

**Phys 375 – Monday/Wednesday sections – Prof. Fuhrer
Homework #4, due in class week of October 15-17, 2007**

1) An electromagnetic wave traveling in the z-direction is initially polarized at 45° toward the y-direction from the x-direction, with a magnitude of the electric field E_0 . It passes through a “phase retarder” with its slow axis oriented along the y-direction: this plate is designed such that it produces a $\pi/10$ phase lag of the y-component of the electric field relative to the x-component of the electric field.

A) Write an expression for the electric field **vector** as a function of \vec{r} , \vec{k} , ω , and t of the outgoing wave.

B) Draw a picture of what the electric field vector of the outgoing wave looks like in the x-y plane, i.e. trace the tip of the electric field vector in time as it completes one period. Include enough information that the magnitude of the vector at various times could be determined.

2) Unpolarized light is incident upon two crossed polarizers, so that no light is transmitted through the pair. A sample of corn syrup is inserted between the two polarizers, and then 50% of the unpolarized light incident upon the first polarizer is now transmitted through the second polarizer. By what possible angle or angles did the corn syrup rotate the direction of polarization of the light incident upon it?

3) An ideal polarizer rotates with an angular frequency of ω between a pair of stationary crossed polarizers. The set of three polarizers is illuminated by unpolarized light. Show that the intensity of the light transmitted by the entire apparatus as a function of time is $I = I_0(1 - \cos(4\omega t))/8$, where I_0 is the intensity of the unpolarized light.

4) Pedrotti, problem 15-2.

5) Pedrotti, problem 15-8.