* 0000800000001 *

Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9183227412

PHYSICS **5054/31**

Paper 3 Practical Test **May/June 2025**

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 You will investigate the resistance of a lamp.

You are provided with a circuit consisting of:

- a power supply
- a lamp
- a switch in the 'off' position
- an ammeter
- a voltmeter.

You are also provided with a 10 Ω resistor and an additional connecting lead.

(a) The circuit shown in Fig. 1.1 has been set up for you.

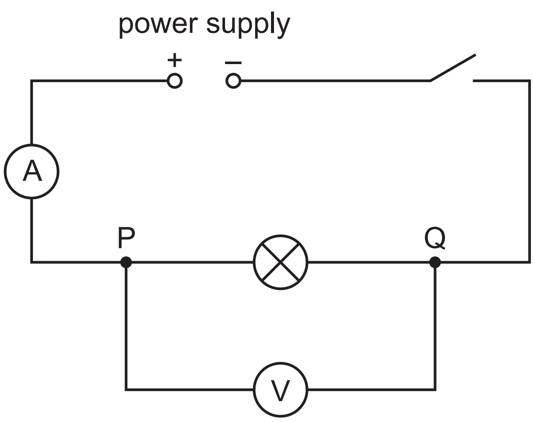

Fig. 1.1

(i) Close the switch.

Record the readings of current I_L and potential difference V_L.

I_L = ... A

V_L = ... V
[2]

Open the switch.

(ii) Suggest why you are instructed to open the switch after you have recorded the readings.

....

.... [1]

(iii) Use the equation:

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

to calculate the resistance R_L of the lamp.

Give your answer to 2 significant figures.

R_L = ... Ω [2]

(b) Disconnect the voltmeter at point P.

Add the 10 Ω resistor into the circuit in series with the lamp and reconnect the voltmeter as shown in Fig. 1.2.

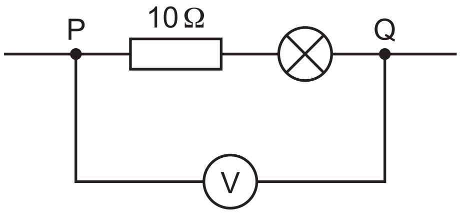

Fig. 1.2

(i) Repeat **(a)(i)** to find the readings of I_C and V_C.

Use the equation given in **(a)(iii)** to find the combined resistance R_C of the lamp and the resistor connected in series.

I_C = ... A

V_C = ... V

R_C = ... Ω [2]

(ii) Theory states that the value of the resistance of the lamp R_L in the circuit shown in Fig. 1.2 is given by:

$$R_L = R_C - 10\,\Omega$$

Find the resistance of the lamp R_L predicted by theory.

predicted R_L = ... Ω [1]

(iii) Use your values of the current in the circuits and any observations about the brightness of the lamp to explain why the value of R_L in **(b)(ii)** is lower than in **(a)(iii)**.

....

....

.... [2]

[Total: 10]

2 You will investigate the light reflected from a plane mirror.

You are provided with:

- a plane mirror in a holder
- a slit cut into card and a lamp to illuminate it, or a ray box and a single slit
- a protractor
- a 30 cm ruler.

(a) Fig. 2.1 shows a straight line AB.

Fig. 2.1

(i) Draw a line from point A at an angle of 30° in an anticlockwise direction from AB.

This line should be more than 10 cm long.

Label the end of the line as point C. [1]

(ii) Mark a point D on the line AB, 4.0 cm from point A.

Draw a line perpendicular to AB **through** point D.

This line must also pass **through** the line AC that you have drawn in part **(a)(i)**.

Label, with an E, the point where the line through point D passes through AC. [1]

(b) **(i)** Place the front surface of the mirror along the line AC on Fig. 2.1 with the reflective surface facing point B.

Using the illuminated slit, pass a ray of light along the line DE towards the mirror. The ray should reflect from the mirror.

Mark with crosses (X) **two** points on the reflected ray.

Label these points P_1 and P_2. [1]

(ii) Remove the mirror.

Draw a line through points P_1 and P_2 and extend it to meet line AC.

This is the reflection of the line DE. [1]

(iii) Describe how points P_1 and P_2 are chosen to give as accurate a reflected line as possible.

....

.... [1]

(iv) Label the angle between CE and EP_1 as θ.

Measure and record angle θ.

θ = ... ° [1]

(c) (i) Fig. 2.2 shows a second line labelled A′B′.

On Fig. 2.2, draw a line from point A′ at an angle of 60° in an anticlockwise direction from line A′B′.

This line should be more than 10 cm long.

Label the end of the line with a C′.

Fig. 2.2

Mark a point D′ on the line A′B′, 4.0 cm from point A′.

Draw a line perpendicular to A′B′ **through** point D′.

This line must also pass **through** the line A′C′ that you have drawn.

Label the point where the line through point D′ passes through A′C′ with an E′.

Place the front surface of the mirror along the line A′C′ on Fig. 2.1, with the reflective surface facing point B′.

Using the illuminated slit, pass a ray of light along the line D′E′ towards the mirror. The ray should reflect from the mirror.

Mark with crosses (X) **two** points on the reflected ray.

Label these points P_3 and P_4.

Remove the mirror.

Draw a line through points P_3 and P_4 and extend it to meet line A′C′.

This is the reflection of the line D′E′. [1]

(ii) Label the angle between C′E′ and E′P_3 on Fig. 2.2 as α.

Measure and record angle α.

α = ... ° [1]

(iii) Assume that the line E′P_3 has been drawn accurately.

State **one** practical precaution, other than your answer to **(b)(iii)**, that you take to ensure that the drawn angle α can be measured accurately.

....

.... [1]

(d) Theory suggests that:

$$\theta = 2\alpha$$

where θ is the answer to **(b)(iv)** and α is the answer to **(c)(ii)**.

State whether your results support this theory.

Give a reason for your answer.

....

....

.... [1]

[Total: 10]

3 You will investigate the time taken for water to flow through a small hole in the bottom of a can.

You are provided with:

- a clamp, boss and stand
- a can with a small hole at the bottom
- a supply of water in a 250 cm^3 beaker labelled 'supply of water'
- a 50 cm^3 measuring cylinder
- a 100 cm^3 measuring cylinder
- a funnel
- a stopwatch
- paper towels to mop up spillage.

Some of the apparatus has been arranged for you as shown in Fig. 3.1.

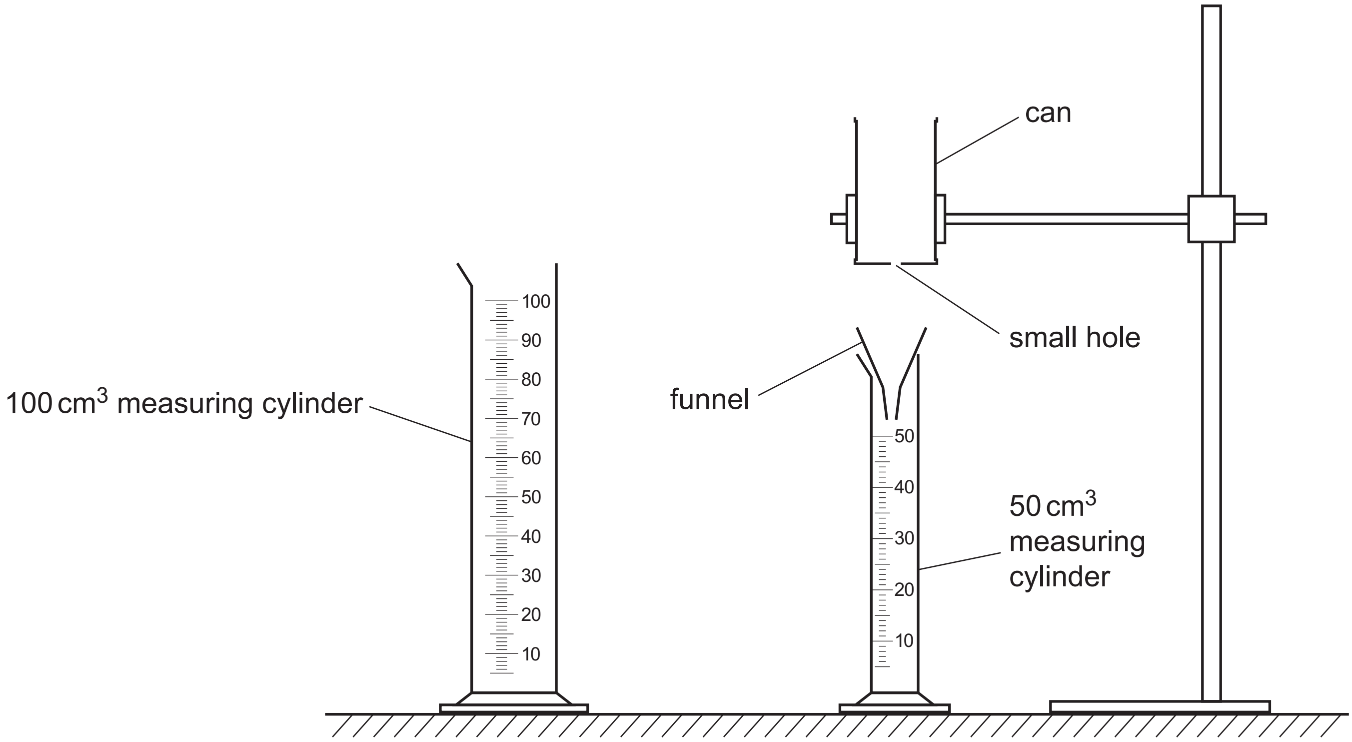

Fig. 3.1

(a) **(i)** Use the 100 cm^3 measuring cylinder to measure a volume $V = 70\,cm^3$ of water.

Hold your finger under the hole at the bottom of the can. Pour the volume V of water into the can.

Remove your finger and start the stopwatch immediately.

Stop the stopwatch when the volume of water in the 50 cm^3 measuring cylinder is 30 cm^3.

Put your finger back over the hole in the bottom of the can.

Unclamp the can and empty the water remaining in it, and the water in the measuring cylinder, back into the beaker labelled 'supply of water'.

The reading on the stopwatch is time t_1.

Record t_1.

t_1 = ... s [1]

(ii) Repeat **(a)(i)** one more time. Record the time as t_2.

Find the average time t_{av} of t_1 and t_2.

Give your answer to the nearest 0.1 s.

t_2 = ... s

t_{av} = ... s [2]

(iii) The average flow rate R is given by:

$$R = \frac{30\,cm^3}{t_{av}}$$

Calculate R and give the unit of your answer.

R = ... unit .... [2]

(b) Repeat **(a)(i)** and **(a)(ii)** for values of V = 100 cm^3, 90 cm^3, 80 cm^3, 60 cm^3 and 50 cm^3.

Record all your results, including those you obtained for volume V = 70 cm^3 in **(a)(i)** and **(a)(ii)**, in Table 3.1.

Calculate t_{av} for each value of volume V and enter your answers into Table 3.1.

Complete Table 3.1 by writing appropriate headings, with units, in the top row.

Table 3.1

V	....	....	....
100			
90			
80			
70			
60			
50			

[3]

(c) On the grid provided in Fig. 3.2, plot a graph of t_{av} on the y-axis against V on the x-axis.

You do **not** need to start your axes at (0, 0).

Draw the curve of best fit. [4]

(d) Suggest why values of t_1 and t_2 for values of V below 50 cm^3 are not measured.

....

.... [1]

(e) On your graph, sketch the line you would expect to see if the small hole in the can is made slightly bigger. Label this line L. [1]

[Total: 14]

Fig. 3.2

4 When a table tennis ball is dropped as shown in Fig. 4.1, it will bounce back upwards. Some of the initial gravitational potential energy (GPE) of the ball is lost in the bounce.

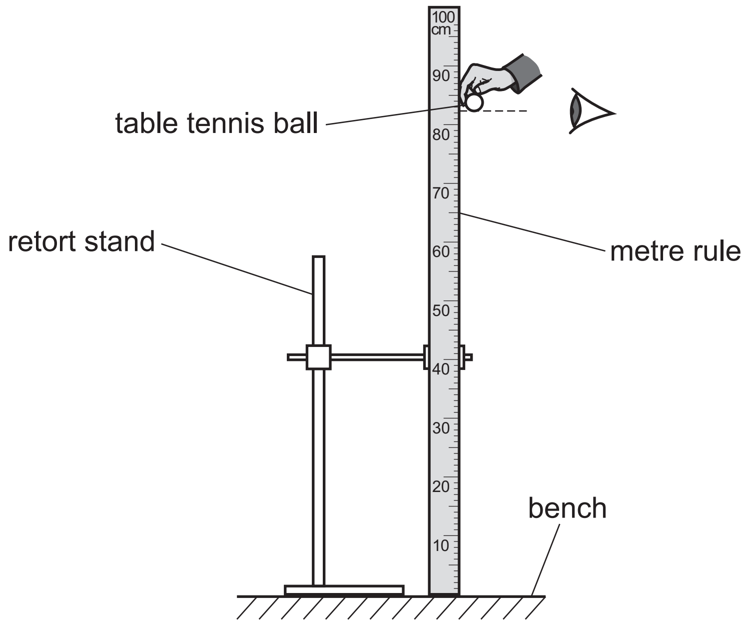

Fig. 4.1

Plan an experiment to investigate how the height from which the ball is dropped affects the percentage of GPE lost in each bounce.

You may use any apparatus commonly found in a school laboratory in addition to the apparatus shown in Fig. 4.1.

GPE is given by the equation:

$$GPE = mgh$$

where m is the mass of the ball, g is the gravitational field strength and h is the height above the bench from which the ball is dropped.

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

In your plan, you should:

- state what you will measure (dependent variable) and any additional apparatus you may use
- state any key variables to keep constant
- explain how you will ensure the results are as accurate as possible
- draw a table with column headings to display the results
- explain how you will use the results to draw a conclusion.

[6]

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