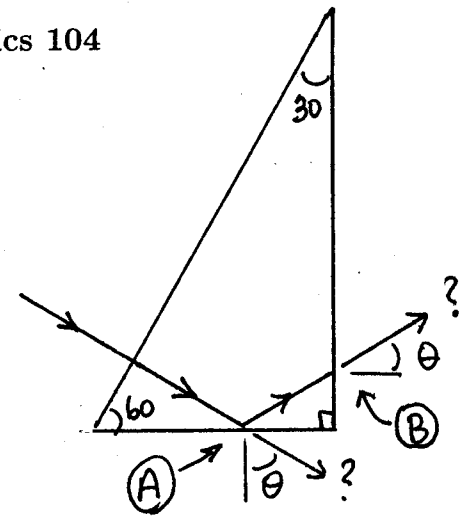
Physics 104 **QUIZ #4** **Fall 2006**



NAME: SOLUTIONS

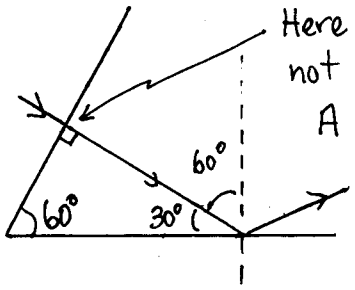
SECTION # : _____

TA: _____

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$
$$\theta_i = \theta_r$$

A light ray is incident perpendicular to the surface of a glass prism ($n = 1.5$) as shown in the drawing.

(a) Is it possible for any light to emerge from the glass at point A? If so, find the angle θ at which the light leaves the glass.

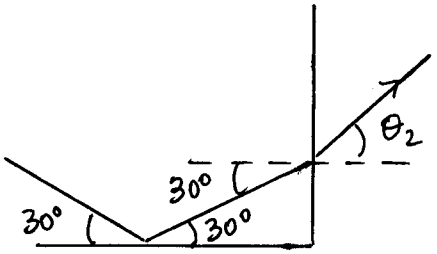


Here the angle of incidence is 0°, so the light ray does not bend. By geometry, the angle of incidence at point A is 60°. Use Snell's law to find the angle of refraction.

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

$1.5 \sin 60° = 1.0 \sin\theta_2 \Rightarrow \sin\theta_2 = 1.3 \Rightarrow$ no solution $\Rightarrow$ no refracted ray $\Rightarrow$ total reflection

(b) At least some of the light reflects at A and travels to point B. Is it possible for any light to emerge from the glass at point B? If so, find the angle θ at which the light leaves the glass.



By geometry, the angle of incidence at B is 30°

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

$\sin\theta_2 = \frac{1.5}{1.0} \sin 30°$ Light emerges @

$\theta_2 = 48.6°$

(c) Repeat part (a) for a glass prism that is submerged in water ($n = 1.33$).

$1.5 \sin 60° = 1.33 \sin\theta_2$

$\sin\theta_2 = 0.9767$ Light emerges @

$\theta_2 = 77.6°$