

41. (a) The rotation cannot be done with a single sheet. If a sheet is placed with its polarizing direction at an angle of 90° to the direction of polarization of the incident radiation, no radiation is transmitted. It can be done with two sheets. We place the first sheet with its polarizing direction at some angle θ , between 0 and 90° , to the direction of polarization of the incident radiation. Place the second sheet with its polarizing direction at 90° to the polarization direction of the incident radiation. The transmitted radiation is then polarized at 90° to the incident polarization direction. The intensity is $I_0 \cos^2 \theta \cos^2(90^\circ - \theta) = I_0 \cos^2 \theta \sin^2 \theta$, where I_0 is the incident radiation. If θ is not 0 or 90° , the transmitted intensity is not zero.
- (b) Consider n sheets, with the polarizing direction of the first sheet making an angle of $\theta = 90^\circ/n$ relative to the direction of polarization of the incident radiation. The polarizing direction of each successive sheet is rotated $90^\circ/n$ in the same sense from the polarizing direction of the previous sheet. The transmitted radiation is polarized, with its direction of polarization making an angle of 90° with the direction of polarization of the incident radiation. The intensity is $I = I_0 \cos^{2n}(90^\circ/n)$. We want the smallest integer value of n for which this is greater than $0.60I_0$. We start with $n = 2$ and calculate $\cos^{2n}(90^\circ/n)$. If the result is greater than 0.60 , we have obtained the solution. If it is less, increase n by 1 and try again. We repeat this process, increasing n by 1 each time, until we have a value for which $\cos^{2n}(90^\circ/n)$ is greater than 0.60 . The first one will be $n = 5$.