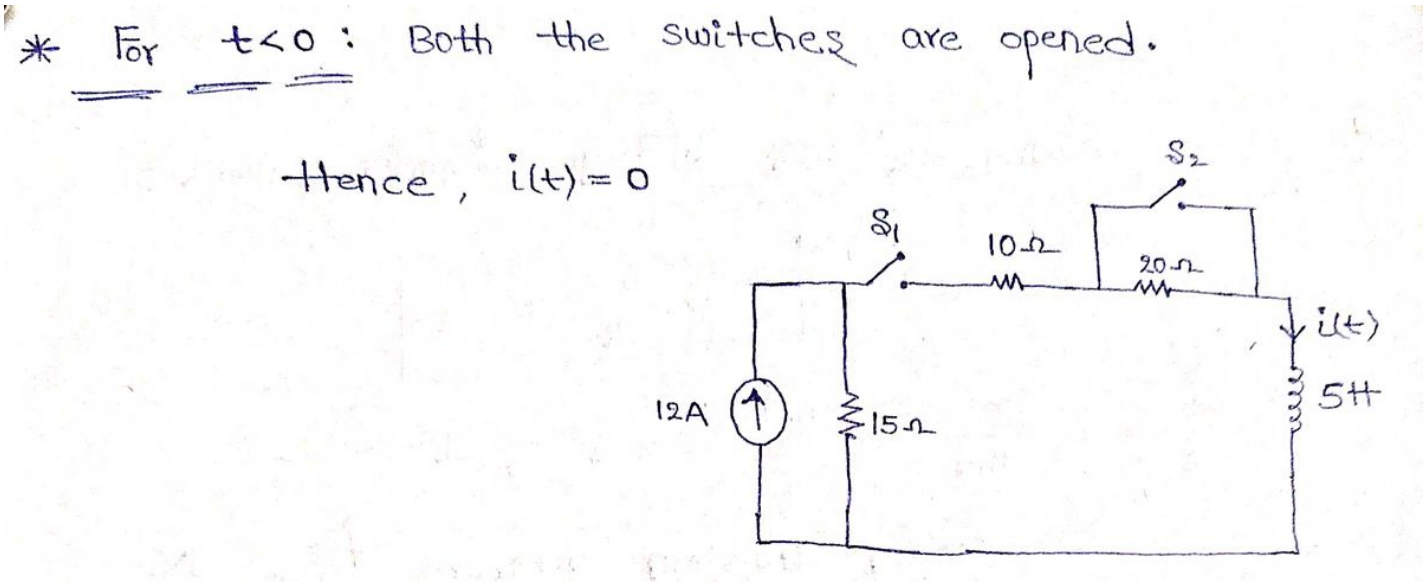
Answer

Step 1

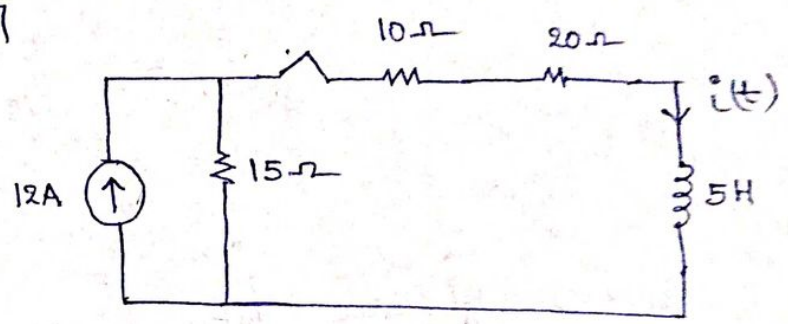


Step 2

* For $0 \le t \le 2$: only S_1 is closed.

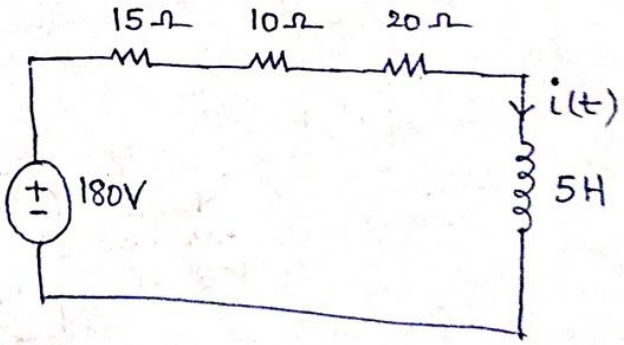
S_2 is OFF.

* For a first order R-L circuit.



⇩ Source Transformation

$$i(t) = \frac{V}{R}\left(1 - e^{\frac{-t}{\tau}}\right); \quad 0 \le t \le 2$$



$$\tau = \frac{L}{R} = \frac{5}{15+10+20}$$

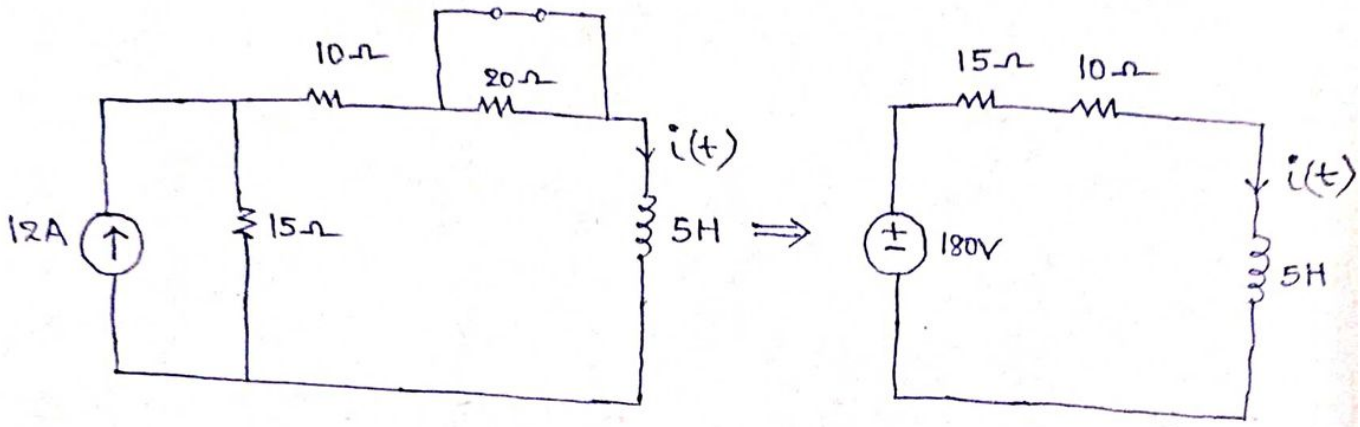
$$= \frac{1}{9} \text{ sec.}$$

$$\therefore \; i(t) = \frac{180}{45}\left(1 - e^{-9t}\right)$$

$$\boxed{i(t) = 4\left(1 - e^{-9t}\right); \quad 0 \le t \le 2}$$

Step 3

* For $t \geq 2$: The two switches are at closed positio



* Initial current, $i(2) = 4\left(1 - e^{-18}\right) \approx 4$ A.

* Final current, $i(\infty) = \frac{V}{15+10} = \frac{180}{25} = 7.2$ A.

{∵ Inductor acts as short circuit at steady state.}

$$\tau = \frac{L}{R} = \frac{5}{15+10} = \frac{1}{5} \text{ sec.}$$

$$\therefore \quad i(t) = 7.2 + \left[4 - 7.2\right] e^{-\left(\frac{t-2}{\tau}\right)} \quad ; \quad t \geq 2$$

$$= 7.2 - 3.2\, e^{-5(t-2)} \quad ; \quad t \geq 2$$

$$\therefore \quad i(t) = \begin{cases} 0 & , \quad t < 0 \\ 4\left(1 - e^{-9t}\right) & , \quad 0 \leq t \leq 2 \\ 7.2 - 3.2\, e^{-5(t-2)} & \end{cases}$$

$$\begin{cases} 7.2 - 3.2e^{(\quad)}, & t \geq 2 \end{cases}$$

$\therefore \quad i(1) = 4\left(1 - e^{-9}\right) = \underline{3.9995\,A}$

$$i(3) = 7.2 - 3.2\,e^{-5(3-2)} = \underline{7.1784\,A}$$