

3.

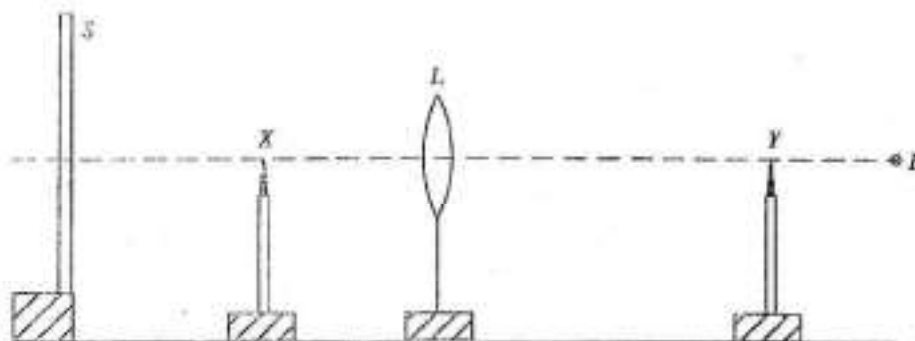


Figure 1

Figure 1 shows a schematic diagram of a properly arranged experimental set up used by a student to determine the focal length of a convex lens  $L$ . In this experiment the position of the real image of pin  $X$  is found with the help of pin  $Y$ .

(a) What is the advantage of having the screen  $S$ ?

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- (b) (i) Figure 2 shows the field of view (with the pin  $Y$ ) that the student sees when he keeps his eye at point  $E$  on the principal axis of the lens to observe the real image of  $X$ . (The image of  $X$  is not shown.)

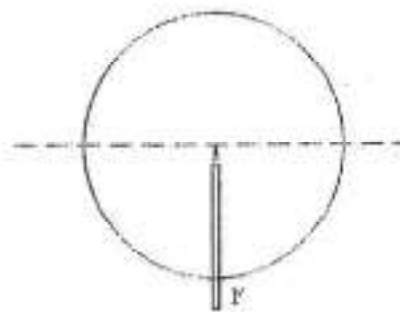


Figure 2

Draw the image of  $X$  on figure 2.

- (ii) If the student moves his eye sideways observing the movements of  $Y$  and the image of  $X$ , what will he see when

(I) the image of  $X$  is not formed at the position of  $Y$ ?

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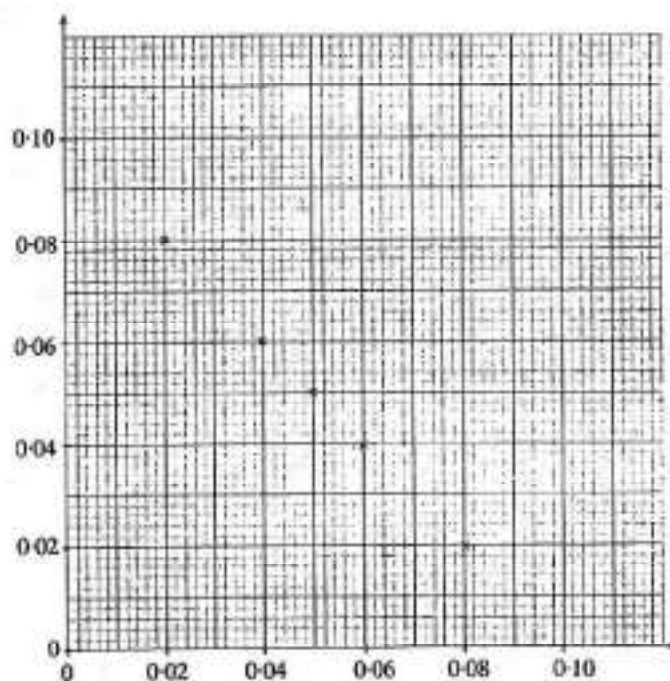
(II) the image of  $X$  is formed at the position of  $Y$ ?

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- (c) Write down the relationship among the object distance  $U$ , image distance  $V$  and the focal length  $f$  of the lens, for this experiment, after applying the sign convention to the lens equation.

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(d)



The student recorded  $U$  and  $V$  in cm and plotted the graph shown, with properly selected axes, to determine the focal length of the lens. Note that the student used the values recorded in cm to draw the graph.

- (i) Label the axes of the graph.
- (ii) Determine the focal length of the lens  $L$ .

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(e) For a certain position of  $X$ , a virtual image is observed by the student. He decided to find the position of this virtual image using a plane mirror.

By drawing in figure 1, show how he should place the plane mirror and the pin  $Y$  for this. Label the plane mirror as  $M$  and the new position of  $Y$  as  $Y'$ .