Physics 321, Autumn Quarter 2015
Electrodynamics: Homework Assignment 8

(a) Turn in all problems and clearly note all constants and assumptions you use. (1-point penalty each otherwise)

(b) Use 8½ x 11 paper & staple (1-point penalty each otherwise)

Due 9:30 am Tuesday November 24
(Short problem set due to Holiday week)

1. An electret is the electrical equivalent of the permanent magnet. In most dielectrics, the polarization vanishes quickly upon removal of the external field. Some dielectrics retain their polarization for a long time. The longest time I know of are in some polymers that have extrapolated lifetimes of thousands of years. Anyway, consider a flat sheet of thickness *d* of such a material with uniform polarization **P** in the direction normal to the surface. (a) Find the charges; (b) find the electric field everywhere.

2. Consider two dipoles $\mathbf{p}_1$ and $\mathbf{p}_2$ oriented at right angles relative to each other and separated by a large distance *d*. Find the torques on the two dipoles. Hint: the two torques are not equal and opposite.

3. Now consider a dipole **p** a large distance *d* from a point charge *Q*. The orientation of the dipole is θ relative to the line joining the dipole and charge. Find the torque on the dipole.

4. Problem 4.7 in the text. I'm surprised this was not discussed in the text. Show that the electrostatic energy *U* of an electric dipole **p** in an electric field is $U = -\mathbf{p} \cdot \mathbf{E}$

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