Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

9139519918

PHYSICS **5054/41**

Paper 4 Alternative to Practical **October/November 2014**

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

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1 A student hangs two pendulums A and B from a metre rule, as shown in Fig. 1.1.

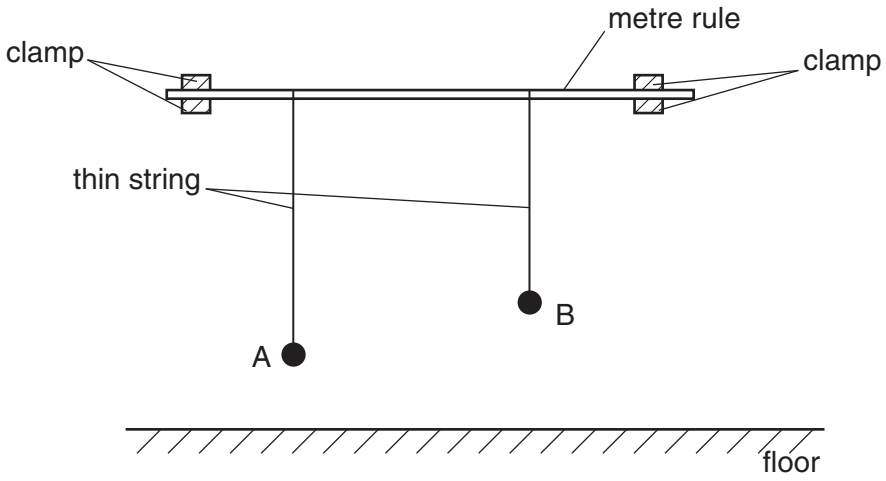


Fig. 1.1

(a) Describe how the student checks that the metre rule is horizontal. You may draw on Fig. 1.1 if you wish.

.....

.....

.....[1]

(b) Pendulum A has length 85.0 cm and its length does not change during the experiment.

Pendulum B is shorter than pendulum A, by a length *x*.

(i) On Fig. 1.1, mark and label the length *x*. [1]

(ii) Describe how the student can measure *x* accurately.

.....

.....[1]

(c) The student pulls A and B towards him and releases them at exactly the same time.
Pendulum A takes longer to complete one swing than pendulum B.
At the start, A and B swing backwards and forwards together, in step. They then become out of step and, after a while, A is swinging forwards when B is swinging backwards.
They then become back in step swinging backwards and forwards together.

The student counts the number *N* of swings of A until A and B are exactly back in step.

The student repeats the experiment and finds *N* for different values of *x*.

The results are recorded in Fig. 1.2.

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x/cm	N
3.0	55
5.0	32
7.0	22
9.0	17
11.0	13
13.0	10

Fig. 1.2

On Fig. 1.3, plot the graph of N on the y-axis against x/cm on the x-axis.
Start your axes from the origin. Draw the smooth curve of best fit. [4]

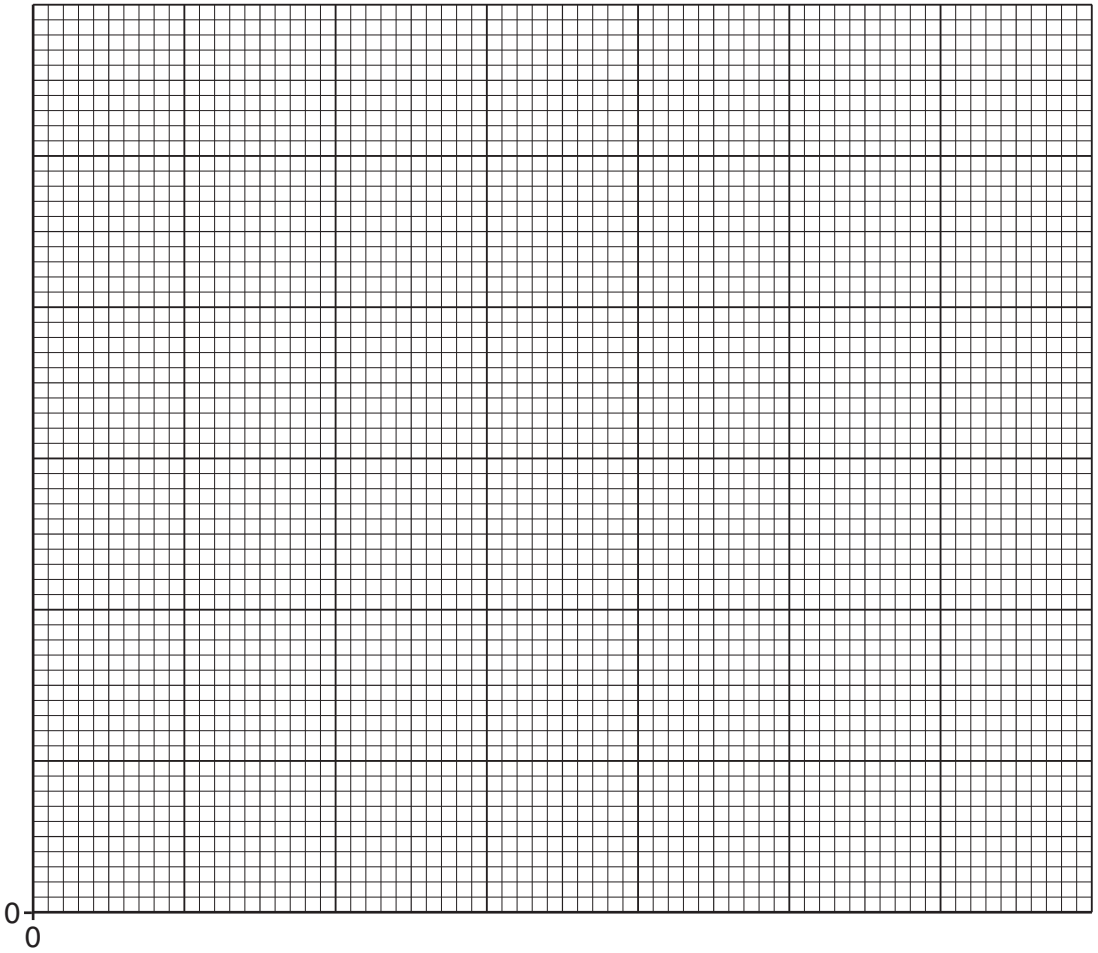


Fig. 1.3

(d) Before taking any readings, the student attached the pendulums A and B close together on the metre rule.

(i) Give one reason why it is helpful to have the strings close together.

.....

.....[1]

(ii) Suggest one problem this may cause.

.....

.....[1]

(e) **(i)** The length L_A of pendulum A is 85.0 cm. The length L_B of pendulum B is 75.0 cm. Use your graph in Fig. 1.3 to obtain a value for N.

$N =$ .....[1]

(ii) Theory shows that

$$N = \frac{\sqrt{L_B}}{\sqrt{L_A} - \sqrt{L_B}}$$

Calculate the value for N when L_A is 85.0 cm and L_B is 75.0 cm.
Give your answer to two significant figures.

$N =$ .....[2]

(iii) Comment on whether your two values for N are in agreement.

.....

.....[1]

2 A group of students measure the heights of the seats of five similar laboratory stools. The stools are shown in Fig. 2.1.

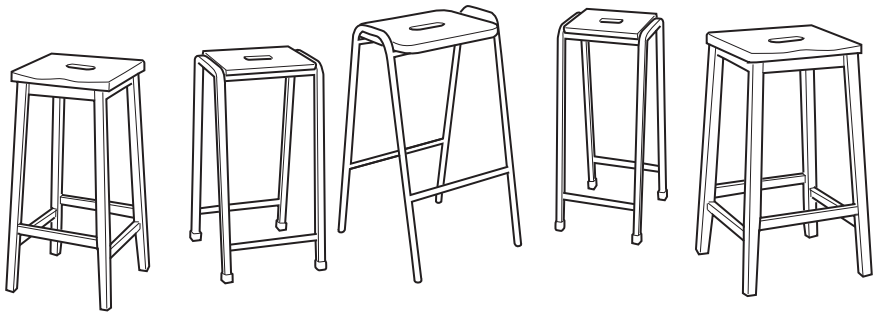


Fig. 2.1

(a) State the name of a suitable instrument for measuring the heights.

.....[1]

(b) **(i)** Explain what is meant by *parallax error*.

.....

.....[1]

(ii) Describe how the student can avoid parallax error when measuring the height of a stool.

.....

.....

.....[1]

(c) The students obtain the following results. The heights are measured in centimetres.

62.2 37.6 61.9 62.5 62.1

(i) One of the results is very different from the other four.

Suggest how the student used the measuring instrument incorrectly to obtain this result.

.....

.....[1]

(ii) Calculate the average value of the height of a stool.
Give your answer to 3 significant figures.

average height = ...[2]

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3 A student calibrates a thermometer.

Fig. 3.1 shows the thermometer with no scale marked on the stem.

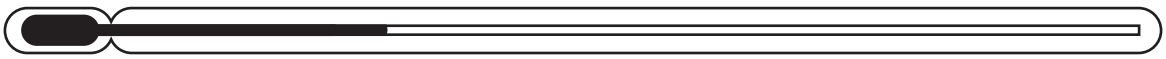


Fig. 3.1

(a) Describe how the student finds the correct positions for the 0 °C and the 100 °C points on the thermometer.

0 °C: .....

.....

100 °C: .....

.....

[2]

(b) Fig. 3.2 shows the thermometer with 0 °C and the 100 °C marked by the student.
The thermometer in Fig. 3.2 is at room temperature.

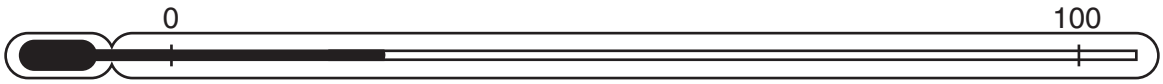


Fig. 3.2

(i) By taking measurements from Fig. 3.2, calculate a value for room temperature.
Show your working.

room temperature = ...[2]

(ii) State one assumption made in calculating the room temperature.

.....

.....[1]

Please turn over for Question 4.

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4 A student is given a 1 m length of thin wire of approximate diameter 1 mm.
She is asked to measure accurately the diameter of the wire.
The other apparatus available is shown below.

Apparatus List	
marker pen	*pencil*
metre rule	*scissors*
30 cm ruler	*Blu-Tack*
thin string	*Sellotape*
thick string	*lined paper*
wooden rods of various diameters	*plain paper*

(a) Describe in detail how the student can obtain an accurate value for the diameter of the wire using some of this apparatus.

In your account you should
- state the equipment used,
- explain how the equipment is used,
- state any readings taken,
- explain how the value for the diameter is obtained,
- describe how to make the measurement accurate.

.....

.....

.....

.....

.....

.....[5]

(b) State the name of a measuring instrument that the student can use to find the diameter of the wire more accurately.

.....[1]

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