UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8619388720

PHYSICS **5054/41**

Paper 4 Alternative to Practical **October/November 2013**

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 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.

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 **9** printed pages and **3** blank pages.

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1 A student investigates a wooden sphere rolling down a plastic channel and falling to the floor.

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The channel is set up at the end of a bench.
The sphere is initially held in the channel at the position shown in Fig. 1.1.

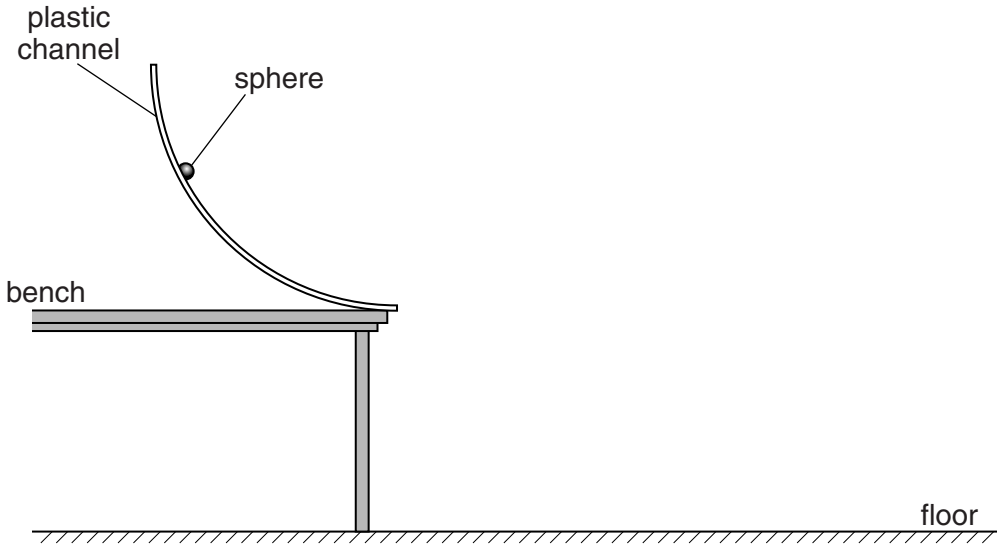


Fig. 1.1 (not to scale)

(a) **(i)** On Fig. 1.1, mark and label the height *h* of the sphere above the bench before it is released. [1]

(ii) Describe how the student ensures that the sphere is released from the same point each time.

.....

.....[1]

(b) The sphere is released, rolls down the channel and lands on the floor.
When the sphere leaves the end of the channel, it is travelling horizontally.

On Fig. 1.1,

(i) draw a possible path of the sphere after it leaves the channel and until it hits the floor, [1]

(ii) mark and label the horizontal distance *d* travelled by the sphere after it leaves the channel and until it hits the floor. [1]

(c) Suggest a method for finding the point where the sphere hits the floor.

.....

.....[1]

(d) With h set at 30 cm, the student repeats the experiment and measures d six times. The student obtains the following values of d in cm.

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68.5 64.0 67.0 66.5 65.0 64.5

Calculate the average distance d_{av}.
Give your answer to a suitable number of significant figures.

d_{av} = ...cm [1]

(e) The student repeats the experiment with different values of h. The results obtained for h and d_{av} are recorded in Fig. 1.2.

h/cm	d_{av}/cm
2	14
5	22
10	33
15	45
20	54
25	60
30	

Fig. 1.2

On Fig. 1.2, write your value for d_{av} from **(d)**.

(i) By considering the experimental arrangement, suggest, with a reason, whether $d_{av} = 0$ when $h = 0$.

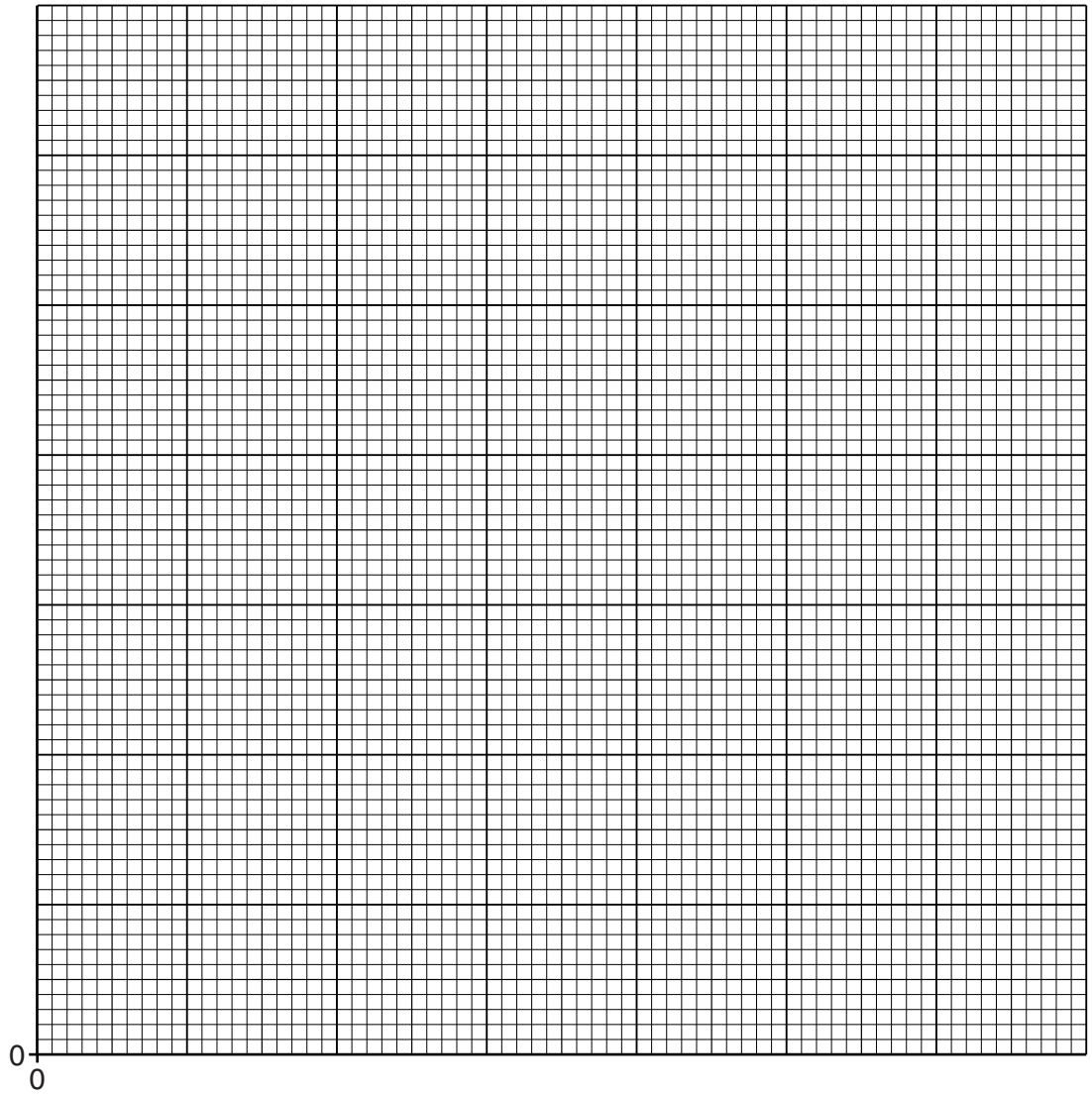
.....

.....[1]

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(ii) On Fig. 1.3, plot the graph of d_{av}/cm on the *y*-axis against *h*/cm on the *x*-axis. Start your axes from the origin. Draw a smooth curve of best fit.

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[4]

Fig. 1.3

(iii) Another student suggests that d_{av} is directly proportional to *h*.
Use your graph to explain whether this student is correct.

.....

.....

.....[1]

2 A group of students investigate their reaction times.

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The students mark a 30 cm strip of card in equal sections, as shown in Fig. 2.1.

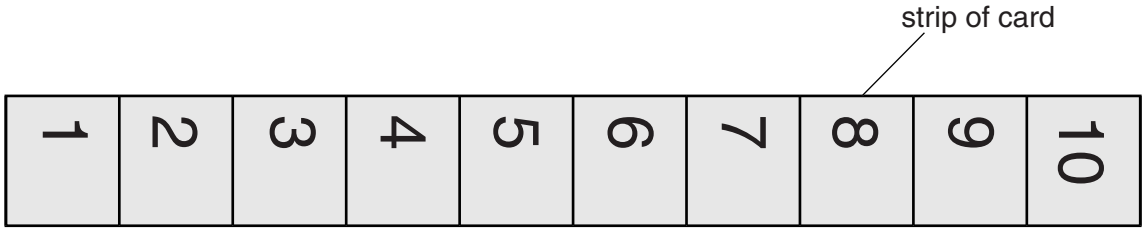


Fig. 2.1

Student A holds the card at one end so that it hangs vertically.
Student B holds his thumb and first finger about 2 cm apart just below the lower end of the card, as shown in Fig. 2.2.

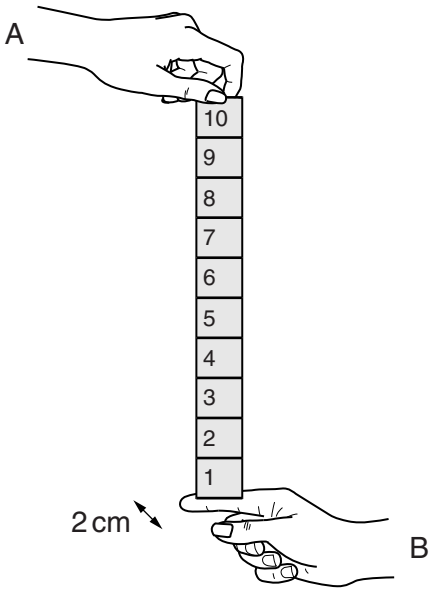


Fig. 2.2

Student A releases the card.
Student B catches the card between his thumb and first finger, without moving his hand up or down.
Several pairs of students perform the experiment.

(a) (i) Explain what happens if student B is not concentrating.

.....

.....[1]

(ii) State how the card shows which student has the shortest reaction time.

.....

.....[1]

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(b) The distance h, in centimetres, fallen by the card in time t, in seconds, is given by

$$h = 500t^2.$$

(i) Calculate h for $t = 0.1$ s.

$h =$ ..... [1]

(ii) A student catches the card after it has fallen 15 cm. Calculate his reaction time.

reaction time = ... [1]

(iii) A teacher draws lines on the back of the card to calibrate it so that the students can measure reaction times directly in seconds.

1. Explain what, in this case, is meant by *calibrate*.

.....

..... [1]

2. On Fig. 2.3, without further calculation, sketch the card calibrated by the teacher. You may use your answer from **(b)(ii)**. [1]

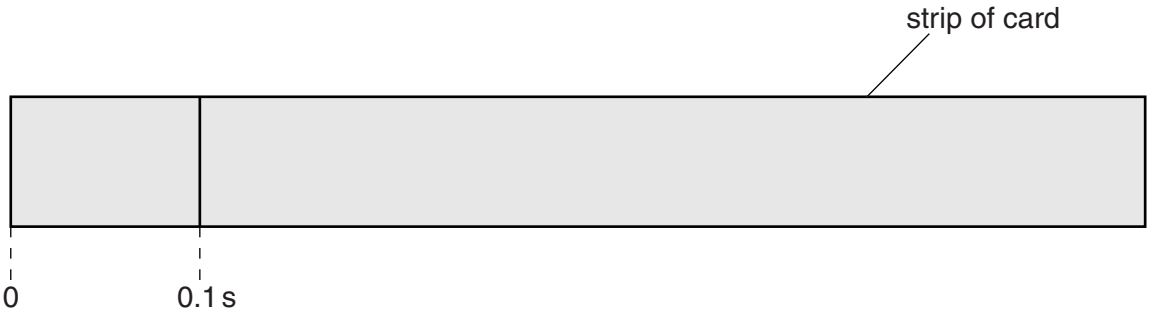


Fig. 2.3

3 A student starts an experiment to determine the path of light through a glass block.

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The student uses a rectangular glass block and optical pins. He places the glass block on a sheet of paper on a soft board, as shown in Fig. 3.1.

The student draws a line L to represent an incident ray.

(a) (i) On Fig. 3.1, draw the normal at the point where L meets the glass block. [1]

(ii) On Fig. 3.1, label the angle of incidence *i*. Measure *i*.

i = ...[1]

(b) The student then places a pin P_1 on the incident ray, as shown in Fig. 3.1.

(i) Suggest a reason why the student uses a board under the piece of paper.

.....

.....[1]

(ii) The student places a second pin P_2 on L. Suggest where, on L, pin P_2 should be placed.

.....[1]

(iii) To find the path of the emergent ray, the student views P_1 and P_2 through the glass block.
He moves his head until P_1 and P_2 are in line.

Explain why it is important for the pins to be vertical.

.....

.....[1]

(c) The student finds it difficult to mark the emergent ray with the apparatus as it is set up in Fig. 3.1.
Suggest and explain a reason for this.

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.....[2]

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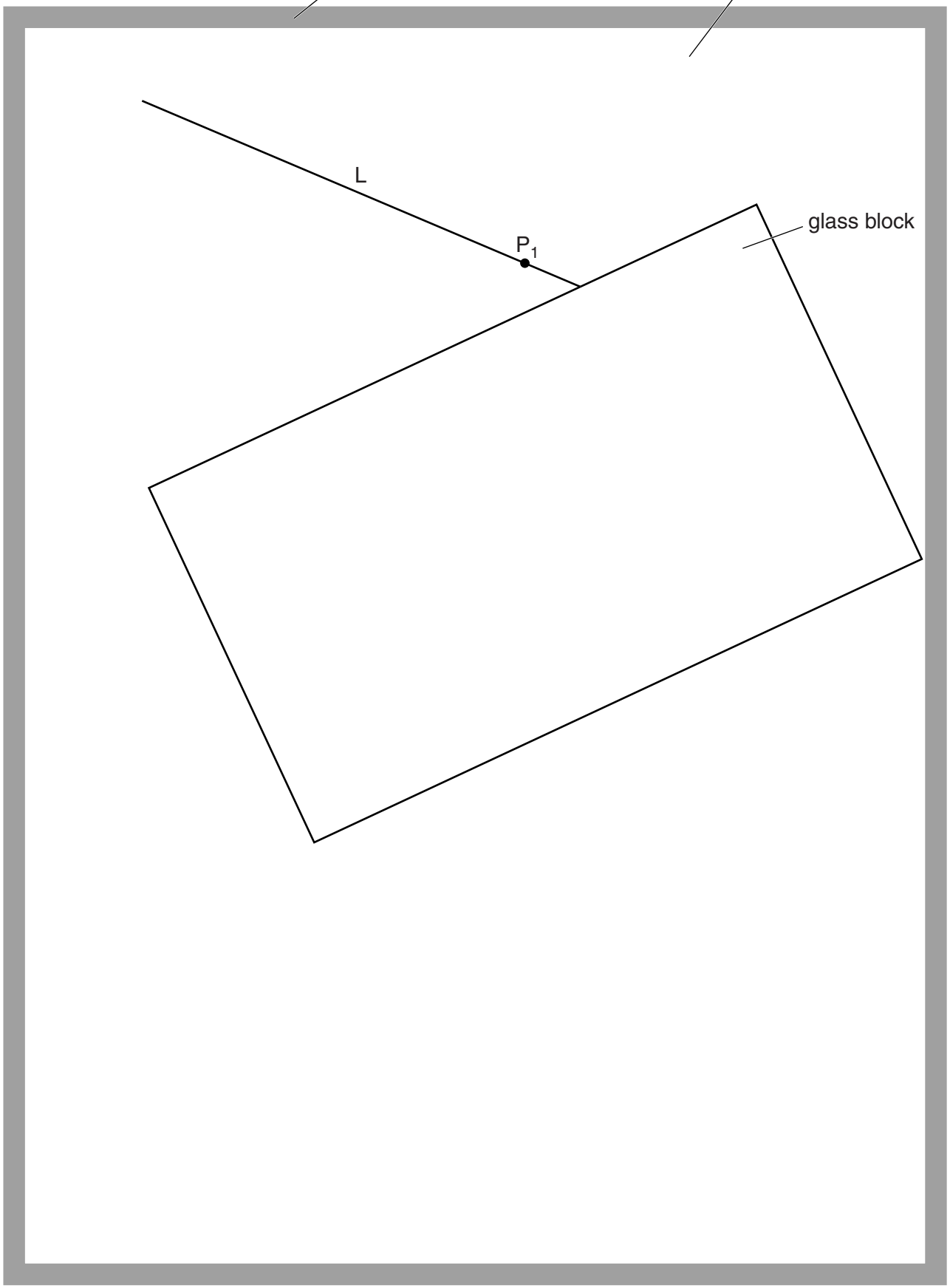


Fig. 3.1 (full scale)

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[Turn over

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4 **(a)** Describe an experiment to measure the resistance of a resistor using an ammeter and a voltmeter.

Your account should include

- a circuit diagram,
- the readings taken,
- a method of taking a range of readings,
- a method of determining the resistance from the readings.

.....

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.....

.....[4]

(b) Describe one way to improve the accuracy of the result.

.....

.....[1]

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