This circuit is at equilibrium.

- Find the charge $Q_7$ on capacitor $C_7$ [$Q_5$ on $C_5$].
- Find the energy $U_5$ on capacitor $C_5$ [$U_7$ on $C_7$].
- Find the voltages $V_2$, $V_4$ across capacitors $C_2$, $C_4$ [$V_3$, $V_6$ across $C_3$, $C_6$].
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- Find the energy $U_5$ on capacitor $C_5$ [$U_7$ on $C_7$].
- Find the voltages $V_2, V_4$ across capacitors $C_2, C_4$ [$V_3, V_6$ across $C_3, C_6$].

**Solution:**

- $Q_7 = (24\text{V})(7\mu\text{F}) = 168\mu\text{C}$  [$Q_5 = (24\text{V})(5\mu\text{F}) = 120\mu\text{C}$]
- $U_5 = \frac{1}{2}(5\mu\text{F})(24\text{V})^2 = 1440\mu\text{J}$  [$U_7 = \frac{1}{2}(7\mu\text{F})(24\text{V})^2 = 2016\mu\text{J}$]
- $V_2 + V_4 = 24\text{V}$, \quad $V_2C_2 = V_4C_4 \quad \Rightarrow \quad V_2 = 16\text{V}, \quad V_4 = 8\text{V}$
  
  $[V_3 + V_6 = 24\text{V}$, \quad $V_3C_3 = V_6C_6 \quad \Rightarrow \quad V_3 = 16\text{V}, \quad V_6 = 8\text{V}$]
Consider the resistor circuit on the left [right].
Find the currents $I_1, I_2 [I_3, I_4]$ and the potential difference $V_a - V_b [V_c - V_d]$

(a) when the switch $S_w [S_y]$ is open,
(b) when the switch $S_w [S_y]$ is closed
Consider the resistor circuit on the left [right]. Find the currents $I_1$, $I_2$ [$I_3$, $I_4$] and the potential difference $V_a - V_b$ [$V_c - V_d$]

(a) when the switch $S_w$ [$S_y$] is open,
(b) when the switch $S_w$ [$S_y$] is closed

Solution:

(a) $I_1 = I_2 = \frac{3V + 6V}{5\Omega + 3\Omega} = 1.125A, \quad V_a - V_b = 9V.$

\[ I_3 = I_4 = \frac{2V + 5V}{6\Omega + 4\Omega} = 0.7A, \quad V_c - V_d = 7V. \]

(b) $I_1 = \frac{3V}{5\Omega} = 0.6A, \quad I_2 = \frac{6V}{3\Omega} = 2A, \quad V_a - V_b = 9V.$

\[ I_3 = \frac{5V}{4\Omega} = 1.25A, \quad I_4 = \frac{2V}{6\Omega} = 0.333A, \quad V_c - V_d = 7V. \]
The switch S of this circuit has been open for a long time. The capacitor has capacitance $C = 6\text{pF}$ [$C = 4\text{pF}$]. Each resistor has resistance $R = 6\Omega$ [$R = 4\Omega$].

(a) Find the currents $I_1, I_2, I_3$ right after the switch has been closed.

(b) Find the currents $I_1, I_2, I_3$ a long time later.
The switch S of this circuit has been open for a long time. The capacitor has capacitance $C = 6\, \text{pF}$ [$C = 4\, \text{pF}$]. Each resistor has resistance $R = 6\, \Omega$ [$R = 4\, \Omega$].

(a) Find the currents $I_1, I_2, I_3$ right after the switch has been closed.
(b) Find the currents $I_1, I_2, I_3$ a long time later

**Solution:**

(a) no voltage across capacitor: $R_{eq} = 9\, \Omega$ [from solution, $R_{eq} = 6\, \Omega$]  
$I_3 = I_1 + I_2 = \frac{36\, \text{V}}{9\, \Omega} = 4\, \text{A}$,  
$I_1 = I_2 = 2\, \text{A}$  
$\begin{bmatrix}
I_3 = I_1 + I_2 = \frac{36\, \text{V}}{6\, \Omega} = 6\, \text{A}, \\
I_1 = I_2 = 3\, \text{A}
\end{bmatrix}$.  

(b) no current through capacitor: $R_{eq} = 12\, \Omega$ [from solution, $R_{eq} = 8\, \Omega$]  
$I_1 = I_3 = \frac{36\, \text{V}}{12\, \Omega} = 3\, \text{A}$,  
$I_2 = 0$  
$\begin{bmatrix}
I_1 = I_3 = \frac{36\, \text{V}}{8\, \Omega} = 4.5\, \text{A}, \\
I_2 = 0
\end{bmatrix}$.  

25/10/2017 [tsl559 – 3/3]