CH 37, 7th Ed, HW Solutions

P37.1 $\Delta y_{\text{bright}} = \dfrac{\lambda L}{d} = \dfrac{(632.8\times10^{-9})(5.00)}{2.00\times10^{-4}}\text{ m} = \boxed{1.58\text{ cm}}$

P37.2 $y_{\text{bright}} = \dfrac{\lambda L}{d} m$

For $m = 1$, $\lambda = \dfrac{yd}{L} = \dfrac{(3.40\times10^{-3}\text{ m})(5.00\times10^{-4}\text{ m})}{3.30\text{ m}} = \boxed{515\text{ nm}}$

P37.7 (a) For the bright fringe,

$$y_{\text{bright}} = \frac{m\lambda L}{d} \text{ where } m = 1$$

$$y = \frac{(546.1\times10^{-9}\text{ m})(1.20\text{ m})}{0.250\times10^{-3}\text{ m}} = 2.62\times10^{-3}\text{ m} = \boxed{2.62\text{ mm}}.$$

(b) For the dark bands, $y_{\text{dark}} = \dfrac{\lambda L}{d}\left(m + \dfrac{1}{2}\right)$; $m = 0, 1, 2, 3, \ldots$

$$y_2 - y_1 = \frac{\lambda L}{d}\left[\left(1+\frac{1}{2}\right)-\left(0+\frac{1}{2}\right)\right] = \frac{\lambda L}{d}(1)$$

$$= \frac{(546.1\times10^{-9}\text{ m})(1.20\text{ m})}{0.250\times10^{-3}\text{ m}}$$

$$\Delta y = \boxed{2.62\text{ mm}}.$$

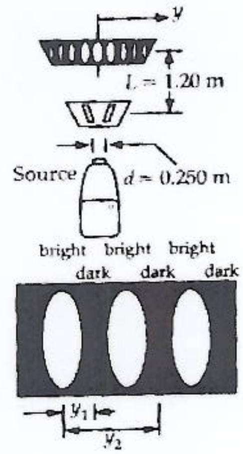

FIG. P37.7

P37.~~30~~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

$$\frac{\lambda_n}{2} + 2t = \lambda_n$$

where $\lambda_n = \dfrac{\lambda}{n}$ is the wavelength in the material.

Then $2t = \dfrac{\lambda_n}{2} = \dfrac{\lambda}{2n}$

$$\lambda = 4nt = 4(1.33)(115\text{ nm}) = \boxed{612\text{ nm}}.$$

P37.~~35~~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 $2t = \dfrac{m\lambda_{\text{cons}}}{n}$

and for destructive interference, $2t = \dfrac{[m + (1/2)]\lambda_{\text{des}}}{n}$.

Then $\dfrac{\lambda_{\text{cons}}}{\lambda_{\text{dest}}} = 1 + \dfrac{1}{2m} = \dfrac{640\text{ nm}}{512\text{ nm}} = 1.25$ and $m = 2$.

Therefore, $t = \dfrac{2(640\text{ nm})}{2(1.25)} = \boxed{512\text{ nm}}.$

P37.3~~7~~0 If the path length difference $\Delta = \lambda$, the transmitted light will be bright. Since $\Delta = 2d = \lambda$,

$$d_{\min} = \frac{\lambda}{2} = \frac{580\text{ nm}}{2} = \boxed{290\text{ nm}}.$$