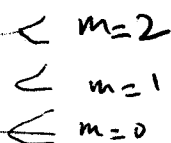
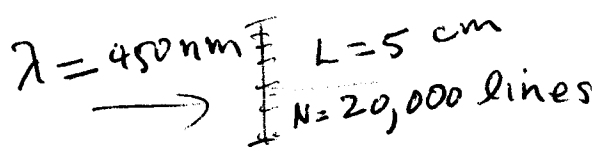


Physics 1C Winter 2010

Quiz 3 form A.

1) Diffraction Gratings



$$d \sin \theta = m \lambda$$

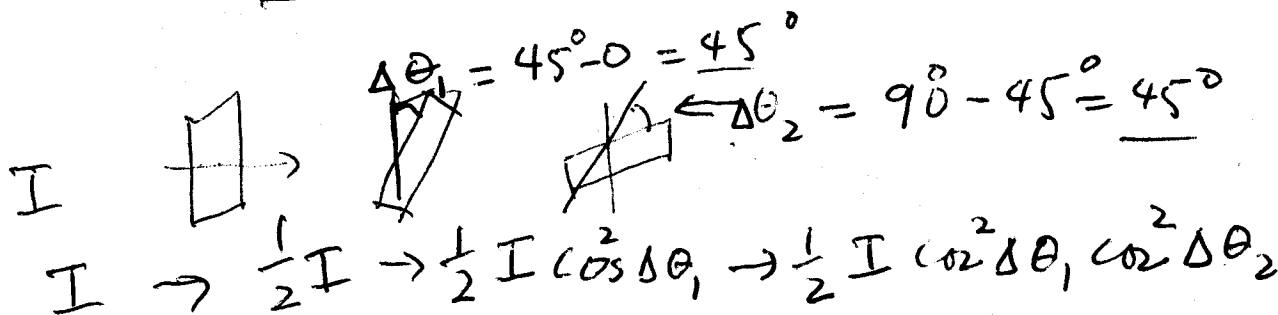
$$d = \frac{L}{N}$$

$$\sin \theta = \frac{m \lambda}{d} = \frac{m \lambda N}{L} = \frac{2 (450 \times 10^{-9} \text{ m}) (20,000)}{5 \times 10^{-2} \text{ m}}$$

$$\sin \theta = 0.36$$

$$\theta = 21.1^\circ$$

2)

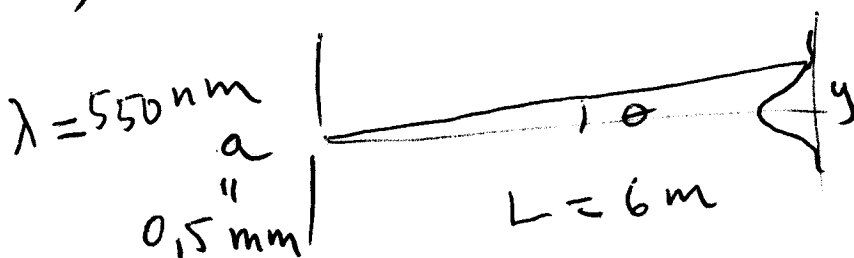


$$I \rightarrow \frac{1}{2} I \rightarrow \frac{1}{2} I \cos^2 \Delta \theta_1 \rightarrow \frac{1}{2} I \cos^2 \Delta \theta_1 \cos^2 \Delta \theta_2$$

final intensity

$$\frac{1}{2} I (\cos^2 45^\circ) (\cos^2 45^\circ) = \frac{1}{8} I = 0.125 I$$

3) Single slit diffraction



$$a \sin \theta = m \lambda \text{ to minimum}$$

small angle $\sin \theta \approx \frac{y}{L}$

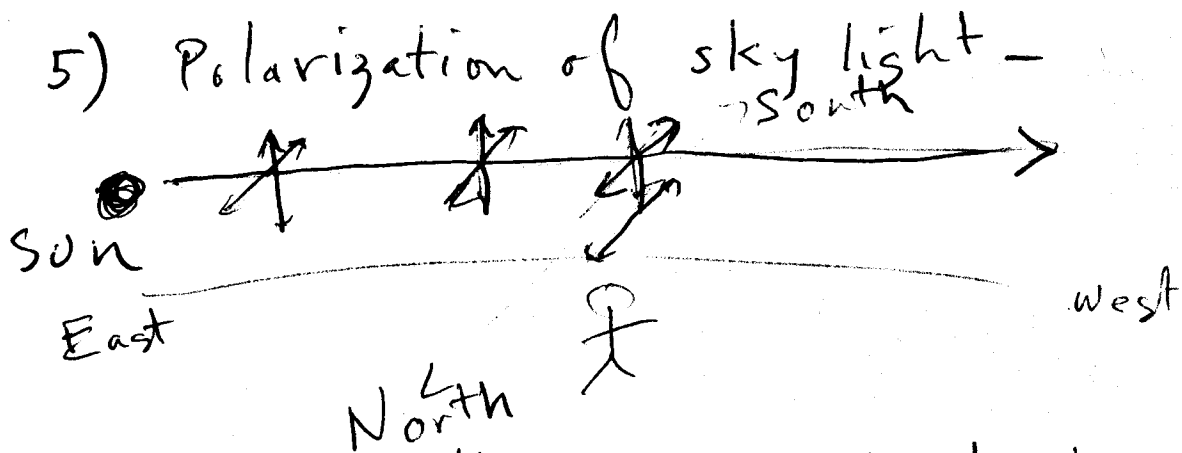
$$a \frac{y}{L} = \lambda$$

$$y = \frac{\lambda L}{a} = \frac{550 \times 10^{-9} \text{ m} (6 \text{ m})}{0.15 \times 10^{-3} \text{ m}}$$

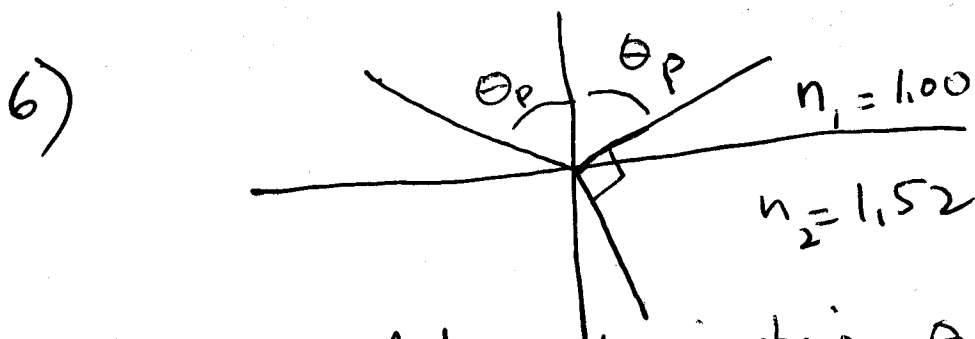
$$3) \quad y = \frac{\lambda L}{a} = \frac{550 \times 10^{-9} \text{ m} (6 \text{ m})}{0.5 \times 10^{-3} \text{ m}} = 6.6 \times 10^{-3} \text{ m}$$

6.6 mm

4) Polarization ^{can be} observed in transverse waves, but not longitudinal waves.



Light scattered from the sky is polarized in the North-South direction

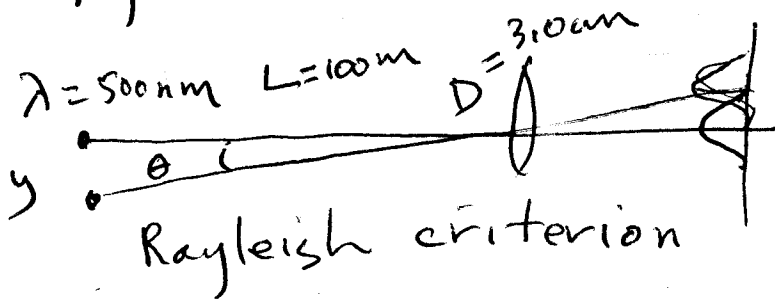


for complete polarization θ is at the polarizing angle -

$$\tan \theta_p = \frac{n_2}{n_1} = \frac{1.52}{1} = 1.52$$

$\theta_p = 57^\circ$

7) Spy Camera



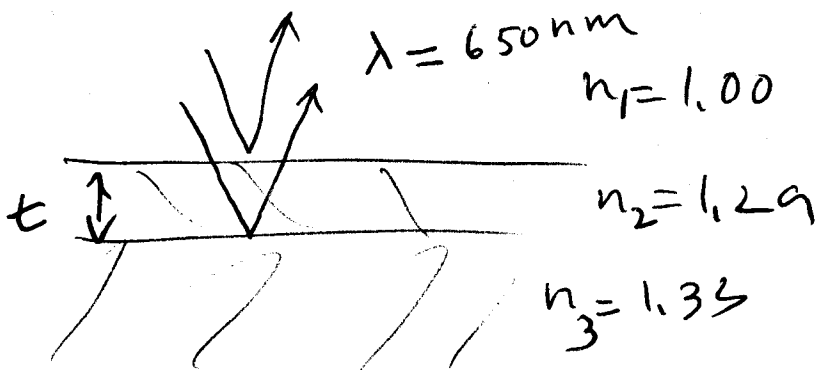
$$\theta_{\min} = \frac{1.22 \lambda}{D} = \frac{y}{L} \quad \text{for small angles}$$

$$y = \frac{1.22 \lambda L}{D} = \frac{1.22 (500 \times 10^{-9} \text{ m})(100 \text{ m})}{3 \times 10^{-2} \text{ m}}$$

$$= 2 \times 10^{-3} \text{ m}$$

2 mm

8)



For maximal reflection constructive interference
 $m = 1$ for thinnest film - (non zero).
 phase shifted at both interfaces \rightarrow no net
 phase shift - condition for constructive
 interference

$$2t = m \frac{\lambda}{n_2} = \frac{\lambda}{n_2}$$

$$t = \frac{\lambda}{2n_2} = \frac{650 \text{ nm}}{2(1.29)} = \boxed{252 \text{ nm}}$$