Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0408500524

PHYSICS **5054/42**

Paper 4 Alternative to Practical **May/June 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 **12** printed pages.

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CAMBRIDGE International Examinations

[Turn over

1 A student measures the acceleration of free-fall *g*. He drops a metal ball from a height of 1.000 m onto the floor, and measures the time *t* it takes to hit the floor.

Fig. 1.1 shows the ball and a metre rule, held vertically in a clamp.

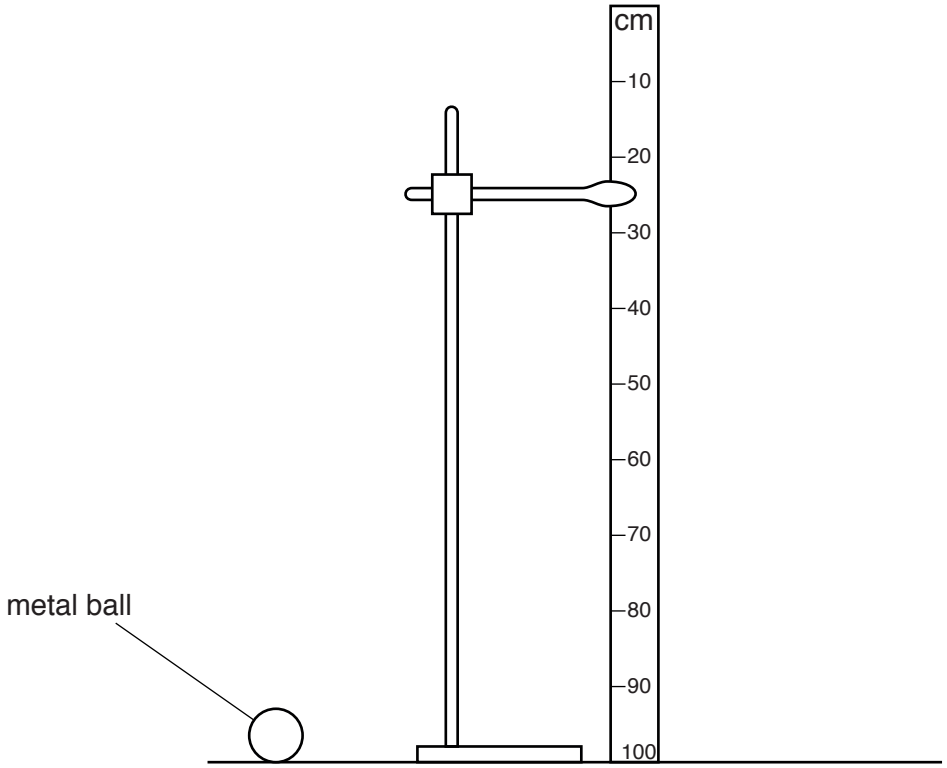


Fig. 1.1

(a) On Fig. 1.1, draw the position of the ball at its point of release. [1]

(b) He repeats the experiment and obtains the following five values of *t*, measured in seconds.

0.65 0.60 0.68 0.59 0.61

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

t_{av} = ...[2]

(ii) Suggest why the value for t_{av} is not given to more than two decimal places.

.....

.....[1]

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(c) The acceleration due to free-fall g is given by the equation

$$g = \frac{2h}{t_{av}^{\ 2}},$$

where $h = 1.000\,\text{m}$.

(i) Calculate a value for g.

$g =$ ..... m/s^2 [1]

(ii) Another student suggests that, to obtain a better value for g, the ball should be dropped from a height greater than 1.000 m.

Explain why this student is correct.

.....

.....

.....

.....[2]

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[Turn over

2 A student investigates a series circuit containing two non-identical lamps P and Q. Both lamps need a working voltage of 2.5 V to be at full brightness.

She sets up the circuit shown in Fig. 2.1.

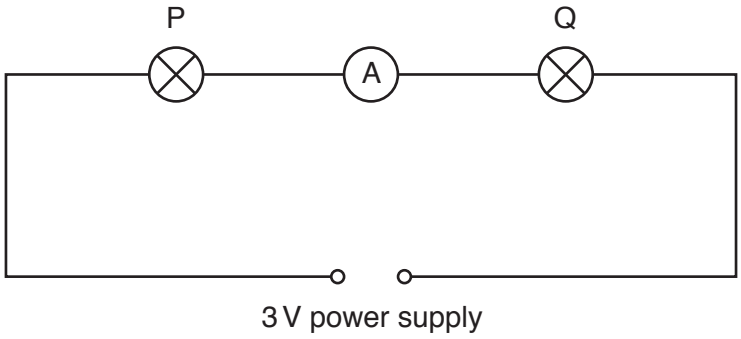


Fig. 2.1

The student adds a voltmeter to the circuit to measure the potential difference (p.d.) across lamp P.

(a) (i) On Fig. 2.1, draw the symbol for a voltmeter to show where it is connected. [1]

(ii) Fig. 2.2 shows the reading on the voltmeter.

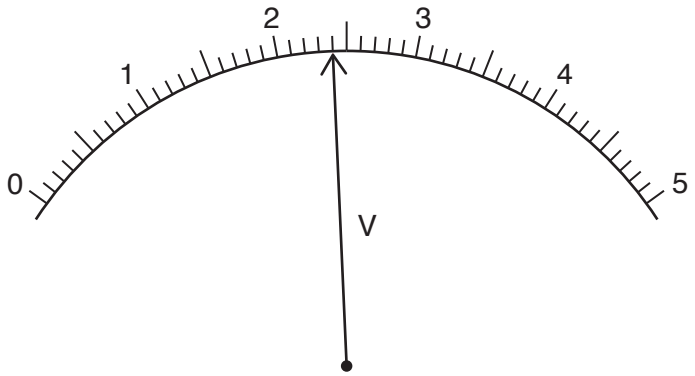


Fig. 2.2

State the voltmeter reading V_P shown on Fig. 2.2.

V_P = ... V [1]

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(b) She measures the p.d. across lamp Q and records the value in Fig. 2.3, together with the brightness of the lamps.

lamp	potential difference / V	brightness
P		bright
Q	0.6	not lit

Fig. 2.3

(i) Add your result from **(a)(ii)** to the table in Fig. 2.3.

(ii) Fig. 2.4 shows the reading on the ammeter in the circuit of Fig. 2.1.

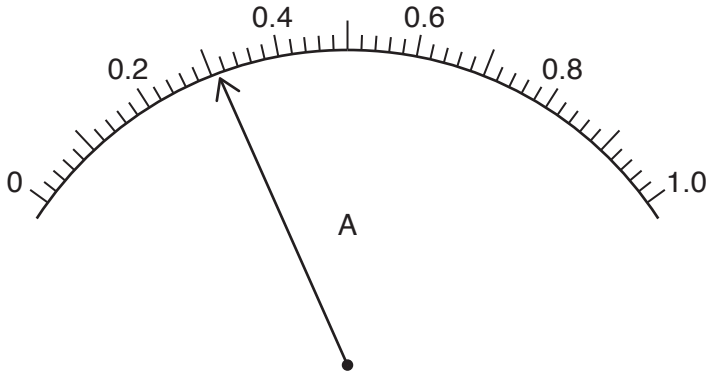


Fig. 2.4

State the ammeter reading I shown on Fig. 2.4.

I = ...A [1]

(iii) The student states that, because lamp Q is not lit, its filament is broken. Explain how the results show that this statement is incorrect.

.....

.....[1]

(iv) Suggest one reason why lamp Q does not glow.

.....

.....[1]

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3 A student investigates the effect of three different insulating materials on the cooling of hot water in a beaker.

The following apparatus is available:

- thermometer
- stopwatch
- 250 cm^3 glass beaker
- 250 cm^3 measuring cylinder
- cardboard
- cotton wool
- cloth
- boss, clamp and stand

A supply of hot water is also available.

Write a plan for the experiment.

You should:

(a) explain how to carry out the experiment; a diagram is not required, but you may draw one if it helps to explain your plan,

.....

.....

.....

.....

.....

.....

.....[2]

(b) state any quantities that need to be kept constant,

.....

.....

.....[1]

(c) draw a table, with headings, to show how to display the results,

[1]

(d) explain how the readings can be used to reach a conclusion.

.....

.....

.....[1]

4 An object is moved between a lamp and a screen. A student investigates how the height of the shadow cast by the object on the screen changes.

The apparatus is shown in Fig. 4.1.

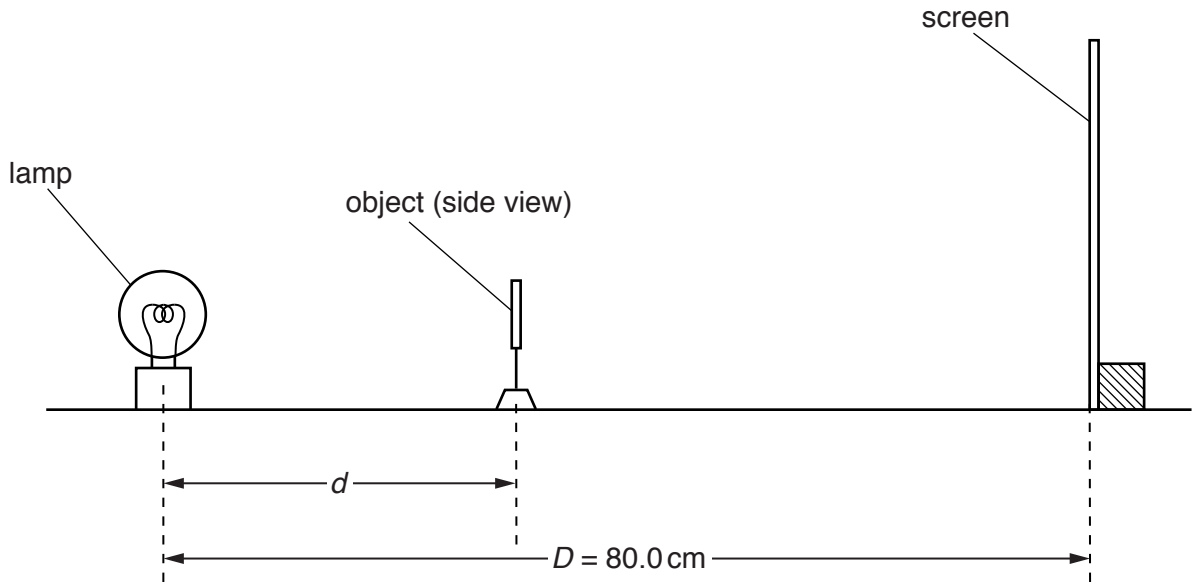


Fig. 4.1 (not to scale)

The object is a square sheet of white card. The length of each side is *H*. The object is attached to a pin and supported by a cork, as shown in Fig. 4.2.

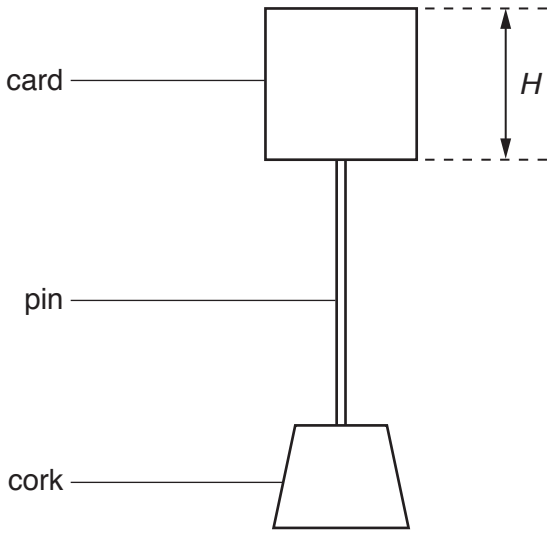


Fig. 4.2 (full size)

(a) Measure and record the length *H* as shown in Fig. 4.2.

H = ... cm [1]

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(b) The screen is placed at a distance $D = 80.0$ cm from the centre of the lamp.

She places the object at a distance $d = 70.0$ cm from the centre of the lamp and observes the shadow made by the object on the screen. The shadow is shown in Fig. 4.3.

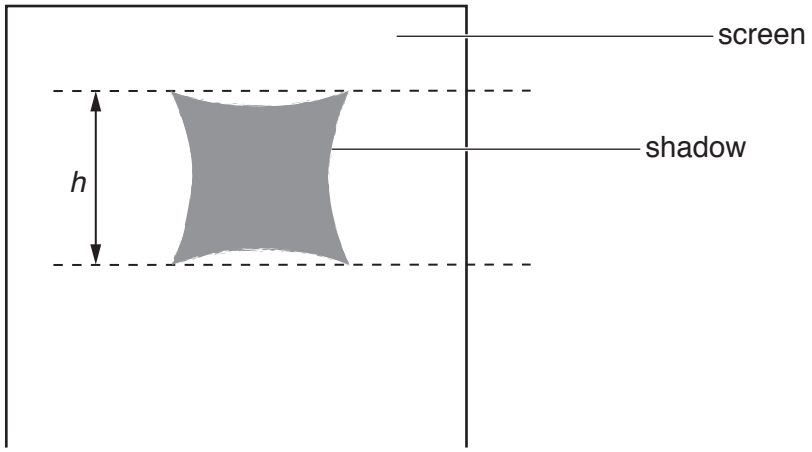


Fig. 4.3 (full size)

(i) Measure and record the length h of the shadow shown in Fig. 4.3.

h = ... cm [1]

(ii) Suggest why it would be difficult to measure accurately the length of the shadow.

.....

.....[1]

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(c) She repeats the procedure for values of d of 60.0 cm, 55.0 cm, 45.0 cm, 30.0 cm and 25.0 cm. Her results are recorded in the table of Fig. 4.4.

d/cm	h/cm
70.0	
60.0	2.7
55.0	2.9
45.0	3.6
30.0	5.3
25.0	6.4

Fig. 4.4

(i) Add your value of h from **(b)(i)** to the table in Fig. 4.4.

(ii) On Fig. 4.5, plot a graph of h/cm on the y-axis against d/cm on the x-axis. Start both axes from the origin. Draw the smooth curve of best fit.

Question 4 continues on page 12.

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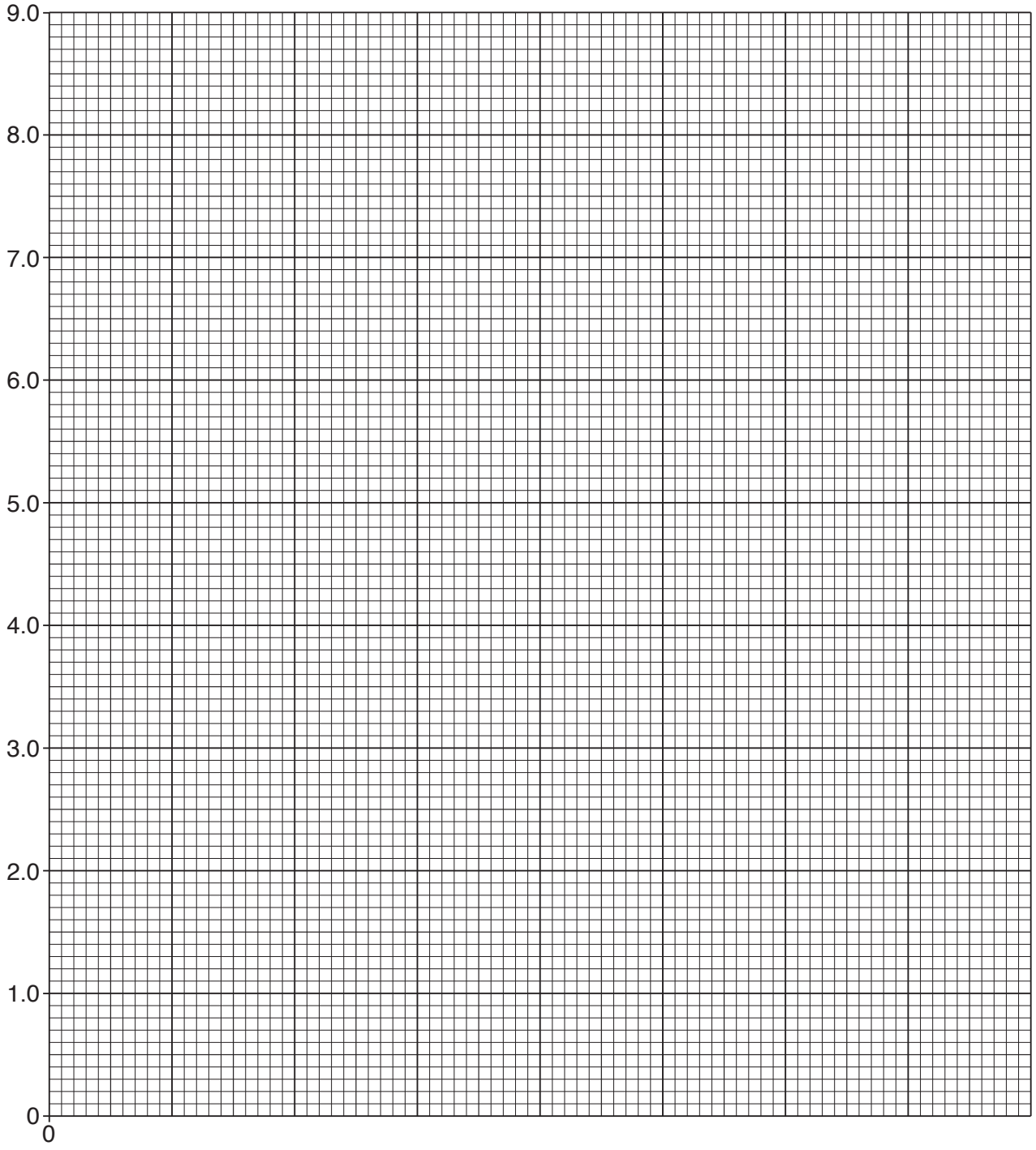


Fig. 4.5

[4]

(d) (i) Use your graph to find h_{40}, the value of h when the object is 40.0 cm from the centre of the lamp.

h_{40} = ... cm [1]

(ii) The student suggests that the value of h_{40}, is related to the length H of the object by the equation

$$h_{40} = 2H.$$

Calculate the length H of the object using this equation.

H = ... cm [1]

(iii) Compare the value for H calculated in **(d)(ii)** with the value that you measured in **(a)**.

State whether your results support the student's suggestion and justify your answer by reference to the results.

statement .....

justification .....

.....
[1]

(e) (i) Extend your graph to predict the length h_{20} of the shadow when d = 20.0 cm.

h_{20} = ... cm [1]

(ii) The student suggests that the distance d should not be less than 10.0 cm. Give **one** reason why this is a sensible suggestion.

.....

.....[1]

(f) D was kept constant throughout the investigation. Suggest why.

.....

.....[1]

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