

1. Converging - It must focus rays from a point on the object to increase the brightness of the image.
2. The image is real, inverted, and most often smaller
3. The objective lens is mobile to allow focusing the image at a constant image distance (d_i) for various object distances. (d_o).
4. The image, a point of light, is focused at the focal point. Parallel rays from the object at infinity focus in a point at the focal point.



$$d_i = 7 \text{ cm} \quad f = 6 \text{ cm}$$

$$d_o = ?$$

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

$$\frac{1}{d_o} = \frac{1}{f} - \frac{1}{d_i}$$

$$d_o = \left[\frac{1}{f} - \frac{1}{d_i} \right]^{-1}$$

$$= \left[\frac{1}{6 \text{ cm}} - \frac{1}{7 \text{ cm}} \right]^{-1}$$

$$\boxed{d_o = 42 \text{ cm}}$$

6.

$$f = 6 \text{ cm} = 0.06 \text{ m}$$

$$\frac{h_i}{h_o}$$

$$h_o = 1.74 \times 10^6 \text{ m}$$

$$h_i = ?$$

$$d_o = 3.84 \times 10^8 \text{ m}$$

$$d_i = ?$$



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

$$M = \frac{-d_i}{d_o} = \frac{h_i}{h_o}$$

$$h_i = -\frac{d_i}{d_o} h_o$$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$$

$$\frac{1}{d_i} = \frac{d_o - f}{f d_o}$$

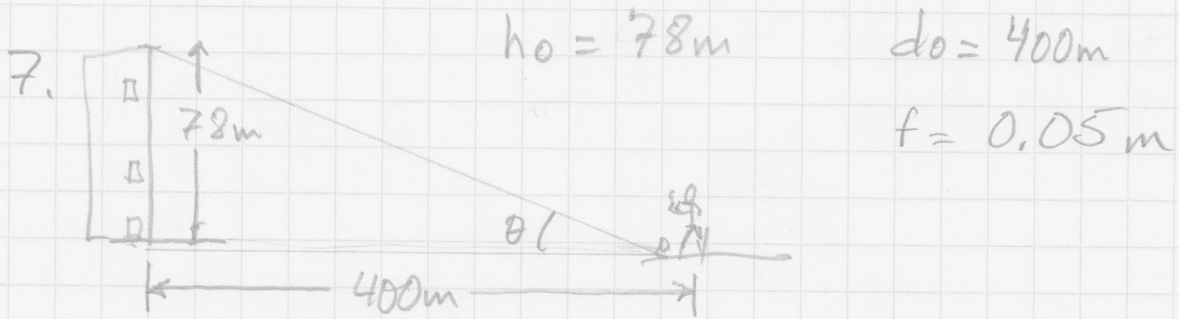
$$h_i = \frac{-f d_o}{d_o - f} \left(\frac{1}{d_o} \right) h_o$$

$$d_i = \frac{f d_o}{d_o - f}$$

$$= \frac{f h_o}{f - d_o}$$

$$h_i = \frac{(0.06 \text{ m})(1.74 \times 10^6 \text{ m})}{(0.06 \text{ m}) - 3.84 \times 10^8 \text{ m}} = 2.7 \times 10^{-4} \text{ m}$$

$$h_i = 2.7 \times 10^{-4} \text{ m}$$



$$a) \quad \theta = \tan^{-1}\left(\frac{78\text{m}}{400\text{m}}\right) = 10.2^\circ$$

$$\theta = 10.2^\circ$$

$$b) \quad d_i = ? \quad \frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$$

$$d_i = \left(\frac{1}{f} - \frac{1}{d_o}\right)^{-1} = \left(\frac{1}{0.05\text{m}} - \frac{1}{400\text{m}}\right)^{-1}$$

$$\boxed{d_i \approx 0.05\text{m}}$$

$$c) \quad M = \frac{-d_i}{d_o} = \frac{h_i}{h_o} \quad h_i = ?$$

$$h_i = \frac{-d_i}{d_o} h_o = -\frac{0.05\text{m}}{400\text{m}} (78\text{m})$$

$$\boxed{h_i = 9.75 \times 10^{-3}\text{m}} \quad \approx 0.975\text{cm}$$