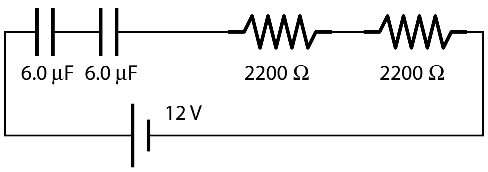
26 P 44 Two 6.0 μF capacitors, two 2.2 kΩ resistors, and a 12.0 V source are connected in series. Starting from the uncharged state, how long does it take for the current to drop from its initial value to 1.50 mA?



Replace the C's by equivalent value

$$\frac{1}{C_{\text{eff}}} = \frac{1}{6.0\,\mu\text{F}} + \frac{1}{6.0\,\mu\text{F}} \Rightarrow C_{\text{eff}} = 3.0\,\mu\text{F},$$

and the R's by equivalent value

$$R_{\text{eff}} = 2.2\,\text{k}\Omega + 2.2\,\text{k}\Omega = 4400\,\Omega.$$

The time constant is

$$R_{\text{eff}}C_{\text{eff}} = (3.0\times 10^{-6}\,\text{F})(4400\,\Omega) = 13.2\,\text{ms}$$

At the instant the current starts, the capacitors are uncharged, so the voltage drop is entirely across the resistors. Hence the initial value of the current is

$$I_0 = \frac{12\,\text{V}}{4400\,\Omega} = 2.727\,\text{mA}.$$

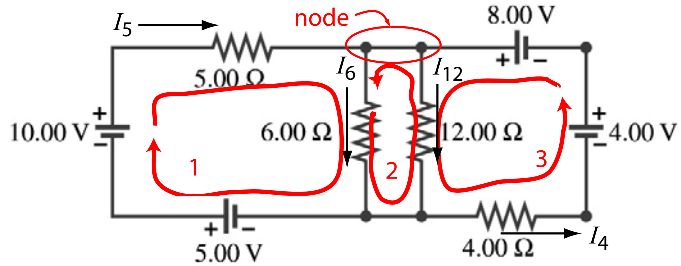
We must solve

$$\exp(-t/13.2\,\text{ms}) = \frac{1.50\,\text{mA}}{2.727\,\text{mA}} = 0.55.$$

The result is

$$t = 13.2\,\text{ms}\times\ln\left(\frac{1}{.55}\right) = 7.9\,\text{ms}$$

26 P 80 Determine the current in each resistor of the circuit shown in Fig. 26-57.



Each current is labelled by the resistor it flows through.

node: $I_5 + I_4 = I_6 + I_{12}$
loop 1: $5 + 10 - 5I_5 - 6I_6 = 0$
loop 2: $-6I_6 + 12I_{12} = 0$
loop 3: $4 + 8 - 12I_{12} - 4I_4 = 0$

The node equation is determined by looking at the oval region marked "node;" the current flowing in must be equal to the current flowing out.

From loop 2, we see that $I_6 = 2I_{12}$, so we can eliminate I_6 in the node equation and in loop 1. Rearranging gives

node: $I_5 + I_4 = 3I_{12}$
loop 1: $5I_5 + 12I_{12} = 15$
loop 3: $4I_4 + 12I_{12} = 12$

Now solve for I_4 from the second form of the node equation and substitute into loop 3:

loop 1: $5I_5 + 12I_{12} = 15$
loop 3: $4(3I_{12} - I_5) + 12I_{12} = 24I_{12} - 4I_5 = 12$

Now it's easy to solve for I_5 and I_{12}:

$$I_5 = 1.286\,\text{A}, \quad I_{12} = 0.714\,\text{A}.$$

Substitute back to get

$$I_4 = 0.857\,\text{A}, \quad I_6 = 1.429\,\text{A}.$$