Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

9572284243

PHYSICS **5054/32**

Paper 3 Practical Test **May/June 2024**

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 investigate the resistance of a diode when different currents flow through it.

You are provided with:

- a power source
- an ammeter
- a voltmeter
- a diode
- a 3.3 Ω resistor, a 6.8 Ω resistor and a 10 Ω resistor
- a switch
- a resistor labelled P
- two spare connecting leads.

The supervisor has set up the circuit shown in Fig. 1.1.

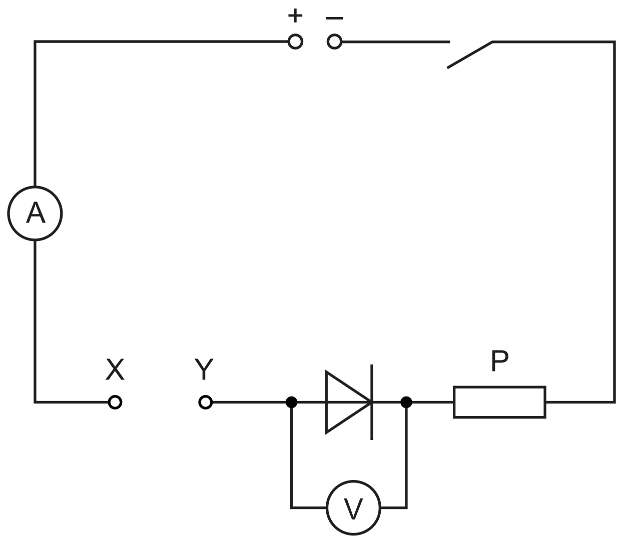

Fig. 1.1

(a)
- Use a spare connecting lead to connect the terminals X and Y together.
- Close the switch.
- Record the voltmeter reading *V* in the top row of Table 1.1.
- Record the ammeter reading *I* in the top row of Table 1.1.
- Open the switch and remove the connecting lead.

[2]

Table 1.1

resistance between X and Y / Ω	voltmeter reading V / V	ammeter reading I / A	resistance R of diode / Ω
0			
3.3			
6.8			
10			

(b)
- Use both spare connecting leads to connect the 3.3 Ω resistor between terminals X and Y.
- Close the switch.
- Record the voltmeter reading V in Table 1.1.
- Record the ammeter reading I in Table 1.1.
- Open the switch and remove the connecting leads and the 3.3 Ω resistor.

[2]

(c) Repeat the procedure in **(b)** for the resistors of 6.8 Ω and 10 Ω. [1]

(d) Calculate the resistance R of the diode for each pair of readings of V and I, using the equation:

$$R = \frac{V}{I}$$

Record your answers in Table 1.1. [2]

(e) As the resistance between terminals X and Y is changed, the current in the circuit changes.

Examine your results in Table 1.1.

Describe how the change in **current** affects:

(i) the voltage across the diode ....

.... [1]

(ii) the resistance of the diode. ....

.... [1]

(f) A student sets up a circuit using the diagram shown in Fig. 1.1.

The student finds that, when the connecting lead is connected across the terminals X and Y and the switch is closed, the ammeter does not give a reading.

The ammeter is not broken.

Suggest the error that the student has made while assembling the circuit.

....

.... [1]

[Total: 10]

2 In this experiment you will investigate the rate of cooling of hot water in a test-tube under different conditions.

You are provided with:

- a test-tube
- a 250 cm^3 glass beaker
- a thermometer, –10 °C to 110 °C, graduated in 1 °C intervals
- a 100 cm^3 or 250 cm^3 measuring cylinder
- a stop-watch
- a clamp, boss and stand
- a supply of hot water (approximately 80 °C)
- a supply of cold water (at room temperature)
- a supply of warm water (approximately 40 °C).

(a) The test-tube has been arranged as shown in Fig. 2.1.

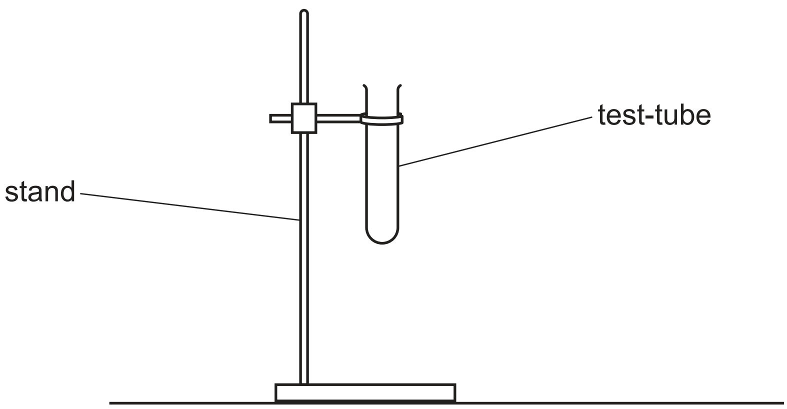

Fig. 2.1

- Pour 200 cm^3 of cold water into the beaker.
- Ask the supervisor to pour hot water into the test-tube until it is approximately one-third full.
- Lower the test-tube into the beaker of cold water until the level of the hot water in the test-tube is below the level of the cold water in the beaker. See Fig. 2.2.

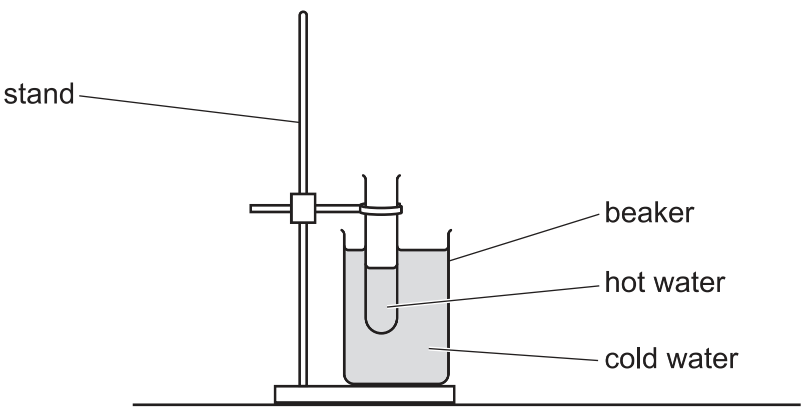

Fig. 2.2

- Place the thermometer into the test-tube.
- Wait for approximately 30 s before measuring the temperature and starting the stop-watch.

(i) Measure the temperature θ of the hot water in the test-tube and start the stop-watch immediately.

Record the temperature at time t = 0 in the second column of Table 2.1. [1]

Table 2.1

time t/s	test-tube cooling in cold water temperature θ/°C	test-tube cooling in warm water temperature θ/°C
0		
30		
60		
90		
120		
150		
180		

(ii) Measure the temperature θ of the hot water every 30 s for 180 s. Record your readings in the second column of Table 2.1. [2]

(b) Describe in detail **one** precaution that you take to make sure that the temperature measurements are as accurate as possible.

....

.... [1]

(c)
- Empty the test-tube.
- Empty the cold water from the beaker.
- Pour 200 cm^3 of **warm** water into the beaker.
- Ask the supervisor to pour hot water into the test-tube until it is approximately one-third full.
- Lower the test-tube into the beaker of warm water until the level of the water in the test-tube is below the level of the warm water in the beaker.
- Place the thermometer into the test-tube.
- Wait for approximately 30 s before measuring the temperature and starting the stop-watch.

Repeat the steps described in **(a)(i)** and **(a)(ii)**, recording your results in the third column of Table 2.1. [2]

(d) Calculate the temperature decrease of the hot water in the test-tube after cooling for 180 s in both the beaker of cold water and the beaker of warm water.

Use your temperature readings in Table 2.1.

temperature decrease when cooling in the cold water = ... °C

temperature decrease when cooling in the warm water = ... °C
[1]

(e) **(i)** Use your answers to **(d)** to decide how the temperature of the water in the beaker affects the **rate** of cooling of hot water in the test-tube.

State your conclusion.

....

....

.... [2]

(ii) Suggest **one** improvement to the experimental procedure described in **(a)** and **(c)** that allows a more valid comparison to be made between the two rates of cooling.

....

.... [1]

[Total: 10]

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3 In this experiment you will investigate the balancing of a loaded metre rule.

You are provided with:

- a metre rule with a load of mass *M* fixed to it
- a pivot
- a set of 10 g slotted masses.

The position of the load has been fixed, with its centre directly above the 5.0 cm mark.

Do **not** attempt to adjust the position of the fixed load during the experiment.

(a)
- Place the pivot under the 50.0 cm mark of the rule.
- Using the 10 g slotted masses, place another load of mass *m* = 50 g on the rule.
- Adjust the position of the load of mass *m* = 50 g until the rule is as close to balanced as possible as shown in Fig. 3.1.

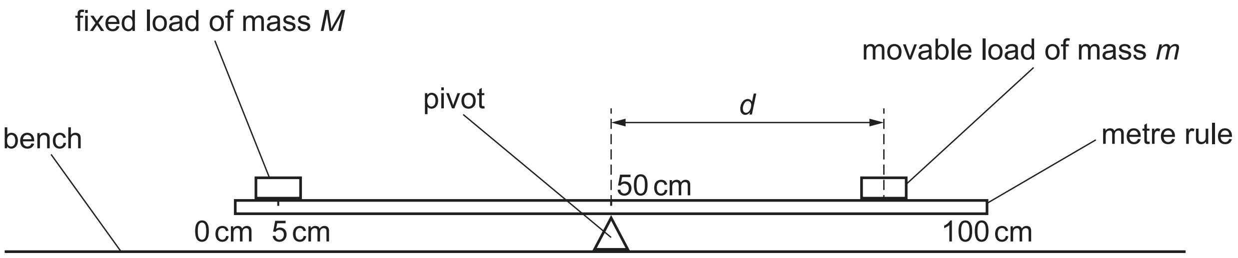

Fig. 3.1

Measure and record, to the nearest 0.1 cm, the distance *d* from the **centre** of the 50 g mass to the 50.0 cm mark on the rule when the rule is balanced.

d = ... cm [1]

(b) It is difficult to balance the rule exactly.

Describe the technique you use to make sure that your value of *d* is as accurate as possible.

....

....

.... [1]

(c) **(i)** Repeat **(a)** for values of mass *m* from 60 g to 100 g.

Record all your readings in Table 3.1. Include your readings from **(a)**.

Table 3.1

mass m / g	distance d / cm	$\frac{1000}{d} \Big/ \frac{1}{\text{cm}}$

[2]

(ii) Calculate the value of $\frac{1000}{d}$ for each value of *d*.

Record your values of $\frac{1000}{d}$ in Table 3.1 to an appropriate number of significant figures for this experiment. [2]

(d) On the grid provided in Fig. 3.2 on page 11, plot a graph of *m* on the *y*-axis against $\frac{1000}{d}$ on the *x*-axis. The axes do not need to start from the origin (0, 0).

Draw the straight line of best fit. [4]

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

G = ... [2]

Fig 3.2

(f) The mass M of the load fixed to the rule can be determined using the equation:

$$M = 22.2 \times G$$

Use your value of G from **(e)** to calculate the mass M of the load fixed to the rule.

mass M = ... g [1]

(g) Suggest why this method of determining the mass M of the load fixed to the rule is unsuitable if a movable load of mass m = 40 g is used.

....

.... [1]

[Total: 14]

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4 A student has a converging (convex) lens and needs to determine its focal length.

Plan an experiment that will enable the student to measure an accurate value for the focal length *f* of the lens.

The focal length *f* of a lens can be calculated using the equation:

$$f = \frac{uv}{u + v}$$

where *u* is the distance between an object and the lens and *v* is the distance between the focussed image of the object and the lens.

Fig. 4.1 shows some of the apparatus available.

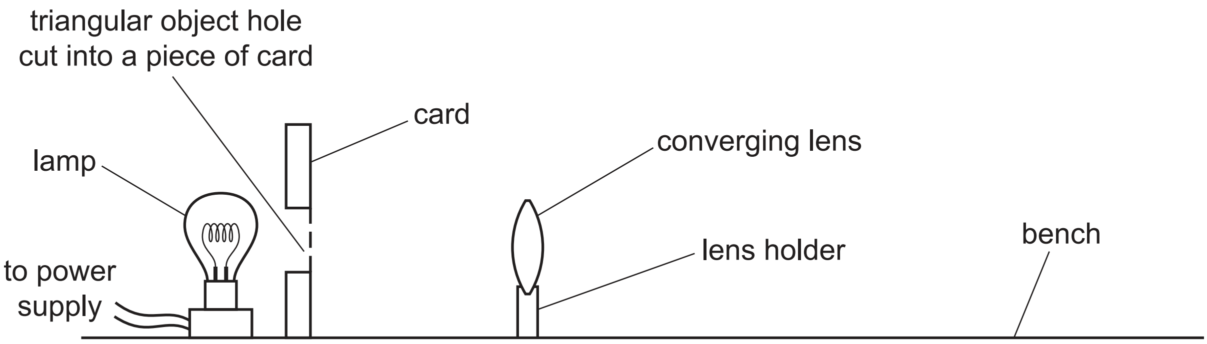

Fig. 4.1

The lamp is connected to a power supply and can be switched on and off as required.

Write a plan for the experiment.

You are not required to do this experiment.

In your plan you should:

- list any additional apparatus needed
- draw a diagram of the arrangement of the apparatus, labelling *u* and *v*
- explain briefly how to do the experiment
- state the steps taken to obtain a sharp, focussed image
- explain how to use your readings to determine *f*.

[6]

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