Capacitors in Circuits

Use this simple circuit diagram for questions 1-4

1. A 2.0mF capacitor is connected to a 1.50V cell. When the switch is closed, how many electrons will leave the cell in order to fully charge the capacitor?

2. The capacitor has plates with a surface area of 2.4x10-4m2 separated by 1.10mm. The gap is filled with a dielectric with κ=5.0. If the potential difference of the cell is 6.00V, how much charge is stored by the capacitor?

3. A capacitor is connected to a 4.00V battery through a switch. The switch is closed and 8.00μC of charge build up on the plates of the capacitor. The switch is then opened.

a. What is the capacitance?

b. How much energy is stored by the capacitor?

With the switch opened, the air gap between the plates is filled with a dielectric with κ=2.0.

c. What is the new capacitance?

d. What is the charge stored on the plates?

e. What is the potential difference between the plates?

f. How much energy is stored by the capacitor?

4. A capacitor is connected to a 4.00V battery through a switch. The switch is closed and 8.00μC of charge build up on the plates of the capacitor.

a. What is the capacitance?

b. How much energy is stored by the capacitor?

With the switch remaining closed, the air gap between the plates is filled with a dielectric with κ=2.0.

c. What is the new capacitance?

d. What is the charge stored on the plates?

e. What is the potential difference between the plates?

f. How much energy is stored by the capacitor?

5. Two capacitors are connected in parallel to a 9.00V cell

as shown at left. The switch is closed until the plates are

fully charged, and then re-opened.

a. What is the potential difference across C1? C1 C2

b. What is the potential difference across C2? 2.0mF 4.0mF

c. How much charge is stored on C1?

d. How much charge is stored on C2?

6. Two capacitors are connected in parallel to a 2.00V cell A

as shown at left. The switch is closed until the plates are

fully charged, and then re-opened.

a. How much charge is stored on C1? C1 C2

b. How much charge is stored on C2? 1.0mF 5.0mF

c. What is the total amount of charge

that passed through points A and B? B

d. What is the charge stored between points A and B?

e. What is the potential difference between points A and B?

f. What is the capacitance between points A and B?

g. Notice anything?

h. What?

i. Write a formula to find the equivalent capacitance of n capacitors connected in parallel.

7. Two capacitors are connected in series to a 8.00V cell A

as shown at left. The switch is closed until the plates are

fully charged, and then re-opened.

a. What is the potential diference between C1=6.0μF

points A and B? C2=12μF

b. How does the number of electrons that passed

through A compare to the number of electrons B

that passed through B?

c. How does the amount of charge that passed through A compare to the amount of charge that passed through B?

d. How does the total number of electrons deposited on the bottom plate of C2 compare to the total number of electrons evacuated from the top plate of C1?

e. What is the total amount of charge stored between A and B?

f. What is the potential difference between points A and B?

g. What is the capacitance between A and B?

h. Notice anything?

i. Try harder. Notice anything?

j. Write a formula to find the equivalent capacitance of n capacitors connected in series.

8. Consider the circuit below.

100V 4 μF

20μF 20 μF

4μF

10μF

a. What is the equivalent capacitance of the circuit?

b. What is the charge stored on each of the 4 μF capacitors at steady state?

c. What is the voltage of the 10 μF capacitor at steady state?