Phy 4C 3/15

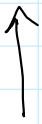
Wednesday, March 15, 2017 12:03 PM

Polarization

1)

unpolarized light

Polarizing filter



Polarized Light

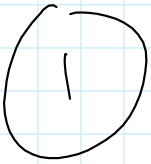
Polarizing filter

No Light

---

2)

I_0



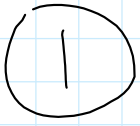
$I_1 = \frac{I_0}{2}$

$I_2 = I_1 \cos^2\theta$

---

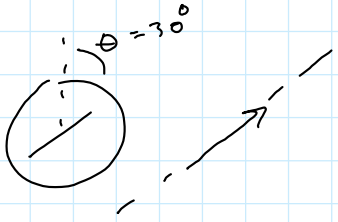
3)

I_0



I_1

$I_1 = \frac{1}{2} I_0$

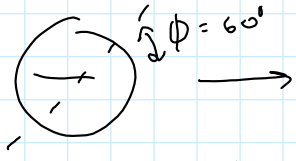


I_2

$I_2 = I_1 \cos^2\theta$

$I_2 = \frac{I_0}{2} \cos^2 30^\circ$

$=$



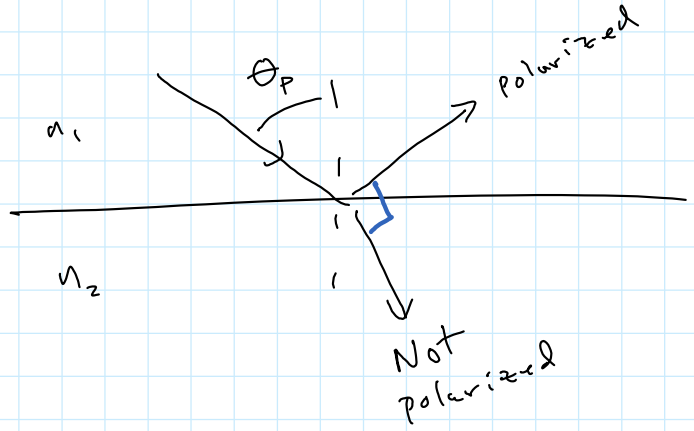
I_3

$I_3 = I_2 \cos^2\phi$

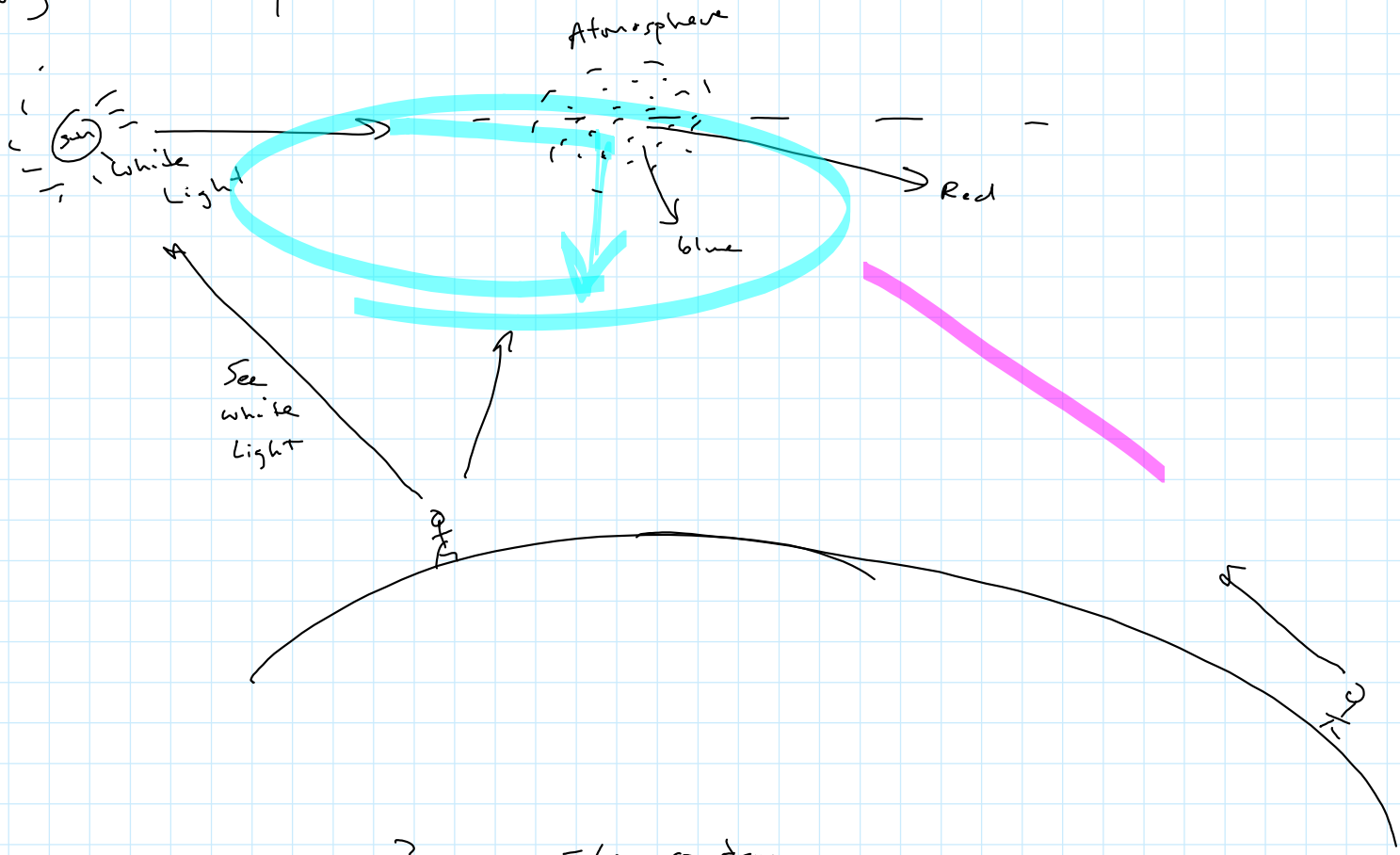
Reflected light is partially polarized

At a special angle → complete polarization
called Brewster's Angle

Brewster's Law: $\tan \theta_p = \frac{n_2}{n_1}$

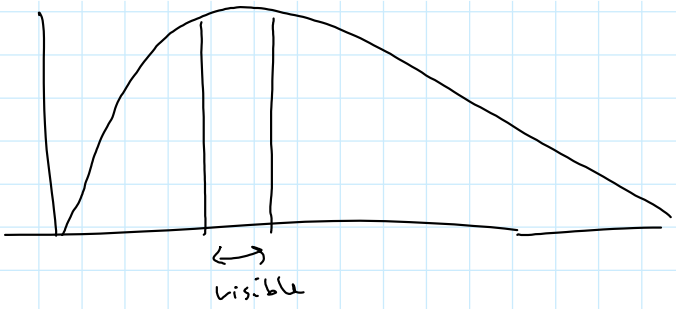


Why is the sky blue?



1. Why not violet?

E/M Spectrum

1) 

more blue than violet from sun

2) eyes are more sensitive to blue than violet

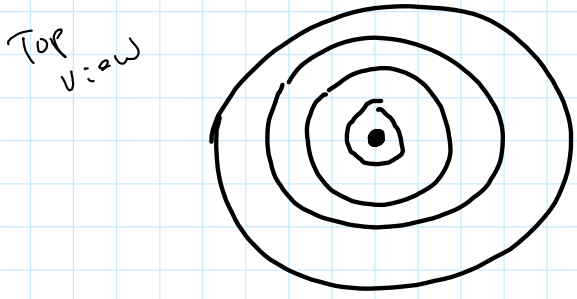
3) combination of other colors of light intensifies the blue

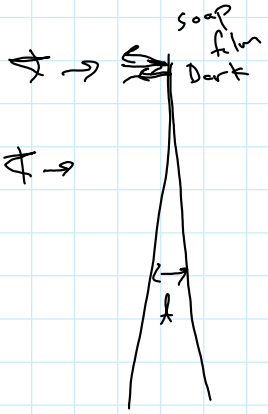
Prob. 37-39 Newton's Rings

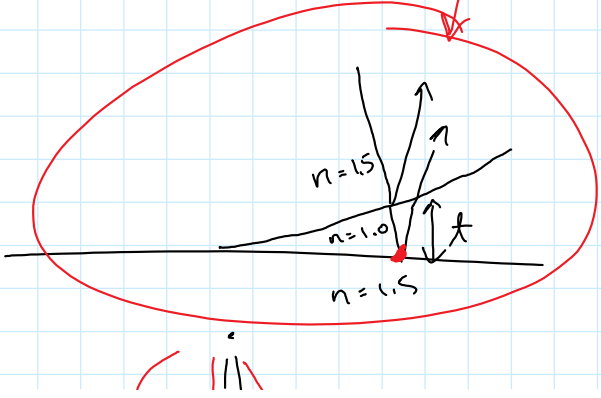
$n = 1.5$

$\lambda = 500$ nm

find t for the 10^{th} ring

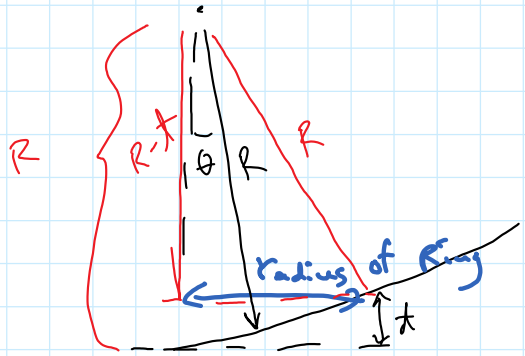






constructive:

$$\frac{\lambda}{2} + 2t = m\lambda$$



$t = R - R\cos\theta$

$\theta = \sin^{-1}\frac{0.75}{R}$ (Radius of 10th Ring)

$R\sin\theta = 0.75$

$$\frac{\lambda}{2} + 2t = m\lambda$$

$$2t = \left(m - \tfrac{1}{2}\right)\lambda$$

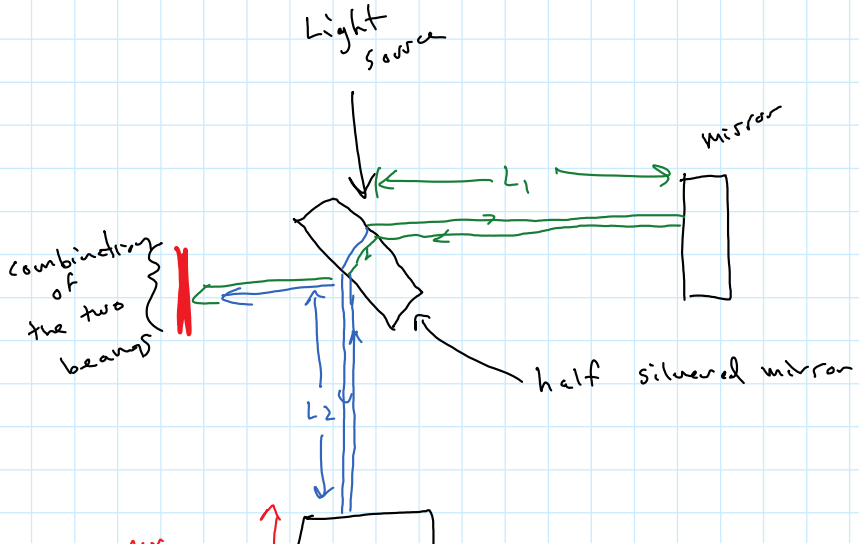
$$t = \frac{\left(10 - \frac{1}{2}\right)\left(500\times10^{-9}\right)}{2} = 2.38\times10^{-6}\ \text{m}$$

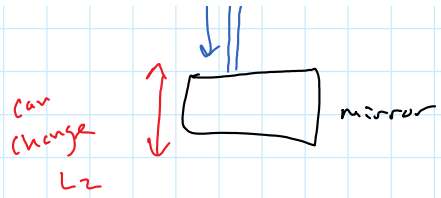
Space filled with liquid (n_{film})

$$\frac{\lambda_{film}}{2} + 2t = m\lambda_{film} \qquad \lambda_{film} = \frac{\lambda_{vacuum}}{n_{film}}$$

Solve for n_{film}

Michelson Interferometer





prob 37-37

$\lambda = 600$ nm

30 dark fringes

find d

phase shifts

path difference

For destructive interference

$$\frac{\lambda}{2} + 2t = \left(m + \frac{1}{2}\right)\lambda \qquad m = 0, 1, 2, \ldots, 29$$

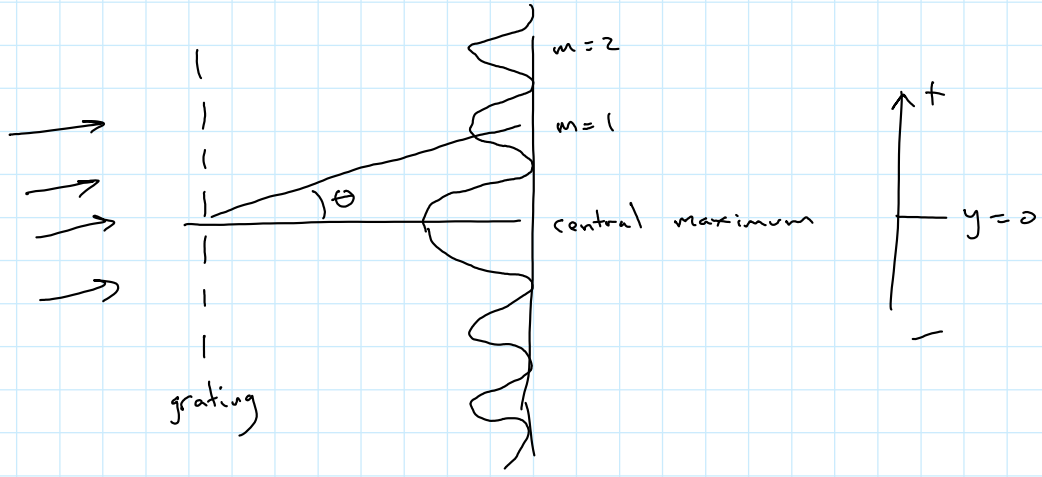
30^{th} dark fringe

$$2t = m\lambda$$

$$t = \frac{29}{2}(600\text{ nm})$$

$$= 8700\text{ nm}$$

prob 38-35



diffraction grating: $d \sin\theta_{bright} = m\lambda$

a) find lines per cm, given $m = 3$

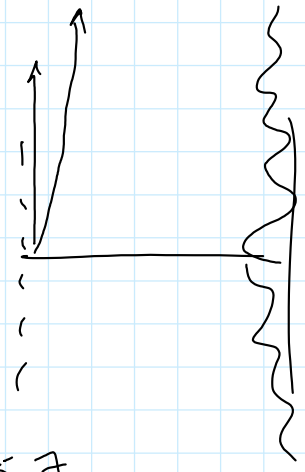
$\theta = 32^\circ$

$\lambda = 500\ nm$

$$d = \frac{(3)(500\ nm)}{\sin 32^\circ} = 2.83 \times 10^{-4}\ cm$$

$$\frac{1}{d} = 3533\ \frac{rulings}{cm} \text{ or } \frac{lines}{cm}$$

b) solve for m when $\theta = 90^\circ$



$$m = \frac{d \sin\theta}{\lambda} = 5.7$$

So, 5 bright fringes on each side of central max →

So, 11 total