

1. A convex lens has a focal point 22 cm away from it. 14 cm behind the first lens is a converging lens that has a focal point 8 cm away. If a 6 cm tall object is placed 12 cm in front of the first lens...

- (a) Where is the final image located?
- (b) How tall is the final image?
- (c) Is the final image upright or inverted? (circle one)
- (d) Is the final image real or virtual? (circle one)

SHOW ALL WORK

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$
$$\frac{1}{22 \text{ cm}} = \frac{1}{12 \text{ cm}} + \frac{1}{q_1}$$
$$q_1 = -26.4 \text{ cm}$$

$$p_2 = 26.4 + 14 = 40.4 \text{ cm}$$

$$\frac{1}{8 \text{ cm}} = \frac{1}{40.4 \text{ cm}} + \frac{1}{q_2}$$
$$q_2 = 9.975 \text{ cm}$$

The image is 9.975 cm beyond the second lens.

$$m_{total} = m_1 m_2 = \left(\frac{-(-26.4 \text{ cm})}{12 \text{ cm}} \right) + \left(\frac{-(9.975 \text{ cm})}{40.4 \text{ cm}} \right) = -.5432$$

$$m = -.5432 = \frac{h_i}{h_o} = \frac{h_i}{6 \text{ cm}}$$

$$h_i = -3.259 \text{ cm}$$

The image is real and inverted.