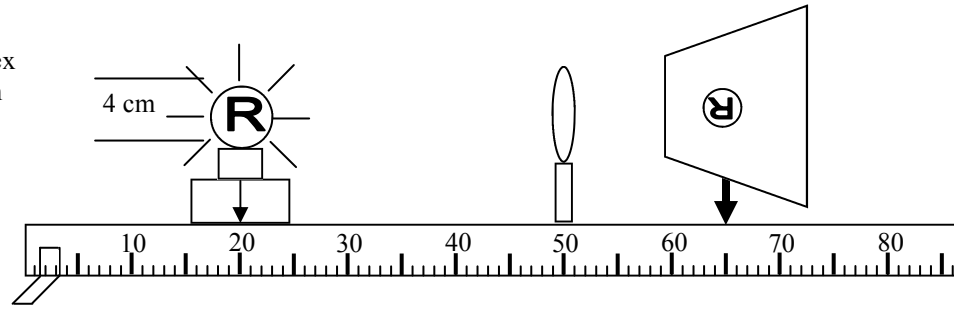
Magnification (no units) → $M = \frac{h'}{h} = -\frac{q}{p}$ ← Image height; Object height

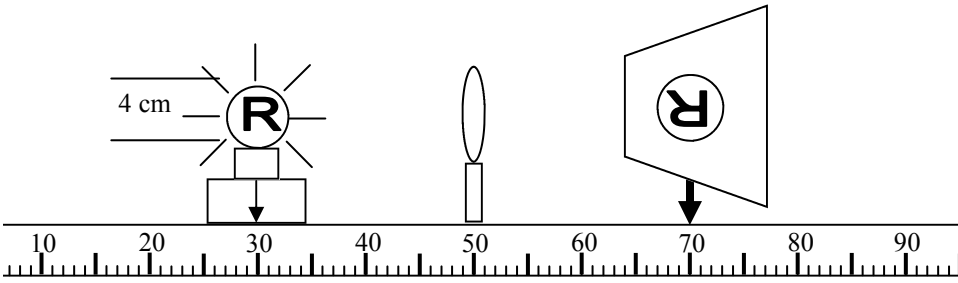
PreAP Light and Optics 9

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.

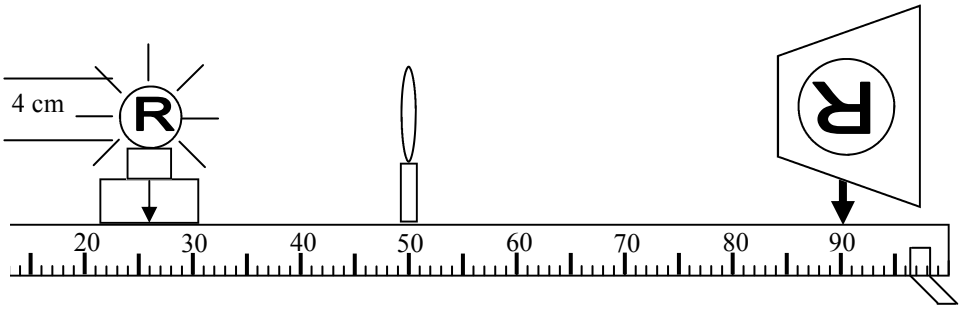


   A. p = q =
   B. Calculate the focal length for this lens.

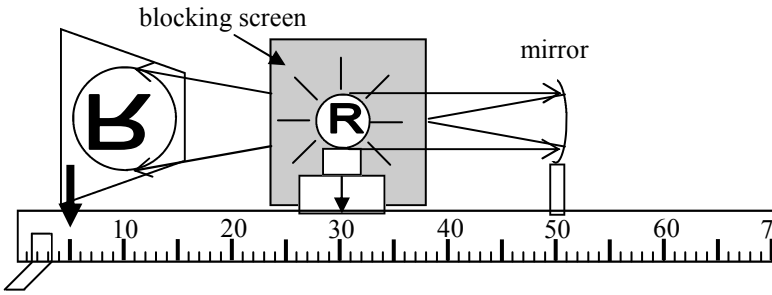
   Now that you know it is the same lens, with the same focal length, mark f and C on both sides of the lens.
   C. In relation to f and C, where is p? Where is q?

   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.



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 light.

   A. What kind of mirror is it?

   B. What side of the mirror is real?

   C. Which is greater: p or q?

   D. Is the object magnified or reduced?

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

   E. So, p is: at f; between f and C; at C, outside of C.

   F. And q must be: at f; between f and C; at C, outside of C.

   G. Calculate the focal length of this mirror.

   H. Mark f and C on the diagram.

   I. Relook at your answers to part E and F, above.

   J. 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*.)

1A) p = 30 cm (from the lens to the object) q = 15 cm
1B) f = 10 cm (use 1/p + 1/q = 1/f)
1D) p is outside of C (C = 20 cm) q is between f and C
1F) 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%)
1G) -2cm (neg means inverted)
2D) M = -1 (again, neg means it is inverted [and therefore real] and the "1" means same size)
3F) image is inverted and magnified and q > q.