Electric Charges and Electric Fields

Work your choice of one of the following three problems. Hand in your solutions at the end of the hour, or the start of class tomorrow morning.

1. The diameter of a nucleus is roughly $10^{-15}$ meters. Calculate the repulsive force between two protons (charge=$1.6 \times 10^{-19}$ coulombs) this distance apart. Compare this to the gravitational force on a 60 kg human (take a ratio).

2. Imagine that space aliens could deposit extra electrons in equal amounts on both your car and the earth. Assume that the earth’s charge is spread uniformly so that it acts as if all the charge were concentrated at the center of the earth (radius=$6.8 \times 10^6$ meters). Your car’s tires would act as insulators so that electrons could not escape from your car. What charge would have to be placed on your car and the earth to make the car levitate (i.e., just barely overcome gravity)?

3. Identical positive charges $Q$ are placed at three corners of a square of side $L$. The fourth corner is empty. Calculate the electric field at the empty corner of the square.