42. ***REASONING*** Malus' law, $\bar{S} = \bar{S}_0 \cos^2 \theta$ (Equation 24.7), relates the average intensity $\bar{S}_0$ of polarized light incident on the polarizing sheet to the average intensity $\bar{S}$ of light transmitted by the sheet, where θ is the angle between the polarization axis of the incident light and the transmission axis of the polarizing sheet. The incident light is horizontally polarized, so the angle θ is measured from the horizontal, and is, therefore, the angle we seek.

SOLUTION Solving $\bar{S} = \bar{S}_0 \cos^2 \theta$ (Equation 24.7) for θ, we obtain

$$\cos^2 \theta = \frac{\bar{S}}{\bar{S}_0} \qquad \text{or} \qquad \cos\theta = \sqrt{\frac{\bar{S}}{\bar{S}_0}} \qquad \text{or} \qquad \theta = \cos^{-1}\left(\sqrt{\frac{\bar{S}}{\bar{S}_0}}\right) \tag{2}$$

Substituting the given values of the average incident and transmitted intensities yields

$$\theta = \cos^{-1}\left(\sqrt{\frac{0.764 \text{ W/m}^2}{0.883 \text{ W/m}^2}}\right) = \boxed{21.5^\circ}$$