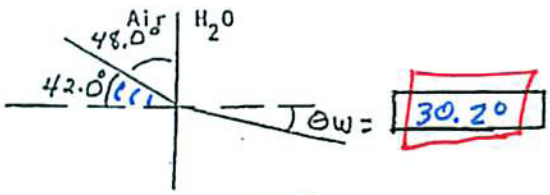
(Snell's Law) Name: KEY Per:

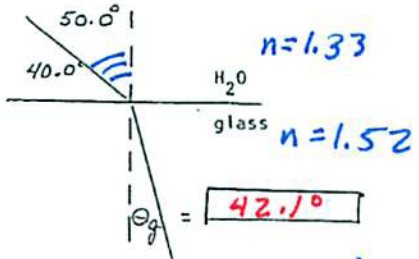
Show work on all problems. Basic equations, numbers with units, answers to correct (3) sig. figs in boxes provided.

#1) Determine the angle the light path takes in the material as shown. *Note: Indices are in the text. Also, Not all interfaces are horizontal. The dotted lines are the normal lines.*



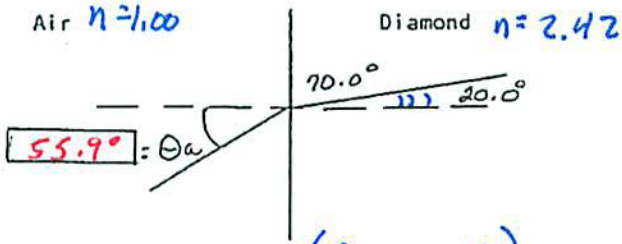
$n_1 \sin\theta_1 = n_2 \sin\theta_2$

$\theta_w = \sin^{-1}\left(\frac{n_{air}}{n_w} \cdot \sin\theta_{air}\right) = \sin^{-1}\left(\frac{1}{1.33} \cdot \sin 42^\circ\right)$



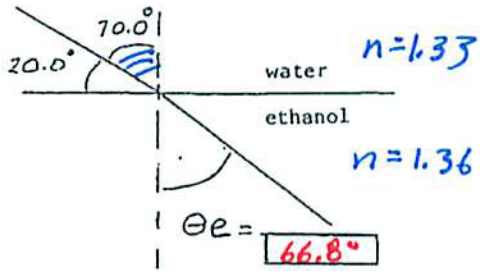
$\theta_g = \sin^{-1}\left(\frac{n_w}{n_g} \cdot \sin\theta_w\right)$

$= \sin^{-1}\left(\frac{1.33}{1.52} \cdot \sin 50^\circ\right) =$



$\theta_{air} = \sin^{-1}\left(\frac{n_D}{n_{air}} \cdot \sin\theta_D\right)$

$= \sin^{-1}\left(\frac{2.42}{1.00} \cdot \sin 20^\circ\right) =$



$\theta_e = \sin^{-1}\left(\frac{n_w}{n_e} \cdot \sin\theta_w\right)$

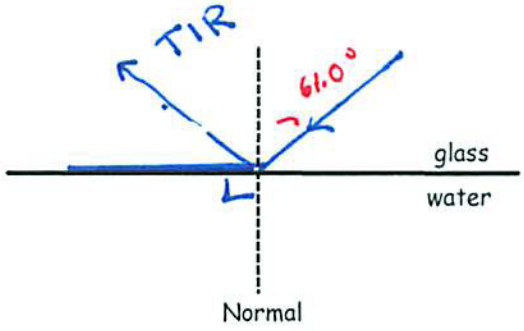
$= \sin^{-1}\left(\frac{1.33}{1.36} \cdot \sin 70^\circ\right)$

#2) Calculate the critical angle for the light passing between glass and water. On the drawing, sketch a ray of light moving at the critical angle of incidence in the proper direction and show clearly where that light goes after hitting the interface.

Glass/water

set $\theta_{refracted} = 90^\circ$ (θ_w)

sketch:



Work:

$n_g \sin\theta_g = n_w \underbrace{\sin\theta_w}_{1}$ (90°)

$\theta_c = \sin^{-1}\left(\frac{n_w}{n_g}\right) = \sin^{-1}\left(\frac{1.33}{1.52}\right) =$ 61.0°