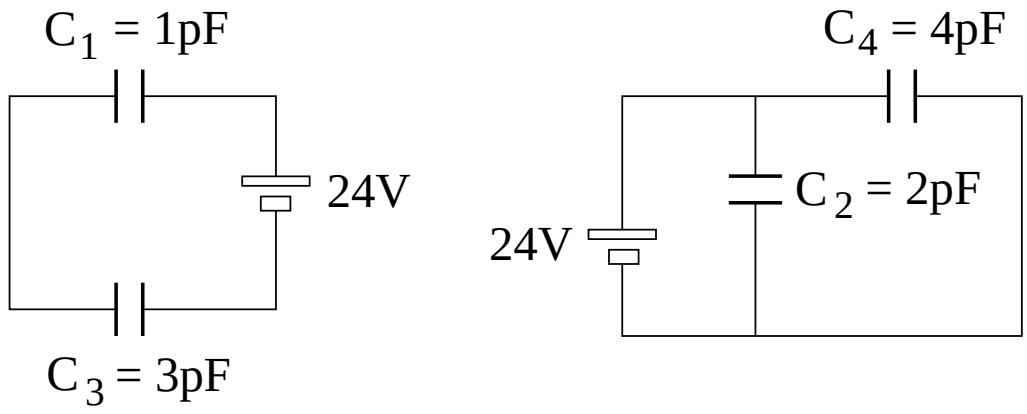
Unit Exam II: Problem #1 (Spring '11)

Both capacitor circuits are at equilibrium.
(a) Find the charge Q_1 on capacitor 1.
(b) Find the voltage V_3 across capacitor 3.
(c) Find the charge Q_2 on capacitor 2.
(d) Find the energy U_4 stored on capacitor 4.



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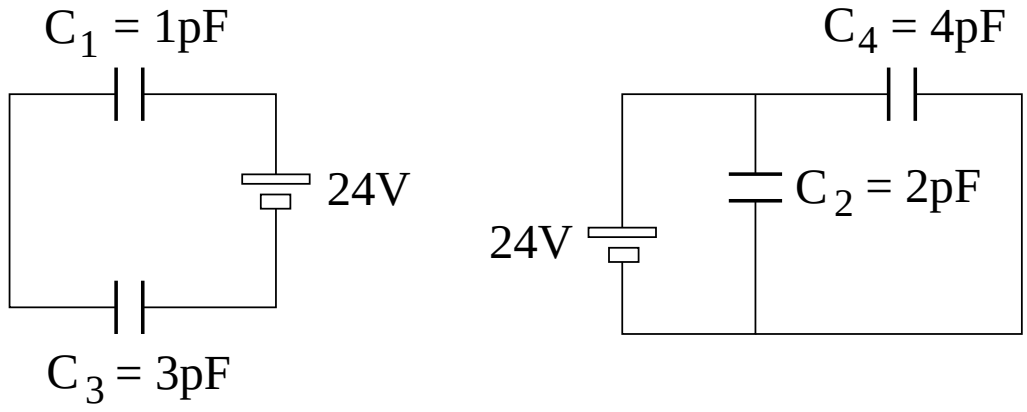


Solution:

(a) $C_{13} = \left(\frac{1}{C_1} + \frac{1}{C_3}\right)^{-1} = 0.75\text{pF}, \quad Q_1 = Q_3 = Q_{13} = (24\text{V})(0.75\text{pF}) = 18\text{pC}.$

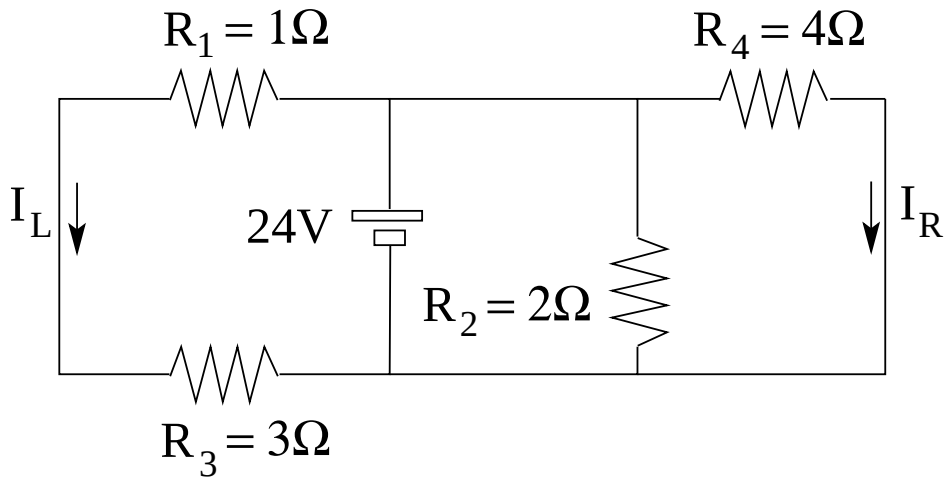
(b) $V_3 = \frac{Q_3}{C_3} = \frac{18\text{pC}}{3\text{pF}} = 6\text{V}.$

(c) $Q_2 = (24\text{V})(2\text{pF}) = 48\text{pC}.$

(d) $U_4 = \frac{1}{2}C_4V_4^2 = \frac{1}{2}(4\text{pF})(24\text{V})^2 = 1152\text{pJ}.$

Unit Exam II: Problem #2 (Spring '11)

Consider the resistor circuit shown.
(a) Find the current I_L on the left.
(b) Find the current I_R on the right.
(c) Find the equivalent resistance R_{eq} of all four resistors.
(d) Find the power P_2 dissipated in resistor 2.



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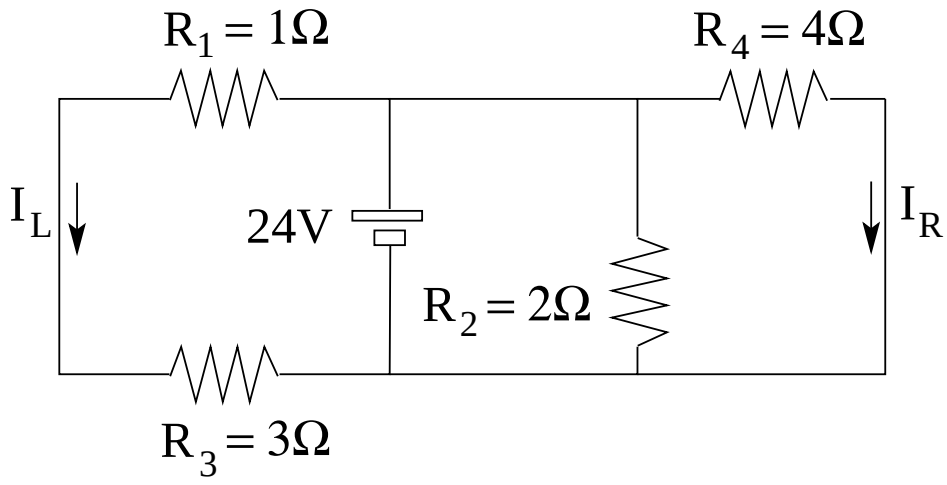


Solution:

(a) $I_L = \dfrac{24\text{V}}{1\Omega + 3\Omega} = 6\text{A}.$

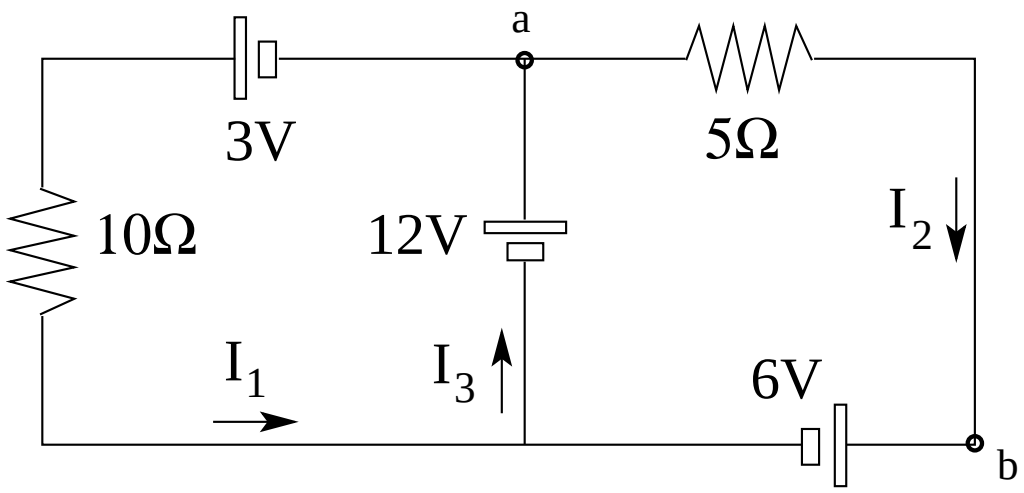
(b) $I_R = \dfrac{24\text{V}}{4\Omega} = 6\text{A}.$

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

(d) $P_2 = \dfrac{(24\text{V})^2}{2\Omega} = 288\text{W}.$

Unit Exam II: Problem #3 (Spring '11)

Consider the electric circuit shown.
(a) Find the current I_1.
(b) Find the current I_2.
(c) Find the current I_3.
(d) Find the potential difference $V_a - V_b$.



Unit Exam II: Problem #3 (Spring '11)

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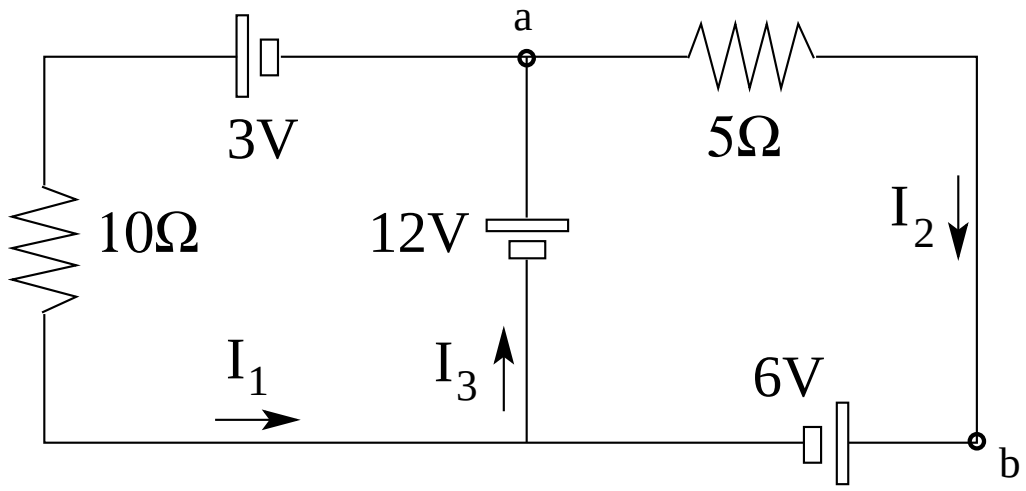

Solution:

(a) $12\text{V} + 3\text{V} - I_1(10\Omega) = 0 \quad \Rightarrow \; I_1 = \dfrac{15\text{V}}{10\Omega} = 1.5\text{A}.$

(b) $-6\text{V} + 12\text{V} - I_2(5\Omega) = 0 \quad \Rightarrow \; I_1 = \dfrac{6\text{V}}{5\Omega} = 1.2\text{A}.$

(c) $I_3 = I_1 + I_2 = 2.7\text{A}.$

(d) $V_a - V_b = -6\text{V} + 12\text{V} = 6\text{V}.$