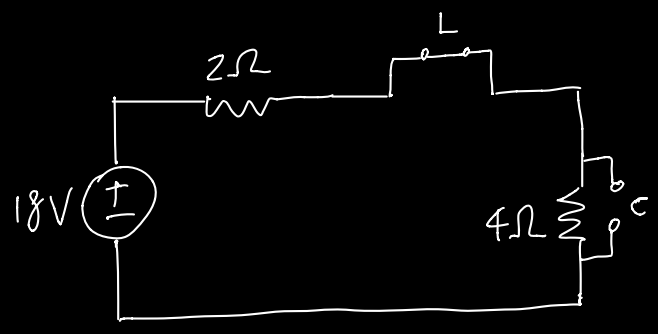
6.2

$t = 0^-$

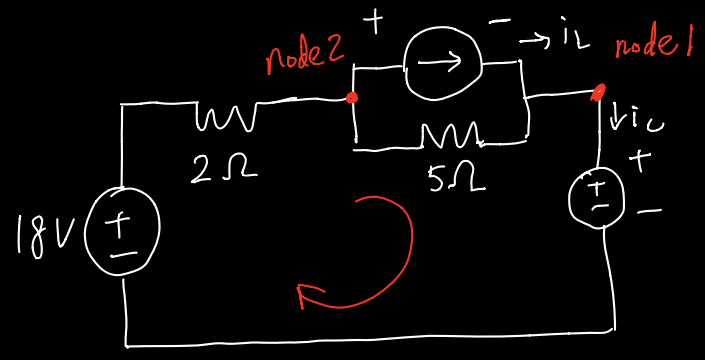


$i_L(0^-) = \frac{18}{2+4} = 3A$

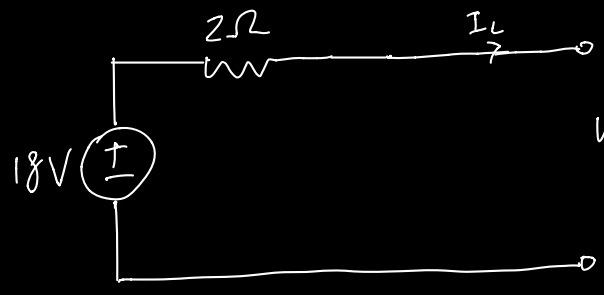
$V_C(0^-) = 18 \times \frac{4}{2+4}$

$= 12(V)$

$t = 0$



$t = \infty$



$i_L(\infty) = 0$ A

$V_C(\infty) = 18$ V

$$V_C(0) = V_C(0^-) = 12(V)$$

$$i_L(0) = i_L(0^-) = \frac{18}{2+4} = 3\,A$$

According to kcl at node 1: $i_L(0) + i_{5\Omega}(0) = i_C(0)$

where $i_{5\Omega}(0) = \frac{V_L(0)}{5\Omega}$

According to kcl at node 2: $\frac{V_{2\Omega}}{2} = i_L(0) + i_{5\Omega}(0)$

According to kvl: $-18 + V_{2\Omega} + V_L(0) + V_C(0) = 0$

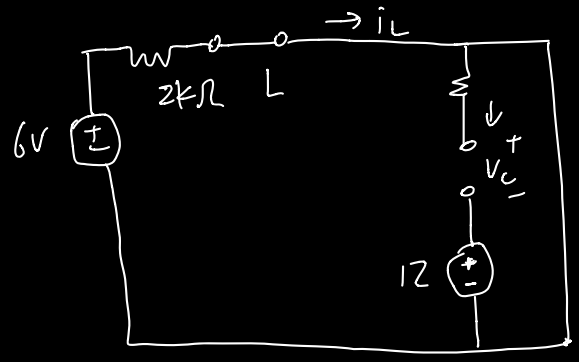
Using these 3 equations:

$$\begin{cases} 3 + \dfrac{V_L(0)}{5} = i_c(0) \\ \dfrac{V_{2\Omega}}{2} = 3 + \dfrac{V_L(0)}{5} \\ -18 + V_{2\Omega} + V_L(0) + 12 = 0 \end{cases} \Rightarrow \boxed{\begin{cases} V_L(0) = 0 \\ i_c(0) = 3 \end{cases}}$$

$$\boxed{\begin{aligned} V_c(\infty) &= 12\,(V) \\ i_L(\infty) &= 0\,(A) \end{aligned}}$$

6.3

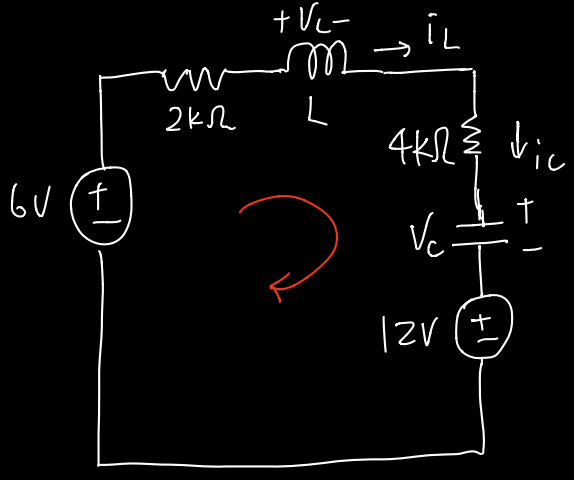
$t=0^-$



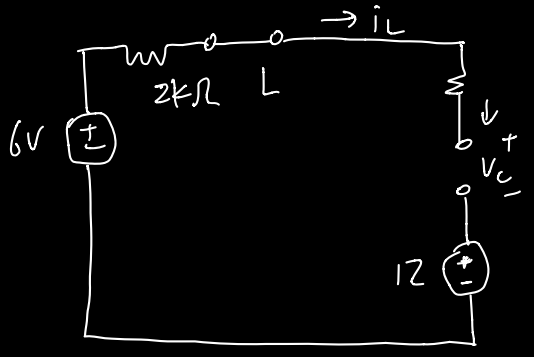
$V_c(0^-) = -12\ V$

$i_L(0^-) = \frac{6}{2k} = 3mA$

$t=0$



$t=\infty$



$V_c(0) = V_c(0^-) = \boxed{-12V}$

$i_L(0) = i_L(0^-) = \boxed{3mA}$

KVL: $-6 + 2k \times 3m + V_L(0) + 4k \cdot 3m - 12 + 12 = 0$

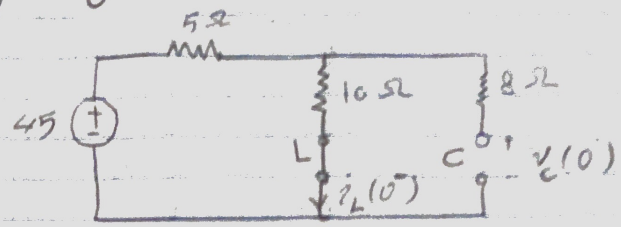
$\Rightarrow V_L(0) = \boxed{-12V}$

$i_C(0) = i_L(0) = \boxed{3mA}$

$V_c(\infty) = \boxed{-6V}$

$i_L(\infty) = \boxed{0\ A}$

6.4) At time $t = 0^-$, the capacitor acts as open circuit and the inductor as short circuit, because both are fully charged, thus at $t = 0^-$

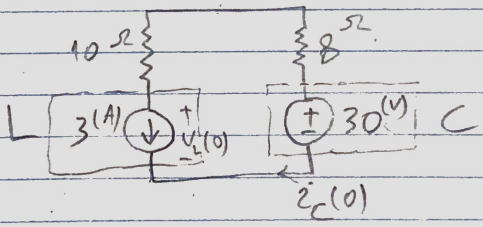


6.4_a) $$v_c(0) = v_c(0^-) = 45 \cdot \frac{10}{5+10} = 30 \ (V)$$

$$i_L(0) = i_L(0^-) = \frac{45}{5+10} = 3 \ (A)$$

6.4_b) At time $t = 0$ as we disconnect the power supply, the inductor acts as current power source and the capacitor acts as voltage power source:

at $t = 0$:



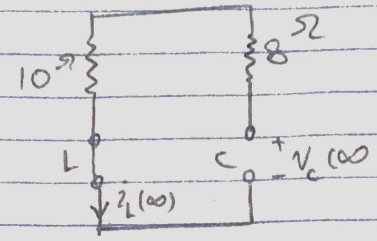
$$i_c(0) = -i_L(0) = -3 \ (A)$$

KVL: $$-v_L(0) - 3\times10 - 3\times8 + 30 = 0$$

$$\Rightarrow \quad v_L(0) = -24 \ (V)$$

6.4.c) At time $t = \infty$ both inductor and the capacitor are fully discharged. As, we do not have any power source thus,

at $t \to \infty$

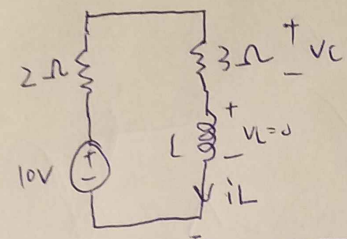


$$V_c(\infty) = 0$$

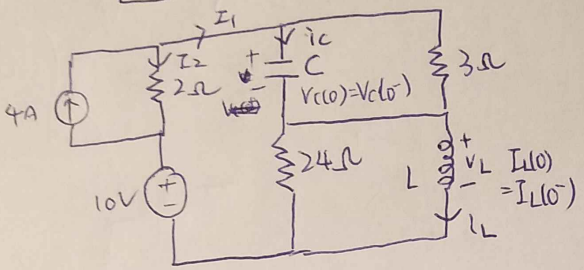
$$i_L(\infty) = 0$$

6.5

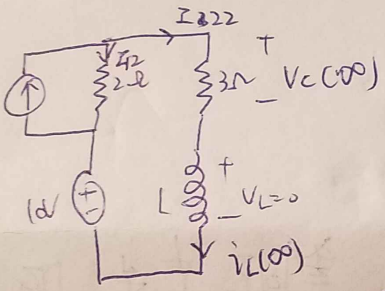
$t=0^-$



$t=0$



$t=\infty$



(a) $V_c(0)=V_c(0^-)=10V\times\frac{3\Omega}{3\Omega+2\Omega}=6V$

$i_L(0)=i_L(0^-)=\frac{10V}{3\Omega+2\Omega}=2A$

(b) $\begin{cases} 4A=I_1+I_2 \\ I_2\cdot 2\Omega+10V=V_c(0)+[I_1-i_L(0)]\cdot 24\Omega \end{cases} \Rightarrow \begin{cases} I_1=\frac{30}{13}A \\ I_2=\frac{22}{13}A \end{cases}$

$i_c(0)=I_1-\frac{V_c(0)}{3\Omega}=\frac{4}{13}A$ $\quad V_L(0)=[I_1-i_L(0)]\times 24\Omega=\frac{96}{13}V$

(c) $\begin{cases} 4A=I_{12}+I_{22} \\ I_{12}\times 2\Omega+10V=I_{22}\times 3\Omega \end{cases} \Rightarrow \begin{cases} I_{12}=\frac{2}{5}A \\ I_{22}=\frac{18}{5}A \end{cases}$

$V_c(\infty)=I_{22}\times 3\Omega=\frac{54}{5}V$

$i_L(\infty)=I_{22}=\frac{18}{5}A$