UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **5054/42**

Paper 4 Alternative to Practical **May/June 2010**

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.

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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[Turn over

1 A group of students performs an experiment to investigate the flow of oil at different temperatures.

200 cm^3 of oil is heated gently and its temperature θ is recorded. The oil is then poured through a funnel into a second beaker, as shown in Fig. 1.1.

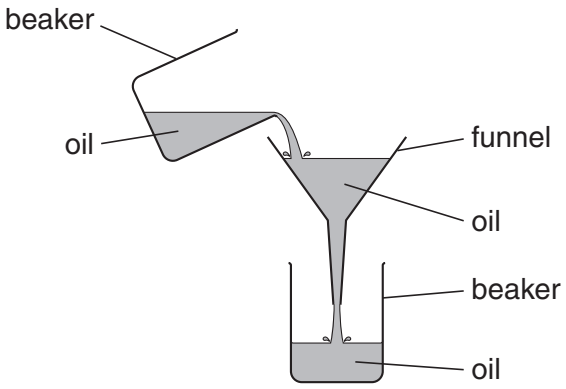


Fig. 1.1

The time *t* taken for the oil to flow through the funnel is recorded with a stopwatch.

(a) State why it is important to stir the oil during heating.

.....

..... [1]

(b) Explain why the oil is heated **gently**.

.....

..... [1]

(c) The experiment is repeated for several values of θ. Values of θ and *t* are recorded in the table of Fig. 1.2.

θ/°C	*t*/s
69	13.69
52	14.97
35	17.34
24	21.16
17	25.16
10	28.85

Fig. 1.2

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(i) On Fig. 1.3, plot the graph of t/s on the y-axis against θ/°C on the x-axis.

Start your graph from θ = 0 °C and t = 12 s. Draw the curved line of best fit.

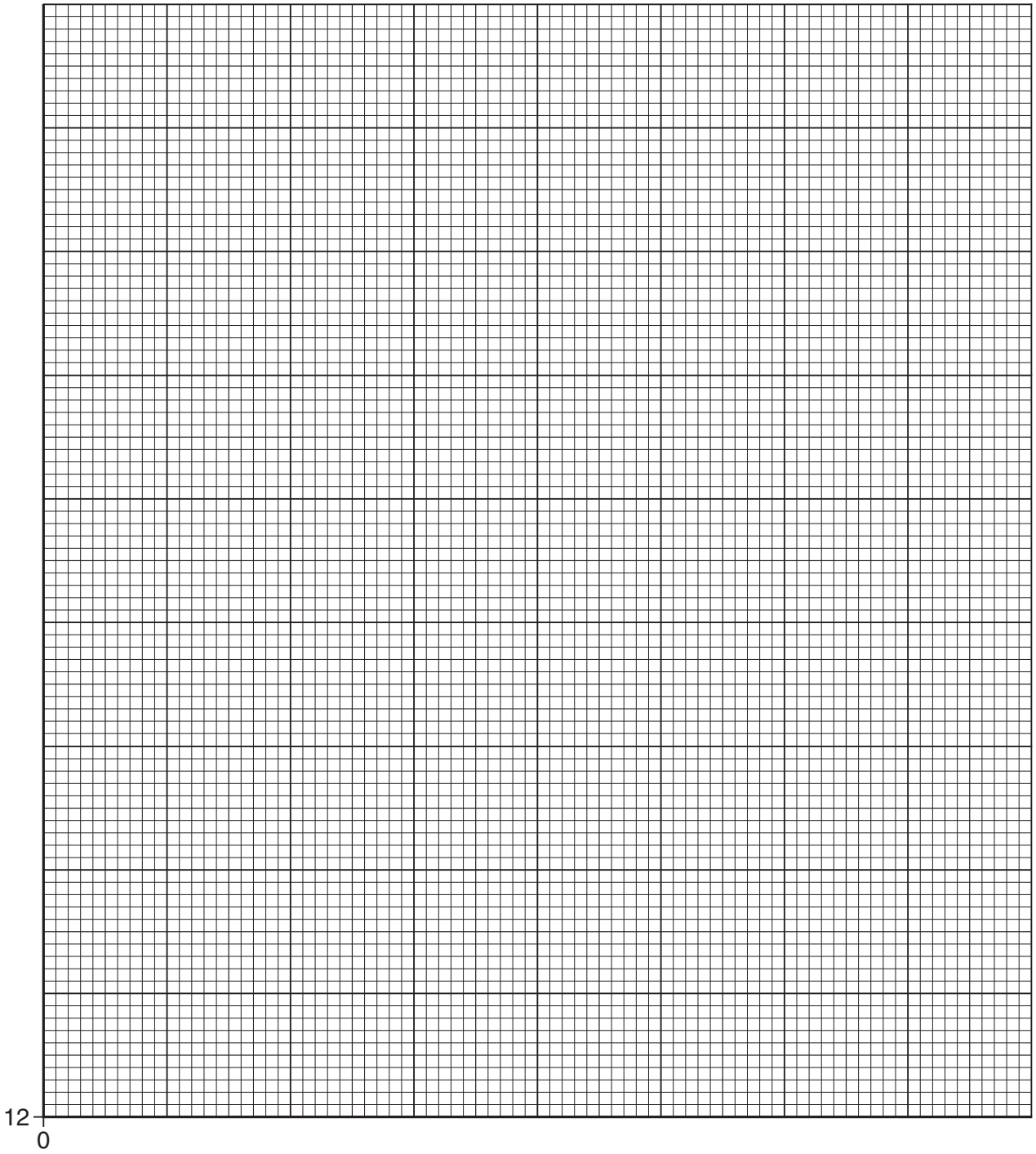


Fig. 1.3 [4]

(ii) Estimate the time taken for oil at 80 °C to flow through the funnel.

..... [1]

(iii) State the maximum reading on a standard laboratory liquid-in-glass thermometer that is suitable for this experiment.

..... [1]

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(d) Explain why it is not possible to repeat a reading immediately after it is taken.

.....

..... [1]

(e) Tick **two** boxes to show which of the following will make the experiment more accurate.

using a more sensitive thermometer	
using two people to take the measurements	
using a thicker oil	
using a larger range of readings	
pouring the oil quickly after taking its temperature	

[2]

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2 Fig. 2.1 shows a wooden metre rule with small holes drilled through it.

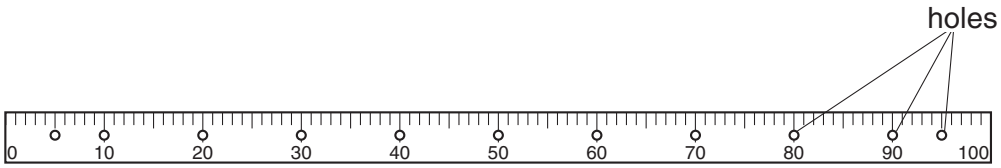


Fig. 2.1

The metre rule is suspended from the hole at 5.0 cm so that it can swing freely, as shown in Fig. 2.2.

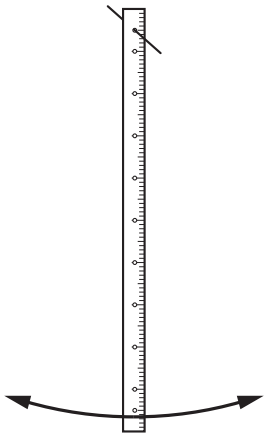


Fig. 2.2

The rule is made to swing from side-to-side and the time T for one complete swing is determined.

(a) Describe three experimental techniques used to obtain an accurate value for T.

1. .....

.....

2. .....

.....

3. .....

.....

[3]

(b) The distance d between a hole and the zero end of the rule is varied, by suspending the rule from different holes.

The time T is determined for each value of d.

The results are recorded in the table of Fig. 2.3.

d/cm	T/s
5.0	1.61
10.0	1.57
20.0	1.52
30.0	1.58
40.0	1.91

Fig. 2.3

(i) Describe how T varies with d.

.....

.....

.....

..... [2]

(ii) Suggest the value of T for $d = 95.0$ cm.

T = ... [1]

(iii) Suggest why T was not measured for $d = 50.0$ cm.

.....

.....

..... [1]

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3 The efficiency of a motor is measured using the apparatus shown in Fig. 3.1.

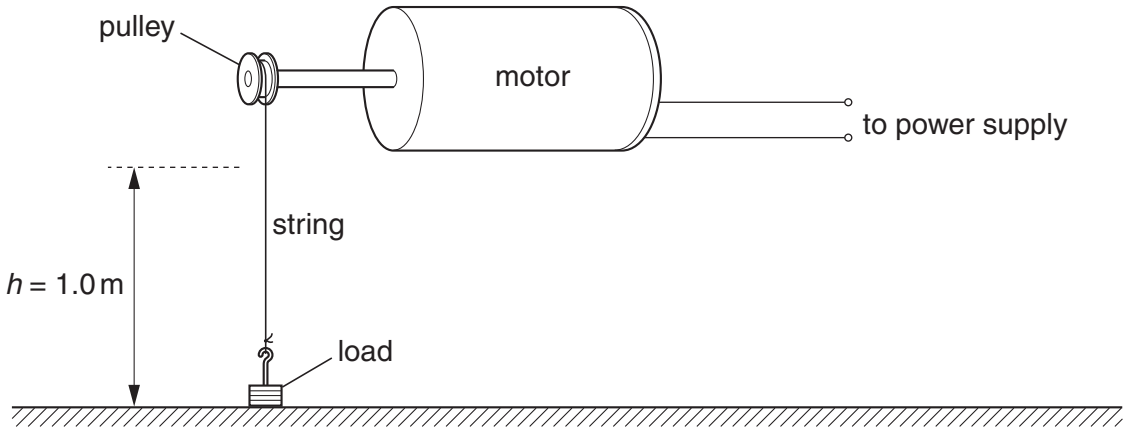


Fig. 3.1 (not to scale)

When the motor is switched on, the string winds round the pulley and the load is lifted. Six students measure the time t taken for the load to be lifted a height h of 1.0 m.

(a) The times recorded are

4.47 s, 4.53 s, 4.39 s, 4.44 s, 5.92 s, 4.61 s.

(i) The result of 5.92 s is discarded.

Suggest why this result is very much larger than the others.

..... [1]

(ii) Calculate the average time t_{av} of the other results.

Considering the variation in the students' results, give your answer to an appropriate number of significant figures. Show your working.

t_{av} = ... s [2]

(b) The efficiency E of the motor is given by the relationship

$$E = \frac{2 \times 10^2}{3 \times t_{av}} \%.$$

Use this relationship to calculate E.

E = ... [1]

(c) Describe one way in which the students can measure h accurately.

.....

.....

..... [1]

4 A student performs an experiment using optical pins to find the effect of a circular block, made of transparent plastic, on parallel rays of light.

Fig. 4.1 shows the circular plastic block on a sheet of white paper.

The student draws round the block with a sharp pencil. The student also draws three parallel lines up to the block before starting the experiment.

(a) Explain why the student draws round the block.

.....

..... [1]

(b) The student places pins P_1 and P_2 on line 1, representing an incident ray of light.

Describe how the student places pins P_3 and P_4 to locate the emergent ray.

.....

.....

..... [1]

(c) On Fig. 4.1,

(i) complete the path of the ray along line 1 through the block, [1]

(ii) draw the normal at the point where the ray along line 1 enters the block, [1]

(iii) measure the angle of incidence *i* where the ray along line 1 enters the block.

i = ... [1]

(d) Explain why a ray along line 2 passes through the block without changing direction.

.....

..... [1]

(e) On Fig. 4.1, complete the path of a ray along line 3 through the block. [1]

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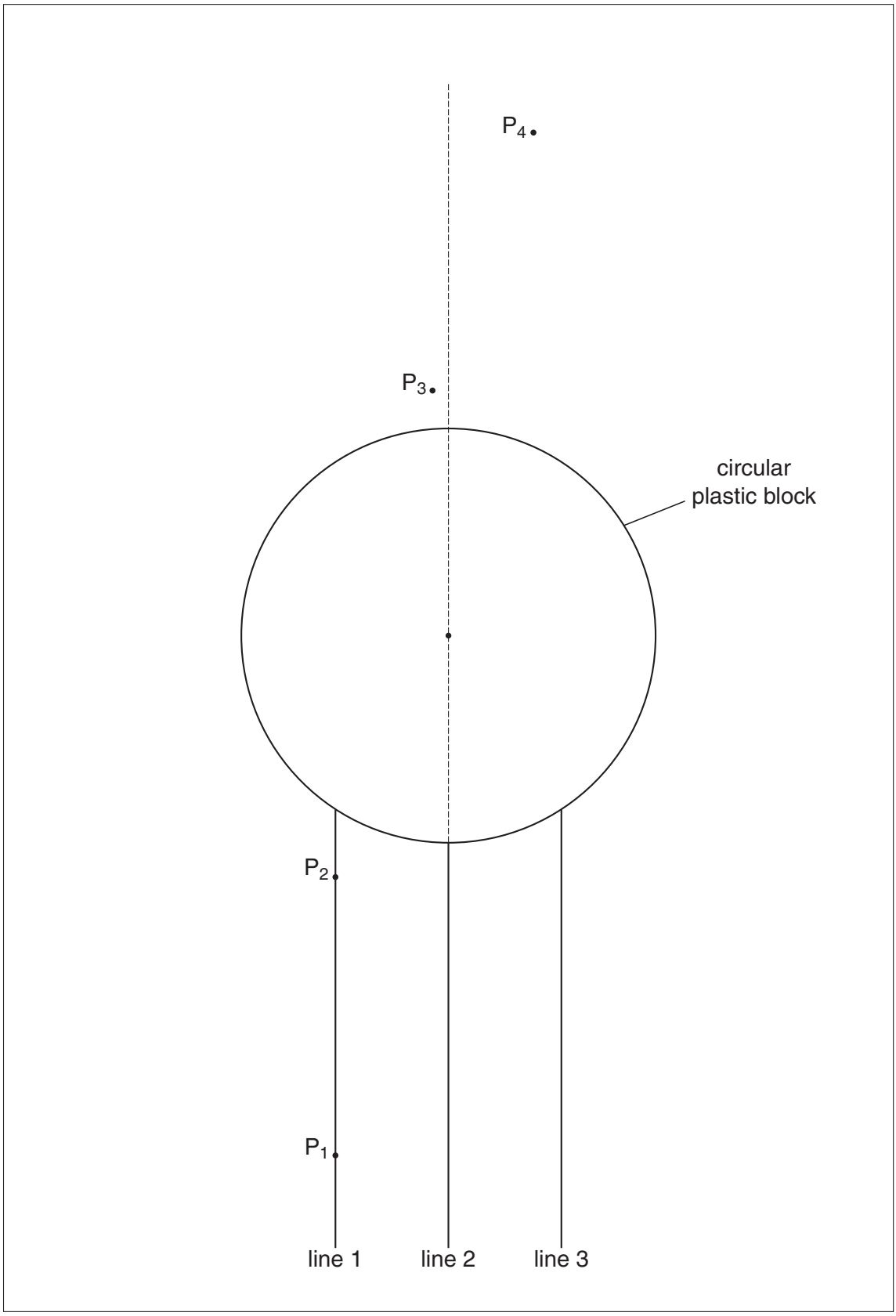


Fig. 4.1

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