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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4972920081

PHYSICS **0625/62**

Paper 6 Alternative to Practical **October/November 2024**

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.

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1 Fig. 1.1 represents a stack of glass microscope slides.

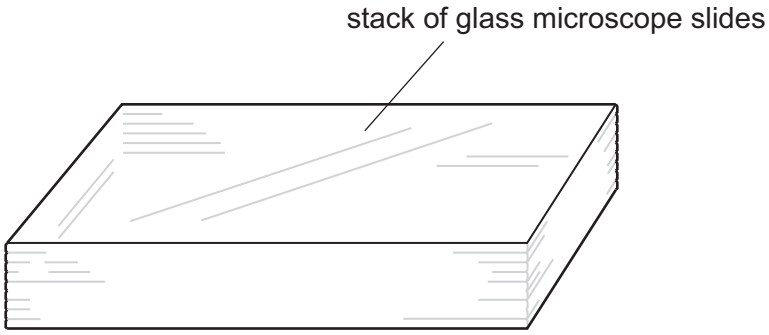

Fig. 1.1 (not to scale)

A student takes measurements from a stack of glass microscope slides in order to estimate the number of slides in the stack.

The sides of the stack have been covered with tape so that the student cannot count the number of slides in the stack.

Fig. 1.2 shows side views of the taped stack of slides given to the student. This figure has been drawn at full scale.

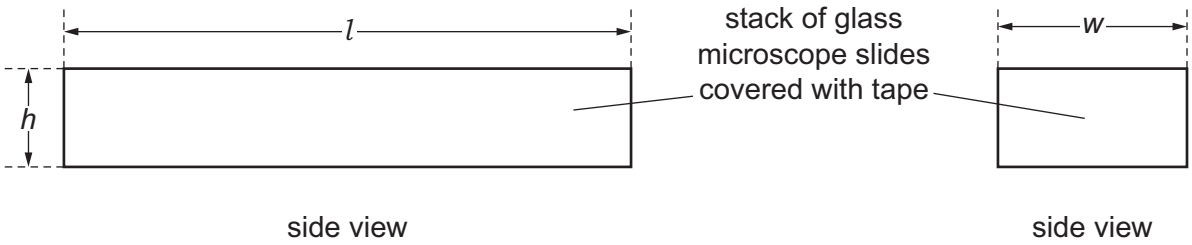

Fig. 1.2

(a) Using Fig. 1.2, measure the length l, the width w and the height h of the covered stack of slides in centimetres to the nearest millimetre.

l = ... cm

w = ... cm

h = ... cm
[2]

(b) (i) The student uses a balance to measure the mass M of the covered stack of slides.

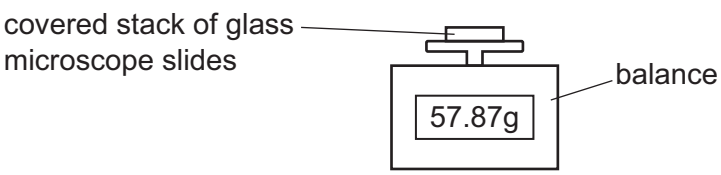

Fig. 1.3

Write down the mass M of the covered slides to the nearest 0.1 g.

M = ... g [1]

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(ii) Calculate the density ρ of the glass. Use your results from **(a)** and **(b)(i)** and the equation shown.

$$\rho = \frac{M}{lwh}$$

Give the unit for your answer.

ρ = ...

unit = ...
[2]

(c) The teacher writes down the mass m and the thickness t of a single microscope slide on a piece of card, as shown in Fig. 1.4.

thickness of a single slide t = 0.11 cm
mass of a single slide m = 4.2 g

Fig. 1.4

(i) Use your answer to **(b)(i)** and information from the card in Fig. 1.4 to estimate the number of microscope slides N_1 in the covered stack.

N_1 = ... [2]

(ii) Use your answer to **(a)** and information from the card in Fig. 1.4 to obtain another estimate of the number of microscope slides N_2 in the covered stack.

N_2 = ... [1]

(d) Two quantities can be considered to be equal within the limits of experimental accuracy if their values are within 10% of each other.

State whether your values of N_1 and N_2 from **(c)(i)** and **(c)(ii)** can be considered equal.

Support your statement with a calculation.

calculation

statement ..... [2]

(e) Suggest **one** reason why the estimated values of N are different.

.....

..... [1]

[Total: 11]

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2 A student measures the resistance of a light-emitting diode (LED) when the current in it changes.

The student sets up the circuit shown in Fig. 2.1.

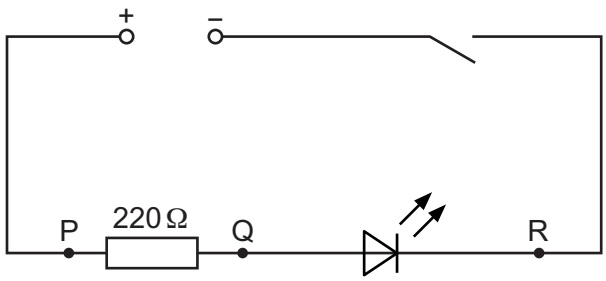

Fig. 2.1

(a) The student:

- connects a voltmeter to measure the potential difference across the 220 Ω resistor
- closes the switch
- records the voltmeter reading V_{PQ} in the top row of Table 2.1
- opens the switch.

(i) On Fig. 2.1, draw the symbol for a voltmeter connected to measure the potential difference across the 220 Ω resistor. [2]

(ii) The voltmeter reading is shown in Fig. 2.2.

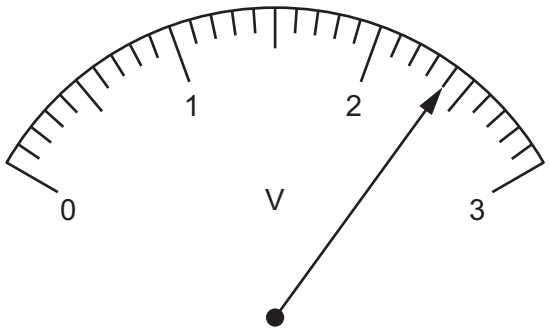

Fig. 2.2

Write down the reading in the top row of Table 2.1 under the heading V_{PQ}. [1]

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Table 2.1

resistance between P and Q /Ω	V_{PQ}/V	V_{QR}/V	I/A	R_{LED}/Ω
220		2.1		
330		2.0	0.0076	263

(b) The student:

- disconnects the voltmeter from points P and Q
- reconnects the voltmeter across the LED between points Q and R
- closes the switch.
- records the voltmeter reading V_{QR} in the top row of Table 2.1
- opens the switch.

Calculate the current I in the circuit in part **(a)** using the equation

$$I = \frac{V_{PQ}}{R}$$

where $R = 220\,\Omega$.

Record your answer in the top row of Table 2.1. [1]

(c) Calculate the resistance R_{LED} of the LED using the equation

$$R_{LED} = \frac{V_{QR}}{I}$$

Record your answer to a suitable number of significant figures for this experiment in the top row of Table 2.1. [2]

(d) The student:

- removes the 220 Ω resistor from the circuit and replaces it with a 330 Ω resistor
- reconnects the voltmeter across the resistor between points P and Q
- repeats parts **(a)** to **(c)** for the 330 Ω resistor.

Use the information in Table 2.1 to calculate the value of the potential difference V_{PQ} across the 330 Ω resistor.

Show your working and record your answer in Table 2.1.

[1]

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(e) As the resistance between points P and Q changes, the current in the circuit changes.

Use your results in Table 2.1 to write a conclusion, stating how the change in current affects the potential difference V_{QR} across the LED and the resistance R_{LED} of the LED.

.....

.....

.....

..... [2]

(f) **(i)** Another student uses a variable resistor to control the current in the circuit.

Draw the symbol for a variable resistor.

[1]

(ii) Explain **one** advantage of using a variable resistor for this purpose rather than the procedure carried out in **(a)** and **(b)**.

.....

..... [1]

[Total: 11]

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3 A student investigates the image formed by a converging lens.

The apparatus is set up as shown in Fig. 3.1.

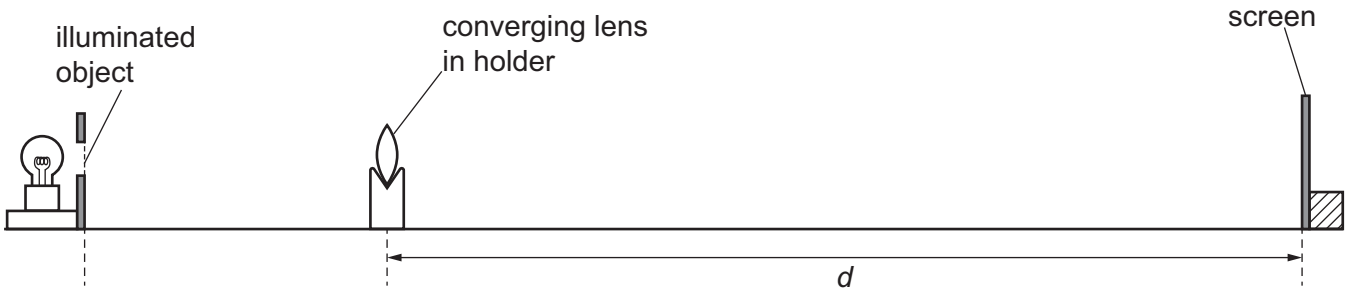

Fig. 3.1

(a) (i) The student:

- switches on the lamp
- places the lens a distance u = 20.0 cm from the illuminated object (a triangular hole in the card)
- adjusts the position of the screen until a sharp image of the illuminated object is formed on the screen.

Measure on Fig. 3.1, to the nearest 0.1 cm, the image distance d from the centre of the lens to the screen.

d = ... cm [1]

(ii) Fig. 3.1 is drawn to a scale of one-fifth $\left(\frac{1}{5}\right)$ full size.

Calculate the actual image distance v from the lens and record your value in Table 3.1.

Table 3.1

object distance u / cm	image distance v / cm
20.0	
25.0	37.2
35.0	26.5
45.0	22.7
55.0	20.9
60.0	20.2

[1]

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(b) The diagram in Fig. 3.2 shows the illuminated object and its image drawn full size when $u = 20.0\,\text{cm}$.

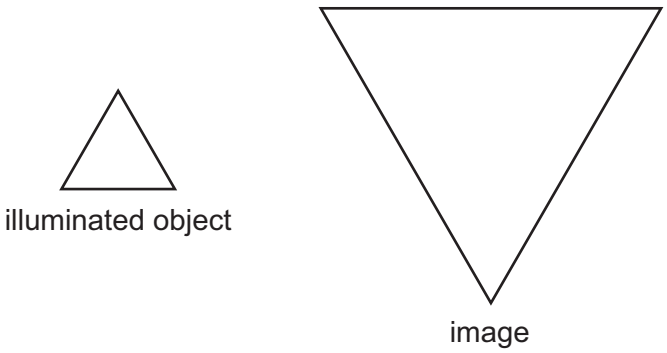

Fig. 3.2

(i) State **two** ways in which the image differs from the object.

1 .....

2 .....

[1]

(ii) The magnification m of the image can be calculated using the equation shown.

$$m = \frac{v}{u}$$

Use your answer to **(a)(ii)** to calculate the magnification m of the image.

m = ... [1]

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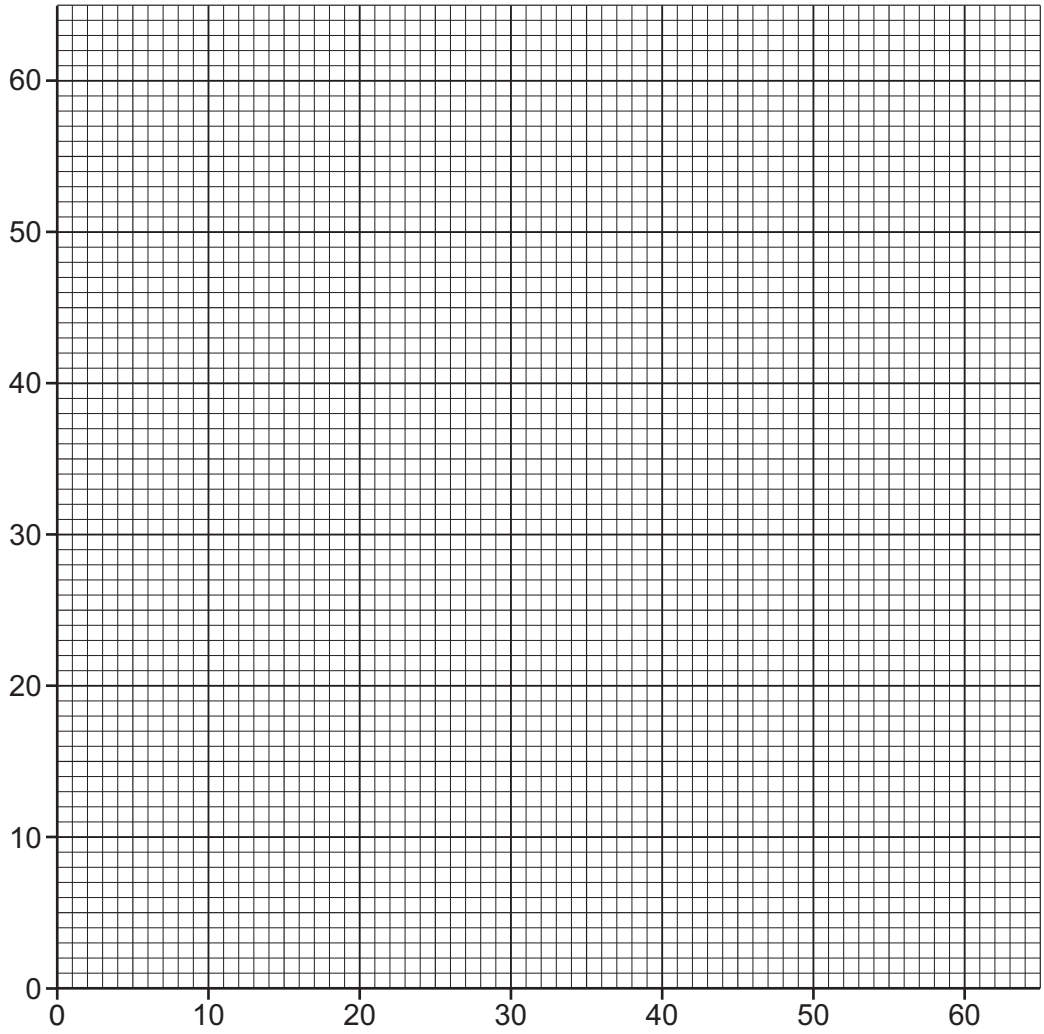
(c) The student repeats the procedure in **(a)(i)** for values of $u = 25.0\,\text{cm}$, $u = 35.0\,\text{cm}$, $u = 45.0\,\text{cm}$, $u = 55.0\,\text{cm}$ and $u = 60.0\,\text{cm}$.

The student's results are shown in Table 3.1.

Plot a graph of v / cm (y-axis) against u / cm (x-axis).

Draw the best-fit curve. [3]



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(d) Use your graph to find the value of v when u = 30.0 cm. Show clearly on the graph how you obtained the necessary information.

v = ... cm [2]

(e) The focal length f of the lens can be found using the equation $f = \frac{uv}{(u + v)}$.

Use the values of u and v from **(d)** to calculate the focal length of the lens.

f = ... cm [1]

(f) State **one** technique you use when doing the experiment to ensure that the image on the screen is as clearly focussed as possible.

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..... [1]

[Total: 11]

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4 Hot water is poured into a glass beaker and allowed to cool down.

Plan an experiment to investigate how the rate at which the water cools depends upon the diameter of the water surface exposed to the air.

You are provided with:

- a supply of hot water
- a set of glass beakers of different sizes
- a measuring cylinder.

You may use any other common laboratory apparatus.

In your plan, include:

- any other apparatus needed
- a brief description of the method, including what you will measure and how you will make sure your measurements are accurate
- the key variables you will control
- a results table to record your measurements (you are **not** required to enter any readings in the table)
- how you will process your results to reach a conclusion.

You may include a labelled diagram if you wish.

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