Physics 2220
Spring 2000
George A. Williams

SIXTH MIDTERM

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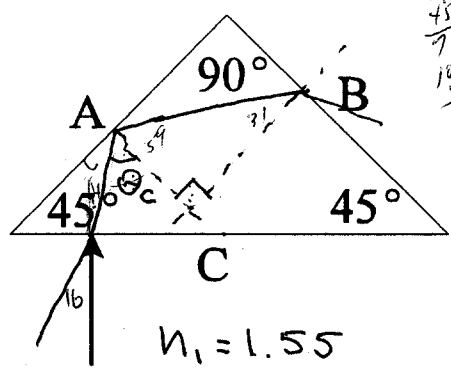
Discussion Section # _____ Student ID #: _____

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

A 45°-45°-90° prism of glass with refractive index 1.55 is immersed in water (refractive index 1.33).

(a) Light is incident perpendicular to the base as shown. Calculate the direction of refracted ray (measured from the normal) emerging from the prism at surface (A).
(b) Find the minimum angle of incidence to the base where the beam is totally internally reflected at surface (A).
(c) Find the face, (A), (B) or (C), and angle that the beam in (b) emerges from the prism.



a) $n_1 \sin\theta_1 = n_2 \sin\theta_2$

$\theta_2 = \sin^{-1}\left(\frac{n_1}{n_2}\sin 45°\right) = 55.5°$ ✓

b) $\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right) = 59.1°$

$\theta_1 = \theta_c - 45° = 14.1°$

$\theta_2 = \sin^{-1}\left(\frac{n_1}{n_2}\sin\theta_1\right) = 16.5°$ ✓

c) emerges from B

$\theta_1 = 90° - \theta_c = 30.9°$

$\theta_2 = \sin^{-1}\left(\frac{n_1}{n_2}\sin\theta_1\right) = 36.8°$

$n_1 = 1.55$
$n_2 = 1.33$

θ_1 - in glass
θ_2 - in water
for a), b), c)