37.4 $\lambda = \dfrac{v}{f} = \dfrac{354 \text{ m/s}}{2000\text{/s}} = 0.177 \text{ m}$

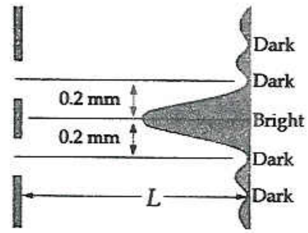
(a) $d \sin \theta = m\lambda$ so $(0.300 \text{ m}) \sin \theta = 1(0.177 \text{ m})$ and $\theta = \boxed{36.2°}$

(b) $d \sin \theta = m\lambda$ so $d \sin 36.2° = 1(0.0300 \text{ m})$ and $d = \boxed{5.08 \text{ cm}}$

(c) $(1.00 \times 10^{-6} \text{ m}) \sin 36.2° = 1\lambda$ so $\lambda = 590 \text{ nm}$

$$f = \frac{c}{\lambda} = \frac{3.00 \times 10^{8} \text{ m/s}}{5.90 \times 10^{-7} \text{ m}} = \boxed{508 \text{ THz}}$$

37.8 Taking $m = 0$ and $y = 0.200$ mm in Equation 37.6 gives



$$L \approx \frac{2dy}{\lambda} = \frac{2(0.400 \times 10^{-3} \text{ m})(0.200 \times 10^{-3} \text{ m})}{442 \times 10^{-9} \text{ m}} = 0.362 \text{ m}$$

$$L \approx \boxed{36.2 \text{ cm}}$$

Geometric optics incorrectly predicts bright regions opposite the slits and darkness in between. But, as this example shows, interference can produce just the opposite.

37.17 (a) From Equation 37.8,

$$\phi = \frac{2\pi d}{\lambda} \sin \theta = \frac{2\pi d}{\lambda} \cdot \frac{y}{\sqrt{y^2 + D^2}}$$

$$\phi \approx \frac{2\pi yd}{\lambda D} = \frac{2\pi (0.850 \times 10^{-3} \text{ m})(2.50 \times 10^{-3} \text{ m})}{(600 \times 10^{-9} \text{ m})(2.80 \text{ m})} = \boxed{7.95 \text{ rad}}$$

(b) $$\frac{I}{I_{max}} = \frac{\cos^2\left(\dfrac{\pi d}{\lambda} \sin \theta\right)}{\cos^2\left(\dfrac{\pi d}{\lambda} \sin \theta_{max}\right)} = \frac{\cos^2 \dfrac{\phi}{2}}{\cos^2 m\pi}$$

$$\frac{I}{I_{max}} = \cos^2 \frac{\phi}{2} = \cos^2\left(\frac{7.95 \text{ rad}}{2}\right) = \boxed{0.453}$$

37.32 $2nt = \left(m + \dfrac{1}{2}\right)\lambda$ so $t = \left(m + \dfrac{1}{2}\right)\dfrac{\lambda}{2n}$

$$\text{Minimum } t = \left(\frac{1}{2}\right)\frac{(500 \text{ nm})}{2(1.30)} = \boxed{96.2 \text{ nm}}$$

37.35 If the path length $\Delta = \lambda$, the transmitted light will be bright. Since $\Delta = 2d = \lambda$,

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