Preparation Assignment - Due Sept. 25, 2000

1. What is the approximate capacitance of the earth?

2. Why do charged bodies attract small uncharged bodies?

Preparation Assignment - Due Sept. 27, 2000

1. We only advocate the use of Fields and Waves I for peace and the good of mankind. (Fields and Waves II is not my problem). However, many people in the military are interested in electromagnetic launchers. These usually have a power supply that is a capacitor bank. Let's say that you wanted to launch a bullet of 10g at a velocity of 800 m/s. Assume 0.3 efficiency (70 % of the energy is lost). If we had a bank of capacitors charged to 10 kV, how much capacitance would we need to fire the bullet?

Homework 3 - Due Sept. 28, 2000

1. A parallel plate capacitor has surface area $S = 100\ cm^2$ and has two layers of dielectric. One layer of thickness $d_1 = 1\ cm.$ has relative permittivity of $\epsilon_r = 3$. The second layer is air and the thickness is $d_2 = 0.5\ cm.$ If the dielectric strength of air is $3 \times 10^6\ V/m$ then what is the voltage on the capacitor which will cause the air to break down?

2. An air filled capacitor is connected to a dc voltage source of voltage V_0 and then disconnected. The capacitor is then filled with oil of relative permittivity ϵ_r.

a)What is the voltage on the oil filled capacitor?

b) Find the energy stored in the capacitor before and after the oil in inserted. Comment on these values.

3. Two parallel plate conductors in air form a capacitor. One is charged with $5\times10^{-6}\ C$ and the other to $-5\times10^{-6}\ C$. The surface area is $S = 0.05\ m^2$ and the separation distance is 1 cm.

a) Find the electric field.

b) An uncharged conductor is now inserted between the two plates. It is 5 mm thick and is placed 2 mm from the positive plate. Find the electric field and compare it to part a)

c) Find the Capacitance with and without the third plate.

4. Use a spread sheet to find the field around an air capacitor. The plates are parallel and 0.001 m apart and are 0.01 m wide and 1 m deep. Model some air around the capacitor so you can see the fringing field. Find the capacitance and compare to the closed form result.