UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

4168823480

PHYSICS **5054/41**

Paper 4 Alternative to Practical **May/June 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 **8** printed pages.

1 A student investigates the time taken for a light paper cup to fall to the floor.

For Examiner's Use

The student holds one paper cup, as shown in Fig. 1.1.

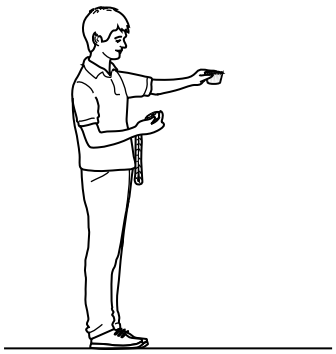


Fig. 1.1

The student drops the cup and measures the time t for it to fall to the floor.

(a) The student repeats the experiment and obtains the following five values for t, measured in seconds.

1.19 1.00 0.93 1.03 1.08

(i) Calculate t_{av}, the average value for t.
Give your answer to two decimal places.

t_{av} = ... [2]

(ii) The student records his value for t_{av} to more than two decimal places. Suggest why two decimal places is more suitable in this case.

.....

.....[1]

(iii) The student finds it difficult to drop the cup and measure t. Suggest how two students working together can measure t more accurately.

.....

.....

.....[2]

(b) The student repeats the experiment with two cups, as shown in Fig. 1.2.

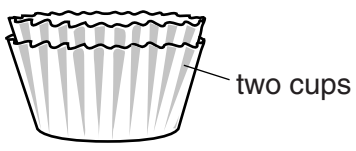


Fig. 1.2

The experiment is repeated for an increasing number of cups. The results obtained are recorded in Fig. 1.3, where N is the number of cups.

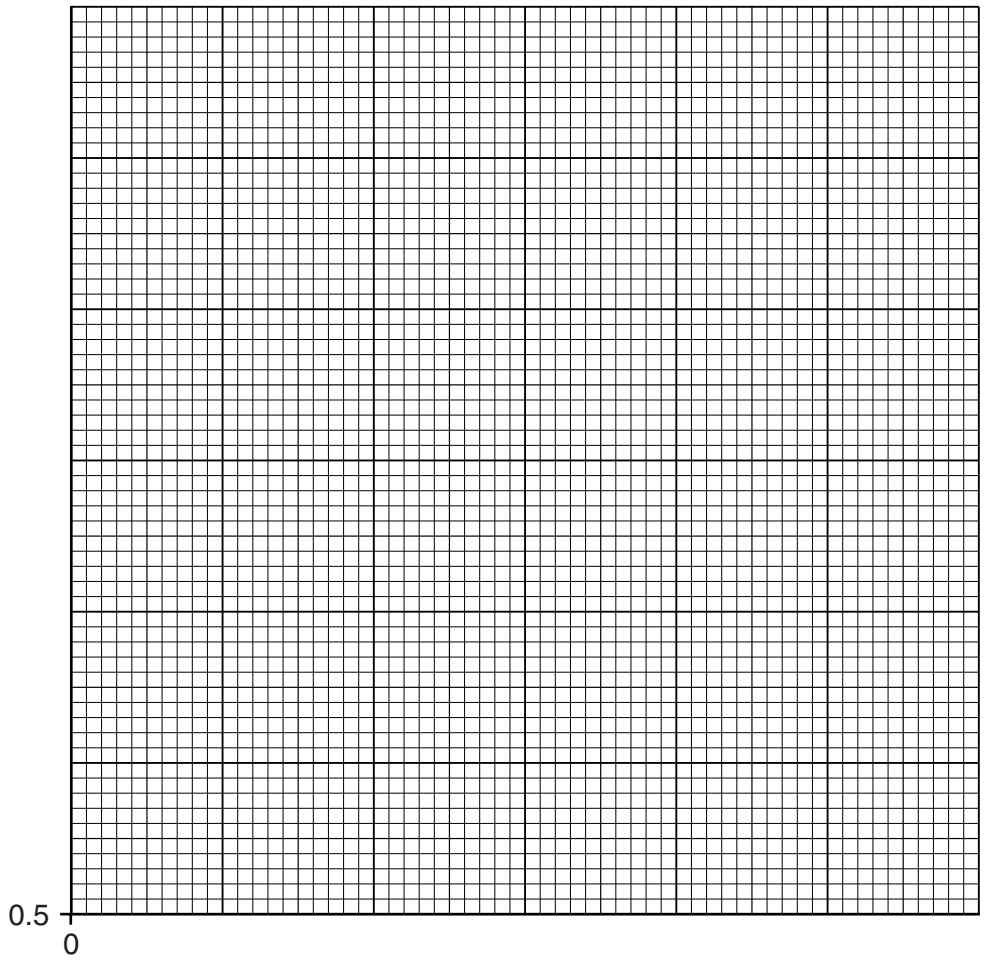
For Examiner's Use

Add to Fig. 1.3 your value of t_{av} for one cup from **(a)(i)**.

N	t_{av}/s
1	
2	0.89
3	0.82
5	0.69
7	0.63
9	0.61
11	0.61

Fig. 1.3

(i) On Fig. 1.4, plot the graph of t_{av}/s on the y-axis against N on the x-axis. Start your axes from $t_{av} = 0.5$ s and $N = 0$. Draw the smooth curve of best fit.



[4]

Fig. 1.4

(ii) When two quantities x and y are inversely proportional to each other, they obey the relationship

$$x \times y = \text{constant}.$$

Use data from the graph or table to explain whether t_{av} is inversely proportional to N.

.....

.....

.....

.....[2]

(c) It is important to drop the cup from the same height each time. Explain how the student does this without measuring the height.

.....

.....[1]

(d) Name the physical quantity being changed by increasing the number of cups.

.....[1]

(e) The student accidentally stands on one cup. Explain why it should not be used in the investigation.

.....

.....[1]

(f) Suggest a reason why the last two values for t_{av} in Fig. 1.3 are the same.

.....

.....[1]

2 A student investigates the behaviour of resistors.

(a) Three resistors A, B and C are labelled 100 Ω, 150 Ω and 220 Ω respectively.

(i) **1.** Draw the arrangement of A, B and C that gives the largest possible total resistance.

[1]

2. Calculate the resistance of this arrangement.

resistance = ... [1]

(ii) Draw the arrangement of A, B and C that gives the smallest possible total resistance.

[1]

(b) A fourth resistor is shown in Fig. 2.1. The resistor colour code is shown in Fig. 2.2.

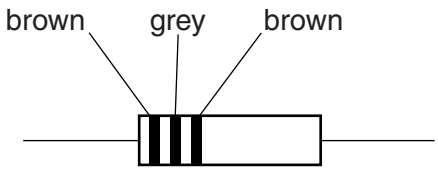


Fig. 2.1

colour band	value
black	0
brown	1
red	2
orange	3
yellow	4
green	5
blue	6
violet	7
grey	8
white	9

Fig. 2.2

State the resistance of this resistor.

resistance = ... [1]

3 A laboratory thermometer is used to measure the temperature of oil in a test-tube. The thermometer is initially at room temperature.

Fig. 3.1 shows the thermometer.

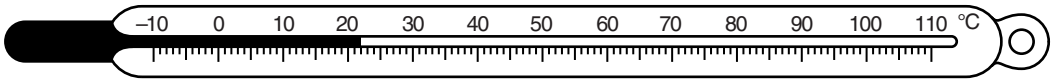


Fig. 3.1

(a) State the temperature shown by the thermometer in Fig. 3.1.

temperature = ... [1]

(b) A test-tube of oil is heated in a bath of very hot water for 15 minutes, as shown in Fig. 3.2.

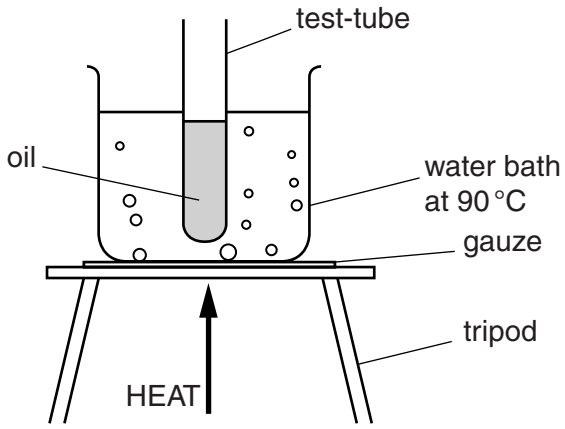


Fig. 3.2

(i) Explain why the level of oil in the test-tube should be below the level of water in the water bath.

.....

.....[1]

(ii) A student removes the test-tube from the water bath. He then places the thermometer in the oil. Describe how the reading on the thermometer changes over the next few minutes.

.....

.....

.....[2]

(iii) Describe how the student reads the thermometer accurately.

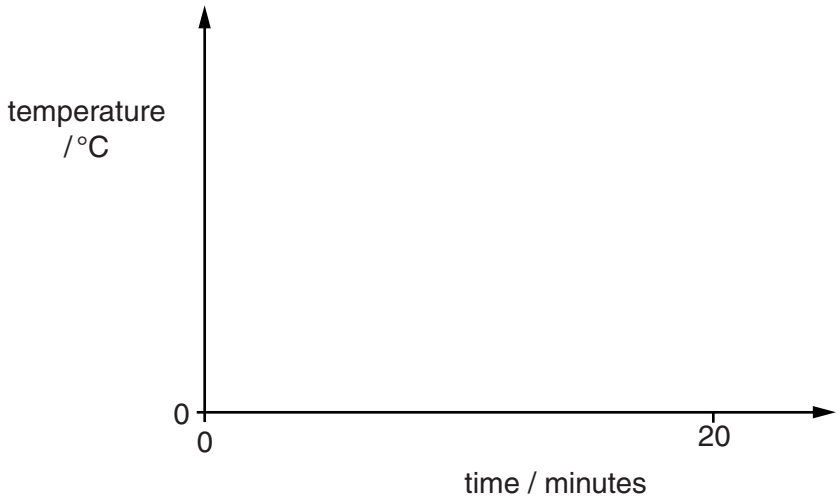
.....

.....[1]

(c) A second student repeats the experiment in **(b)** using a temperature sensor instead of a thermometer. The temperature sensor is connected to a data logger. The data logger records the temperature every 0.1 s for 20 minutes.

For Examiner's Use

On the axes shown in Fig. 3.3, sketch the shape of the graph produced by the data logger.



[2]

Fig. 3.3

Please turn over for Question 4.

4 Fig. 4.1 shows a triangular cardboard lamina with three small holes.

For Examiner's Use

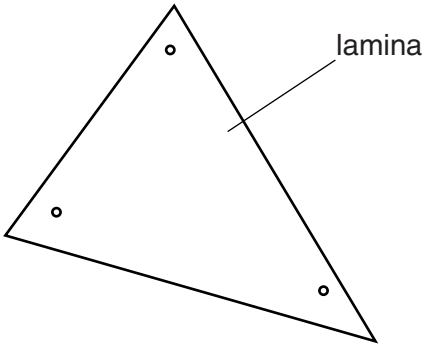


Fig. 4.1

Describe an experiment to find the position of the centre of mass of the lamina.
You may use any common laboratory equipment.

Your answer must include a labelled diagram of the apparatus being used.

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.....[4]