

Examples

1. Calculate and describe the refraction of a light ray incident at 45° from the normal on a thin layer of water on top of a horizontal sheet of glass.

Solution

We first use the law of refraction at the first interface between air (medium 1) and water (medium 2), to find the angle of the refracted light ray in water:

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

$$\theta_2 = \text{Arcsin}\left(\frac{n_1 \sin \theta_1}{n_2}\right) = \text{Arcsin}\left(\frac{(1) \sin 45^\circ}{(1.329)}\right) = 32.14^\circ.$$

By inspection of the geometry involved, this is also the angle of incidence at the interface between water (medium 2) and glass (medium 3):

$$n_2 \sin \theta_2 = n_3 \sin \theta_3,$$

$$\theta_3 = \text{Arcsin}\left(\frac{n_2 \sin \theta_2}{n_3}\right) = \text{Arcsin}\left(\frac{(1.329) \sin 32.14^\circ}{(1.52)}\right) = 27.72^\circ.$$

Note that the angle in the higher n medium is always smaller.

