



# Cambridge IGCSE™

CANDIDATE  
NAME

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CENTRE  
NUMBER

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NUMBER

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## PHYSICS

0625/61

Paper 6 Alternative to Practical

May/June 2020

1 hour

You must answer on the question paper.

No additional materials are needed.

### 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.

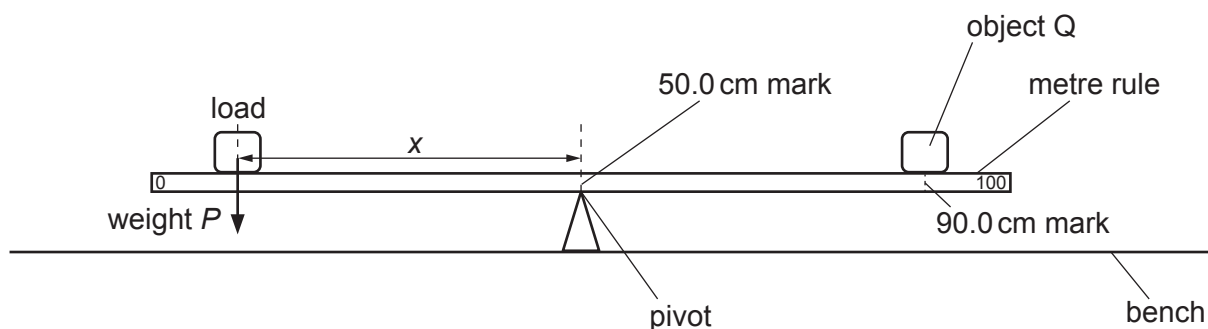
### INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Blank pages are indicated.

- 1 A student investigates the balancing of a metre rule.

Fig. 1.1 shows the arrangement.



**Fig. 1.1**

- (a) The student places the metre rule on the pivot at the 50.0 cm mark. He places an object Q on the metre rule with its centre at the 90.0 cm mark. He places a load of weight  $P = 2.0\text{ N}$  on the metre rule and adjusts the position of the load so that the metre rule is as near as possible to being balanced.

He measures the distance  $x$  from the centre of the load to the pivot.

He repeats the procedure using loads of weight  $P = 3.0\text{ N}$ ,  $4.0\text{ N}$ ,  $5.0\text{ N}$  and  $6.0\text{ N}$ . All the values of  $P$  and  $x$  are recorded in Table 1.1.

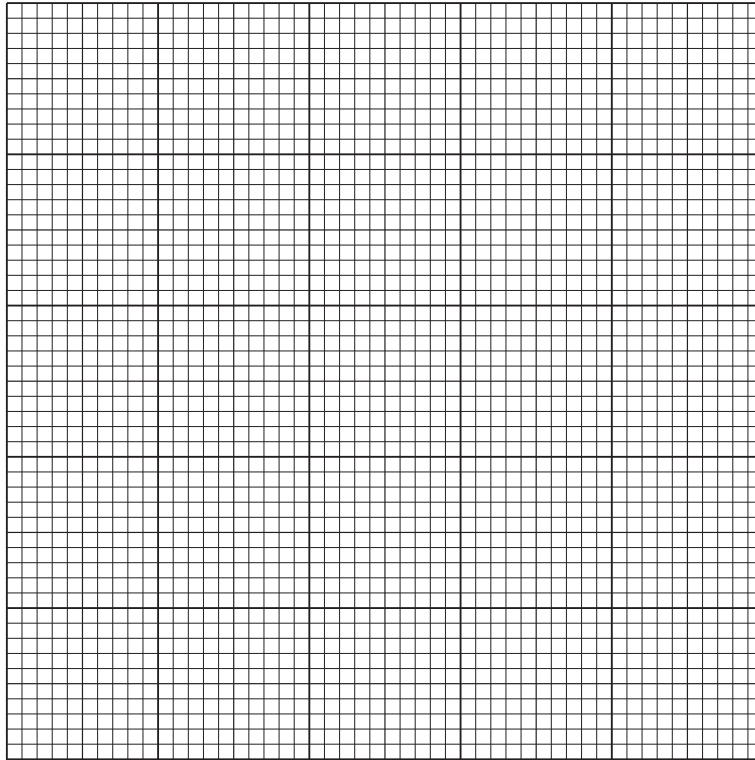
**Table 1.1**

$P/\text{N}$	$x/\text{cm}$	$\frac{1}{x} / \frac{1}{\text{cm}}$
2.0	40.0	
3.0	27.0	
4.0	20.0	
5.0	15.9	
6.0	13.3	

Calculate, and record in Table 1.1, the values of  $\frac{1}{x}$ .

[2]

- (b) Plot a graph of  $P/N$  ( $y$ -axis) against  $\frac{1}{x} / \frac{1}{\text{cm}}$  ( $x$ -axis). Start both axes at the origin (0,0).



[4]

- (c) In this experiment,  $x_{\text{max}}$ , the maximum possible value for  $x$  is 50.0 cm. Calculate  $\frac{1}{x_{\text{max}}}$ .

$$\frac{1}{x_{\text{max}}} = \dots\dots\dots \frac{1}{\text{cm}}$$

Use the graph to determine the minimum value of  $P$  required to balance the metre rule in this experiment. Show clearly on the graph how you determined this value.

minimum value of  $P = \dots\dots\dots$  [2]

(d) In this experiment, the width of object Q is slightly greater than the width of the metre rule. Explain briefly how you would place the object Q as accurately as possible on the 90.0 cm mark of the metre rule. You may draw a diagram.

.....  
.....  
.....  
..... [1]

(e) In this experiment, it is difficult to determine the exact position of the load that will make the metre rule balance.

(i) Explain briefly why this is difficult.

.....  
.....  
..... [1]

(ii) Explain briefly how you would find the best position of the load that will make the metre rule balance.

.....  
.....  
..... [1]

[Total: 11]

2 A student determines the resistances of some filament lamps.

Fig. 2.1 shows the first circuit she uses.

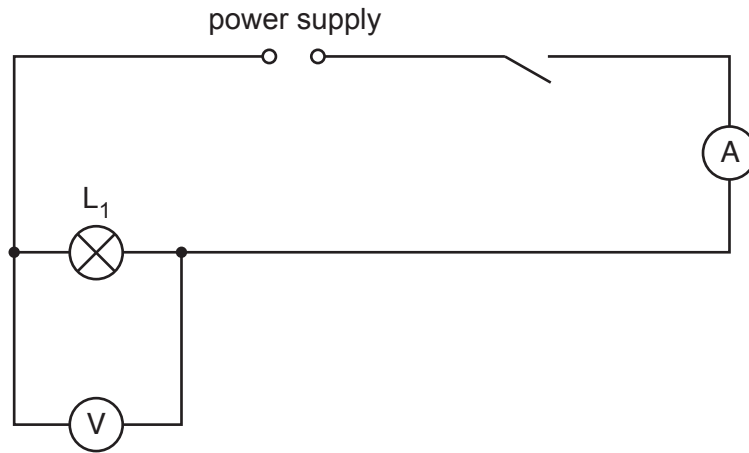


Fig. 2.1

(a) (i) Record the potential difference  $V_1$  across the lamp  $L_1$ , as shown on the voltmeter in Fig. 2.2.

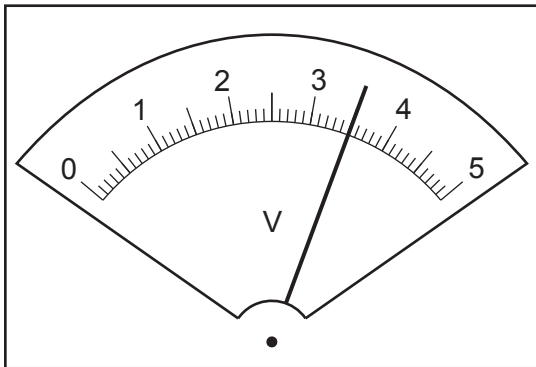


Fig. 2.2

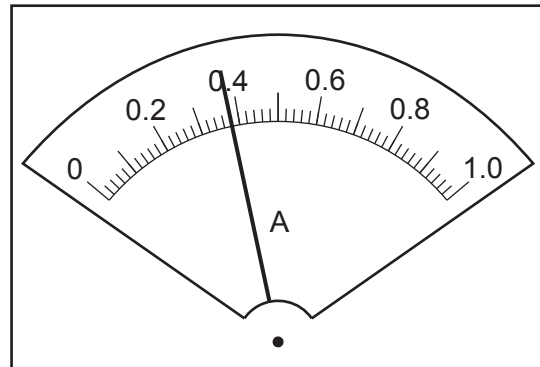


Fig. 2.3

$V_1 = \dots\dots\dots$  V [1]

(ii) Record the current  $I_1$  in the circuit, as shown in Fig. 2.3.

$I_1 = \dots\dots\dots$  A [1]

(iii) Calculate the resistance  $R_1$  of the filament of lamp  $L_1$ . Use the equation  $R_1 = \frac{V_1}{I_1}$ . Include the unit.

$R_1 = \dots\dots\dots$  [2]

- (b) The student disconnects the voltmeter. She connects lamp  $L_2$  in series with lamp  $L_1$ . She connects the voltmeter across lamp  $L_2$ .

She measures the current  $I_2$  in the circuit and the potential difference  $V_2$  across lamp  $L_2$ .

$$I_2 = \frac{0.30 \text{ A}}{\dots\dots\dots}$$

$$V_2 = \frac{1.7 \text{ V}}{\dots\dots\dots}$$

Calculate the resistance  $R_2$  of the filament of lamp  $L_2$ . Use the equation  $R_2 = \frac{V_2}{I_2}$ .

$$R_2 = \dots\dots\dots$$

The student disconnects the voltmeter. She connects lamp  $L_3$  in series with lamps  $L_1$  and  $L_2$ . She connects the voltmeter across lamp  $L_3$ .

She measures the current  $I_3$  in the circuit and the potential difference  $V_3$  across lamp  $L_3$ .

$$I_3 = \frac{0.26 \text{ A}}{\dots\dots\dots}$$

$$V_3 = \frac{1.2 \text{ V}}{\dots\dots\dots}$$

Calculate the resistance  $R_3$  of the filament of lamp  $L_3$ . Use the equation  $R_3 = \frac{V_3}{I_3}$ .

$$R_3 = \dots\dots\dots [1]$$

- (c) Calculate  $R_1 + R_2 + R_3$ . Give your answer to a suitable number of significant figures for this experiment.

$$R_1 + R_2 + R_3 = \dots\dots\dots [1]$$

- (d) Some students make suggestions about the results of the experiment.

Suggestion **A**:  $R_1 + R_2 + R_3$  should be equal to  $3 \times R_1$ .

Suggestion **B**:  $R_1 + R_2 + R_3$  should be less than  $3 \times R_1$ .

Suggestion **C**:  $R_1 + R_2 + R_3$  should be greater than  $3 \times R_1$ .

State which suggestion **A**, **B** or **C** agrees with your results. Justify your answer by reference to your results.

statement .....

justification .....

.....

[2]

- (e) Draw a circuit diagram to show the circuit used in part (b) with all three lamps connected in series.

[3]

[Total: 11]

- 3 A student investigates the position of the image in a plane mirror.

Fig. 3.1 shows the ray-trace sheet he uses.

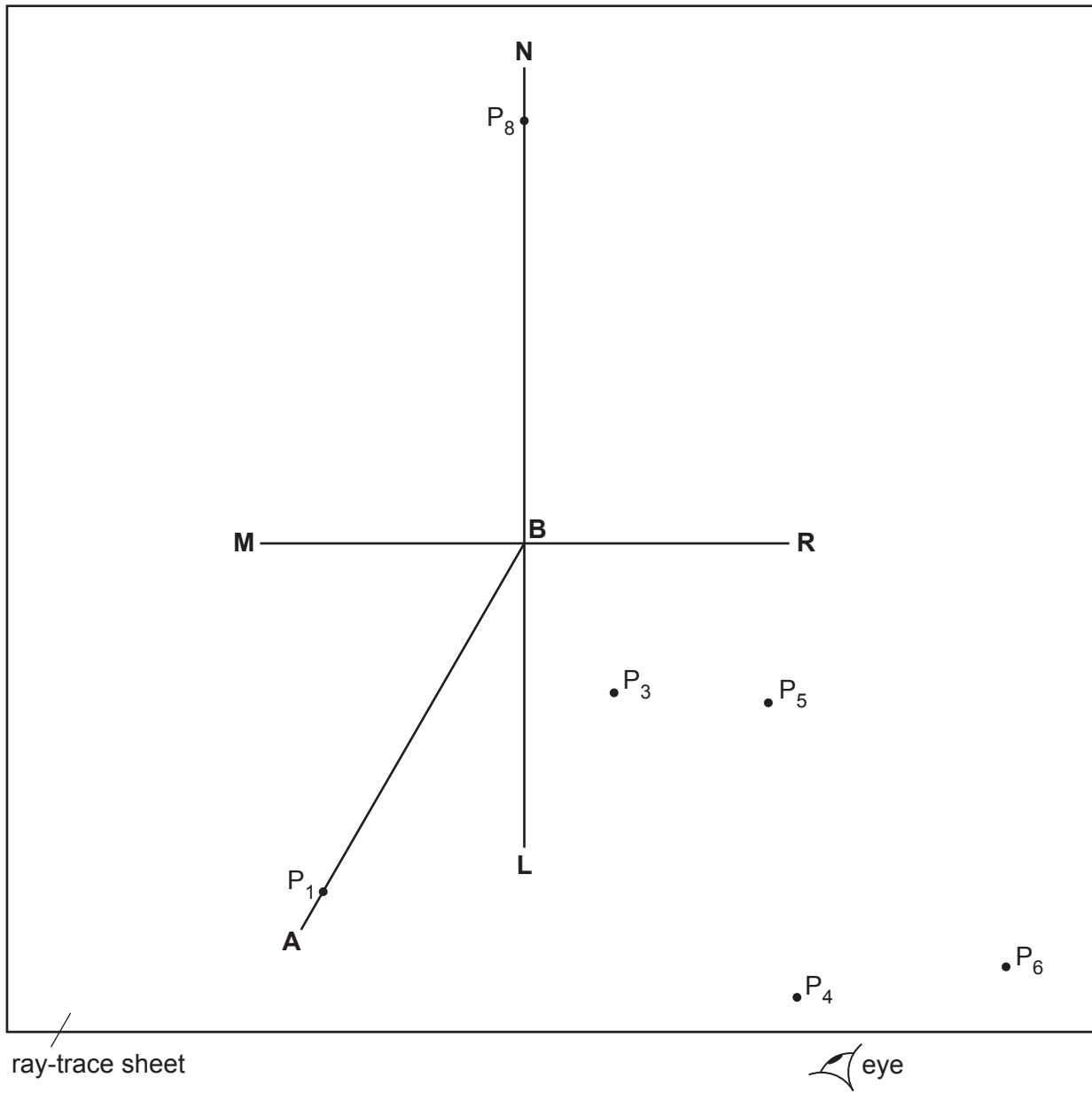


Fig. 3.1



(a)

- The student draws the line **MR**.
  - He draws a normal **NL** to this line that passes through the centre of **MR**.
  - He labels the point at which **NL** crosses **MR** with the letter **B**.
  - He draws a line from **B** at an angle of incidence  $i = 30^\circ$  to the normal below **MR** and to the left of the normal. He labels the end of this line **A**.
  - He places a pin  $P_1$  on line **AB**, as shown in Fig. 3.1. He places another pin  $P_2$  on the line **AB**.
  - He places the reflecting face of the mirror vertically on the line **MR**.
  - He views the images of pins  $P_1$  and  $P_2$  from the direction indicated by the eye in Fig. 3.1.
- (i) On Fig. 3.1, mark with a cross a suitable position for pin  $P_2$  in this experiment. [1]
- He places two pins  $P_3$  and  $P_4$  some distance apart so that pin  $P_3$  and the images of  $P_2$  and  $P_1$  all appear exactly behind pin  $P_4$ . The positions of  $P_3$  and  $P_4$  are shown on Fig. 3.1.
- (ii) Draw the line joining the positions of  $P_3$  and  $P_4$ . Continue the line until it extends at least 7.0 cm beyond **MR**. [2]

(b)

- The student keeps pin  $P_1$  in the same position but moves pin  $P_2$  so that the angle of incidence  $i = 40^\circ$ .
- The pin positions  $P_5$  and  $P_6$  for the reflected ray are marked on Fig. 3.1.

- (i) Draw the line joining the positions of  $P_5$  and  $P_6$ . Continue the line until it extends at least 7.0 cm beyond **MR**.

Label with the letter **Y** the point where the two lines cross beyond **MR**. [1]

- (ii) Draw a line from  $P_1$  to **MR** that meets **MR** at a right angle. Measure and record the length  $a$  of this line.

$a = \dots\dots\dots$  [1]

- (iii) Draw a line from the point labelled **Y** to **MR** that meets **MR** at a right angle. Measure and record the length  $b$  of this line.

$b = \dots\dots\dots$  [1]

(c)

- The student removes all the pins. He places pin  $P_7$  on the normal at a distance 6.0 cm from the front of the mirror.
- He views the image of  $P_7$  in the mirror.
- He places pin  $P_8$  on the normal behind the mirror.
- He adjusts the position of  $P_8$  so that the image of the bottom of the pin  $P_7$  and the top of pin  $P_8$  seen over the mirror appear as one pin when viewed from all angles in front of the mirror.

(i) On Fig. 3.1, measure the distance  $x$  along the normal between  $P_8$  and the mirror.

$x = \dots\dots\dots$  [1]

(ii) Complete the diagram in Fig. 3.2 to show the appearance of the image of pin  $P_7$  and pin  $P_8$  as described in (c).

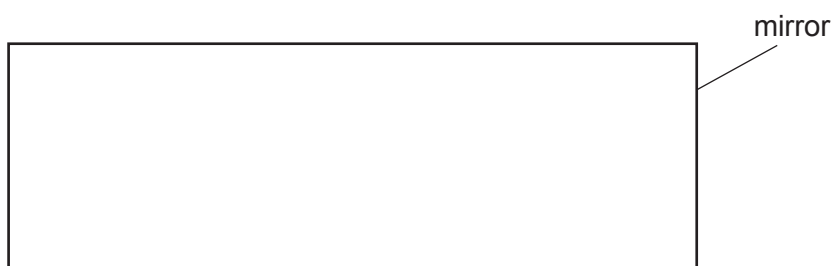


Fig. 3.2

[1]

(d) The student expects the readings to show that the image formed in a plane mirror is the same distance behind the mirror as the object is in front of the mirror. Readings of  $a = b$  and  $x = 6.0$  cm will show this.

State whether your readings show that the image formed in a plane mirror is the same distance behind the mirror as the object is in front of the mirror. Justify your statement by reference to the readings.

statement .....

justification .....

.....

[2]

(e) The student carries out this experiment with care. Suggest a practical reason why the results may not be accurate.

.....

..... [1]

[Total: 11]

- 4 A student investigates the effect of the colour of the surface of a metal container on the rate of loss of heat from the container. She knows that black surfaces are better radiators of thermal energy than white surfaces and wants to investigate the effect of other colours.

The following apparatus is available:

metal containers each with the outer surface painted a different colour  
a thermometer  
a stop-watch  
a supply of hot water.

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

Plan an experiment to investigate the effect of the colour of the surface of a metal container on the rate of loss of heat from the container.

You should:

- draw a diagram of the apparatus used
- explain briefly how you would carry out the investigation
- state the key variables to be kept constant
- draw a table, or tables, with column headings, to show how you would display your readings (you are **not** required to enter any readings in the table)
- explain how you would use your readings to reach a conclusion.

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