Worksheet: Unit 1, Gauss' Law

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1 Memory Bank

$\vec{E} \cdot \vec{A} = q_{enc}/\epsilon_0$ ... Gauss' Law

2 Gauss' Law Procedure

1. Observe Fig. 1. The procedure to obtain the electric field of the spherical charge distribution is outlined below. In Fig. 1, show that the volume of the spherical shell inside is $V_{shell} = 4\pi r'^2 dr'$. Think about the volume of any

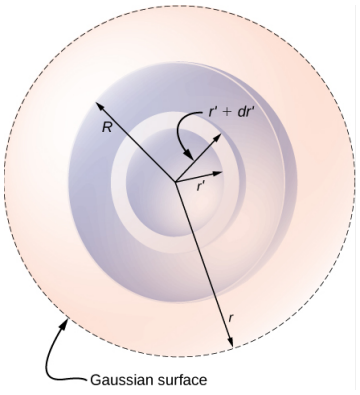

Figure 1: A charge distribution with spherical symmetry.

spherical shell with thickness dr'.

2. Suppose the charge density is given by
$$\rho(r') = \rho_0 r'^n \tag{1}$$
(a) What are the units of ρ_0? (b) What charge dq is contained within V_{shell}, if the charge *density* is given by Eq. 1?

3. Write an integral from 0 to some radius r that sums up all the dq inside of r. Make sure that it has the correct units.

4. Perform the integral in the prior problem, and simplify. What are the units of the answer? (They should be Coulombs).

5. The result of the integral is the total charge contained within our sphere of radius r. Insert this charge as the *enclosed charge* in Gauss' law to obtain the E-field. What do you put for A?