

Closed book. No calculators are to be used for this quiz.

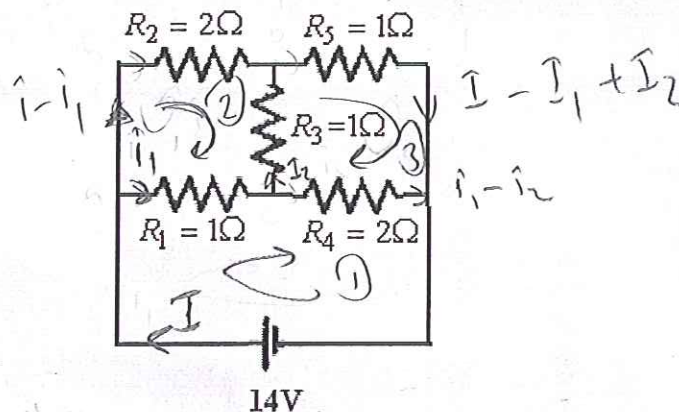
Quiz duration: 10 minutes

Name:

Student ID:

Signature:

Find the current through each resistor in the circuit.



$$\textcircled{1} \rightarrow 14 - I_1 - (I_1 - I_2) 2 = 0 \rightarrow 3I_1 + 2I_2 = 14 \quad (a)$$

$$\textcircled{2} \rightarrow -(i - i_1) 2 + i_2 + i_1 = 0 \rightarrow -2i + 3i_1 + i_2 = 0 \quad (b)$$

$$\textcircled{3} \rightarrow -(i - i_1 + i_2) + (i_1 - i_2) 2 - i_2 = 0 \rightarrow -i + 3i_1 - 4i_2 = 0 \quad (c)$$

$$(a) - (b) \rightarrow 2I - 3i_2 = 14$$

$$(c) - (b) \rightarrow i - 5i_2 = 0 \quad \left. \begin{array}{l} 2I - 3i_2 = 14 \\ i - 5i_2 = 0 \end{array} \right\} \rightarrow 7i_2 = 14A \rightarrow i_2 = 2A$$

$$I = 10A$$

then,

$$i_1 = 6A$$

$$i_{R_2} = I - i_1 = 10A - 6A = 4A$$

$$i_{R_3} = i_2 = 2A$$

$$i_{R_4} = i_1 - i_2 = 2A$$

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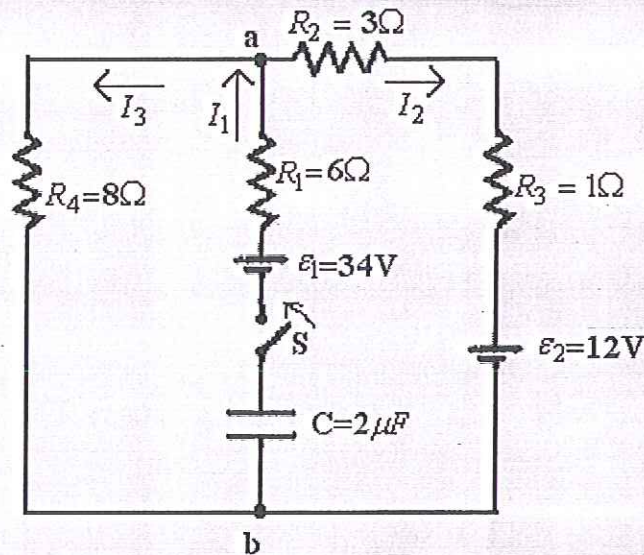
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Consider the circuit in the figure. The capacitor is initially uncharged and the switch S is closed at $t=0$. Find the currents I_1 , I_2 and I_3 long time after (t goes to infinity) the switch S is closed.



$$12 - 1I - 3I - 8I = 0 \rightarrow I = 1A, \quad I = I_3 = 1A$$

$$I_2 = -1A$$

$$I_1 = 0$$

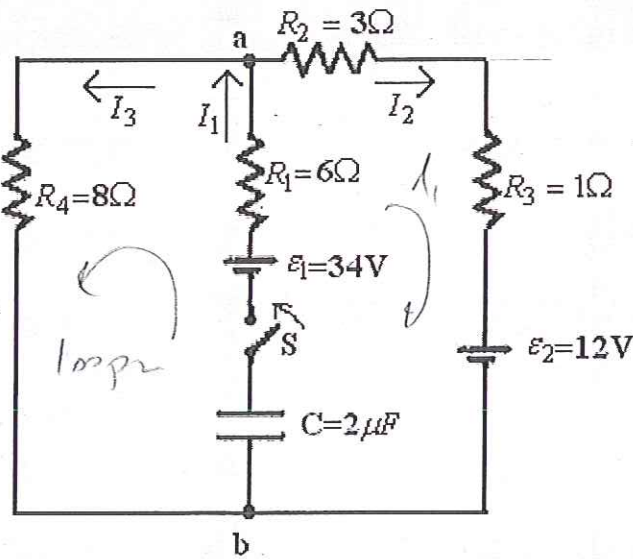
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Consider the circuit in given the figure. The capacitor is initially uncharged and the switch S is closed at $t=0$. Find the currents I_1 , I_2 and I_3 just after the switch S is closed.



$$i_1 = i_2 + i_3$$

loop1

$$-3I_2 - I_2 - 12 + 3I_1 - 6I_1 = 0$$

$$\rightarrow 6I_1 + 4I_2 = 22$$

loop2

$$3I_1 - 6I_1 - 8I_3 = 0 \rightarrow 3I_1 + 4I_3 = 17$$

$$6I_1 + 4I_2 = 22$$

$$+ 3I_1 + 4I_3 = 17$$

$$9I_1 + 4I_2 + 4I_3 = 39 \rightarrow 13i_1 = 39$$

$\begin{aligned} i_1 &= 3 \text{ A} \\ i_2 &= 1 \text{ A} \\ i_3 &= 2 \text{ A} \end{aligned}$

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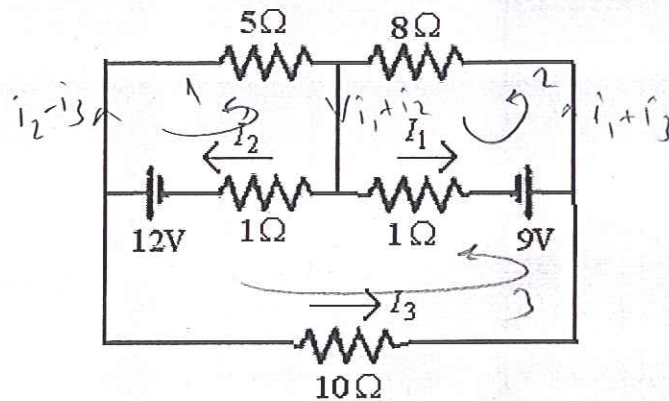
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Calculate the three currents I_1 , I_2 and I_3 indicated in the circuit diagram.



Loop 1
 $-12V + I_2 + (I_2 - I_3) 5 = 0 \rightarrow 6I_2 - 5I_3 = 12A \quad (1)$

Loop 2
 $-I_1 + 9 - (I_1 + I_3) 8 = 0 \rightarrow 8I_1 + 8I_3 = 9A \quad (2)$

Loop 3
 $-I_3 10 - 9V + I_1 - I_2 + 12 = 0 \rightarrow -I_1 + I_2 + 10I_3 = 3A \quad (3)$

(1) $\rightarrow I_2 = 2 + \frac{5}{6} I_3$

(2) $\rightarrow I_1 = 1 - \frac{8}{8} I_3$

Sub (1) into (3): $\frac{8}{3} I_3 + \frac{5}{6} I_3 + \frac{100}{10} I_3 = 2$

$\rightarrow I_3 = 0.171A$

$\rightarrow I_2 = 2.147A$

$\rightarrow I_1 = 0.68A$

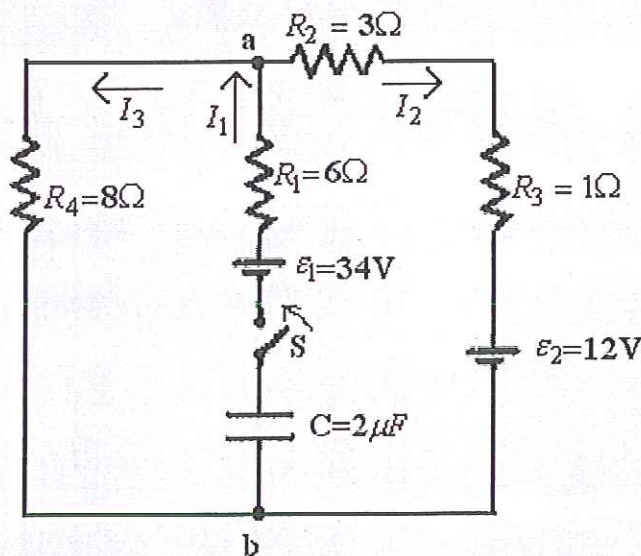
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Consider the circuit given in the figure. The capacitor is initially uncharged and the switch S is closed at $t=0$. Long time after (t goes to infinity) the switch S is closed, find the potential difference $V_a - V_b$. What is the maximum charge on the $2 \mu\text{F}$ capacitor?



as $t \rightarrow \infty$, no current through the switch

$$R_{eq} = R_3 + R_2 + R_4 = 12$$

$$i_3 = i = \frac{\epsilon_2}{R_{eq}} = \frac{12}{12} = 1 \text{ A}$$

$$V_a - i_3 R_4 = V_b \rightarrow V_a - V_b = 8 \text{ V}$$

capacitor must have $36 - 8 = 26 \text{ V}$

$$C = 2 \times 10^{-6} = \frac{q}{26} = 52 \times 10^{-6} \text{ C} = 52 \mu\text{C}$$