Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6586957715

PHYSICS **5054/41**

Paper 4 Alternative to Practical **May/June 2018**

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 **12** printed pages.

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CAMBRIDGE International Examinations

1 A student has two metal rods. One rod is made of copper and the other is made of iron. She carries out an experiment to see which metal is the better conductor. She lays the rods across a heat-proof mat placed on a tripod stand with the rods touching at one end, as shown in Fig. 1.1.

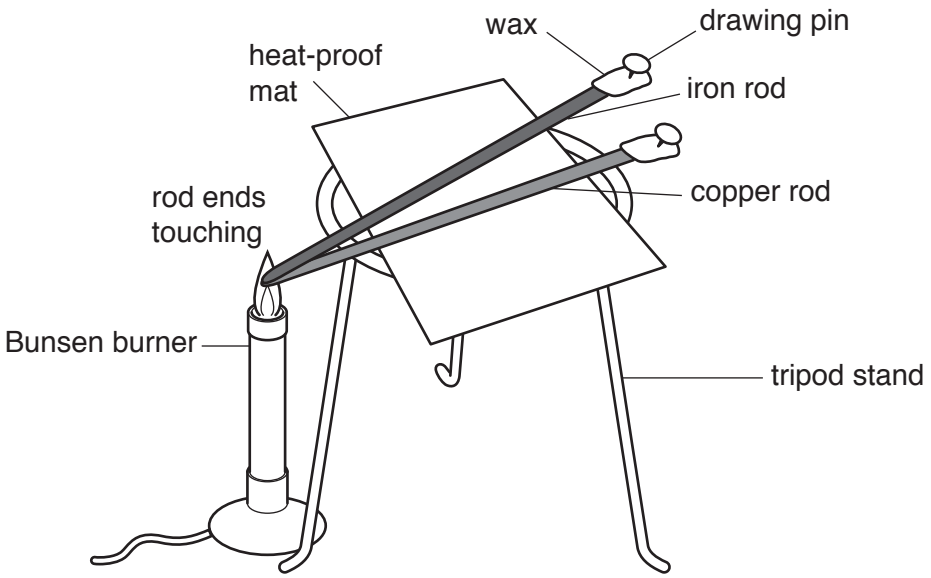


Fig. 1.1

She fixes a drawing pin to the other end of each rod using a small amount of wax, which has a low melting point. She then heats the rods at the touching ends as shown.

(a) State two features of the apparatus shown in Fig. 1.1 that ensure that the experiment is fair.

1. .....

2. .....
[2]

(b) Explain what happens and state how she determines which metal is the better conductor.

.....

.....[1]

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2 A student has two identical springs. He suspends them from a thin metal bar that is held in a horizontal position between two stands.

(a) He hangs a load from one of the springs, as shown in Fig. 2.1. This spring extends by a distance *h*.

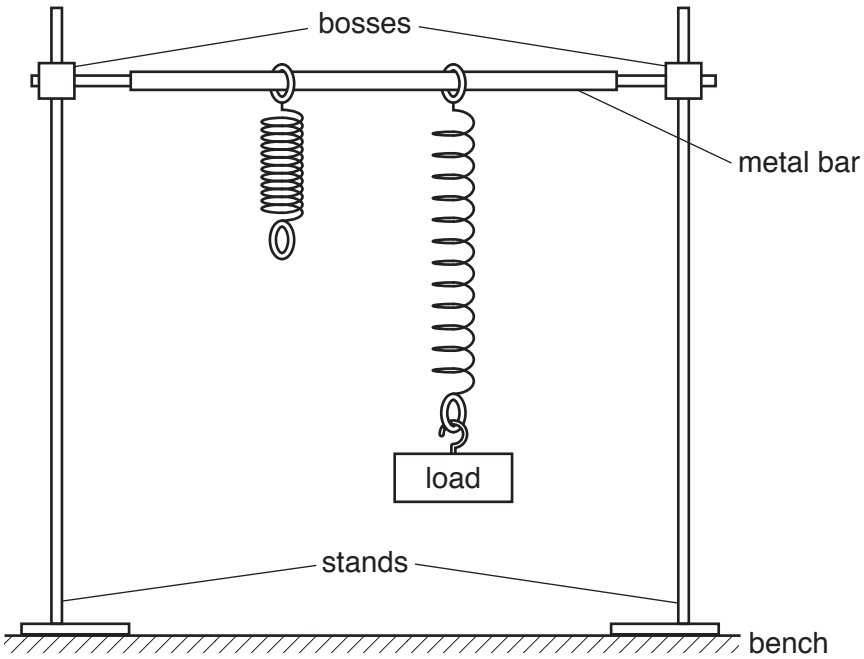


Fig. 2.1 (not to scale)

(i) On Fig. 2.1, show clearly the distance *h*. [1]

(ii) Describe a practical method that the student can use to ensure that he measures the distance *h* accurately.

.....

.....

.....

.....[1]

(b) The student removes the load and then inserts a small wooden rod of negligible mass into the rings at the end of each of the two springs. He suspends the load from the middle of the rod, as shown in Fig. 2.2. He checks that the wooden rod is horizontal and then measures the extension *h* of one of the springs.

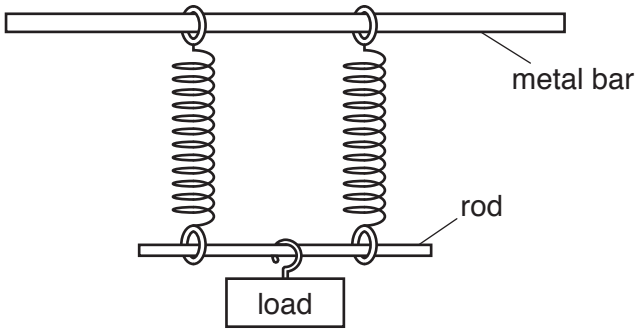


Fig. 2.2 (not to scale)

(i) Explain why it is important for the wooden rod to be horizontal.

.....

.....

.....[1]

(ii) Suggest how the student checks that the wooden rod is horizontal.

.....

.....

.....

.....[1]

(iii) The experiment is repeated using more identical springs until there are eight springs hanging side by side. The extension *h* is measured each time a spring is added. The results are shown in the table of Fig. 2.3.

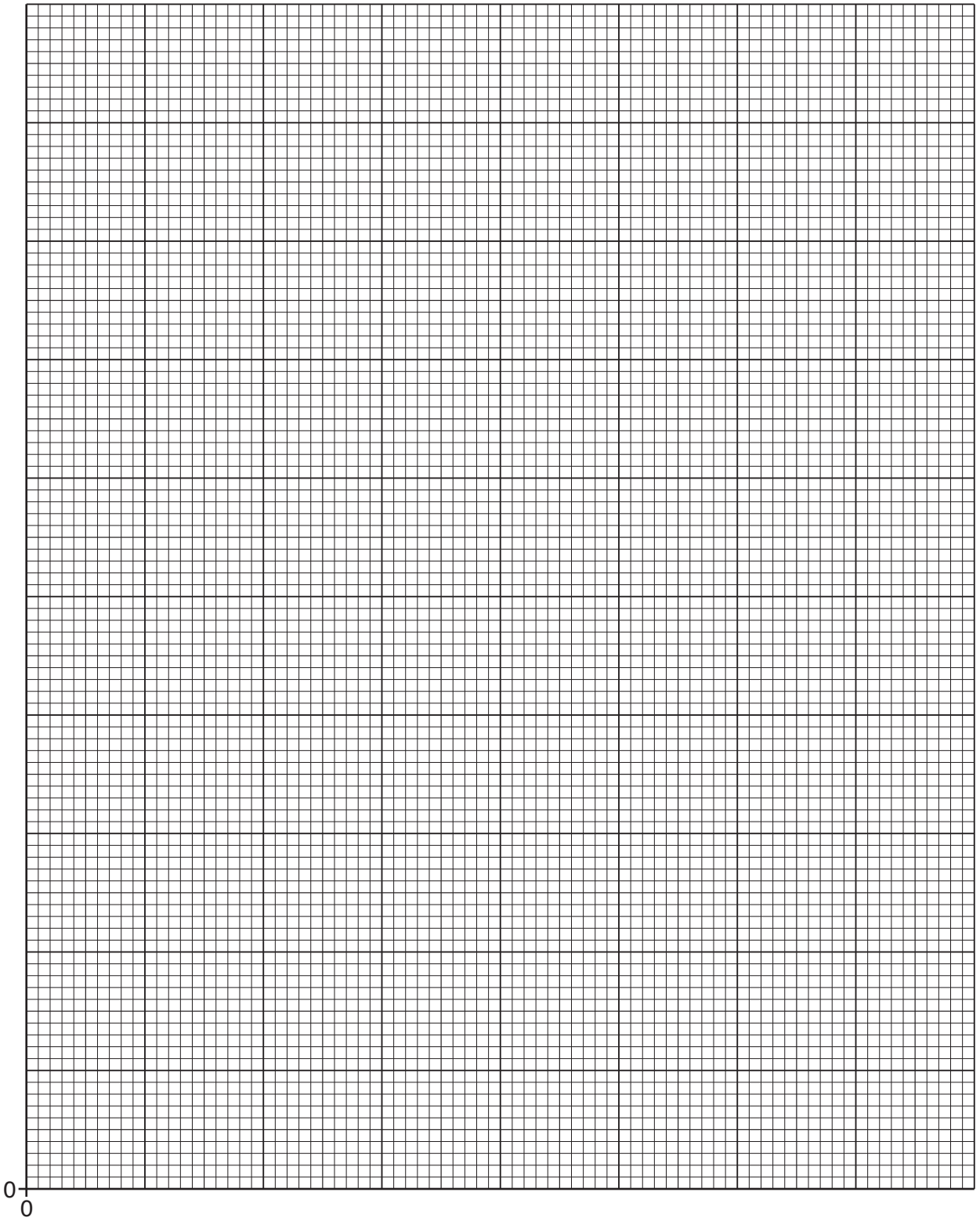
total number of springs *N*	*h*/cm
1	19.8
2	9.9
3	6.5
4	4.9
5	4.0
6	3.6
7	2.8
8	2.5

Fig. 2.3

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On Fig. 2.4, plot a graph of h/cm on the y-axis against N on the x-axis.

Start your axes from (0,0). Draw a smooth curve of best fit.



[4]

Fig. 2.4

(iv) Describe the relationship between N and h.

.....

.....

.....[2]

(c) The student now hangs one spring from the end of a second spring and suspends them as before. He hangs the same load from the end of the spring combination, as shown in Fig. 2.5.

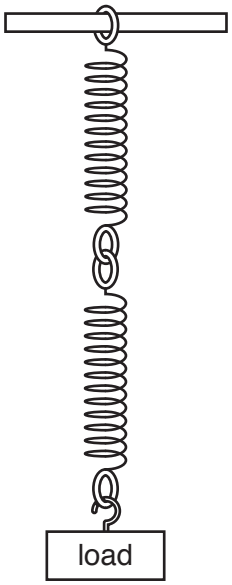


Fig. 2.5 (not to scale)

Suggest a value for the total extension of the pair of springs in Fig. 2.5.

extension = ...[1]

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3 A student has 50 small glass beads of different sizes and shapes in a jar, as shown in Fig. 3.1.

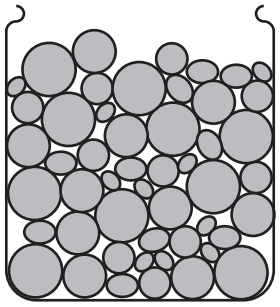


Fig. 3.1

(a) One of the glass beads is spherical.

(i) Suggest a piece of apparatus that measures the diameter of this bead more accurately than a ruler.

.....[1]

(ii) This bead is drawn to full size in Fig. 3.2.

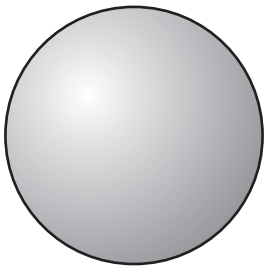


Fig. 3.2 (full size)

1. Use a ruler to measure the diameter of the glass bead in Fig. 3.2.

diameter = ...[1]

2. Explain how you measured the diameter as accurately as possible. You may draw on the diagram if you wish.

.....

.....

.....[1]

(b) The student finds the average density of the glass of the glass beads in the jar in Fig. 3.1.

(i) Describe a method to find the total volume of the 50 glass beads. State the apparatus used and explain how it is used. You may draw a diagram if you wish.

.....

.....

.....

.....

.....

.....[3]

(ii) State a precaution taken to ensure an accurate value for the volume.

.....

.....

.....

.....[1]

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(iii) The total volume of the beads is 196 cm^3 and the total mass is 523 g.

Use the equation

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

to determine the average density of the glass of the beads.

Give your answer to three significant figures.

density = ...[1]

4 A student measures the refractive index *n* of a rectangular glass block. One face of the block is shown in Fig. 4.1.



Fig. 4.1

The student traces the path of a ray of light entering the block at side AB and leaving the block at side CD.

(a) Suggest the apparatus needed to carry out the task.

.....

.....[1]

(b) Explain in detail how the student traces the ray of light through the block. You may add to the diagram in Fig. 4.1 if you wish.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[3]

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(c) Fig. 4.2 shows the ray that the student traces through the block.

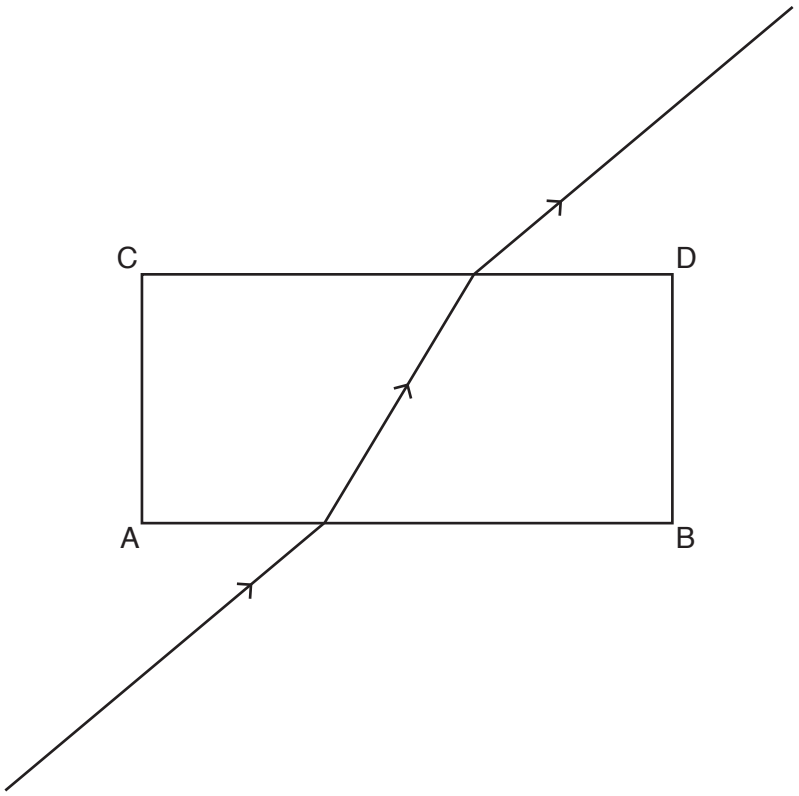


Fig. 4.2

Measure the angle of incidence *i* and the angle of refraction *r* at the point where the light enters the glass.

i = ...

r = ...
[2]

(d) The refractive index n of glass is given by the equation:

$$n = \frac{\sin i}{\sin r}$$

The student repeats the experiment using rays with different values of i.

In the space below, draw a suitable results table that the student uses to record all the data needed to find n. In your table, show the values for i that the student should choose.

[2]

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