Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

6672908398

PHYSICS **5054/41**

Paper 4 Alternative to Practical **May/June 2019**

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 **11** printed pages and **1** blank page.

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Cambridge Assessment International Education

1 A student investigates how the resistance of a light-dependent resistor (LDR) depends on the brightness of light.

He uses a lamp to vary the brightness of light on the LDR. The LDR is mounted on a wooden block so that it is a distance l above the bench. The lamp is placed directly above the LDR at a distance h above the bench, as shown in Fig. 1.1.

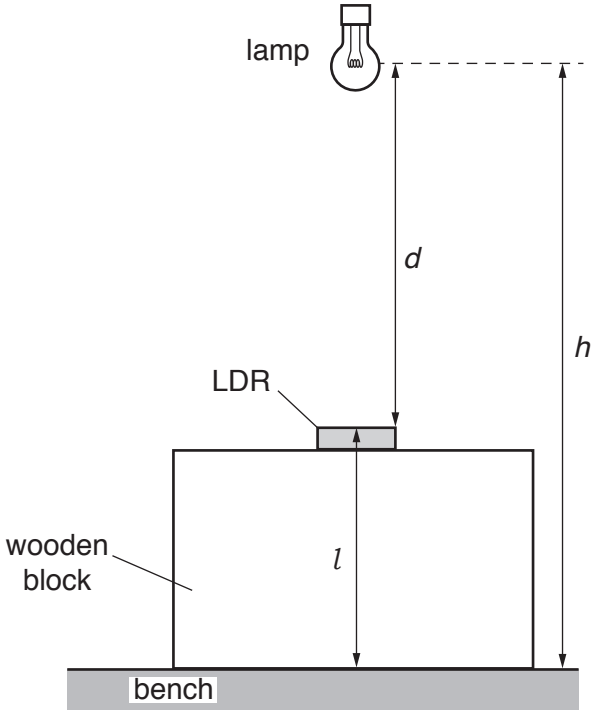


Fig. 1.1 (full scale)

(a) (i) On Fig. 1.1, measure the distances l and h.

l = ... cm

h = ... cm
[1]

(ii) Calculate the distance d from the lamp to the LDR.

d = ... cm [1]

(iii) The student uses a ruler to measure h.

Suggest one difficulty that the student has when making this measurement.

.....

..... [1]

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(b) (i) Fig. 1.2 shows some of the apparatus used in the experiment.

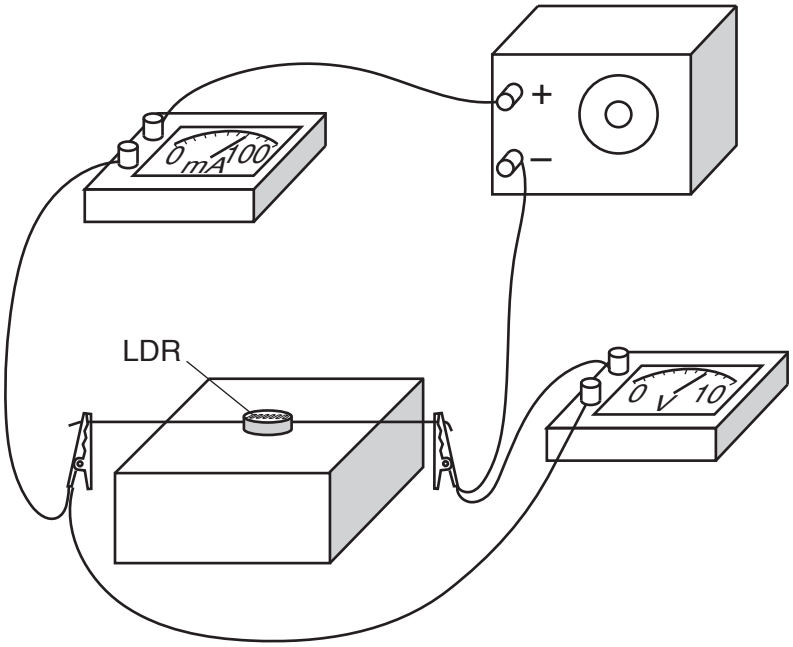


Fig. 1.2

In the space below, draw a circuit diagram for this apparatus.

[2]

(ii) Fig. 1.3 shows the readings of voltage V across the LDR and current I in the circuit when the lamp is at the distance d above the LDR calculated in **(a)(ii)**.

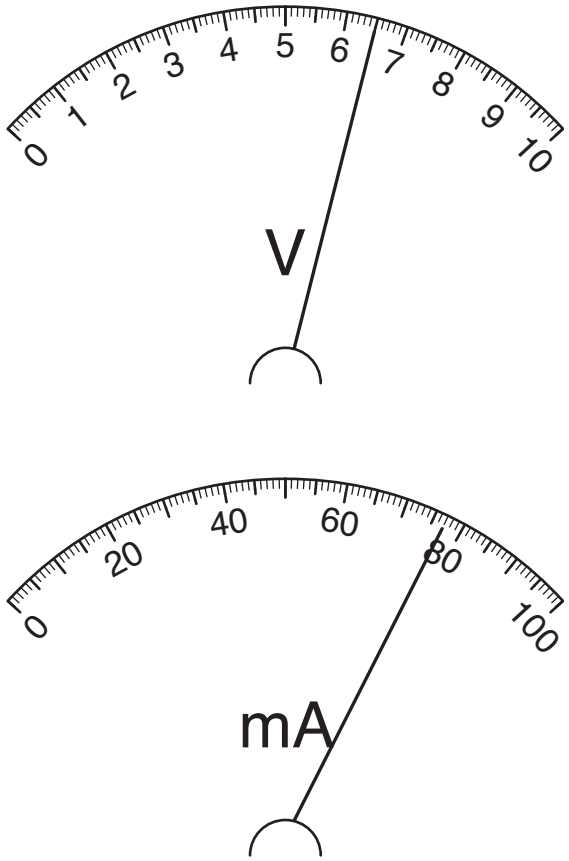


Fig. 1.3

1. Record the readings V and I.

V = ... V

I = ... mA
[1]

2. The resistance R of the LDR for this lamp position is calculated using the equation:

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

Calculate R, giving your answer to 2 significant figures with unit.

R = ... [2]

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(c) The student repeats the experiment for different values of *d*. The results are shown in Table 1.1.

Table 1.1

d/cm	*I*/mA
7.0	43
11.1	28
19.0	16
26.8	12
35.0	10

(i) Use the readings taken in **(a)(ii)** and **(b)(ii)** to complete the top row of Table 1.1.

On the grid in Fig. 1.4, plot the graph of *I*/mA on the *y*-axis against *d*/cm on the *x*-axis. Start your axes from (0,0).

Draw the smooth curve of best fit.

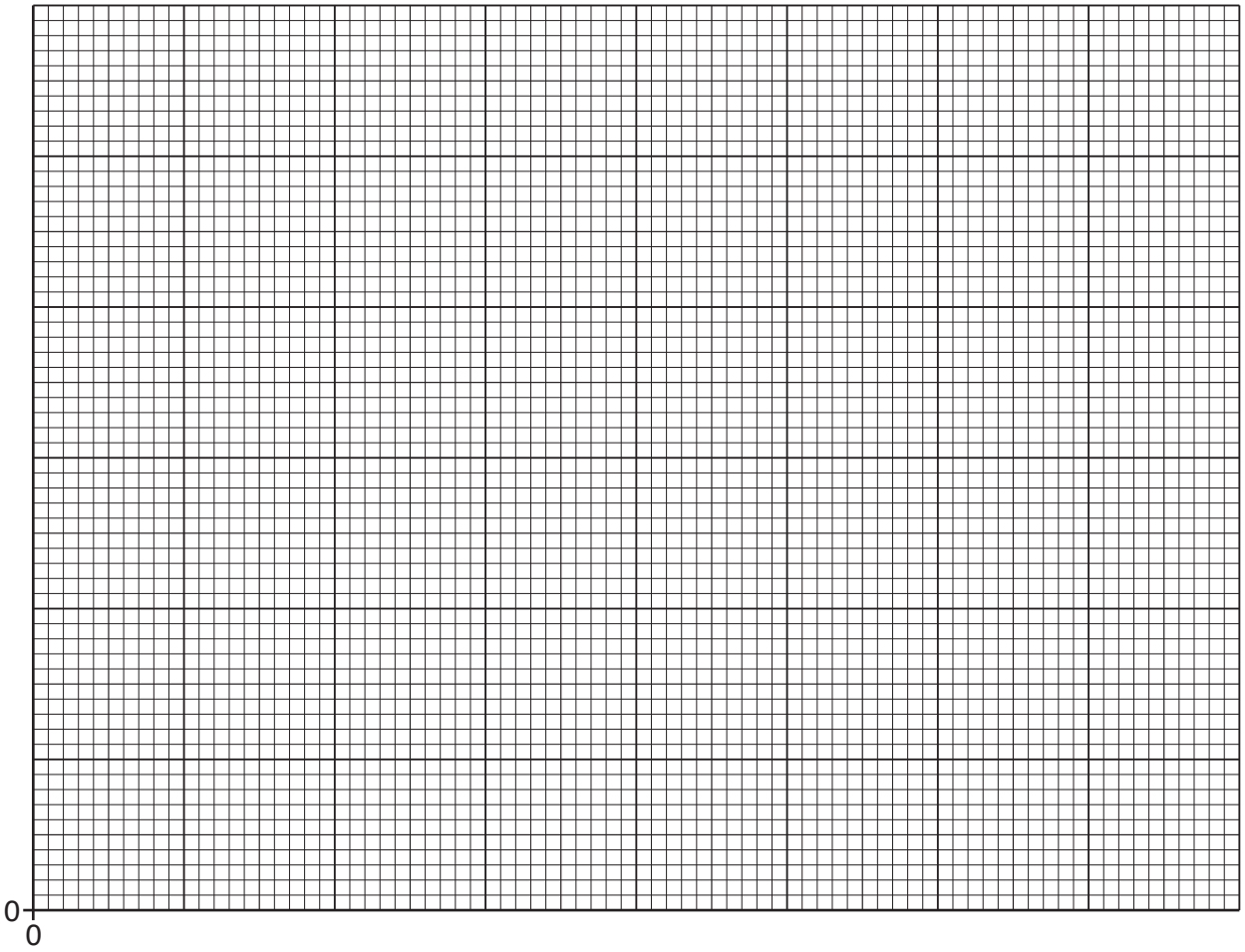


Fig. 1.4 [4]

(ii) The voltage *V* is constant throughout. Suggest how the resistance *R* of the LDR varies with *d*.

.....

..... [1]

[Total: 13]

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2 A student investigates the speed of sound *v* in air using an oscilloscope.

He uses the apparatus shown in Fig. 2.1.

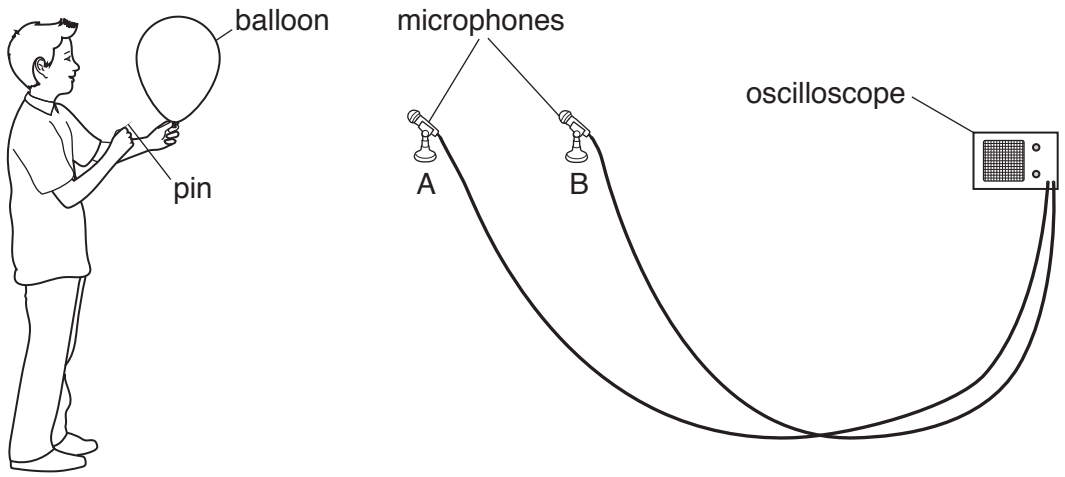


Fig. 2.1

(a) The balloon and the two microphones are in a straight line. The student uses a pin to burst the balloon, creating a loud sound. The sound is detected first by the microphone at A and then by the microphone at B. The corresponding traces on the screen of the oscilloscope are shown in Fig. 2.2.

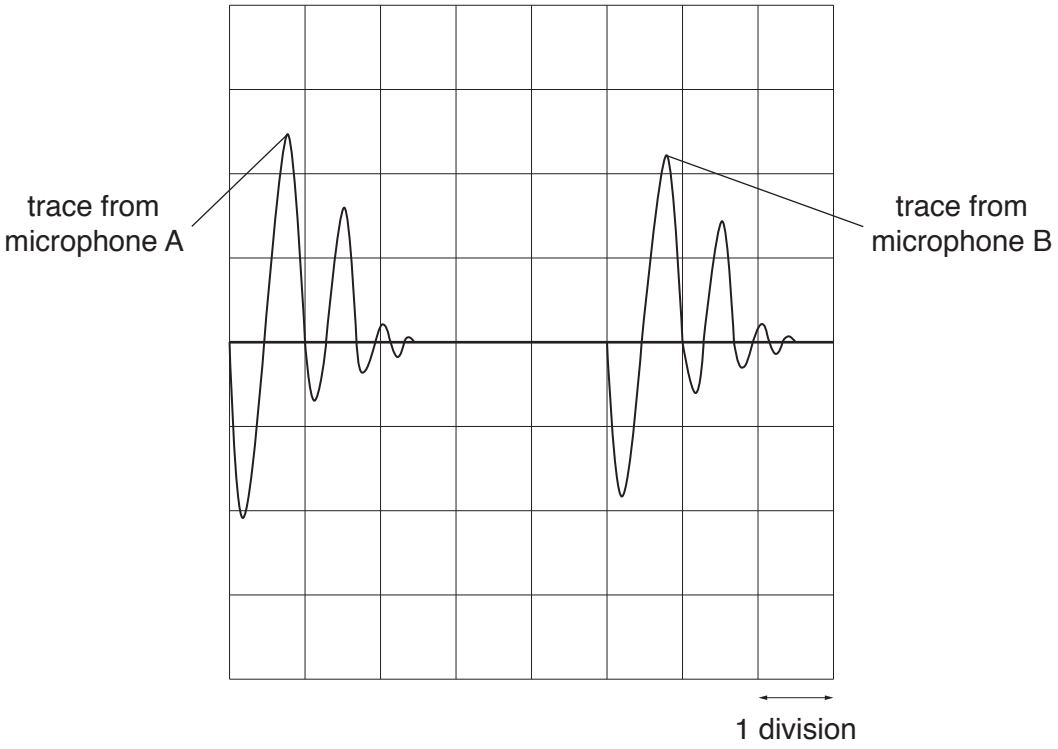


Fig. 2.2

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The timebase on the oscilloscope is set to 0.50 ms / division.

Use Fig. 2.2 to calculate the time for the sound to travel from A to B.

time = ... ms [1]

(b) The student uses an old metre rule to find the distance between A and B. Fig. 2.3 shows the position of A and of B on the metre rule, a distance of 82 cm apart.

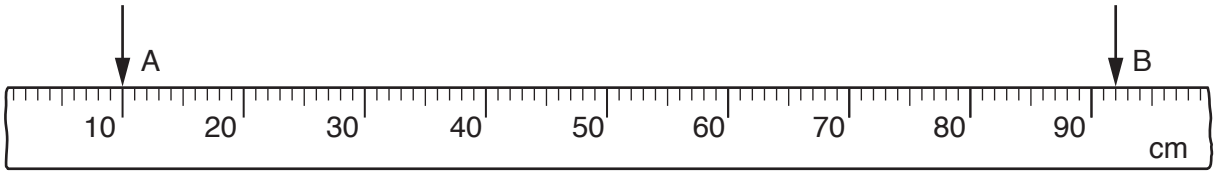


Fig. 2.3

Suggest a reason why the student did not place microphone A at the 0.0 cm mark on this metre rule.

.....

..... [1]

(c) Use the equation

$$v = \frac{\text{distance travelled}}{\text{time taken}}$$

to calculate the speed v of sound.

v = ... m / s [1]

(d) Suggest one way in which the student can obtain a more accurate value for v using the same apparatus.

.....

..... [1]

[Total: 4]

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[Turn over

3 A student investigates the upward force on a cylinder placed in water.

He attaches the cylinder to the end of a newton meter before it is placed in water, as shown in Fig. 3.1.

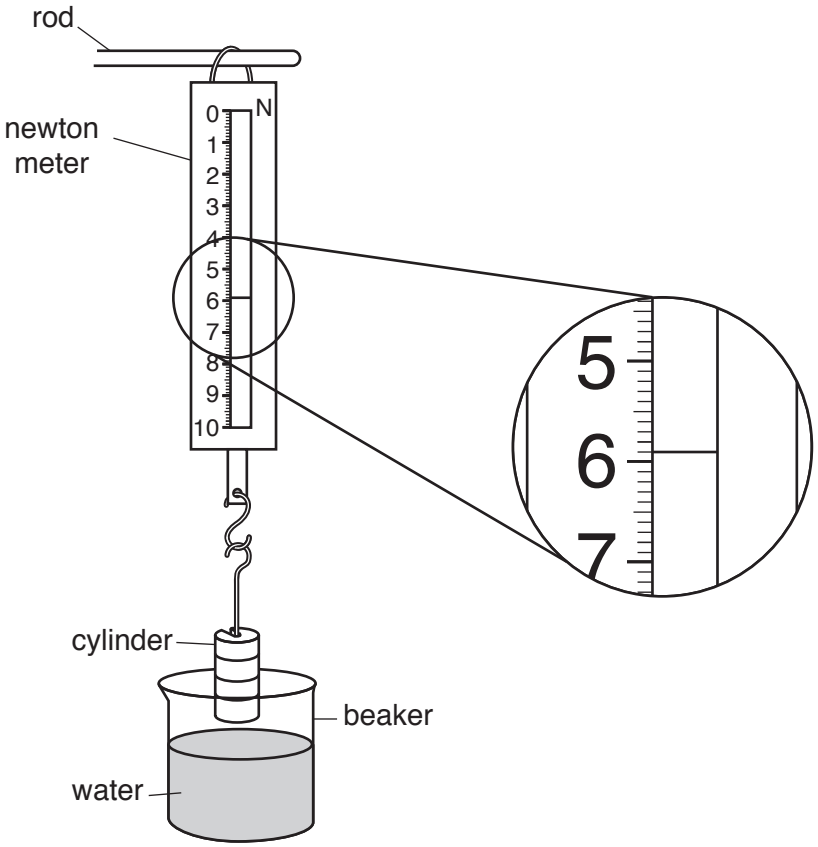


Fig. 3.1

(a) State the weight of the cylinder before it is placed in water.

weight = ... N [1]

(b) (i) The student lowers the cylinder into the beaker of water until it is fully immersed. The new reading is shown in Fig. 3.2.

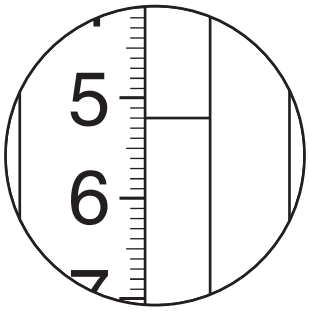


Fig. 3.2

State the new reading shown in Fig. 3.2.

reading on newton meter = ... N [1]

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(ii) Calculate the upward force on the cylinder due to the water.

upward force = ... N [1]

(c) The cylinder is shown in Fig. 3.3.

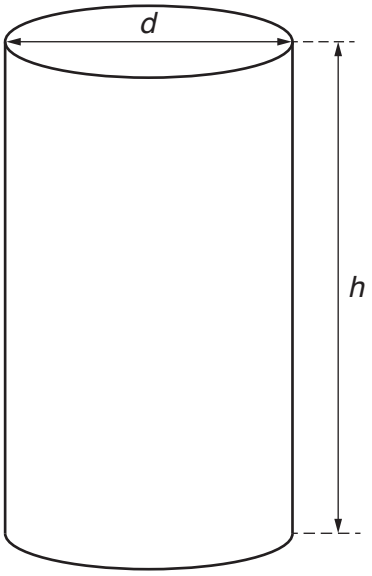


Fig. 3.3

(i) The height h of the cylinder is 6.5 cm and the diameter is 3.8 cm.

Calculate the volume V of the cylinder using the equation:

$$V = \frac{\pi d^2 h}{4}$$

V = ... cm^3 [1]

(ii) The diameter d is measured with a ruler.

Describe how this is done accurately. You may draw a diagram if you wish.

.....

.....

..... [1]

(iii) Theory suggests that the upward force on the cylinder is given by:

$$\text{upward force} = Vg\rho$$

where $g = 10\,\text{N/kg}$ and $\rho = 0.0010\,\text{kg/cm}^3$.

1. Use your value of V from **(c)(i)** to calculate the upward force suggested by this theory.

upward force = ... N [1]

2. State whether the value of the upward force determined in **(b)(ii)** supports the theory. Give a reason for your answer.

.....

.....

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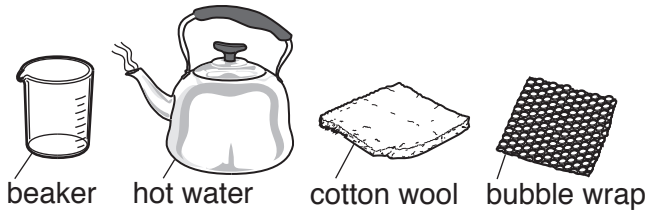
..... [1]

[Total: 7]

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4 A student does an investigation to find out whether cotton wool or bubble wrap is the better insulator. She is provided with the following apparatus:

- a 100 cm^3 glass beaker
- a supply of hot water
- a rectangular piece of cotton wool
- a rectangular piece of bubble wrap
- adhesive tape.



(a) State two further pieces of apparatus that are needed for the investigation.

..... [2]

(b) **(i)** Describe in detail how the student does the investigation.

State any measurements that need to be taken and explain how she decides which is the better insulator.

.....

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.....

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.....

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..... [3]

(ii) Explain how the student makes a fair comparison between the cotton wool and the bubble wrap.

.....

..... [1]

[Total: 6]

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