Problem-set 10: Polarization

1. Unpolarized light with an intensity of $I_0 = 16$ W/m^2 is incident on a pair of polarizers. The first polarizer has its transmission axis aligned at 50° from the vertical. The second polarizer has its transmission axis aligned at 20° from the vertical. What is the intensity of the light when it emerges from the second polarizer?

2. What kind of polarization has an electromagnetic wave if the projections of the vector E on the x and y axes perpendicular to the direction of propagation are:

   (a) $E_x = E \cos(\omega t - kz)$, $E_y = E \sin(\omega t - kz)$

   (b) $E_x = E \cos(\omega t - kz)$, $E_y = E \cos(\omega t - kz + \pi/4)$

   (c) $E_x = E \cos(\omega t - kz)$, $E_y = E \cos(\omega t - kz + \pi)$

3. Unpolarized light of intensity I_0 is incident normally on thre polarizers P1, P2 and P3 all arranged in series. The pass axis of each polarizer makes an angle of 45° with the earlier sheet (in the same diection). (i) What is the intensity of the transmitted beam (ii) What is the intensity of the transmitted beam if the polarizer P2 is replaced with a quarter wave plate Q2 with its optic axis along the pass axis of P2?

4. Carvone molecule is a chiral molecule, which has two enantiomers, *S* and *R*. The specific rotation of (*S*)-Carvone is (+)61° (measured "neat", i.e. without any solvent). The optical rotation of a "neat" sample of a mixture of (*S*)- and (*R*)-Carvone is measured as (-)23°. What are the percentages of (*S*)- and (*R*)-Carvone in the sample?