

Assignment #4: PHYS 322: Electromagnetic Theory I
Due: November 9, 2009

All questions are worth 15 points.

1. Griffiths 2.44
2. Griffiths 2.45
3. *This is not meant to be a hard question and you should be able to do this easily! If you can't, learn how.* Consider a spherical capacitor. The “outer radius” of the inner sphere is a and the “inner radius” of the outer sphere is b . Because of symmetry $V(\mathbf{r})$ only depends on r .
 - (a) Write Laplace's equation if you have only r dependence. What is the general solution to the ordinary homogeneous differential equation?
 - (b) If the inner sphere is held at V_0 and the outer sphere is grounded give the specific solution for $V(\mathbf{r})$ in the $a < r < b$ region.
 - (c) Calculate the electric field. Calculate Q and σ on the inner surface. Give the capacitance.
 - (d) Imagine that outer conducting sphere has some thickness to it and you have a spherical Gaussian surface with radius just greater than b . What is the LHS of Gauss' Law? What is the total charge enclosed?
 - (e) Calculate the electrostatic energy and show that $U = \frac{1}{2}CV^2$ is satisfied. ($V = V_0$ in this case.)