Physics 114 - Fall 2010 – Module 10

1. The energy flow to the earth associated with sunlight is about 1.4 kW/m^2. a) find the maximum values of E and B for a sinusoidal wave with this intensity. b) The distance from the earth to the sun is about 1.5x10^{11} m. Find the total power radiated by the sun.
2. A beam of light is a mixture of polarized light and unpolarized light. When it is sent through a Polaroid sheet (a linearly polarizing sheet), it is found that the transmitted intensity can be varied by a factor of five depending on the orientation of the Polaroid sheet. Find the relative intensities of the two components of the incident beam.

3. An electromagnetic wave has a frequency of 100 MHz and is traveling in a vacuum. The magnetic field is given by
   $\vec{B}(z,t) = (10^{-8}\,\mathrm{T})\cos(kz - \omega t)\hat{i}$
   (a) find the wavelength and the direction of propagation of this wave
   (b) find the electric field.

4. The radiation pressure from a laser beam supports a particle against the force of gravity. What power 654-nm laser is necessary to support a perfectly reflecting spherical particle having a diameter of 10 μm and a density of 0.2 g/cm^3?

5. Two mirrors face each other across a square room. An infinite series of reflections can be seen. Why do the images that seem further away also seem dimmer?

6. An electromagnetic wave is described by

   $\vec{E} = E_0 \sin(kx - \omega t)\hat{j} + E_0 \cos(kx - \omega t)\hat{k}$

   What direction does this wave propagate? What is the polarization of this wave?

Can you write an equation for a wave that has linear (circular) polarization? (Choose whichever you believe the equation above is *not*.