1. The energy flow to the surface of the earth associated with sunlight is about 1.4 kW/m².
   (a) Find the maximum values of $E$ and $B$ at the surface for the earth for a sinusoidal wave of this intensity.
   (b) Find the total power radiated by the sun knowing that the separation between the sun and earth is about $1.5 \times 10^{11}m$.

2. A plane light wave in vacuum is incident normally upon a plane interface with a dielectric having a dielectric constant $\kappa_E = 4$ and relative permeability $\kappa_M = 1$.
   (a) What will be the velocity of the electromagnetic wave in the dielectric?
   (b) If the incident wave has a wavelength of 500nm in vacuum, what will be its wavelength in the dielectric?
   (c) What will be the ratio of the E vectors for the reflected and incident wave.
   (d) What is the reflectivity of the surface for the normal incident light wave?
   (e) What is the transmission of the light wave through the interface?
   (f) Calculate the ideal dielectric constant and thickness for a thin film antireflection coating on the above plane surface to make the reflectivity zero for an incident wave with $\lambda = 500nm$ in vacuum.

3. Explain why the blue sky looks darkest when looking directly upwards for certain orientations of your polarized glasses.

4. We can hear sounds from around the corner of a building but cannot see around the corner in spite of the fact that both sound and light are waves. Explain the difference.

5. Why doesn’t the light from the two headlights of a distant car produce an interference pattern?

6. Calculate the angular resolution of the Hubble telescope for light at $\lambda = 500nm$ assuming that the primary mirror has a 2.4m diameter. Calculate what is the spatial resolution on the surface of the Earth achieved by the Hubble telescope at this wavelength if the telescope is at an altitude of 500km. Compare this to the diffraction limited resolution of the eye of an astronaut at the same altitude assuming that the eye has an aperture of $5mm$. diameter.

7. A “Peeping Tom” tries to peer through a 0.02mm diameter pin hole at an object 5 meters away. What will be the maximum spatial resolution of the object that Tom can achieve?