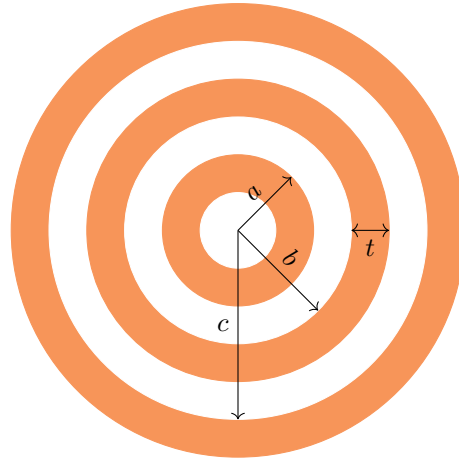# Chapter 24 - Capacitance and Dielectrics

Physics 207

1. Find the capacitance of a system of three concentric spherical conducting shells shown below. The inner shell has an outer radius a. The middle shell has an inner radius b and a thickness t. The outer shell has an inner radius c.


2. A parallel-plate capacitor is made from two plates x on each side and d apart. Half of the space between these plates contains only air, but the other half is filled with Plexiglas of dielectric constant α. A battery with voltage V is connected across the plates.
a) What is the capacitance of this combination?
b) How much energy is stored on the capacitor?
c) If the Plexiglass is removed, how much energy will be stored in the capacitor?
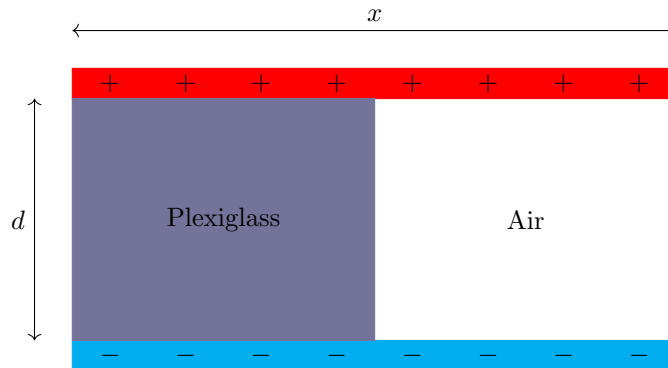

3. A parallel-plate capacitor is made from two plates x on each side and d apart. Some of the space between these plates contains only air, but the other portion with thickness a is filled with a material. A battery with voltage V is connected across the plates.
a) What is the capacitance of this combination if the material is a conductor?
b) What is the capacitance of this combination if the material is a dielectric with constant κ?
c) Do the answers to a and b change if the material is somewhere in the middle and not against one of the plates? If so, how? Assume a is still smaller d.
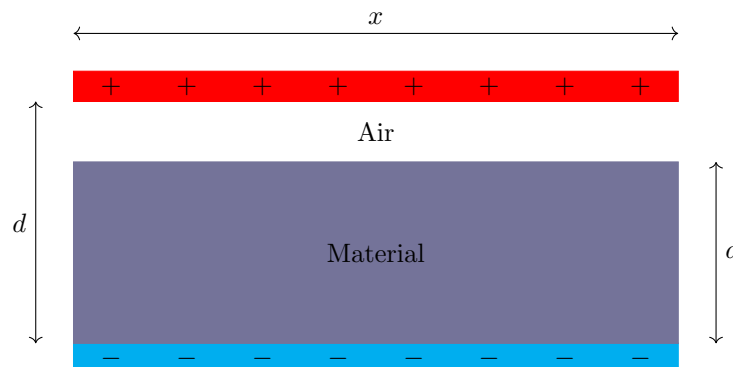
4. Two capacitors, C_1 and C_2, are independently fully charged to the same voltage, V. The two capacitors are then placed in a circuit as shown. Assume that $C_1 > C_2$.

Configuration 1
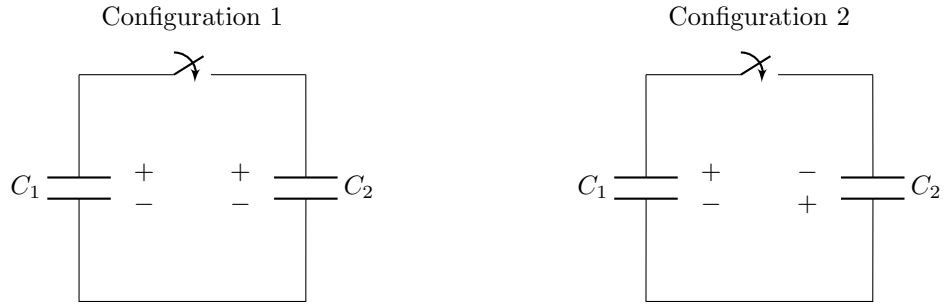
Configuration 2

a) What is the final charge for configuration 1 on each of the capacitors when the system has reached a steady state once the switch is closed?

b) What is the final charge for configuration 2 on each of the capacitors when the system has reached a steady state once the switch is closed?

5. A network of capacitors is seen below.

a) Compute the equivalent capacitance of the network between points a and b.

b) Compute the charge on each of the three capacitors nearest a and b when $V_{ab} = V_0$.

c) Find V_{cd} if $V_{ab} = V_0$.
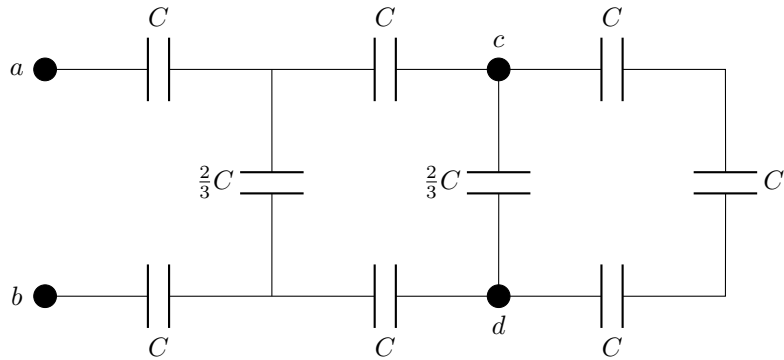
6. What is the effective capacitance of the infinite chain of capacitors as drawn below?
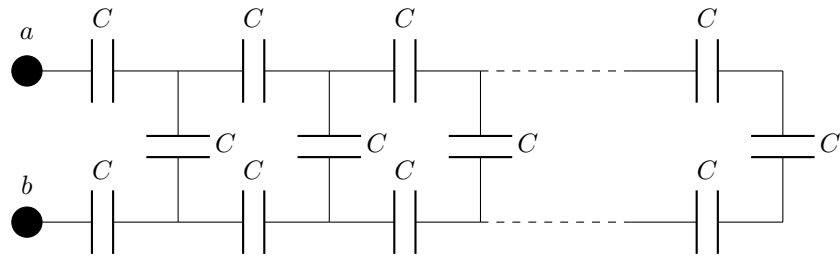
7. What is the equivalent capacitance of the following network?