Physics 173
Spring Quarter 1988
May 27, 1988
George Williams

AVERAGE = 15.3
DEVIATION = 6.3
N = 211

1

THIRD EXAM

Name (print) MOLINA Name (signed) _____

Discussion Instructor (circle one): Cady McAllister Molina Stone

Discussion Section #: _____

-1 : sig. fig.
-1 : units

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

(a) A diamond (n = 2.42) is under water (n = 1.33). Calculate the polarizing angle for light incident on the diamond. 5

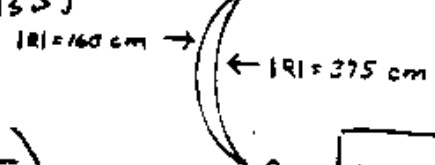
$\tan\theta_p = \frac{n_D}{n_w} = \frac{2.42}{1.33} \Rightarrow \theta_p = \tan^{-1}\left(\frac{2.42}{1.33}\right) =$ **61.2°**

(b) Yellow light, of wavelength 589 nm, is incident normally on a single slit. The second minimum from the center is 2.75 cm from the center of the pattern on a screen 4.35 m away from the slit. Calculate the slit width. 5

$a \sin\theta = m\lambda$

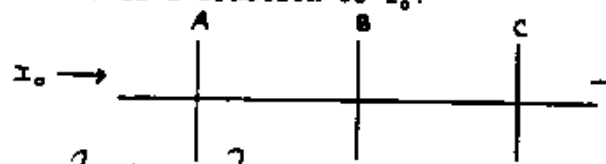
$\Rightarrow a = m\lambda / \sin\theta = \frac{2 \times 589\times10^{-9}}{(2.75/435)} = 1.86\times10^{-4}\,(m) =$ **186 μm**

(c) Calculate the focal length of the lens shown, in air. The lens is made of glass with n = 1.65. 5



$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = (1.65-1)\left(\frac{1}{160} - \frac{1}{375}\right) \Rightarrow f =$ **429 (cm)**

(d) Completely unpolarized light is incident on three polarizers. The polarization axes of A and B make an angle of 30.0° with each other and the axes of B and C make an angle of 55° with each other. Calculate the intensity that comes out of C as a fraction of I_o. 5



$I = \frac{1}{2} I_o \cdot \cos^2(30^\circ)\cos^2(55^\circ) = 0.123\, I_o \Rightarrow$ **$\frac{I}{I_o} = 0.123$**

(e) Red light, of λ = 635 nm, shines through a fine wire screen. The first maximum from the center occurs at θ = 1.00°. The sixth maximum (the center counts as zero) is missing. This is the first one missing. Calculate the open spacing between the wires of the screen. 5

interf. $d \sin(1^\circ) = 1\cdot\lambda \Rightarrow d = \frac{\lambda}{\sin(1^\circ)} = 36.4\,\mu m$

diffract. $a \sin\theta = n\lambda$ (MIN)

interf $d \sin\theta = m\lambda$ (MAX)

$\frac{n\lambda}{a} = \frac{m\lambda}{d} \Rightarrow a = \frac{dn}{m} = \frac{d\cdot1}{6} = \frac{d}{6} =$ **6.07 μm**