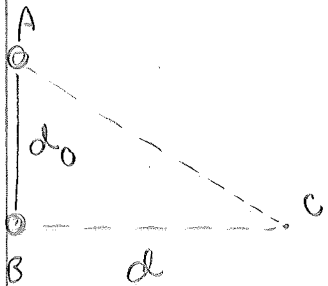
HW #4 solutions

35.46



Destructive: $AC - BC = (n+\frac{1}{2})\lambda \quad n = 0,1,\ldots$

$$(d_0^2+d^2)^{1/2} - d = (n+\tfrac{1}{2})\lambda$$

$$d_0^2 + d^2 = ((n+\tfrac{1}{2})\lambda + d)^2$$

$$d_0^2 + \cancel{d^2} = (n+\tfrac{1}{2})^2\lambda^2 + 2d\lambda(n+\tfrac{1}{2}) + \cancel{d^2}$$

$$d_0^2 - (n+\tfrac{1}{2})^2\lambda^2 = 2d\lambda(n+\tfrac{1}{2})$$

$$\frac{1}{2\lambda(n+\frac{1}{2})}\left[d_0^2 - (n+\tfrac{1}{2})^2\lambda^2\right] = d$$

$d_0 = 200$ m $\quad \lambda = \frac{c}{f} = \frac{3\times10^8}{5.8\times10^6} = 51.7$ m

A short computer calculation gave

n	d (m)
0	760.8
1	219.1
2	90.1
3	20.1

There are no others!
Farther away, path length diff $\to 0$.

35.56. Herring

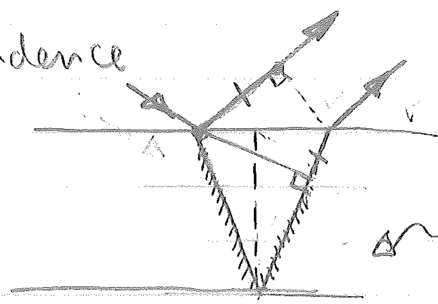
For constructive interference in a symmetric thin film,

$$2t = (m+\tfrac{1}{2})\lambda = (m+\tfrac{1}{2})\frac{\lambda_0}{n} \quad \text{or} \quad 2tn = (m+\tfrac{1}{2})\lambda_0$$

For guanine, $2tn = 266.4$ nm
For cyto, $2tn = 266.6$ nm
With $m=0$, then $\lambda_0 = 533$ nm. Green reflection.

b) there is enhanced reflectivity because the successive films add to the reflected amplitude ... only a small % reflects from a single film.

c) angle dependence



extra path is not $2t$ if not normal incidence.

(it's actually $2t\cos\theta_i$)

So the plates get effectively thinner when viewed at an angle: reflection max will be bluer.