UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

9462936456

PHYSICS **5054/42**

Paper 4 Alternative to Practical **October/November 2011**

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.

This document consists of **7** printed pages and **1** blank page.

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1 A student measures the focal length of a converging lens.

The student sets up the apparatus as shown in Fig. 1.1.

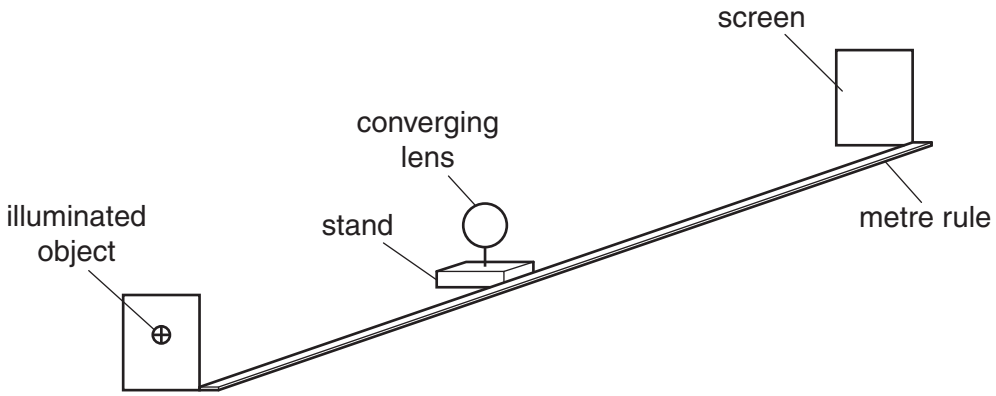


Fig. 1.1

(a) The distance *D* between the illuminated object and the screen is fixed initially at 1.00 m.

(i) The image on the screen is blurred. Describe the adjustment that the student makes to obtain a sharply focused image, without changing *D*.

.....

.....[1]

(ii) The focused image is at the top of the screen. Describe one adjustment that the student makes to move the focused image to the centre of the screen.

.....

.....[1]

(iii) The lens is in a holder on a stand. The position of the centre of the lens is to be marked accurately on the stand. Describe how the student does this.

.....

.....[1]

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(b) The student finds that, for the same value of D, there are two positions of the lens that produce a focused image on the screen. These positions are at distances u_1 and u_2 from the illuminated object, as shown in Fig. 1.2.

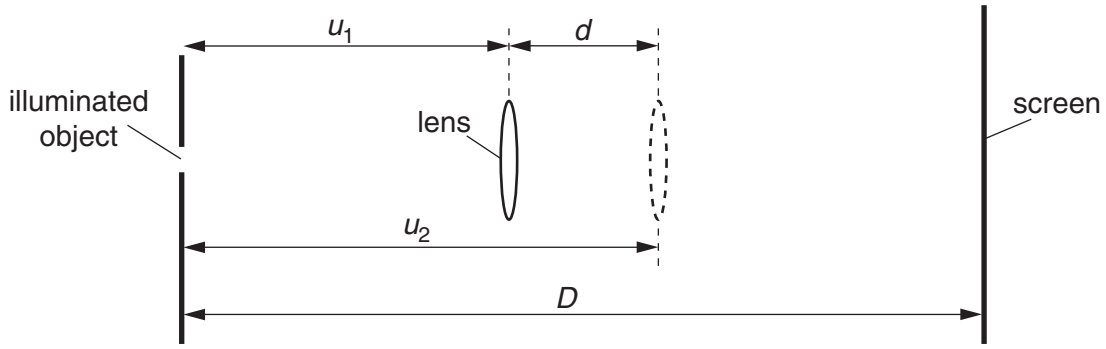


Fig. 1.2

The two distances u_1 and u_2 are measured for $D = 1.00\,\text{m}$.
The values obtained are $u_1 = 0.42\,\text{m}$ and $u_2 = 0.56\,\text{m}$.

(i) Calculate the distance d between the two lens positions.

$d =$ .....[1]

(ii) Theory shows that the focal length f of the lens is given by the relationship

$$f = \frac{(D^2 - d^2)}{4D}.$$

Calculate f.

$f =$ .....[1]

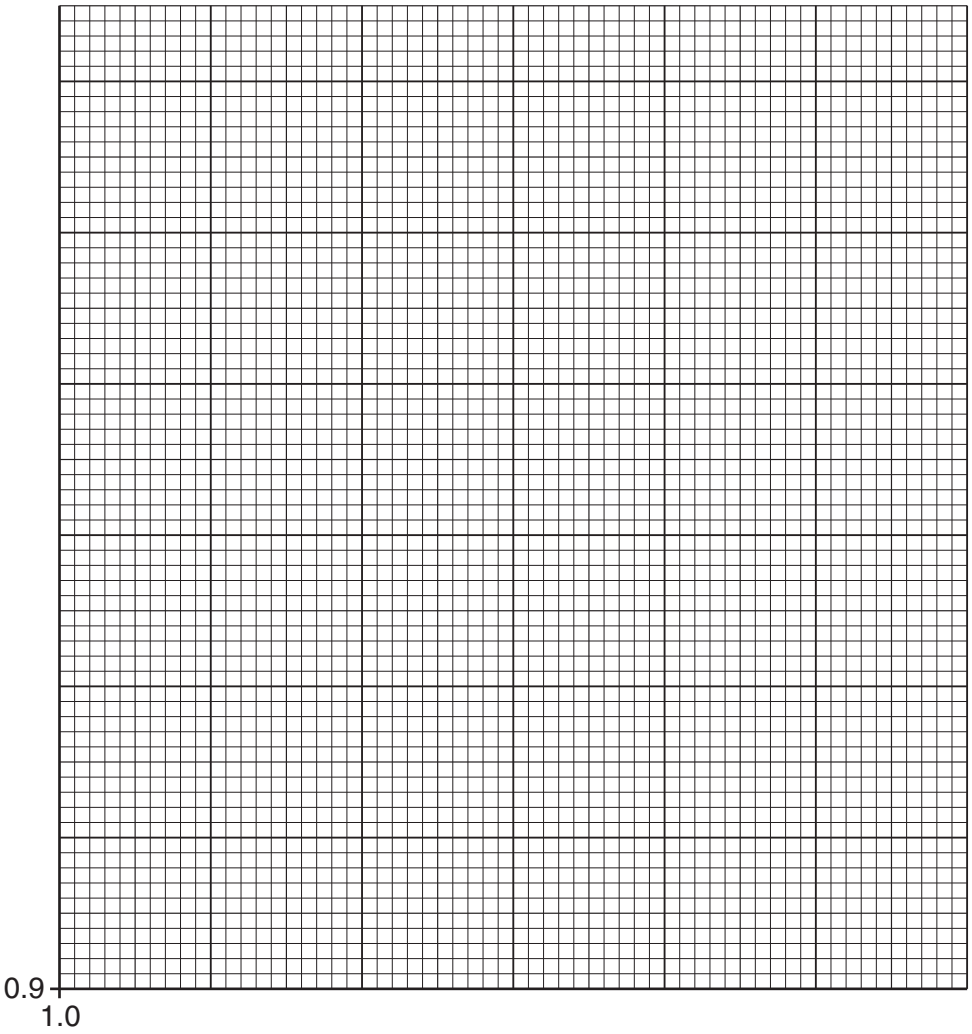
(c) The student repeats the experiment for different values of D and calculates values of $(D^2 - d^2)$ each time.
Fig. 1.3 shows the student's results.

D/m	$(D^2 - d^2)$/m^2
1.10	1.08
1.20	1.18
1.30	1.29
1.40	1.38
1.50	1.47

Fig. 1.3

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(i) On Fig. 1.4, plot the graph of $(D^2 - d^2)/\text{m}^2$ on the *y*-axis against D/m on the *x*-axis.
Start your graph from $(D^2 - d^2) = 0.90\,\text{m}^2$ and $D = 1.00\,\text{m}$.
Draw the straight line of best fit.



[4]

Fig. 1.4

(ii) Determine the gradient of the line of best fit. Show your working clearly.

gradient = ...[2]

(iii) Calculate *f* using the relationship

$$f = \frac{\text{gradient}}{4}.$$

f = ...[1]

(d) Explain why it is better to determine *f* using the method in **(c)** rather than the method in **(b)**.

.....

.....[1]

2 A teacher demonstrates the force on a wire carrying a current in a magnetic field.

Fig. 2.1 shows some of the apparatus used.

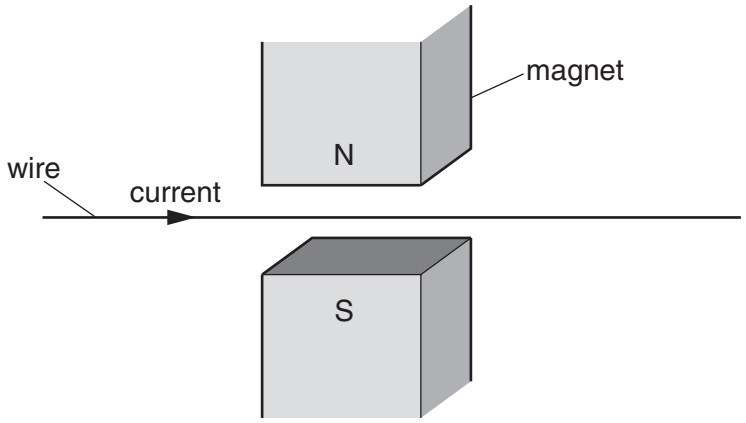


Fig. 2.1

(a) The current is to be varied and measured.

(i) On Fig. 2.1, draw the circuit diagram of the circuit used to provide the current. Include a method to vary and measure the current. [2]

(ii) Describe how to increase the current in the wire.

.....

.....[1]

(iii) Describe how to reverse the direction of the current in the wire.

.....

.....[1]

(iv) Describe how to reverse the direction of the magnetic field.

.....

.....[1]

(b) The current is increased to a very large value.
Suggest one problem this may cause.

.....

.....[1]

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3 A teacher demonstrates convection in water to a class.

The teacher fills a large beaker with cold water, as shown in Fig. 3.1a, and leaves it to stand for 10 minutes.
He then places a purple crystal at the bottom of the beaker. The crystal starts to dissolve and the water around the crystal turns purple.
Gentle heating is applied to the beaker directly underneath the crystal, as shown in Fig. 3.1b.

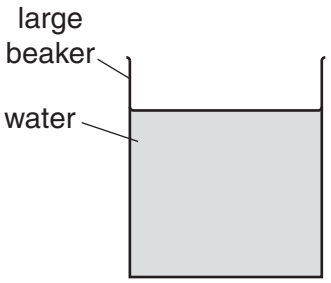


Fig. 3.1a

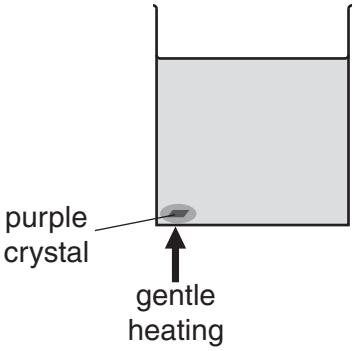


Fig. 3.1b

(a) (i) Suggest a reason why the teacher uses a large beaker.

.....

.....[1]

(ii) Explain why the teacher leaves the beaker of water to stand for 10 minutes before placing the crystal at the bottom.

.....

.....[1]

(iii) Explain why the water is heated gently.

.....

.....[1]

(b) On Fig. 3.1b, draw the initial movement of the water as it is heated gently. [2]

(c) The teacher repeats the demonstration five minutes later.
Suggest why it is better to use another beaker of water than to reuse the same beaker and water.

.....

.....[1]

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4 A teacher demonstrates the existence of background radiation.

Fig. 4.1 shows a counter and a radiation detector placed on a bench, with no laboratory source of radiation present.

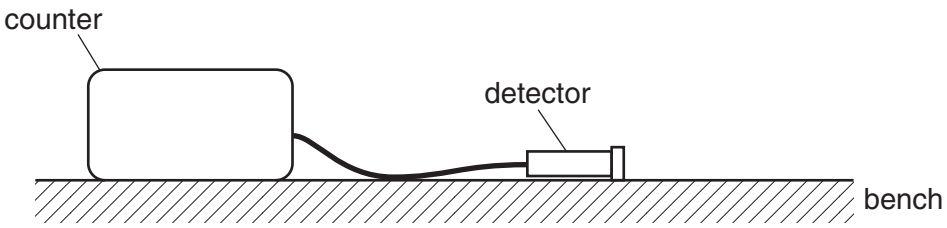


Fig. 4.1

(a) State the name of a suitable detector.

.....[1]

(b) The teacher measures the count for 2 minutes and repeats this five times.

The counts recorded each time are:

58 46 69 53 42

(i) Calculate the average count per second.
Give your answer to two significant figures.

average count rate = ... counts / s [2]

(ii) State why the five counts are all different.

.....

.....[1]

(c) Explain why safety precautions for radiation hazards are not necessary while taking these readings.

.....

.....[1]

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