Physics 173
Spring Quarter 1988
May 6, 1988
George Williams
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AVERAGE = 21.0
DEVIATION = 4.5
N = 228

1

SECOND EXAM

Name (print) MOLINA Name (signed) _____

Discussion Instructor (circle one): Cady McAllister Molina Stone

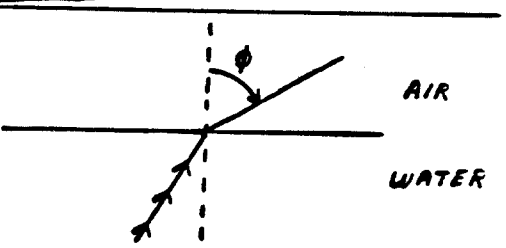
Discussion Section #: _____

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

(a) Calculate the critical angle for total internal reflection for diamond (n = 2.42).

$\theta_c = \sin^{-1}\left(\frac{n_{AIR}}{n_{DIAM}}\right) = \sin^{-1}\left(\frac{1}{2.42}\right) = \boxed{24.4^\circ}$ or 0.427 rad

(b) Light approaches an air-water surface from below at an angle of 27.2° from the normal. Water has n = 1.33. Calculate the angle ϕ for the emerging beam.



Snellis Law: $1.33 \sin(27.2) = \sin\phi$

$\Rightarrow \phi = \sin^{-1}(1.33 \sin(27.2)) = \boxed{37.4^\circ}$ or 0.653 rad

(c) A red laser has a wavelength of 654 nm. Calculate the wavelength in glass of n = 1.65.

$\lambda_{GLASS} = \frac{\lambda_0}{n_{GLASS}} = \frac{654\,(nm)}{1.65} = \boxed{396\,(nm)}$

(d) Sunlight is incident on the Physics parking lot with $S_{AV} = 727\ W/m^2$. Calculate the maximum value of the magnetic field in the sunlight.

$S_{AV} = \frac{c}{2\mu_0} B_m^2 \Rightarrow B_m = \left(\frac{2\mu_0 S_{AV}}{c}\right)^{1/2} = \boxed{2.47 \times 10^{-6}\,(T)}$

(e) A violin string is tuned to 440 Hz. In the course of the performance the tension decreases by 1.50%. Calculate the new frequency.

$f = \frac{c}{\lambda} = \sqrt{\frac{T}{\mu}}\frac{n}{2L}$ $\quad T \rightarrow T' = 0.985T$

$\Rightarrow f \rightarrow f' = \sqrt{0.985}\, f$

$= \sqrt{0.985} \times 440\,(Hz) = \boxed{437\,(Hz)}$

-1 : wrong units
-1 : wrong sig. figs
-5 : wrong answer.