PHYS 1220-02 Group Work Sheet
Capacitors

Key Formulas

Capacitor rule (C, Q, V)

Energy stored (C, Q, V)

Electric field (A, d, κ, Q)

Voltage (E, d; A, d, κ, Q)

Parallel plate capacitance (A, d, κ)

Problems

1. What are the SI units for dielectric constant κ?

2. Two different capacitors, one with capacitance C_1 and the other with capacitance C_2, are charged to the same voltage V.
   A. What is the charge on each individual capacitor?

   B. What is the total charge on the two capacitors?

   C. What is the energy stored on each individual capacitor?

   D. What is the total energy stored on the two capacitors?

   E. What are the answers to all these questions if C_1 = 3.0 nF, C_2 = 5.00 nF, and V = 150 V?

3. Two different capacitors, one with capacitance C_1 and the other with capacitance C_2, are given the same charge Q.
   A. What is the voltage of each individual capacitor?

   B. What is the total voltage of the two capacitors?

   C. What is the energy stored on each individual capacitor?

   D. What is the total energy stored on the two capacitors?

   E. What are the answers to all these questions if C_1 = 3.0 nF, C_2 = 5.00 nF, and Q = 30.0 nC?

4. A 600 nF capacitor is charged to a voltage of 50 V.
   A. What is the charge on the plates?

   B. How much energy is stored in the capacitor?

5. A capacitor is constructed of two parallel plates of area A with a dielectric layer of thickness d between them. The dielectric constant of the dielectric is κ, and its dielectric strength is E.
   A. What is the maximum voltage the capacitor can bear before breaking down?

   B. What is the maximum charge the capacitor can bear before breaking down?

   C. What are the answers to these questions for a paper dielectric, $\kappa = 3.8$ and $E = 16$?

6. I want to make a 5.00-μF parallel-plate capacitor with a mica dielectric ($\kappa = 5$, $E =$ 118 kV/mm) that can bear a voltage of 9.0 V.
   A. What should the separation between the plates be?

   B. What must the area of the plates be?