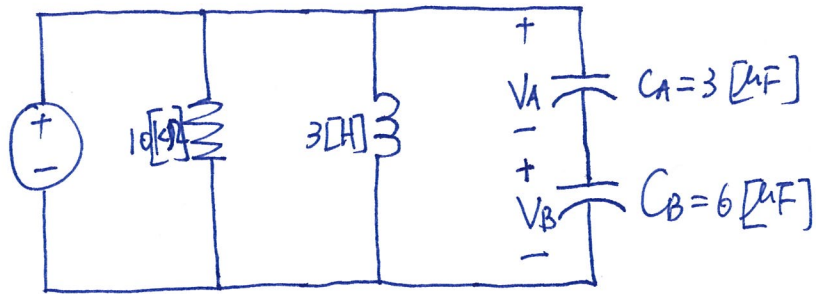


$$V_s(t) = 5[V] \cdot e^{-\frac{t}{2[ms]}}$$

$$t \geq 0$$



$$V_A(0) = -3V$$

- Find the energy stored in capacitor  $C_B$  at  $t=0$ .
- Find the expression for  $V_A(t)$  as function of time  $t$ , for  $t \geq 0$ .
- Find  $V_B(t)$  at  $t=3[ms]$ .

$$a): \text{KVL: } -V_S(t) + V_A(t) + V_B(t) = 0$$

$$\begin{aligned} \therefore V_B(t) &= V_S(t) - V_A(t) \\ &= 5[V] - (-3[V]) \\ &= 8[V] \end{aligned}$$

$$\begin{aligned} \therefore W_{\text{sto. by } C_B} &= \frac{1}{2} C_B [V_B(t)]^2 \\ &= \frac{1}{2} \times 6 \mu\text{F} \times (8[V])^2 \\ &= 192 \times 10^{-6} [\text{J}] \\ &= 1.92 \times 10^{-4} [\text{J}] \end{aligned}$$

$$b): C_{A||B} = \frac{C_A \cdot C_B}{C_A + C_B} = 2 [\mu\text{F}]$$

$$\begin{aligned} i_{A||B} &= C_{A||B} \cdot \frac{dV_S(t)}{dt} = 5[V] \times 2[\mu\text{F}] \times \left(-\frac{1}{2}\right) \cdot e^{-\frac{t}{2\tau\text{[s]}}} \quad t \geq 0. \\ &= 5 \times 10^{-6} [\text{A}] \cdot e^{-\frac{t}{2\tau\text{[s]}}} \quad (t \geq 0) \end{aligned}$$

$$\begin{aligned} \therefore V_A(t) &= \frac{1}{C_A} \cdot \int_0^t i_{A||B}(t) dt + V_A(0) \\ &= -\frac{1}{3\mu\text{F}} \cdot 5 \times 10^{-6} [\text{A}] \cdot \int_0^t e^{-\frac{t}{2\tau\text{[s]}}} dt + (-3[V]) \\ &= -\frac{5}{3} [V] \cdot (-2) \cdot \int_0^t e^{-\frac{t}{2\tau\text{[s]}}} d\left(\frac{t}{2\tau\text{[s]}}\right) - 3[V] \\ &= \frac{10}{3} [V] \cdot e^{-\frac{t}{2\tau\text{[s]}}} \Big|_0^t - 3[V] \\ &= \frac{10}{3} [V] \cdot e^{-\frac{t}{2\tau\text{[s]}}} - \frac{10}{3} [V] - 3[V] \\ &= \frac{10}{3} [V] e^{-\frac{t}{2\tau\text{[s]}}} - \frac{19}{3} [V] \quad t \geq 0 \end{aligned}$$



$$c): U_B(t) = \frac{1}{C_B} \int_0^t i_{A/B}(t) \cdot dt + V_B(0)$$

$$= -\frac{1}{6 \mu F} \cdot 5 \times 10^{-6} [A] \cdot \int_0^t e^{-\frac{t}{2ES}} dt + 8 [V]$$

$$= \frac{5}{6} \times 2 [V] \cdot \int_0^t e^{-\frac{t}{2ES}} d\left(\frac{-t}{2ES}\right) + 8 [V]$$

$$= \frac{10}{6} [V] \cdot e^{-\frac{t}{2ES}} \Big|_0^t + 8 [V]$$

$$= \frac{10}{6} [V] \cdot e^{-\frac{t}{2ES}} - \frac{10}{6} [V] + 8 [V]$$

$$= \frac{5}{3} [V] \cdot e^{-\frac{t}{2ES}} + \frac{19}{3} [V] \quad t \geq 0$$

$$V_B(3) = \frac{5}{3} [V] \cdot e^{-\frac{3ES}{2ES}} + \frac{19}{3} [V]$$

$$= 6.7 [V]$$