For the capacitor network given in the figure, the terminals $a$, and $b$ are kept at a constant potential difference. What can be the value of $C_3$ if;
(a) $C_1$ and $C_3$ have the same potential?
(b) $C_1$ and $C_3$ have the same charge?
(c) $C_1$ and $C_2$ have the same potential?
(d) $C_1$ and $C_2$ have the same charge?
The capacitors in the figure are initially uncharged. The terminals \( a \) and \( b \) are connected to a battery to have a potential difference \( V_{ab} = 9 \text{ V} \). Calculate the potential difference between the terminals \( c \) and \( d \) (\( V_{cd} \)). (Hint: What is \( V_{ac} + V_{cd} + V_{da} = ? \).)
For the capacitor network given in the figure, the switch \( S \) is initially open, \( C_1 \) is charged with a potential of 12 V, and \( C_2 \) and \( C_3 \) are uncharged. Then \( S \) is closed (this is a parallel connection) Calculate the ratio of the electric potential energy that was stored in capacitor \( C_1 \) before and after the switch was closed.
Two parallel plate capacitors in the figure are connected in parallel. In this configuration, the capacitor $C_1$ has charge $Q_0$. Now, suppose that a dielectric slab with dielectric constant $K = 2$ is inserted between the plates of $C_2$ and it fills the space between the plates completely. How much charge has flowed through the point $S$ and in which direction?
Two identical parallel plate capacitors $C_1 = C_2 = C$ are connected in parallel and to a battery of potential difference $V$ as shown in the figure. Consider the following separate cases:

(I) The switch is opened so that the battery is disconnected and then the separation between the plates of $C_1$ is doubled.

(II) The battery remains connected and the separation between the plates of $C_1$ is doubled.

Determine the ratio of the charge stored in $C_2$ in these cases.
Two parallel plate capacitors in the figure are connected in parallel. In this configuration, the capacitor $C_1$ has charge $Q_0$. The separation between the plates of $C_2$ is $d$. Now, suppose that a metal slab of thickness $d/3$ is inserted between the plates of $C_2$ without touching to any of the plates. The metal slab has the same area and shape as the plates. Determine the ratio of the charge of $C_2$ before and after the metal slab was inserted.