Light is incident along the normal on face AB of a glass prism of refractive index 1.52, as shown. Find the largest value the angle a can have without any light refracted out of the prism at face AC if

(a) the prism is immersed in air, and

(b) the prism is immersed in water.



(a)

Total internal reflection occurs at AC when : $n \sin \mathbf{q} = (1.00) \sin 90^\circ = 1.00$ (1.52) sin ? = 1.00 $\mathbf{q} = 41.1^\circ$ $\mathbf{a} + \mathbf{q} = 90^\circ \rightarrow \mathbf{a} = 90^\circ - 41.1^\circ = 48.9^\circ$

If a is larger, q is smaller and thus less than the critical angle, so this answer is the *largest* that a can be.

(b)

Use the same approach as in (a), except AC is now a glass-water boundary. $n \sin ? = n_w \sin 90^\circ = 1.333$ $1.52 \sin ? = 1.333$ $? = 61.3^\circ$ $a = 90^\circ - 61.3^\circ = 28.7^\circ$