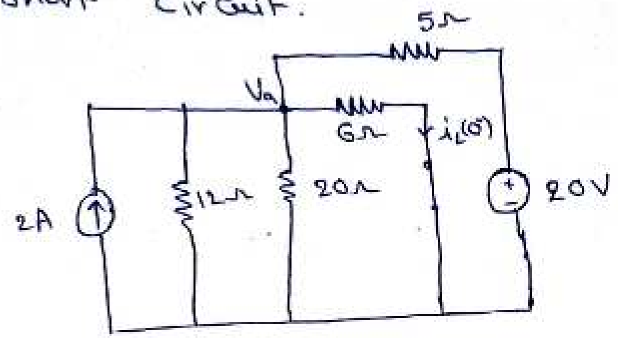
Answer

from $t=-\infty$ to $t=0^-$ switch is closed, inductor acts as short circuit.



Apply nodal analysis at 'V_a'

$$-2+\frac{V_a}{12}+\frac{V_a}{20}+\frac{V_a}{6}+\frac{V_a-20}{5}=0$$

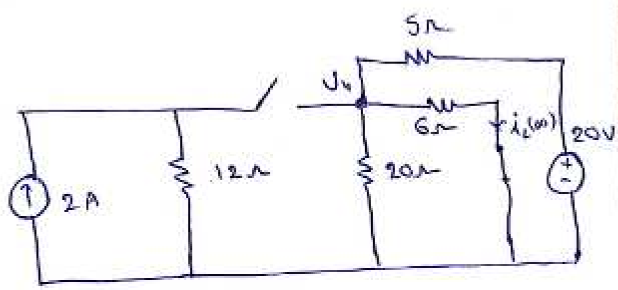
$$V_a\left[\frac{1}{12}+\frac{1}{20}+\frac{1}{6}+\frac{1}{5}\right]=6$$

$$\boxed{V_a=12V}$$

$$\therefore i_L(0^-)=i_L(0^+)=\frac{V_a}{6}=\frac{12}{6}$$

$$\boxed{i_L(0^+)=2A}$$

at $t=0$ switch is open, at $t=\infty$ inductor acts as short circuit.



Apply nodal analysis at 'V_b'

$$\frac{V_b}{20}+\frac{V_b}{6}+\frac{V_b-20}{5}=0$$

$$V_b\left[\frac{1}{20}+\frac{1}{6}+\frac{1}{5}\right]=4$$

$\boxed{V_b = 9.6V}$

$\therefore i_L(\infty) = \frac{V_b}{6} = 1.6A.$

for $t>0$

$$\therefore i_L(t) = i_L(\infty) + [i_L(0^+) - i_L(\infty)]\, e^{-t/\tau}$$

$$\tau = \frac{L}{R_{eq}}$$

$$R_{eq} = 6 + (20 \parallel 5) = 6 + \frac{20 \times 5}{20+5}$$

$$R_{eq} = 10\,\Omega$$

$$\tau = \frac{0.5}{10} = 0.05 \text{ sec}$$

$$\therefore i_L(t) = 1.6 + (2-1.6)\, e^{-t/0.05} \text{ A}$$

$$i_L(t) = (1.6 + 0.4 e^{-20t}) \text{ A}$$

$$\therefore V_L(t) = L \frac{di_L(t)}{dt}$$

$$= 0.5 \frac{d}{dt}(1.6 + 0.4 e^{-20t})$$

$$\boxed{V_L(t) = -4 e^{-20t} \text{ V}} \quad t>0$$

Likes: 3 **Dislikes: 0**