Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

0123456789

PHYSICS **5054/03**

Paper 3 Practical Test **For examination from 2023**

SPECIMEN PAPER **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.

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1 In this experiment, you will investigate the effect of varying the amount of light reaching a light-dependent resistor (LDR).

You are provided with:

- a power supply
- a switch
- a light-dependent resistor (LDR)
- a resistor
- a voltmeter
- connecting leads
- a 250 cm^3 glass beaker containing 150 cm^3 of water
- a light source
- a container with a small amount of cloudy (non-transparent) liquid
- a 5 cm^3 plastic syringe
- a stirrer
- paper towels or cloths to clean up spillages.

The supervisor has set up the apparatus as shown in Fig. 1.1.

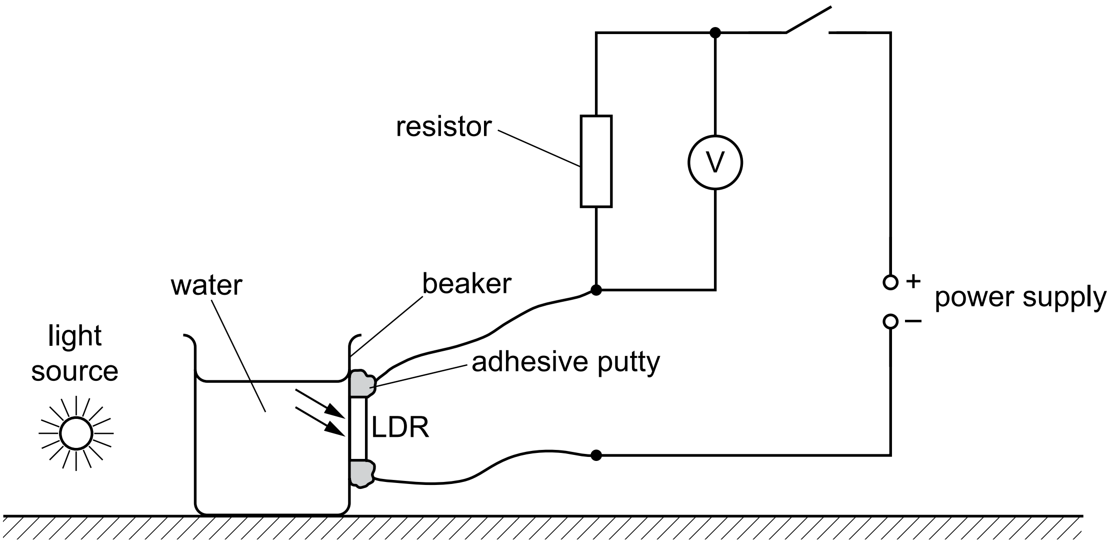

Fig. 1.1

(a) Switch on the light source and close the switch in the electrical circuit.

Measure and record the reading on the voltmeter.

voltmeter reading = ... V [1]

Record your voltmeter reading in the first row of Table 1.1.

(b) Use the syringe to measure 2 cm^3 of cloudy liquid from the container.

Add this liquid to the water in the beaker and use the stirrer to mix the liquids together.

Record the new voltmeter reading in Table 1.1.

Continue by adding 2 cm^3 of the cloudy liquid to the water at a time, recording each new voltmeter reading in Table 1.1.

Table 1.1

volume of cloudy liquid / cm^3	voltmeter reading / V
0	
2	
4	
6	
8	
10	
12	

[1]

(c) On Fig. 1.2, plot a graph of the voltmeter reading against the volume of cloudy liquid.

Draw the best-fit curve.

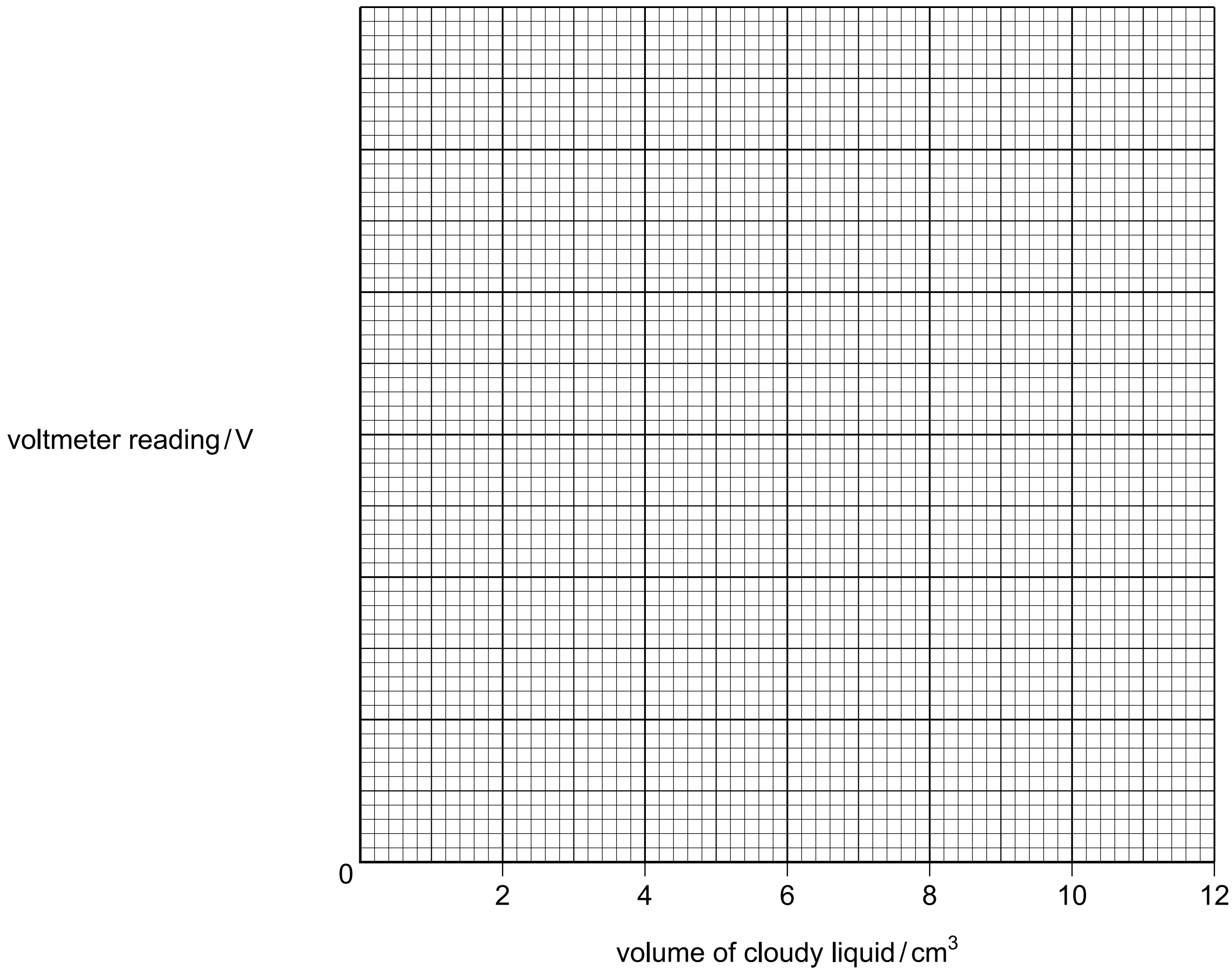

Fig. 1.2 [2]

(d) **(i)** Draw a tangent to the curve at 5 cm^3. [1]

(ii) Calculate the gradient of the tangent.

Show your working and indicate on the graph the values that you use.

gradient = ... [2]

(e) Describe **one** precaution taken to ensure that the reading from your voltmeter is accurate.

....

.... [1]

(f) Another student performs the same experiment. He calculates a gradient which is slightly different to the value you obtained in **(d)(ii)**.

Suggest **two** variables that are difficult to control that may result in different gradients.

1 ....

....

2 ....

....
[2]

[Total: 10]

2 In this experiment, you will investigate the effect of two lenses on the size of a shadow.

You are provided with:

- a lamp connected to a power supply
- a lens held in a clamp
- a second lens
- a sheet of graph paper
- a small circular piece of adhesive putty
- a metre rule
- a stand, weight, two clamps and two bosses.

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

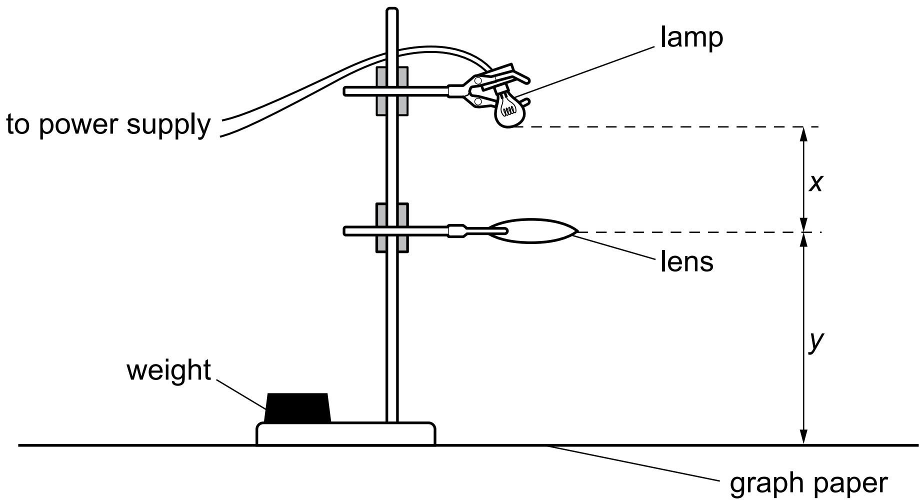

Fig. 2.1

(a) Describe **two** precautions taken to ensure the apparatus is set up safely.

1 ....

....

....

2 ....

....

.... [2]

(b) Adjust the position of the clamped lens so that distance x is approximately 20 cm.

Switch on the lamp. Place the small piece of adhesive putty on top of the clamped lens, in the centre of the lens.

Observe the circular shadow of the adhesive putty on the graph paper.

Hold the **second** lens under the lamp. The lamp and second lens should be touching.

Move the second lens down to the clamped lens and observe how the diameter D of the shadow of the adhesive putty changes.

On Fig. 2.2 sketch a graph to show how D changes as you move the second lens from the lamp at x = 0 cm to the clamped lens at x = 20 cm.

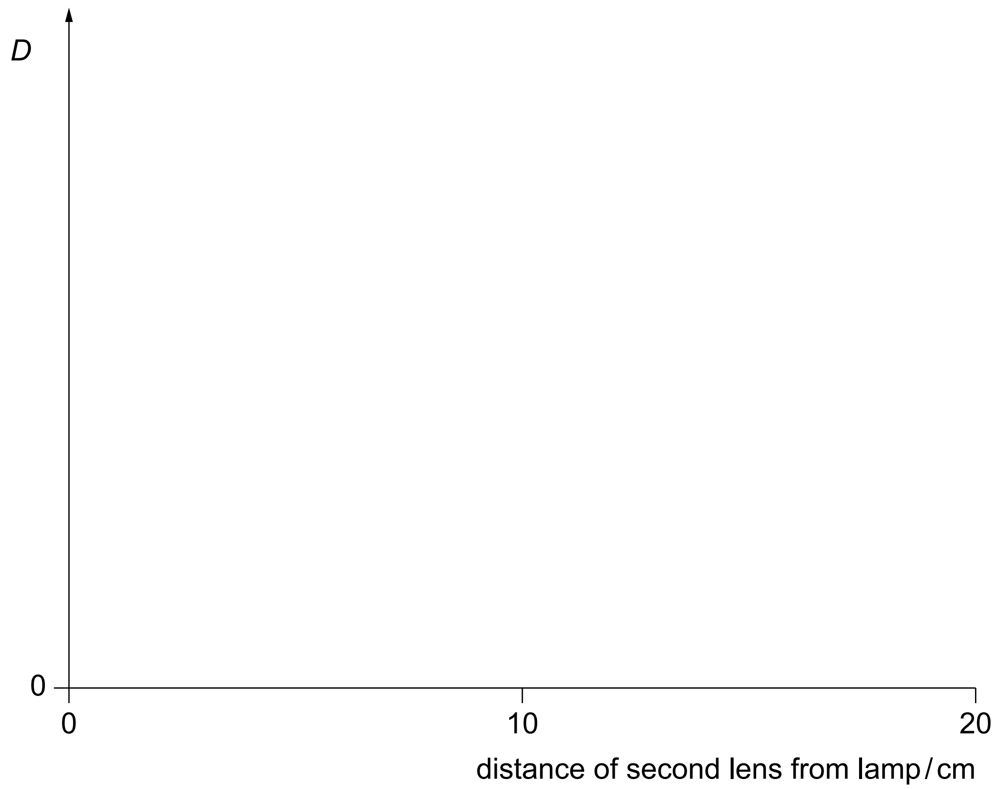

Fig. 2.2 [2]

(c) **(i)** Remove the small piece of adhesive putty from the clamped lens.

Adjust the position of the clamped lens so that the image of the light from the lamp is as small and bright as possible on the graph paper.

You may find that your smallest, brightest image is not in focus.

Measure and record:

the new value of *x* from the centre of the lens to the centre of the lamp

$x =$ .... cm

the new value of *y* from the bench to the centre of the lens

$y =$ .... cm
[2]

(ii) A student suggests that the focal length *f* of the lens can be calculated by using the equation

$$f = \frac{xy}{x + y}$$

where *x* and *y* are determined for a focused image.

Calculate the value of *f* using this equation and your values from **(c)(i)**.

Show your working.

$f =$ .... cm [2]

(d) **(i)** State why the arrangement of the apparatus shown in Fig. 2.1 **cannot** be used to accurately determine the focal length of the clamped lens.

....

.... [1]

(ii) Suggest how the arrangement of the apparatus can be changed in order to **accurately** determine the focal length of the clamped lens.

....

.... [1]

[Total: 10]

3 In this experiment, you will investigate the oscillation of masses attached to a metre rule.

You are provided with:

- a metre rule
- a G-clamp
- a stopwatch
- a small piece of wood to protect the scale on the rule
- two 100 g masses
- adhesive putty
- a 30 cm ruler.

(a) **(i)** The diameter *d* and width *w* of **one** of the masses are shown in Fig. 3.1.

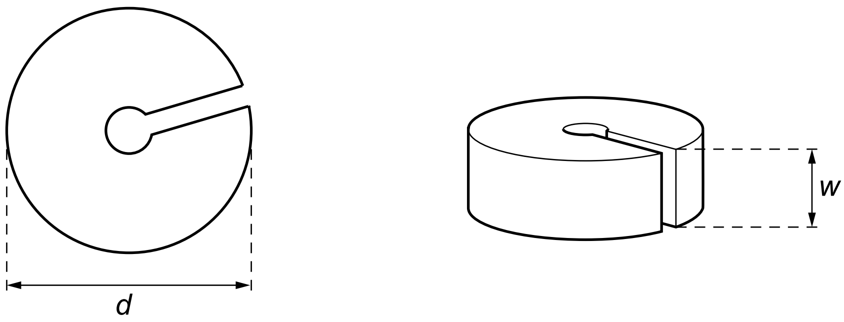

Fig. 3.1

Measure and record *d* and *w* for **one** of the masses provided.

d = ... unit = ...

w = ... unit = ...
[1]

(ii) Use some of the adhesive putty to attach the two 100 g masses together.

Set up the apparatus as shown in Fig. 3.2 so that approximately 90 cm of the metre rule extends out from the bench. Ensure that the masses are secured to the end of the rule.

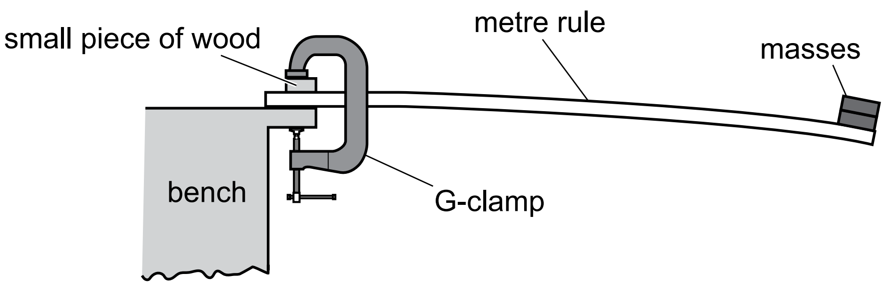

Fig. 3.2

Describe a method to determine the position of the centre of the masses on the metre rule.

....

.... [1]

(iii) Determine the distance *L*, along the rule, from the edge of the bench to the point on the rule directly below the centre of the masses.

Show your working.

L = ... cm [2]

(b) Lift the free end of the metre rule until the rule is approximately horizontal.

Release the rule and observe the rule and masses oscillating. One oscillation is when the masses move down and then back up to their starting position.

(i) Determine the time *t* for **one** oscillation.

Show your working.

t = ... s [2]

(ii) Repeat **(b)(i)** for four more values of *L* by moving the masses along the top surface of the metre rule. Ensure that the masses stick to the rule using the adhesive putty provided.

Record all your readings in Table 3.1.

Add appropriate headings with units to each column.

Table 3.1

[3]

(c) Explain why it is **not** practical to reduce the value of *L* to less than 40 cm.

....

.... [1]

(d) On the grid, plot a graph of *t* on the *y*-axis against *L* on the *x*-axis.

You do **not** need to start your graph from the origin (0, 0).

Draw the straight line of best fit.

[4]

[Total: 14]

4 A student places a small metal container inside a larger metal container, as shown in Fig. 4.1. There is an air gap between the two containers. The student investigates the effect of the size of the air gap on the rate of cooling of hot water.

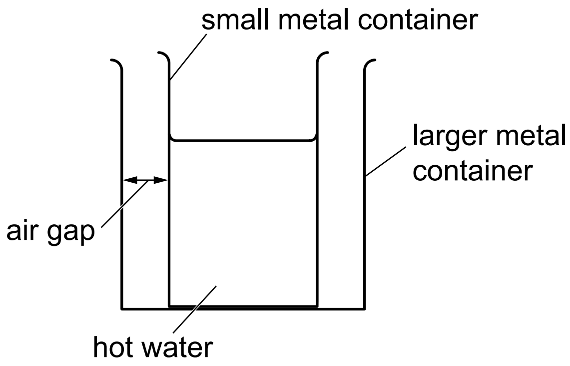

Fig. 4.1

Plan an experiment to investigate the effect of the size of the air gap between the small metal container and larger metal containers on the rate of cooling of hot water.

The following apparatus is available:

a small metal container
a number of metal containers of different diameters (all larger than the small container)
a thermometer
a stopwatch
a measuring cylinder
a supply of hot water.

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

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

In your plan, you should:

- explain briefly how to carry out the investigation
- state the key variables to control
- 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)
- explain how to use your readings to reach a conclusion.

A diagram is **not** required but you may draw one if it helps your explanation.

....

....

....

....

....

....

....

.... [6]