Answer

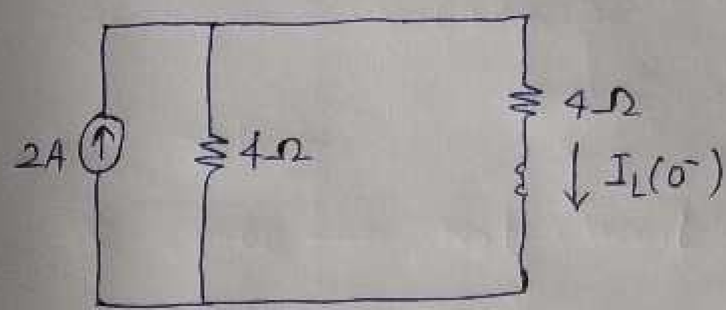
ANSWER :

GIVEN THAT :

at $t = 0^-$ (steady state)

switch is open

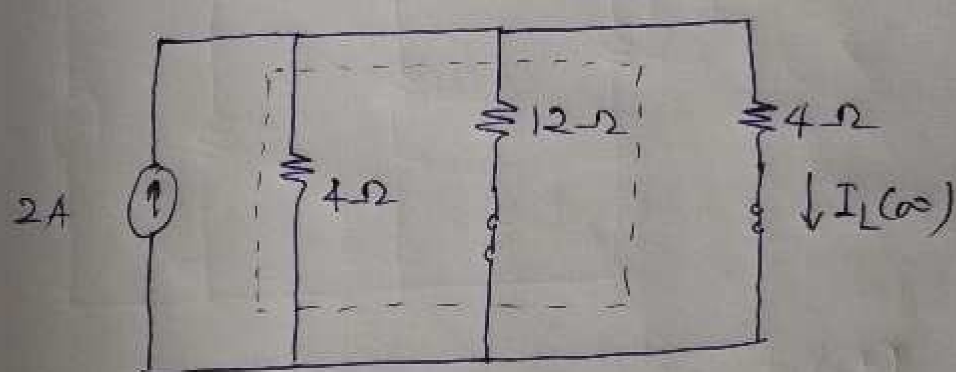
Inductor → short circuit   short



$$I_L(0^-) = I_L(0^+) = 2 \times \frac{4}{4+4} = 1A \quad \left[\begin{array}{c}\text{current}\\ \text{divison}\end{array}\right]$$

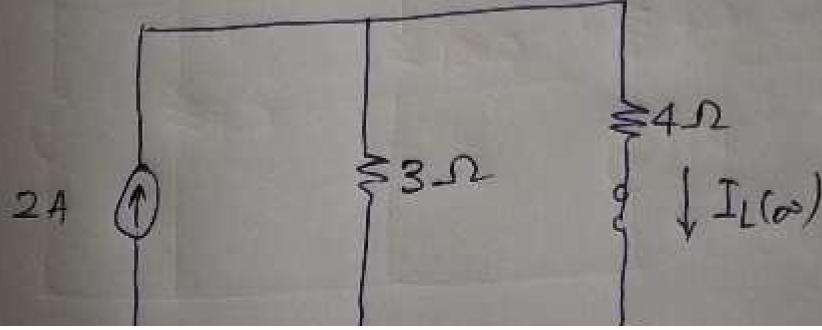
At $t = \infty \Rightarrow$ switch is ON

Inductor → short circuit



$$4 \parallel 12 = \frac{4 \times 12}{4+12} = 3\Omega$$

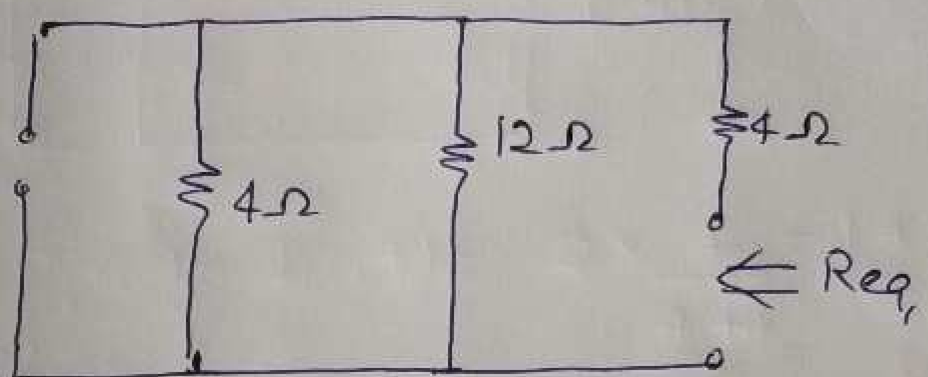
↳ in parallel



$$I_L(\infty) = 2 \times \frac{3}{3+4} = 2 \times \frac{3}{7} = \frac{6}{7}\ A$$

$$\tau = \text{time constant} = \frac{L}{R_{eq}}$$

R_{eq}:



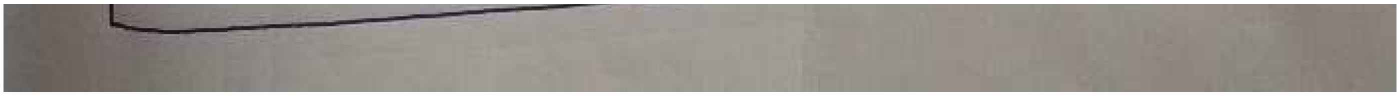
$$R_{eq} = [4 \,\|\, 12] + 4 = \left[\frac{4 \times 12}{4+12}\right] + 4$$

$$= 7\,\Omega$$

$$i(t) = I_L(\infty) + \left[I_L(0^+) - I_L(\infty)\right] e^{-t/\tau}$$

$$= \frac{6}{7} + \left[1 - \frac{6}{7}\right] e^{-t \times \frac{7}{3.5}}$$

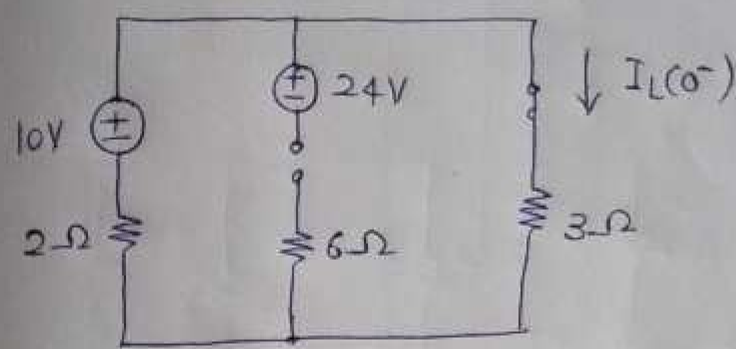
$$\boxed{\therefore\ i(t) = \frac{6}{7} + \frac{1}{7} e^{-2t} \ ;\ t \geq 0}$$



b) At $t = 0^-$ (steady state)

switch → open

Inductor → short circuit

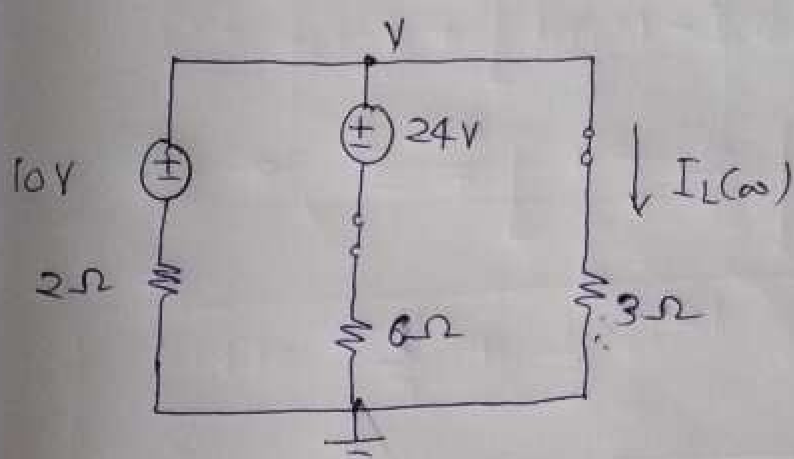


$$I_L(0^-) = I_L(0+) = \frac{10}{5} = 2A$$

At $t = \infty$ (steady state)

switch → close

Inductor → short circuit



KCL at Node - V

$$\frac{V-10}{2} + \frac{V-24}{6} + \frac{V}{3} = 0$$

$$V = \frac{10}{2} + \frac{24}{6} = 9V$$

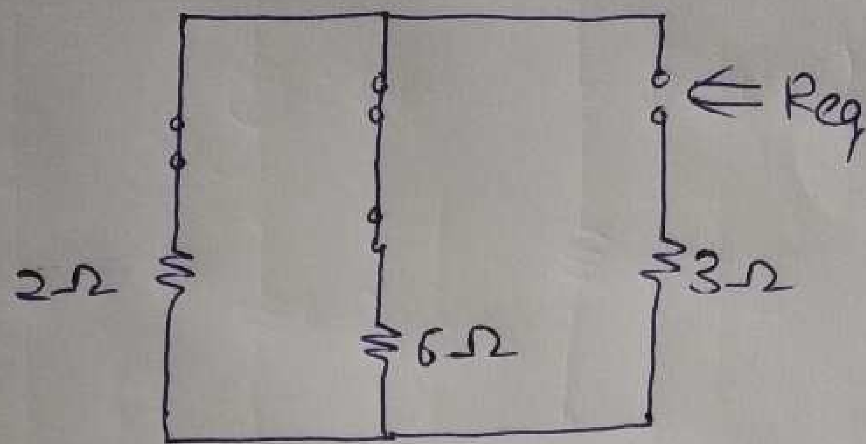
$I_L(\infty) = 9 = 3A$

3

$$i(t) = I_L(\infty) + [I_L(0^+) - I_L(\infty)]e^{-t/\tau}$$

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

R_{eq}:



$$R_{eq} = 3 + [2 \| 6]$$

$$= 3 + \left[\frac{2 \times 6}{2+6}\right] = \frac{9}{2}$$

$$\tau = \frac{2}{9/2} = 2 \times \frac{2}{9} = \frac{4}{9}$$

$$\boxed{i(t) = 3 + [2-3]e^{-\frac{9}{4}t} \; ; t \geq 0}$$

Likes: 3 **Dislikes: 0**