Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

2519588723

PHYSICS **5054/41**

Paper 4 Alternative to Practical **May/June 2017**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **8** printed pages.

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1 A strip of paper is attached to a small toy car. As the toy car moves, it pulls the strip of paper through a timer. The timer marks a dot on the paper every 0.020 s.

Fig. 1.1 shows a section of the paper strip with the first four dots marked. The first of these dots to be marked on the paper is labelled A.



Fig. 1.1 (full scale)

(a) (i) Tick the box that describes the motion of the car.

- ☐ acceleration
- ☐ constant speed
- ☐ deceleration

(ii) Explain your answer.

.....

.....

[2]

(b) The distance of each dot from A is *d*. Dot A was marked on the strip at time $t = 1.000$ s.

Take measurements from Fig. 1.1 and, in the space below, draw a table of results for *d* against *t*.

[4]

(c) Use your data to calculate the average speed of the car between $t = 1.000$ s and $t = 1.060$ s.

Use the equation

$$\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}.$$

average speed = ...[1]

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2 A student investigates the flow of water through a hole in the bottom of a straight-sided plastic bottle. A small circular hole is drilled in the bottom of the bottle. A scale is drawn on the side of the bottle, as shown in Fig. 2.1. The bottle is held in a clamp and placed above a sink.

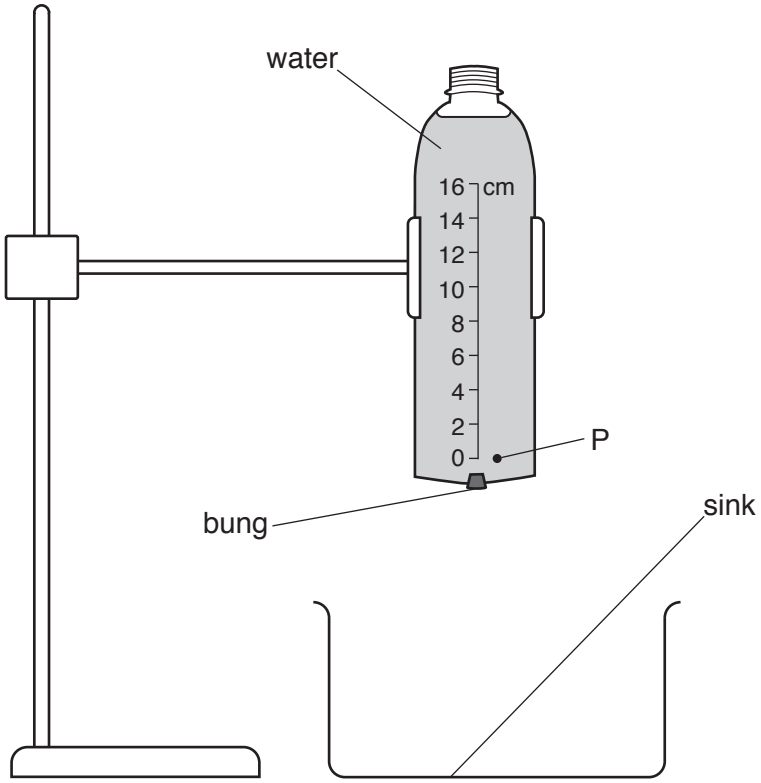


Fig. 2.1 (not to scale)

The student fills the bottle with water and removes the bung at the bottom. He starts his stopwatch when the water level passes one of the marks on the scale and stops it when the water level reaches P, a point which is a few centimetres above the base of the bottle. The water level falls a distance *h*.

(a) The time *t* for the water level to fall a distance *h* is measured three times.

When $h = 14.0\,\text{cm}$, the times measured in seconds are:

35.4 35.6 35.3

Calculate the average time t_{av}.

t_{av} = ...[1]

(b) The experiment is repeated for a range of values of h. The results are shown in Fig. 2.2.

h/cm	t_{av}/s
2.0	6.5
4.0	12.5
6.0	18.4
8.0	23.1
10.0	27.1
12.0	32.1
14.0	

Fig. 2.2

On Fig. 2.2, add your value for t_{av} from **(a)**.

On Fig. 2.3, plot a graph of t_{av}/s on the y-axis against h/cm on the x-axis.
Start both axes from the origin. Draw the smooth curve of best fit.

(c) The diameter d of the bottle is 10.0 cm. The average flow rate R of water is given by the equation

$$R = \frac{\pi d^2 h}{4 t_{av}}.$$

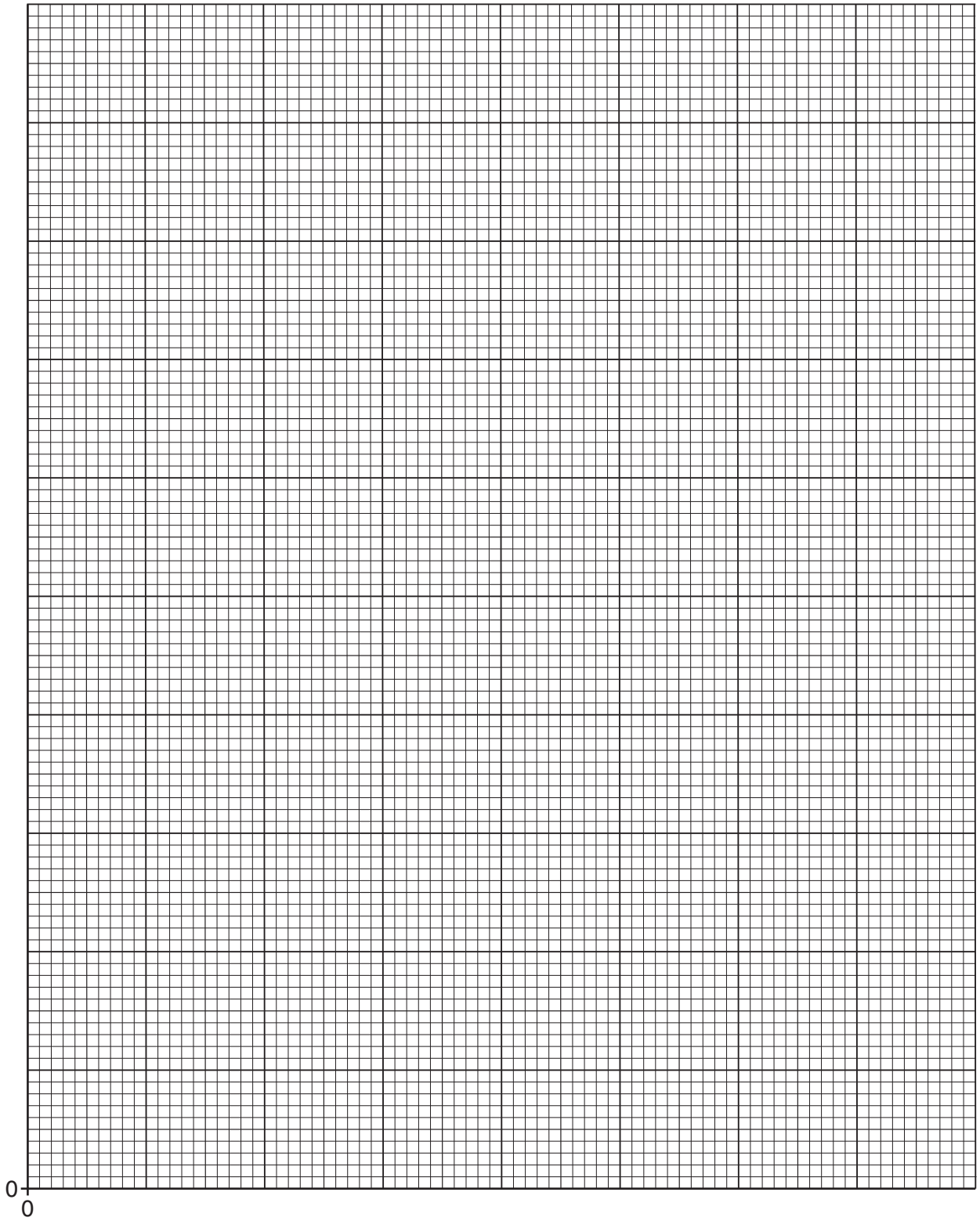
Use your answer to **(a)** to find the average flow rate for h = 14.0 cm. Give your answer to two significant figures.

R = ...cm^3/s [2]

(d) The student increases the diameter of the hole in the bottle and repeats the experiment.

On Fig. 2.3, draw a possible second curve to represent the results you expect from this larger hole. Label this line S. [1]

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[4]

Fig. 2.3

(e) Suggest why the student did not measure the time taken for the bottle to empty completely.

.....

.....

.....[1]

3 The lines AB and CD, as shown in Fig. 3.1, represent mirrors. A student traces a ray of light that reflects off both the mirrors.

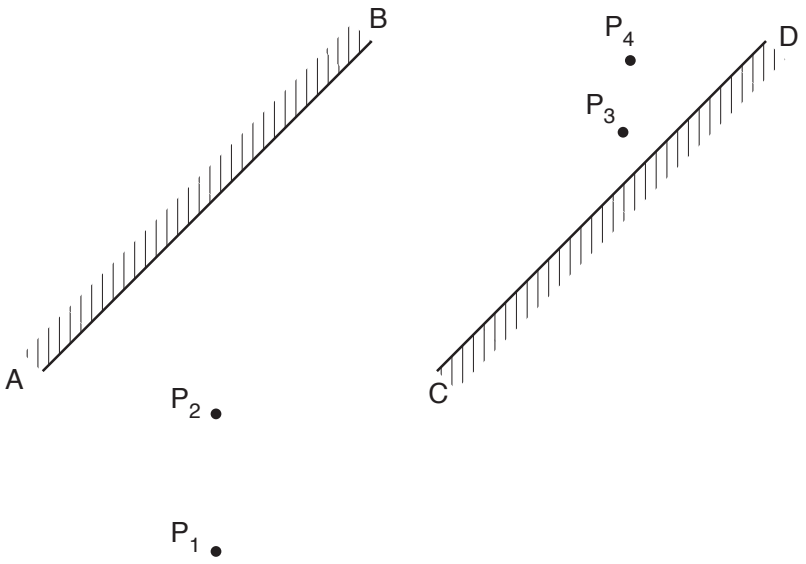


Fig. 3.1

The student places two optics pins P_1 and P_2 on the ray that is incident on the mirror AB. The student places two other optics pins P_3 and P_4 on the ray after reflection by the mirror CD.

(a) (i) On Fig. 3.1, using the positions of pins P_1, P_2, P_3 and P_4, draw lines to show the path of the ray through the mirror system. [1]

(ii) Describe the steps that you took to draw these lines.

.....

.....

.....[2]

(iii) State a precaution that you took to ensure that the lines are drawn accurately.

.....

.....[1]

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(b) The ray meets mirror AB at Q.

On Fig. 3.1,

(i) label Q,

(ii) draw the normal at Q,

(iii) measure the angle of incidence *i* at Q,

i = ...

(iv) measure the angle of reflection *r* at Q.

r = ...

[3]

(c) Explain how the student could improve the positions of P_3 and P_4 to achieve a more accurate value for the angle *r*.

.....

.....[1]

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4 A student determines the resistance R of a resistor. Fig. 4.1 shows the circuit used.

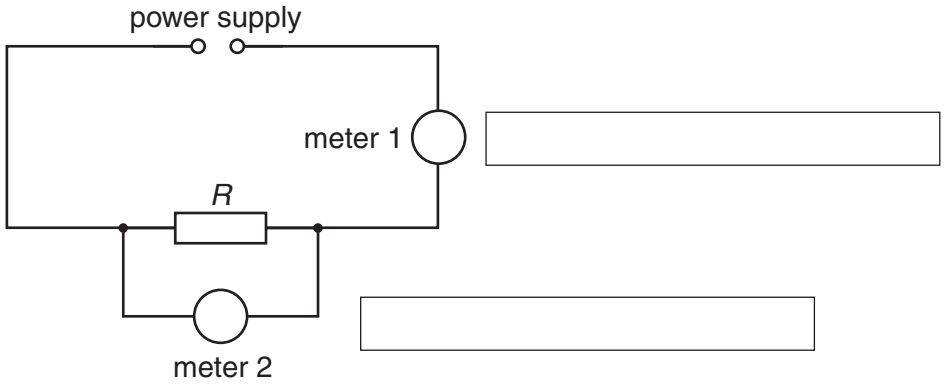


Fig. 4.1

(a) He uses two meters. In the boxes above, write the names of the meters. [1]

(b) State the quantities that are measured by these meters.

meter 1 measures ……..

meter 2 measures …….. [1]

(c) Fig. 4.2 shows the readings on the meters.

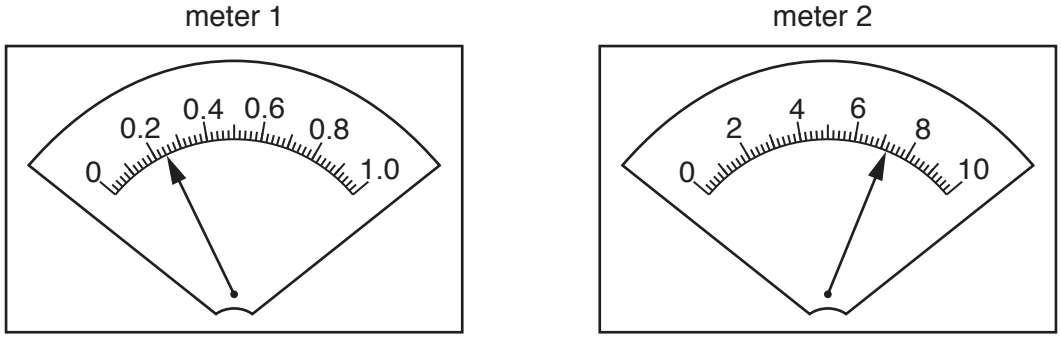


Fig. 4.2

Record the readings below.

meter 1 .....

meter 2 ..... [2]

(d) Use your readings to find the value of the resistance R using the equation

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

R = ...[1]

(e) Describe a precaution the student should take to ensure that the value for R is accurate.

.....

.....[1]