

ANSWERS AND SOLUTIONS

$$10. \frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

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

$$= \frac{1}{5.0 \text{ cm}} - \frac{1}{-7.0 \text{ cm}}$$

$$d_o = 2.92 \text{ cm}$$

$$M = \frac{d_i}{d_o}$$

$$= \frac{-7.0 \text{ cm}}{2.92 \text{ cm}}$$

$$= 2.4$$

concave

$$11. \frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$\frac{1}{5.0 \text{ cm}} = \frac{1}{d_o} + \frac{1}{0.5 d_o}$$

$$\frac{1}{5.0 \text{ cm}} = \frac{1+2}{d_o}$$

$$d_o = 15 \text{ cm}$$

$$12. M = \frac{d_i}{d_o}$$

$$d_i = M(d_o)$$

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

$$= \frac{1}{2f + 2.0 \text{ cm}} + \frac{1}{(0.30)(2f + 2.0 \text{ cm})}$$

$$= \frac{0.30 + 1}{(0.30)(2f + 2.0 \text{ cm})}$$

$$1.3f = 0.60f + 0.60 \text{ cm}$$

$$0.70f = 0.60 \text{ cm}$$

$$f = 0.857 \text{ cm}$$

$$R = 2f$$

$$= 2(0.857 \text{ cm})$$

$$= 1.7 \text{ cm}$$

$$1. \frac{v_a}{v_p} = \frac{n_p}{n_a}$$

$$\frac{3.00 \times 10^8 \text{ m/s}}{v_p} = \frac{1.40}{1.00}$$

$$v_p = 2.14 \times 10^8 \text{ m/s}$$

$$2. \frac{v_a}{v_1} = \frac{n_1}{n_a}$$

$$\frac{3.00 \times 10^8 \text{ m/s}}{2.3 \times 10^8 \text{ m/s}} = \frac{n_1}{1.00}$$

$$n_1 = 1.3$$

$$3. \frac{\sin \theta_a}{\sin \theta_g} = \frac{n_g}{n_a}$$

$$\frac{\sin \theta_a}{\sin 10.0^\circ} = \frac{1.50}{1.00}$$

$$\theta_a = 15.1^\circ$$

$$4. \frac{\lambda_a}{\lambda_w} = \frac{n_w}{n_a}$$

$$\frac{5.30 \times 10^{-7} \text{ m}}{\lambda_w} = \frac{1.33}{1.00}$$

$$\lambda_w = 3.98 \times 10^{-7} \text{ m}$$

$$5. \frac{\lambda_a}{\lambda_1} = \frac{n_1}{n_a}$$

$$\frac{6.0 \times 10^{-7} \text{ m}}{5.0 \times 10^{-7} \text{ m}} = \frac{n_1}{1.00}$$

$$n_1 = 1.2$$

$$6. \frac{\sin \theta_a}{\sin \theta_1} = \frac{\lambda_a}{\lambda_1}$$

$$\frac{\sin 25.0^\circ}{\sin \theta_1} = \frac{5.75 \times 10^{-7} \text{ m}}{4.32 \times 10^{-7} \text{ m}}$$

$$\theta_1 = 18.5^\circ$$

$$7. \frac{\lambda_a}{\lambda_1} = \frac{v_a}{v_1}$$

$$\frac{5.20 \times 10^{-7} \text{ m}}{3.91 \times 10^{-7} \text{ m}} = \frac{3.00 \times 10^8 \text{ m/s}}{v_1}$$

$$v_1 = 2.26 \times 10^8 \text{ m/s}$$