P37.1 \[ \lambda_{\text{height}} = \frac{dL}{d} = \frac{632.8 \times 10^{-9} \text{ m} \cdot (5.00 \text{ m})}{2.00 \times 10^{-3} \text{ m}} = 1.58 \text{ cm} \]

P37.2 \[ y_{\text{bright}} = \frac{4L}{d} \]

For \( m = 1 \), \[ \lambda = \frac{4L}{d} \left( \frac{3.40 \times 10^{-3} \text{ m} \cdot (5.00 \times 10^{-4} \text{ m})}{3.30 \text{ m}} \right) = 515 \text{ cm} \]

P37.7 (a) For the bright fringe, \[ y_{\text{height}} = \frac{mL}{d} \] where \( m = 1 \)

\[ y = \frac{546.1 \times 10^{-9} \text{ m} \cdot 1.20 \text{ m}}{0.250 \times 10^{-3} \text{ m}} = 2.62 \times 10^{-3} \text{ m} = 0.262 \text{ mm} \]

(b) For the dark bands, \( y_{\text{dark}} = \frac{y}{d} \left( m + 1 \right) \)

\[ y_{2} - y_{1} = \frac{L}{d} \left[ \left( m + 1 \right) - \left( m - 1 \right) \right] = \frac{L}{d} (1) \]

\[ = \frac{546.1 \times 10^{-9} \text{ m} \cdot 1.20 \text{ m}}{0.250 \times 10^{-3} \text{ m}} \]

\[ \Delta y = 2.62 \text{ mm} \]

FIG. P37.7

P37.24 Light reflecting from the first surface suffers phase reversal. Light reflecting from the second surface does not, but passes twice through the thickness \( t \) of the film. So, for constructive interference, we require

\[ \Delta = \frac{\lambda}{2} + 2t = \lambda \]

where \( \lambda = \frac{\lambda}{n} \) is the wavelength in the material.

Then

\[ 2t = \frac{\lambda}{2} - \frac{\lambda}{2n} \]

\[ \lambda = 4nt = 4(1.33)(115 \text{ nm}) = 612 \text{ nm} \]

P37.25 Since \( 1 < 1.25 < 1.33 \), light reflected both from the top and from the bottom surface of the oil suffers phase reversal.

For constructive interference we require

\[ 2t = \frac{m\lambda_{\text{top}}}{n} \]

and for destructive interference,

\[ 2t = \frac{m(1/2)\lambda_{\text{dest}}}{n} \]

Then

\[ \frac{\lambda_{\text{top}}}{\lambda_{\text{dest}}} = 1 + \frac{1}{2n} \]

\[ \frac{640 \text{ nm}}{512 \text{ nm}} = 1.25 \]

and \( m = 2 \).

Therefore,

\[ t = \frac{2(640 \text{ nm})}{2(1.25)} = 512 \text{ nm} \]

P37.26 If the path length difference \( \Delta = \lambda \), the transmitted light will be bright. Since \( \Delta = 2t = \lambda \),

\[ d_{\text{min}} = \frac{\lambda}{2} = \frac{650 \text{ nm}}{2} = 325 \text{ nm} \]