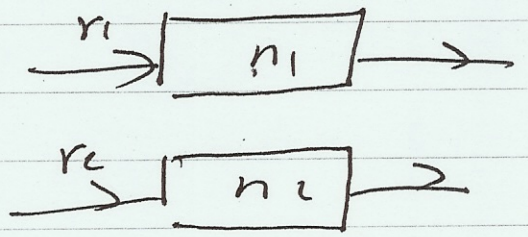
CH#35
H.W. Solution

#9.



Initaly the two waves were $\frac{\lambda}{2}$ out of phase

$\Rightarrow N_2 - N_1 = \frac{n}{2}$, in-order to put the back in phase, where n is an odd number

So

$$N_2 - N_1 = \frac{1}{\lambda}(n_2 - n_1)$$

$$= \frac{1}{\lambda} \times 0.2$$

a. the smallest L is when

$$N_2 - N_1 = \frac{1}{2}$$

or $L_1 = \frac{\frac{1}{2} \times \lambda \times 0.2}{0.2} = 1.55\mu m$

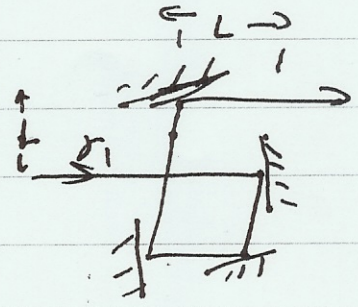
b. $\Delta = \frac{3}{2}$

$N_2 - N_1 = \frac{3}{2}$

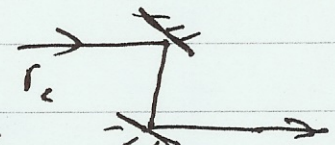
So $L_2 = 3L_1$

$= 4.65\ \mu m.$

#12.



The path difference between r_1 and r_2



is $\Delta L = 5L - 4L = L$

a. $4L = \frac{\lambda}{2}$ or $L = \frac{\lambda}{8}$

$= 52.5\ nm$

b. $4L = \frac{3\lambda}{2}$, $L = \frac{3\lambda}{8}$

$= 157.5\ \mu m.$

#27

The fluck caused a phase shift of 7π

or $N = \frac{L}{\lambda}(1.58-1) = 7$

or $L = \frac{7\lambda}{1.58-1}$

$= \frac{7 \times 550 \times 10^{-9}}{0.58}$

$= 6.64 \times 10^{-6}\ m$

$= 6.64\ \mu m$.

#34. The phase angle is

$\phi = 39.6\ rad$

$\beta = \frac{\phi}{2} = \frac{39.6}{2} = 19.8\ rad$

a. $E = 2E_0 \cos\beta = 2 \times 2 \cos 19.8$

$E = 2.32\ \mu V/m$

#34 cont

b.

at the center $\beta = 0$

$$I_c = 4I_0$$

at point P, $\beta = 19.8$ rad

$$I_p = 4I_0 \cos^2\beta$$

$$= 4I_0$$

$$= 4 \times 0.33\, I_0$$

$$\frac{I_p}{I_0} = \frac{4 \times 0.33\, I_0}{4\, I_0} = 0.33$$

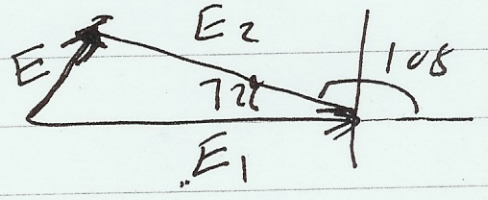
c. The phase angle is 39.6 rad

or $\phi = 6.3(2\pi)$.

$\therefore$ Point P is between the 6 maxima & 6 minima and closer to the maxima.

#34 Cont

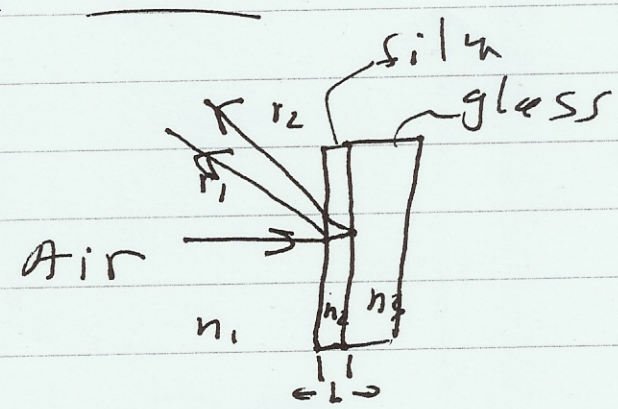
$\theta = 0.3 \times 2\pi = 108^\circ$



d. $\omega = 1.26 \times 10^{15}$ rads/sec.

e- $\Phi = 34.6$ rad.

#39



Path difference = 2L

$2L = \frac{1}{2}\frac{\lambda}{n_2}$

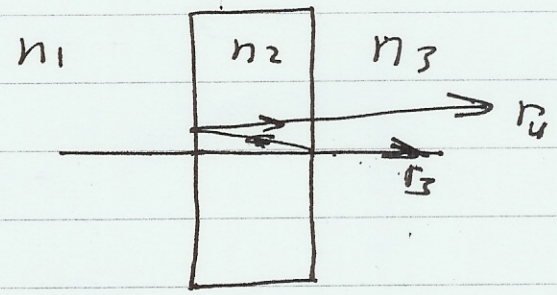
$L = \frac{1}{4}\frac{\lambda}{n_2} = \frac{1}{4} \times \frac{600 \times 10^{-9}}{1.75}$

$= 0.12\ \mu m$

$= 120\ nm$

#41 Similar to #39

#58 , $n_1 = 1.55$, $n_2 = 1.4$, $n_3 = 1.8$



First note ~~that~~ r_4 changed phase two time ~~one~~ once at the n_2-n_4 boundry ~~&~~ then at n_2-n_1 boundry

So the over all phase change due to reflection of r_4 is $\frac{\lambda}{n}$, So reflection will not cause change of phase.

second r_4 went twice inside n_2 while ~~r_3~~ r_3 only once.

Path difference is L.

For the two waves to form a maxima

$$L = \frac{m\lambda}{n} = \frac{m\lambda}{n_2}, \quad m = 1$$

$$\lambda = n_2 \times L = 200 \times 1.4 = 280 \text{ nm}$$

#79

$$2(d_2 - d_1) = N\lambda$$

$$\lambda = \frac{2 \times 0.233}{792}$$

$$\lambda = 588.4 \text{ nm}$$