Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

3039539750

PHYSICS **5054/32**

Paper 3 Practical Test **May/June 2023**

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 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 [ ].

For Examiner's Use	
1	
2	
3	
4	
Total	

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

1 In this experiment you will measure the capacity of a drinks cup by three different methods.

The capacity of a cup is the maximum volume of liquid that it can hold.

You are provided with:

- a drinks cup with a capacity of approximately 200 cm^3
- a 30 cm ruler
- a metre rule
- approximately 80 cm of thin string
- a 250 cm^3 measuring cylinder
- a supply of water.

(a) method 1

Fig. 1.1 shows the measurements to be taken.

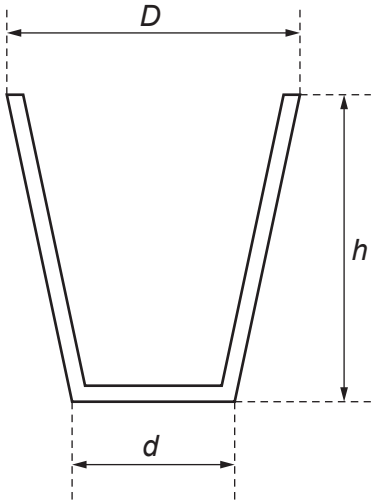

Fig. 1.1

(i) Measure the height *h*, the diameter *D* and the diameter *d* of the cup provided.

h = ... cm

D = ... cm

d = ... cm
[2]

(ii) Calculate the average diameter d_A of the cup using your readings from **(a)(i)** and the equation:

$$d_A = \frac{(D + d)}{2}$$

d_A = ... cm [1]

(iii) Calculate a value for the capacity V_1 of the cup using the equation:

$$V_1 = \frac{\pi\, d_A^{\,2} h}{4}$$

V_1 = ... cm^3 [1]

(b) method 2

Use the string and the metre rule to determine the average circumference C of the cup.

(i) Describe the method you use and show your working.

You may draw a diagram, if you wish.

.....

.....

.....

.....

C = ... cm [2]

(ii) Calculate a value for the capacity V_2 of the cup using the equation:

$$V_2 = \frac{C^2 h}{4\pi}$$

V_2 = ... cm^3 [1]

(c) method 3

Pour water into the measuring cylinder up to a level that is greater than 200 cm^3 and record the volume. This is reading R_1.

Pour water from the measuring cylinder into the cup until it is full and record the volume of water left in the measuring cylinder. This is reading R_2.

Determine the volume of water V_3 in the cup. Show your working.

R_1 = ... cm^3

R_2 = ... cm^3

V_3 = ... cm^3
[1]

(d) All three methods of determining the capacity of the drinks cup give values which are approximate.

State **one** reason why the volume calculated in **method 2** and **one** reason why the volume calculated in **method 3** are **not** accurate.

method 2 .....

.....

.....

method 3 .....

.....

.....
[2]

[Total: 10]

Question 2 is on page 6.

2 In this experiment you will investigate the effective resistance of different combinations of resistors and lamps in circuits.

You are provided with:

- power source
- a switch
- an ammeter
- a voltmeter
- three identical resistors
- three identical lamps
- one additional connecting lead.

The supervisor has set up the apparatus as shown in Fig. 2.1.

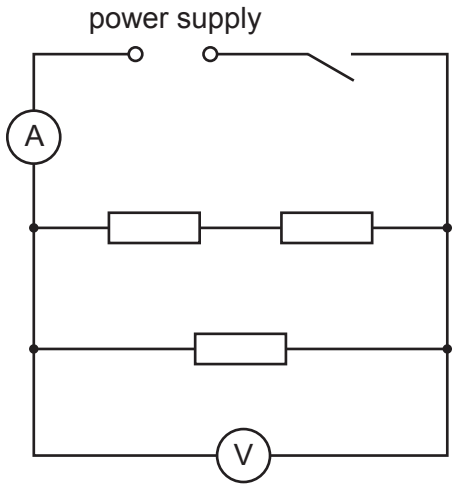

Fig. 2.1

(a) (i) Close the switch.

Record the potential difference V_1 across the resistors, and the current I_1 in the circuit.

Open the switch.

V_1 = ... V

I_1 = ... A
[1]

(ii) Calculate the effective resistance R_1 of the combination of resistors using the equation:

$$R_1 = \frac{V_1}{I_1}$$

R_1 = ... Ω [1]

(iii) Suggest why the switch is opened after the readings of potential difference and current have been taken.

.....

..... [1]

(b) Rearrange the circuit so that the resistors are connected as shown in Fig. 2.2.

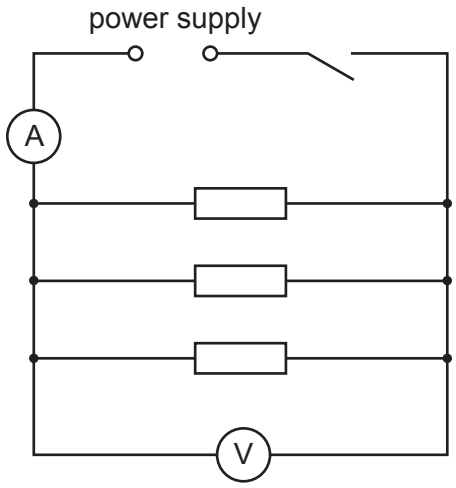

Fig. 2.2

(i) Close the switch.

Record the potential difference V_2 across the resistors and the current I_2 in the circuit.

Open the switch.

V_2 = ... V

I_2 = ... A
[1]

(ii) Calculate the effective resistance R_2 of the combination of resistors using the equation:

$$R_2 = \frac{V_2}{I_2}$$

Record your answer on the answer line.

Write down the value of $2R_2$

R_2 = ... Ω

$2R_2$ = ... Ω
[1]

(c) If the resistors are identical, theory suggests that $R_1 = 2R_2$.

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 results indicate that the resistors are identical. Support your statement with a calculation.

calculation

statement .....
[2]

(d) Set up the circuit shown in Fig. 2.1 on page 6, replacing the resistors with the lamps.

Close the switch.

Calculate the effective resistance R_3 of the combination of lamps.

Record any readings you take and show your working.

R_3 = ... Ω [1]

(e) Rearrange the circuit as shown in Fig. 2.2 on page 7, replacing the resistors with the lamps.

Close the switch.

Calculate the effective resistance R_4 of the combination of lamps.

Record any readings you take and show your working.

R_4 = ... Ω
[1]

(f) The teacher explains that the resistance of the lamp filaments changes due to a heating effect and therefore R_3 is not equal to $2R_4$.

Describe **one** observation that you made while doing the experiment that supports the teacher's explanation.

.....

..... [1]

[Total: 10]

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3 In this experiment you will investigate the image formed by a converging lens.

You are provided with:

- a converging lens in a lens holder
- a metre rule
- a 30 cm ruler
- a white screen
- a triangular object in a piece of white card
- a lamp with a power supply to illuminate the triangular object.

Set up the apparatus as shown in Fig. 3.1.

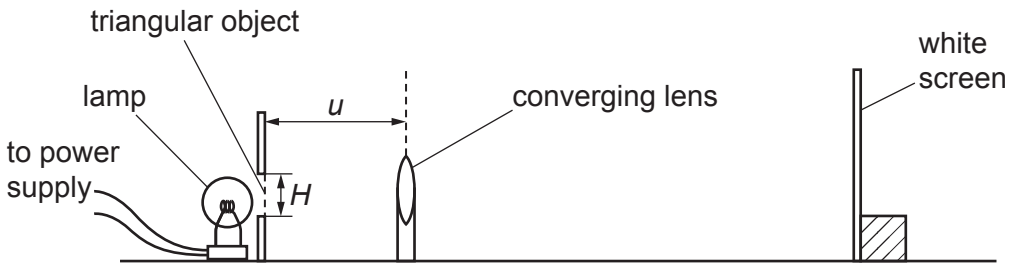


Fig. 3.1

(a) Measure and record the height H of the triangular object provided.

H = ... cm [1]

(b) Switch on the lamp and place the lens a distance u = 20.0 cm from the triangular object.

Adjust the position of the screen until a sharp, focussed image of the triangular object is formed on the screen.

(i) Measure the height h of the image on the screen.

h = ... [1]

(ii) Calculate the value of $\frac{1}{h}$.

Give your answer to 2 significant figures.

$\frac{1}{h}$ = ... [1]

(c) Repeat **(b)** for values of u between $u = 25.0\,\text{cm}$ and $u = 50.0\,\text{cm}$.

Record all your readings and calculations in Table 3.1. Include your readings from **(b)**.

Add appropriate headings with units to each column.

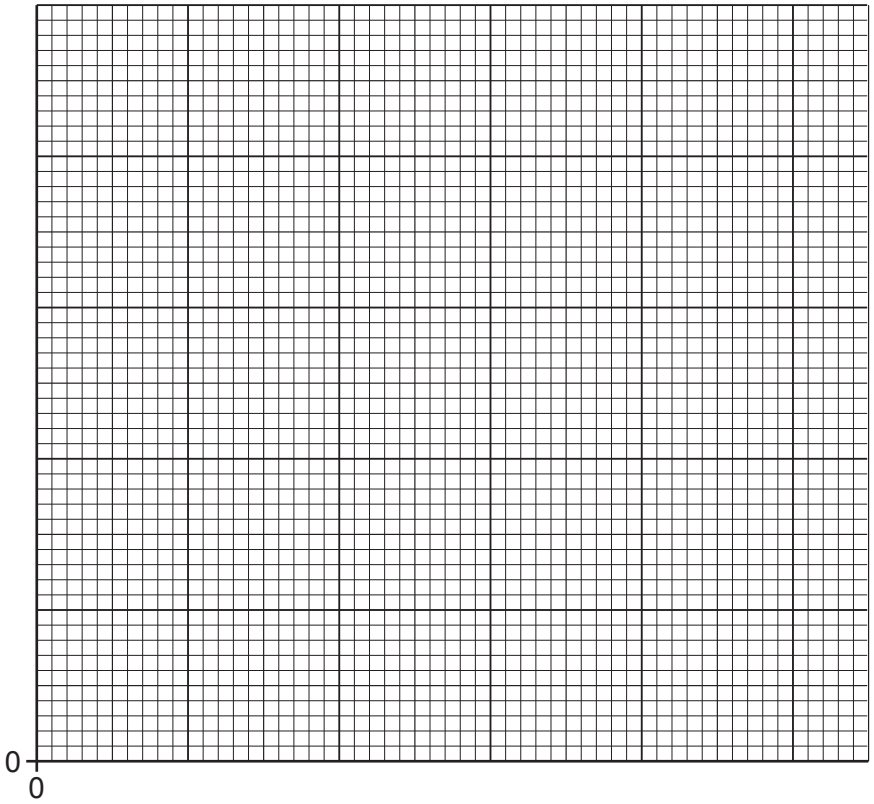
Table 3.1

...../.....	...../.....	...../.....

[3]

(d) On the grid provided, plot a graph of $\frac{1}{h}$ on the y-axis against u on the x-axis.

Start both axes from the origin (0, 0). Draw the straight line of best fit.



[4]

(e) **(i)** Calculate the gradient *m* of your line. Show all working and indicate on the graph the values you use.

m = ... [2]

(ii) Calculate the focal length *f* of the lens. Use your value of *H* from **(a)** and the equation:

$$f = \frac{1}{mH}$$

f = ... cm [1]

(f) When measuring the height of the image on the screen, your hand and the ruler may obstruct the light from the object and prevent it from reaching the screen.

Suggest **one** improvement to the apparatus provided to overcome this problem.

.....

..... [1]

[Total: 14]

4 A student investigates the time taken for ice cubes to melt when they are placed in a beaker of hot water.

Plan an experiment to investigate how the thickness of the cardboard insulation around a beaker affects the time taken for the ice cubes in the beaker to melt.

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

The following apparatus is available:

250 cm^3 beaker
supply of hot water
supply of ice cubes
thermometer
stopwatch
supply of 2 mm thick cardboard sheets.

In your plan you should:

- explain briefly how to carry out the investigation
- state the key variables to keep constant
- draw a table with column headings to show how to display the readings
- explain how to use your readings to reach a conclusion.

.....

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.....

.....

[6]

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