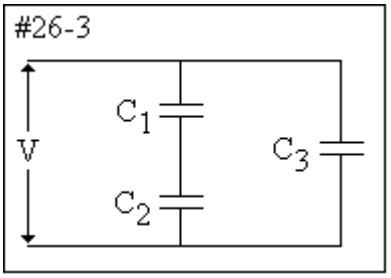
Phsx 2220 - Homework #4

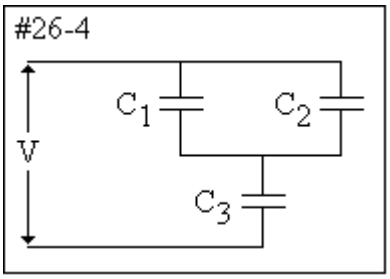
26-1. You have two flat metal plates, each of area 1.00 m^2, with which to construct a parallel-plate capacitor. If the capacitance of the device is to be 1.00 F, what must be the separation between the plates? Could this capacitor actually be constructed?

26-2. The plates of a spherical capacitor have radii 38.0 and 40.0 mm. (a) Calculate the capacitance. (b) What must be the plate area of a parallel-plate capacitor with the same plate separation and capacitance?

26-3. In the figure at right find the equivalent capacitance of the combination. Assume that C_1 = 10.0 μF, C_2 = 5.00 μF, and C_3 = 4.00 μF.



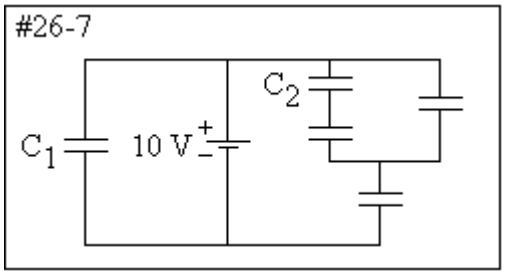
26-4. In the figure at right find the equivalent capacitance of the combination. Assume that C_1 = 10.0 μF, C_2 = 5.00 μF, and C_3 = 4.00 μF.



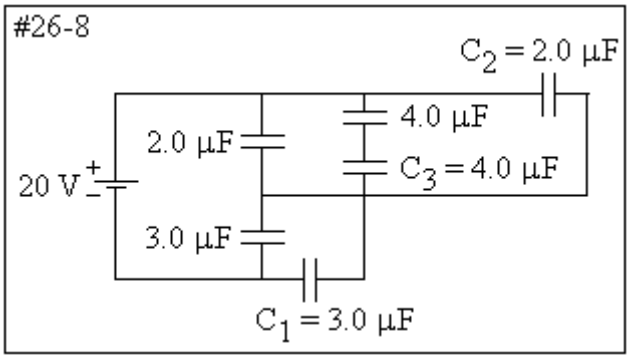
26-5. A capacitance C_1 = 6.00 μF is connected in series with a capacitance C_2 = 4.00 μF, and a potential difference of 200 V is applied across the pair. (a) Calculate the equivalent capacitance. (b) What is the charge on each capacitor? (c) What is the potential difference across each capacitor?

26-6. Repeat Problem 26-5 for the same two capacitors but with them now connected in parallel.

26-7. In the figure at right, the battery has a potential difference of 10 V and the five capacitors each have a capacitance of 10 μF. What is the charge on (a) capacitor C_1 and (b) capacitor C_2?



26-8. In the figure at right, the battery has a potential difference of 20 V. Find (a) the equivalent capacitance of all the capacitors and (b) the charge stored on that equivalent capacitance. Give the potential across and charge on (c) capacitor C_1, (d) capacitor C_2, and (e) capacitor C_3.



26-9. A parallel-plate air-filled capacitor having area 40 cm^2 and plate spacing 1.0 mm is charged to a potential difference of 600 V. Find (a) the capacitance, (b) the magnitude of the charge on each plate, (c) the stored energy, (d) the electric field between the plates, and (e) the energy density between the plates.

26-10. (a) Calculate the energy density of the electric field at distance r from the center of an electron at rest. (b) If the electron is assumed to be an infinitesimal point what does this calculation yield for the energy density in the limit of r -> 0?

26-11. A charged isolated metal sphere of diameter 10 cm has a potential of 8000 V relative to V = 0 at infinity. Calculate the energy density in the electric field near the surface of the sphere.

26-12. A parallel-plate air-filled capacitor has a capacitance of 50 pF. (a) If each of its plates has an area of 0.35 m^2, what is the separation? (b) If the region between the plates is now filled with material having $\kappa = 5.6$, what is the capacitance?