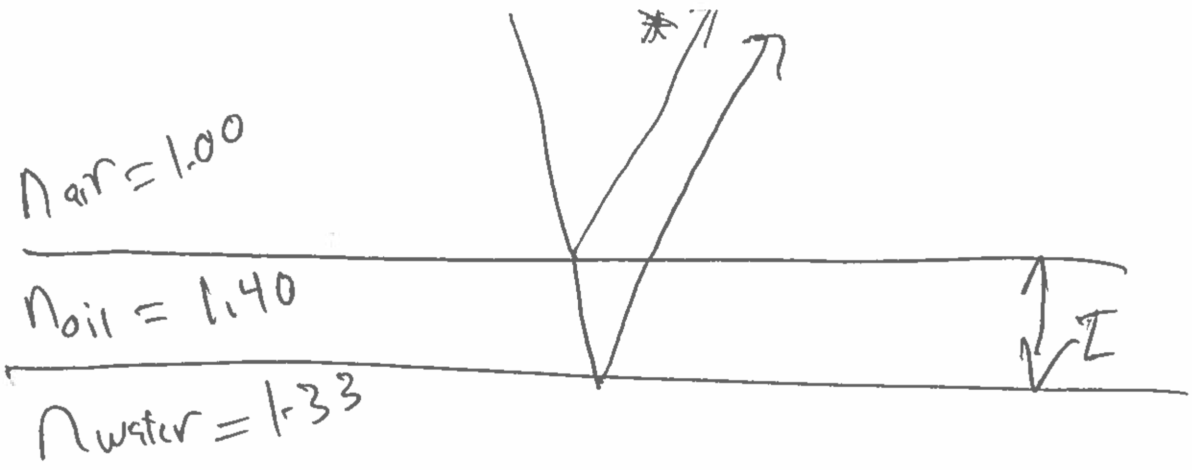


for constructive or Bright: Total phase diff $= m\lambda$

for Destructive or Dark: Total phase diff $= (m+\frac{1}{2})\lambda$

Total phase diff = optical path diff + phase shifts

optical path $= n_{path}$ (physical path)

Here optical path $= 2 n_{oil} t$

Here for Bright $2 n_{oil} t + \frac{1}{2}\lambda = m\lambda$

$$2 n_{oil} t = (m+\tfrac{1}{2})\lambda$$ bright cond.

Here for Dark

$$2 n_{oil} t + \frac{1}{2}\lambda = (m + \frac{1}{2})\lambda$$

$$\boxed{2 n_{oil} t = m\lambda}$$ dark cond.

find thinnest film that constructively reflects orange light 600 nm

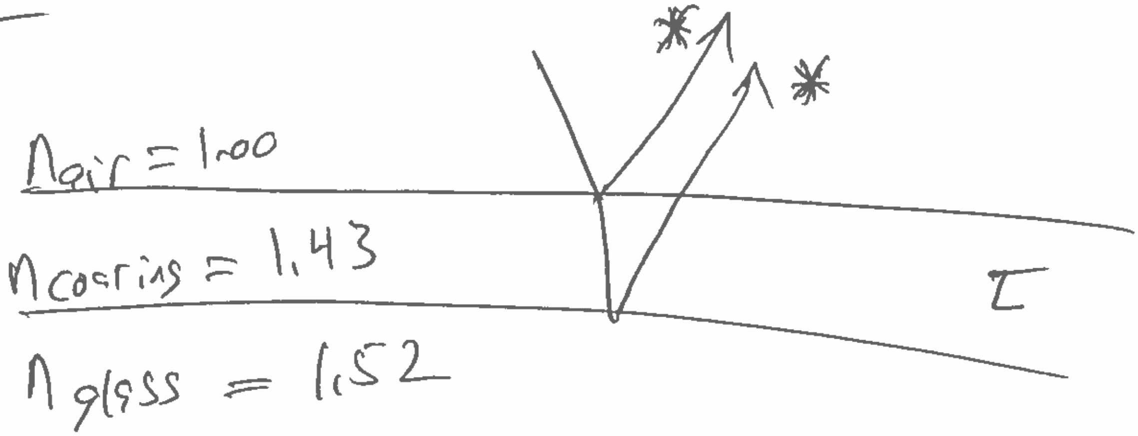
Constructive Bright $\Rightarrow 2 n_{oil} t = (m + \frac{1}{2})\lambda$

$$2 n_{oil} t = \frac{1}{2}\lambda$$

$$t = \frac{\lambda}{4 n_{oil}} = \frac{600\text{ nm}}{4(1.40)}$$

$$\boxed{t = 107.\text{ nm}}$$

27-15 non-reflective coating



$t = 1.07 \times 10^{-7}$ m $\quad \lambda_{long} = ?$ non-reflective

$$\text{Phase Diff} = 2 n_{coat} t + 2\left(\tfrac{1}{2}\lambda\right) = \left(m + \tfrac{1}{2}\right)\lambda$$

$$\left(m + \tfrac{1}{2}\right)\lambda = 2 n_{coat} t$$

$$\lambda = \frac{2 n_{coat} t}{m + \frac{1}{2}}$$

longest $\lambda \Rightarrow$ smallest denominator $\Rightarrow m = 0$

$$\lambda = \frac{2 n_{coat} t}{\frac{1}{2}} = 4 n_{coat} t$$

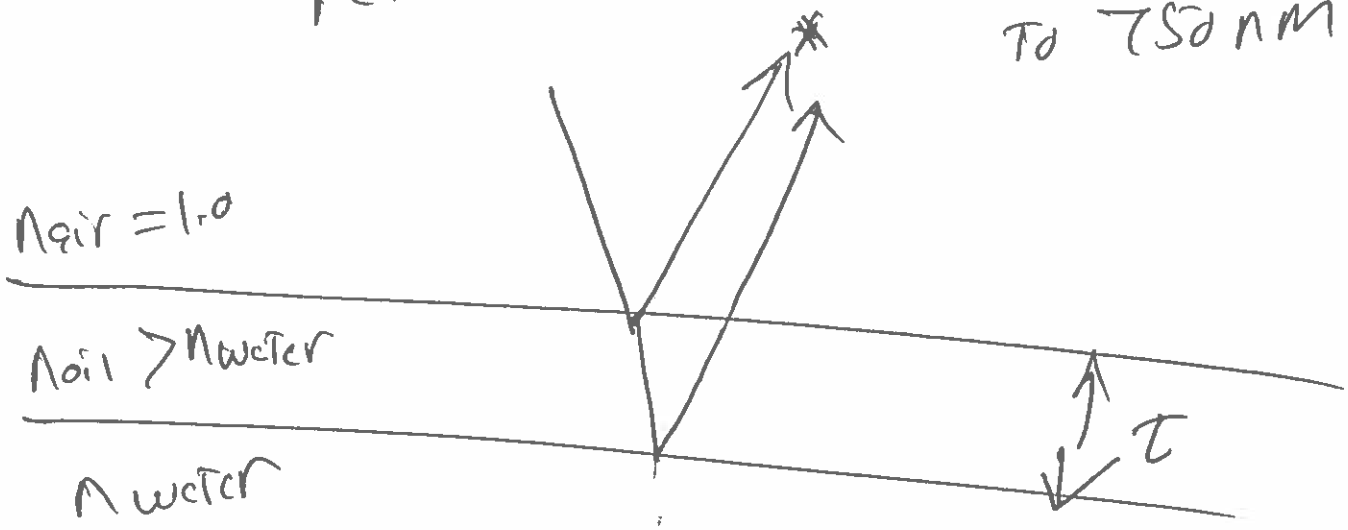
$$\lambda = 4(1.43)(1.07 \times 10^{-7}\text{ m}) = 6.12 \times 10^{-7}\text{ m}$$

$$\boxed{\lambda = 612\text{ nm}}$$ — orangish color

27-18 oil on wet pavement $n_{oil} > n_{water}$

minimum non zero thickness dark due to red ($\lambda = 640.0$ nm)

For which λ's do we get bright reflections between $\lambda = 380$ nm to 750 nm?



Destructive

$$2 n_{oil} t + \frac{1}{2}\lambda = (m + \tfrac{1}{2})\lambda$$

$$2 n_{oil} t = m\lambda$$

minimum non zero thickness $\Rightarrow m = 1$

$$\boxed{t = \frac{\lambda_{red}}{2 n_{oil}}}$$

Constructive

$$2 n_{oil} t + \frac{1}{2}\lambda = m\lambda$$

$$2 n_{oil} t = (m + \tfrac{1}{2})\lambda$$

$$\lambda = \frac{2 n_{oil} t}{m + \frac{1}{2}} = \frac{2 n_{oil}\left(\frac{\lambda_{red}}{2 n_{oil}}\right)}{m + \frac{1}{2}}$$

$$\lambda = \frac{\lambda_{red}}{m + \frac{1}{2}} = \frac{640.0\ nm}{m + \frac{1}{2}}$$

$m = 0$ $$\lambda = \frac{640.0\ nm}{\frac{1}{2}} = 2(640.0\ nm) = 1280\ nm$$

$> 750\ nm$

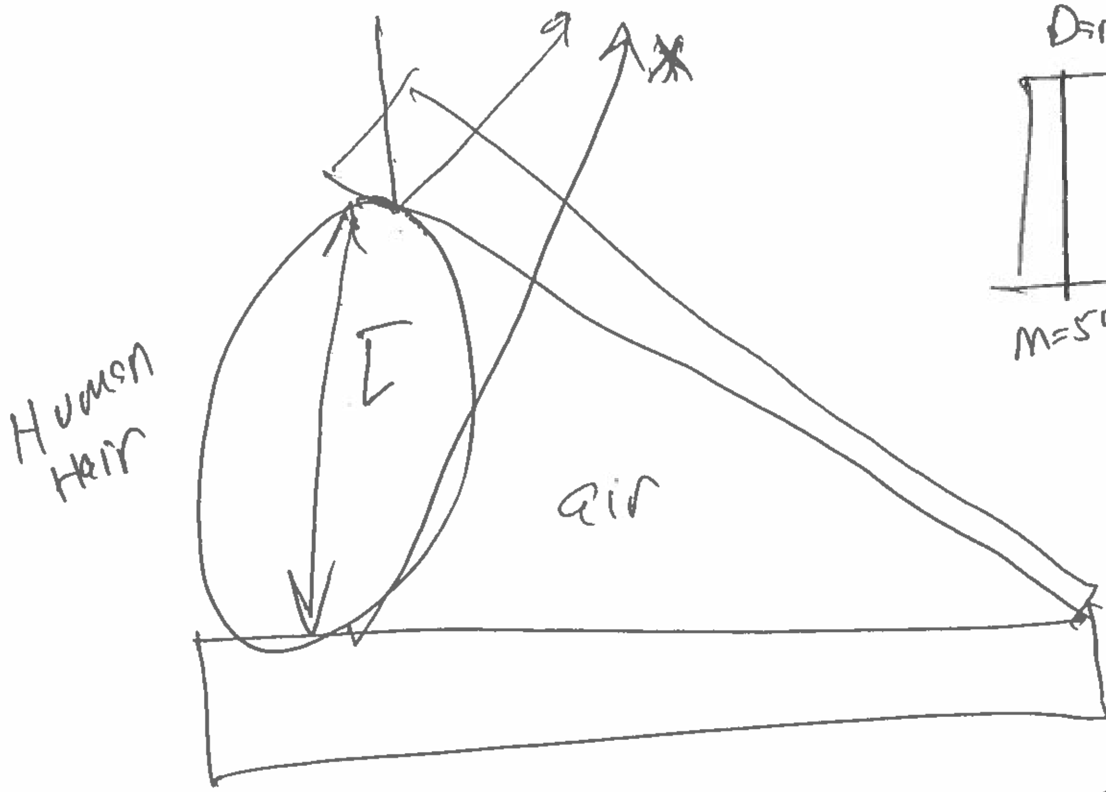
$m = 1$ $$\lambda = \frac{640.0\ nm}{1 + \frac{1}{2}} = \frac{640\ nm}{\frac{3}{2}} = 426.7\ nm$$ ✓

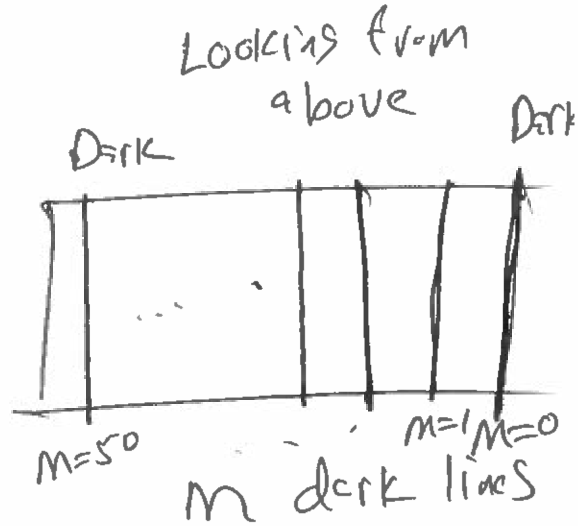
$m = 2$ $$\lambda = \frac{640.0\ nm}{2 + \frac{1}{2}} = \frac{640\ nm}{\frac{5}{2}} = 256.0\ nm$$

$< 380\ nm$

Only 426.7 nm reflects

Air wedges





Phase diff $= 2 n_{air} t + \frac{1}{2}\lambda = (m + \frac{1}{2})\lambda$ for Dark

$n_{air} = 1$

$2t = m\lambda$ for Dark lines

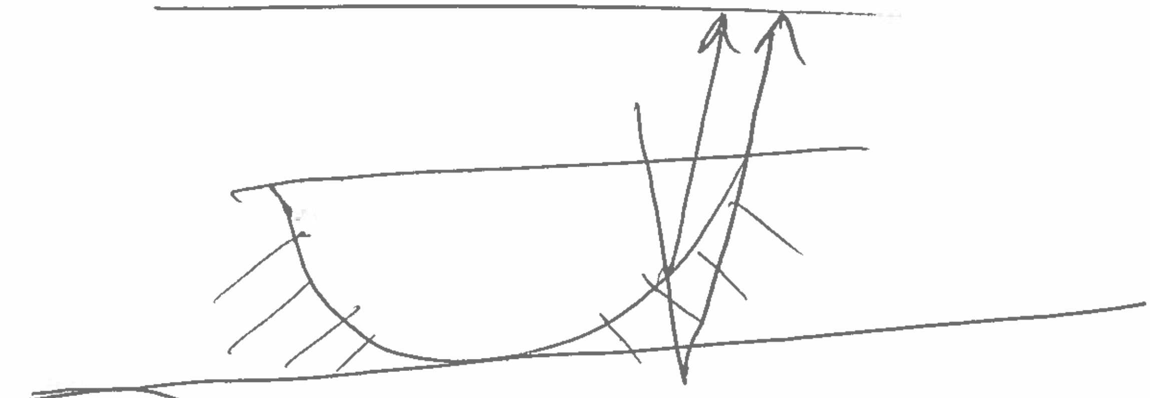
$\lambda = 480\,nm$ $\quad m = 50 \Rightarrow 51$ dark lines

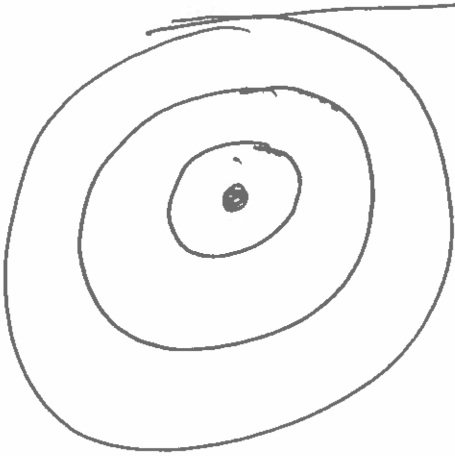
$$t = \frac{50\lambda}{2} = 25(480\,nm)$$

$$\boxed{t = 12{,}000\,nm = 12.0\,\mu m}$$

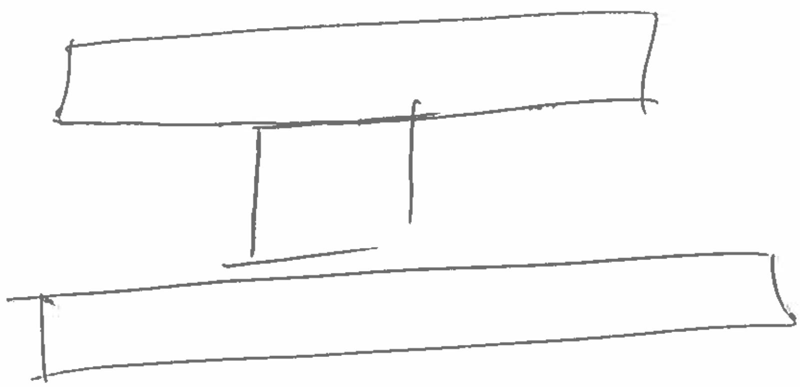
microns

Newton's Rings





Newton's Rings



Interferometer

Interferometer's use interference to determine things

Michaelson - interferometer