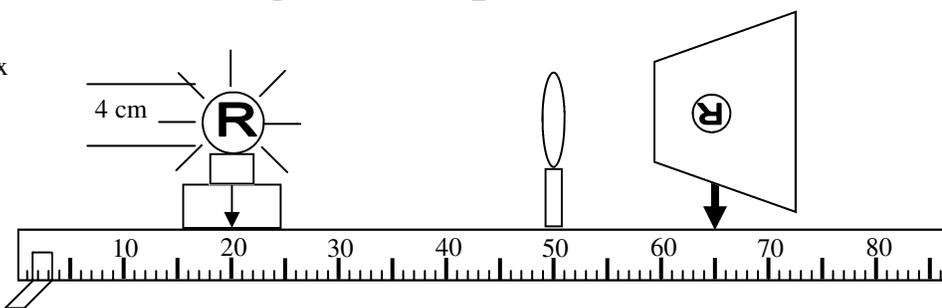


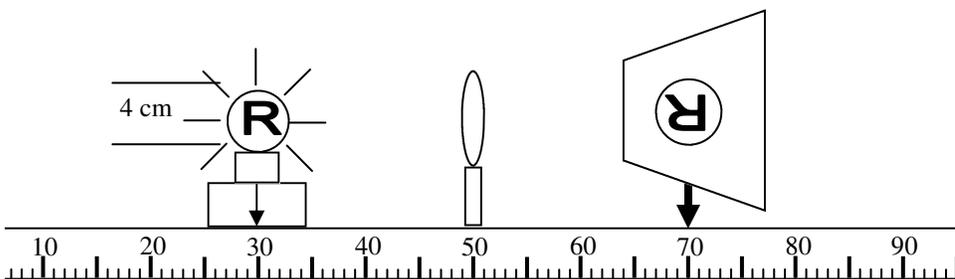
# 2011-12 PreAP Light and Optics 9

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.

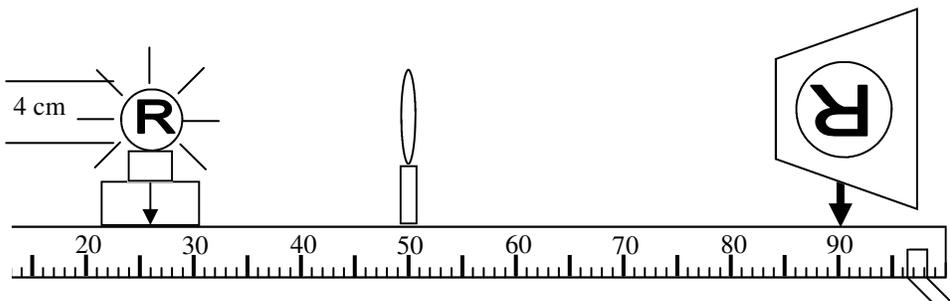


- A.  $p =$                        $q =$   
 B. Calculate the focal length for this lens.

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.

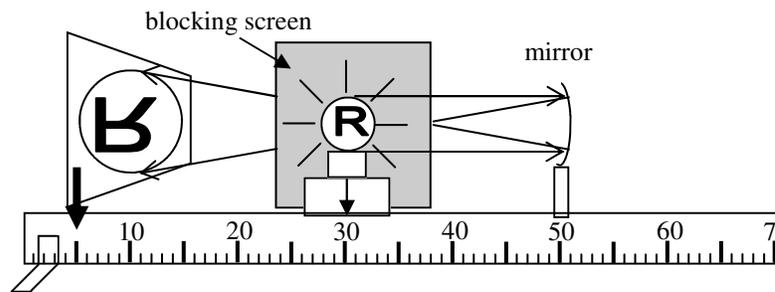
3. The lens is actually changed, now. (Notice it is thinner.) The object is at 26cm.



- 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.

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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.
- 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  $q > p$ .