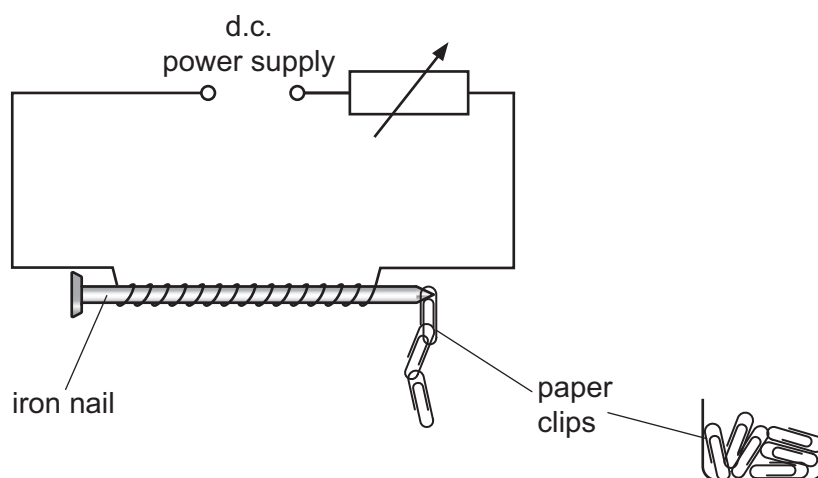


Figure 4.1

Plan an experiment to investigate how the current in the coil affects the maximum number of paper clips that can be suspended in a chain from one end of the nail.

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

In your plan, you should:

- state any additional apparatus you use and how it is added into the circuit
- state how you will change the current in the coil
- state any key variables to control
- draw a table with column headings to display the results (you are not required to enter any readings into the table)
- explain how you will use the results to reach a conclusion.





11

[6]



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