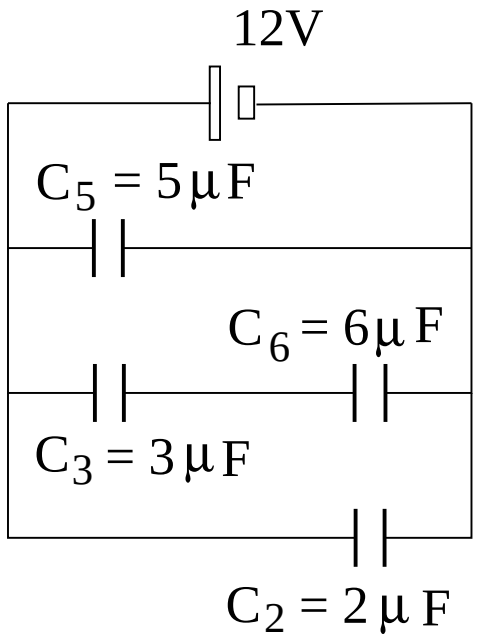
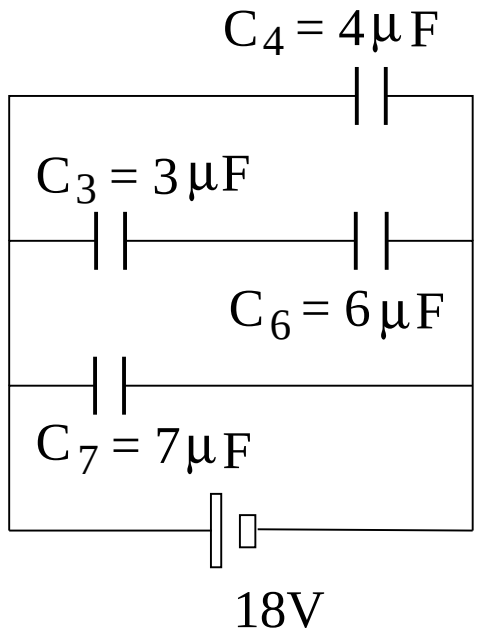
# Unit Exam II: Problem #1 (Fall '16)

The capacitors (initially discharged) have been connected to the battery. The circuit is now at equilibrium. Find ...

(a) the voltage $V_2$ across capacitor $C_2$,
(b) the energy $U_5$ on capacitor $C_5$,
(c) the charge $Q_3$ on capacitor $C_3$,
(d) the equivalent capacitance $C_{eq}$.




(a) the voltage $V_4$ across capacitor $C_4$,
(b) the energy $U_7$ on capacitor $C_7$,
(c) the charge $Q_6$ on capacitor $C_6$,
(d) the equivalent capacitance $C_{eq}$.



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(b) the energy $U_7$ on capacitor $C_7$,
(c) the charge $Q_6$ on capacitor $C_6$,
(d) the equivalent capacitance $C_{eq}$.

**Solution:**

(a) $V_2 = 12\text{V}.$

(b) $U_5 = \frac{1}{2}(5\mu\text{F})(12\text{V})^2 = 360\mu\text{J}.$

(c) $C_{36} = 2\mu\text{F}$
$\Rightarrow\ Q_3 = Q_{36} = (12\text{V})(2\mu\text{F}) = 24\mu\text{C}.$

(d) $C_{eq} = C_5 + C_{36} + C_2 = 9\mu\text{F}.$

(a) $V_4 = 18\text{V}.$

(b) $U_7 = \frac{1}{2}(7\mu\text{F})(18\text{V})^2 = 1134\mu\text{J}.$

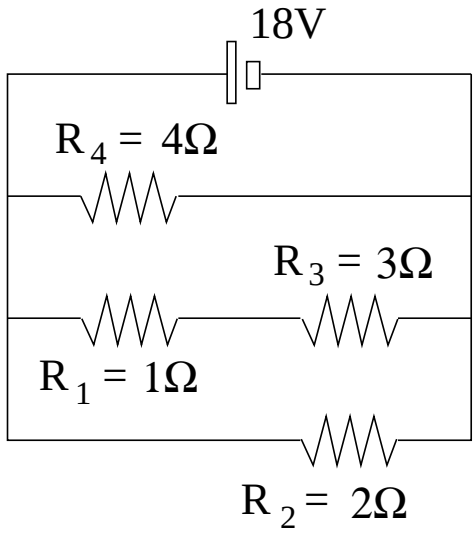
(c) $C_{36} = 2\mu\text{F}$
$\Rightarrow\ Q_6 = Q_{36} = (18\text{V})(2\mu\text{F}) = 36\mu\text{C}.$

(d) $C_{eq} = C_4 + C_{36} + C_7 = 13\mu\text{F}.$

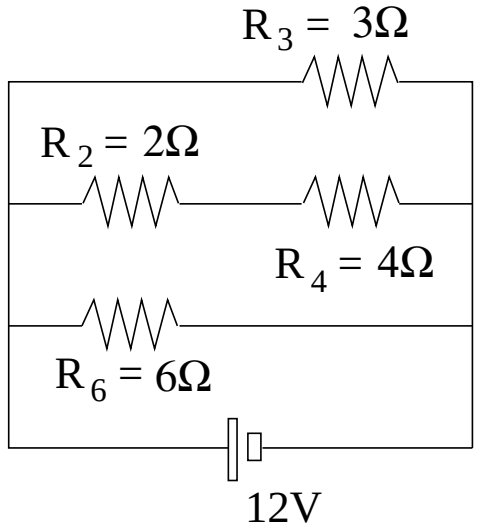
# Unit Exam II: Problem #2 (Fall '16)

This resistor circuit is in a state of steady currents. Find ...

(a) the voltage $V_2$ across resistor $R_2$,
(b) the power $P_4$ dissipated in resistor $R_4$,
(c) the current $I_3$ flowing through resistor $R_3$
(d) the equivalent resistance $R_{eq}$.




(a) the voltage $V_3$ across resistor $R_3$,
(b) the power $P_6$ dissipated in resistor $R_6$,
(c) the current $I_4$ flowing through resistor $R_4$,
(d) the equivalent resistance $R_{eq}$.



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(b) the power $P_6$ dissipated in resistor $R_6$,
(c) the current $I_4$ flowing through resistor $R_4$,
(d) the equivalent resistance $R_{eq}$.

**Solution:**

(a) $V_2 = 18\text{V}.$

(b) $P_4 = \dfrac{18\text{V}^2}{4\Omega} = 81\text{W}.$

(c) $I_3 = \dfrac{18\text{V}}{3\Omega + 1\Omega} = 4.5\text{A}.$

(d) $R_{eq} = \left(\dfrac{1}{4\Omega} + \dfrac{1}{1\Omega + 3\Omega} + \dfrac{1}{2\Omega}\right)^{-1} = 1\Omega.$

(a) $V_3 = 12\text{V}$

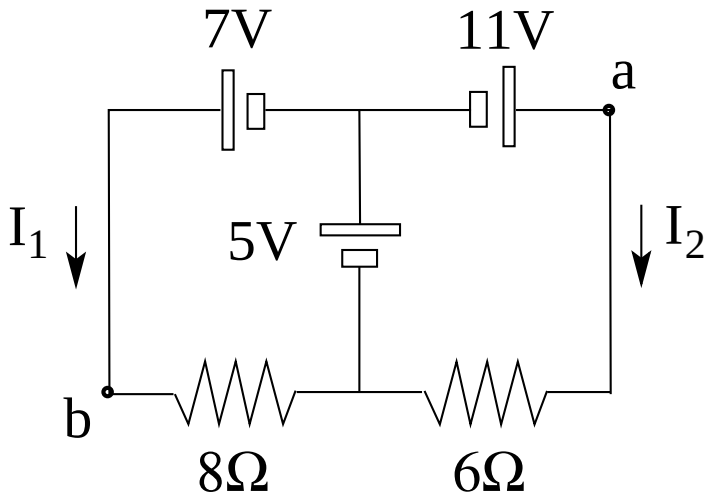
(b) $P_6 = \dfrac{12\text{V}^2}{6\Omega} = 24\text{W}.$

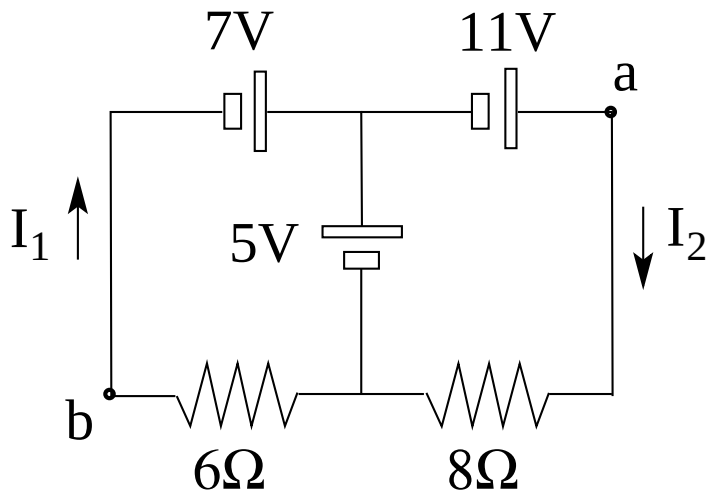
(c) $I_4 = \dfrac{12\text{V}}{2\Omega + 4\Omega} = 2\text{A}.$

(d) $R_{eq} = \left(\dfrac{1}{3\Omega} + \dfrac{1}{2\Omega + 4\Omega} + \dfrac{1}{6\Omega}\right)^{-1} = 1.5\Omega$

# Unit Exam II: Problem #3 (Fall '16)

This two-loop resistor circuit is in a state of steady currents. Find ...
(a) the current $I_1$,
(b) the current $I_2$,
(c) the potential difference $V_a - V_b$.



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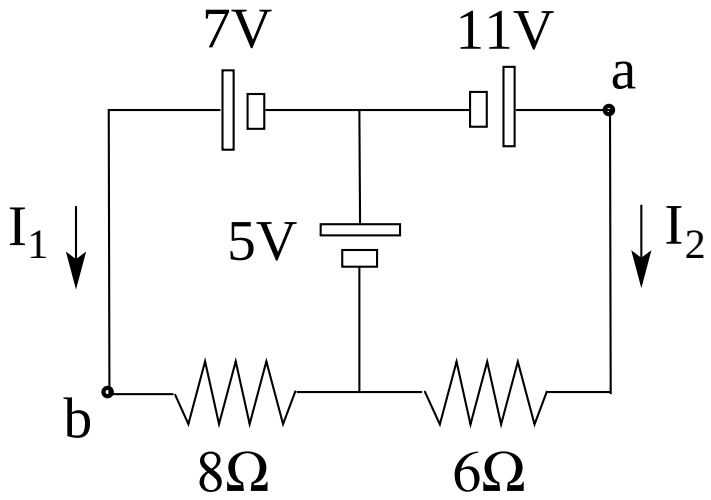


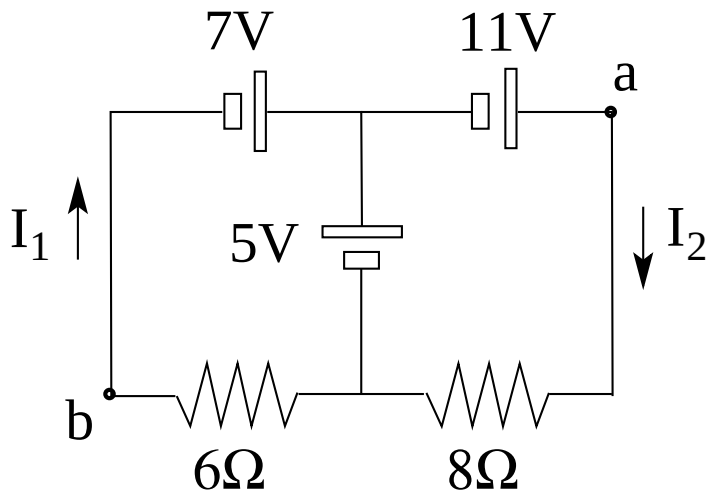


**Solution:**

(a) $I_1 = \dfrac{5\text{V} + 7\text{V}}{8\Omega} = +1.5\text{A}.$

(b) $I_2 = \dfrac{5\text{V} + 11\text{V}}{6\Omega} = +2.67\text{A}.$

(c) $V_a - V_b = -7\text{V} + 11\text{V} = +4\text{V}.$

(a) $I_1 = \dfrac{7\text{V} - 5\text{V}}{6\Omega} = +0.333\text{A}.$

(b) $I_2 = \dfrac{5\text{V} + 11\text{V}}{8\Omega} = +2\text{A}.$

(c) $V_a - V_b = 7\text{V} + 11\text{V} = +18\text{V}.$