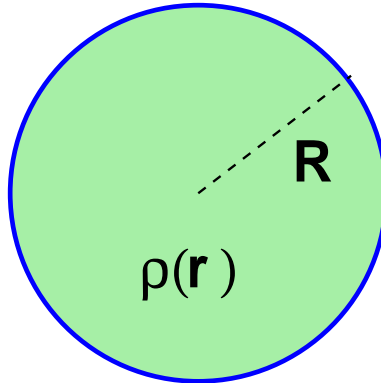


**Physics 122: Practice Problem of the Day****Problem #14: Gauss' Law for a Non-uniform Charged Sphere**

Thursday February 12, 2009



You are given a solid sphere of insulating material of a given radius  $R$ . Inside the sphere, a continuous spherically-symmetric but non-uniform charge density is given as follows:

$$\rho(r) = \rho_0 \left( \frac{r}{R} \right)$$

where  $\rho_0$  is a given fixed positive constant of the appropriate units.

**Part a)** What is the *total charge* associated with the field in terms of given parameters?

**Part b)** Calculate the charged *enclosed* by an imaginary surface of radius  $r$  centered on the sphere. Give you answers in terms of the given parameters.

**Part c)** Calculate the magnitude and direction of the electric field *everywhere*.

**Part d)** What is the voltage  $V(r)$  as a function of radial distance in terms of the given parameters? Here we define the zero-point reference for the voltage as the point corresponding to  $r$  at infinity.