

Assignment #6 Physics 346

Due 4:30 pm **Friday** March 9, 2012

Use Phys 346 drop box located at entrance to Physics Dept. off main floor of AQ.

1. This question explores the magnetic field generated by high voltage transmission lines
 - (a) A single transmission line is 40 m above the surface of the earth and carries 2000A of current. What is the peak magnetic field at ground level directly under the wire?
 - (b) Suppose now that we have a two wire system in which the currents are opposite in direction at the same height. Assume that the maximum current from part (a) is flowing in each wire. Suppose the wires are separated horizontally by 4 m. What is the magnetic field at a point on the surface of the earth, directly under the midpoint between the two wires? Note that you will have to use vectors for this part. You only need to focus on the y components (why?).
2. A fluorescent lamp consists of a glass insulating tube with two electrodes 1 m apart. It is mounted vertically below a 250 kV power line with one end embedded in the ground (ground end is at zero volts). It takes ~ 1 kV across the electrodes to start it. If the power line is 50m high, does the lamp light up?
3. A home owner who lives beside a 60 Hz power line decides to "harvest" some energy from the oscillating field. The person constructs a 100 turn coil with area 1m^2 and places it directly under the power line (for simplicity assume a single wire line).
 - (a) How should they orient the coil for maximum output?
 - (b) If the power line has a height of 40m and a current of 2000A, what is the peak induced voltage in the coil?
4. Your laptop WiFi transmits at 900MHz.
 - (a) Calculate the wavelenth of the EM waves
 - (b) Calculate the energy for a single photon for this frequency. Is this significant in terms of biological damage and why?
5. Questions from your text:
Ch 8 Problems # 9, 13, 14, 15