Problems for HW 6

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Due **Wednesday**, 17 Feb 2010, 5 pm

1 HW6 Problem 1

Recall the problem of the polarized sphere from class, and the argument that the field outside is a pure dipole with dipole moment $\vec{p} = \vec{P}V$, where V is the volume of the sphere. The resulting electric field inside, $\vec{E}_{ind}$, is uniform, and given by continuity of the potential at the poles (or by boundary conditions on tangential and normal components of $\vec{E}$ or $\vec{D}$).

Suppose that a sphere of electric susceptibility χ_e and radius a is placed in a external electric field; far from the sphere the field is uniform: $\vec{E}_{ext} = E_0\hat{z}$. Inside the sphere, the electric field is $\vec{E}_{tot} = (\vec{E}_{ext} + \vec{E}_{ind})$. Find the polarization of the sphere, and the resulting dipole field.

What is the electric susceptibility of a dilute gas of such spheres, if the gas contains N spheres per unit volume, separated by $1/\sqrt[3]{N} >> a$?

2 HW Problems from Jackson

4.10, 4.12