7.1 The switch in the circuit in Fig. P7.1 has been closed for a long time before opening at $t = 0$.

a) Find $i_1(0^-)$ and $i_2(0^-)$.

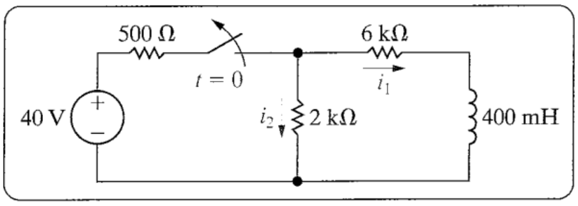
b) Find $i_1(0^+)$ and $i_2(0^+)$.

c) Find $i_1(t)$ for $t \geq 0$.

d) Find $i_2(t)$ for $t \geq 0^+$.

e) Explain why $i_2(0^-) \neq i_2(0^+)$.

Figure P7.1



7.3 The switch shown in Fig. P7.3 has been open a long time before closing at $t = 0$.

a) Find $i_o(0^-)$.

b) Find $i_L(0^-)$.

c) Find $i_o(0^+)$.

d) Find $i_L(0^+)$.

e) Find $i_o(\infty)$.

f) Find $i_L(\infty)$.

g) Write the expression for $i_L(t)$ for $t \geq 0$.

h) Find $v_L(0^-)$.

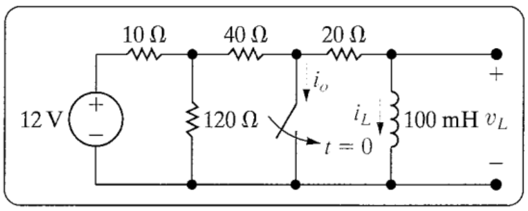
i) Find $v_L(0^+)$.

j) Find $v_L(\infty)$.

k) Write the expression for $v_L(t)$ for $t \geq 0^+$.

l) Write the expression for $i_o(t)$ for $t \geq 0^+$.

Figure P7.3



7.4 In the circuit in Fig. P7.4, the voltage and current expressions are

$$v = 400e^{-5t} \text{ V}, \quad t \geq 0^+;$$

$$i = 10e^{-5t} \text{ A}, \quad t \geq 0.$$

Find

a) R.

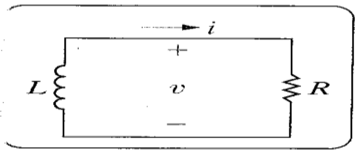
b) τ (in milliseconds).

c) L.

d) the initial energy stored in the inductor.

e) the time (in milliseconds) it takes to dissipate 80% of the initial stored energy.

Figure P7.4



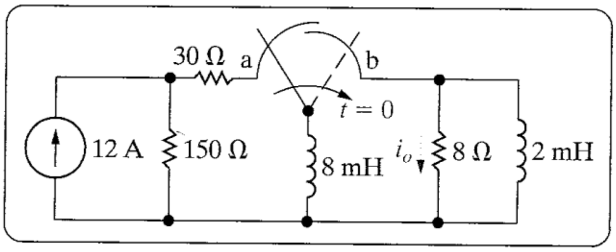
7.8 **P** In the circuit shown in Fig. P7.8, the switch has been in position a for a long time. At $t = 0$, it moves instantaneously from a to b.

a) Find $i_o(t)$ for $t \geq 0$.

b) What is the total energy delivered to the 8 Ω resistor?

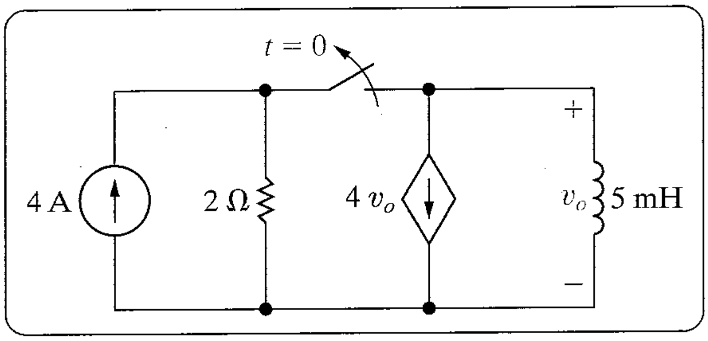
c) How many time constants does it take to deliver 95% of the energy found in (b)?

Figure P7.8



7.13 The switch in the circuit in Fig. P7.13 has been closed for a long time before opening at $t = 0$. Find $v_o(t)$ for $t \geq 0^+$.

Figure P7.13



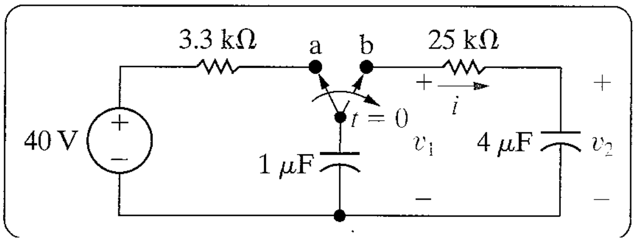
7.21 The switch in the circuit in Fig. P7.21 has been in position a for a long time. At $t = 0$, the switch is thrown to position b. Calculate

a) i, v_1, and v_2 for $t \geq 0^+$.

b) the energy stored in the capacitor at $t = 0$.

c) the energy trapped in the circuit and the total energy dissipated in the 25 kΩ resistor if the switch remains in position b indefinitely.

Figure P7.21



7.23 In the circuit in Fig. P7.23 the voltage and current expressions are

$$v = 48e^{-25t}\ \text{V}, \qquad t \geq 0;$$

$$i = 12e^{-25t}\ \text{mA}, \qquad t \geq 0^{+}.$$

Find

a) R.

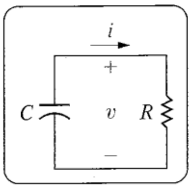
b) C.

c) τ (in milliseconds).

d) the initial energy stored in the capacitor.

e) the amount of energy that has been dissipated in the resistor 60 ms after the voltage has begun to decay.

Figure P7.23

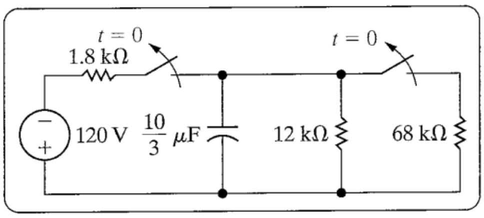


7.25 In the circuit shown in Fig. P7.25, both switches operate together; that is, they either open or close at the same time. The switches are closed a long time before opening at $t = 0$.

a) How many microjoules of energy have been dissipated in the 12 kΩ resistor 12 ms after the switches open?

b) How long does it take to dissipate 75% of the initially stored energy?

Figure P7.25

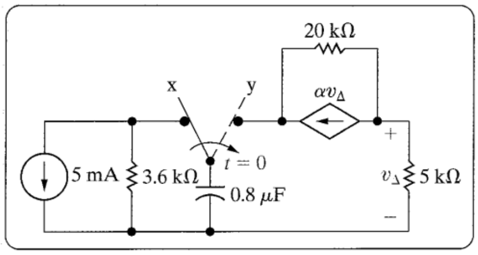


7.26 The switch in the circuit seen in Fig. P7.26 has been in position x for a long time. At $t = 0$, the switch moves instantaneously to position y.

a) Find α so that the time constant for $t > 0$ is 40 ms.

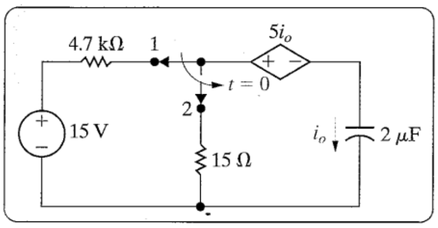
b) For the α found in (a), find v_Δ.

Figure P7.26



28 The switch in the circuit in Fig. P7.28 has been in position 1 for a long time before moving to position 2 at $t = 0$. Find $i_o(t)$ for $t \geq 0^+$.

Figure P7.28



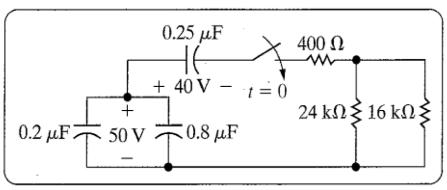
7.29 At the time the switch is closed in the circuit in Fig. P7.29, the voltage across the paralleled capacitors is 50 V and the voltage on the 0.25 μF capacitor is 40 V.

a) What percentage of the initial energy stored in the three capacitors is dissipated in the 24 kΩ resistor?

b) Repeat (a) for the 400 Ω and 16 kΩ resistors.

c) What percentage of the initial energy is trapped in the capacitors?

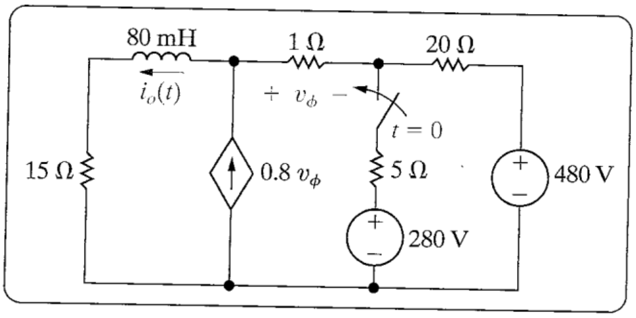
Figure P7.29



7.39 The switch in the circuit in Fig. P7.39 has been open a long time before closing at $t = 0$. Find $i_o(t)$ for $t \geq 0$.

P

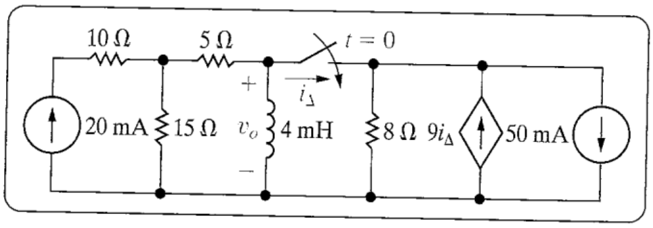
Figure P7.39



7.40 The switch in the circuit in Fig. P7.40 has been open a long time before closing at $t = 0$. Find $v_o(t)$ for $t \geq 0^+$.

P

Figure P7.40



7.48 The switch in the circuit shown in Fig. P7.48 has been closed a long time before opening at $t = 0$. For $t \geq 0^+$, find

a) $v_o(t)$.

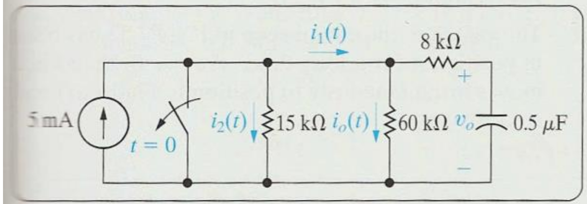
b) $i_o(t)$.

c) $i_1(t)$.

d) $i_2(t)$.

e) $i_1(0^+)$.

Figure P7.48



7.49 The current and voltage at the terminals of the capacitor in the circuit in Fig. 7.21 are

$$i(t) = 3e^{-2500t} \text{ mA}, \quad t \geq 0^+;$$

$$v(t) = (40 - 24e^{-2500t}) \text{ V}, \quad t \geq 0.$$

a) Specify the numerical values of I_s, V_o, R, C, and τ.

b) How many microseconds after the switch has been closed does the energy stored in the capacitor reach 81% of its final value?

7.50 The switch in the circuit in Fig. P7.50 has been in position x for a long time. The initial charge on the 10 nF capacitor is zero. At $t = 0$, the switch moves instantaneously to position y.

a) Find $v_o(t)$ for $t \geq 0^+$.

b) Find $v_1(t)$ for $t \geq 0$.

Figure P7.50