Physics II

Capacitor Circuits

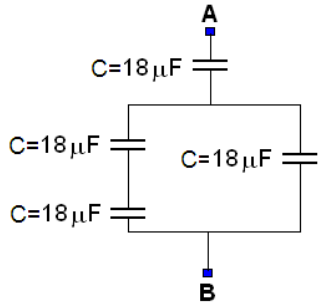
$C = \frac{Q}{V}$ Definition of capacitance

$C = K\varepsilon_0 \frac{A}{d}$ Capacitance for parallel plates

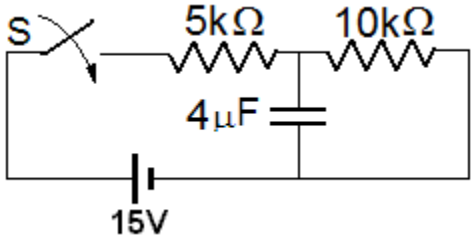
$E = \frac{1}{2}CV^2$ Energy stored in a capacitor

Problem 1.- A 6μF capacitor is connected in series with a 12μF one. What will be the energy stored if we apply 5V to the circuit?

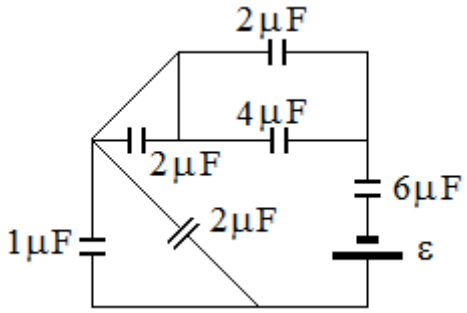
Problem 2.- Determine the capacitance of the following arrangement of capacitors and find how much energy is stored when you apply 10V between terminals A and B.



Problem 3.- Find the energy stored in the 4μF a long time after closing the switch S.



Problem 4.- In the circuit shown below, the voltage in the 6μF capacitor is 4V.

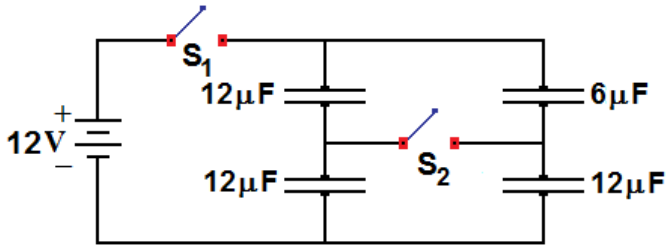


Find

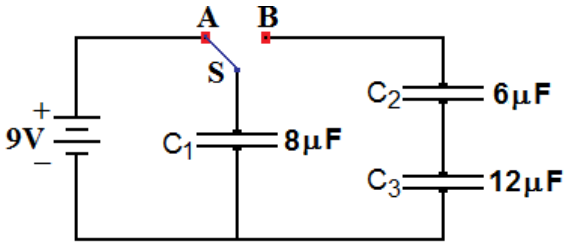
a) The capacitance of the whole circuit.
b) The source voltage.

Problem 5.- Consider the circuit shown in the figure.

a) With S_1 closed and S_2 open, calculate the total capacitance.
b) In that same position, calculate the total energy stored in the circuit.
c) With both S_1 and S_2 closed, calculate the total capacitance.
d) In this last position, calculate the total stored energy.



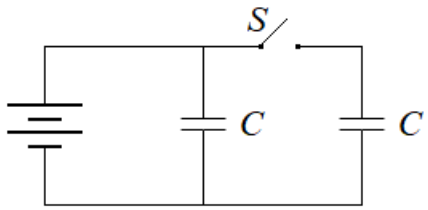
Problem 6.- In the circuit shown, S is first in A and C_2 and C_3 are initially uncharged. Then, S is switched to B, connecting C_1 with C_2 and C_3.



Answer:

a) What is the charge in C_1 when S is in A?
b) What is the charge in C_1 long after changing S to B?
c) What is the final voltage in C_1?
d) What is the final voltage in C_2?
e) What is the final voltage in C_3?

Problem 7.- the figure shows two identical capacitors. Initially, with the switch S open, one capacitor is uncharged and the other has a charge Q_0. The stored energy in this last capacitor is U_0. The switch is closed and after a while the capacitors have charges Q_1 and Q_2. The voltage and charge in each capacitor are V_1, U_1, V_2 y U_2. Which of the following alternatives is incorrect?



(A) $Q_0 = \frac{Q_1 + Q_2}{2}$ (B) $Q_1 = Q_2$ (C) $V_1 = V_2$ (D) $U_1 = U_2$ (E) $U_0 = U_1 + U_2$

Problem 8.-

i) Calculate the equivalent capacitance of the circuit from the terminals a and b.

ii) Calculate the charge in each capacitor if we connect a 16V source across a and b.

iii) Calculate the voltage across the 4μF capacitor in case (ii).