Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1437271428

PHYSICS **5054/41**

Paper 4 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 30.
- The number of marks for each question or part question is shown in brackets [ ].

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

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1 A student has two measuring cylinders. One cylinder contains water and the other cylinder contains ethanol, as shown in Fig. 1.1.

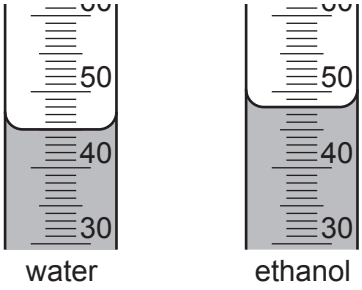


Fig. 1.1

(a) Write down the volumes of water and ethanol in the measuring cylinders shown in Fig. 1.1.

volume of water = ... cm^3

volume of ethanol = ... cm^3

[1]

(b) The student then pours the ethanol into the water and allows the liquids to mix. There is no chemical reaction.

Fig. 1.2 shows the volume of the mixture.

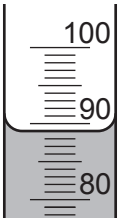


Fig. 1.2

(i) Use your answers to **(a)** to calculate the total volume of water and ethanol before they are mixed.

total volume before mixing = ... cm^3

Write down the combined volume of the mixture, as shown in Fig. 1.2.

combined volume = ... cm^3

[1]

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(ii) Suggest **one** possible reason for the difference between the two answers in **(b)(i)**.

.....

.....

..... [1]

(c) A second student says that the result after mixing must be incorrect.

State what the first student does to check the data.

.....

..... [1]

[Total: 4]

2 A student investigates the time taken for a glass ball to roll down a slope.

(a) She uses two metre rules, placed side by side with a small gap between them, to make a channel along which a ball can travel. A stack of identical sheets of paper is placed at one end to create the slope, as shown in Fig. 2.1.

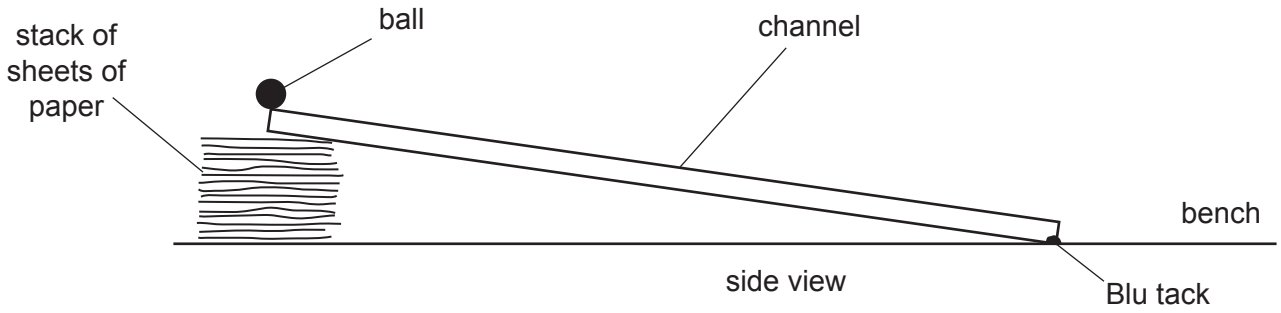


Fig. 2.1 (not to scale)

The height of the slope is changed by changing the number of sheets of paper in the stack.

(i) The slope is 100 cm long.

On Fig. 2.1, show the position of the ball when it has travelled 100 cm down the slope. [1]

(ii) The paper stack is made from 20 identical sheets of paper. The student uses a micrometer to find the height *h* of the stack. The micrometer reading is shown in Fig. 2.2. Write down the height *h* of the stack.

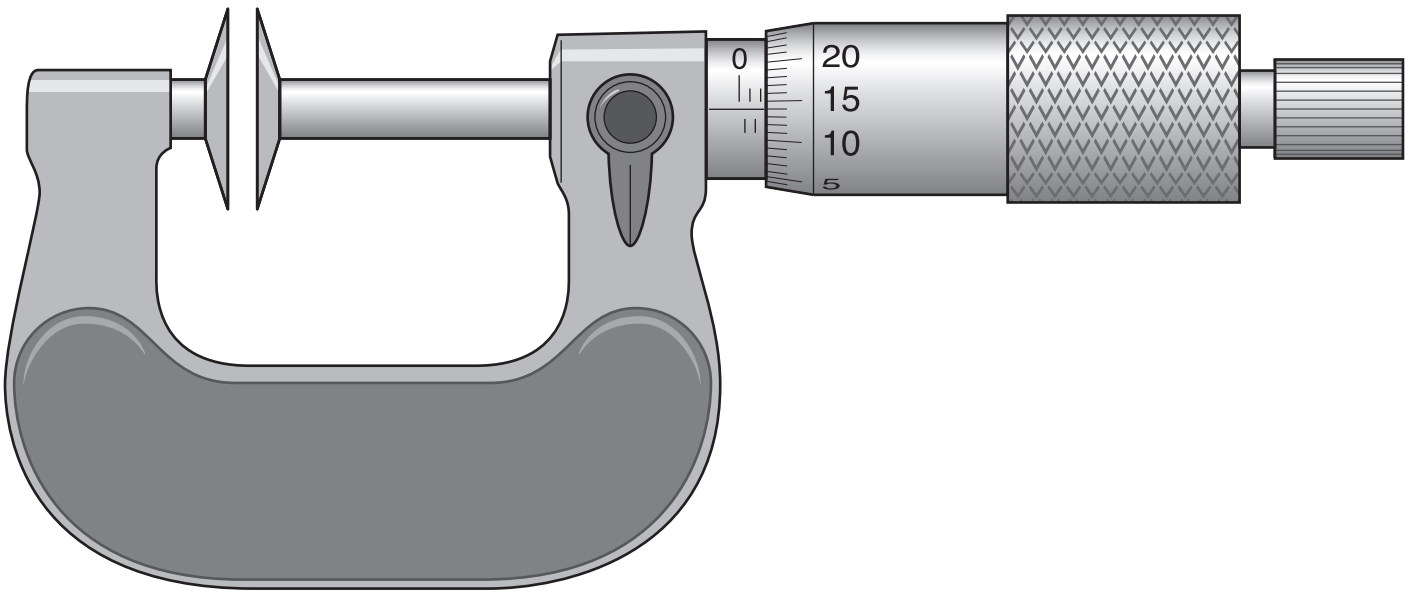


Fig. 2.2 (not to scale)

h = ... mm [1]

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(b) The student then uses a stop-watch to find the time taken for the ball to roll from the top to the bottom of the slope. She repeats the reading and gets the following values:

8.45 s 8.54 s 8.47 s 5.85 s 8.46 s

(i) Explain how the student uses this data to find the average time taken for the ball to roll down the slope.

.....

.....

..... [1]

(ii) Calculate the average time taken for the ball to travel down the slope. Give your answer to 2 significant figures.

Record your answer on the answer line and in Table 2.1 on page 6.

average time = ... s [2]

(iii) Explain why an answer to 2 significant figures is more appropriate for the average reading in this case.

.....

.....

..... [1]

(iv) Use the equation:

$$\text{average speed} = \frac{\text{distance}}{\text{average time}}$$

to calculate the average speed of the ball on the slope.

Give the unit of your answer.

average speed = ... unit ..... [2]

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[Turn over

(c) The student extends the experiment and changes the height of the slope by increasing the number *N* of sheets of paper used in the stack.

She finds the average time *t* for the ball to roll down the ramp for different values of *N*.

The results are shown in Table 2.1.

Table 2.1

N	average time *t* / s
20	
40	7.2
60	6.2
80	5.8
100	5.5
120	5.2
140	5.1

(i) Using the data from Table 2.1, draw, on the grid in Fig. 2.3, a graph of average time *t* on the *y*-axis against *N* on the *x*-axis. Start your axes from (0, 5.0) as shown.

Draw the best-fit curve. [4]

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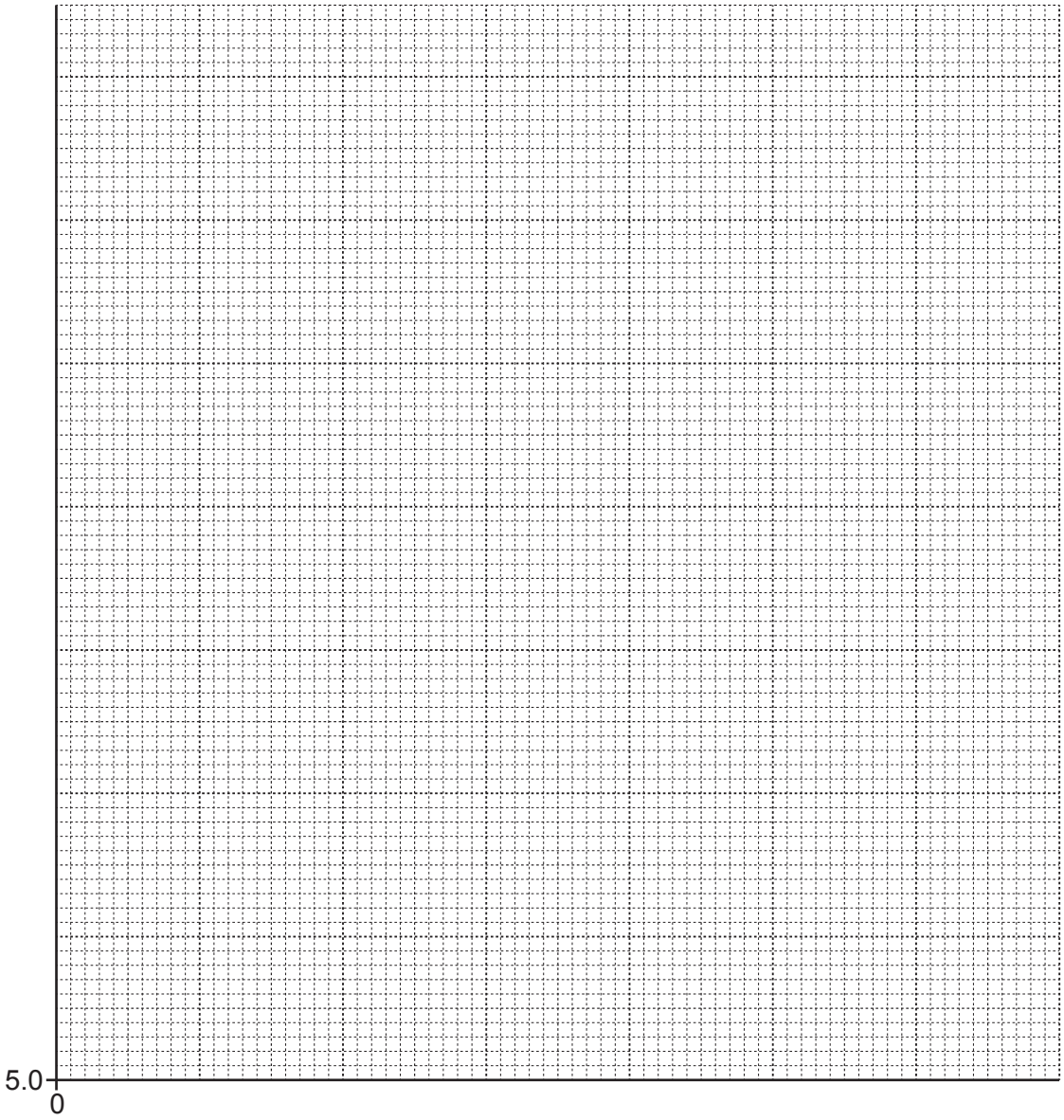


Fig. 2.3

(ii) State the relationship between *N* and the average speed of the ball.

..... [1]

(d) A second student carries out the same experiment but she does not have access to a micrometer.

Explain in detail how she can find an accurate value for the height of the stack of 20 sheets using a metre rule.

.....

.....

..... [2]

[Total: 15]

3 A student makes a periscope using cardboard tubing and mirrors. He looks through the periscope at a flower, as shown in Fig. 3.1.

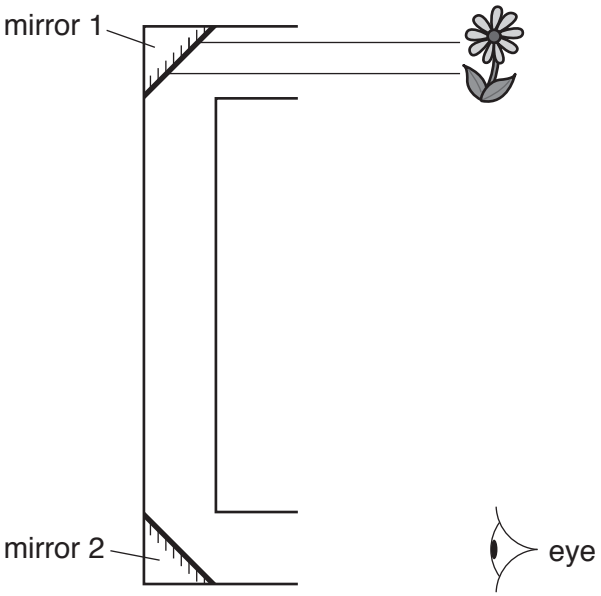


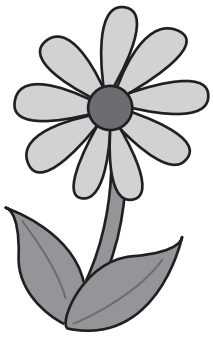
Fig. 3.1

Two rays of light are shown going from the flower to mirror 1.

(a) (i) Complete the ray diagram in Fig. 3.1 to show both rays as they reflect at mirror 1 and then mirror 2. [2]

(ii) Draw an arrow on each ray to show the direction in which light is travelling. [1]

(iii)



original flower image

Fig. 3.2

Fig. 3.2 shows the original flower.

On Fig. 3.2, sketch the image of the flower as seen by the student through the periscope. [2]

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(b) A second student also makes a periscope. Her periscope is shown in Fig. 3.3.

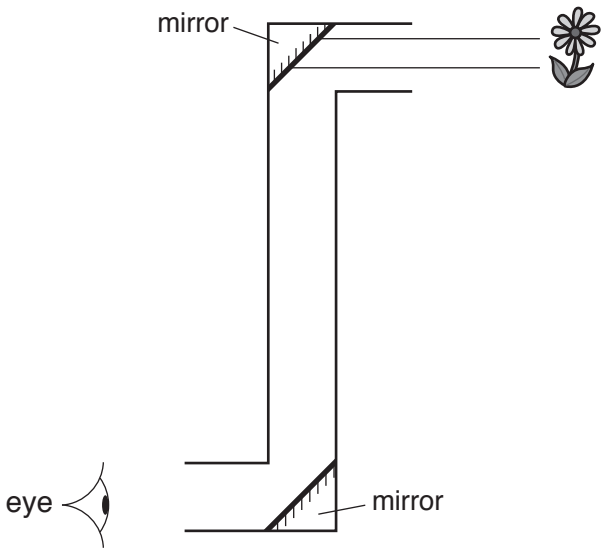


Fig. 3.3

State how the image of the flower seen by the second student differs from that seen by the first student.

You may draw the rays on Fig. 3.3 if you wish.

.....

..... [1]

[Total: 6]

4 A student is given two closed boxes. One box contains a fixed resistor and the other contains a filament lamp.

The student is asked to identify the contents of each box.

(a) Fig. 4.1 shows part of the circuit used to identify the contents of each box.

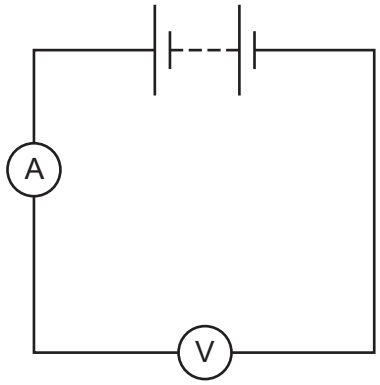
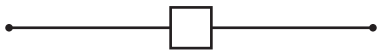


Fig. 4.1

On Fig. 4.1, show how a box is connected in the circuit so that the current through it and potential difference across it may be measured.

Use the symbol:



to represent the box. [1]

(b) The student now uses his circuit to identify the contents of the boxes.

(i) Describe how he uses the circuit.

The number of cells used can be varied.

.....

.....

..... [1]

(ii) State the readings that he takes.

.....

..... [1]

(iii) Explain how he uses his readings to decide which box contains the filament lamp.

.....

..... [2]

[Total: 5]

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