Name ________________________ Date ____________________

Honors Physics Lab #31H

Period _____________ Mrs. Libretto

Partners: Due Date ________________

Converging Lens

Lab Write-Up Required

This is only a guide for you to follow as you carry out the lab. As expected, you will create and turn in your own lab write-up at the end of this lab. Remember that lab write-ups should have everything in a correct order – there should be no page flipping to find your data and other information. (10 pts)

Purpose

- To calculate the focal length of a convex lens.

Research Question

- What is the effect of object distance on image distance?
- What is the effect of object distance on image size?

Hypothesis (3 pts)

Variables (6 pts)

- Independent –
- Dependent –
- Constants/Control -

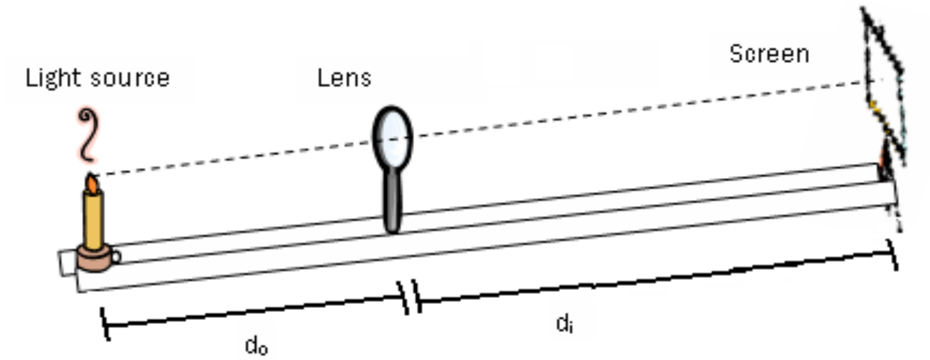
Materials

- Candle
- Cardboard screen
- Lens holder
- Convex lens
- Screen mount
- Optical bench – Meter Stick and 2 supports

Procedure

***Safety concern – all long hair needs to be tied back. Watch your hair and clothing near the candle!**

1. Begin by determining the focal length of the lens. Use the lens to focus the light of a very distant object (parking lot, gym roof) onto the screen.
2. Move the screen back and forth until the image of the distant object is as clear as possible.
3. Measure the distance between the lens and the screen. This is the accepted focal length. Record in the space provided using appropriate uncertainty.
4. Arrange your convex lens, meter stick and screen as shown in the diagram on the following page. Mount the candle (serving as the object) to one end of the meter stick. Place scrap paper under the candle to catch any wax drippings. Light the candle.



5. Place your lens at the **center** of the meter stick. Move the candle more than two focal lengths (center of curvature) away from the lens. Measure the distance between the object and the lens. Record as *object distance* using appropriate uncertainty.
6. On the other side of the lens, focus the image (candle flame) on the screen. Measure the distance between the image (screen) and the lens. Record as *image distance* using appropriate uncertainty.
7. Repeat steps 5 – 6 moving the candle successively to positions listed in the data table. Record all data in the table. For any values that cannot be determined, place an X in the box.
8. **For the last data set**, between F and lens, hold the convex lens in front of a page in a book or this lab. Make sure the distance is less than the focal length. *The image is virtual in this arrangement.* Study the image of the page as seen through the lens. Record your observations in the data table.
9. Using the measured values of object and image distance and the lens equations, compute the focal length for each trial. Record your values to the tenths place in the data table.

Data Collection (25 pts)   Record Lens Letter ________ (A or B)

Accepted focal length ________ (cm) ± _______ (cm)   Center of Curvature ___________ (cm)

Light Placement	Object distance (cm)	Image distance (cm)	Size (larger/ same/smaller)	Type (real/virtual)	Orientation (upright/inverted)	Calculated focal length
Beyond C						
At C						
Between C & f						
At f						X
Between f & lens		X				X

± _______   ± _______

Data Calculation (6 pts)

Show a sample calculation for focal length for **one** trial using the GUESS method and appropriate significant figures. Calculate for the remaining trials and record your data in the table above. [In your write-up, delete these instructions and leave enough space to show your work.]

Post – Lab Questions

Leave space in your write-up to show ALL of your work for questions 1 and 2. Type your answers in complete sentences for questions 3 and 4.

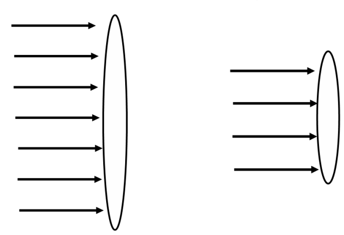
1. Calculate the percent error between the measured focal length and **each** of your calculated values of the focal length. Show all work using the GUESS method and appropriate significant figures. (15 pts)

2. For this question you will determine the image location using a ray diagram. You can accomplish this by following the subsequent instructions. (10 pts)
   - Create a scale for your diagram.
   - Draw a convex lens at the center.
   - Using your data and your scale, draw the focal point and center of curvature at the correct distances along the principal axis.
   - Draw a candle (or arrow) at your distance value for beyond C.
   - Draw three rays from the arrow through the lens.
   - Where the rays intersect, draw your image.
   - Measure this value and compare to your scale.

   Now describe how this value of d_i compares to your measured value on your data table.

3. Using your notes give an example of a device that is a practical application of the case in which the object is located between f and C. What device is a practical application of the case in which the object is located between f and the lens? Be as specific as possible. Explain your choices. (5 pts)

4. If a larger lens of the same focal length as the one used in the experiment is available, what change, if any, would you expect to observe in the image for each case? Explain. (5 pts)



Conclusion (15 pts)

Using full, complete English sentences, write a conclusion which relates to the purpose of this lab. Include any ideas that were reinforced during the lab and any new concepts you may have learned. This includes describing how the size of the image changes as the object is brought closer to the lens. Remember to report the results of your experiment. This includes your measured focal length, the calculated focal lengths and the percent errors. Also, include any sources of errors (at least two) that may have occurred during data collection, an explanation how they may have occurred and an explanation how they affected the results of your experiment. It's important to choose your words carefully and identify and report only relevant information.