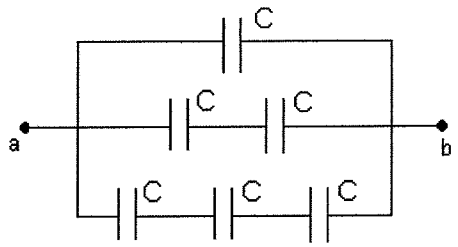
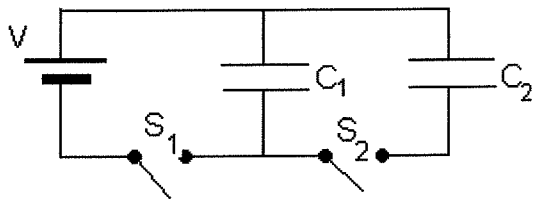
Physics 111 Homework Set #8

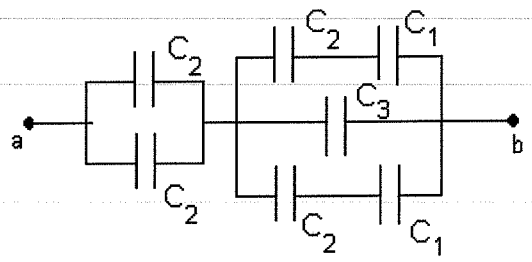
1) Two conductors insulated from each other are charged by transferring electron from one to the other. After 1.6×10^{12} electrons have been transferred the potential difference between the conductors is 14V. What is the capacitance of the system?
2) Two conducting spheres with diameters of 0.4m and 1.0m are separated by a distance that is much greater than one meter. The spheres are connected by a thin wire and charged to 7μC. How is the total charge shared between the spheres? What is the potential relative to V=0 at infinity?
3) An air filled capacitor consists of two parallel plates with area $A=7.6\ cm^2$, separated by a distance d=1.8mm. If a 20V potential difference is applied to these plates calculate (a) the E-field between the plates, (b) the surface charge density, (c) the capacitance, and (d) the charge on each plate.
4) A 1Mbit computer memory chip contains many 60fF capacitors. Each capacitor has a plate area $A=21 \times 10^{-12} m^2$. Determine the plate separation of the capacitors assuming an air gap. The characteristic atomic diameter is 10^{-10} m= 1 angstrom. Express the plate separation in angstroms.
5) What is the equivalent capacitance of the group of capacitors shown? (All capacitors in the group are identical.)



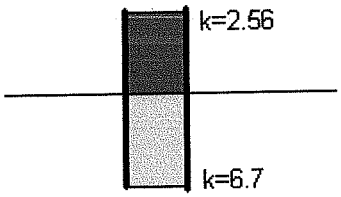
6) Consider the circuit shown with $C_1=6\mu F$, $C_2=3\mu F$ and V=20 V. C_1 is charged by closing S_1. S_1 is then opened and S_2closed. Calculate the initial charge on C_1 and the final charge on each capacitor.



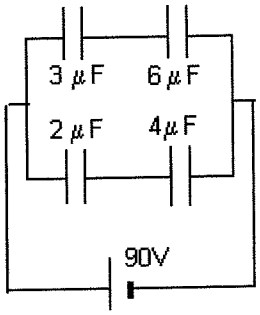
7) Find the equivalent capacitance for the group of capacitors shown. $C_1=5\mu F$, $C_2=10\mu F$, $C_3=2\mu F$



8) A capacitor is constructed from two square metal plates of side L=2cm, separated by d=0.75mm. Half of the space is filled with polystyrene (κ=2.56) and the other half is filled with neoprene rubber (κ=6.7). Calculate the capacitance of this device.



9) For the system of capacitors shown find (a) the equivalent capacitance of the system, (b) the potential difference across each capacitor, (c) the charge on each capacitor and (d) the total energy stored by the group.



10) A 2nF parallel plate capacitor is charged to 100V and isolated. The dielectric between the plates is mica with κ=5.0. (a) How much work is required to withdraw the mica sheet? What is the potential difference across the capacitor with the sheet withdrawn?

11) It is possible to obtain large voltages by first charging a group of capacitors in parallel and then hooking them up in series. What is the maximum potential difference that can be obtained in this manner using 10 500μF capacitors and an 800 V power supply?