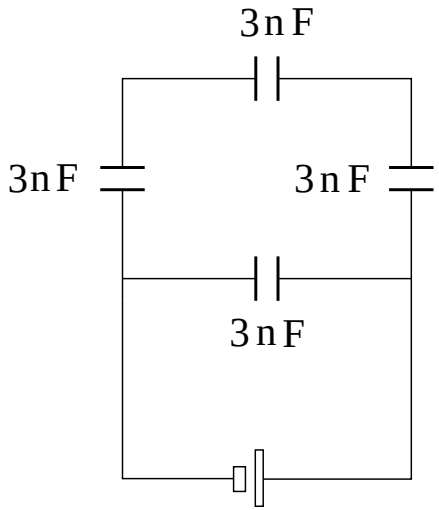
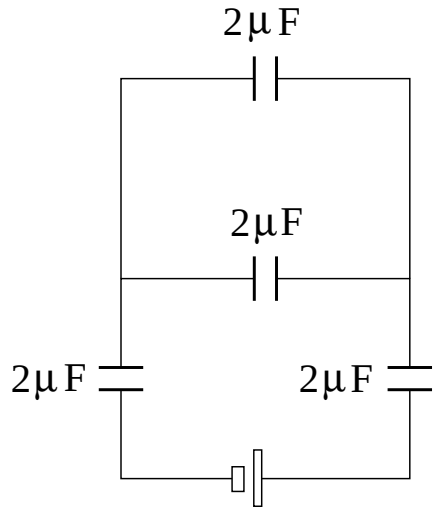
Unit Exam II: Problem #1 (Spring '12)

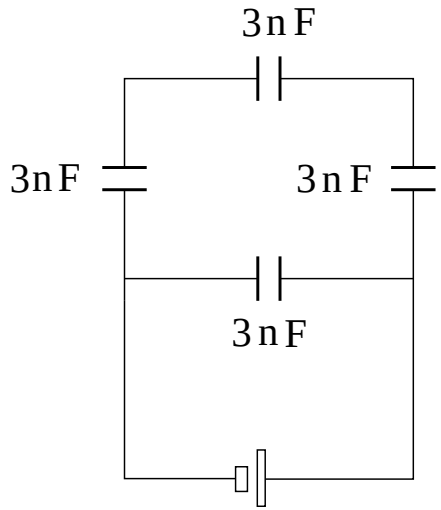
Find the equivalent capacitances C_{eq} of the two capacitor circuits.

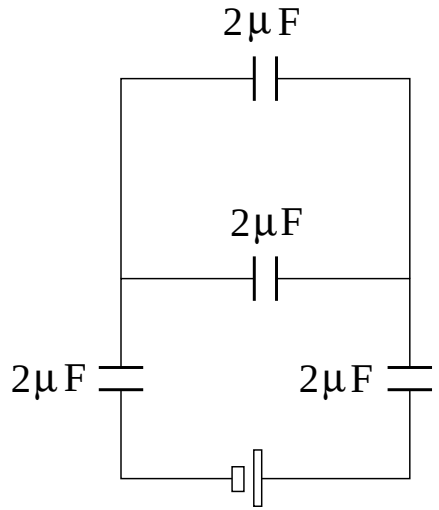




Unit Exam II: Problem #1 (Spring '12)

Find the equivalent capacitances C_{eq} of the two capacitor circuits.



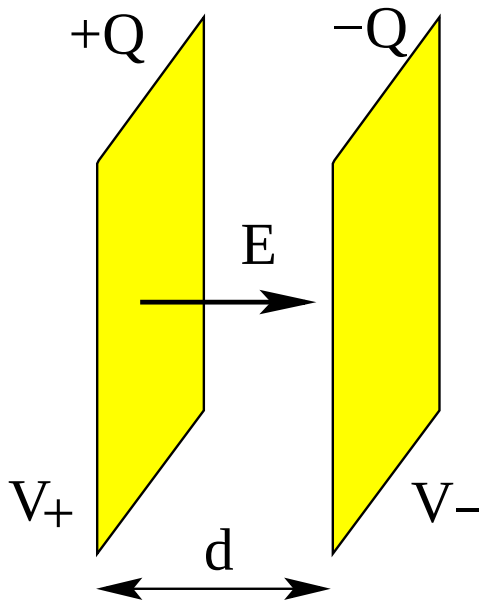


Solution:

- $C_{eq} = 3\text{nF} + \left(\frac{1}{3\text{nF}} + \frac{1}{3\text{nF}} + \frac{1}{3\text{nF}}\right)^{-1} = 4\text{nF}.$
- $C_{eq} = \left(\frac{1}{2\mu\text{F}} + \frac{1}{2\mu\text{F} + 2\mu\text{F}} + \frac{1}{2\mu\text{F}}\right)^{-1} = \frac{4}{5}\mu\text{F}.$

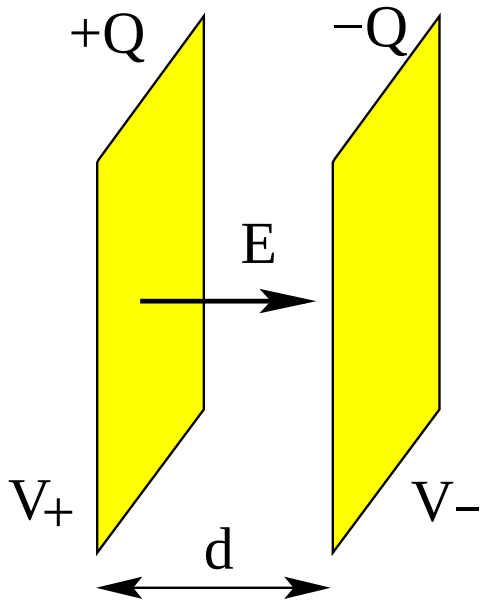
Unit Exam II: Problem #2 (Spring '12)

Consider a parallel-plate capacitor of capacitance $C = 6$pF with plates separated a distance $d = 1$mm and a potential difference $V = V_+ - V_- = 3$V between them.
(a) Find the magnitude E of the electric field between the plates.
(b) Find the amount Q of charge on each plate.
(c) Find the energy U stored on the capacitor.
(d) Find the area A of each plate.



Unit Exam II: Problem #2 (Spring '12)

Consider a parallel-plate capacitor of capacitance $C = 6\text{pF}$ with plates separated a distance $d = 1\text{mm}$ and a potential difference $V = V_+ - V_- = 3\text{V}$ between them.
(a) Find the magnitude E of the electric field between the plates.
(b) Find the amount Q of charge on each plate.
(c) Find the energy U stored on the capacitor.
(d) Find the area A of each plate.



Solution:

(a) $E = \dfrac{V}{d} = \dfrac{3\text{V}}{1\text{mm}} = 3000\text{V/m}.$

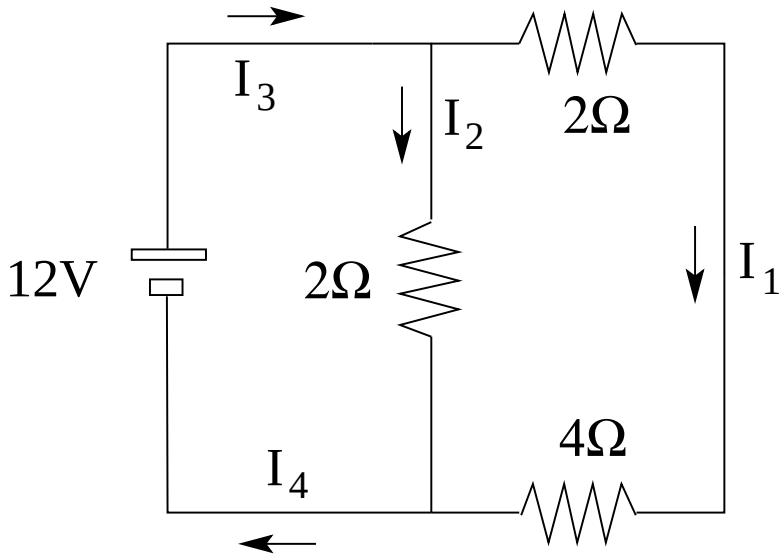
(b) $Q = CV = (6\text{pF})(3\text{V}) = 18\text{pC}.$

(c) $U = \dfrac{1}{2}QV = 0.5(18\text{pC})(3\text{V}) = 27\text{pJ}.$

(d) $A = \dfrac{Cd}{\epsilon_0} = \dfrac{(6\text{pF})(1\text{mm})}{8.85 \times 10^{-12}\text{C}^2\text{N}^{-1}\text{m}^{-2}} = 6.78 \times 10^{-4}\text{m}^2.$

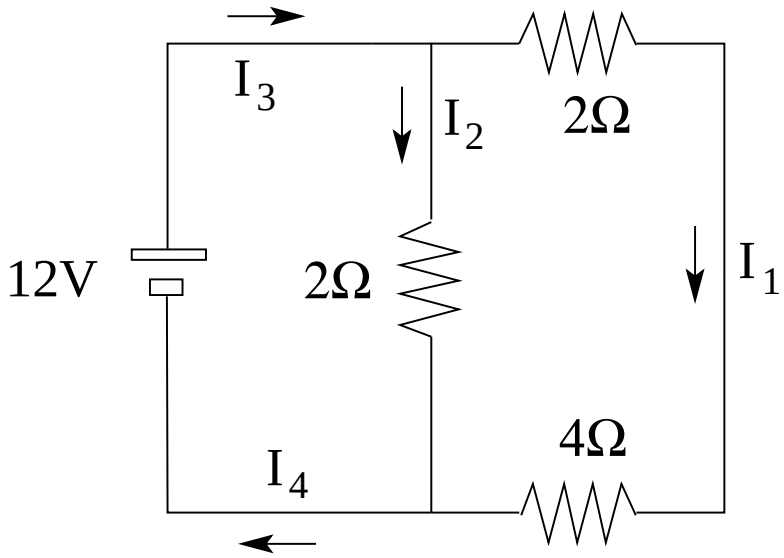
Unit Exam II: Problem #3 (Spring '12)

Consider the electric circuit shown. Find the currents I_1, I_2, I_3, and I_4



Unit Exam II: Problem #3 (Spring '12)

Consider the electric circuit shown. Find the currents I_1, I_2, I_3, and I_4

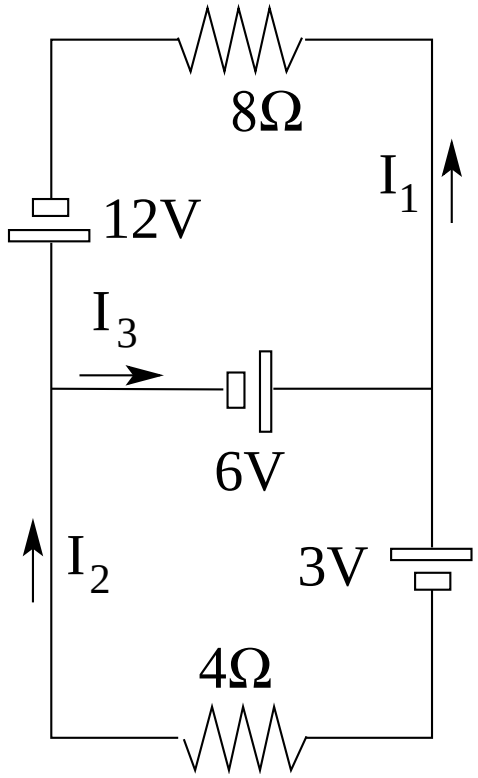


Solution:

- $I_1 = \dfrac{12\text{V}}{2\Omega + 4\Omega} = 2\text{A}.$
- $I_2 = \dfrac{12\text{V}}{2\Omega} = 6\text{A}.$
- $I_3 = I_4 = I_1 + I_2 = 8\text{A}.$

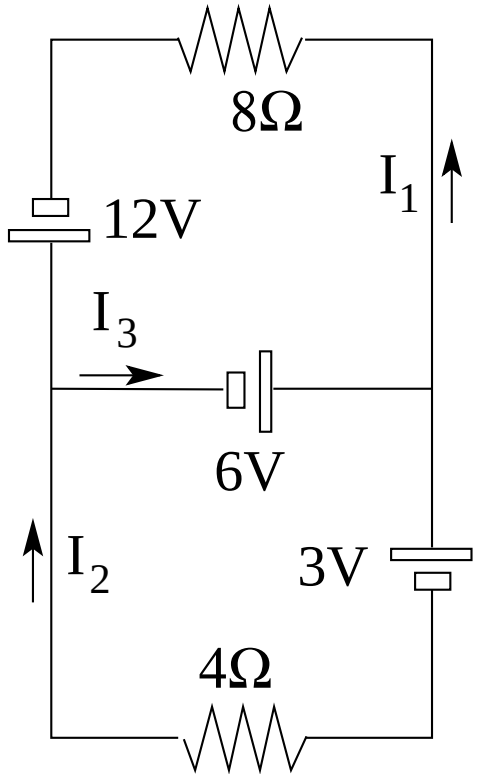
Unit Exam II: Problem #4 (Spring '12)

Consider the electric circuit shown. Find the currents I_1, I_2, and I_3



Unit Exam II: Problem #4 (Spring '12)

Consider the electric circuit shown. Find the currents I_1, I_2, and I_3



Solution:

- $12\text{V} + 6\text{V} - (8\Omega)I_1 = 0 \quad \Rightarrow \; I_1 = \frac{9}{4}\text{A} = 2.25\text{A}.$
- $6\text{V} - 3\text{V} - (4\Omega)I_2 = 0 \quad \Rightarrow \; I_2 = \frac{3}{4}\text{A} = 0.75\text{A}.$
- $I_3 = I_1 + I_2 = 3.00\text{A}.$