Practical Problem Set 4

February 6, 2017

1. Two infinite slabs have thickness a and both are uniformly charged as shown in Fig. 1. The charge densities are ρ and $-\rho$ respectively. They have a distance between them of d. Calculate the electric field inside and outside the slabs.

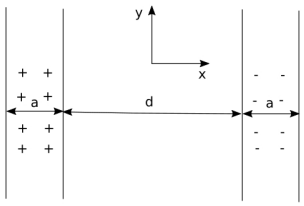

Figure 1: Two infinite charged slabs.

2. An infinitely long cylinder has charge uniformly distributed inside it with a positive volume charge density of ρ. Part of this cylinder has been removed to form another cylindrical shape. The vertical axis of this hollow shape is parallel to that of the original cylinder and these axes have a distance of a as shown in Fig. 2. Calculate the electric field in the hollow part.

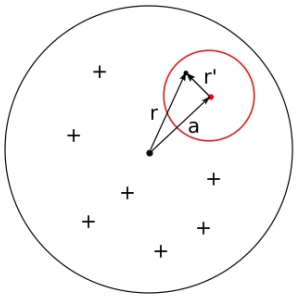

Figure 2: A infinitely long cylinder with a hollow cylindrically shaped part.

3. Imagine a point charge q located in the centre of a spherical conducting shell (which can be considered very thin, radius of R). The net charge on the shell could be zero or not.
(1)Fig. 3 shows the diagram of electric field distribution inside and outside the shell. Determine the net charge on this conducting shell, and describe the charge distribution on the inner surface and outer surface;
(2)If the net charge on the whole spherical conducting shell is zero,

a. Draw a diagram to indicate the electric field inside and outside the shell;

b. What if the point charge is shifted from the centre of the shell? Is the induced charge on the inner surface uniformly distributed? Is the induced charge on the outer surface uniformly distributed?

c. In Fig. 4, when the point charge is shifted d from the centre, calculate the electric field in the space.

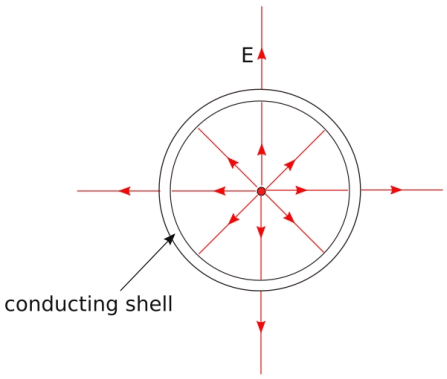

Figure 3: A point charge q located in the centre of a spherical conducting shell. The red lines with arrows indicate the electric field.

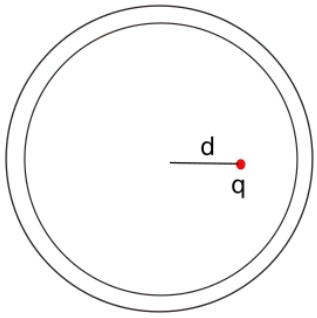

Figure 4: A point charge q is shifted from the centre of a spherical conducting shell by a radial distance d.