<u>HW-5</u>

Capacitance and Dielectric

1- An air-filled capacitor consists of two parallel plates, each with an area of 7.60 cm², separated by a distance of 1.80 mm. A 20.0 V potential difference is applied to these plates. Calculate (a) the electric field between the plates, (b) the surface charge density, (c) the capacitance, and (d) the charge on each plate?

2- When a potential difference of 150 V is applied to the plates of a parallelplate capacitor, the plates carry a surface charge density of 30.0 nC/cm^2 . What is the spacing between the plates?

3- Four capacitors are connected as shown in the figure. (a) Find the equivalent capacitance between points *a* and *b*. (b) Calculate the charge on each capacitor if $\Delta Vab = 15.0$ V.



4- Consider the circuit shown in the figure where $C_1 = 6.00 \ \mu\text{F}$, $C_2 = 3.00 \ \mu\text{F}$, and $\Delta V = 20.0 \ \text{V}$. Capacitor C1 is first charged by the closing of switch S₁. Switch S₁ is then opened, and the charged capacitor is connected to the uncharged capacitor by the closing of S₂. Calculate the initial charge acquired by C_1 and the final charge on each capacitor.



5- Find the equivalent capacitance between points *a* and *b* for the group of capacitors connected as shown in the figure. Take $C_1 = 5.00 \ \mu\text{F}$, $C_2 = 10.0 \ \mu\text{F}$, and $C_3 = 2.00 \ \mu\text{F}$.



6- Two capacitors, $C_1 = 25.0 \ \mu\text{F}$ and $C_2 = 5.00 \ \mu\text{F}$, are connected in parallel and charged with a 100 V power supply. (a) Draw a circuit diagram and calculate the total energy stored in the two capacitors. (b) **What If?** What potential difference would be required across the same two capacitors connected in series in order that the combination stores the same amount of energy as in (a)? Draw a circuit diagram of this circuit.

7- A parallel-plate capacitor in air has a plate separation of 1.50 cm and a plate area of 25.0 cm^2 . The plates are charged to a potential difference of 250 V and disconnected from the source. The capacitor is then immersed in distilled water. Determine (a) the charge on the plates before and after immersion, (b) the capacitance and potential difference after immersion, and (c) the change in energy of the capacitor. Assume the liquid is an insulator.