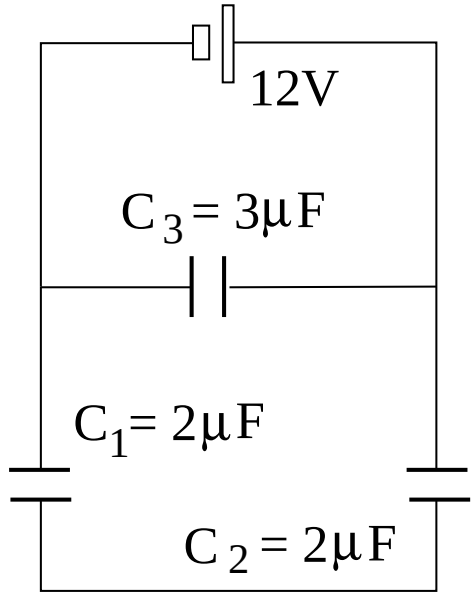
Intermediate Exam II: Problem #1 (Spring '06)

The circuit of capacitors connected to a battery is at equilibrium.

(a) Find the charge Q_3 on capacitor C_3.

(b) Find the charge Q_2 on capacitor C_2.



Solution:

(a) $Q_3 = C_3(12\text{V}) = (3\mu\text{F})(12\text{V}) = 36\mu\text{C}.$

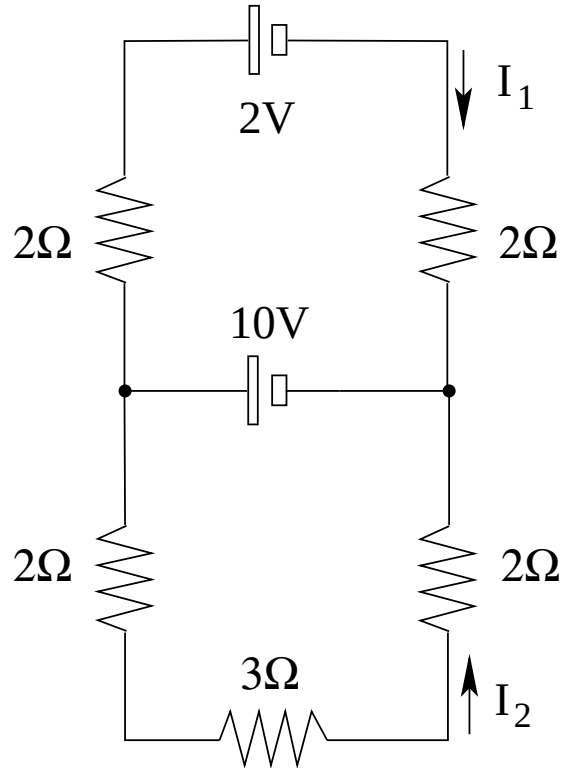
(b) $Q_2 = Q_{12} = C_{12}(12\text{V}) = (1\mu\text{F})(12\text{V}) = 12\mu\text{C}.$

Intermediate Exam II: Problem #2 (Spring '06)

Consider the two-loop circuit shown.

(a) Find the current I_1.

(b) Find the current I_2.



Solution:

(a) $-(2\Omega)(I_1) + 10\text{V} - (2\Omega)(I_1) - 2\text{V} = 0 \quad \Rightarrow \; I_1 = \dfrac{8\text{V}}{4\Omega} = 2\text{A}.$

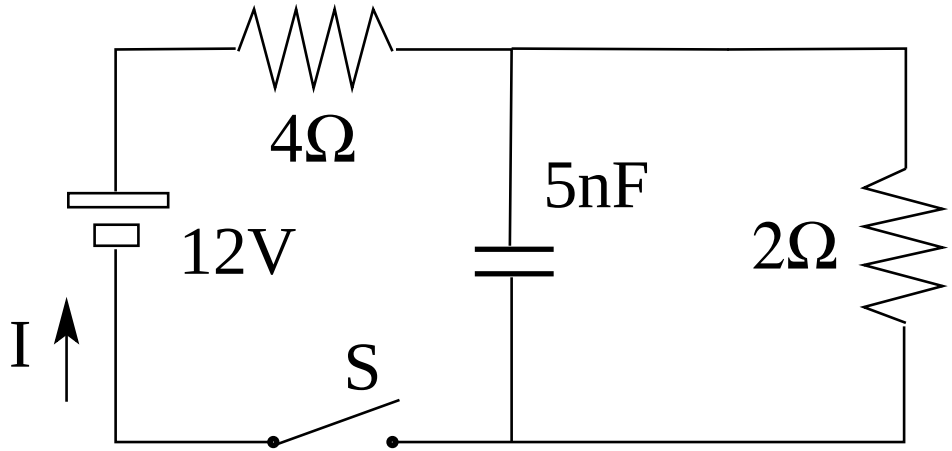
(b) $-(2\Omega)(I_2) + 10\text{V} - (2\Omega)(I_2) - (3\Omega)(I_2) = 0 \quad \Rightarrow \; I_2 = \dfrac{10\text{V}}{7\Omega} = 1.43\text{A}.$

Intermediate Exam II: Problem #3 (Spring '06)

In this RC circuit the switch S is initially open as shown.

(a) Find the current I right after the switch has been closed.

(b) Find the current I a very long time later.



Solution:

(a) No current through 2Ω-resistor: $I = \dfrac{12\text{V}}{4\Omega} = 3\text{A}.$

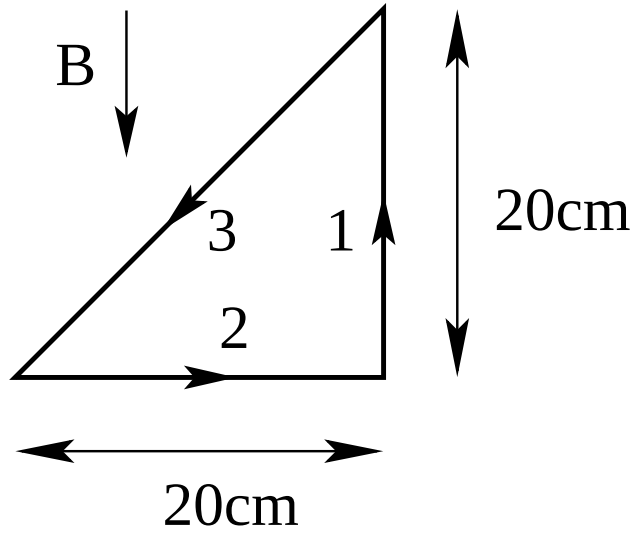
(b) No current through capacitor: $I = \dfrac{12\text{V}}{6\Omega} = 2\text{A}.$

Intermediate Exam II: Problem #4 (Spring '06)

A current loop in the form of a right triangle is placed in a uniform magnetic field of magnitude $B = 30$mT as shown. The current in the loop is $I = 0.4$A in the direction indicated.

(a) Find magnitude and direction of the force $\vec{F}_1$ on side 1 of the triangle.

(b) Find magnitude and direction of the force $\vec{F}_2$ on side 2 of the triangle.



Solution:

(a) $\vec{F}_1 = I\vec{L} \times \vec{B} = 0$ (angle between $\vec{L}$ and $\vec{B}$ is $180°$).

(b) $F_2 = ILB = (0.4\text{A})(0.2\text{m})(30 \times 10^{-3}\text{T}) = 2.4 \times 10^{-3}\text{N}$.
Direction of $\vec{F}_2$: $\otimes$ (into plane).