

A level Physics B

H557/03 Practical skills in physics

Question Set 4

- 1 (a) (i) This question is about determining the focal length of a converging lens using the apparatus shown in Fig. 1.1.

u is the distance between the lens and the object and v is the distance between the lens and the image.

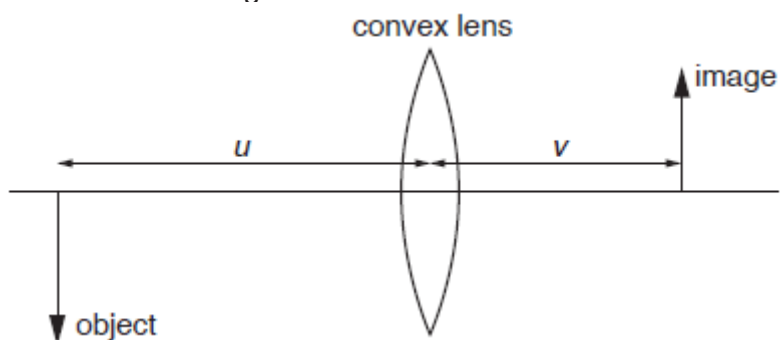


Fig. 1.1

Fig. 1.2 shows some data taken by a student.

$u/m \pm 1\text{ mm}$	$v/m \pm 5\text{ mm}$
-0.500	0.220
-0.475	0.230
-0.450	0.230
-0.425	0.240
-0.400	0.250
-0.375	0.260
-0.350	0.270
-0.325	0.290
-0.300	0.310
-0.275	0.340
-0.250	0.390
-0.225	0.480
-0.200	0.660

Fig.1.2

State which measurement, u or v , has the greatest absolute uncertainty and suggest why this is the case.

[1]

To assess the reliability of the experiment, the student decided to repeat one measurement (with value of u equal to -0.250) multiple times. These data are shown below in **Fig. 1.3** in a dot-plot, the points at 0.330 and 0.430 are potential outliers.

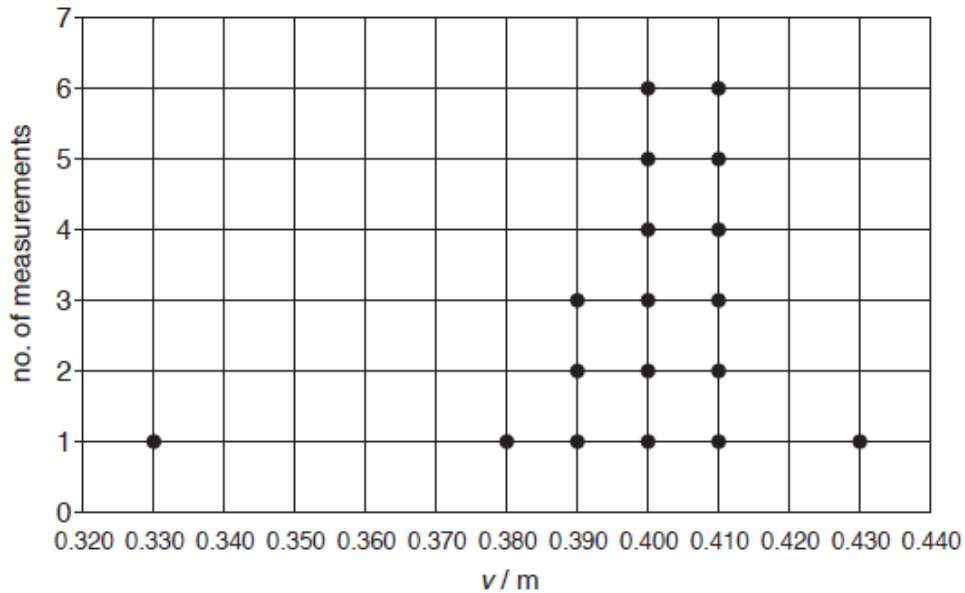


Fig. 1.3

- (ii) Ignoring the two potential outliers, calculate the range of the typical values on the dot-plot.

range = m

[1]

- (iii) Calculate the mean of the values within the range calculated in (a)(ii). Mark this on the dot-plot above.

mean = m [2]

- (iv) The spread of data is given by; $spread = \pm \frac{1}{2} range$. A measurement can be considered to be an outlier if it is more than twice the spread from the mean. State whether you consider either of the points; 0.330 or 0.430 to be outliers and explain your reasoning.

[2]

(b)

Fig. 1.4 shows a plot of magnification m against v for the data from **Fig. 1.2**. The last two points are missing from the graph. The uncertainties are too small to be shown on this graph.

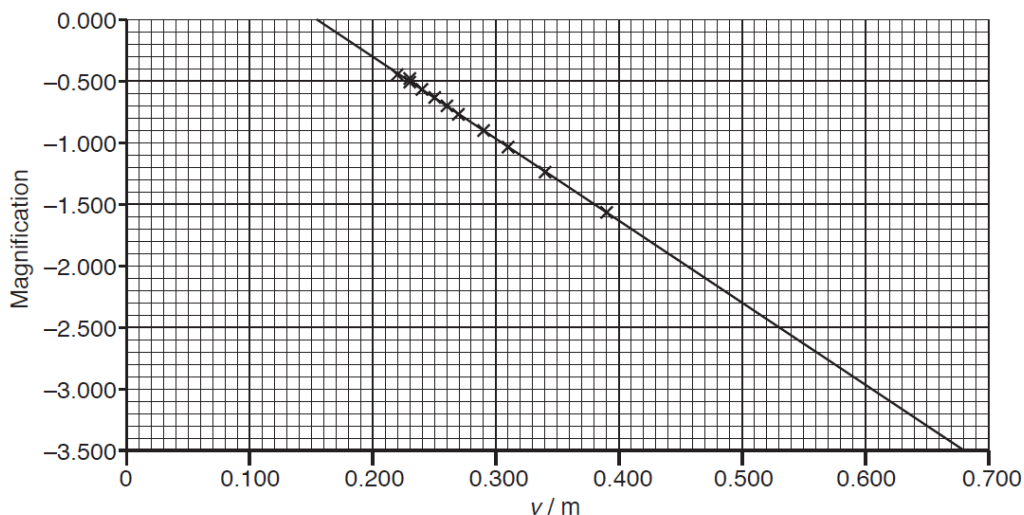


Fig. 1.4

(i) The last two points from **Fig. 1.2** have not been plotted. Complete **Fig. 1.5** below, adding the last two magnification values.

u/m	v/m	m
-0.225	0.480	
-0.200	0.660	

Fig. 1.5

[2]

(ii) Add the remaining points to the graph.

[1]

(iii) Use $\frac{1}{v} = \frac{1}{u} + \frac{1}{f}$ to show that $m = -\frac{v}{f} + 1$.

[2]

(iv) Use data from the graph to calculate the focal length f of the lens.

$f = \dots\dots\dots$ m [2]

- (c) A second converging lens of different focal length is used to form an image. Data for the second lens is displayed in **Fig. 1.6**.

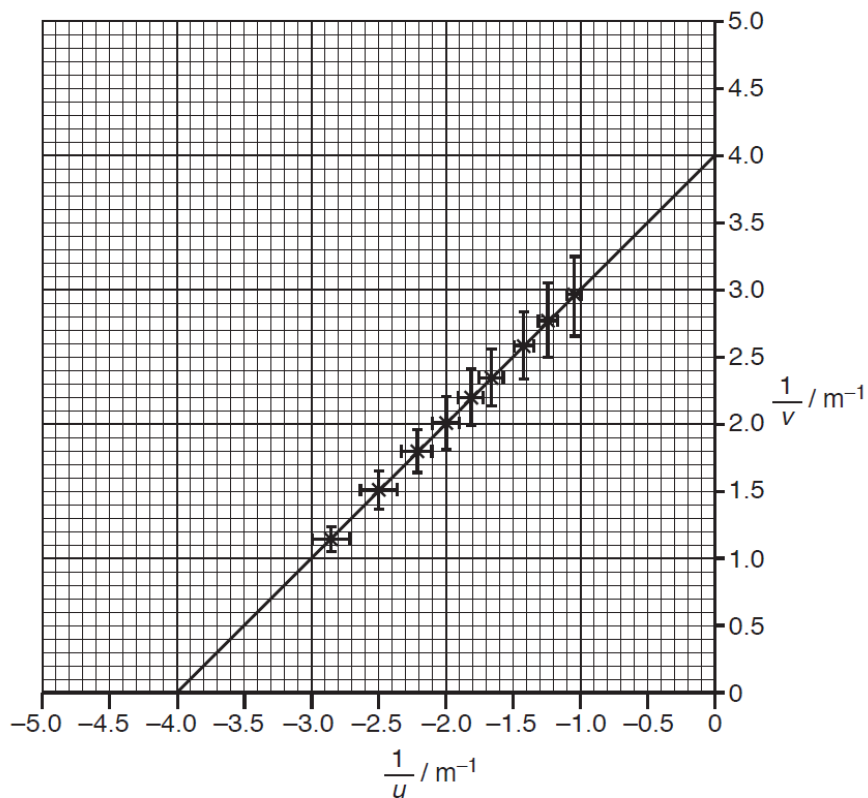


Fig. 1.6

- (i) Use **Fig. 1.6** to determine the power of this lens.

Power = dioptr

[1]

- (ii) Use the uncertainty bars on **Fig. 1.6** to determine the maximum and minimum values for the power of the lens. Use these values to determine the percentage uncertainty in the power of the lens.

Maximum power value = dioptr

Minimum power value = dioptr

Percentage uncertainty =%

[4]

Total Marks for Question Set 4: 18

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