

$$d_o = 2.4 \text{ cm}$$

$$\begin{aligned} M &= \frac{d_i}{d_o} \\ &= \frac{-6.0 \text{ cm}}{2.4 \text{ cm}} \\ &= 2.5 \end{aligned}$$

convex

$$\begin{aligned} 14. \quad M &= \frac{h_i}{h_o} \\ &= 0.33 \end{aligned}$$

$$\begin{aligned} M &= \frac{d_i}{d_o} \\ d_i &= M(d_o) \end{aligned}$$

$$\begin{aligned} \frac{1}{f} &= \frac{1}{d_o} + \frac{1}{d_i} \\ \frac{1}{6.0 \text{ cm}} &= \frac{1}{d_o} + \frac{1}{0.33 d_o} \\ \frac{1}{6.0 \text{ cm}} &= \frac{0.33 + 1}{0.33 d_o} \end{aligned}$$

$$d_o = 24 \text{ cm}$$

15. Find the magnification of the objective lens.

$$\begin{aligned} \frac{1}{f} &= \frac{1}{d_o} + \frac{1}{d_i} \\ \frac{1}{d_i} &= \frac{1}{f} - \frac{1}{d_o} \\ &= \frac{1}{1.6 \text{ cm}} - \frac{1}{2.0 \text{ cm}} \end{aligned}$$

$$d_i = 8.0 \text{ cm}$$

$$\begin{aligned} M &= \frac{d_i}{d_o} \\ &= \frac{8.0 \text{ cm}}{2.0 \text{ cm}} \\ &= 4.0 \end{aligned}$$

Find the distance this image is from the eyepiece, and this will be the d_o for the eyepiece.

$$\begin{aligned} d_o &= 10.0 \text{ cm} - 8.0 \text{ cm} \\ &= 2.0 \text{ cm} \end{aligned}$$

$$\begin{aligned} \frac{1}{f} &= \frac{1}{d_o} + \frac{1}{d_i} \\ \frac{1}{d_i} &= \frac{1}{f} - \frac{1}{d_o} \\ &= \frac{1}{3.0 \text{ cm}} - \frac{1}{2.0 \text{ cm}} \\ d_i &= 6.0 \text{ cm} \end{aligned}$$

Magnification of eyepieces is:

$$\begin{aligned} M &= \frac{d_i}{d_o} \\ &= \frac{6.0 \text{ cm}}{2.0 \text{ cm}} \\ &= 3.0 \end{aligned}$$

Total magnification is: $4.0 \times 3.0 = 12$ **Additional Exercises**

$$\begin{aligned} 1. \quad v &= \frac{d}{t} \\ &= \frac{25.5 \text{ m}}{60 \text{ s}} \\ &= 0.425 \text{ m/s} \end{aligned}$$

$$\begin{aligned} v &= \lambda f \\ \lambda &= \frac{v}{f} \\ &= \frac{0.425 \text{ m/s}}{10.0 \text{ Hz}} \\ &= 0.0425 \text{ m} \end{aligned}$$

$$\begin{aligned} 2. \quad v &= \lambda f \\ &= (3.00 \times 10^{-1} \text{ m})(5.00 \times 10^{-1} \text{ Hz}) \\ &= 0.15 \text{ m/s} \end{aligned}$$

$$\begin{aligned} v &= \frac{d}{t} \\ t &= \frac{d}{v} \\ &= \frac{25.0 \text{ m}}{0.15 \text{ m/s}} \\ &= 167 \text{ s} \end{aligned}$$

3.

