



Cambridge IGCSE™ (9–1)

CANDIDATE
NAME

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PHYSICS

0972/61

Paper 6 Alternative to Practical

October/November 2020

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 **12** pages. Blank pages are indicated.

- 1 A student determines the density of modelling clay by two methods.

Method 1

- (a) Fig. 1.1 shows one face of a piece of modelling clay that the student uses. This is sample A.

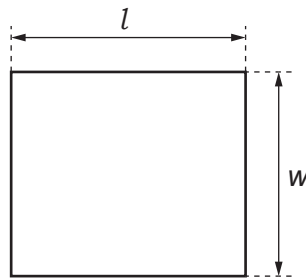


Fig. 1.1

The student measures the depth d of sample A.

$$d = \dots\dots\dots 3.2 \dots\dots\dots \text{cm}$$

- (i) Measure and record the length l and the width w of the sample A of modelling clay. Fig. 1.1 is drawn actual size.

$$l = \dots\dots\dots \text{cm}$$

$$w = \dots\dots\dots \text{cm}$$

[1]

- (ii) Calculate the volume V_A of sample A using the equation $V_A = l \times w \times d$.

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

- (iii) Fig. 1.2 shows sample A on a balance. Record the mass m_A of sample A to the nearest g.

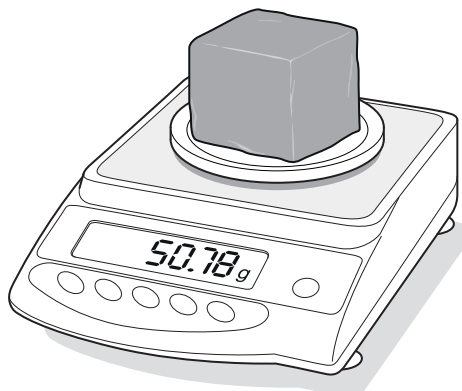


Fig. 1.2

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

- (iv) Calculate the density ρ_A of sample A of modelling clay using the equation $\rho_A = \frac{m_A}{V_A}$.

Give your answer to a suitable number of significant figures for this method and include the unit.

$$\rho_A = \dots\dots\dots [2]$$

Method 2

- (b) The student records the volume V_1 of water in a measuring cylinder.

$$V_1 = \dots\dots\dots 150 \dots\dots\dots \text{cm}^3$$

He carefully lowers sample B of the same modelling clay into the measuring cylinder until it is completely covered with water.

He records the new reading V_2 of the water level in the measuring cylinder.

$$V_2 = \dots\dots\dots 182 \dots\dots\dots \text{cm}^3$$

- (i) Calculate the volume V_B of sample B using the equation $V_B = V_2 - V_1$.

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

- (ii) The student measures the mass m_B of sample B.

$$m_B = \dots\dots\dots 60 \dots\dots\dots \text{g}$$

Calculate the density ρ_B of sample B using the equation $\rho_B = \frac{m_B}{V_B}$. Give your answer to a suitable number of significant figures for this method and include the unit.

$$\rho_B = \dots\dots\dots [1]$$

- (c) A student suggests that the density of modelling clay is **not** affected by the mass or the volume of the sample used.

State whether your results agree with the suggestion. Justify your answer by reference to your results.

statement

justification

..... [2]

4

- (d) Tick the boxes that describe the correct line of sight for taking a reading of the volume of water in a measuring cylinder. Fig. 1.3 shows the curved surface of water, which is called the meniscus.

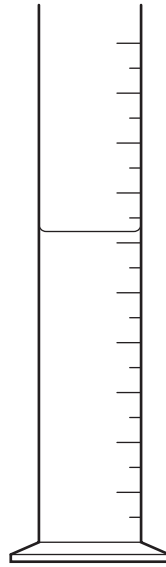


Fig. 1.3

- along the scale
- parallel to the scale
- perpendicular to the scale
- vertical to the scale
- in line with the bottom of the meniscus
- in line with the top of the meniscus
- in line with midway between the top and bottom of the meniscus.

[2]

[Total: 11]

- 2 A student investigates the cooling of water under different conditions.

Fig. 2.1 shows the apparatus she uses.

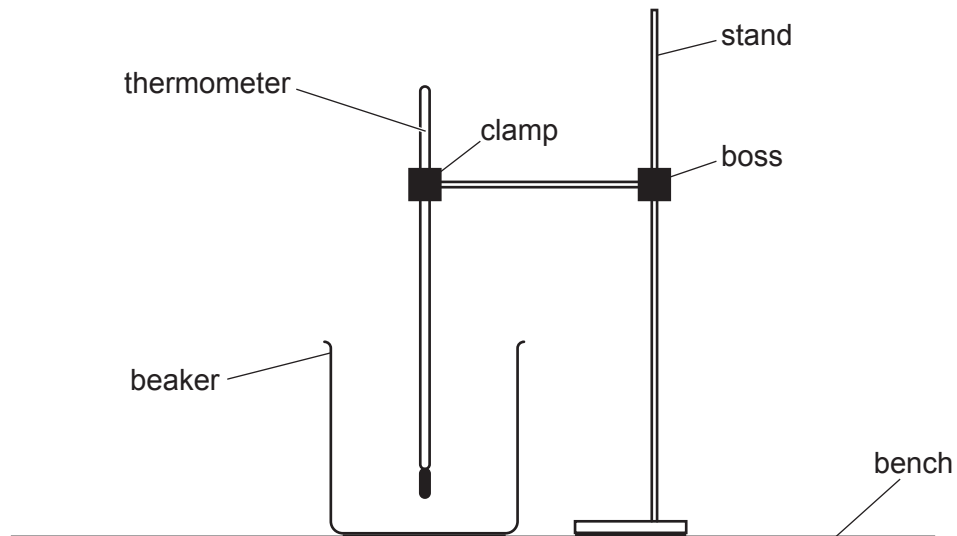


Fig. 2.1

- (a) The thermometer in Fig. 2.2 shows the room temperature θ_R at the beginning of the experiment. Record θ_R .

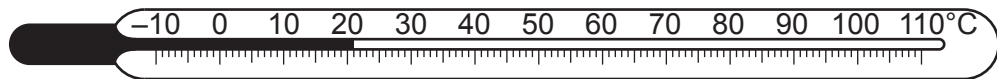


Fig. 2.2

$\theta_R = \dots\dots\dots$ [1]

- (b) The student pours 200 cm^3 of hot water into the beaker.

She records the temperature θ of the hot water at time $t = 0$. She immediately starts a stopclock.

After 180s, she measures the temperature θ shown on the thermometer. Her temperature readings are shown in Table 2.1.

Table 2.1

$t/$	$\theta_1/$
	85
	69

- (i) Complete the time column and the column headings in Table 2.1. [1]
- (ii) Calculate the drop in temperature $\Delta\theta_1$ between times $t = 0$ and $t = 180\text{ s}$.

$$\Delta\theta_1 = \dots\dots\dots [1]$$

- (iii) Calculate the average rate of cooling R_1 of the water using the equation $R_1 = \frac{\Delta\theta_1}{\Delta t}$,

where $\Delta t = 180\text{ s}$. Include the unit.

$$R_1 = \dots\dots\dots [1]$$

- (c) The student empties the beaker. She pours 150 cm^3 of hot water into the beaker. She adds 50 cm^3 of cold water to the beaker. She repeats the timing and temperature recording procedure described in (b). The temperature readings are shown in Table 2.2.

Table 2.2

$t/$	$\theta_2/$
	69
	57

- (i) Complete the time column and the column headings in Table 2.2. [1]
- (ii) Calculate the drop in temperature $\Delta\theta_2$ between times $t = 0$ and $t = 180\text{ s}$.

$$\Delta\theta_2 = \dots\dots\dots$$

Calculate the average rate of cooling R_2 of the water using the equation $R_2 = \frac{\Delta\theta_2}{\Delta t}$,

where $\Delta t = 180$ s. Include the unit.

$$R_2 = \dots\dots\dots [1]$$

(d) A student suggests that the average rate of cooling R of the water depends on the difference D between the temperature of the water at time $t = 0$ and room temperature.

(i) Calculate the difference D_1 using the readings in Table 2.1 and your answer to (a).

$$D_1 = \dots\dots\dots$$

Calculate the difference D_2 using the readings in Table 2.2 and your answer to (a).

$$D_2 = \dots\dots\dots [1]$$

(ii) Write a conclusion about the relationship between R and D . Justify your answer by reference to your results.

conclusion

.....

justification

.....

..... [2]

(e) (i) Explain why the thermometer scale should be read at right-angles.

.....

..... [1]

(ii) Explain why the mixture of hot and cold water should be stirred before taking the temperature reading at the start of the experiment in (c).

.....

..... [1]

[Total: 11]

- 3 A student investigates the magnification of the image produced by a lens.

Fig. 3.1 shows the apparatus used.

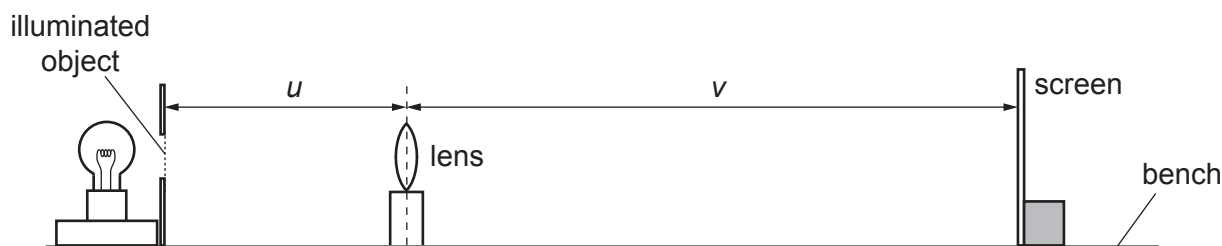


Fig. 3.1

Fig. 3.2 shows a triangular hole in a card that forms the illuminated object. Fig. 3.2 is drawn actual size.

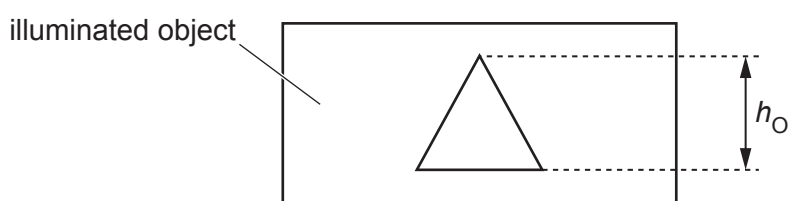


Fig. 3.2

- (a) On Fig. 3.2, measure and record the height h_O of the object.

$$h_O = \dots\dots\dots [1]$$

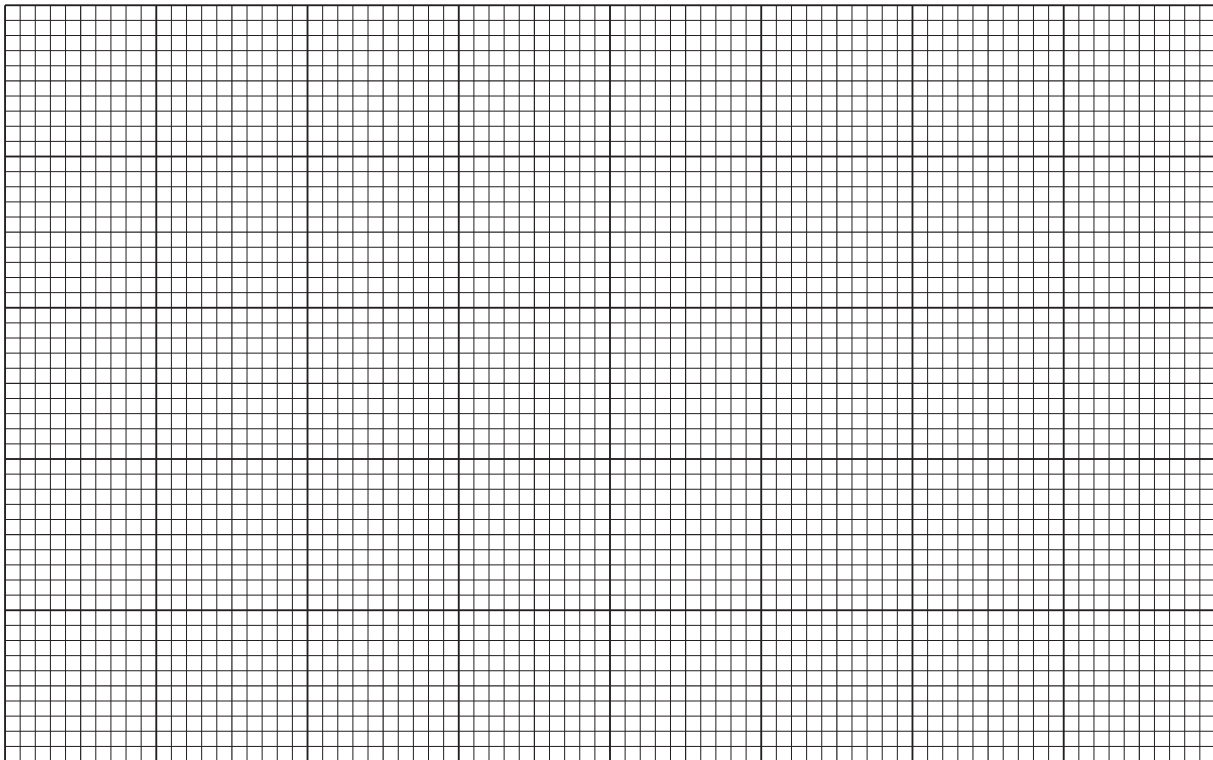
- (b)
- The student places the lens a distance $u = 20.0$ cm from the illuminated object.
 - He moves the screen slowly until a clearly focused image is formed on the screen.
 - He measures the distance v between the centre of the lens and the screen.
 - He repeats the procedure using values of u equal to 25.0 cm, 30.0 cm, 35.0 cm and 40.0 cm.
 - The readings are shown in Table 3.1.

Table 3.1

u/cm	v/cm	m
20.0	70.9	
25.0	41.5	
30.0	32.5	
35.0	28.1	
40.0	25.6	

Calculate, and record in Table 3.1, the magnification m for each value of u . Use the equation $m = \frac{v}{u}$. [1]

(c) Plot a graph of u/cm (y -axis) against m (x -axis). Start the y -axis at $u = 20.0\text{ cm}$.



[4]

(d) Use your graph to determine the value of the object distance u_1 when the magnification $m = 1.0$.

Show clearly on the graph how you obtained the necessary information.

$$u_1 = \dots\dots\dots \text{ cm [2]}$$

(e) Calculate the focal length f of the lens using the equation $f = \frac{u_1}{2}$.

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

(f) State **two** precautions that you would take with this experiment in order to obtain accurate readings.

1.

.....

2.

.....

[2]

[Total: 11]

- 4 A student investigates the resistances of different wires.

Plan an experiment to investigate the resistances of wires made from different metals.

Resistance is calculated using the equation $R = \frac{V}{I}$.

The following apparatus is available:

ammeter
voltmeter
power supply
metre rule
a selection of wires made from different metals.

You can also use other apparatus and materials that are usually available in a school laboratory.

In your plan, you should:

- write a list of suitable metals for the wires you will investigate
- draw a diagram of a suitable electrical circuit using standard electrical symbols
- explain briefly how to carry out the investigation
- state the key variables to keep constant
- 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).

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