Today Topic

Questions session

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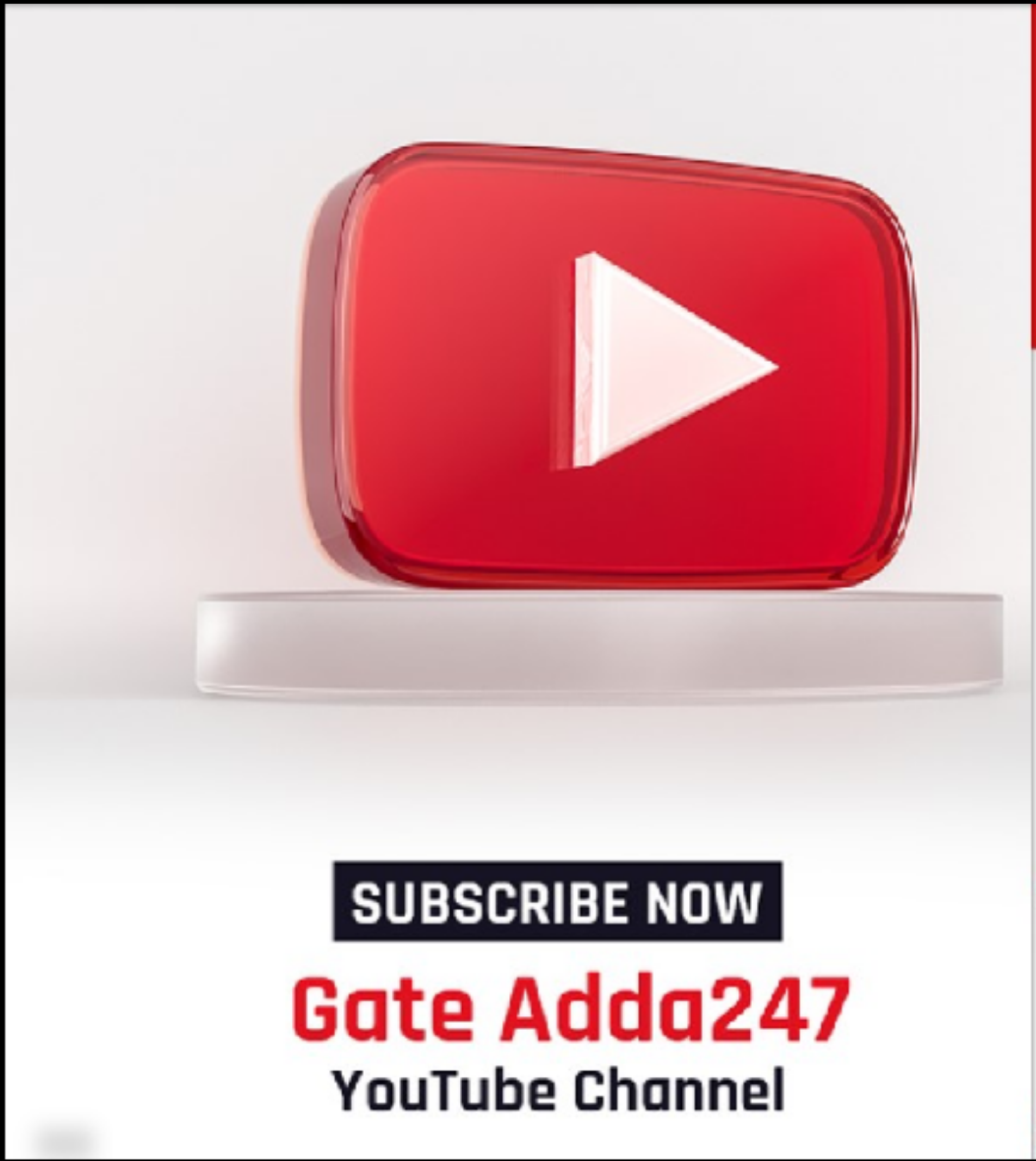
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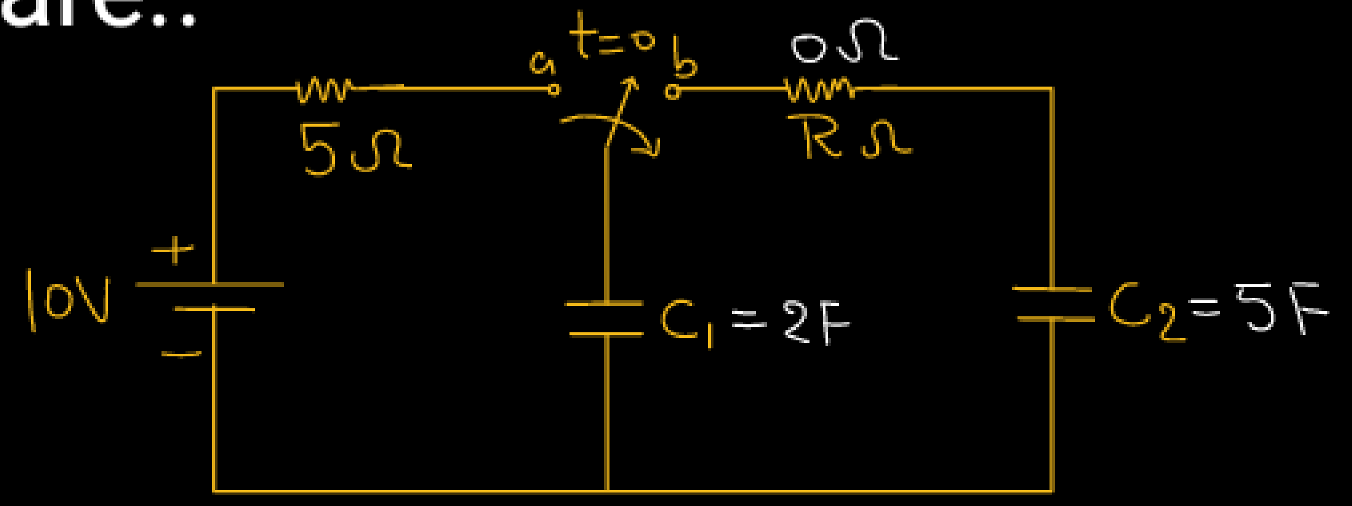
Ex-1 The Steady State voltage across both Capacitor are..

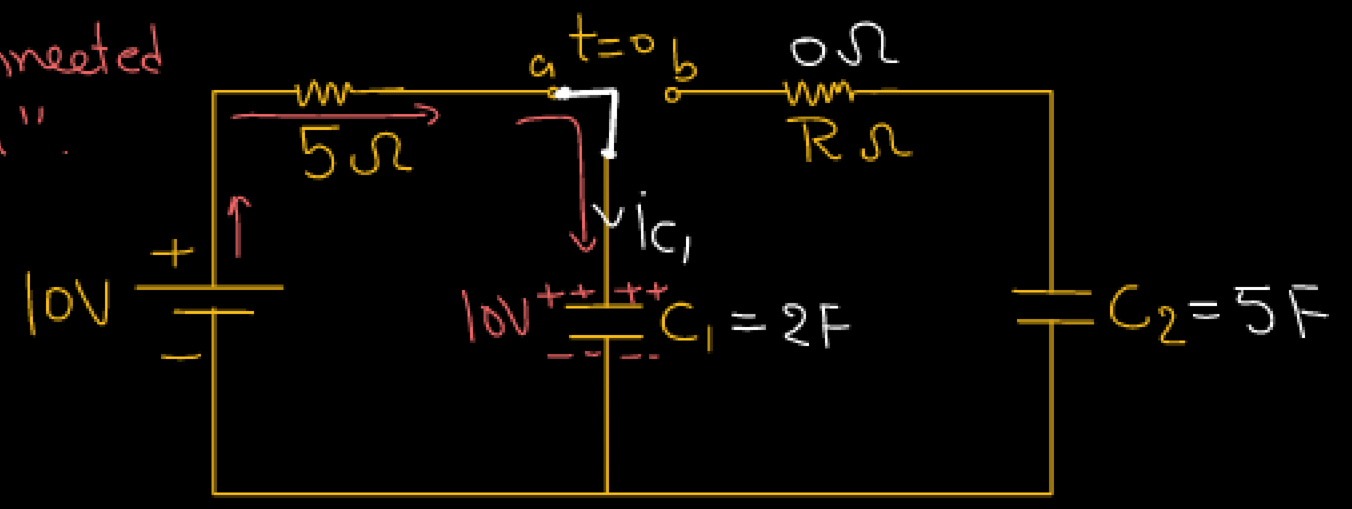


Solⁿ: Determin initial Vol. of both cap.

case ① $t \le 0^-$; $-\infty \le t \le 0^-$

Switch is connected at point "a".

* here, cap- C_2 will not charge.



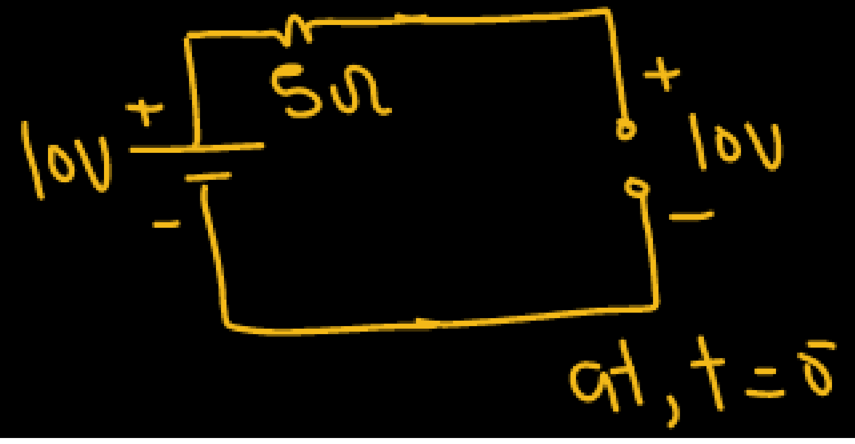
$V_{C_2} = 0V, \; -\infty \le t \le 0^-$

⇒ cap. C_1 will charge, due to excitation of 10V D.C. Vol. supply.

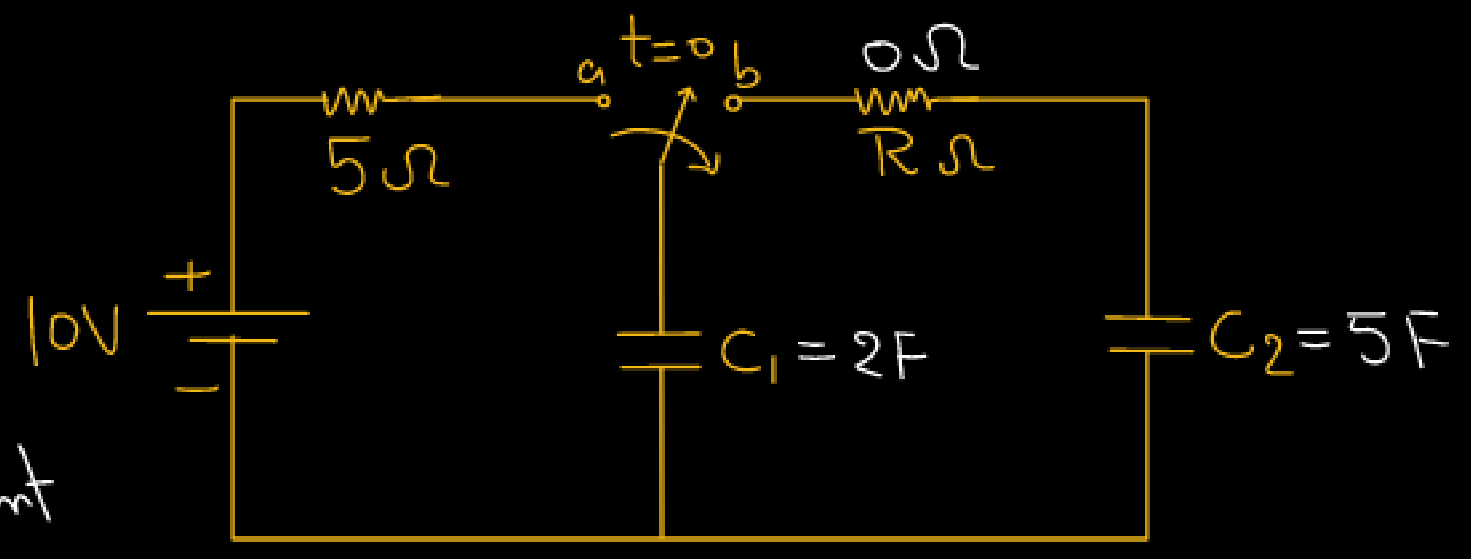
So, at $t = 0^-$, cap. will reach into S.S. and will maintain 10V.

$\therefore V_{C_1 0^-} = 10V$

$V_{C_2 0^-} = 0V$



Case (II) $t \geq 0$



We know that –

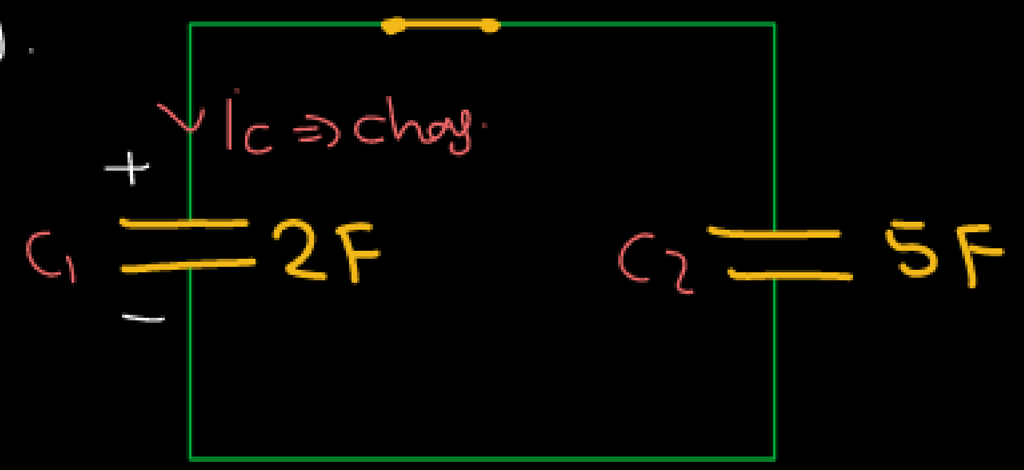
$V_c(t^-) = V_c(t^+)$;

but when cap. current is not impulsive

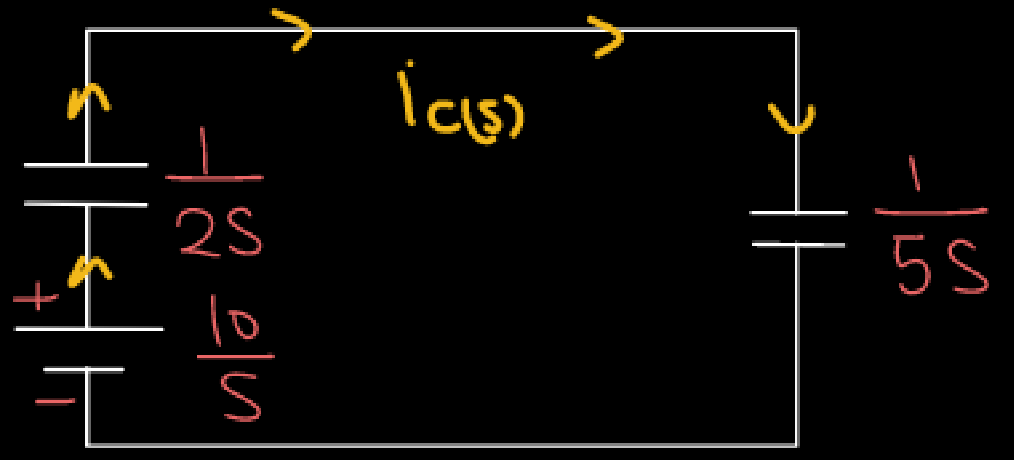
⇒ Now, switch is connected with point "b"

$V_{C10^-} = 10V$, $V_{C20^-} = 0V$.

ckt in freq. domain.



By KVL:-



$$\frac{10}{S} = I_{c(s)}\left(\frac{1}{2S} + \frac{1}{5S}\right)$$

$$\frac{10}{S} = I_{c(s)}\left[\frac{5+2}{10S}\right]$$

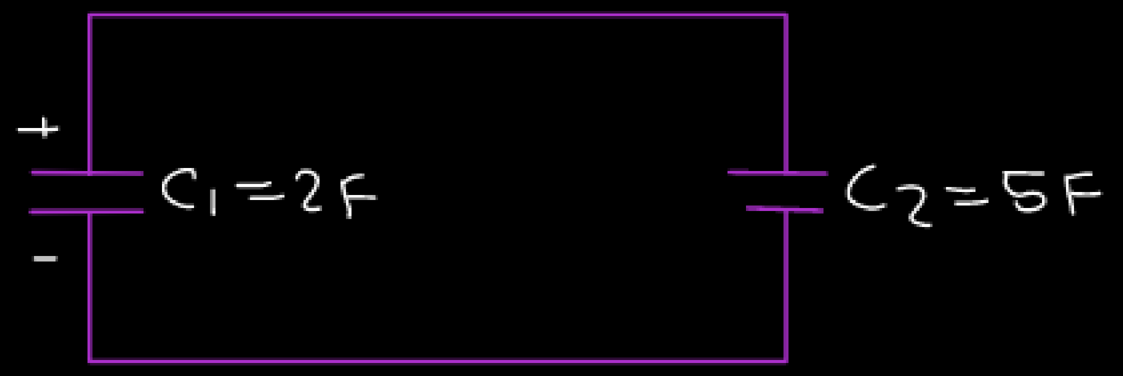
$$\frac{10}{\cancel{S}} = I_{c(s)}\left[\frac{0.7}{\cancel{S}}\right]$$

$$\therefore I_{c(s)} = \frac{10}{0.7} = \frac{100}{7} = 14.2857$$

take inv. lap. trfm.

$$\boxed{i_c(t) = 14.2857\,\delta(t)}$$

$i_c(t) = 14.2857\,\delta(t)$ Amp.



$V_{C_1 0^-} = 10V \qquad V_{C_2 0^-} = 0V$

$$V_{C_2} = \frac{1}{C}\int_{-\infty}^{t} i_c(t)\,dt$$

$$V_{C_2} = \frac{1}{C_2}\int_{0}^{t} i_c(t)\,dt$$

$$V_{C_2} = \frac{1}{5}\int_{0}^{t=0^+} 14.2857\,\delta(t)\,dt$$

$$= \left(\frac{14.2857}{5}\right)\left[\int_{0}^{0^+} \delta(t)\,dt = 1\right]$$

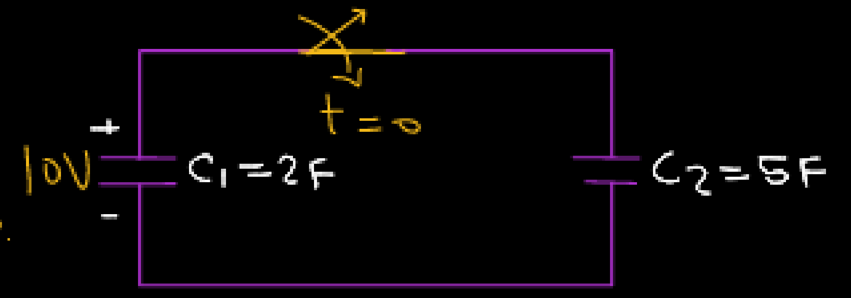
$$= 2.857 \text{ Volts}$$

$V_{C_2 0^-} = 0V$ but $V_{C_2 0^+} = 2.857$ Volts $; t \geq 0$

$[V_{C_2}(t) = 2.857\,u(t)$ Volts

(11) $V_{C_1}(t)\ ;\ t \geq 0$

$i_c(t) = 14.2857\,\delta(t)$ Amp.



⇒ By KVL ⇒ $V_{C_1}(t) = V_{C_2}(t) = 2.857\,u(t)$

$V_{C_1 0^-} = 10V,\ V_{C_1 0^+} = 2.857V$

method ⇒

$$V_{C_1}(t) = \frac{1}{C_1}\int_{-\infty}^{t} i_c(t)\,dt \Rightarrow$$

$$V_{C_1}(t) = \underbrace{\frac{1}{C_1}\int_{-\infty}^{0^-} i_c(t)\,dt\Big|_{t\leq 0^-}}_{V_{C_1 0^-}} + \underbrace{\frac{1}{C_1}\int_{0}^{t} i_c(t)\,dt\Big|_{t\geq 0}}$$

$$= 10 + \frac{1}{2}\int_{0}^{t} -14.2857\,\delta(t)\,dt$$

$$= 10 + \frac{1}{2}(-14.2857)\left[\int_{0}^{0^+} \delta(t)\,dt = 1\right]$$

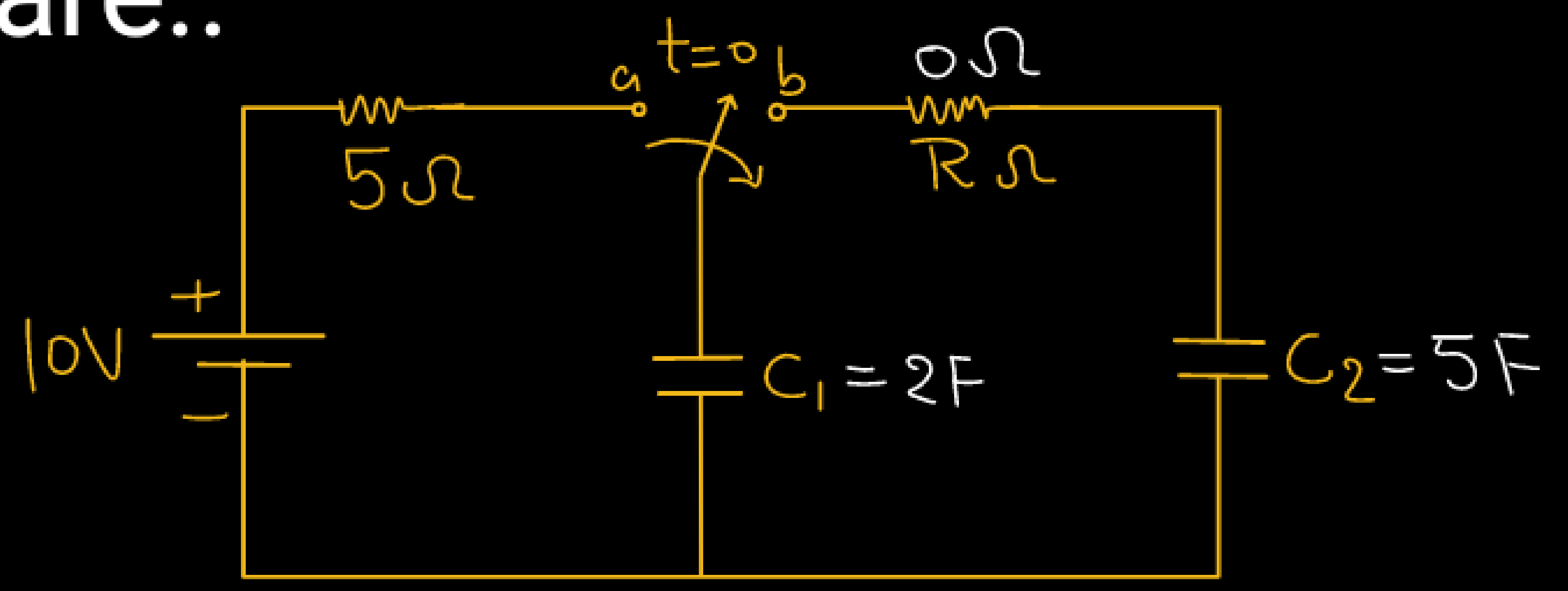
$$V_{C_1}(t) = 2.857\,u(t)$$

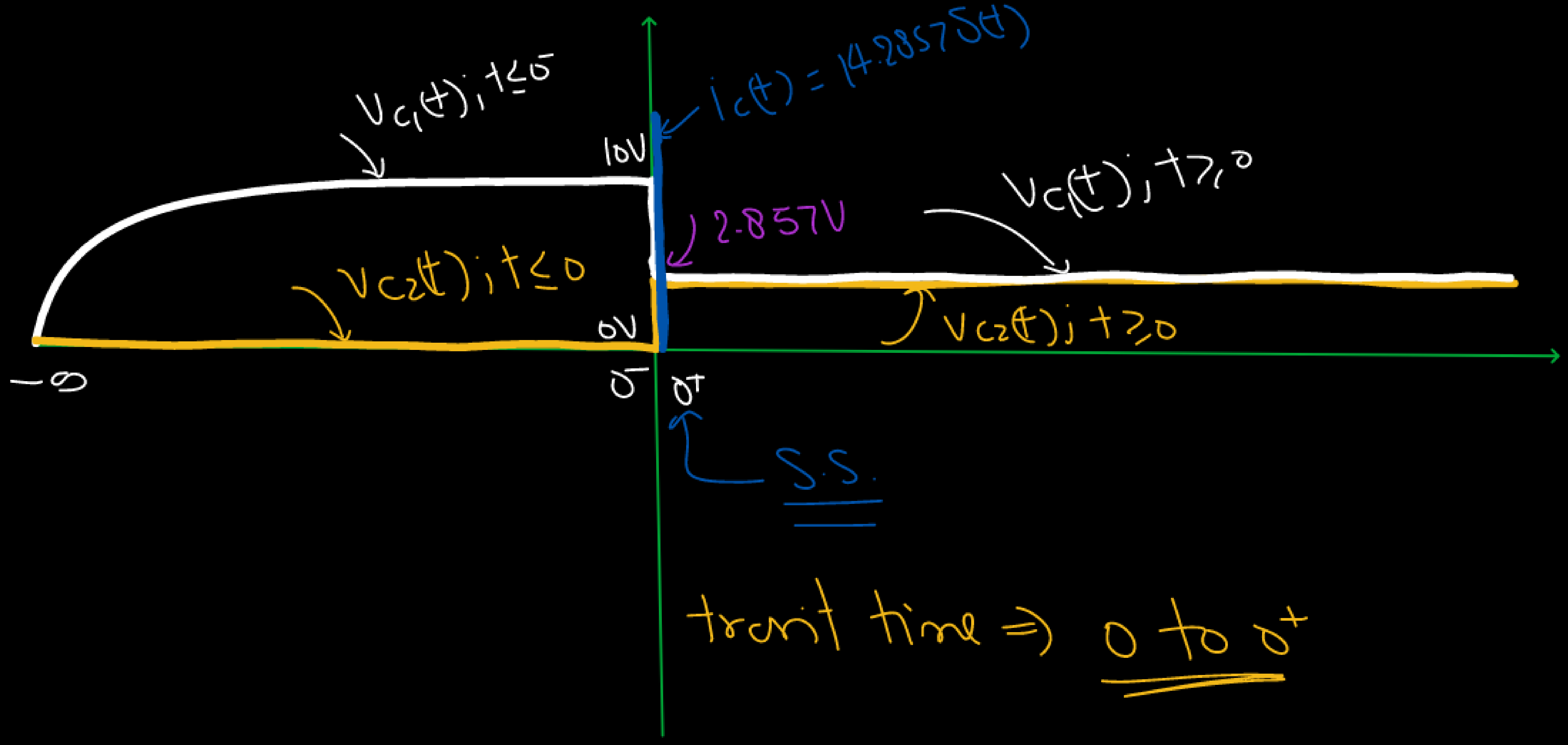
⇒ $V_{C_1 0^-} = 10V,\ V_{C_1 0^+} = 2.857V.$

$V_{C_2 0^-} = 0V,\ V_{C_2 0^+} = 2.857V$

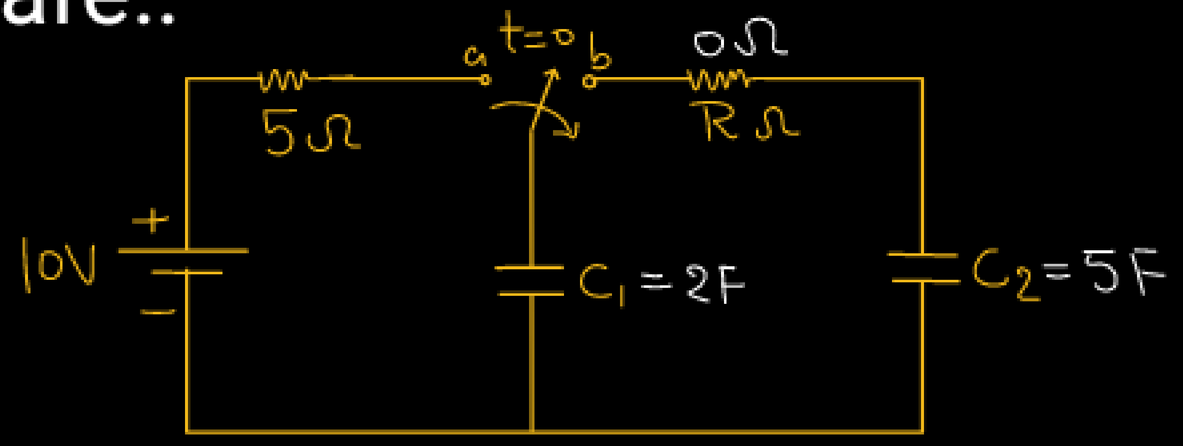
} b/z cap. is passing impulsive current.

Ex-1 The Steady State voltage across both Capacitor are..





Ex-1 The Steady State voltage across both Capacitor are..



$\Rightarrow V_{C_1 0^-} = 10V$, $W_{C_1 0^-} = \frac{1}{2} C_1 V_{C_1 0^-}^2$

$= \frac{1}{2} \times 2 \times 10^2 = 100J$

$\Rightarrow W_{C_1 0^+} = \frac{1}{2} C_1 V_{C_1 0^+}^2 = \frac{1}{2} \times 2 \times 2.857^2$

$= 8.16J$

$\Rightarrow W_{C_2 0^+} = \frac{1}{2} \times 5 \times 2.857^2 = 20.41J$

$\Rightarrow W_{C_1 0^+} + W_{C_2 0^+} = 28.57J$

$\Rightarrow$ energy loss in S/W $\rightarrow$ $100 - 28.57$

$= 71.4J$

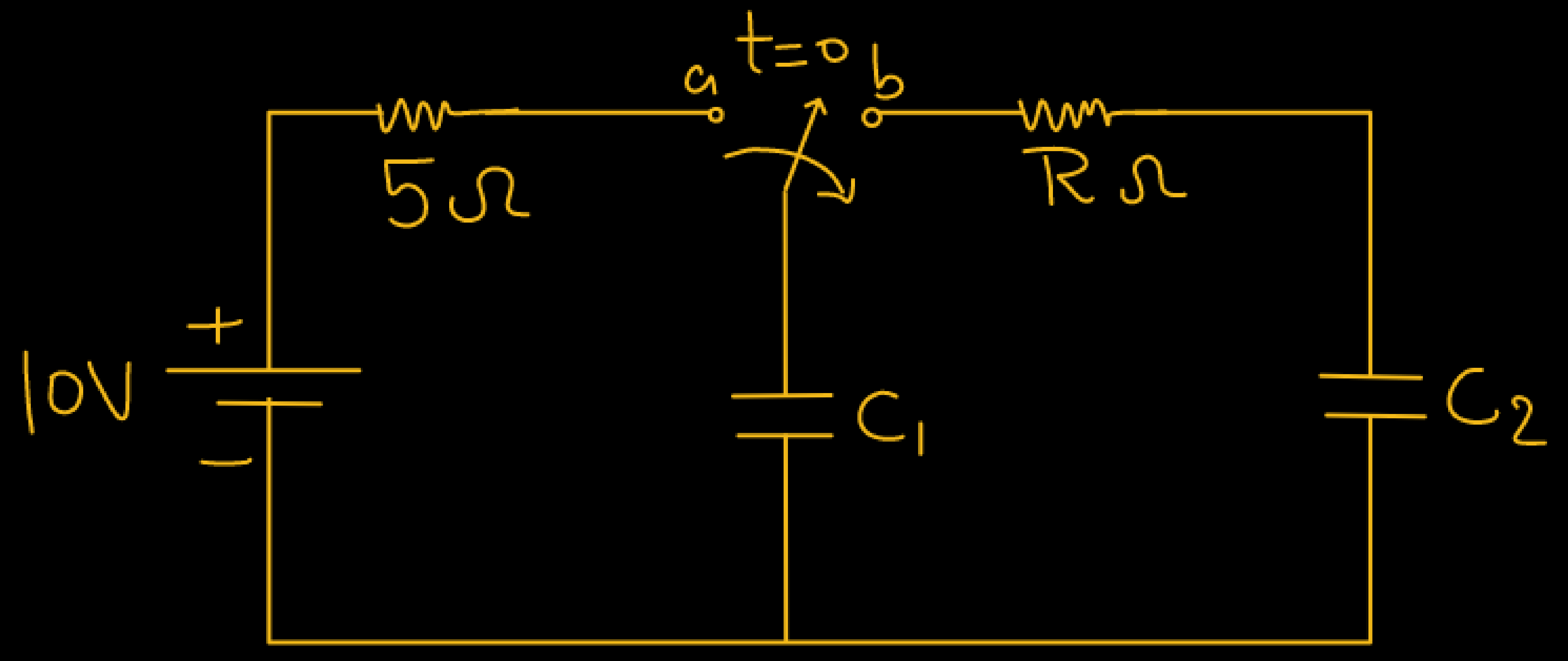
Ex-2

The Steady State voltage across both Capacitor and energy dissipated by resistance in Steady State will be

$R = 10\Omega$

$C_1 = 2F$

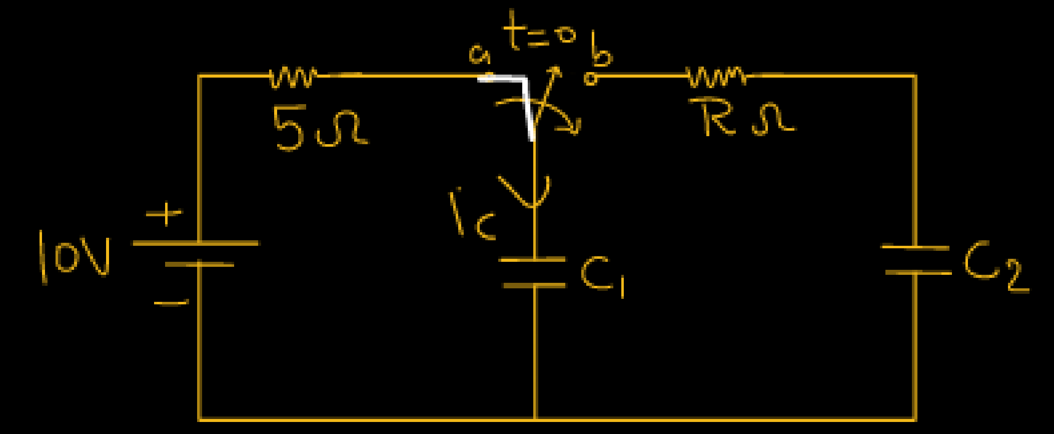
$C_2 = 5F$



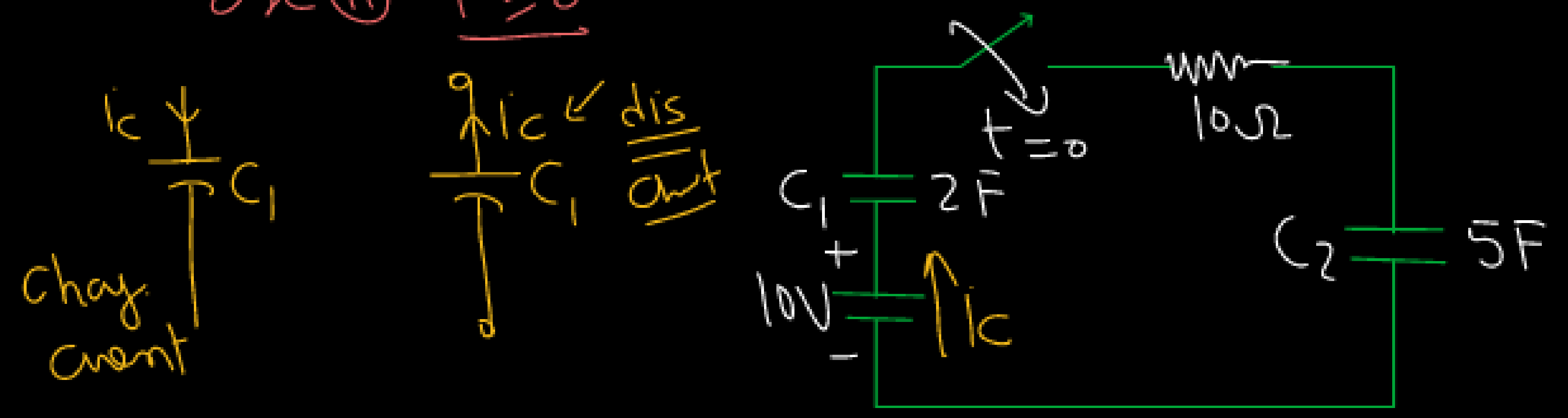
case I $t \le 0^-$

$V_{C_1 0^-} = 10V$

$V_{C_2 0^-} = 0V$



case II $t \ge 0$



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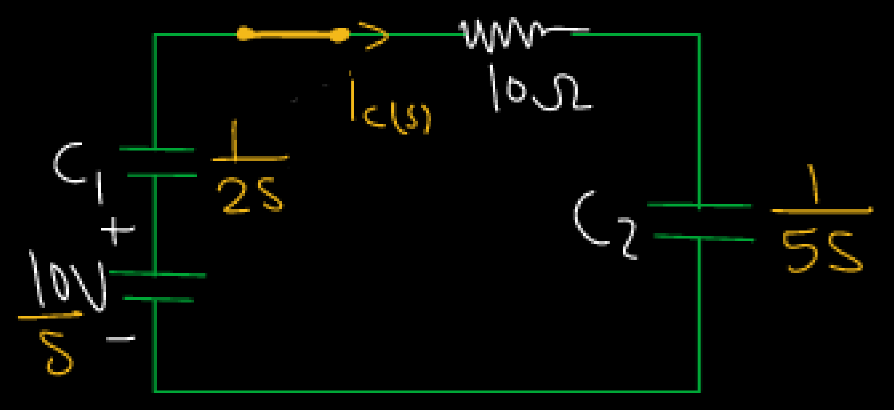


$$I_{c(s)}\left[10 + \frac{1}{2S} + \frac{1}{5S}\right] = \frac{10}{S}$$

$$I_{c(s)}\left[10 + \frac{0.5}{S} + \frac{0.2}{S}\right] = \frac{10}{S}$$

$$I_{c(s)}\left[\frac{10S + 0.7}{S}\right] = \frac{10}{S}$$

$$I_{c(s)}\left[S + 0.07\right]10 = 10$$

$$I_{c(s)} = \frac{1}{(S+0.07)}$$ take inv. lap. trfm.

$$I_c(t) = \left(e^{-0.07t}\right) \text{ Amp.}$$

$$V_{C_2}(t) = \frac{1}{C_2}\int_0^t i_c(t)\,dt = \frac{1}{5}\int_0^t 1 . e^{-0.07t}\,dt .$$

$$V_{C_1}(t) = 10 - \frac{1}{2}\int_0^t e^{-0.07t}\,dt$$

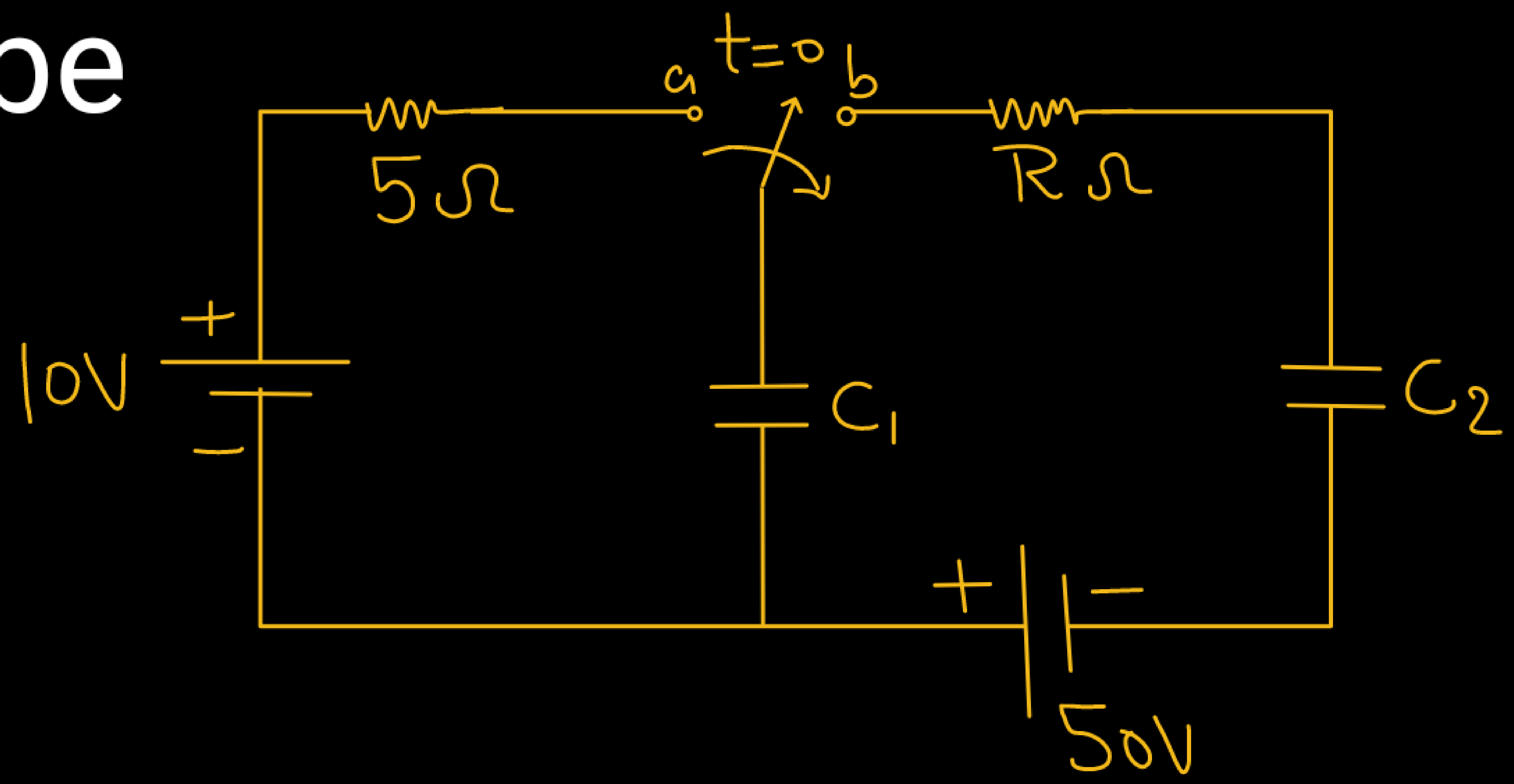
energy $\quad w = \int_t p\,dt$

$$W_R = \int_0^t i^2 R\,dt$$

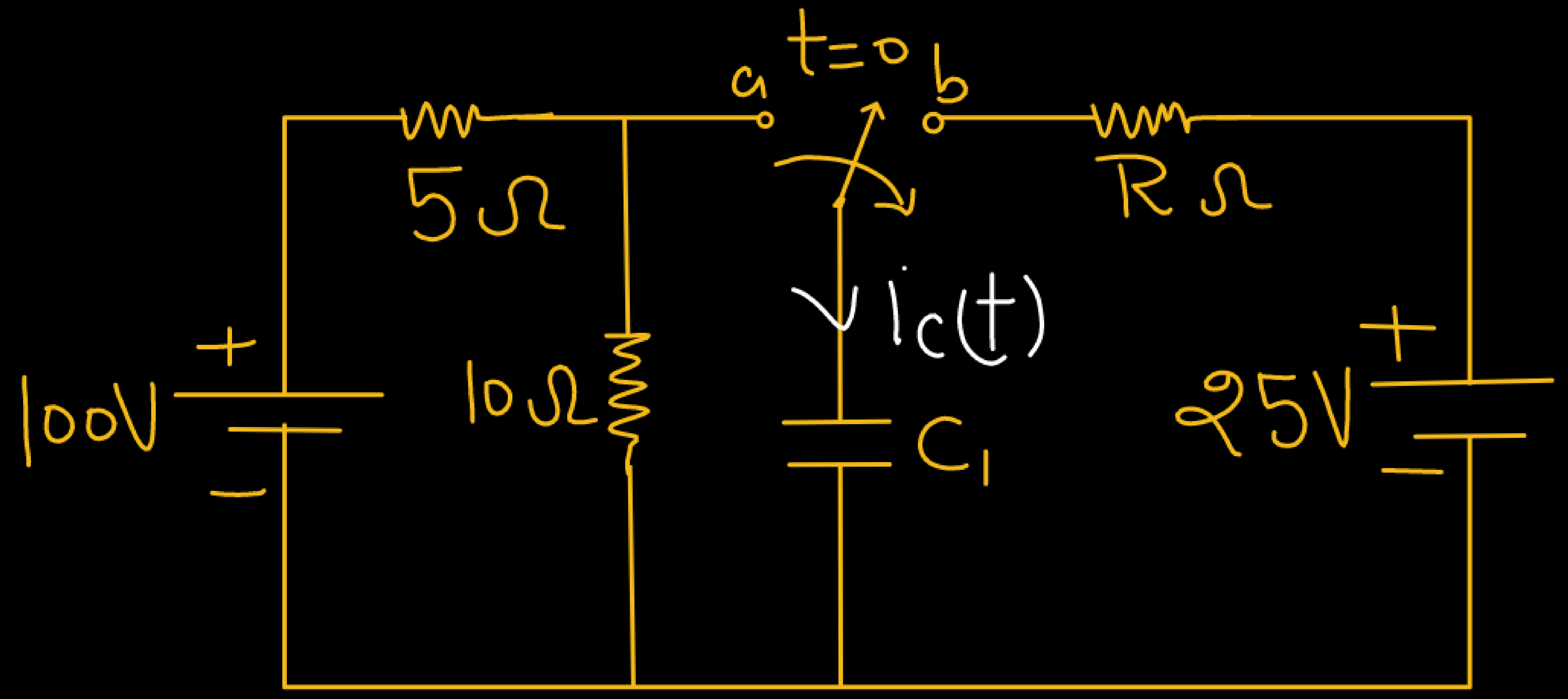
$$= \int_0^t \left(e^{-0.07t}\right)^2 \times 10\,dt \quad J$$

Ex-1

The Steady State voltage across both Capacitor will be



The Capacitor's current Response for , t> 0 is..



The Capacitor's voltage Response for , t≥ 0 is..