

PH4210 HW6**DUE: Friday Dec. 14, 2007**

J1. Pollack & Stump 6.2

J2. A sphere of radius R carries a polarization $\vec{P}(\vec{r}) = k\vec{r}$, where k , is a constant and \vec{r} is the vector from the center.

- (a) Calculate the bound charge densities ρ_b , σ_b .
- (b) Find the electric field inside and outside of the sphere.

J3. When a neutral dielectric material is polarized, charge moves a little bit, but the total charge remains zero. Prove that the total bound charge in a polarized neutral dielectric is zero, using the definitions of bound charge $\rho_b = -\vec{\nabla} \cdot \vec{P}$, and $\sigma_b = \vec{P} \cdot \hat{n}$.

J4. A thick spherical shell of inner radius a and outer radius b is made of dielectric material with a "frozen-in" polarization $\vec{P}(\vec{r}) = kr^{-1}\hat{r}$. There is no free charge in the problem.

- (a) Find all bound charges and use Gauss's law to find the electric field everywhere.
- (b) Argue that the displacement $\vec{D} = 0$ everywhere. Now find the electric field using $\vec{D} \equiv \epsilon_0 \vec{E} + \vec{P}$.

J5. Pollack & Stump 6.7

J6. Pollack & Stump 6.10

J7. Pollack & Stump 6.27