OPHW1-1 Soln)

This is a critical angle for total internal reflection problem. The ray that enters the glass on the left will continue horizontally, since the angle of incidence on the glass is 0° . A little geometry tells us that the angle of incidence on the right hand surface will be the complement of angle ϕ . The relationship derived in class was that

 $\sin \theta_{\rm C} = n_2/n_1,$

so we can change this to

 $\cos \phi = n_2/n_1$.

If *phi* were any larger than this value, theta would be smaller than its critical value and light would escape.

a) $n_1 = n_{glass} = 1.52$ $n_2 = n_{air} = 1$ so, $\phi = \arccos(n_2/n_1) = \arccos(1/1.52) = 48.9^{\circ}$. b) $n_1 = n_{glass} = 1.52$ $n_2 = n_{water} = 1.33$ so, $\phi = \arccos(n_2/n_1) = \arccos(1.33/1.52) = 29.0^{\circ}$.