

PHY505 - Classical Electrodynamics

Homework No. 6

Due: Monday, October 21, 2002

1. Two spherical conductors of radii R_1 and R_2 are separated by a distance d where $d \gg R_1, R_2$. Show that the capacitance of the system is given approximately by

$$C = 4\pi\epsilon_0\tilde{C}_0 \left(1 + \frac{2\tilde{C}_0}{d}\right)$$

where

$$\tilde{C}_0 = \frac{R_1 R_2}{R_1 + R_2}.$$

2. Consider a system of three concentric conducting spherical shells with radii $R_1 < R_2 < R_3$. Find the coefficients of capacitance of the system. If a charge $2Q$ is placed on the middle shell and charges $-Q$ are placed on both the inner and outer shells, how much energy is stored in the system?
3. At a plane interface between two dielectrics (of constants ϵ_1 and ϵ_2 , respectively), the electric field in the first dielectric has magnitude E_1 and makes an angle θ_1 with the normal to the interface. (Take the direction of the normal to be directed from the first into the second dielectric.) Find expressions for the angle θ_2 that the electric field makes in the second dielectric and for the magnitude of this electric field.