Optics HW 15-E

1. Light coming from water

To find the angle of incidence for complete polarization (Brewster's angle), we use Brewster's law:

$$\tan \theta_w = \frac{n_{\text{flint}}}{n_{\text{water}}}$$

Given:

$$n_{\text{water}} = \frac{4}{3}, \quad n_{\text{flint}} = 1.72$$

We need to solve for θ_w:

$$\theta_w = \arctan\left(\frac{n_{\text{flint}}}{n_{\text{water}}}\right)$$

Substituting the values:

$$\theta_w = \arctan\left(\frac{1.72}{\frac{4}{3}}\right) = \arctan\left(\frac{1.72 \times 3}{4}\right) = \arctan\left(\frac{5.16}{4}\right) = \arctan(1.29)$$

Calculating the angle in degrees:

$$\theta_w \approx 73.91°$$

2. Light coming from flint glass

For light coming from the flint glass side:

$$\tan \theta_f = \frac{n_{\text{water}}}{n_{\text{flint}}}$$

We need to solve for θ_f:

$$\theta_f = \arctan\left(\frac{n_{\text{water}}}{n_{\text{flint}}}\right)$$

Substituting the values:

$$\theta_f = \arctan\left(\frac{\frac{4}{3}}{1.72}\right) = \arctan\left(\frac{4}{3 \times 1.72}\right) = \arctan\left(\frac{4}{5.16}\right) = \arctan(0.775)$$

Calculating the angle in degrees:

$$\theta_f \approx 44.42°$$

Therefore.

1. The angle of incidence for complete polarization when light comes from the water side is approximately $73.91°$.

2. The angle of incidence for complete polarization when light comes from the flint glass side is approximately $44.42°$.