

02ELMA - Homework 5

Assigned for the week of Mar 17, 2025

Questions

1. A metal sphere of radius R carries a total charge Q . What is the force of repulsion between the northern and southern hemispheres?
2. Suppose that the plates of a parallel plate capacitor move closer together by an infinitesimal distance ϵ , as a result of their mutual interaction. What is the amount of work done by electrostatic forces, in terms of the electric field E and the area of the plates A ? (Hint: Use $P = \frac{\epsilon_0}{2} E^2$)
3. Find the capacitance *per unit length* of two cylindrical coaxial metal tubes, of radii a and b .
4. Four particles are placed in the following positions: $-2q \rightarrow (0, -a, 0)$, $-2q \rightarrow (0, a, 0)$, $q \rightarrow (0, 0, -a)$, $3q \rightarrow (0, 0, a)$. Find a simple approximate formula for the potential that is valid at points far from the origin.