



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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0625/53

October/November 2023

1 hour 15 minutes

You must answer on the question paper.

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

- 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 determine the density of sand by two methods.

Carry out the following instructions, referring to Fig. 1.1 and Fig. 1.2.

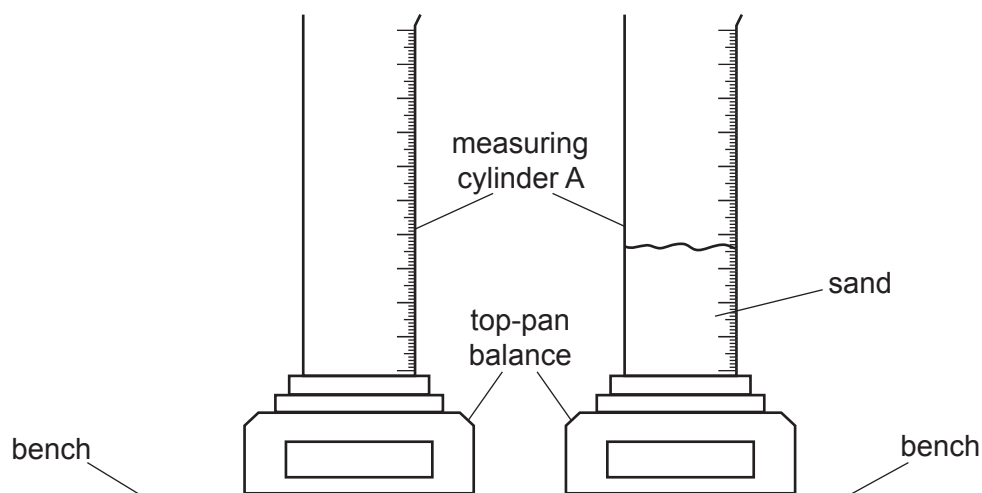


Fig. 1.1

Fig. 1.2

Method 1

- (a) (i) Measure the mass m_1 of measuring cylinder A using the top-pan balance, as shown in Fig. 1.1.

$$m_1 = \dots\dots\dots \text{ g}$$

Pour approximately 100 cm^3 of sand into **measuring cylinder A**.

The sand is to remain in the measuring cylinder for the rest of the experiment.

Measure the volume V_1 of sand in measuring cylinder A.

$$V_1 = \dots\dots\dots \text{ cm}^3$$

Measure the mass m_2 of measuring cylinder A and the sand using the top-pan balance, as shown in Fig. 1.2.

$$m_2 = \dots\dots\dots \text{ g}$$

Use your values of m_1 and m_2 to calculate the mass m_3 of the sand.

$$m_3 = \dots\dots\dots \text{ g} \quad [2]$$

- (ii) Calculate a value for the density ρ_1 of the sand. Use your values from (a)(i) and the equation $\rho_1 = \frac{m_3}{V_1}$. Include a unit.

$$\rho_1 = \dots\dots\dots [2]$$

- (iii) Describe **one** possible source of inaccuracy in the measurements taken in **method 1**. You may assume that all measurements are taken carefully and involve good experimental practice.

.....
 [1]

Method 2

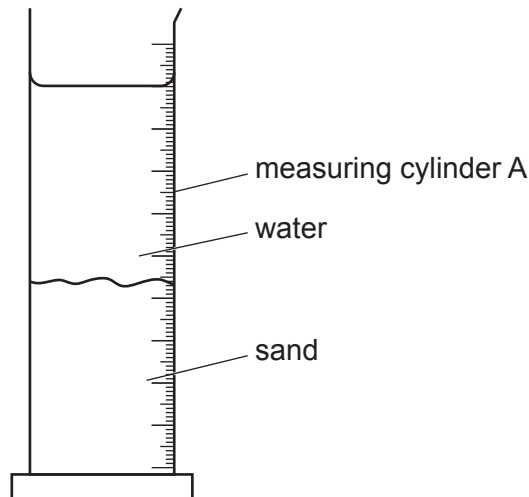


Fig. 1.3

- (b) (i) Pour exactly 100 cm^3 of water into **measuring cylinder B**.

Pour this water into measuring cylinder A, as shown in Fig. 1.3.

Wait until the water level is constant then record the reading V_2 of the water level in measuring cylinder A.

$$V_2 = \dots\dots\dots \text{ cm}^3 \quad [1]$$

- (ii) On Fig. 1.3, draw an arrow showing the correct line of sight for reading the water level in measuring cylinder A. [1]

- (iii) Calculate another value for the density ρ_2 of the sand.

Use your values from **(a)(i)** and **(b)(i)** and the equation $\rho_2 = \frac{m_3}{(V_2 - k)}$, where $k = 100\text{ cm}^3$.

$$\rho_2 = \dots\dots\dots \quad [2]$$

- (c) Another student wants to determine the density of the particles in a sample of sand.

- (i) Explain why **method 1** would **not** be a suitable method for her to use.

.....
 [1]

- (ii) Explain why **method 2** would give a more accurate value for the density of the particles in the sample of sand.

.....
 [1]

[Total: 11]

- 2 In this experiment, you will investigate the cooling of hot water in surroundings with different temperatures.

Carry out the following instructions, referring to Fig. 2.1 and Fig. 2.2.

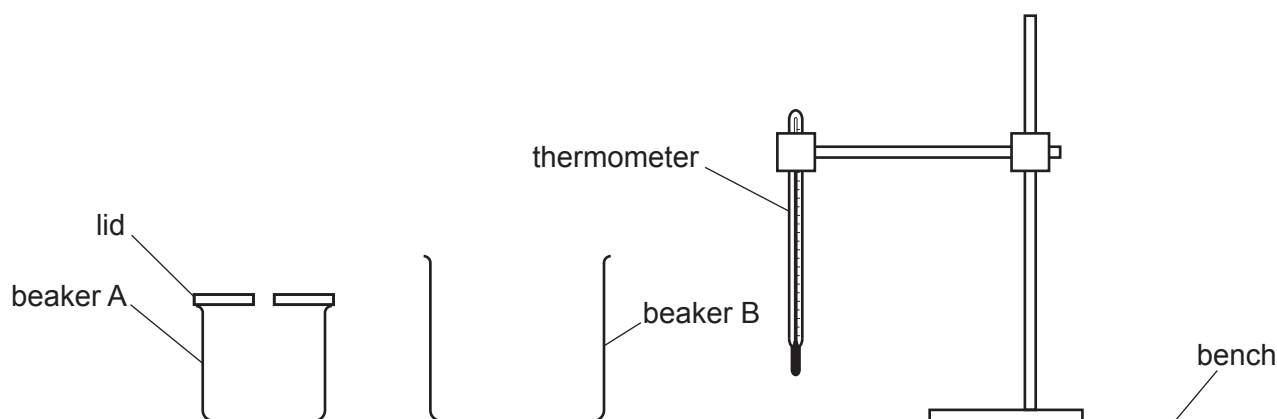


Fig. 2.1

- (a) (i) Pour 100 cm^3 of cold water into beaker B.
Place the thermometer in the water.

Measure, and record in the appropriate column heading of Table 2.1, the temperature θ_1 of the water. [1]

- (ii) Remove the thermometer from the water in beaker B.
Remove the lid from beaker A.
Place beaker A inside beaker B, as shown in Fig. 2.2, so that the water in beaker B rises between the sides of the two beakers.

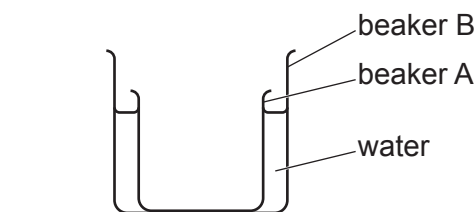


Fig. 2.2

Pour 150 cm^3 of hot water into beaker A and replace the lid.
Place the thermometer in the water in beaker A.

In Table 2.1, record the temperature θ_A of the water at time $t = 0$ and immediately start the stop-watch.

Record the temperature θ_A of the water at $t = 30\text{ s}$, 60 s , 90 s , 120 s , 150 s and 180 s .

[1]

- (b) (i) Remove the thermometer and lid from beaker A.
Remove beaker A from beaker B and empty both beakers.

Pour 50 cm³ of cold water and 50 cm³ of hot water into beaker B.
Place the thermometer in the water.

Measure, and record in the appropriate column heading of Table 2.1, the temperature θ_2 of the water.

[1]

- (ii) Repeat (a)(ii) for this arrangement.

[2]

Table 2.1

	beaker A in cold water $\theta_1 = \dots\dots\dots^\circ\text{C}$	beaker A in warm water $\theta_2 = \dots\dots\dots^\circ\text{C}$
t/s	$\theta_A/^\circ\text{C}$	$\theta_A/^\circ\text{C}$
0		
30		
60		
90		
120		
150		
180		

- (c) Write a conclusion stating in what way the temperature of the water surrounding beaker A affects the rate of cooling of the hot water in beaker A.
Justify your answer by reference to values from your readings.

.....

 [2]

- (d) Calculate the average cooling rate R for beaker A cooling in **cold** water. Use your readings for beaker A from Table 2.1 and the equation

$$R = \frac{\theta_{A0} - \theta_{A180}}{T}$$

where $T = 180\text{ s}$ and θ_{A0} and θ_{A180} are the temperatures of the water in beaker A at $t = 0$ and $t = 180\text{ s}$. Include the unit for the cooling rate.

$R =$ [2]

- (e) Another student repeats this experiment at the same room temperature.

State **one** other variable that she controls in order to obtain readings as close as possible to your readings.

.....
 [1]

- (f) During the experiment, the increase in temperature of the water surrounding beaker A affects the results of the investigation.

Suggest **one** change to the experiment to reduce this effect.

.....

 [1]

[Total: 11]

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- 3 In this experiment, you will determine the focal length of a converging lens.

Carry out the following instructions, referring to Fig. 3.1.

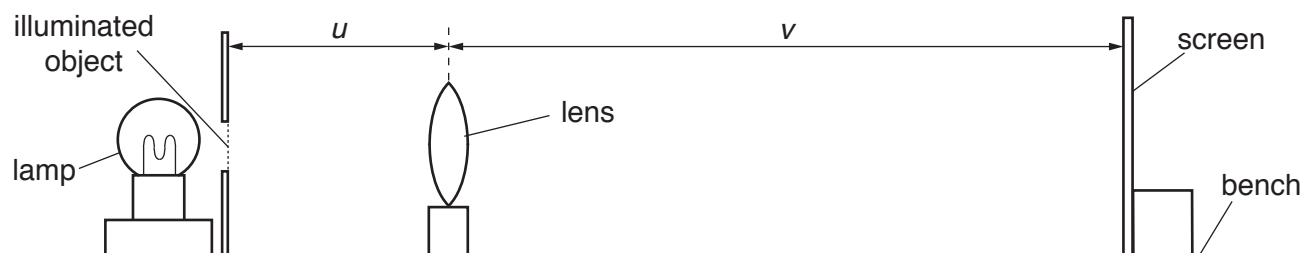


Fig. 3.1

- (a) (i) Place the lens a distance $u = 20.0\text{ cm}$ from the triangular illuminated object.
Place the screen near the lens.
Switch on the lamp.
Move the screen until a clear focused image of the triangular illuminated object is seen on the screen.

Measure, and record in Table 3.1, the distance v between the lens and the screen.

Repeat the procedure for $u = 30.0\text{ cm}$, 40.0 cm , 50.0 cm and 60.0 cm .

Switch off the lamp.

Table 3.1

u/cm	v/cm	$\frac{u}{v}$
20.0		
30.0		
40.0		
50.0		
60.0		

[2]

- (ii) Describe a technique to obtain an image on the screen that is as sharp as possible in this experiment.

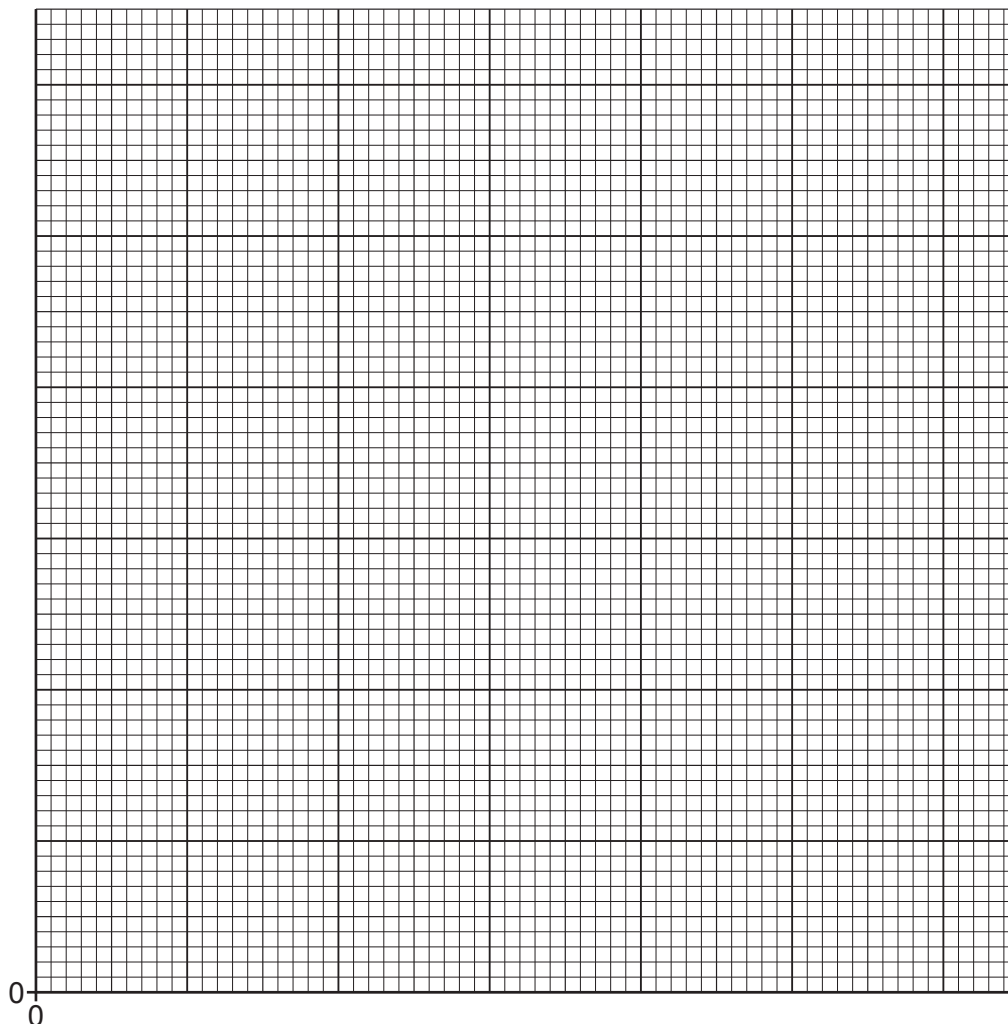
.....

..... [1]

(b) For each distance u , calculate, and record in Table 3.1, a value for $\frac{u}{v}$. [1]

(c) Plot a graph of u/cm (y -axis) against $\frac{u}{v}$ (x -axis). Start your graph at the origin (0,0).

Draw the best-fit line.



[4]

(d) (i) Determine the value u_0 of u when $\frac{u}{v} = 0$.

$u_0 = \dots\dots\dots$ [1]

(ii) The gradient of the graph is numerically equal to the focal length f of the lens.

Determine the value of f for this experiment.

Show clearly on the graph how you obtained the necessary information to determine the gradient.

$f = \dots\dots\dots$ [2]

4 A student investigates the brightness of a lamp.

Plan an experiment to investigate how the intensity (brightness) of the light produced by the lamp is affected by the current in the lamp.

The apparatus available includes:

- a lamp and power supply
- a light meter which measures the intensity of light arriving at it
- an ammeter
- a variable resistor.

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

In your plan, you should:

- complete the circuit diagram in Fig. 4.1 to show the variable resistor connected to control the current in the lamp
- state the key variables to be kept constant
- explain briefly how to do the experiment
- draw a table 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.

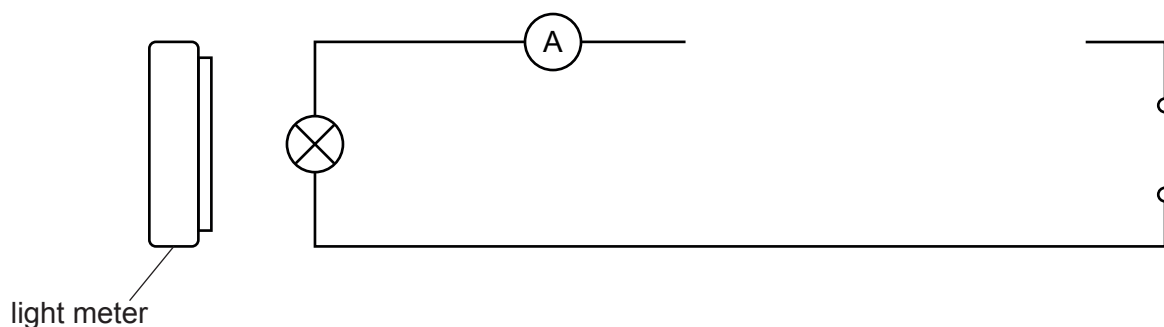


Fig. 4.1

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