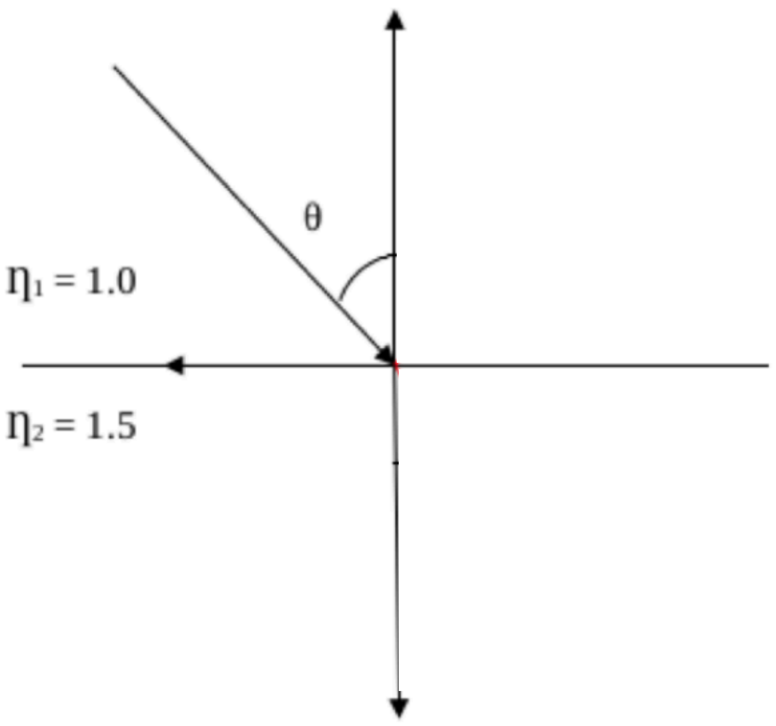
- Draw the light-surface interactions for the following case of a dielectric interface. Also compute the various angles for $\theta = 45°$.



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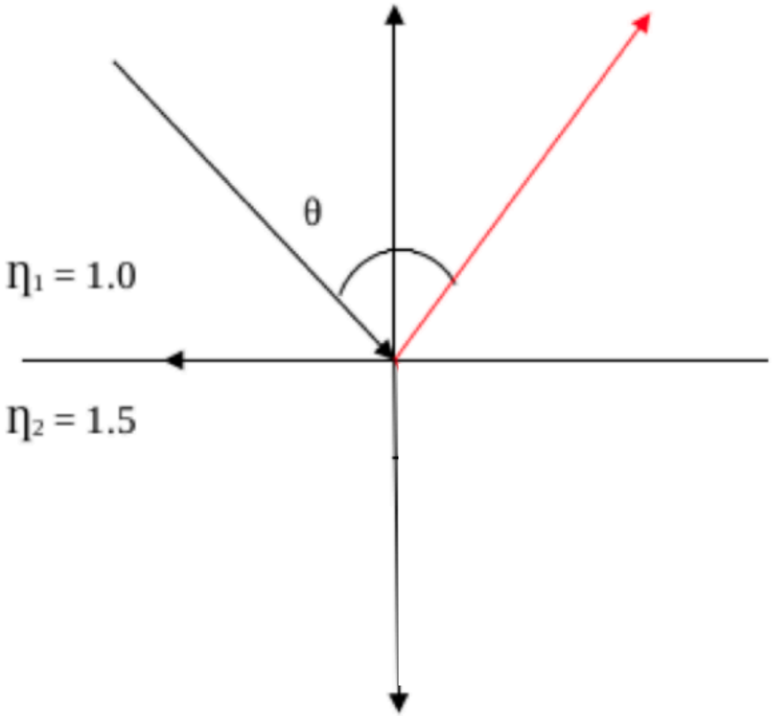

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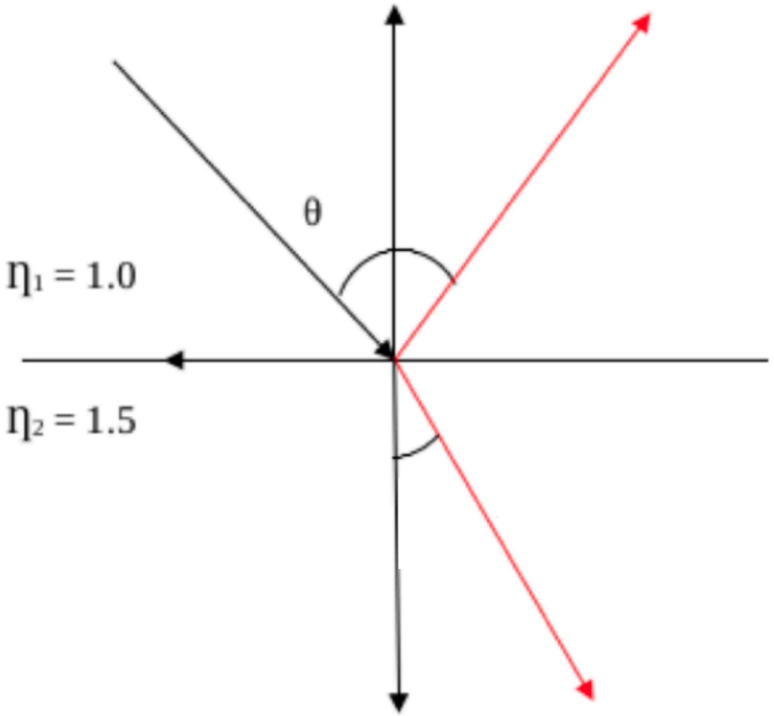

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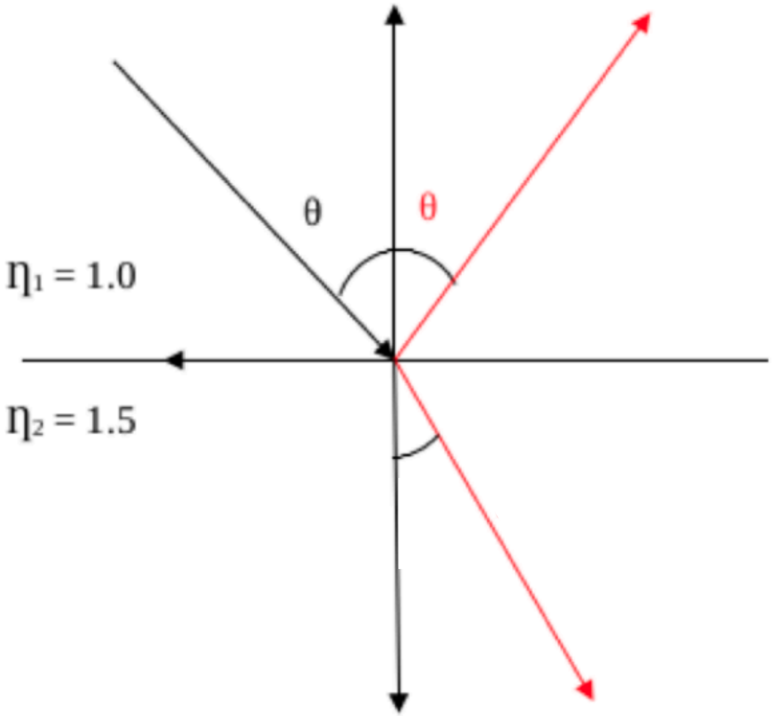

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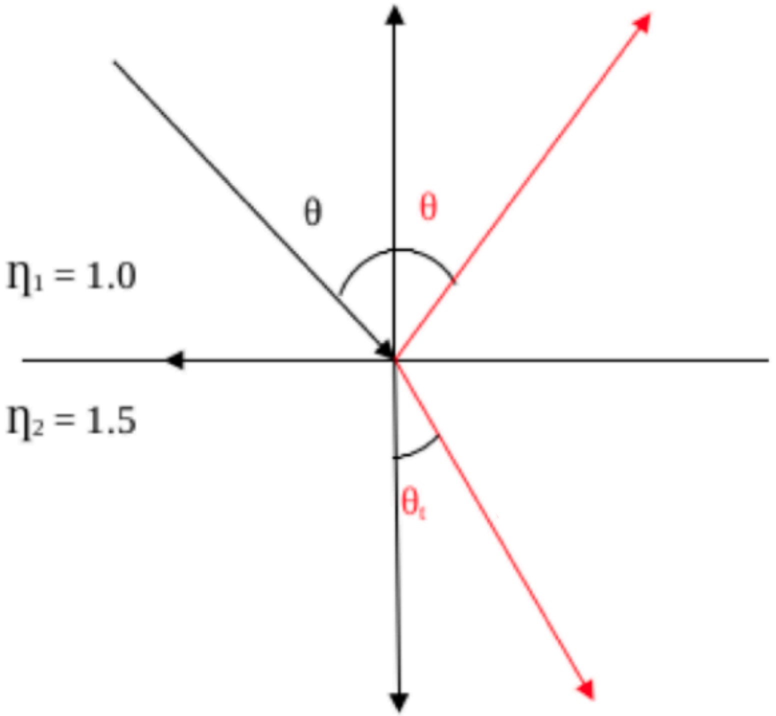

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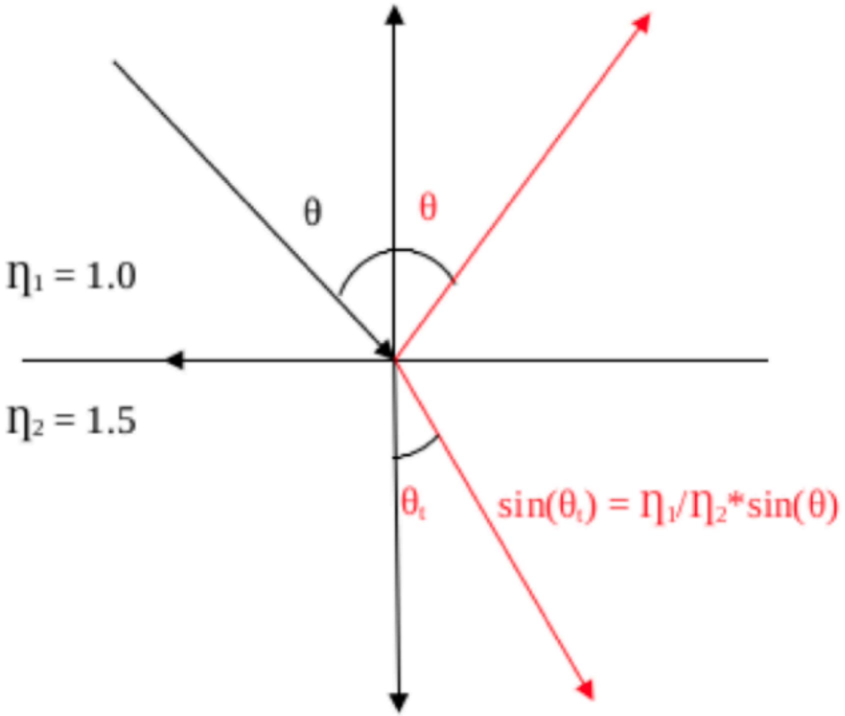

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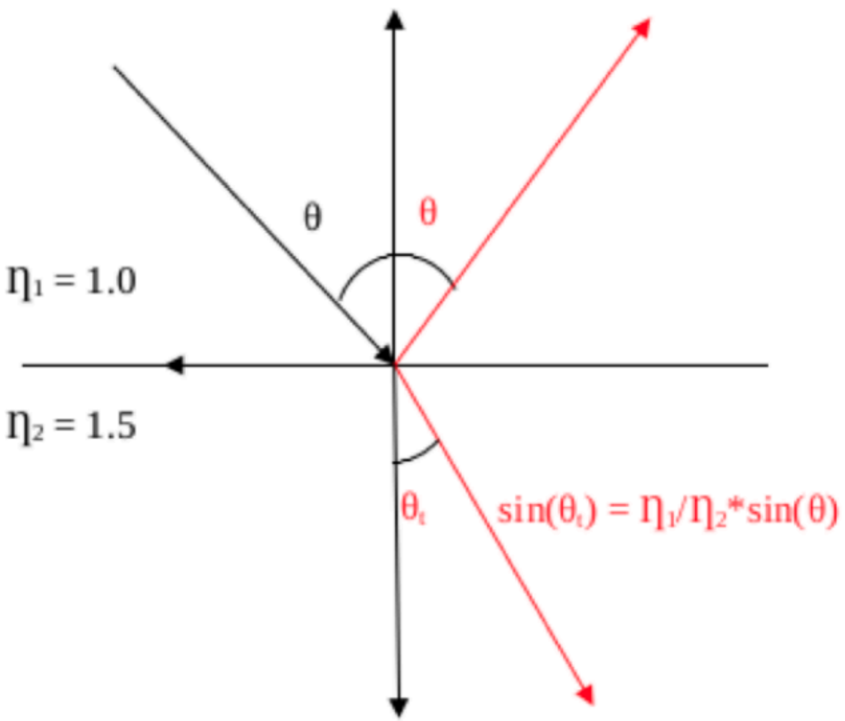

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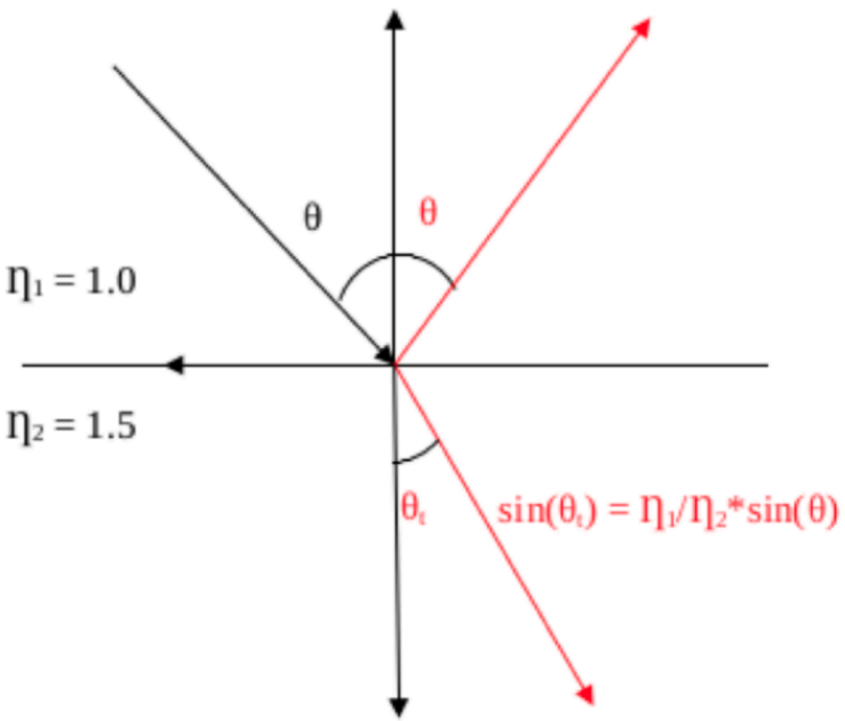

$$\theta_t = \arcsin\left(\frac{n_1}{n_2} * \sin\theta\right) \approx 28\,\text{deg}$$

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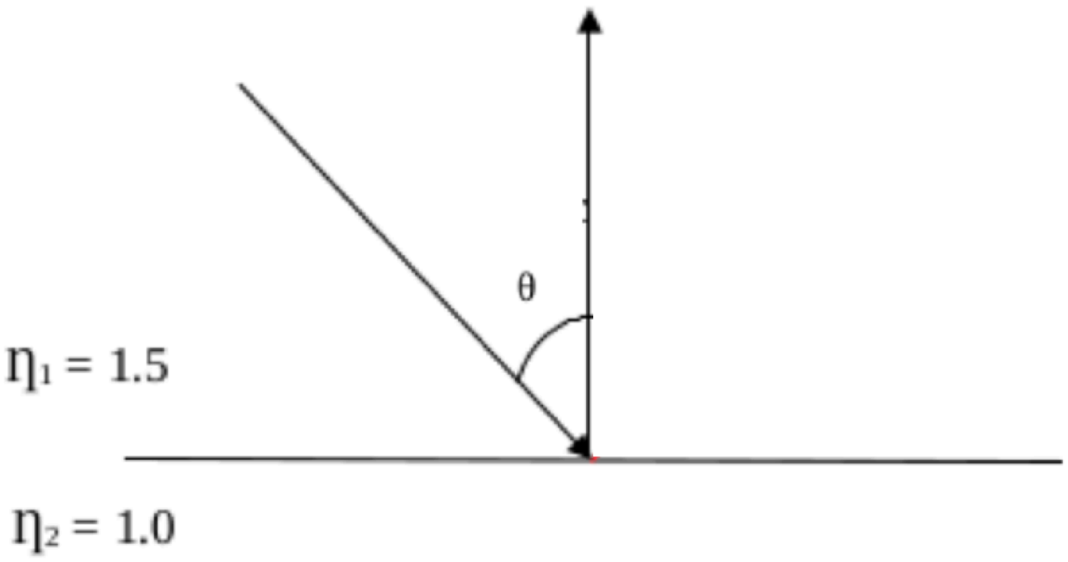

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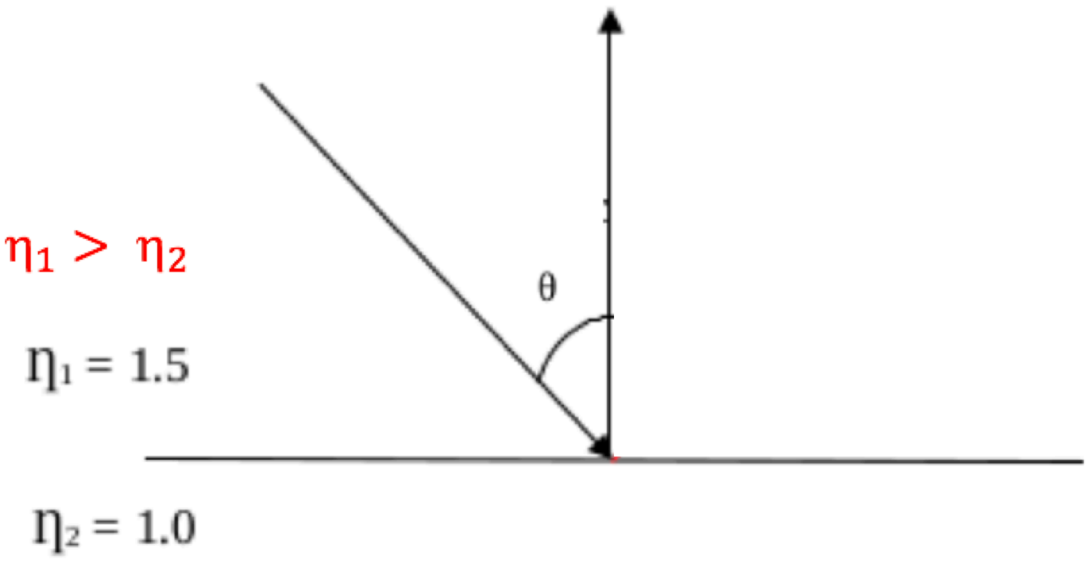

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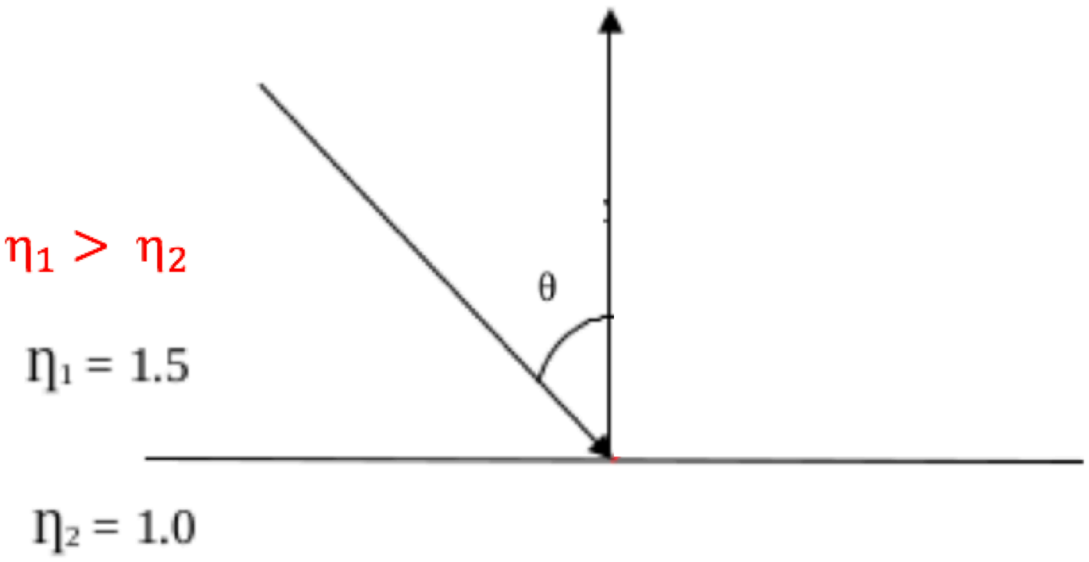

Critical angle:

$$\theta_c = \arcsin(\frac{n_2}{n_1})$$

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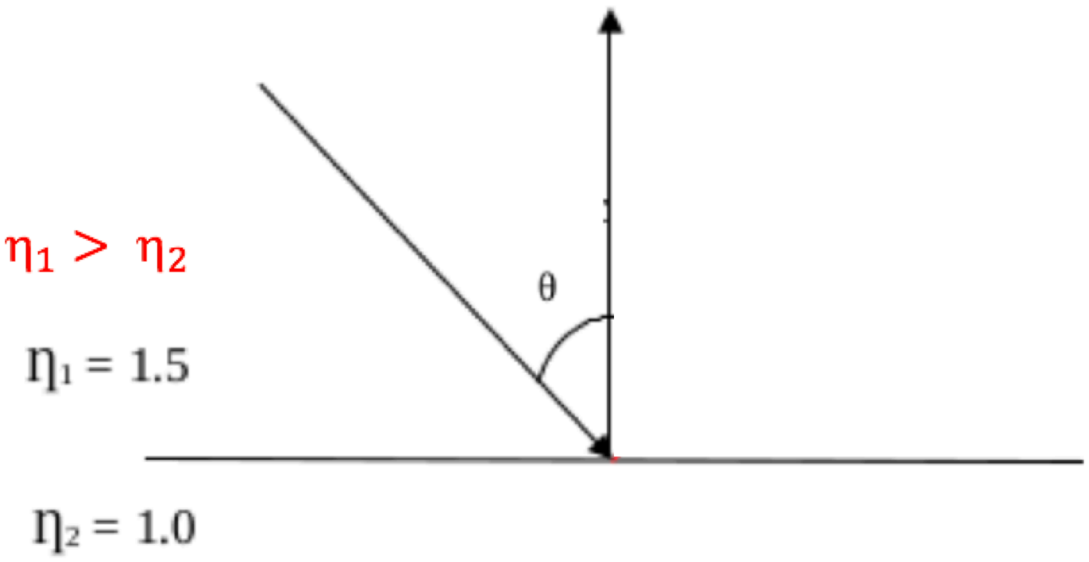

Critical angle:

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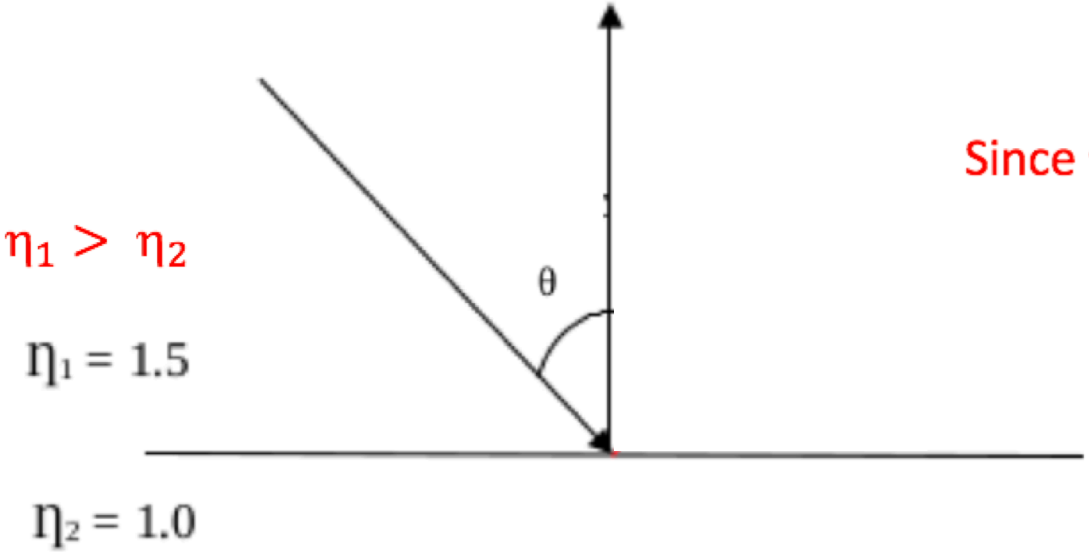

Since $\eta_1 > \eta_2$ and $\theta = 45° > \theta_c = 42°$

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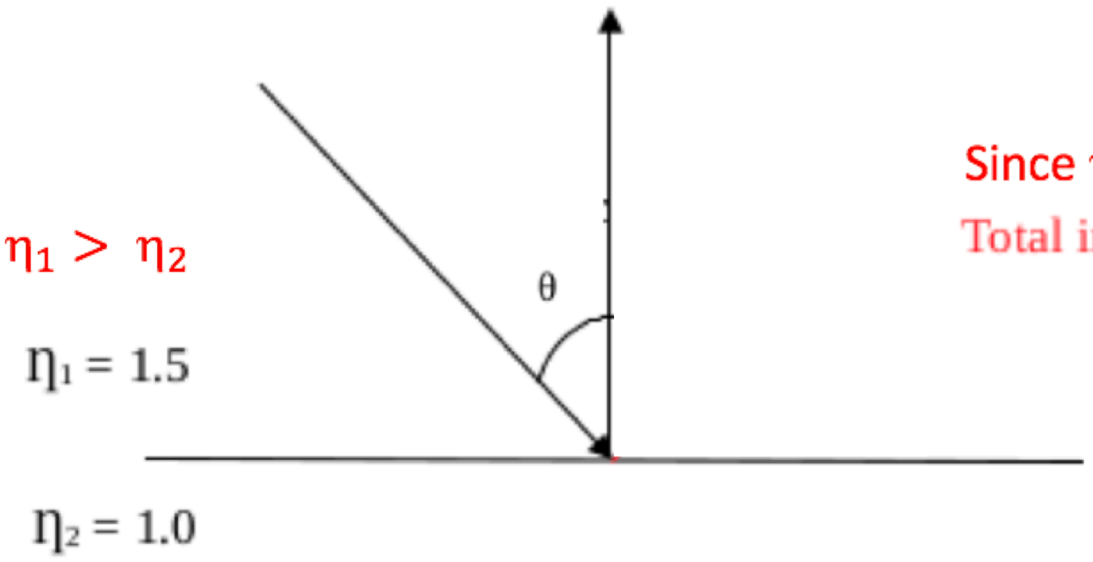

Since $\eta_1 > \eta_2$ and $\theta = 45° > \theta_c = 42°$

Total internal reflection

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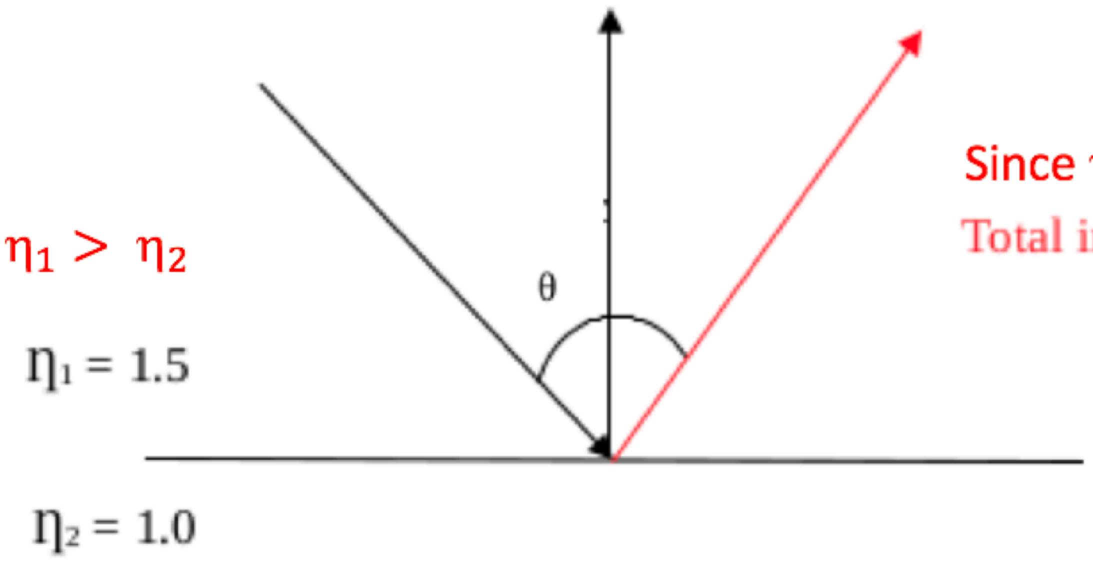

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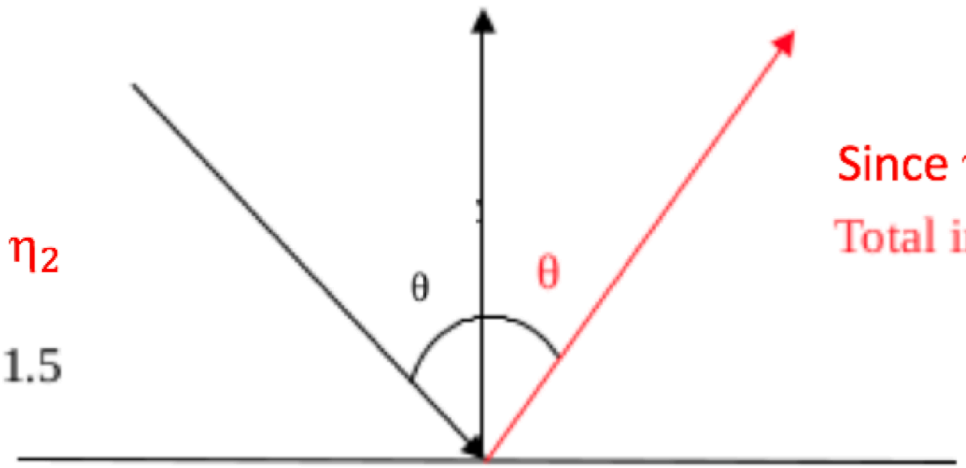

$\eta_1 > \eta_2$

$\eta_1 = 1.5$

$\eta_2 = 1.0$

Since $\eta_1 > \eta_2$ and $\theta = 45° > \theta_c = 42°$

Total internal reflection

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Given the following environment map L in latlong format with MxN pixels:

Assume every pixel has unit radiance. Compute the following integral of the environment map: $\mathbf{I} = \int_{\Omega} \boldsymbol{L_i(\omega_i) d\omega_i}$.

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&= 4\pi
\end{aligned}
$$

Assuming a diffuse surface with albedo $\boldsymbol{\rho_d} = \mathbf{1.0}$, compute the irradiance $\mathbf{E}$ on the surface due to illumination from the given environment map $\mathbf{L}$.

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&= 2 \int_{\theta_i=0}^{\frac{\pi}{2}} \frac{\sin(2\theta_i)}{2} d\theta_i
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&= \frac{1}{2} [-\cos(2\theta_i)]_0^{\frac{\pi}{2}} \\
&= 1
\end{aligned}
$$

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$$\cos(\theta_i) \sin(\theta_i) = \frac{\sin(2\theta_i)}{2}$$

Given a conductor, estimate the index of refraction of the material given measured reflectance at normal incidence Fr = 0.2. Assume the coefficient of absorption k = 0.

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$$
\begin{aligned}
\boldsymbol{\eta} &= \frac{\mathbf{1}+\sqrt{\boldsymbol{F_r}}}{\mathbf{1}-\sqrt{\boldsymbol{F_r}}} \\
&\approx \mathbf{2.62}
\end{aligned}
$$