Physics 321, Autumn Quarter 2015
Electrodynamics: Homework Assignment 10

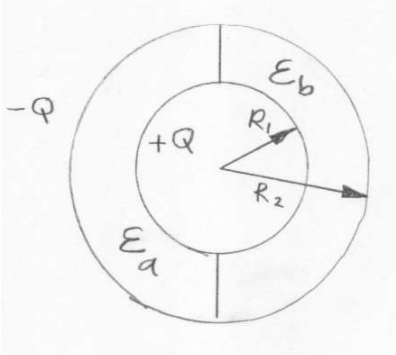
(a) Turn in all problems and clearly note all constants and assumptions you use. (1-point penalty each otherwise)

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

Due 9:30 am Thursday December 10

1. Consider a capacitor consisting of an inner conducting cylinder of radius R_1 and an outer conducting cylinder of radius R_2. The length of the capacitor is L. The region between the conductors consists of a dielectric with permittivity ε. The plates are charged to $\pm Q$. Assuming no fringing fields. (a) Find the **E** and **D** fields everywhere. (b) Find the capacitance. (c) Now connect a constant voltage source V across the terminals of the capacitor. Then you displace the dielectric a very slight distance along the axial direction. Find the magnitude of the force and the direction of the force needed to hold the dielectric in this displaced position.

2. Consider a spherical capacitor of inner radius R_1 and outer radius R_2. The conductors have charge $\pm Q$. The region between R_1 and R_2 is filled with two different dielectrics. Half the region has permittivity ε_a, the other half has permittivity ε_b. (See the figure.) You can assume (incorrectly) that any **E** and **D** fields are purely radial. (a) Find **E** everywhere. (b) Find **D** everywhere. (c) Find the capacitance.



3. Consider a dielectric sphere of radius R and permittivity ε_1 moved into a region of space containing a dielectric of permittivity ε_2 and originally threaded by a constant electric field $\mathbf{E}_0$. Find the new electric field everywhere after the sphere is moved into place.

4. Consider a dielectric sphere of radius R and permittivity ε moved into a region of space originally threaded by a constant electric field $\mathbf{E}_0$. Find the charges everywhere. You may use the result of Griffiths example 4.7.

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