

Chapter 27

$$1. \text{ (a) } h_i = mh_o = -\frac{d_i h_o}{d_o} = \frac{(0.017 \text{ m})(1.6 \text{ m})}{3.0 \text{ m}} = \boxed{9.1 \text{ mm}}$$

$$\text{ (b) } h_i = \frac{(0.017 \text{ m})(1.6 \text{ m})}{4.0 \text{ m}} = \boxed{6.8 \text{ mm}}$$

$$3. \frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o} = \frac{1}{d_i} + \frac{1}{N}$$

$$N = \left(\frac{1}{f} - \frac{1}{d_i}\right)^{-1} = \left(\frac{1}{2.20 \text{ cm}} - \frac{1}{2.60 \text{ cm}}\right)^{-1} = \boxed{14 \text{ cm}}$$

17. Since the student is using a plane mirror, the image distance is twice the distance from the mirror to the student's eyes. So, the greatest distance the student can stand from the mirror is $\frac{1.5 \text{ m}}{2} = \boxed{75 \text{ cm}}$.

$$23. \text{ (a) } \frac{1}{f_1} = \frac{1}{d_{o1}} + \frac{1}{d_{i1}}$$

$$d_{i1} = \left(\frac{1}{f_1} - \frac{1}{d_{o1}}\right)^{-1} = \left(\frac{1}{-6.00 \text{ cm}} - \frac{1}{18.0 \text{ cm}}\right)^{-1} = -4.50 \text{ cm}$$

$d_{o2} = 20.0 \text{ cm} + 4.50 \text{ cm} = 24.5 \text{ cm}$ to the right of the converging lens.

$$\frac{1}{f_2} = \frac{1}{d_{o2}} + \frac{1}{d_{i2}}$$

$$d_{i2} = \left(\frac{1}{f_2} - \frac{1}{d_{o2}}\right)^{-1} = \left(\frac{1}{8.00 \text{ cm}} - \frac{1}{24.5 \text{ cm}}\right)^{-1} = 12 \text{ cm}$$

The final image is located $\boxed{12 \text{ cm to the left of the converging lens}}$.

$$\text{ (b) } m = m_1 m_2 = \left(-\frac{d_{i1}}{d_{o1}}\right)\left(-\frac{d_{i2}}{d_{o2}}\right) = \frac{d_{i1} d_{i2}}{d_{o1} d_{o2}} = \frac{(-4.50 \text{ cm})(12 \text{ cm})}{(18.0 \text{ cm})(24.5 \text{ cm})} = \boxed{0.12}$$

$$24. \frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$f = \left(\frac{1}{d_o} + \frac{1}{d_i}\right)^{-1} = \left(\frac{1}{10.5 \text{ cm}} + \frac{1}{152 \text{ cm}}\right)^{-1} = \boxed{11.3 \text{ cm}}$$

$$25. \frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \approx \frac{1}{d_i} \text{ since } d_o \gg d_i.$$

$$f \approx d_i = \boxed{120 \text{ cm}}$$

$$26. \frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$f = \left(\frac{1}{d_o} + \frac{1}{d_i}\right)^{-1} = \left(\frac{1}{25 \text{ cm}} + \frac{1}{56 \text{ cm}}\right)^{-1} = \boxed{45 \text{ cm}}$$

27. $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$$d_i = \left(\frac{1}{f} - \frac{1}{d_o} \right)^{-1} = \left(\frac{1}{-0.085 \text{ m}} - \frac{1}{8.5 \text{ m}} \right)^{-1} = -8.4 \text{ cm}$$

Her uncorrected far-point distance is 8.4 cm.