wdg

ECE 301
H/W #5
Fall 2006

(1) You are given the circuit of Figure 1.

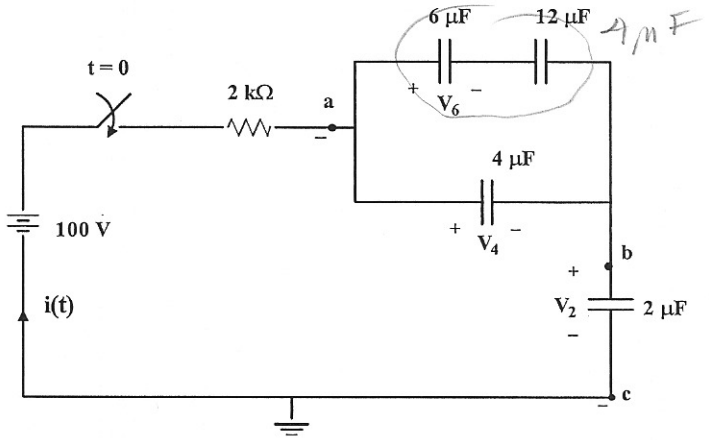
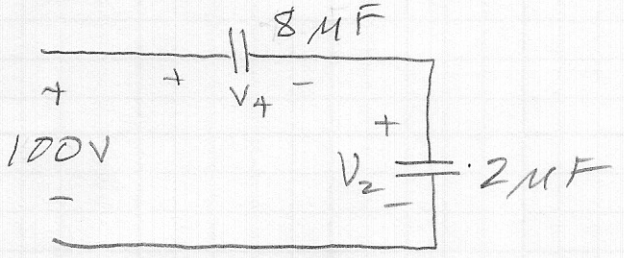


Figure 1: Circuit for problem 1.

(a) Find the steady state voltages, V_2, V_4 and V_6. Ans: 80 V, 20 V and 13.33 V.
(b) Find the value of $i(\infty)$, that is, the steady state value of i(t). Ans: on your own
(c) Find the value of $i(0^+)$. Explain your answer. Ans: 50 mA

(a) Circuit Reduces to



$$V_2 = \frac{100 \times 8\,\mu F}{2\,\mu F + 8\,\mu F} = 80\,V$$

$$\therefore \quad V_4 = 20\,V$$

$$V_6 = \frac{20 \times 12\,\mu F}{12\,\mu F + 6\,\mu F} = 13.33\,V$$

(1) (b) Find $i(\infty)$

Circuit looks like open circuit in steady state. $\therefore$

$$\boxed{i(\infty) = 0}$$

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

Capacitors look like short ckt at $t = 0^+$.

$\therefore$

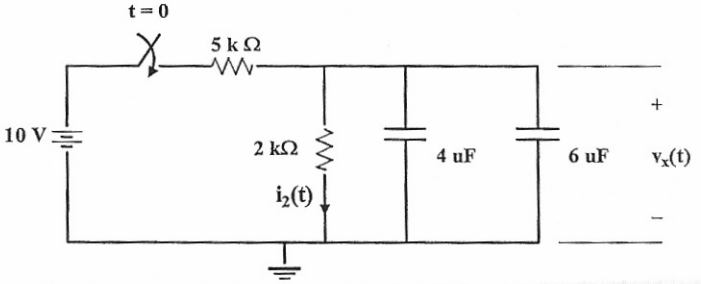
$$\boxed{i(0^+) = \frac{100}{2K} = 50\ mA}$$

(2) For the circuit of Figure 2.

(a) Determine the steady state voltage, v_x. Ans: On your own

(b) Determine $v_x(0^+)$. On your own.

(c) Determine $i_2(0^+)$ (explain your answer). Ans: 0



(a) capacitors look like an open ckt at $t=\infty$

$$\therefore V_x(\infty) = \frac{10 \times 2K}{2K+5K}$$

$$\boxed{V_x(\infty) = 2.86\ V}$$

(b) capacitors look like an short circuit at $t=0^+$

$$\therefore \boxed{V_x(0^+) = 0\ V}$$

(c) Since $V_x(0^+) = 0$

$$\boxed{i_2(0^+) = 0}$$

through 2kΩ

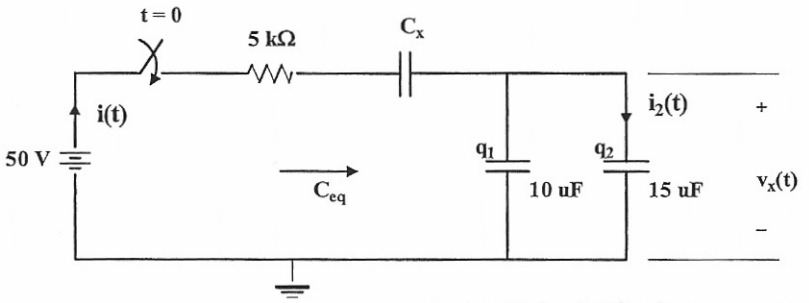
(3) You are given the circuit of Figure 3. It is known that $C_{eq} = 10\,\mu F$.

(a) Determine q_{eq}, q_1, and q_2 in steady state. Ans: $500\,\mu C$, $200\,\mu C$, $300\,\mu C$ 500 uC.

(b) Determine V_x in steady state. Ans: 20 V

(c) Determine $i_2(\infty)$. On your own

(d) Determine i(0^+). Explain your answer. Ans: 10 mA



(a) $C_{eq} = 10\mu F$

$\therefore \quad Q = CV \Rightarrow Q_{eq} = 10\mu F \times 50$

$Q_{eq} = 500\,\mu C$

(b) $V_x = \dfrac{Q_{eq}}{25\mu F} = \dfrac{500\,\mu C}{25\,\mu F} = 20\,V$

$Q_1 = 10\mu F \times 20\,V = 200\,\mu C$

$Q_1 = 200\,\mu C$

$Q_2 = 15\mu F \times 20\,V$

$Q_2 = 300\,\mu C$

(b) From the above $V_x = 20\,V$

(c) $t \to \infty$, capacitors look like an open ckt.

$\therefore \; i_2(\infty) = 0$

(d) initially ($t = 0^+$) capacitors look like shorts

$\therefore \; i(0^+) = \dfrac{50}{5k} = 10\,mA$

(4) You are given the circuit of Figure 4.

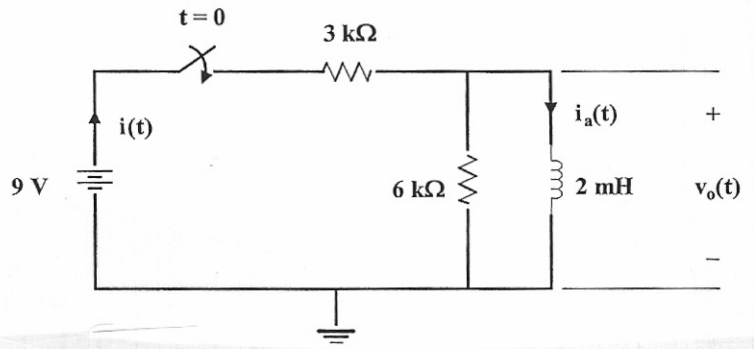
(a) Find $v_o(t)$ for $t = 0^+$. Ans: 6 V

(b) Find $v_o(\infty)$. Ans: On your own

(c) Find $i(0^+)$. 1 mA

(d) Find $i_a(0^+)$ Ans: On your own

(c) Find $i(\infty)$. Ans: On your own



(a) initially coil looks like open ckt.

$\therefore V_o(t) = \frac{9 \times 6k}{6k + 3k} = 6\ V$

(b) in steady state, coil looks like short circuit.

$\therefore V_o(\infty) = 0$

(c) initially coil looks like an open

$\therefore i(0^+) = \frac{9}{9k} = 1\ mA$

(d) initially coil looks like open

$\therefore i_a(0^+) = 0$

(e) with coil as short as $t \to \infty$

$i(\infty) = \frac{9}{3k}$

$i(\infty) = 3\ mA$