

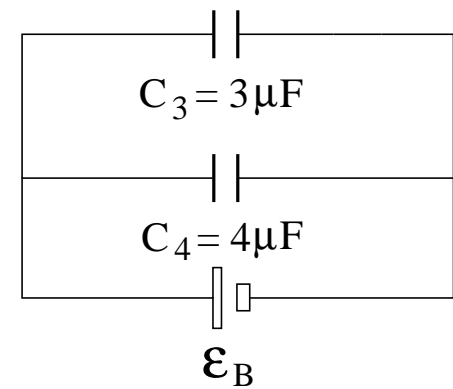
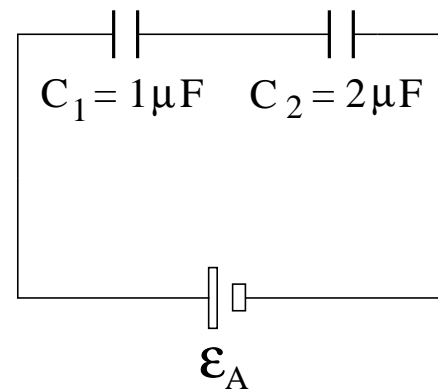
## Unit Exam II: Problem #1 (Spring '09)



Both capacitor circuits are at equilibrium.

(a) In the circuit on the left, the voltage across capacitor 1 is  $V_1 = 8V$ . Find the charge  $Q_1$  on capacitor 1, the charge  $Q_2$  on capacitor 2, and the voltage  $V_2$  across capacitor 2. Find the emf  $\mathcal{E}_A$  supplied by the battery.

(b) In the circuit on the right, the charge on capacitor 3 is  $Q_3 = 6\mu C$ . Find the voltage  $V_3$  across capacitor 3, the voltage  $V_4$  across capacitor 4, and the charge  $Q_4$  on capacitor 4. Find the emf  $\mathcal{E}_B$  supplied by the battery.



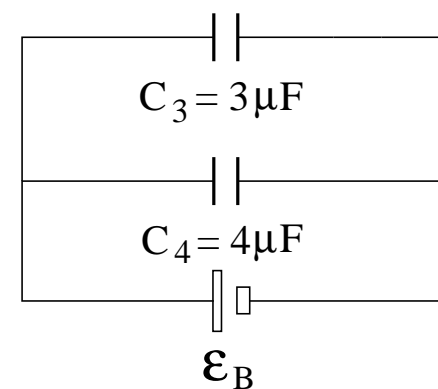
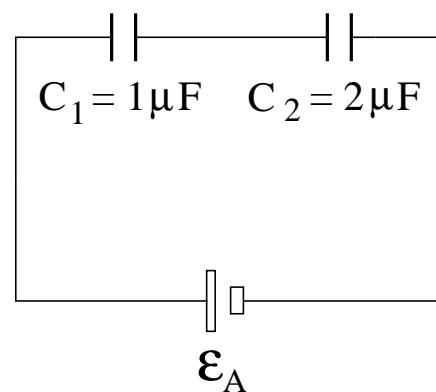
# Unit Exam II: Problem #1 (Spring '09)



Both capacitor circuits are at equilibrium.

(a) In the circuit on the left, the voltage across capacitor 1 is  $V_1 = 8V$ . Find the charge  $Q_1$  on capacitor 1, the charge  $Q_2$  on capacitor 2, and the voltage  $V_2$  across capacitor 2. Find the emf  $\mathcal{E}_A$  supplied by the battery.

(b) In the circuit on the right, the charge on capacitor 3 is  $Q_3 = 6\mu C$ . Find the voltage  $V_3$  across capacitor 3, the voltage  $V_4$  across capacitor 4, and the charge  $Q_4$  on capacitor 4. Find the emf  $\mathcal{E}_B$  supplied by the battery.



**Solution:**

$$(a) \quad Q_1 = (1\mu F)(8V) = 8\mu C, \quad Q_2 = Q_1 = 8\mu C,$$
$$V_2 = \frac{8\mu C}{2\mu F} = 4V, \quad \mathcal{E}_A = 8V + 4V = 12V.$$

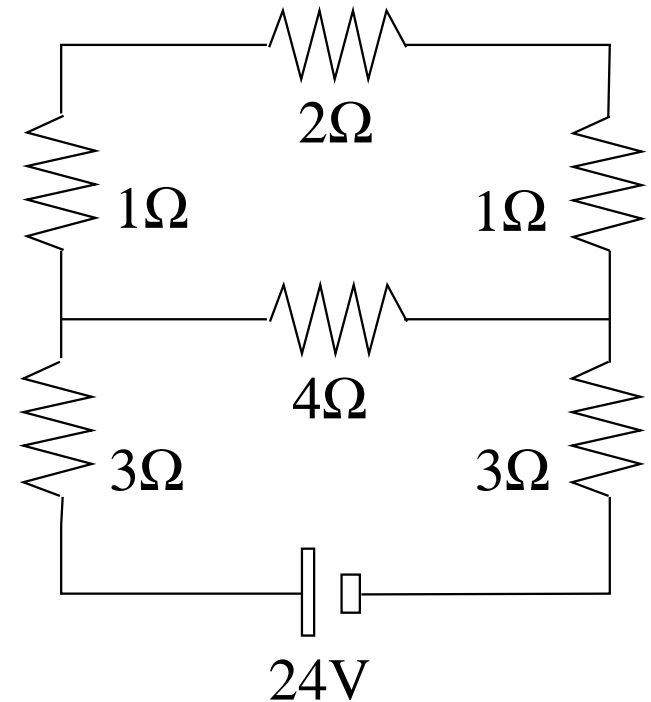
$$(b) \quad V_3 = \frac{6\mu C}{3\mu F} = 2V, \quad V_4 = V_3 = 2V,$$
$$Q_4 = (2V)(4\mu F) = 8\mu C, \quad \mathcal{E}_B = V_3 = V_4 = 2V.$$

## Unit Exam II: Problem #2 (Spring '09)



Consider the resistor circuit shown.

- (a) Find the equivalent resistance  $R_{eq}$ .
- (b) Find the power  $P$  supplied by the battery.
- (c) Find the current  $I_4$  through the  $4\Omega$ -resistor.
- (d) Find the voltage  $V_2$  across the  $2\Omega$ -resistor.



## Unit Exam II: Problem #2 (Spring '09)

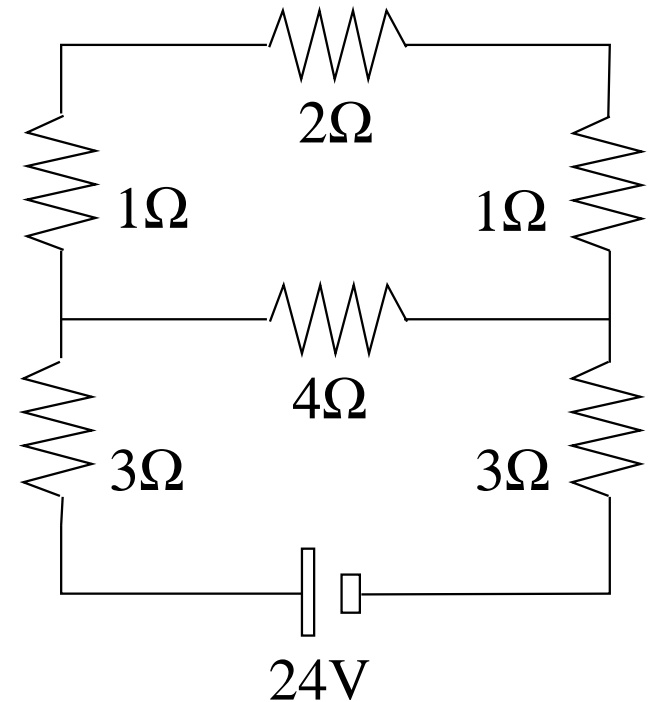


Consider the resistor circuit shown.

- (a) Find the equivalent resistance  $R_{eq}$ .
- (b) Find the power  $P$  supplied by the battery.
- (c) Find the current  $I_4$  through the  $4\Omega$ -resistor.
- (d) Find the voltage  $V_2$  across the  $2\Omega$ -resistor.

**Solution:**

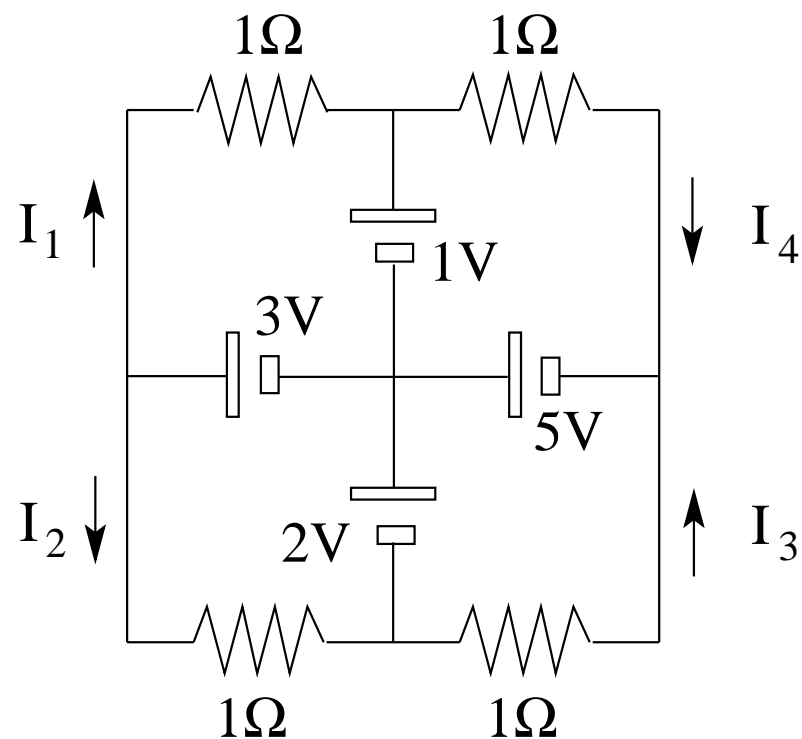
- (a)  $R_{eq} = 8\Omega$ .
- (b)  $P = \frac{(24V)^2}{8\Omega} = 72W$ .
- (c)  $I_4 = \frac{1}{2} \frac{24V}{8\Omega} = 1.5A$ .
- (d)  $V_2 = (1.5A)(2\Omega) = 3V$ .



## Unit Exam II: Problem #3 (Spring '09)



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



## Unit Exam II: Problem #3 (Spring '09)



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

**Solution:**

Use loops along quadrants in assumed current directions.  
Start at center.

$$+3V - I_1(1\Omega) - 1V = 0 \Rightarrow I_1 = 2A.$$

$$+3V - I_2(1\Omega) + 2V = 0 \Rightarrow I_2 = 5A.$$

$$-2V - I_3(1\Omega) + 5V = 0 \Rightarrow I_3 = 3A.$$

$$+1V - I_4(1\Omega) + 5V = 0 \Rightarrow I_4 = 6A.$$

