UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1758401380

PHYSICS **5054/42**

Paper 4 Alternative to Practical **October/November 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.

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1	
2	
3	
4	
Total	

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1 A student investigates the speed of water waves.

A rectangular plastic tray has a layer of water in the bottom, as shown in Fig. 1.1.

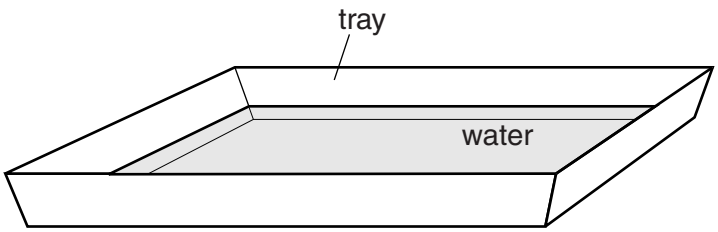


Fig. 1.1

One end of the tray is lifted gently a small distance, as shown in Fig. 1.2a. When the water is still, the tray is lowered quickly. This causes a wave to travel across the surface of the water, as shown in Fig. 1.2b.

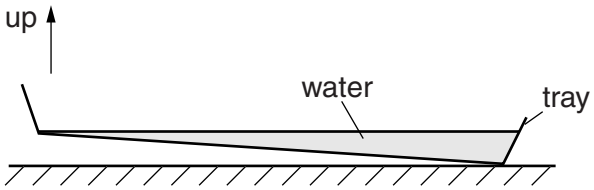


Fig. 1.2a

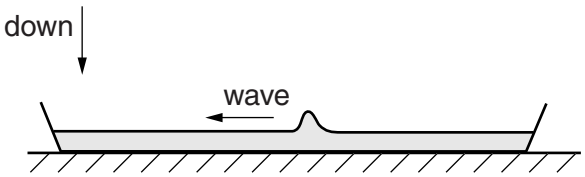


Fig. 1.2b

The wave is reflected by the ends of the tray and travels backwards and forwards several times.

(a) The student estimates the time for the wave to travel one length of the tray to be about one second.

Suggest a reason why the student decides to measure the time for the wave to travel five lengths of the tray.

.....

..... [1]

(b) The ends of the tray slope outwards.

(i) Explain why this makes it difficult to measure accurately the distance travelled by the wave.

.....

..... [1]

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(ii) Describe a possible method of measuring the distance travelled by the wave.
You may use a diagram in your answer.

.....

..... [1]

(c) The student measures the depth *d* of the water. He has two identical 30 cm rulers. Part of one ruler is shown in Fig. 1.3.

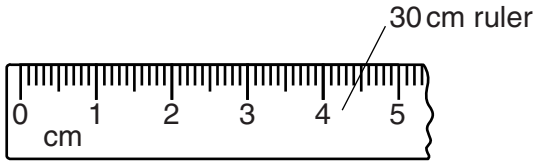


Fig. 1.3

(i) Explain why it is difficult to measure *d* using only one of these rulers.

.....

..... [1]

(ii) Describe a method of measuring *d* using the two rulers.
You may use a diagram in your answer.

.....

..... [2]

(d) The student repeats the experiment for different values of d and calculates the speed v of the wave for each value of d.
Fig. 1.4 shows the student's results.

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d / cm	v / (cm / s)
0.5	20.6
1.0	28.5
1.5	35.5
2.0	42.0
2.5	46.3
3.0	50.5

Fig. 1.4

(i) On Fig. 1.5, plot the graph of v / (cm / s) on the y-axis against d / cm on the x-axis.
Start your graph at $v = 20$ cm / s and $d = 0$.
Draw a smooth curve of best fit.

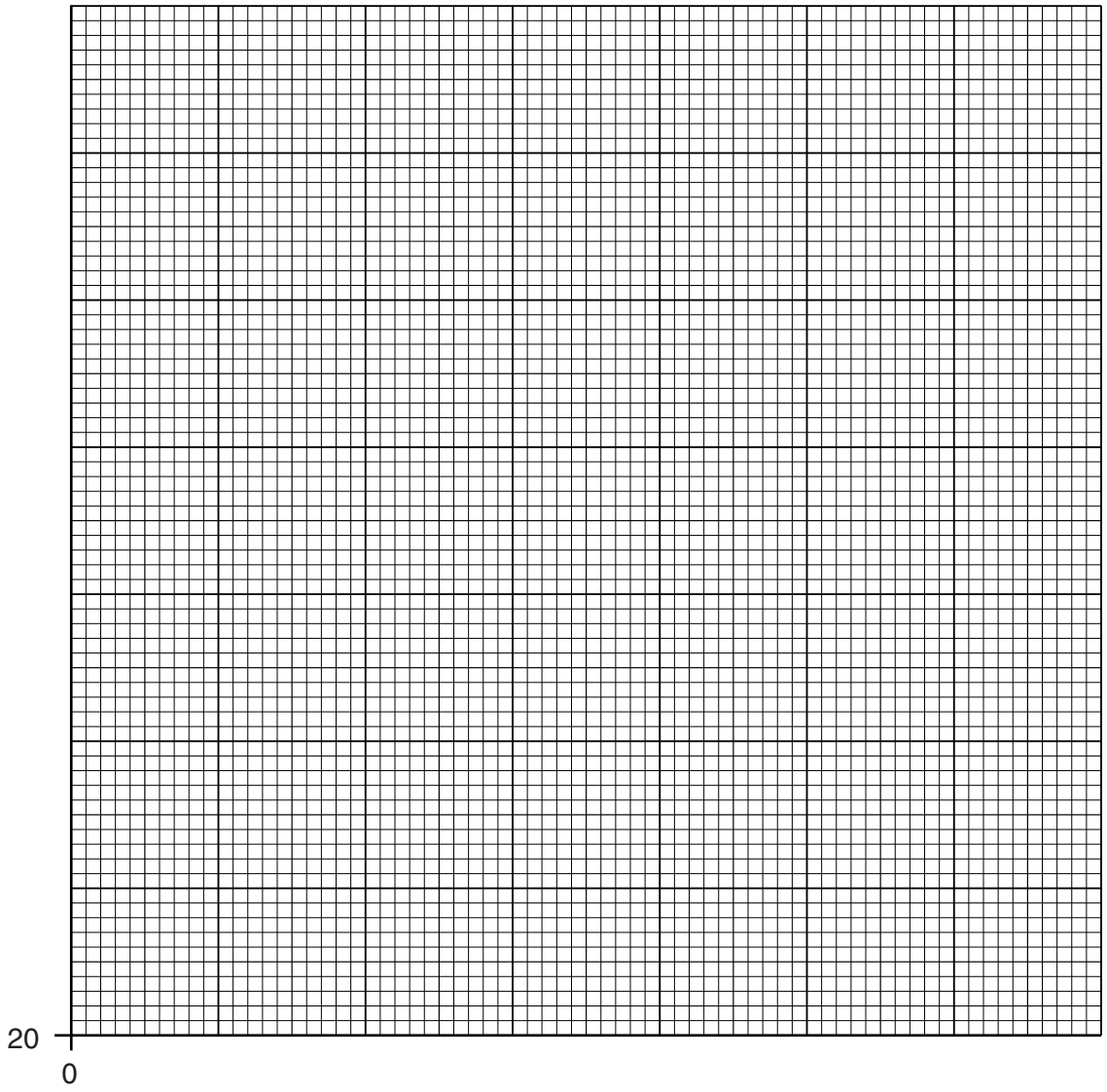


Fig. 1.5

[4]

(ii) Suggest a possible reason why the student cannot take readings for d greater than 3.0 cm.

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.....

..... [1]

(iii) Using your graph, suggest how the speed varies with depth for very large values of d.

.....

..... [1]

2 A student uses an electric kettle to measure the specific heat capacity of water.

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Fig. 2.1 shows a kettle containing 1.0 kg of water.

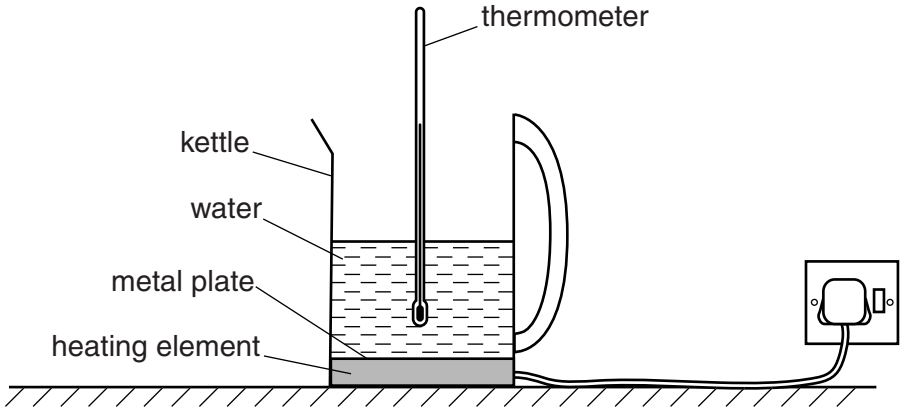


Fig. 2.1

The kettle has a label on the base, as shown in Fig. 2.2.

2755 – 3000 W 230 – 240 V

Fig. 2.2

The initial temperature of the water is 19 °C. The kettle is switched on for 1.0 minute and the final temperature of the water is 53 °C.

(a) The relationship

power × time = mass × specific heat capacity × temperature change

is used to find the specific heat capacity of water.

Use the relationship and the given data to find the smallest possible value for the specific heat capacity *c* of water.
Give your answer to a suitable number of significant figures.

c = ... J/(kg °C) [3]

(b) (i) Explain why the water should be stirred before reading the thermometer.

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.....

..... [1]

(ii) Explain why the thermometer should not touch the metal plate when measuring the temperature of the water.

.....

..... [1]

(c) The student's answer for *c* is larger than the accepted value.
Suggest a reason why this answer is too large.

.....

..... [1]

3 A student investigates the behaviour of a pendulum.

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Fig. 3.1 shows the pendulum hanging from a fixed support.

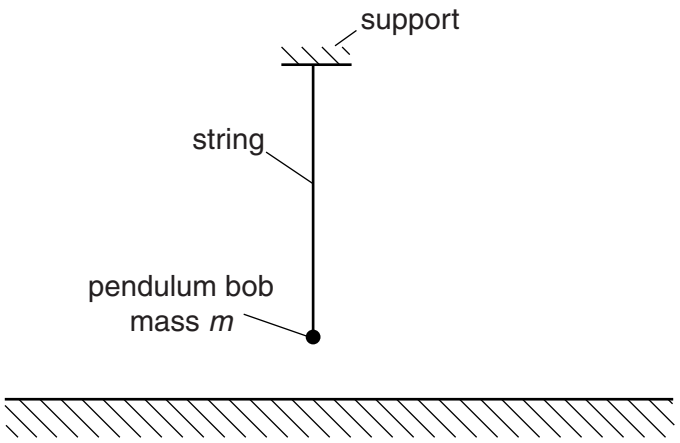


Fig. 3.1

The mass of the pendulum bob is *m*.
The student measures the time *t* for 10 complete swings of the pendulum for different values of *m*.
She starts with *m* = 20 g and increases *m* in 20 g steps up to 100 g.
The values obtained for *t*, in order, are 16.32 s, 16.28 s, 16.38 s, 16.44 s, 16.35 s.

(a) In the space below, draw a table of results for this experiment.

[3]

(b) Using the results from the table,

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(i) comment on whether *m* affects *t*,

.....

..... [1]

(ii) suggest further readings the student can take so that a more reliable comment can be made.

.....

..... [1]

4 A student investigates the deviation of a ray of light by a prism.

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A ray of red light passes through the prism. The student places pins P_1 and P_2 on the incident ray and pins P_3 and P_4 on the emergent ray.

Fig. 4.1 on page 11 shows the positions of the pins and the prism.

(a) (i) On Fig. 4.1, draw a straight line through P_1 and P_2.
Continue this line through the prism. [1]

(ii) On Fig. 4.1, draw a straight line through P_3 and P_4.
Continue this line to cross the line drawn in **(i)**. [1]

(iii) Measure the smaller angle between the line drawn in **(i)** and the line drawn in **(ii)**.

angle = ... [1]

(iv) On Fig. 4.1, draw a line to represent the actual path of the ray through the prism. [1]

(b) Suggest why the student uses red light and not white light in this experiment.

.....

..... [1]

Question 4 continues on page 12.

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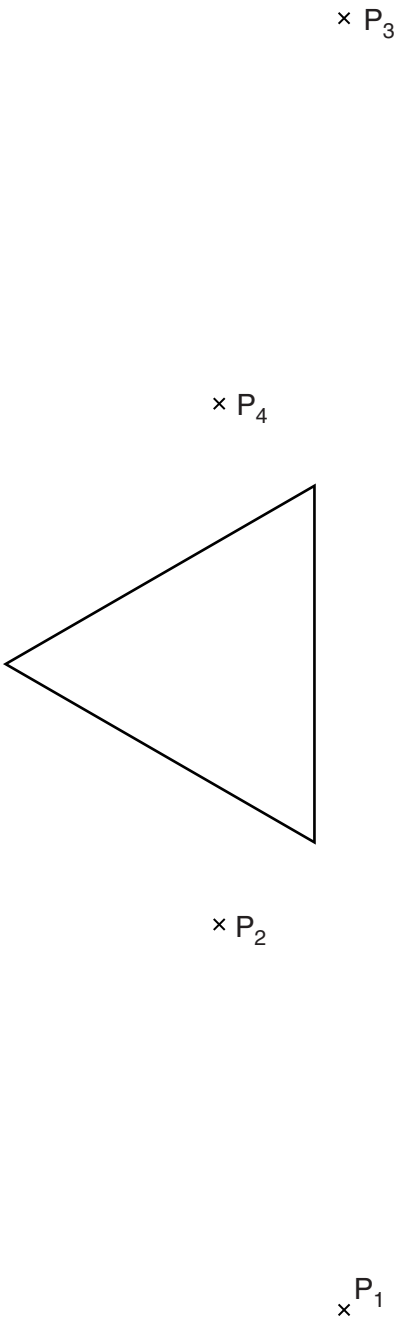


Fig. 4.1

(c) In a different experiment, the student is asked to draw the normal at the point where an incident ray strikes a prism.

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The student draws a line, as shown in Fig. 4.2.

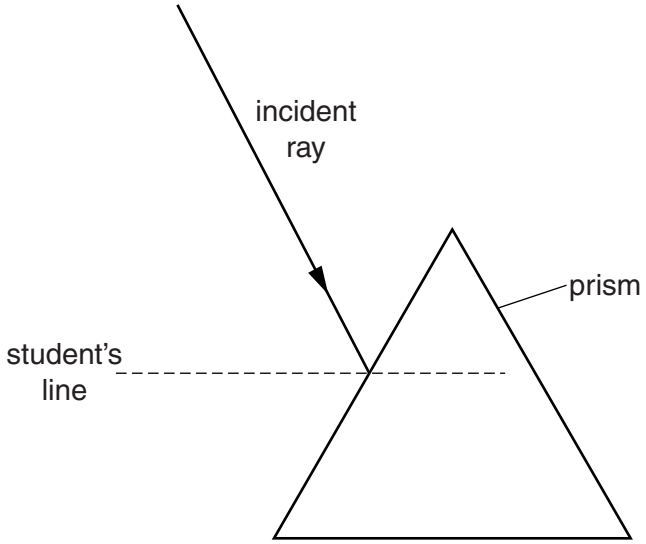


Fig. 4.2

(i) Explain why the student's line is not the normal.

.....

..... [1]

(ii) On Fig. 4.2, draw the correct normal. Measure the angle of incidence *i*.

i = ... [1]

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