Homework 6

Due Monday 3/17/2014 - at beginning of class

Griffiths' 4 Problems (3rd Edition numbers are the same)

4.5

4.15

4.20

4.21

Additional Problems

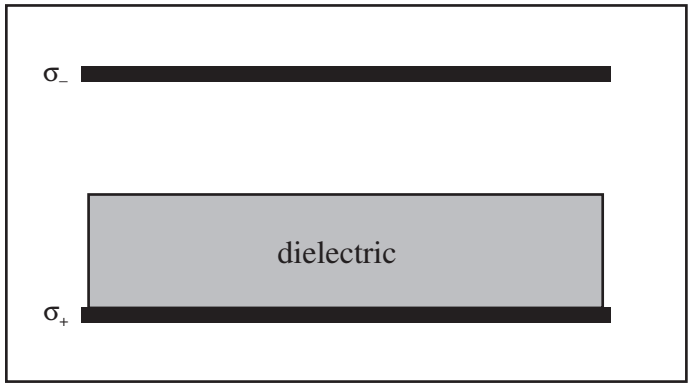
E.6.1 A dipole formed of a $+Q$ and $-Q$ charge spaced a distance a apart has dipole moment pointing in the $+\hat{z}$ direction. The center of the dipole is located at $+R\hat{z}$ a distance R above a neutral dielectric slab occupying the volume $z < 0$ with dielectric constant κ. Compute the force the dielectric plane exerts on the dipole.

E.6.2 A point charge $+Q$ is a distance R above a neutral dielectric slab with dielectric constant κ occupying the volume $z < 0$. Compute the electric field immediately above and below the dielectric surface. From the field, calculate the bound charge density at the surface.

E.6.3 A linear dielectric with dielectric constant κ occupies the volume $-a < z < a$. A uniform volume charge density ρ is fixed within the dielectric. Compute the electric field everywhere. Compute the polarization everywhere.

E.6.4 A spherical system has polarization $\vec{P} = \gamma r^2 \hat{r}$ for radius $r < a$ and $\vec{P} = 0$ for $r > a$. Find the electric field everywhere.

E.6.5 A linear dielectric slab with dielectric constant ϵ_r is placed between two infinite parallel planes of charge with charge density $\pm\sigma$. Find $\vec{D}$, $\vec{E}$, $\vec{P}$, and ρ_b in the dielectric, and the bound charge density on the top and bottom surface of the dielectric.



E.6.6 A potential of $V_0 \cos(\theta)$ is established on the inner surface of a spherical dielectric with inner radius a and outer radius b. The dielectric constant of the material is ϵ_r. Find the potential for $r > a$. You may report a system of equations that needs to be solved to find the coefficients of the potential functions. Actually solving these equations turns out to be quite messy. These equations should be a set of simple linear, non-differential equations.