Problem Sets: Electromagnetism

I. Static Electricity

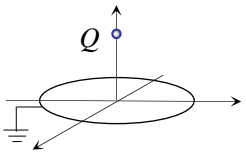
2. Conductors and Dielectrics in Electric Field

2-1. Electric capacitors and their configuration

[1] Isolated two capacitors C_1 and C_2 are charged with voltage V_1 and V_2, respectively. When these two capacitors are connected with a metal wire, find
(a) charge that moved
(b) final voltage

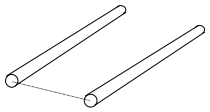
[2] Two capacitors C_1 and C_2 are charged with voltage V_1 and V_2, respectively. When these capacitors are connected in parallel, find the lost electric energy.

[3] Consider a circular metal coil of radius a placed in the x-y plane with the center at O as in Fig. When charge Q is placed at the height of z along the z-axis above the coil, and the coil is grounded, the charge $-Q'$ was induced. Find the capacitance of the coil.

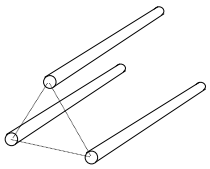


[4] Find the capacitance of a rod, whose radius a, length $2l$.

[5] Consider two long metal wire, radius a, are placed in parallel with the separation distance d between the center of the wire. Find the capacitance of these wires per unit length.



[6] Consider three long metal wire, radius a, are placed in triangular configuration with the side d as in Fig. Find the capacitance of these wires per unit length.



[7] Consider a parallel plate capacitor whose area is S, and separation distance d. Find the attractive force between the plates in each case:
(a) When charge $\pm Q$ are given to the plates.
(b) When the voltage is maintained to be a constant V.

[8] Consider the parallel plate capacitor whose area is S, and separation distance d.
(a) Find the capacitance when a metal plate of thickness t is inserted between the plates.
(b) How much capacitance is changed from the capacitor without the inserted metal plate.

[9] Consider the parallel plate capacitor whose area is S, and separation distance d. Those plates are grounded to the earth. When a metal plate, thickness t, is inserted between the plates at the distance x from one plate, and charge Q is given, find the force exerted on the plate.