Electric dipole and capacitors

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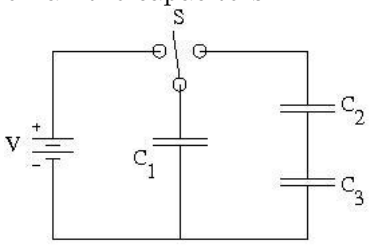
The problem:

In the circuit shown on the work page the capacitors are not charged at the beginning. The switch S is turned left and the first capacitor is charged. The switch is turned right. What are the charges on all the capacitors?



The solution:

The capacitors C_2, C_3 are connected in a series so their charges will be equal $q_2 = q_3$. Let us replace them with an equivalent capacitor $C_{23} = \frac{C_2 C_3}{C_2 + C_3}$ with the same charge.

When S was turned left C_1 was charged with $q = C_1 V_0$. The total charge is conserved after the switch is turned right. We also know that V is equal on C_1 and C_{23}. Let us write the following equations:

$$q = q_1 + q_2 = q_1 + q_3 \tag{1}$$

$$V_{23} = V_1 = \frac{q_2}{C_{23}} = \frac{q_1}{C_1} \tag{2}$$

$$q_2 \left(\frac{1}{C_2} + \frac{1}{C_3} \right) = \frac{q_1}{C_1} \tag{3}$$

$$q_1 = q - q_2 = C_1 V_0 - q_2 \tag{4}$$

$$q_2 \left(\frac{1}{C_2} + \frac{1}{C_3} \right) = V_0 - \frac{q_2}{C_1} \tag{5}$$

$$q_2 \left(\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \right) = V_0 \tag{6}$$

$$q_2 = q_3 = \frac{V_0}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}} \tag{7}$$

$$q_1 = C_1 V_0 - q_2 \tag{8}$$