Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER							CANDIDATE NUMBER					

5607786493

PHYSICS **5054/41**

Paper 4 Alternative to Practical **October/November 2017**

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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.

DC (NH/SW) 134852/2

CAMBRIDGE
International Examinations

[Turn over

1 A student finds the mass of a table-tennis ball using a top-pan balance, as shown in Fig. 1.1. The top-pan balance reads to the nearest gram.

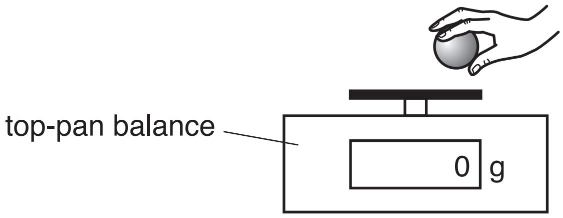

Fig. 1.1

(a) The mass of the ball is about 2.5 g.

Suggest a reason why placing the ball on the top-pan balance does not give an accurate value for the mass of the ball.

....

....[1]

(b) The student uses ten identical balls and a glass beaker to hold them, as shown in Fig. 1.2.

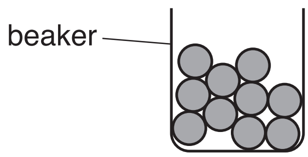

Fig. 1.2

Explain in detail how the student can obtain a more accurate value for the mass of one ball.

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....

....[3]

2 A student investigates how high a table-tennis ball bounces. He drops the ball from a height of 60 cm onto a tiled floor, as shown in Fig. 2.1. He records the height h of the bounce using a metre rule with millimetre divisions.

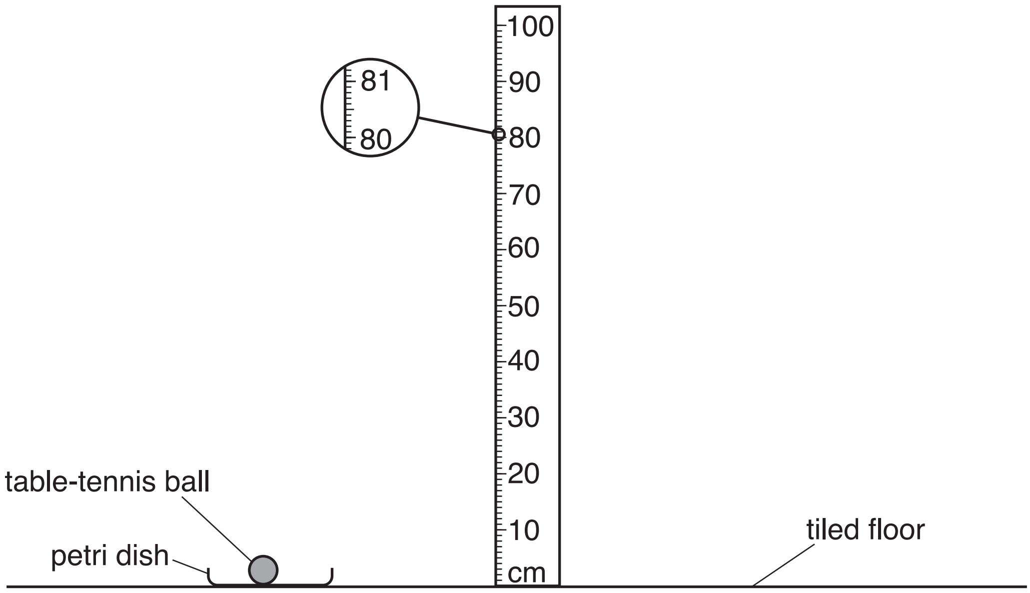


Fig. 2.1

(a) The ball is placed near the metre rule so that, when released, it falls 60 cm before it hits the floor.

On Fig. 2.1, draw the ball in its starting position. [1]

(b) Before recording any values for the height of the bounce, the student performs a trial drop.

Suggest a reason for doing this trial drop.

....

....[1]

(c) He drops the ball five times from 60 cm and records the following values of h.

40 cm 39 cm 40 cm 42 cm 40 cm

(i) Suggest a reason why h is recorded to the nearest cm.

....

....[1]

(ii) Calculate the average bounce height h_{av}. Give your answer to the nearest centimetre.

h_{av} = ...[2]

(d) The student extends the investigation to find the average bounce height h_{av} from other drop heights H. Fig. 2.2 shows the results obtained.

drop height H/cm	bounce height h_{av}/cm
60	
100	56
140	74
180	86
220	94
260	96

Fig. 2.2

(i) On Fig. 2.2, add your value of h_{av} at $H = 60$ cm.

(ii) To get the larger values of H, the student changes his apparatus and method. Suggest how he does this.

....

....

....

....[2]

(iii) On Fig. 2.3, plot a graph of h_{av}/cm on the y-axis against H/cm on the x-axis. Start your axes from (0,0). Draw a smooth curve of best fit.

(e) **(i)** The student does not take any readings of h_{av} for H less than 60 cm.

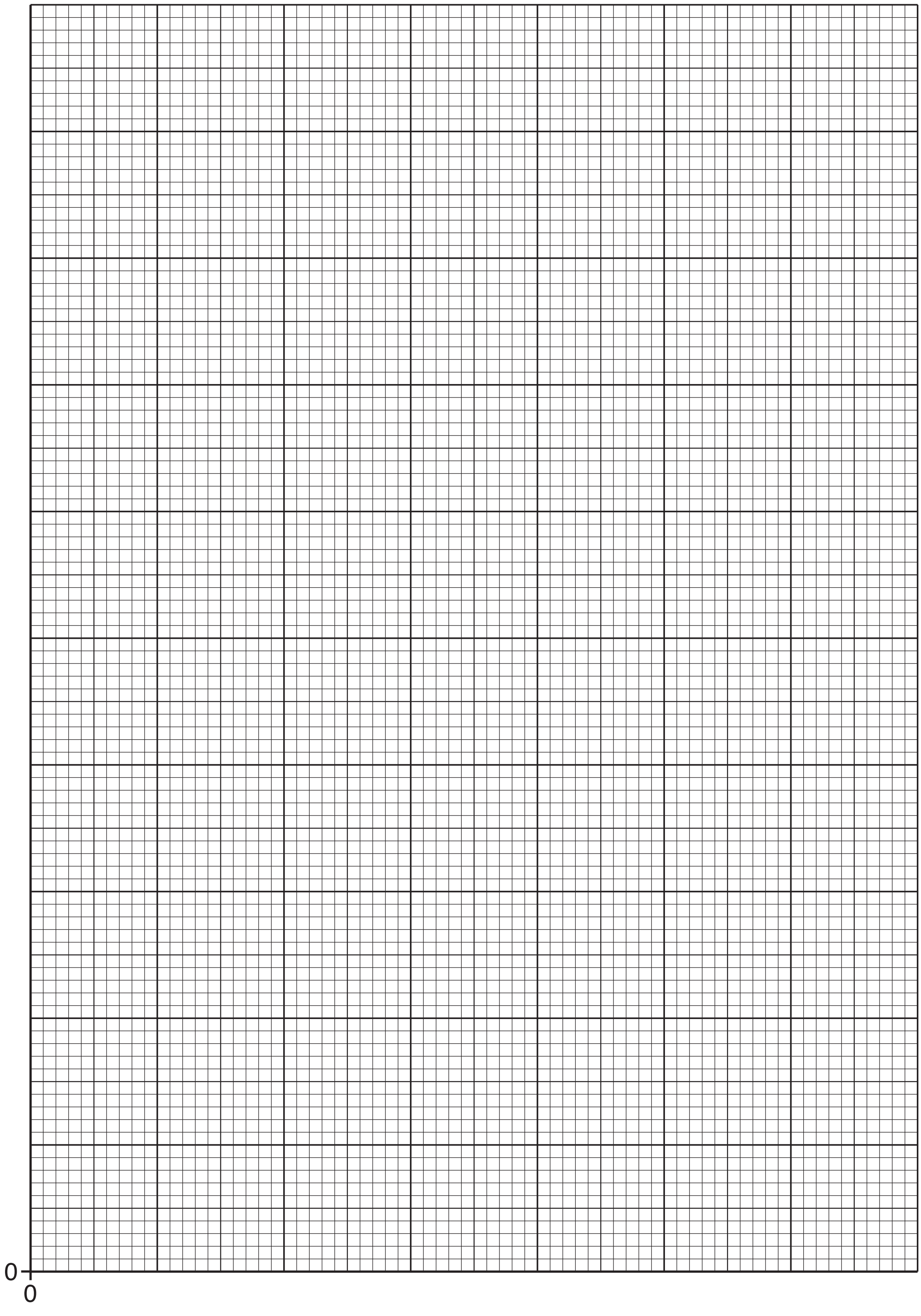
Suggest why these readings are difficult to take.

....

....[1]

(ii) Use your graph to estimate the value of h_{av} when H is 40 cm.

h_{av} = ...[1]



[4]

Fig. 2.3

3 Fig. 3.1 shows a thermistor. A thermistor is a type of resistor whose resistance is affected by changes in temperature.

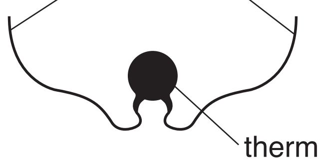


Fig. 3.1

Fig. 3.2 shows a partially completed circuit.

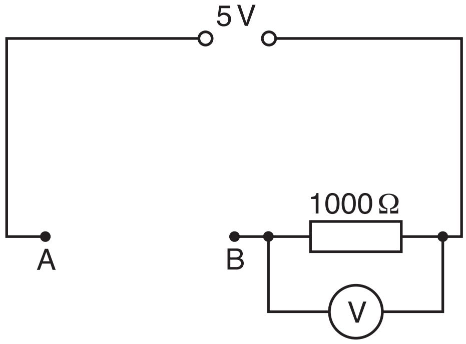


Fig. 3.2

(a) The thermistor is connected between A and B in the circuit.

On Fig. 3.2, draw the correct circuit symbol for the thermistor between A and B. [1]

(b) The thermistor is at room temperature and the reading on the voltmeter is shown in Fig. 3.3.

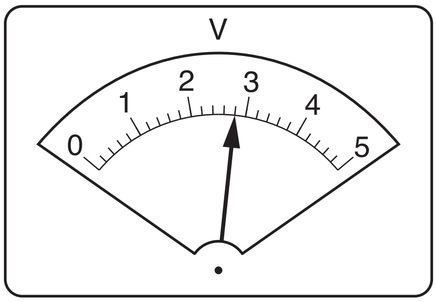


Fig. 3.3

(i) State the reading V on the voltmeter.

V = ...[1]

(ii) The student then records the reading on the voltmeter when the thermistor is at a steady temperature of 0 °C.

Suggest how she can reduce the temperature of the thermistor from room temperature to 0 °C in the laboratory.

....

....

....[1]

(iii) At 0 °C, the reading *V* on the voltmeter is 1.8 V.

The resistance *R* of the thermistor, measured in ohms, can be found using

$$R = \frac{5000}{V} - 1000.$$

Calculate *R* at room temperature and at 0 °C. Give both answers to 2 significant figures.

at room temperature, *R* = ...

at 0 °C, *R* = ...
[2]

(iv) Use your results to state how the resistance of the thermistor changes with temperature.

....

....

....[1]

4 In Fig. 4.1, AB represents a converging lens. An object PQ is placed with end Q on the principal axis ST of the lens.

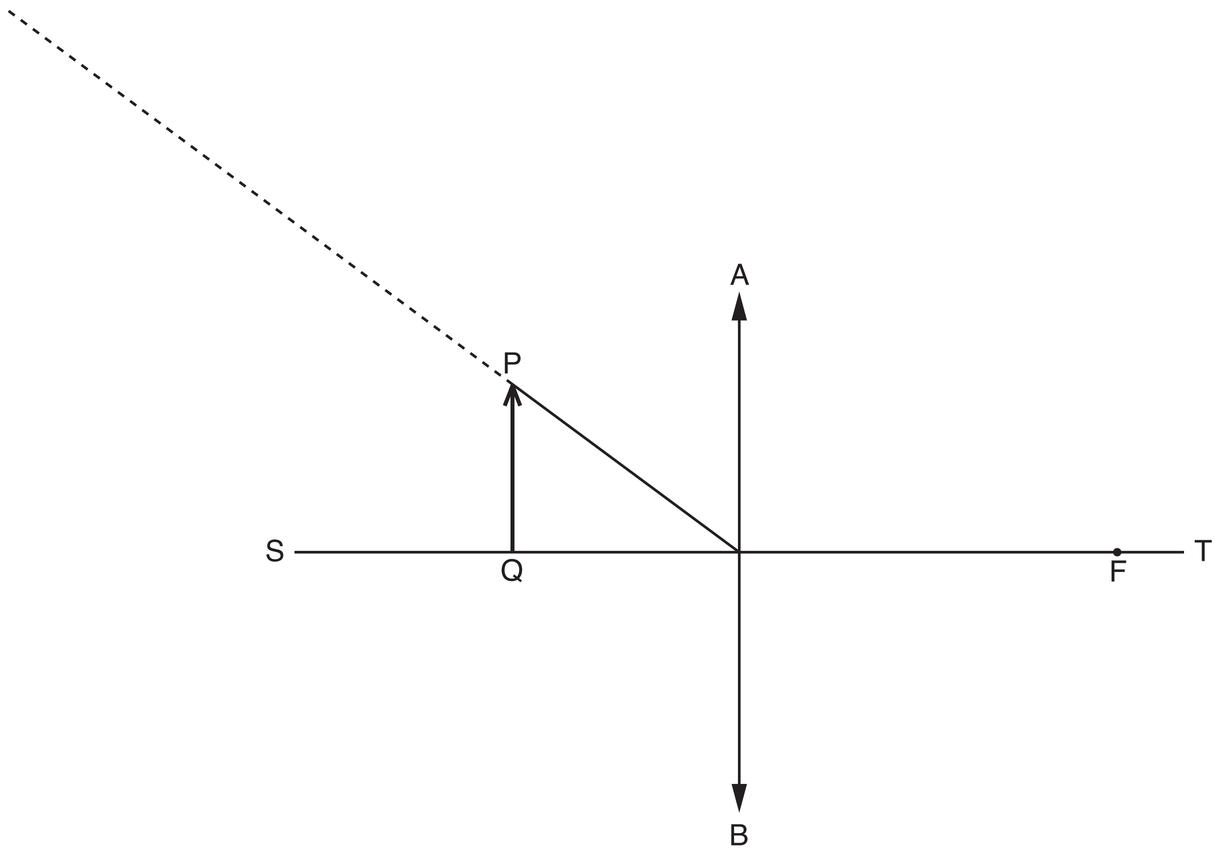


Fig. 4.1 (full scale)

(a) The point F is a focal point (principal focus) of the lens.

Measure the focal length of the lens.

focal length = ...[1]

(b) **(i)** Draw a line from P, parallel to ST, to meet the lens AB at point C. Label C. [1]

(ii) Explain how you ensured that this line is parallel to ST.

....

....

....[1]

(c) Draw a straight line from F to C and extend this line until it meets the dotted line at point R.

Label R. [1]

(d) Measure the angle θ between the lines RC and CP.

θ = ...[1]

(e) Determine the length l in centimetres where

$$l = \frac{2.2}{\sin\theta}.$$

l = ...[1]

(f) Theory suggests that l is equal to the distance CF.

Measure CF and comment on the extent to which your results agree with the theory.

....

....

....[1]

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