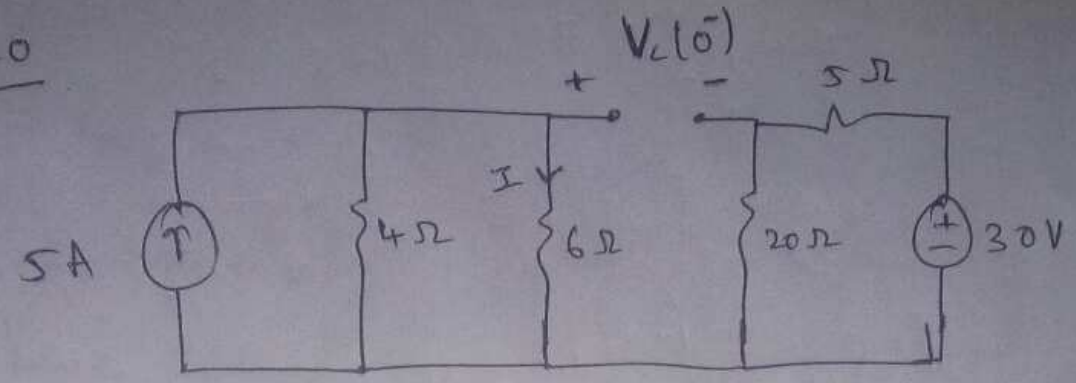
Answer

$t<0$



In steady state for $t<0$ Capacitor will be open Circuited.

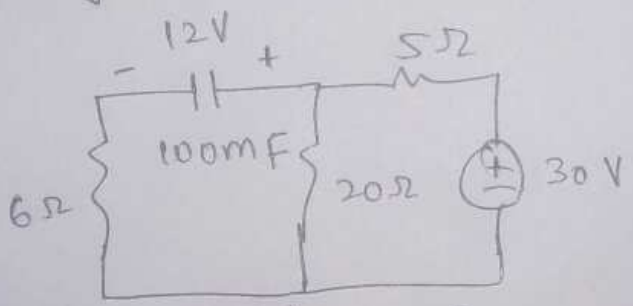
$$I = 5\left(\frac{4}{4+6}\right) = 2\ A \qquad V_+ = = 6I = 6\times 2 = 12V$$

$$V_- = 30\left(\frac{20}{20+5}\right) = 24V$$

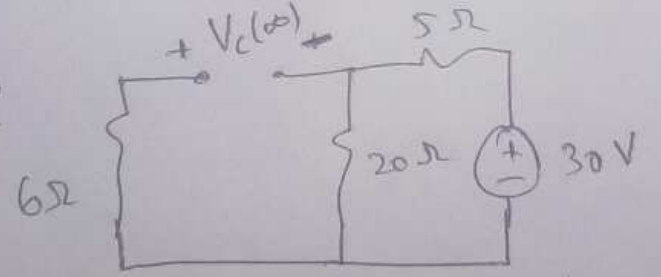
$$V_c(0^-) = V_{+-} = V_+ - V_- = 12-24 = -12\ V$$

As Capacitor Cannot change its Voltage instataneosly $\therefore V_c(0^+) = V_c(0^-) = -12V$

$t>0$



At $t\to\infty$



Again in steady state at $t\to\infty$ C is opened

$$= 30\left(\frac{20}{\quad}\right) = -24V$$

$$V_c(\infty) = -30\left(\frac{20}{20+5}\right)$$

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

$$= -24 + [-12 + 24]\, e^{-t/\tau}$$

$$V_c(t) = 12\left(-2 + e^{-t/\tau}\right) V$$

$\tau = R_{eq} C$

R_{eq} is equivalent resistance seen from open circuited capacitor with all sources nullified

$$R_{eq} = 6 + 20 \| 5 = 6 + \frac{20 \times 5}{20+5} = 10\,\Omega$$

~~$V_c(t) = 12\left(-2 + e^{-t/10}\right) V$~~

$$\tau = 10\left(100 \times 10^{-3}\right) = 1 \text{ sec}$$

$$V_c(t) = 12\left(-2 + e^{-t/1}\right) V$$

$$\boxed{V_c(t) = -24 + 12\, e^{-t}\ V} \quad \text{for } t > 0$$

Likes: 0 **Dislikes: 1**