UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

4677040678

PHYSICS **5054/41**

Paper 4 Alternative to Practical **May/June 2012**

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 a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
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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1 A teacher and a group of students investigate the behaviour of a copper wire when stretched by heavy loads.

A long thin copper wire is clamped at one end and passes over a pulley. A 1.0 N load is attached to the other end of the wire, as shown in Fig. 1.1.

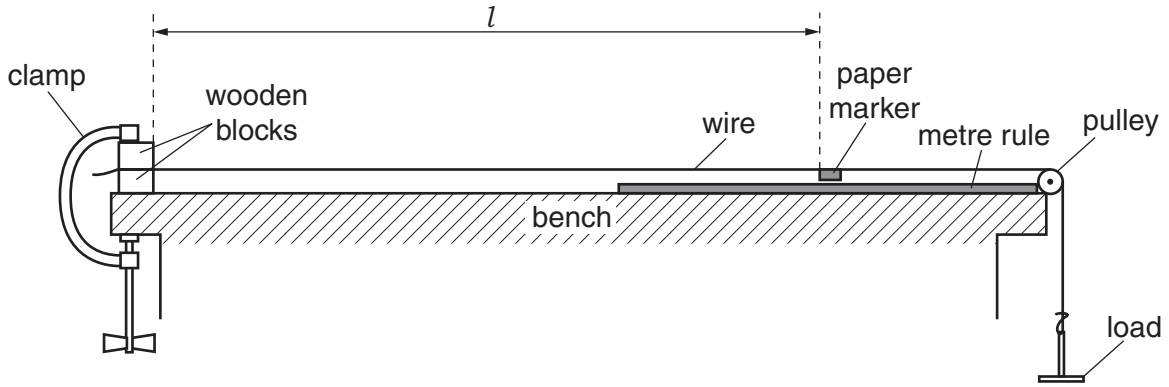


Fig. 1.1 (not to scale)

(a) (i) Explain why one end of the wire has to be clamped **tightly**.

.....

..... [1]

(ii) Explain why the students watching the experiment must wear safety glasses.

.....

..... [1]

(b) A paper marker is attached to the wire. The length l of the wire from the wooden blocks to the marker is measured.
The marker and metre rule are used to measure the extension of the wire as the load is increased.

(i) State what is meant by *extension*.

.....

..... [1]

(ii) Explain why the marker is attached a long distance from the clamped end of the wire.

.....

..... [1]

(iii) Explain why some distance is left between the marker and the pulley.

.....

..... [1]

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(c) Fig. 1.2 shows a magnified view of the wire, marker and rule.

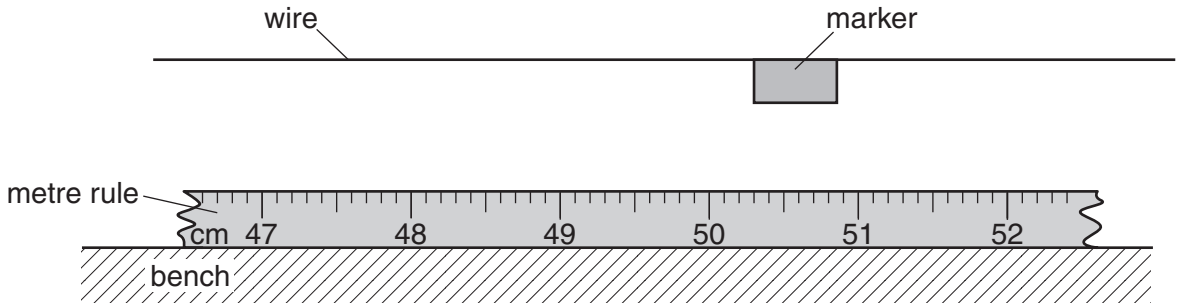


Fig. 1.2

The left-hand side of the marker is used as the reference point.

(i) Use Fig. 1.2 to find the position of the marker.

position = ... [1]

(ii) Suggest why a small 1.0 N load is added before the initial reading of the position of the marker is found.

.....

..... [1]

(iii) Explain why it is difficult for a student to read the position of the marker accurately.

.....

..... [1]

(iv) Describe one change to the apparatus to make it easier to read the position of the marker accurately.

.....

..... [1]

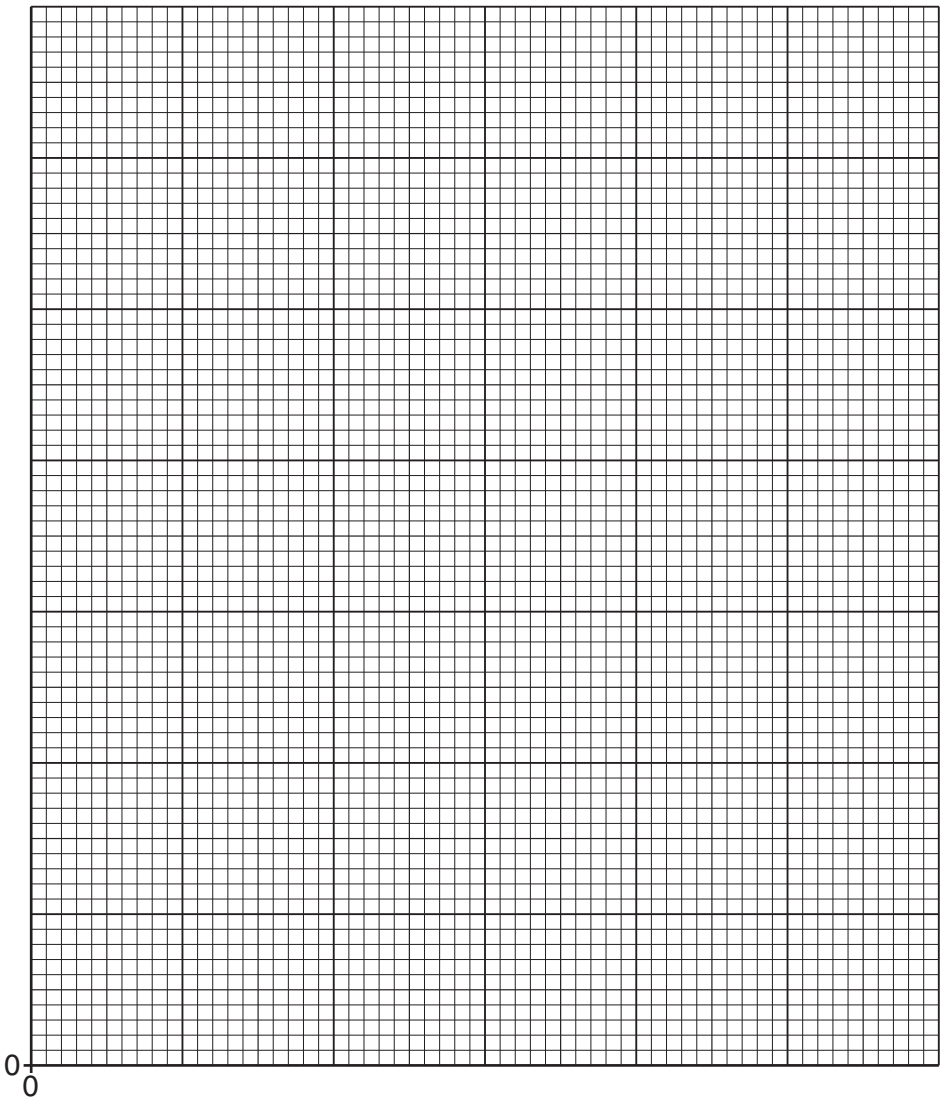
(d) One of the students takes a series of readings of the extension *e* of the wire as the load *F* is increased, as shown in Fig. 1.3.

F/N	*e*/mm
1.0	0
6.0	7
11.0	13
16.0	21
21.0	26
26.0	33

Fig. 1.3

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(i) On Fig. 1.4, plot the graph of e/mm on the y-axis against F/N on the x-axis. Start your axes from the origin. Draw the line of best fit.



[4]

Fig. 1.4

(ii) Describe the relationship between F and e that is shown by your graph.

.....

..... [1]

(e) The teacher continues to increase the load. Describe what happens as the load becomes very large.

.....

..... [1]

2 A student uses a ticker-timer to measure *g*, the acceleration of free fall.

The ticker-timer makes a dot on a piece of paper tape every 0.020 s.
The tape is pulled through the ticker-timer by a falling mass, as shown in Fig. 2.1.

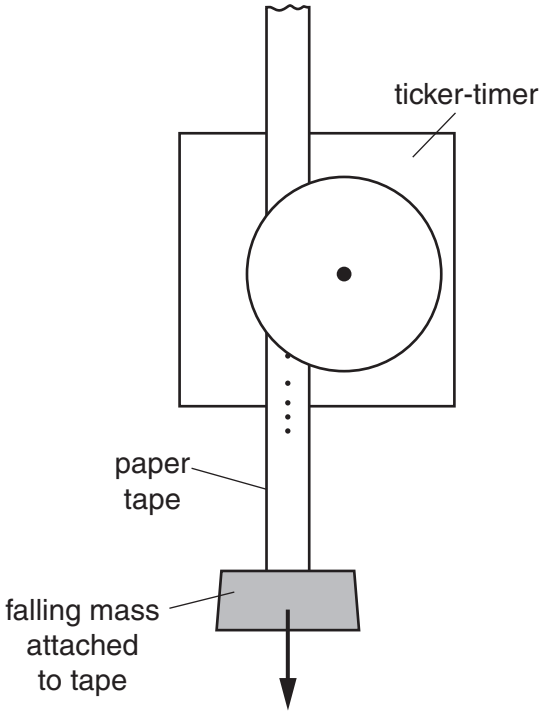


Fig. 2.1 (not to scale)

Fig. 2.2 shows part of the tape after it has fallen through the ticker-timer. The dots have been labelled.

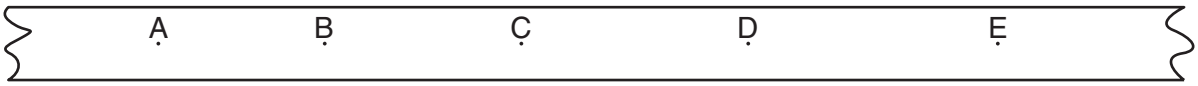


Fig. 2.2 (full size)

The student places the tape on the bench to measure the distances between the dots.

(a) The student measures the distance l_1 between dots A and B, and the distance l_2 between dots D and E.

(i) By taking measurements from Fig. 2.2, find the distances l_1 and l_2.
Give your answers in metres.

l_1 = ... m

l_2 = ... m
[1]

(ii) Using the relationship

$$g = \frac{2.5 \times 10^3}{3}(l_2 - l_1)$$

calculate a value for g. Give your answer to two significant figures.

$g =$ ..... m/s^2 [2]

(b) The accepted value for g is $9.81\,m/s^2$.
State whether the value calculated for g in **(a)(ii)** is too large or too small. Suggest a reason for this difference.

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.....

..... [1]

3 A student compares the conduction of heat through different metals.
Fig. 3.1 shows the apparatus used.

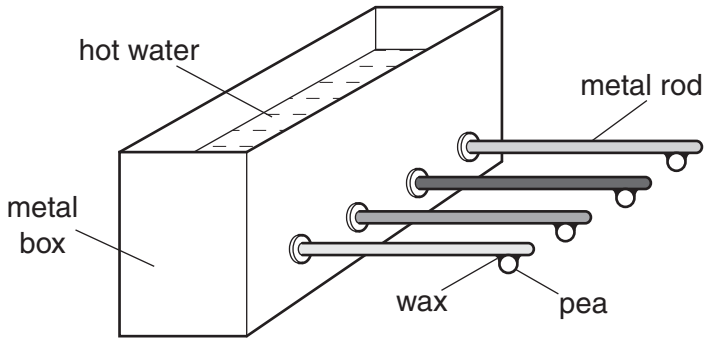


Fig. 3.1

Four rods of different metals each have one end fixed through a cork into a metal box. The metal box contains hot water. Each rod has a pea attached to it by wax.

(a) Heat from the hot water is conducted to the end of each rod.
Describe what happens to the wax and to the pea on one of the rods.

.....

.....

..... [1]

(b) State two factors that should be the same for all the rods in this experiment.

1. .....

2. .....
[2]

(c) State how the experiment shows which of the metals is the best conductor of heat.

.....

..... [1]

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(d) The student is asked to suggest an improvement to the experiment.
He suggests placing several peas along each rod, as shown in Fig. 3.2.

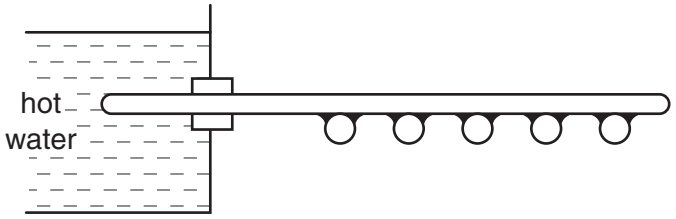


Fig. 3.2

Explain how this gives a better comparison of the conduction of heat through the different metals.

.....

.....

..... [1]

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[Turn over

4 A semi-circular glass block is used to measure the critical angle for light in glass.

Fig. 4.1 on page 11 shows the semi-circular block on a sheet of white paper.

A student shines a narrow ray of light from a ray-box through the semi-circular block and draws two crosses M_1 and M_2 on the emergent ray.

(a) (i) On Fig. 4.1, complete the path of the ray after it emerges from the block. [1]

(ii) On Fig. 4.1, draw the path of the ray through the block. [1]

(iii) Using Fig. 4.1, measure the angle of incidence *i* where the light passes from glass to air.

i = ... [1]

(b) Describe how the student adjusts the apparatus to measure the critical angle for glass. You may use a diagram to help your explanation.

.....

.....

.....

.....

..... [2]

Question 4 continues on page 12.

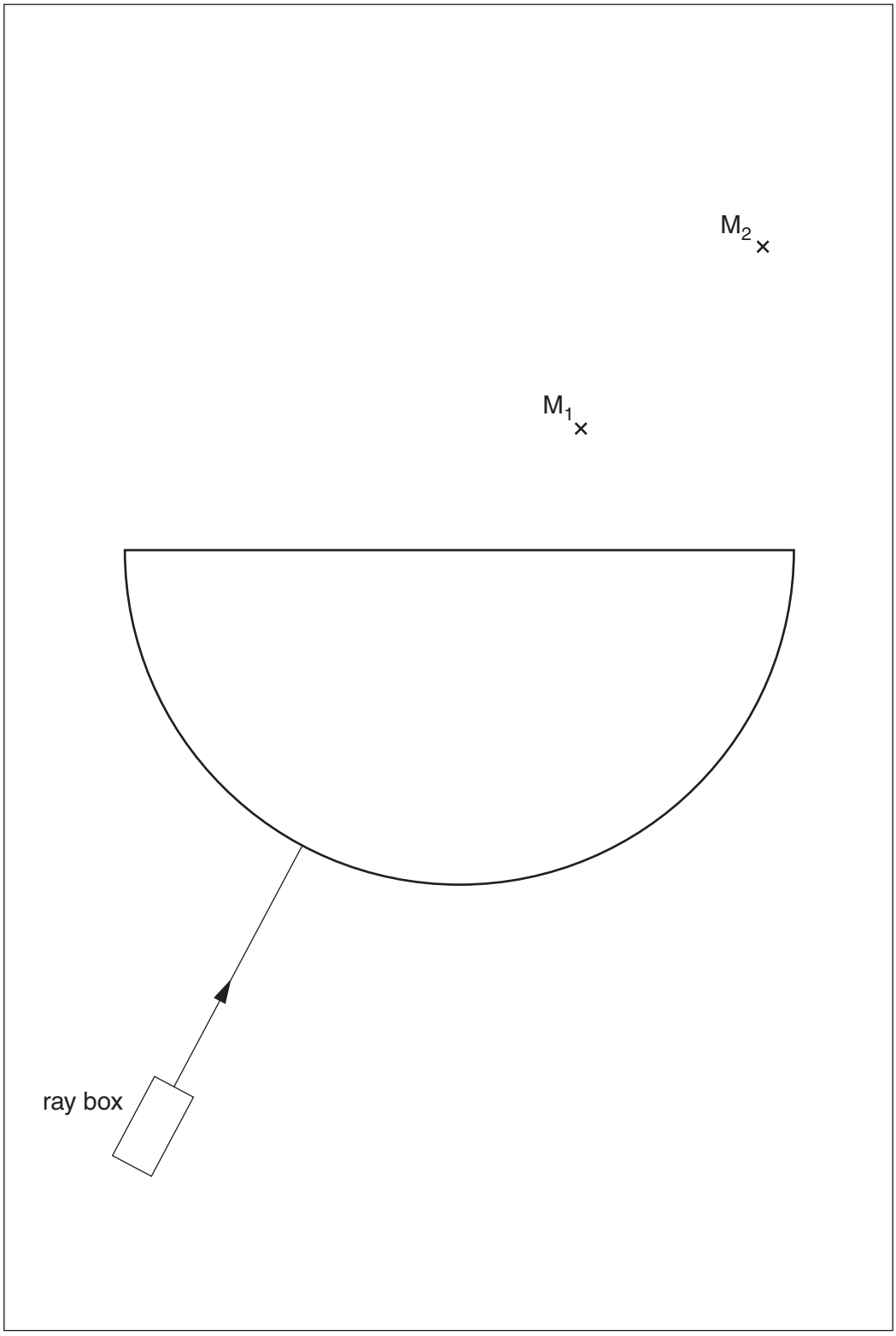


Fig. 4.1

(c) Fig. 4.2 shows the incident ray used by another student. The ray in the block strikes the glass-air surface at the critical angle.

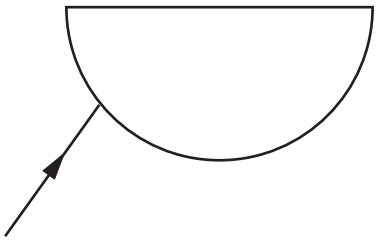


Fig. 4.2

Explain why it is more difficult to measure the critical angle with this arrangement than with the arrangement in **(b)**.

.....

.....

..... [1]

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