UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **5054/41**

Paper 4 Alternative to Practical **October/November 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 **8** printed pages.

UNIVERSITY of CAMBRIDGE International Examinations

1 A student performs an experiment to measure an elastic property of wood.

For Examiner's Use

(a) A metre rule is clamped with its 10.0 cm mark at the edge of a bench, as shown in Fig. 1.1.

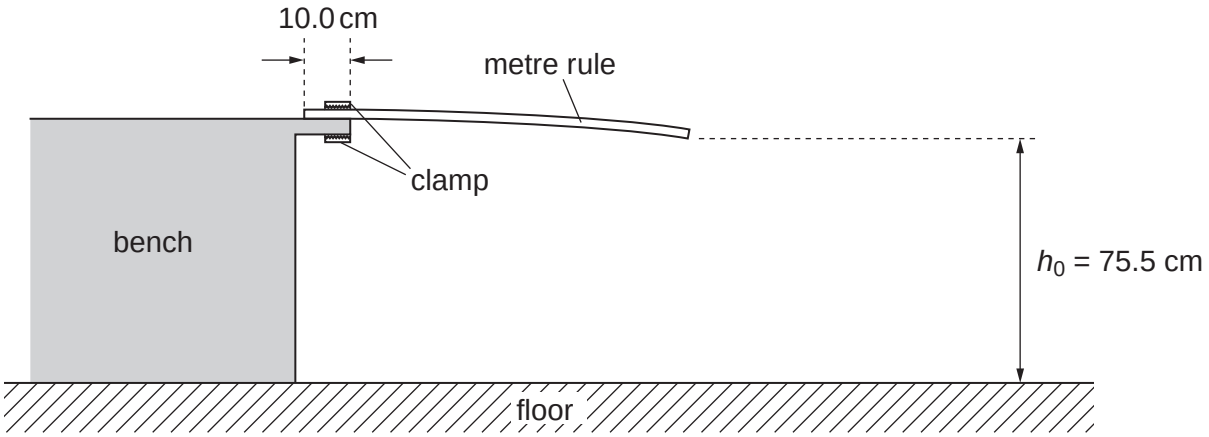


Fig. 1.1

(i) On Fig. 1.1, draw a second rule positioned to measure the height h_0 above the floor of the free end of the clamped metre rule. [1]

(ii) On Fig. 1.1, draw the position of the eye of the student when measuring h_0. [1]

(b) A mass m is hung from the 95.0 cm mark on the clamped metre rule, as shown in Fig. 1.2.

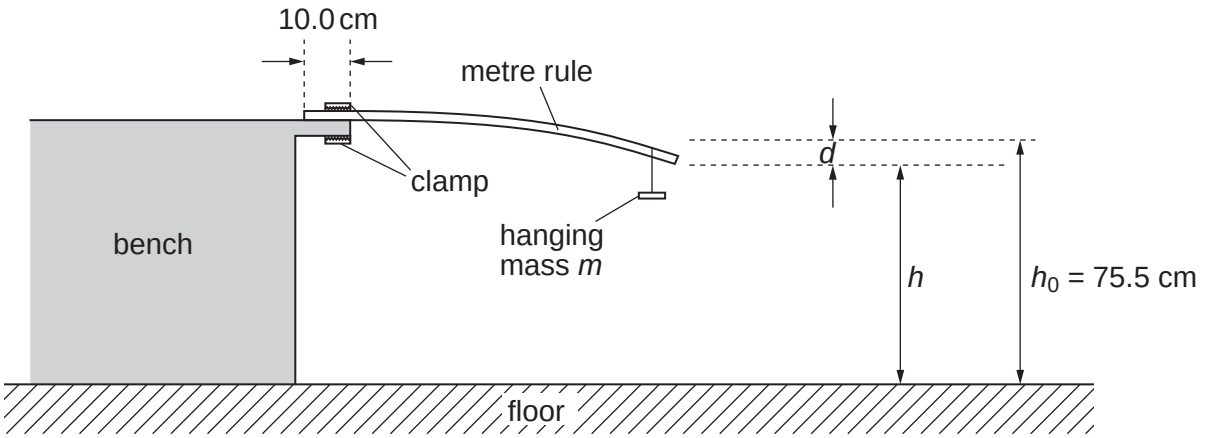


Fig. 1.2

The end of the rule moves down a distance d, where $d = h_0 - h$.

The student takes readings of h for different values of m.
Values of m and h are recorded in the table of Fig. 1.3.

m/g	h/cm	d/cm
20.0	75.0	
40.0	74.2	
60.0	73.4	
80.0	72.7	
100.0	72.0	
120.0	71.2	

Fig. 1.3

(i) Complete Fig. 1.3 to show the values of d. [1]

For Examiner's Use

(ii) On Fig. 1.4, plot the graph of d/cm on the y-axis against m/g on the x-axis. Start your graph from the origin and draw the straight line of best fit.

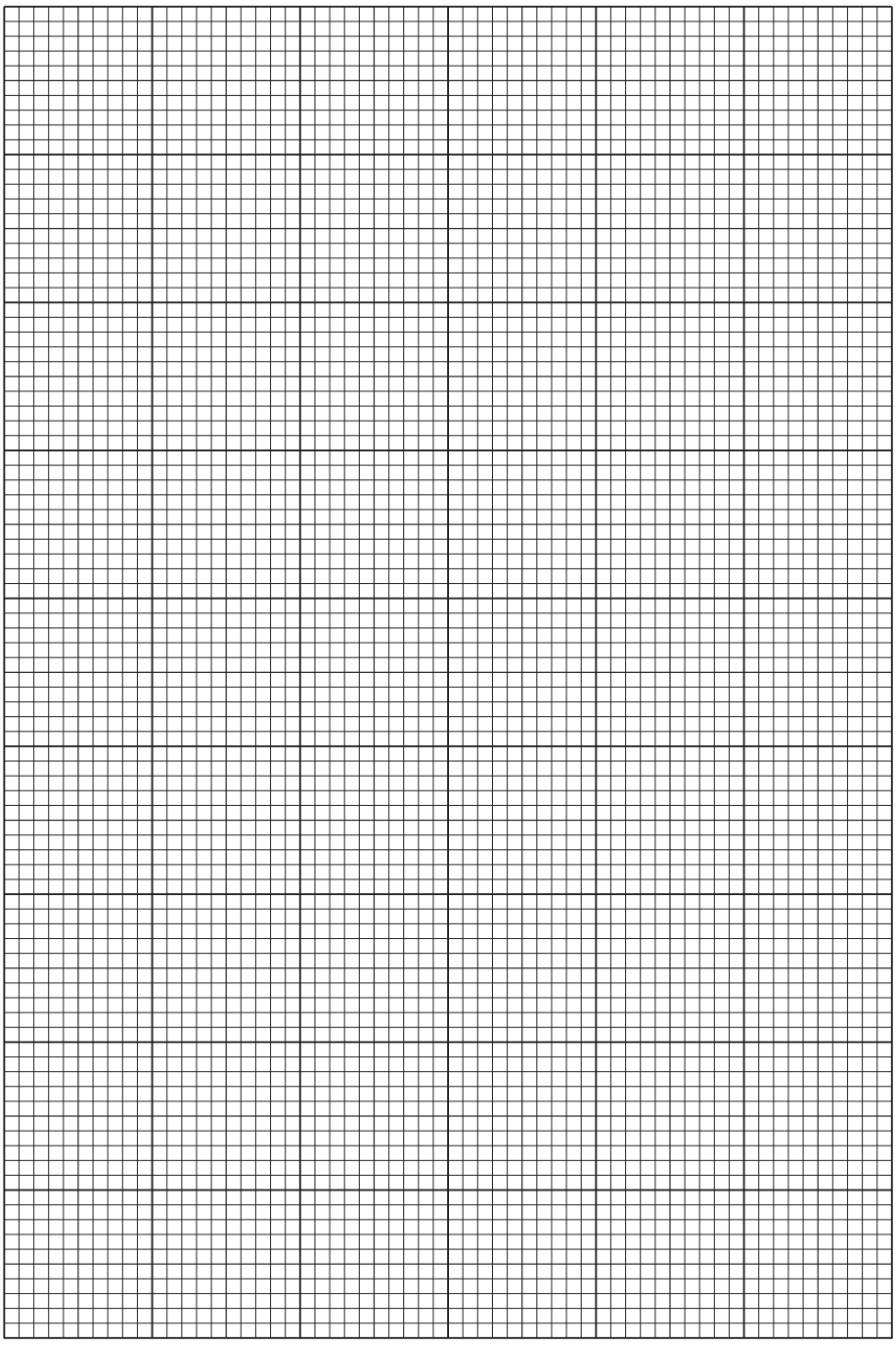


Fig. 1.4

[4]

(iii) Explain how the graph shows that d is not directly proportional to m.

.....

..... [1]

(c) **(i)** Find the gradient of your graph. Show your working clearly.

For Examiner's Use

gradient = ... [2]

(ii) Use information from **(b)** to find the length L along the clamped metre rule from the edge of the bench to the point where the hanging mass is attached.

L = ... [1]

(iii) The elastic property E of the wood is given by the relationship

$$E = \frac{0.72 \times L^3}{\text{gradient}}.$$

Calculate the value of E.
You do not need to give the unit of your answer.

E = ... [1]

2 A group of students measures the speed of a wave along a slinky spring.

For Examiner's Use

A teacher and a student hold the ends of a slinky spring stretched along a bench, as shown in Fig. 2.1.

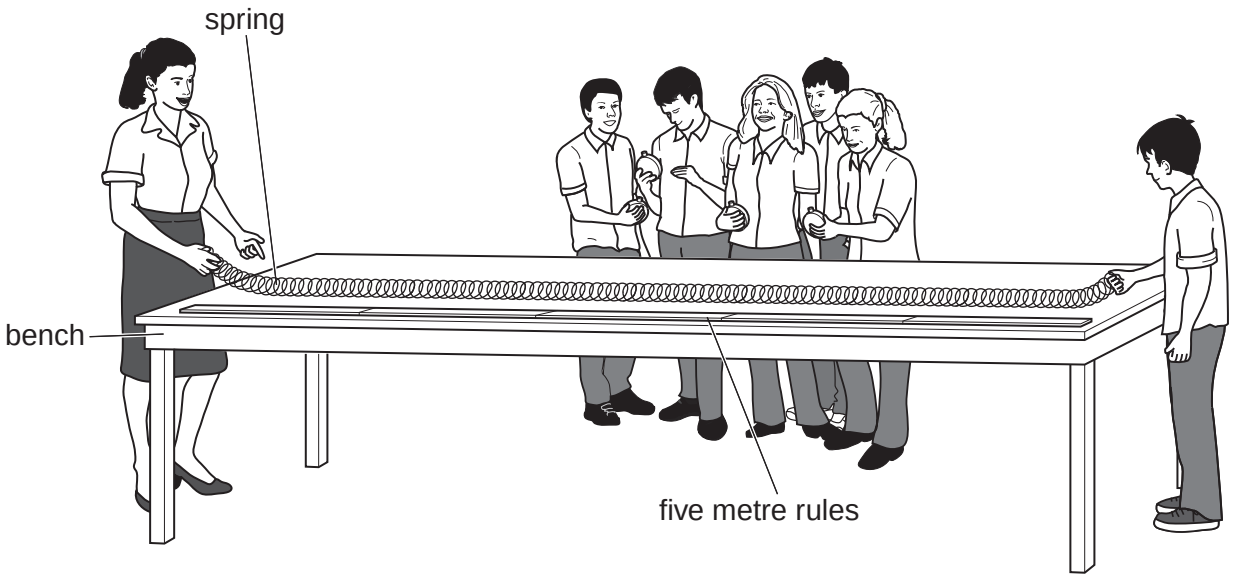


Fig. 2.1

The teacher moves one end of the spring to make a wave pulse travel along the spring.
Five metre rules are placed end-to-end alongside the spring.
Five students with stopwatches stand together near the centre of the spring to measure the time t taken by the wave pulse to travel the distance of 5.0 m.

(a) The five students record the following values for t, measured in seconds.

1.71 1.64 1.78 1.75 1.67

(i) Find the average time t_{av} for the wave to travel 5.0 m along the spring.

t_{av} = ... [1]

(ii) Calculate the average speed v_{av} of the wave pulse along the spring.
Give your answer to a suitable number of significant figures.

v_{av} = ... [2]

(b) **(i)** Explain why, in practice, the position of the students and the metre rules causes a parallax error.

.....

..... [1]

(ii) Explain why this parallax error causes the measured values of *t* to be too small.

.....

..... [1]

(iii) Explain one other reason why the times recorded by the students are not all exactly the same.

.....

..... [1]

(iv) Describe how the students could measure the time *t* more accurately.

.....

.....

.....

..... [2]

(c) One student suggests that the speed of a slower wave pulse can be measured more accurately.
Suggest a method of making a wave pulse travel more slowly along the spring.

.....

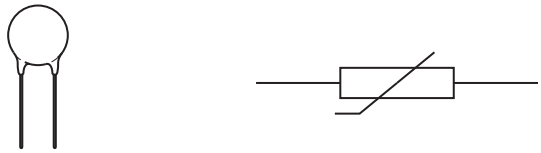
.....

..... [1]

3 The variation of the resistance of a thermistor with temperature is investigated.

For Examiner's Use

Fig. 3.1 shows one type of thermistor and its circuit symbol.



thermistor circuit symbol

Fig. 3.1

(a) In the space below, draw the circuit diagram of a circuit used to measure the resistance of the thermistor.

[2]

(b) Explain, with the aid of a diagram, how the temperature of the thermistor may be measured and varied from room temperature to 90 °C.

.....

.....

..... [3]

(c) A student measures the resistance of the thermistor at different temperatures and plots a graph of resistance against temperature.
Explain why the resistance must be measured at more than two different temperatures.

.....

..... [1]

4 A student investigates pressure using a pencil and two blocks of modelling clay.

For Examiner's Use

The pencil is pushed gently into the clay. The pencil leaves a dent.
The flat end of the pencil is used first and then the pointed end.
This is shown in Fig. 4.1.

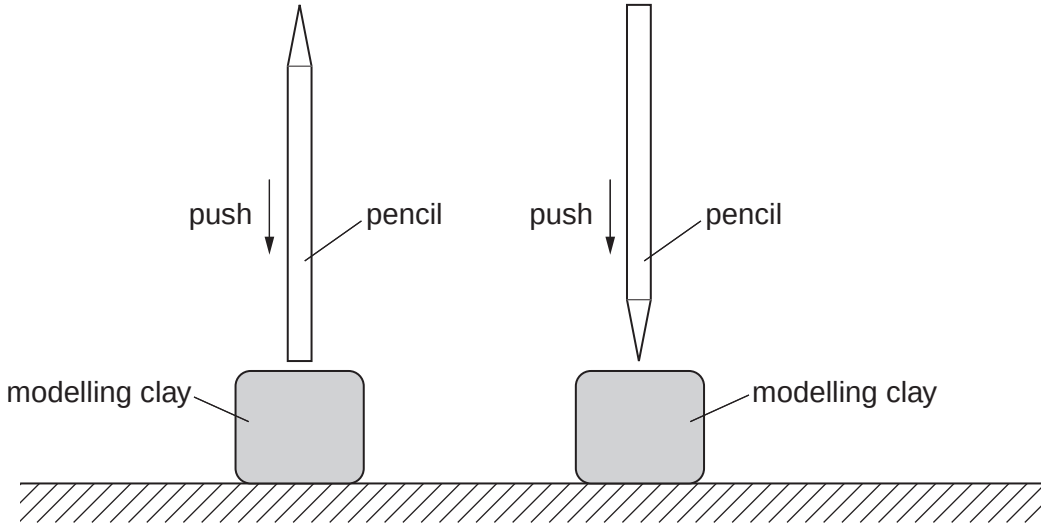


Fig. 4.1

(a) Describe a simple method for pushing the pencil gently into the clay with the same force each time.
You may use a diagram in your answer.

.....

.....

.....

..... [2]

(b) On Fig. 4.1, draw the side view of the dent produced in each piece of clay when the pencil is pushed gently into the clay with the same force each time. [1]