3rd Homework

Due October 23, 2009

1. Consider an initially charged conducting sphere of radius R that has a total charge Q on it. Suppose that another test charge of q is put at a distance $d > R$.

   (a) What will be the new eloctrostatic potential at an arbitrary point?

   (b) What will be the new electric field at an arbitrary point?

   (c) What will be the surface charge density?

   (d) What is the force acting on q?

   (e) What is the electrostatis energy stored in the system?

   (*Hint:* You can use the superposition principle. The surface charge will be a superposition of the previous (uniform) charge distribution, plus the induced charge distribution)

2. Consider two intersecting non-conducting spheres. Assume that the intersection volume is carved out, so it is empty. If the two sphere have a uniform charge density σ distributed over their volume, what will be the electric field inside the cavity at their intersection?

3. Consider a unit point charge placed inside a cube of side length L with conducting walls. Choose a coordinate axis such that one corner of the cube is at the origin and three sides are on the positive x, y and z axis. Assume that the charge is located at the point with coordinate (x_0, y_0, z_0). Calculate the electric field inside the cube. (*Hint:* The Dirac delta function in the cube can be expanded (anti)periodically in the cube in terms of sines/cosines)