Homework Solutions
11/13/2007

Conceptual Questions

18. a. No. The screen is needed to reflect light toward your eye.

    b. Yes. The light is traveling toward your eye and diverging away from the position of the image, the same as if the object were located at that position.

20. D. The entire image would appear because any portion of the lens can form the image. The image would be dimmer because the card reduces the light intensity on the screen by 50%.

Problems

32. a.

$$M = -\frac{q}{p} = -\frac{-3.50p}{p} = +3.5$$

$$\frac{1}{p} + \frac{1}{-3.5p} = \frac{1}{7.50cm}$$

$$\frac{3.5}{3.5p} - \frac{1}{3.5p} = \frac{1}{7.50cm}$$

$$\frac{2.5}{3.5p} = \frac{1}{7.50cm}$$

$$3.5p = 18.75cm$$

$$p = 5.36cm$$

    b.

$$-3.5(5.36cm) = -18.8cm$$

c. I'll show you tomorrow in class.

d. A magnifying glass with a focal length of 7.5 cm is used to create an image with a magnification of 3.5. What are the object and image distances? Describe the image.

33. a.

$$\frac{1}{p}+\frac{1}{q}=\frac{1}{f}$$

$$\frac{1}{p}+\frac{1}{(12.9cm-p)}=\frac{1}{2.44cm}$$

$$p^2-(12.9cm)p+31.5cm^2=0$$

$$p=9.63cm$$

$$p=3.27cm$$

b.

$$\frac{1}{p}+\frac{1}{q}=\frac{1}{f}$$

$$\frac{1}{p}+\frac{1}{(12.9cm+p)}=\frac{1}{2.44cm}$$

$$p^2-(12.9cm)p-31.5cm^2=0$$

$$p=2.10cm$$

$$p=-15.0cm$$

The –15.0 cm solution may be discarded since the object is real.

34.

$$M = -\frac{q}{p} = +2$$

$$q = -2p$$

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

$$\frac{1}{p} - \frac{1}{2p} = \frac{1}{f}$$

$$\frac{2}{2p} - \frac{1}{2p} = \frac{1}{f}$$

$$\frac{1}{2p} = \frac{1}{f}$$

$$f = 2p = 2(2.84cm) = 5.68cm$$

35.

$$M = \frac{h'}{h} = -\frac{q}{p} = -\frac{1.80m}{0.024m} = -75$$

$$q = 75p$$

$$p + q = 3.00m$$

$$p + 75p = 3.00m$$

$$76p = 3.00m$$

$$p = 39.5mm$$

$$\frac{1}{p} + \frac{1}{75p} = \frac{1}{f}$$

$$\frac{76}{75p} = \frac{1}{f}$$

$$f = \frac{75}{76}p = \frac{75}{76}(39.5mm) = 39.0mm$$

39.

$$\frac{1}{p_1} + \frac{1}{q_1} = \frac{1}{f_1}$$

$$p_1 = \infty$$

$$\frac{1}{q_1} = \frac{1}{f_1}$$

$$f_1 = q_1 = -10.0cm$$

$$q_1 = p_2 = 10.0cm + 30.0cm = 40.0cm$$

$$\frac{1}{p_2} + \frac{1}{q_2} = \frac{1}{f_2}$$

$$q_2 = \infty$$

$$\frac{1}{p_2} = \frac{1}{f_2}$$

$$p_2 = f_2 = 40.0cm$$