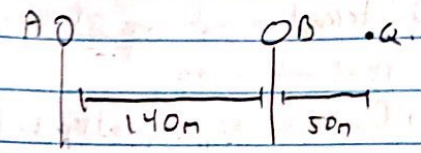
Physics IC Chapter 35 HW

35.2)



a) $\Delta\theta_{tot} = \Delta\theta_{ic} + \Delta\theta_{path}$

$\Delta\theta_{ic} = 0$

$\Delta\theta_{path} = k\Delta L$

$\Delta\theta_{tot} = (2n+1)\pi$

$\frac{2\pi}{\lambda}(140m) = (2n+1)\pi$

$\frac{280m}{2n+1} = \lambda$

Longest @ $n=0$

$\boxed{\lambda = 280m}$

b) $\Delta\theta_{path} = 2n\pi$

$\frac{2\pi}{\lambda}(140m) = 2n\pi$

$\lambda = \frac{140m}{n}$

Longest @ $n=1$

$\boxed{\lambda = 140m}$

35.8) $\lambda = 410nm$

$D = 1.82m$

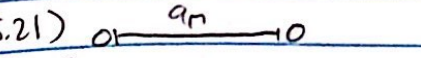
$y_{min} = 3.9mm$

$y_{min} = (n+\frac{1}{2})\frac{\lambda D}{d}$

$d = \frac{\lambda D}{y_{min}}$ → small angle approx

$\boxed{d = 1.89\times10^{-4}m}$

35.21)



$f = 120MHz$

a) $\Delta\theta_{path} = k\Delta L$

$\Delta\theta_{path} = \frac{2\pi}{\lambda}(1.8m)$

$\lambda f = c \rightarrow \lambda = \frac{c}{f}$

$\lambda = 2.5m$

$\boxed{\Delta\theta_{path} = 4.52rads}$

b) $I_0 = 2\varepsilon_0 cE^2$

$I = I_0\cos^2\frac{\phi}{2}$

$\boxed{I = 0.404I_0}$

35.29) $\lambda = 800nm$

$n_p = 1.8$

$\Delta\theta_{tot} = \Delta\theta_{ic} + \Delta\theta_{path}$

$(2n+1)\pi = k\Delta L$

$\Delta L = 2t$

$\pi = \frac{2\pi n_p}{\lambda}(2t)$

$\frac{\lambda}{4n_p} = t$

$\boxed{t = 111.11nm}$

35.31) $\lambda = 633nm$

$y = m\frac{\lambda}{2}$

$x = 1930(\frac{\lambda}{2})$

$\boxed{x = 0.61mm}$

35.14) $\lambda_r = 660nm$, $\lambda_b = 470nm$

$d = 0.410mm$, $D = 4m$

$y_{max} = n\frac{\lambda D}{d} = \frac{\Delta\lambda D}{d}$

$\boxed{y_{max} = 1.9mm}$

35.36) $n_2 = 1.38$, $n_3 = 1.45$, $\lambda = 600nm$

a) $\Delta\theta_{path} = \frac{2\pi}{\lambda}(2tn_2)$

$2n\pi = \frac{2\pi}{\lambda}(2tn_2) + \pi$

$2n = \frac{2}{\lambda}(2tn_2) + 1$

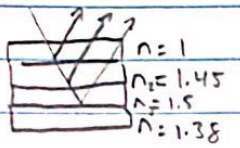
$\frac{\lambda}{4}(\frac{1}{n_2}) = t$

$\boxed{t = 103.44nm}$

b) $\boxed{N_c}$

c) $\boxed{N_0}$

d)



$\Delta\theta_{bt} = \frac{2\pi}{\lambda}(2tn_2) = 2n\pi$

$\frac{1}{\lambda}(2tn_2) = n$

$n\lambda = 2n_2 t$

$n\lambda = 3\times10^{-7}$

no λ reinforced

e) $\Delta\theta_{bt} = \frac{2\pi}{\lambda}(2tn_2) = (2n+1)\pi$

$\frac{2}{\lambda}(2tn_2) = 2n+1$

$\lambda = \frac{2}{2n+1}(2tn_2)$

$\lambda = \frac{5.77\times10^{-7}}{2n+1}$

$\lambda = 600nm$ @ $n=0$

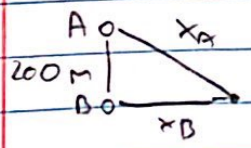
35.41) $d = 200m$, $f = 5.8MHz$

$\Delta\theta_{bt} = (2n+1)\pi$

$\Delta\theta_{bt} = \Delta\theta_{ic} + \Delta\theta_{path}$

$\Delta\theta_{path} = k\Delta L$

$k\Delta L = (2n+1)\pi$



$\Delta L = x_A - x_B$

$200^2 + x_B^2 = x_A^2$

$\Delta L = \sqrt{200^2+x_B^2} - x_B$

$\frac{2\pi}{\lambda}(\sqrt{200^2+x_B^2} - x_B) = (2n+1)\pi$

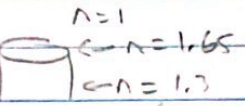
$\lambda = \frac{c}{f}$

$\frac{2\pi f}{c}(\sqrt{200^2+x_B^2} - x_B) = (2n+1)\pi$

$\sqrt{200^2+x_B^2} - x_B = \frac{(2n+1)c}{2f}$

$x_B = 20, 90, 220, 760m$

35.46) $\lambda = 510nm$, $n = 1.30$, $n = 1.65$



a) $\frac{2\pi}{\lambda}(2tn_2) + \pi = (2n+1)\pi$

$\frac{2\pi}{\lambda}(2tn_2) = 2n\pi$

$2tn_2 = n\lambda$

$t = \frac{1}{2}\frac{n\lambda}{n_2}$

$t = 154.54nm$

b) $\frac{2\pi}{\lambda}(2tn_2) + \pi = 2n\pi$

$\frac{2}{\lambda}(2tn_2) + 1 = 2n$

$tn_2 = \frac{(2n-1)\lambda}{4}$

$t = 77.27nm$

35.47) $\lambda_r = 700nm$, $m = 3$

$y_{min} = (n+\frac{1}{2})\frac{\lambda D}{d}$

$y_{max} = n\frac{\lambda D}{d}$

$y_{max} = 2100nm(\frac{D}{d})$

$2100nm(\frac{D}{d}) = (n+\frac{1}{2})\frac{\lambda D}{d}$

$2100nm = (n+\frac{1}{2})\lambda$

$\lambda = \frac{2100}{n+\frac{1}{2}}$

$\lambda = 466.67nm, 600nm$

35.48) $n_g = 1.8$, $n_c = 1.33$

$t_g = 74nm$, $n_c = 100nm$

a) $\Delta\theta_{bt} = 2n\pi$

$\Delta\theta_{path} = \frac{2\pi}{\lambda}(2nt)$

$\frac{2\pi}{\lambda}(2nt) + \pi = 2n\pi$

$\frac{2}{\lambda}(2nt) + 1 = 2n$

$\frac{2}{\lambda}(2nt) = 2n-1$

$\lambda = \frac{2}{2n-1}(2nt)$

$\lambda = 533.2nm$

b) Yes

c) Yes

35.50) $D = 0.950m$

a) $y = n\frac{\lambda D}{d}$

$\boxed{\Delta y = \frac{R\lambda}{d}}$

b) $\Delta y = R\lambda(\frac{1}{d})$

$m = R\lambda$

$\frac{5mm}{9mm^{-1}} = R\lambda$

$\frac{5}{9}mm^2 = (950mm)(\lambda)$

$\boxed{\lambda = 5.85 \times 10^{-4} mm}$

35.56) ?

a) $\boxed{d = 2aA(n-1)}$

b) $b = 2m$

$\lambda = 520nm$

$a = 0.2m$

$A = 3.3mrad$

$n = 1.60$

$d = 2aA(n-1)$

$d = 7.92 \times 10^{-4} m$

$y_{max} = n\frac{\lambda D}{d}$

$D \approx a + b = 2.2m$

$\boxed{y_{max} = 0.0014m}$