1^{st} HOMEWORK
Due March 3, 2008

1. Suppose the electric charge of the proton is $1 + \epsilon$ times its present value. What would be the net electric charge of the Earth? of the Sun? Treating the Sun and the Earth as point like particles, what would be the electric repulsion between the Sun and the Earth? Knowing that the net force acting on Earth due to the Sun is towards the sun, what is the maximum possible value of ϵ? (Look up the values for the masses and the distances. Your answer should not be a formula but a numerical value.)

2. Consider one glass of water. What is the total of the positive charges? the negative charges? Assume that two glasses are separated by a distance of 1 m what is the total of the repulsive electric forces between the two glasses?

3. Suppose that under the influence of the electric force of attraction, the electron in a hydrogen atom orbits around the proton on a circle of radius 0.53×10^{-10} m. What is the orbital speed? What is the orbital period?

4. Salt is an ionic crystal, meaning that salt consists of equal amounts of positively charges Na^+ ions and negative charged Cl^- ions. Find the average distance between the ions from some reference. (not from the interned. Give your reference). Treating the ions as point like particles separated by their average separation, what is the force acting on a Na^+ ion due to the adjacent Cl^- ion?

5. The Earth has not only a magnetic field, but also an atmospheric electric field. During days of fair weather (no thunder clouds), this atmospheric electric field has a strength of about 100 N/C and points down. Taking into account this electric field and also gravity, what will be the acceleration (magnitude and direction) of a grain of dust of mass 1.0×10^{-18} kg and carrying a single electron charge? (H. C. Ohanian, "Physics," pg 603, Ch 23, Q2)

6. A semi infinite line carrying a uniform charge distribution of λ coulombs per meter lies along the positive x axis from $x = 0$ to $x = \infty$. Find the components of the electric field at the point with coordinates x, y, with

$z = 0$; assume $x > 0$ and $y > 0$. (H. C. Ohanian, "Physics," pg605, Ch23, Q22)

7. A very large flat sheet of paper carries charge uniformly distributed over its surface; the amount of charge per unit area is σ. A hole of radius R has been cut out of this paper. Find the electric field on the axis of the hole. (H. C. Ohanian, "Physics," pg606, Ch23, Q28)