P #13

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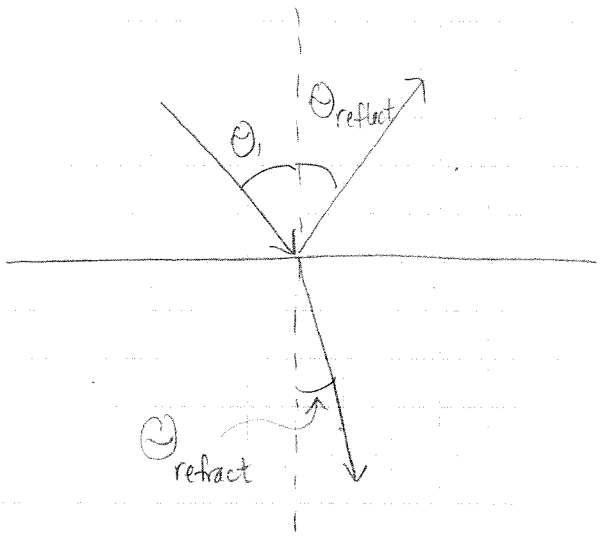
$n_1 = 1.00$ (air)
$n_2 = 1.309$ (ice)

$\theta_1 = 40.0°$



For $\theta_{reflect}$:

$\theta_1 = \theta_2$ so $\theta_{reflect} = 40°$

For $\theta_{refract}$:

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

$(1.00)(\sin 40°) = (1.309) \cdot \sin\theta_2$

$\theta_2 = 29.4°$

For angle between:

$\Delta\theta = 180° - \theta_{reflect} - \theta_{refract}$

$= 180° - 40° - 29.4°$

$\boxed{\Delta\theta = 111°}$