

Physics 252 Examination 1 – 50 possible points

Wednesday, September 27, 2006

Problem 1

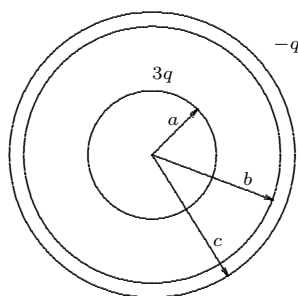


Figure 1: Two concentric charged spheres.

A solid *non-conducting* sphere of radius a carries a net positive charge $3q$, uniformly distributed throughout its volume. Concentric with this sphere is a *conducting* spherical shell with inner radius b and outer radius c , and having a net charge $-q$, as shown in figure 1.

- Construct a spherical Gaussian surface of radius $r > c$ and find the net charge enclosed in the surface.
- What is the direction of the electric field at $r > c$?
- Find the electric field at $r > c$.
- Find the electric field in the region with radius r with $c > r > b$.
- Construct a spherical Gaussian surface of radius r , where $c > r > b$, and find the net charge enclosed by this surface.
- Construct a spherical Gaussian surface of radius r , where $b > r > a$, and find the net charge enclosed by this surface.
- Find the electric field in the region $b > r > a$.
- Construct a spherical Gaussian surface of radius $r < a$ and find an expression for the net charge enclosed in this surface as a function of r . Note that the charge inside this surface is less than $3q$.
- Find the electric field in the region $r < a$.
- Determine the charge on the inner surface of the conducting shell.
- Determine the charge on the outer surface of the conducting shell.
- Draw a rough plot of the magnitude of the electric field versus r .