Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7046742205

PHYSICS **0625/62**

Paper 6 Alternative to Practical **February/March 2022**

1 hour

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 40.
- The number of marks for each question or part question is shown in brackets [ ].

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

© UCLES 2022

1 A student investigates the extension of a spring and uses it to determine the weight of a metre rule.

The spring is shown full size in Fig. 1.1 and Fig. 1.2.

Fig. 1.1 shows the spring without any load.
Fig. 1.2 shows the spring with a load of 1.0 N suspended from it.

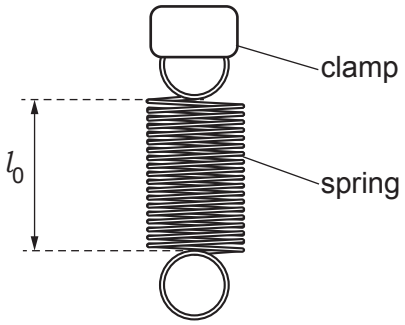


Fig. 1.1

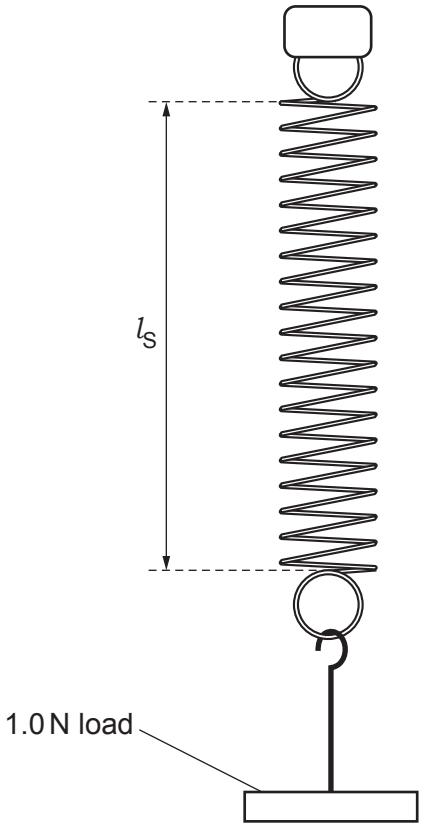


Fig. 1.2

(a) On Fig. 1.1, measure the length l_0 of the spring without any load.

l_0 = ... cm

On Fig. 1.2, measure the stretched length l_S of the spring.

l_S = ... cm
[2]

© UCLES 2022

(b) The student attaches a metre rule to the spring with a wire hook, as shown in Fig. 1.3. The scale of the metre rule faces upwards.

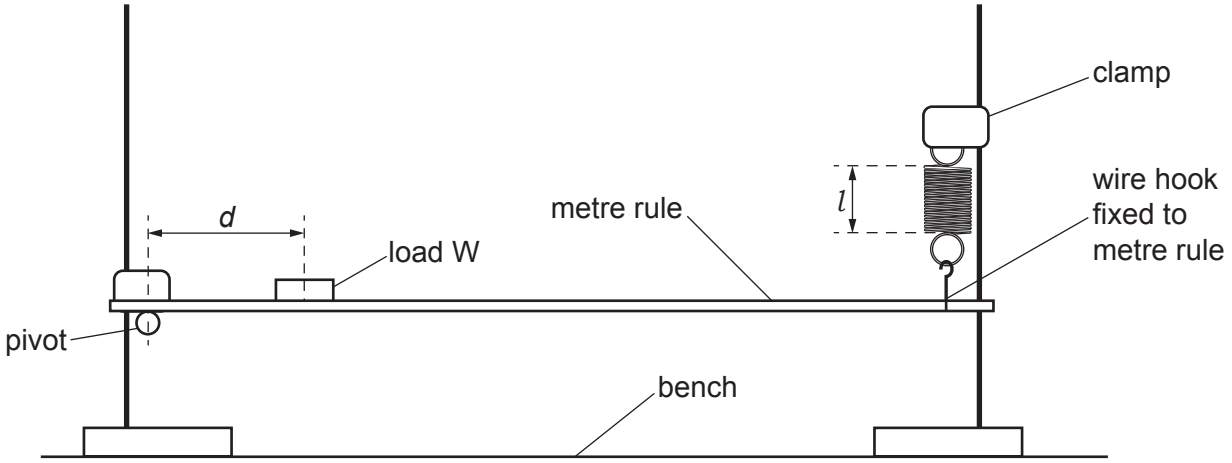


Fig. 1.3

She ensures that the metre rule is horizontal.

Briefly describe how to check that the rule is horizontal. You may draw a diagram if it helps to explain your answer.

.....

.....

..... [1]

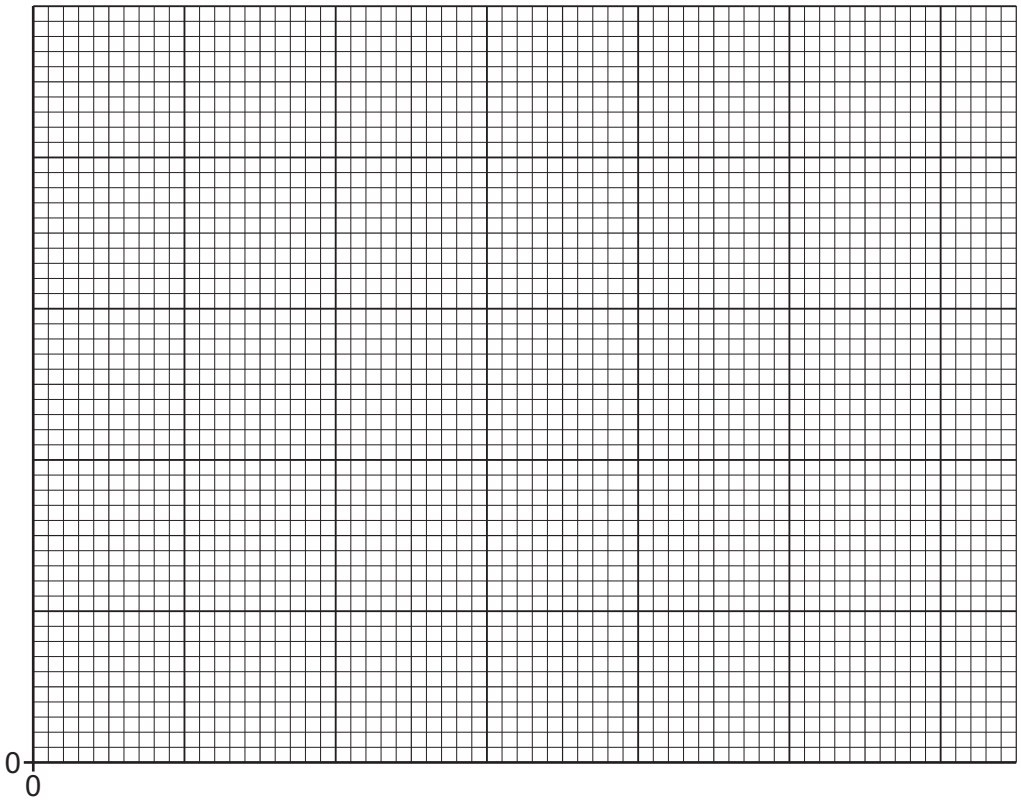
(c) The student moves load W to distances d = 20.0 cm, d = 30.0 cm, d = 40.0 cm, d = 50.0 cm and d = 60.0 cm from the pivot.

She reads the length l of the spring for each value of d.
Her readings are shown in Table 1.1.

Table 1.1

d / cm	l / cm
20.0	6.2
30.0	7.1
40.0	7.6
50.0	8.3
60.0	9.0

(i) Using the values from Table 1.1, plot a graph of l / cm (y-axis) against d / cm (x-axis).
Start the axes at the origin (0,0).



[4]

(ii) From your graph, determine L, the value of l when d = 0.0 cm.

L = ... [1]

© UCLES 2022

(iii) Calculate W_R, the weight of the metre rule, using your value of L from **(c)(ii)**, the values of l_0 and l_S from **(a)** and the equation

$$W_R = \frac{2(L - l_0)}{(l_S - l_0)} \times k$$

where $k = 1.0\,\text{N}$.

W_R = ... [1]

(d) (i) It is sometimes difficult to position the load W on the scale of the metre rule at the correct distance d from the pivot.

Suggest **one** change to the apparatus to overcome this difficulty.

.....

..... [1]

(ii) Suggest **one** possible source of inaccuracy other than the difficulty described in **(d)(i)**. Assume that the experiment is carried out carefully.

.....

..... [1]

[Total: 11]

© UCLES 2022

2 A student investigates the thermal insulation properties of air. He places a thermometer in a clamp, as shown in Fig. 2.1.

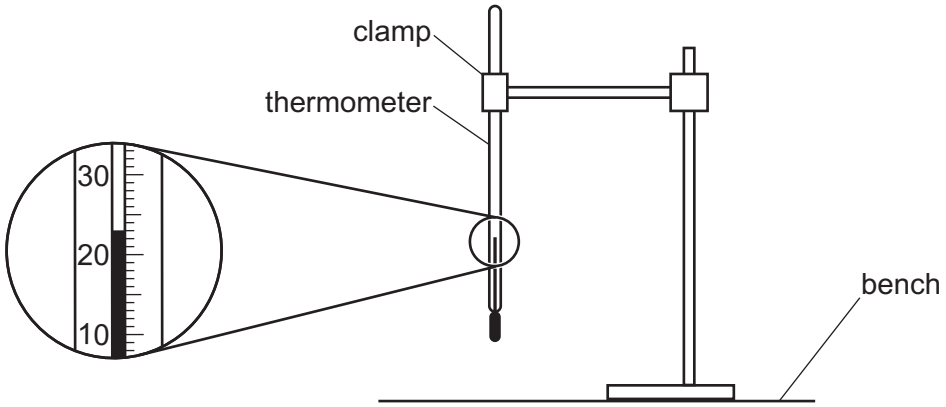


Fig. 2.1

(a) Record room temperature θ_R shown on the thermometer in Fig. 2.1.

θ_R = ... [1]

(b) The student uses the apparatus shown in Fig. 2.1, Fig. 2.2 and Fig. 2.3 to investigate the thermal properties of air.

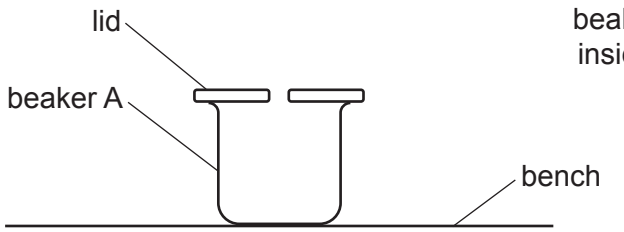


Fig. 2.2

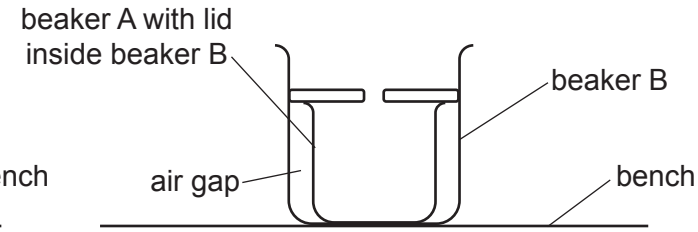


Fig. 2.3

Beakers A and B are made of glass.
Beaker A is placed inside beaker B for the second part of the experiment, as shown in Fig. 2.3.
The lid fits tightly in beaker B.

(i) The student removes the lid from beaker A. He pours 150 cm^3 of hot water into beaker A and replaces the lid. He inserts the thermometer into the hot water and records the temperature θ at time t = 0 and then every 30 s.

Describe **two** precautions that can be taken to ensure that the temperature reading is as accurate as possible.

1. .....

.....

2. .....

..... [2]

(ii) The student pours away the water from beaker A. He then places beaker A inside beaker B so that there is an air gap between the two beakers, as shown in Fig. 2.3.

He repeats the process described in **(b)(i)**. His readings are shown in Table 2.1.

Add units to the column headings in Table 2.1.

Table 2.1

	beaker A	beaker A inside beaker B
t/	θ/	θ/
0	85.0	85.5
30	79.5	83.5
60	75.0	82.0
90	72.0	81.0
120	70.0	80.0
150	68.5	79.5
180	67.5	79.0

[1]

(c) Write a conclusion stating whether the air gap affects the rate of cooling of the water. Justify your answer by reference to values from Table 2.1.

.....

.....

.....

..... [2]

(d) A student suggests that glass is a thermal insulator and the experiment does not just test the effect of the air gap.

Suggest **one** change to the apparatus that would test the air gap more effectively.

.....

..... [1]

(e) Another student repeats this experiment using the same apparatus shown in Fig. 2.1, Fig. 2.2 and Fig. 2.3.

State **two** variables that she should control in order to obtain readings as close as possible to the readings in Table 2.1.

1. .....

.....

2. .....

.....

[2]

(f) Calculate the average cooling rate R for beaker A cooling on its own. Use the readings for **beaker A** in Table 2.1 and the equation

$$R = \frac{\theta_0 - \theta_{180}}{T}$$

where T = 180 s and θ_0 and θ_{180} are the temperatures of the water in beaker A at t = 0 and t = 180 s.
Include the unit for the cooling rate.

R = ... [2]

[Total: 11]

© UCLES 2022

BLANK PAGE

3 A student investigates the refraction of light by a transparent block.

The student's ray-trace sheet is shown full size in Fig. 3.1.

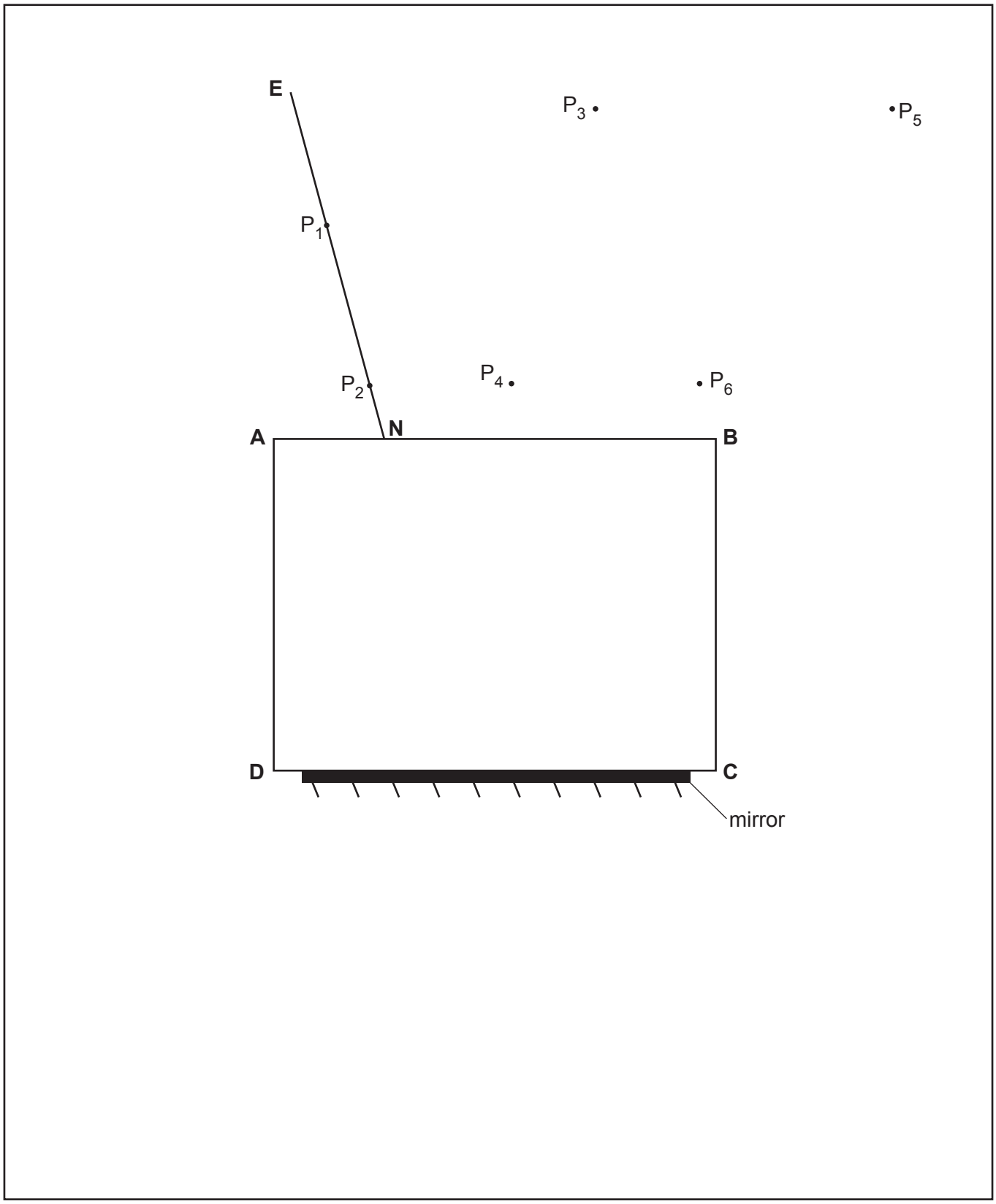


Fig. 3.1

(a) The student places a transparent block **ABCD** near the centre of the ray-trace sheet, as indicated in Fig. 3.1.

(i) Draw a normal to point **N** extending above **AB**. Label the upper end of the normal with the letter **L**. [1]

(ii) The student draws the line **EN**, as shown in Fig. 3.1.

On Fig. 3.1, measure the angle θ_1 between the lines **LN** and **EN**.

θ_1 = ... [1]

(b) The student places two pins, P_1 and P_2, on the line **EN**, as shown in Fig. 3.1.

(i) Measure the distance d between pins P_1 and P_2.

d = ... [1]

(ii) Suggest whether the two pins are a suitable distance apart for accurate ray tracing. Explain your answer.

statement .....

explanation .....

.....

[1]

(c) The student places a plane mirror on line **CD** and views the images of pins P_1 and P_2 through the transparent block.

She places two pins, P_3 and P_4, so that these pins, and the images of pins P_1 and P_2, all appear exactly one behind the other.

On Fig. 3.1:

- Draw a line through points P_3 and P_4 and extend the line 3 cm below **CD**.
- Label the point at which this line meets **AB** with the letter **G**.
- Label the lower end of the line with the letter **H**.

[1]

(d) The student repeats the procedure for an angle $\theta_2 = 35°$.

She places two pins, P_5 and P_6, so that these pins, and the images of pins P_1 and P_2, all appear exactly one behind the other.

On Fig. 3.1:

- Draw a line through points P_5 and P_6 and extend the line 3 cm below **CD**.
- Label the point at which this line meets **AB** with the letter **R**.
- Label the lower end of this line with the letter **S**.
- Label the point at which **GH** and **RS** cross with the letter **T**.

(i) Measure the angle β, where β is the angle between lines **GT** and **RT**.

β = ... [1]

© UCLES 2022

(ii) A student suggests that the angle β should be equal to θ_s, where θ_s is calculated using the equation

$$\theta_s = \theta_2 - \theta_1.$$

State whether your results from **(a)(ii)** and **(d)** support this suggestion. Justify your answer by reference to values from your results.

statement .....

justification .....

.....

[2]

(e) Suggest **two** precautions to take in this type of experiment to ensure accurate results.

1. .....

.....

2. .....

.....

[2]

(f) Suggest **one** reason why different students, all carrying out this experiment carefully, may **not** obtain identical results.

.....

..... [1]

[Total: 11]

© UCLES 2022

BLANK PAGE

4 A student investigates the heating of water using an immersion heater.
An immersion heater is an electrical heater that can be placed directly into water.

Plan an experiment to investigate how **one** factor affects the rate at which the temperature of the water rises when heated using an immersion heater.

The apparatus available includes:
- an immersion heater
- equipment to connect the circuit, part of which is shown in Fig. 4.1
- a stop-clock
- a beaker to contain the water.

In your plan, you should:

- state the **one** factor which you have chosen and list any additional apparatus needed to measure the factor
- complete the circuit diagram in Fig. 4.1
- explain how to do the experiment, including any precautions to ensure reliable results
- state the key variables to be kept constant
- draw a table, or tables, with column headings, to show how to display the readings (you are **not** required to enter any readings in the table)
- explain how to use the readings to reach a conclusion.

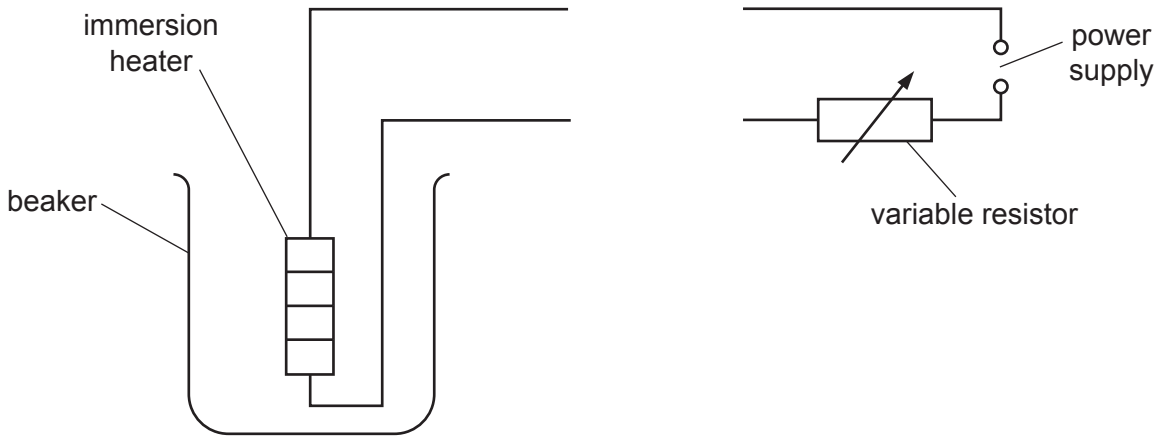


Fig. 4.1

© UCLES 2022

[7]

© UCLES 2022

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 Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2022