694.

Problem 48.11 (RHK)

At a particular beach on a particular day near sundown the horizontal component of the electric field vector is 2.3 *times the vertical component. A standing sunbather puts on Polaroid sunglasses; the glasses suppress the horizontal field component.* (a) *We have to find the fraction of the light energy received before the glasses were put on that reaches the eyes.* (b) *The sunbather, still wearing the glasses, lies on his side. We have to find the fraction of the light energy received before the glasses were put on that reaches the eyes now.*

Solution:

Let the vertical component of the electric field vector of the incident beam be E. As the horizontal component of the electric field vector is 2.3 times the vertical component, it will be $2.3E$. Therefore, the intensity of the incident light will be

$$I_0 = \frac{1}{2\mu_0 c}\left(1^2 + 2.3^2\right)E^2 = \frac{6.29}{2\mu_0 c}E^2.$$

(a)

It is given that the Polaroid glasses suppress the horizontal component of the electric field. Therefore, the intensity of light that will be received by the eyes after the sunbather puts on the glasses and is standing vertically will be given by

$$I_{\text{standing}} = \frac{1}{2\mu_0 c} E^2,$$

and

$$\frac{I_{\text{standing}}}{I_0} = \frac{1}{6.29} = 0.159.$$

(b)

When the sunbather is lying down sideways wearing the Polaroid glasses, the horizontal component of the electric field will pass through the glasses and reach the eyes. Therefore, in this position the fraction of the incident light intensity that is received by the eyes will be

$$\frac{I_{\text{sideways}}}{I_0} = \frac{2.3^2}{6.9} = 0.84.$$