

# ELECTROMAGNETIC WAVES PROBLEMS

More difficult problems are indicated with an asterisk.

1. The apparent intensity of a source seen through two polarizers with their axes aligned is 23 candelas. What is its apparent intensity when the polarizer axes are separated by  $71^\circ$ ?
2. What is the polarization angle for light going from a medium of index 1.34 to a medium of index 1.05?
3. What percentage of normally incident light is reflected at the interface between media of index 1.81 and 1.66?
4. The apparent intensity of a source seen through two polarizers with their axes aligned is 73 candelas. What is its apparent intensity when the polarizer axes are separated by  $51^\circ$ ?
5. What is the polarization angle for light going from a medium of index 1.53 to a medium of index 1.6?
6. What percentage of normally incident light is reflected at the interface between media of index 1.48 and 1.02?
- 7.\* If the magnitude of the electric vector of an electromagnetic wave doubles, by what factor does the magnitude of the Poynting vector change? By what factor does the energy carried by the wave change?
8. Polaroid sunglasses are especially beloved by truckers and anglers. Why?

## ANSWERS to SELECTED PROBLEMS

1. From Malus' law, 2.4 candelas.
2. The Brewster angle is  $38^\circ$ .
3. From Fresnel's law, the answer is 0.19%.
4. From Malus' law, 28.9 candelas.
5. The Brewster angle is  $46^\circ$ .
6. From Fresnel's law, the answer is 3.39%
7. It increases by a factor of  $2^2=4$ . Since the Poynting vector magnitude is proportional to the energy carried by the wave, the energy also increases by a factor of four.