Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

7797217943

PHYSICS **5054/42**

Paper 4 Alternative to Practical **May/June 2016**

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.

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1 A student investigates the oscillations of a metre rule.

(a) The student starts by supporting one end of a heavy rod using a stand, boss and clamp. Fig. 1.1 shows how he assembled the apparatus.

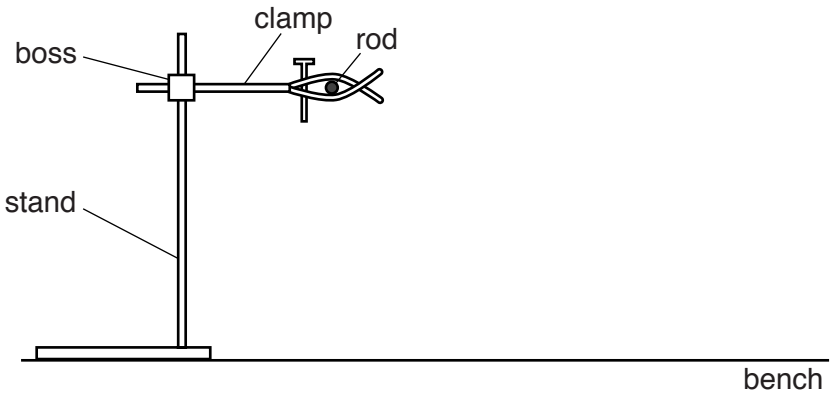


Fig. 1.1

(i) Explain why this is not the best way to assemble one stand, boss and clamp to support a heavy rod.

.....[1]

(ii) In the space to the right of Fig. 1.1, sketch a better way of assembling this apparatus. [1]

(b) Two clamps are used to support the rod horizontally, about 60 cm above the bench, as shown in Fig. 1.2.

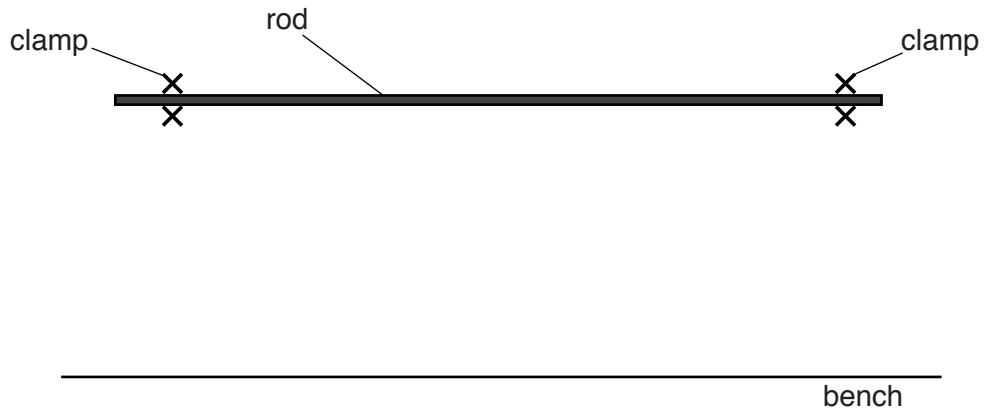


Fig. 1.2

The student is given a metre rule and two set-squares to check that the rod is horizontal.

(i) Draw on Fig. 1.2 to show how the apparatus is used. [1]

(ii) Explain how he can tell that the rod is horizontal.

.....

.....[1]

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(c) The student suspends the metre rule from the rod using two pieces of thread of equal length. A half-metre rule is placed on the bench, under the metre rule, so that the end A of the metre rule is above the 0 cm end of the half-metre rule, as shown in Fig. 1.3.

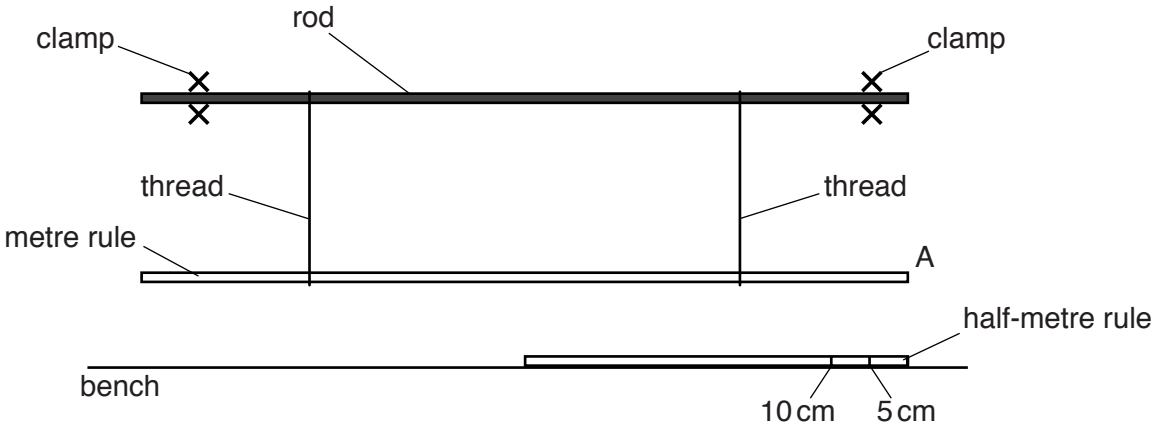


Fig. 1.3

(i) Describe how the student can check that the end A of the metre rule is exactly above the 0 cm end of the half-metre rule.

.....

.....[1]

(ii) The metre rule is moved to the left until the end A is above the 10 cm mark on the half-metre rule. It is then released. As the metre rule swings, the amplitude of the swing decreases.

The student counts the number N of swings until end A no longer passes the 5 cm mark on the half-metre rule. He repeats this several times and his results are shown below.

53 55 52 51 53

Calculate N_{av}, the average value of N.
Give your answer to 2 significant figures.

N_{av} = ...[1]

(d) The student is given one square piece of card of side l. He attaches the centre of the card to the end A of the metre rule with a small piece of Blu-tack, as shown in Fig. 1.4.

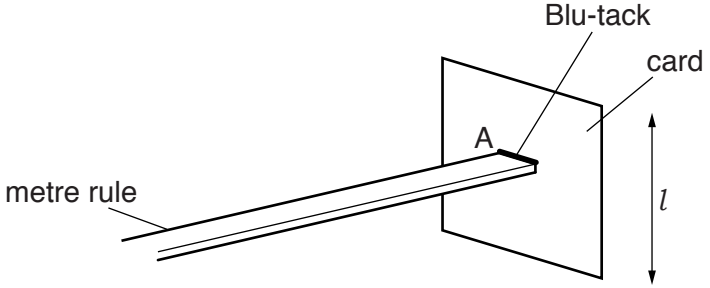


Fig. 1.4

The value of l is 19.0 cm.
The student repeats the experiment in **(c)** to obtain a value for N_{av}.
He then cuts the card to make the square smaller and repeats the experiment with smaller values of l. Fig. 1.5 shows the student's results.

l / cm	N_{av}
19.0	3
15.0	6
11.0	12
7.0	22
3.0	35
0	

Fig. 1.5

(i) Complete Fig. 1.5 by recording your value for N_{av} from **(c)(ii)** for $l = 0$.

(ii) On Fig. 1.6, plot the graph of l / cm on the y-axis against N_{av} on the x-axis.
Start your axes from (0,0). Draw the smooth curve of best fit.

(iii) The graph shows that as l decreases, N_{av} increases.

Two quantities x and y are inversely proportional if they obey the equation

$$x = \frac{k}{y},$$

where k is a constant.

By taking two pairs of values from the graph, show that N_{av} is **not** inversely proportional to l.

.....

.....

.....

.....[2]

(iv) Suggest why the student starts with $l = 19$ cm and then reduces l, rather than starts with $l = 3$ cm and then increases l.

.....

.....

.....[1]

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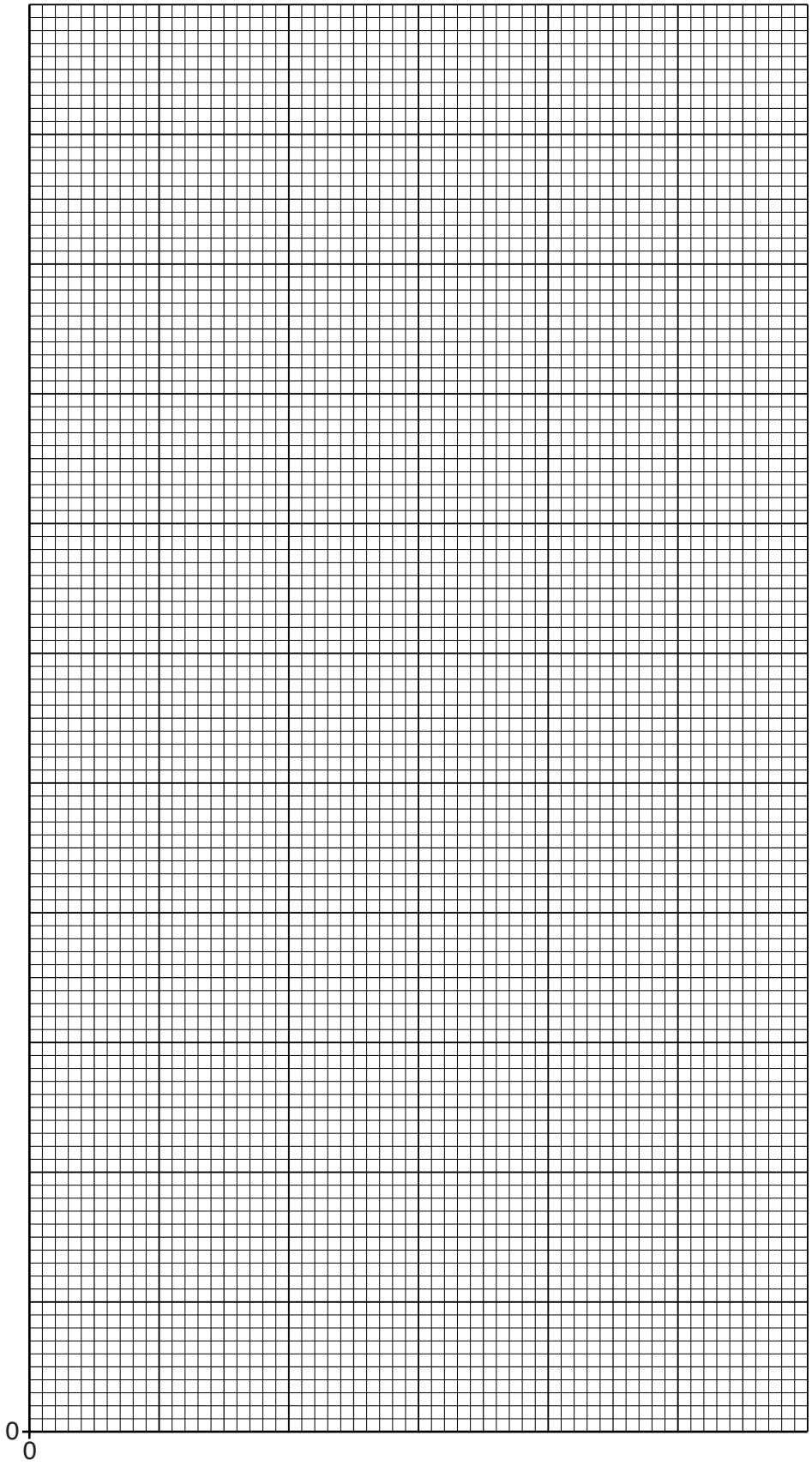


Fig. 1.6

[4]

2 A student investigates the path of a ray of light through a triangular prism.

Fig. 2.1 on page 7 shows the triangular prism placed in the centre of a sheet of white paper.

(a) On Fig. 2.1,

(i) mark and label P, the mid-point of the side AB of the prism, [1]

(ii) draw the normal to the prism at P, [1]

(iii) draw a line to represent a ray of light incident at P with an angle of incidence of 40°. [1]

(b) Fig. 2.2 shows a ray box that produces a narrow ray of light.

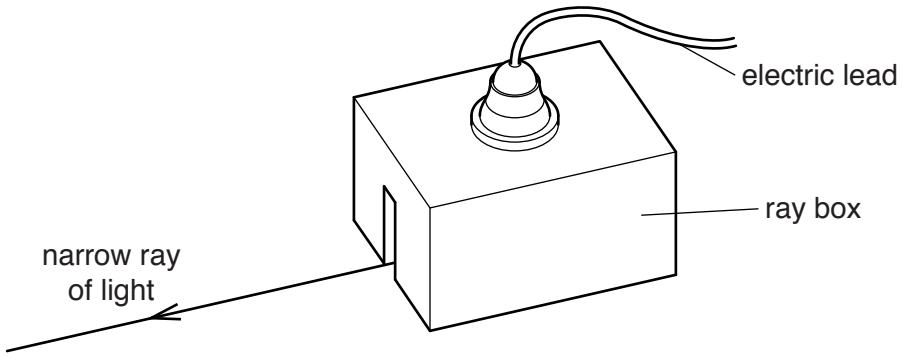


Fig. 2.2

Describe how the student can use the narrow ray of light to find the path of the ray through the prism.

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.....[4]

white paper

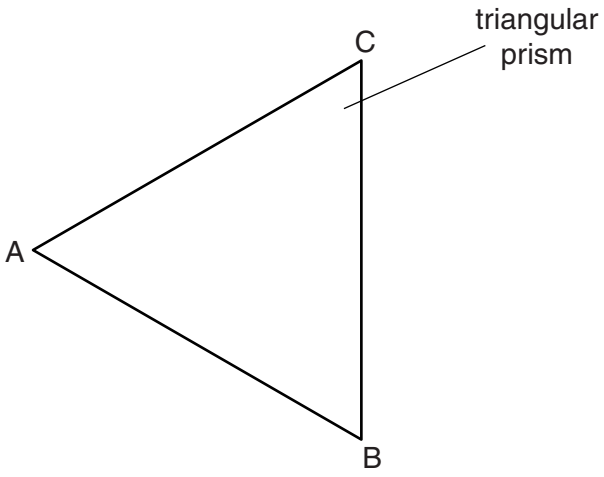


Fig. 2.1

3 A group of students measures forces using a set of bathroom scales.

(a) One student measures his weight by standing on the scales, as shown in Fig. 3.1.



Fig. 3.1

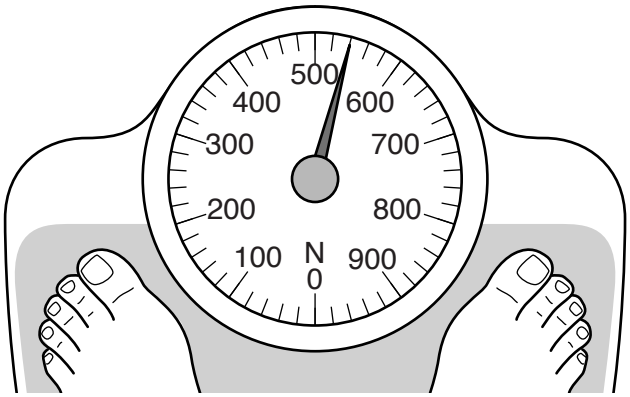


Fig. 3.2

Fig. 3.2 shows the reading on the scales when the student is standing still.

(i) State the weight of the student.

weight = ...[1]

(ii) Explain why the student needs to stand still on the scales.

.....

.....[1]

(iii) Explain why it is more accurate if the student takes the reading from directly above the scale.

.....

.....[1]

(b) Two students use the scales to measure the maximum friction force between a bench and a heavy box. One student places the scales against the side of the box, as shown in Fig. 3.3.

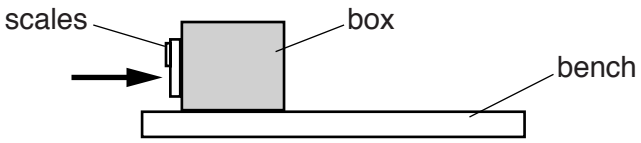


Fig. 3.3

He pushes the scales with both hands and the other student notes the reading on the scales when the box **just** starts to move.

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(i) Explain why it is important that the student pushing the box increases the force slowly.

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.....[1]

(ii) Suggest a reason why the student places the box near the edge of the bench.

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.....[1]

4 Fig. 4.1 shows an empty large reel that was used to hold ribbon.

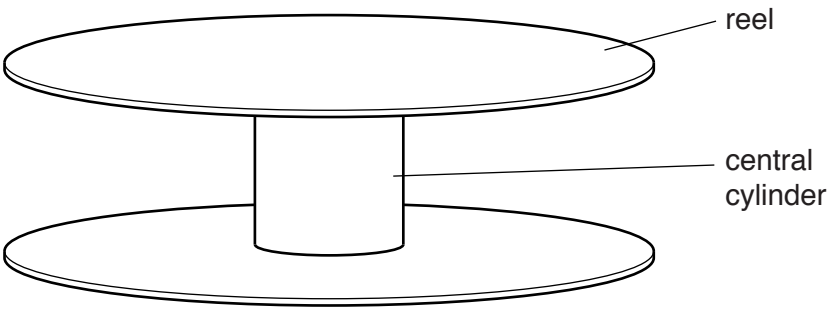


Fig. 4.1

The central cylinder has a diameter of about 3 cm.
Two students use different methods to find the diameter of the central cylinder.

(a) One student uses a ruler and the apparatus shown in Fig. 4.2 when finding the diameter. The distance between points A and B changes as the screw is turned.

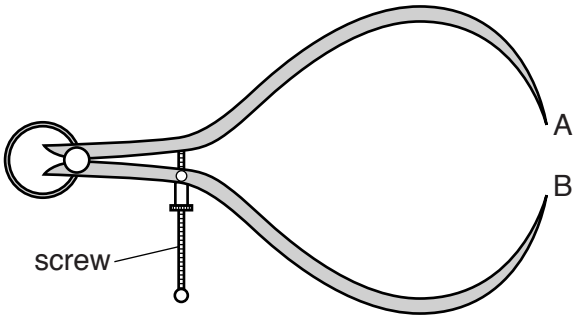


Fig. 4.2

Describe how the student measures the diameter.

.....

.....

.....[1]

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(b) The other student measures the diameter using only the following apparatus:

metre rule, pencil, Blu-tack, one metre of thin thread.

Describe clearly how she can find an accurate value for the diameter.

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.....[4]

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