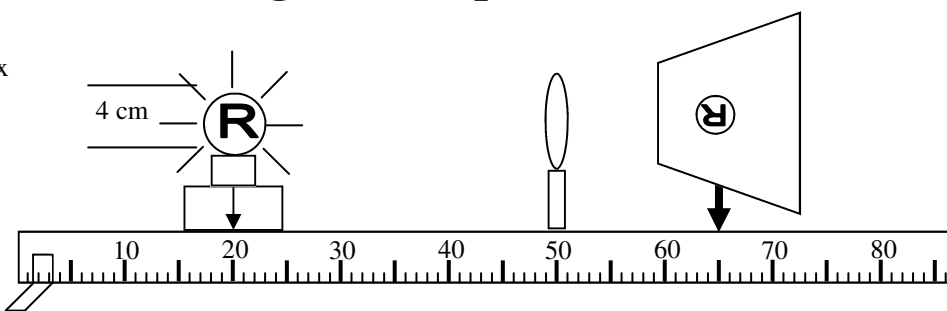


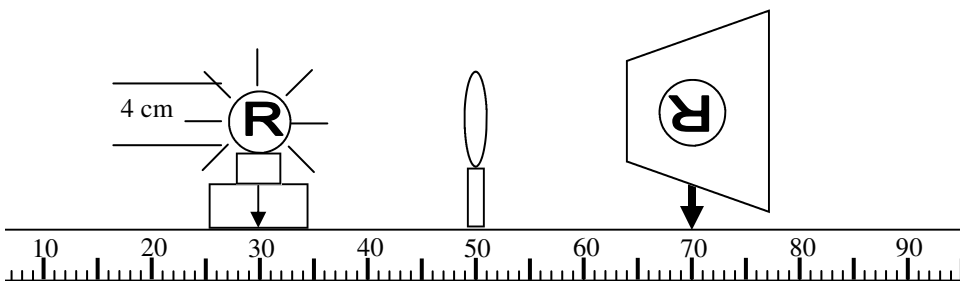
2011-12 PreAP Light and Optics 9

1. The diagram also shows a meter stick, a convex lens, a 4 cm light source, and a viewing screen with the image as seen in the lab.



- A. $p =$ $q =$
 B. * Calculate the focal length for this lens.
 C. Since $C = 2f$, mark C and f on both sides of the lens.
 D. * In relation to f and C , where is p ? * Where is q ?
 E. If you moved the light source (the object) closer to the lens, how would this change f ?
 F. * Calculate the magnification of this lens. G. * Calculate the height of the image.

2. The light source is moved closer to the lens, as shown.

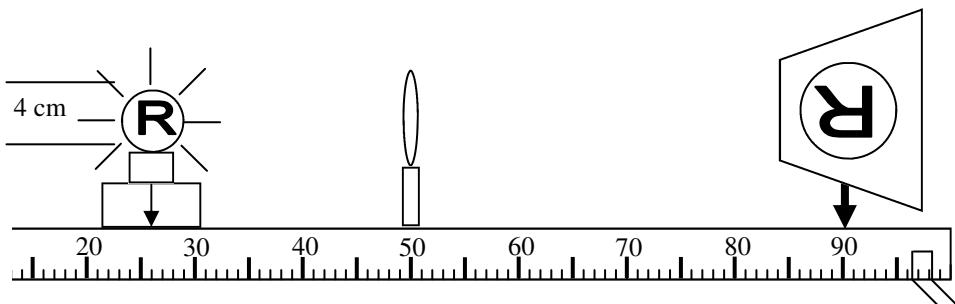


- A. $p =$ $q =$
 B. Calculate the focal length for this lens.

Now that you know it is the same lens, with the same focal length, mark f and C on both sides of the lens.

- C. In relation to f and C , where is p ? Where is q ?
 Just by noticing that $p = q$, you should know they are both at $2f$ (or C) and $f = p/2$ or 10 cm.
 D. * Calculate the magnification of this lens. E. Calculate the height of the image.

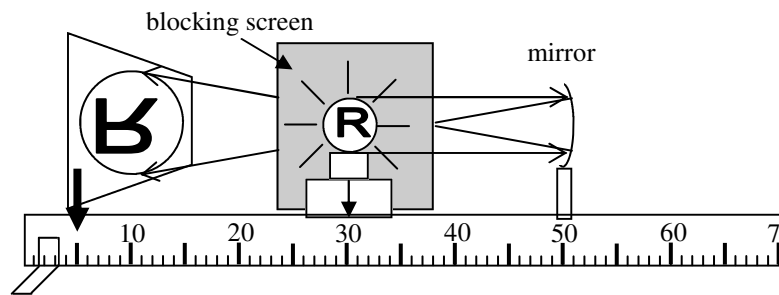
3. The lens is actually changed, now. (Notice it is thinner.) The object is at 26cm.



- A. $p =$ $q =$
 B. Calculate the focal length for this lens.
 C. How does making the lens thinner, change the focal length?
 D. Mark f and C on the diagram on both sides of the lens.
 E. In relation to f and C , where is p ? Where is q ?
 F. *What about the image proved that the image is outside of C before you calculated?
 G. Calculate the magnification of this lens. H. Calculate the height of the image.

2011-12 PreAP Light 9—p.2

4. The lens is replaced with a mirror. The blocking screen is so the image is not washed out (overwhelmed) by the light coming from the back and side of the lens.
- What kind of mirror is it?
 - What side of the mirror is real?
 - Which is greater: p or q ?
 - Is the object magnified or reduced?



This tells you where the object and image are in relation to f and C .

- So, p is: at f ; between f and C ; at C , outside of C .
 - And q must be: at f ; between f and C ; at C , outside of C .
 - Calculate the focal length of this mirror.
- Mark f and C on the diagram.
 - Relook at your answers to part E and F, above.
 - Calculate the magnification of the mirror.
5. A student works the following problem: “A convex lens with a 4 cm focal length produces an image 10 cm from the right side of the lens. Find the distance of the object.” The student works the problem and gets an answer of $p = 9$ cm. **WITHOUT WORKING THE PROBLEM**, how can you tell that they did it wrong? (Notice the lengths of p and q and what you have learned from the previous problems.)

- $p = 30$ cm (from the lens to the object) $q = 15$ cm
- $f = 10$ cm (use $1/p + 1/q = 1/f$)
- p is outside of C ($C = 20$ cm) q is between f and C
- $M = -q/p = -15/30 = -0.5$ (no units) (neg means it is inverted [and therefore real]; 0.5 means half the size of the object (50%))
- 2cm (neg means inverted)
- $M = -1$ (again, neg means it is inverted [and therefore real] and the “1” means same size)
- image is inverted and magnified and $q > p$.