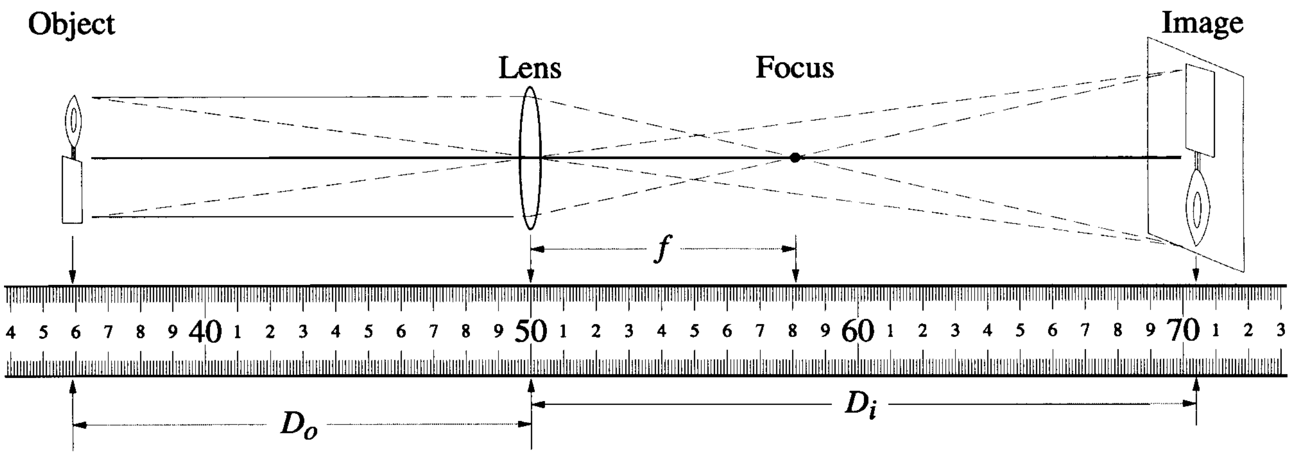
Name **Section #**

Image Formed by a Converging Lens

Purpose

You will determine how well the *thin lens equation* $\frac{1}{f} = \frac{1}{D_o} + \frac{1}{D_i}$ predicts the image distance, D_i if the object distance, D_o and the focal length, f are known.



Procedure

Obtain the focal length, f of your lens by mounting the lens at the 50 cm mark. Progressively move both the lighted candle and the screen equal distances away from the lens (first 1 cm at a time, then 1 mm at a time) until a sharp, focused image is obtained on the screen. When this is accomplished, the object distance and the image distance will be the same ($D_o = D_i$). Let d equal the distance of either the candle or the screen from the lens. The *thin lens equation* can now be rewritten as $\frac{1}{f} = \frac{1}{d} + \frac{1}{d}$ from which, $f = \frac{d}{2}$. Make three determinations of the distance, d and the focal length, f of your lens, calculate the average values, and enter your results in Table I.

Table I: Focal Length, $f = \frac{d}{2}$

	Trial 1	Trial 2	Trial 3	Average Value
d				
f				

After you have determined your lens's focal length, f place the lighted candle at a distance of $4f$ from the lens. Move the screen (not the lens) until you obtain a sharp focused image of the flame. The distance from the lens to the focused image is the *experimental* value of D_i . The *calculated* value for D_i may be obtained by rewriting the thin lens equation as $D_i = \frac{D_o f}{D_o - f}$. Enter your results in Table II below and then repeat the above procedure for the candle placed at the various other object distances listed below. Ask your teacher to explain the method of parallax measurement so that you can measure D_i in the last case where $D_o = 0.75f$. For each case calculate the percent difference between the measured value and the predicted value for D_i. Also indicate whether the image is smaller than, equal to, or larger than the object.

Table II: Relationships between D_o and D_i for f = ______ cm

Case #	Approximate D_o	D_o (cm)	Experimental D_i (cm)	Calculated D_i (cm)	Percent Difference	Relative Size of the Image
1	$4f$					
2	$3f$					
3	$2f$					
4	$1.75f$					
5	$1.25f$					
6	f					
7	$0.75f$					

Questions

How do you account for the difference between your experimental distance for D_i and its corresponding calculated value?

If instead of the lens provided, you had a lens of equal focal length but with a larger diameter, what difference(s) would you expect to see in terms of the image's: (a) distance, (b) size, (c) brightness, and (d) resolution?

Exercise

Draw a ray diagram to scale on this page in landscape mode for Case #2 of Table II. Determine the image location graphically. How does D_i in your scale diagram compare with your experimental D_i and your calculated D_i in the Table?