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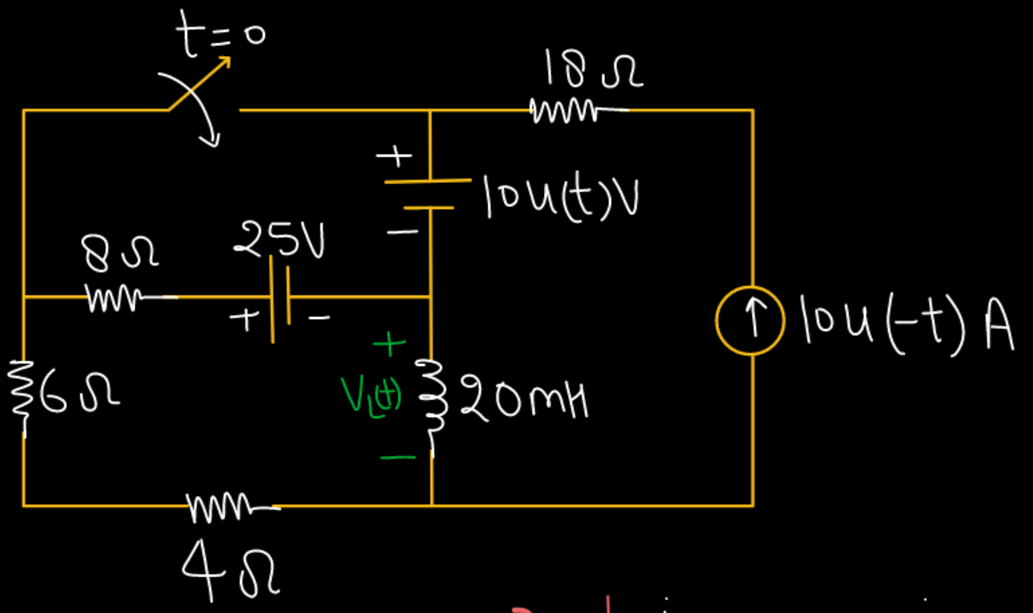
Ex

Draw the Response of Inductor's voltage and also determine Voltage across Inductor at t=0+



Soln: Draw $V_L(t)$; $[-\infty \le t \le \infty]$

$i_L(t)$; $[-\infty \le t \le \infty]$

$i_{6\Omega}(t)$; $[-\infty \le t \le \infty]$

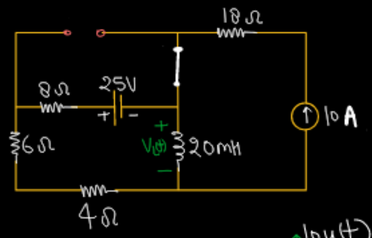
$i_{6\Omega}(-\infty)$, i_{L0^-}, $i_{L}(-\infty)$, i_{L0^+}

$i_L(\infty)$, $V_L(-\infty)$, V_{L0^-}, V_{L0^+},

$i_{6\Omega}(0^-)$, $i_{6\Omega}(0^+)$ - - —

Case ① $t \le 0^-$; $[-\infty \le t \le 0^-]$

At, $t = -\infty$, ckt will look like -

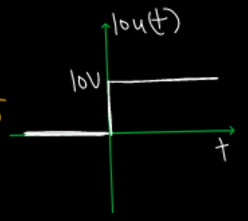


Switch ⇒ open.

⇒ $10u(t)$ ⇒ $10V, t \ge 0$

$0V, t \le 0^-$

$10u(t)$ V.S. will be S/C ; $t \le 0^-$

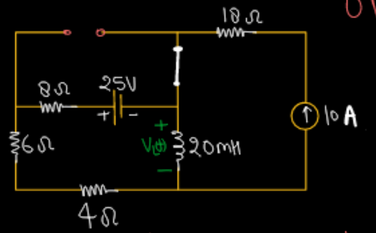


⇒ $10u(-t)$ C.S ⇒ $10A$; $t \le 0^-$

$0A$; $t > 0$

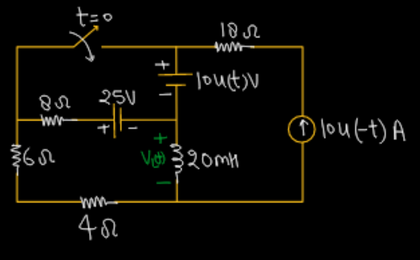
$10u(-t)$ Amp

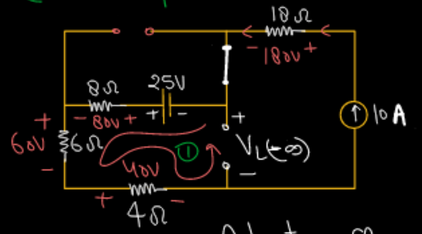
$t \le 0^-$ ⇒



At, $t = -\infty$, inductor will always be on O/C (DC ckt)

$\therefore i_L(-\infty) = 0$ Amp.





At, $t = -\infty$

KVL in mesh ①

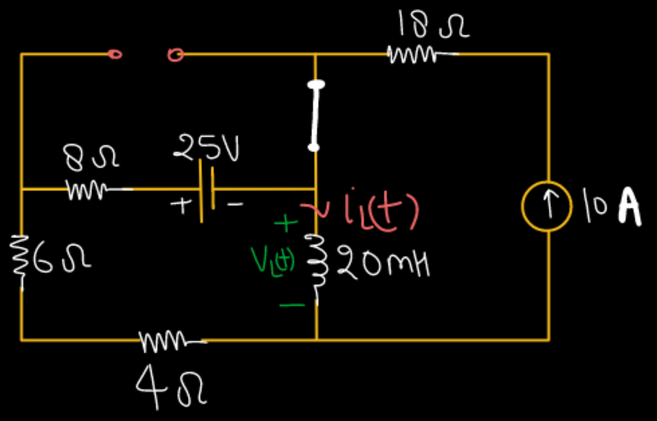
$-25 + 80 + 60 + 40 - V_L(-\infty) = 0$

$V_L(-\infty) = 155$ Volts

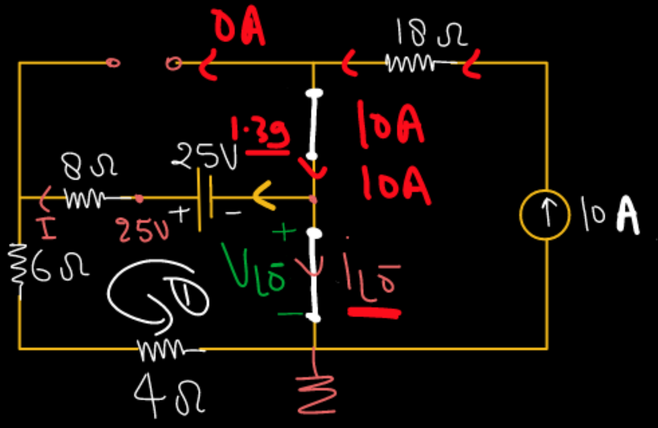
$\Rightarrow [-\infty \le t < 0^-] \Rightarrow$ transient.

in this period, inductor will energized.

$\therefore$ at, $t = 0^-$, Inductor will behave as a S/C.



At, $t = 0^-$, ckt will look like.



KVL in mesh ①

$-25 + 18I = 0$

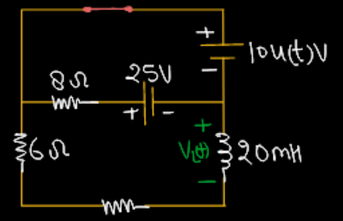
$\therefore I = \frac{25}{18}$ Amp

$= 1.39$ Amp.

$\therefore i_{L0^-} = 10 - 1.39 = 8.61$ Amp

Case (II) $t \geq 0$ $[0 \leq t \leq \infty]$

We know that, inductor doesn't allow sudden change of current.



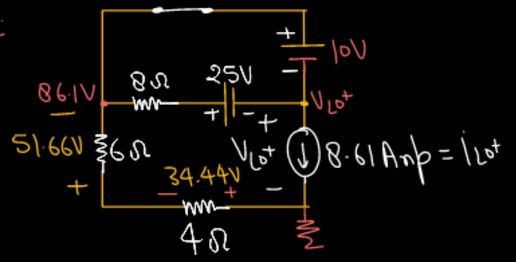
$i_{L0^-} = i_{L0^+} = 8.61$ Amp

$\Rightarrow$ switch is closed.

At, $t = 0^-$, a charged inductor will be S/C but At $t = 0^+$, it will not be a S/C.

Above ckt, At $t = 0^+$

$\Rightarrow$ D.C.C.C.S.



$\Rightarrow 86.1 - V_{L0^+} = 10$

$[V_{L0^+} = 76.1 \text{ Volts}]$

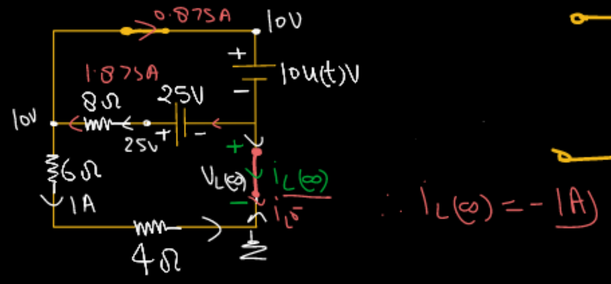
$V_{L0^-} = 0V$

$\Rightarrow i_{L0^-} = 8.61A = i_{L0^+}$

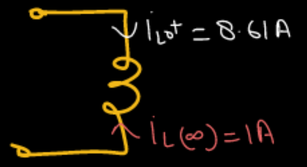
ex- $t \geq 0$, inductor

(a) will behave as a source.

(b) will behave as a load

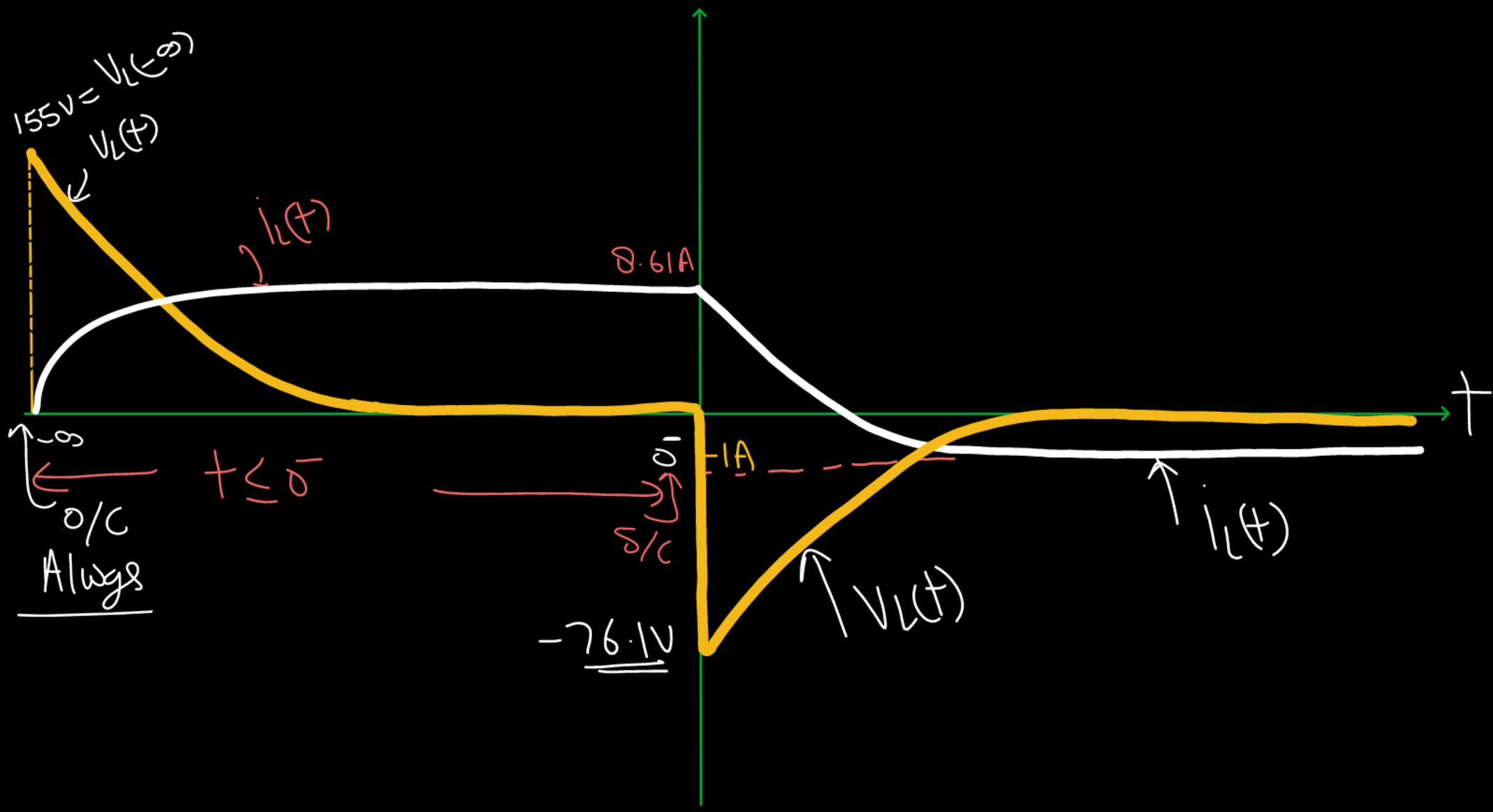


$\therefore i_{L(\infty)} = -1A$



$\Rightarrow$ Sources are present, so inductor will be S/C.

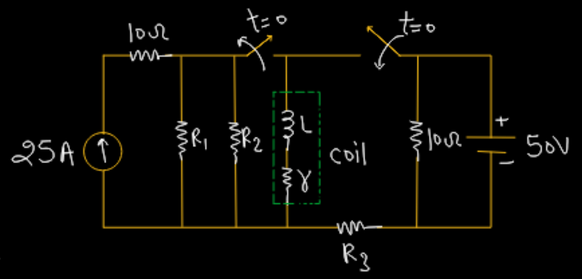
$\therefore V_{L(\infty)} = 0V$


155v = VL(-∞)
VL(t)
iL(t)
0.61A
t
-∞
t ≤ 0⁻
0/C
Always
0⁻
S/C
-1A
iL(t)
VL(t)
-76.1V

Ex

determine Voltage across coil at t=0+

if $R_1 = 10\Omega$
$R_2 = 20\Omega$
$R_3 = 40\Omega$
$L = 100mH$
$\gamma = 5\Omega$



Soln:- $t \le 0^-$

At, $t = 0^-$,

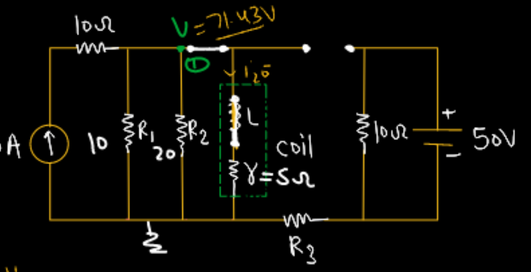
⇒ S/C

KCL at node ①

$\frac{V}{10} + \frac{V}{20} + \frac{V}{5} - 25 = 0$

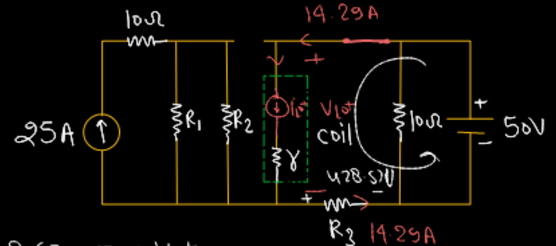
$0.35V = 25$

$V = 71.43$ Volts



$\therefore i_{L^0} = \frac{71.43}{5} = 14.29$ Amp $= i_{L^+}$

At, $t = 0^+$ -



$428.57 - 50 + V_{L^+} = 0$

$\therefore V_{L^+} = 378.57$ Volts

CAPACITOR