# Chapter 2: DIFFRACTION PATTERNS AND POLARIZATION

## Polarization

P 12: Plane-polarized light is incident on a single polarizing disk with the direction of **E** parallel to the direction of the transmission axis. Through what angle should the disk be rotated so that the intensity in the transmitted beam is reduced by a factor of (a) 3.00, (b) 5.0, and (c) 10.0 ?

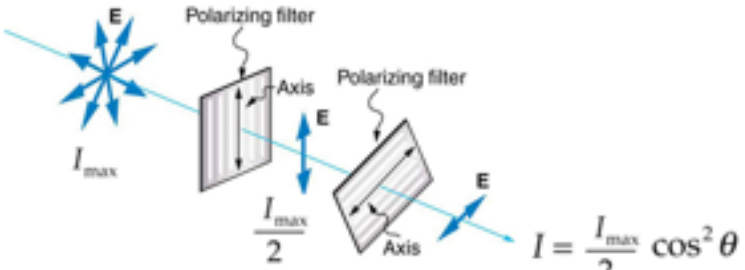
$$I = I_{max}\cos^2\theta \qquad \text{OR} \qquad \theta = \cos^{-1}\sqrt{\frac{I}{I_{max}}}$$

(a) For $I = I_{max}/3.0$, $\theta = \cos^{-1}\left(\frac{I}{I_{max}}\right)^{1/2} = \cos^{-1}\frac{1}{\sqrt{3.00}} = \cos^{-1}0.577 =$ 54.7$^0$

(b) For $I = I_{max}/5.0$, $\theta = \cos^{-1}\left(\frac{I}{I_{max}}\right)^{1/2} = \cos^{-1}\frac{1}{\sqrt{5.00}} = \cos^{-1}0.447 =$ 63.4$^0$

(c) For $I = I_{max}/10.0$, $\theta = \cos^{-1}\left(\frac{I}{I_{max}}\right)^{1/2} = \cos^{-1}\frac{1}{\sqrt{10.0}} = \cos^{-1}0.316 =$ 71.6$^0$

P 13 : Unpolarized light passes through two ideal Polaroid sheets. The axis of the first is vertical, and the axis of the second is at 30° to the vertical. What fraction of the incident light is transmitted?




Let $I_{max}$ be the intensity of incident unpolarised light.

The intensity of light passing through the first polarizing filter is reduced by ½. (Transmitted light is polarized, with E parallel to transmission axis)

Hence the intensity of light falling on the second polarizer is $I_{max}/2$

The second transmits $I = (I_{max}/2)\cos^2 30° = (I_{max}/2)\,¾$

$$\frac{I}{I_{max}} = \frac{1}{2} \times \frac{3}{4} = \frac{3}{8} = 0.375$$