Homework #4

Due at 6pm on Friday, February 20th, 2015

Reading: Chap 24.

1. HRW Chap 23, P3.

2. A particle of charge $+q$ is placed at one corner of a Gaussian cube. What multiple of q/ϵ_0 gives the flux through (a) each cube face forming that corner and (b) each of the other cube faces?

3. HRW Chap 23, P21.
4. HRW Chap 23, P29.

5. A long, nonconducting, solid cylinder of radius 4 cm has a nonuniform volume charge density ρ that is a function of radial distance r from the cylinder axis: $\rho = Ar^2$. For $A = 2.5\mu C/m^5$, what is the magnitude of the electric field at (a) $r = 3$cm and (b) $r = 5$cm?

6. HRW Chap 23, P34.
7. HRW Chap 23, P39.
8. HRW Chap 23, P52.

9. A nonconducting solid sphere has a uniform volume charge density ρ. Let $\vec{r}$ be the vector from the center of the sphere to a general point P within the sphere. (a) Show that the electric field at P is given by $\vec{E} = \rho\vec{r}/3\epsilon_0$. (Note that the result is independent of the radius of the sphere.) (b) A spherical cavity is hollowed out of the sphere, as shown in the Figure at right. Using superposition concepts, show that the electric field at all points within the cavity is uniform and equal to $\vec{E} = \rho\vec{a}/3\epsilon_0$, where $\vec{a}$ is the position vector from the center of the sphere to the center of the cavity.