Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2207489865

PHYSICS **5054/42**

Paper 4 Alternative to Practical **October/November 2015**

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 **10** printed pages and **2** blank pages.

DC (AC/SG) 104757/3

CAMBRIDGE
International Examinations

[Turn over

BLANK PAGE

1 A student performs an experiment to obtain an accurate value for the focal length of a converging lens.

His school has lenses with focal lengths 10 cm and 15 cm.
The student is given a lens from a packet labelled 'focal length 10 cm'.

(a) Describe a simple method the student can use in order to check that the lens has a focal length of 10 cm. You may use a diagram in your answer.

....

....

.... [1]

(b) The student then uses the apparatus in Fig. 1.1 to obtain an accurate value for the focal length *f* of the lens.

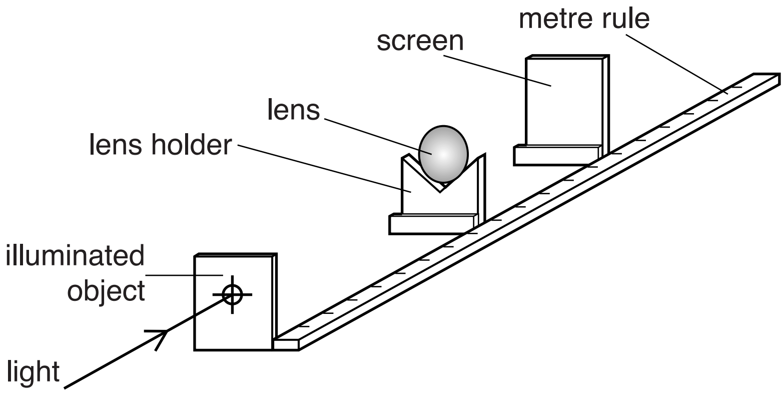

Fig. 1.1 (not to scale)

The student places the lens a measured distance *u* from the illuminated object. He then adjusts the position of the screen until a clear focused image is seen on the screen. He measures the distance *D* from the object to the focused image on the screen.

(i) On Fig. 1.1, mark and label the lengths *u* and *D*. [2]

(ii) The distance *u* is set at 85.0 cm and the student measures the distance *D*. He repeats the experiment and obtains the following values, in cm, for *D*.

96.5 96.3 96.2 96.1 96.2

Calculate D_{av}, the average value of *D*.
Give your answer to three significant figures.

D_{av} = ... [1]

(iii) State one way in which the student can ensure that each measurement of *D* is accurate.

.... [1]

(c) The student repeats the experiment for a range of values of u and obtains a value for D_{av} each time. The results are recorded in Fig. 1.2.

u/cm	D_{av}/cm
85.0	
70.0	81.0
50.0	62.3
25.0	41.6
18.0	40.5
15.0	45.1
12.0	69.5

Fig. 1.2

(i) On Fig. 1.2, add your value of D_{av} for u = 85.0 cm from **(b)(ii)**.

(ii) On Fig. 1.3, plot the graph of D_{av}/cm on the y-axis against u/cm on the x-axis. Start your axes from (0, 30).

The graph shows that D_{av} has a minimum value.
Draw the smooth curve of best fit.

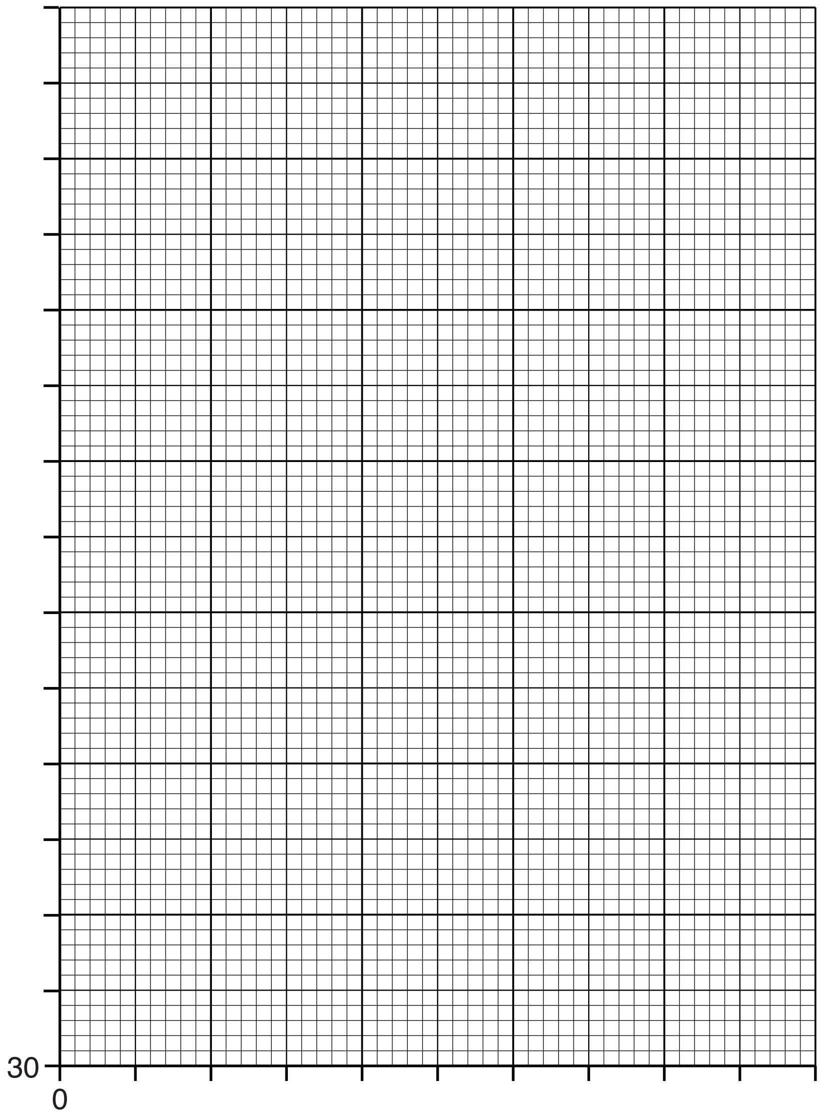

Fig. 1.3

[4]

(iii) Use your graph to find

1. the minimum value of D_{av},

minimum value of D_{av} = ... [1]

2. u_m, the value of u when D_{av} is minimum.

u_m = ... [1]

(iv) Theory shows that the minimum value for D_{av} is when $D_{av} = 4f$ and when $u_m = 2f$.

Calculate $\frac{D_{av}}{4}$ and $\frac{u_m}{2}$ from the values you have given in **(c)(iii)**. Comment on your answers.

....

.... [1]

2 A group of students is asked to determine the diameter of a large inflatable beach ball.

One student uses a long piece of string to find the circumference of the ball. He then calculates the diameter.
Fig. 2.1 shows the student with the beach ball.

Fig. 2.1 (not to scale)

(a) Suggest one practical difficulty in measuring the circumference of the ball.

....

....

.... [1]

(b) **(i)** Describe a different method that another student may use to measure *directly* the diameter of the beach ball.
You may include a diagram in your answer.

....

....

....

.... [2]

(ii) Suggest two ways in which the student in **(b)(i)** can make the measurement of the diameter accurate.

1 ....

....

2 ....

....

[2]

3 The length of a school laboratory is between 5 m and 6 m. Three students A, B and C are asked to measure the length of the laboratory.

(a) Student A is given two metre rules. Describe how he can use these to measure the length of the laboratory.

....

....

.... [1]

(b) Student B is given a 10 m flexible tape, as shown in Fig. 3.1.

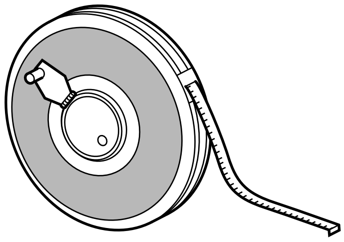

Fig. 3.1

Describe how he can use the tape to measure the length of the laboratory.

....

.... [1]

(c) Student C is given an electronic measuring device, as shown in Fig. 3.2.
The manufacturers claim that the device is accurate to 0.5 mm and has a range of 60 m.

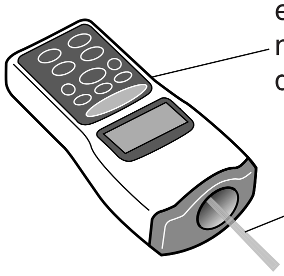

Fig. 3.2

The device emits pulses of laser light that reflect from the opposite wall of the laboratory and return back to the device. It measures the time taken for a pulse to return.
The device calculates the distance to the wall using the time taken for the pulse to return.

(i) State one piece of additional information needed by the device to calculate this distance.

.... [1]

(ii) Suggest a reason why the device uses visible light rather than infra-red radiation.

....

.... [1]

(iii) Describe how student C uses the device to measure the length of the laboratory.

....

.... [1]

(iv) Suggest one disadvantage of using the electronic measuring device.

.... [1]

4 A student is asked to determine the resistance *R* of a resistor.

The student is provided with the following apparatus.

- the resistor with unknown resistance *R*
- four 1.5 V cells
- an ammeter
- a voltmeter
- connecting leads

(a) The student uses one of the 1.5 V cells in a circuit to determine the value of the resistance *R*. In the space below, draw the circuit diagram.

[2]

(b) The ammeter has one red terminal and one black terminal. The red terminal is marked '+'.

(i) Explain why the terminals of the ammeter are different colours.

....

.... [1]

(ii) On your circuit diagram in **(a)**, label, with the letter B, the black terminal of the ammeter. [1]

(c) The student has four 1.5 V cells.

(i) In addition to 1.5 V, state three other voltages that the student could use in her circuit.

.... [1]

(ii) Draw the arrangement of cells that produces the largest voltage.

[1]

(d) The student repeats her experiment using the largest voltage.
State and explain whether this produces a different value for the resistance *R*.

....

.... [1]

BLANK PAGE

