**Corrigé exercice 2 :**

I. 1. Loi des mailles :

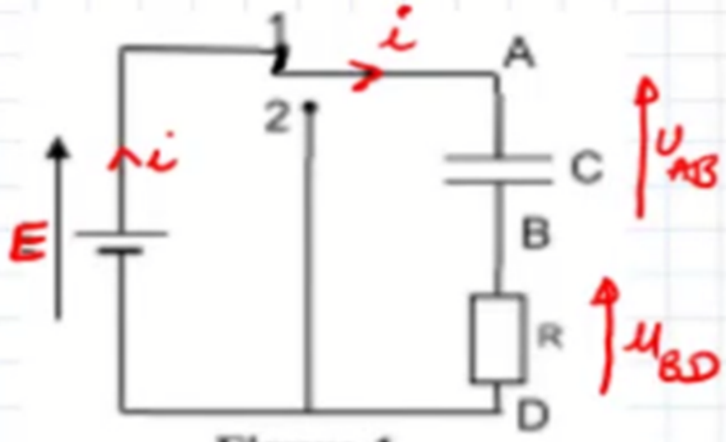


Figure 1

$$u_{BD} + u_{AB} - E = 0$$

$$Ri + u_{AB} = E$$

$$\text{or } i = \frac{dq}{dt} = C.\frac{du_{AB}}{dt}$$

$$\boxed{RC\frac{du_{AB}}{dt} + u_{AB} = E} \quad (1)$$

2. $u_{AB} = a + be^{-\beta t}$

$$\frac{du_{AB}}{dt} = 0 + b(-\beta e^{-\beta t}) = -\beta b e^{-\beta t}$$

(1) donne :

$$-RC\beta b e^{-\beta t} + a + be^{-\beta t} = E$$

$$b e^{-\beta t}(-RC\beta + 1) + a = E$$

ceci est vraie $\forall t$ si

$$\begin{cases} a = E \\ -RC\beta + 1 = 0 \end{cases} \Leftrightarrow \begin{cases} \boxed{a = E} \\ \boxed{\beta = \frac{1}{RC}} \boxed{= \frac{1}{\tau}} \end{cases}$$

A $t=0$ $\quad u_{AB} = a + b\underbrace{e^{0}}_{1} = a + b = 0$

$$\Rightarrow b = -a \Rightarrow \boxed{b = -E}$$

3. $u_{AB} = E(1 - e^{-t/RC}) = E - Ee^{-t/RC}$

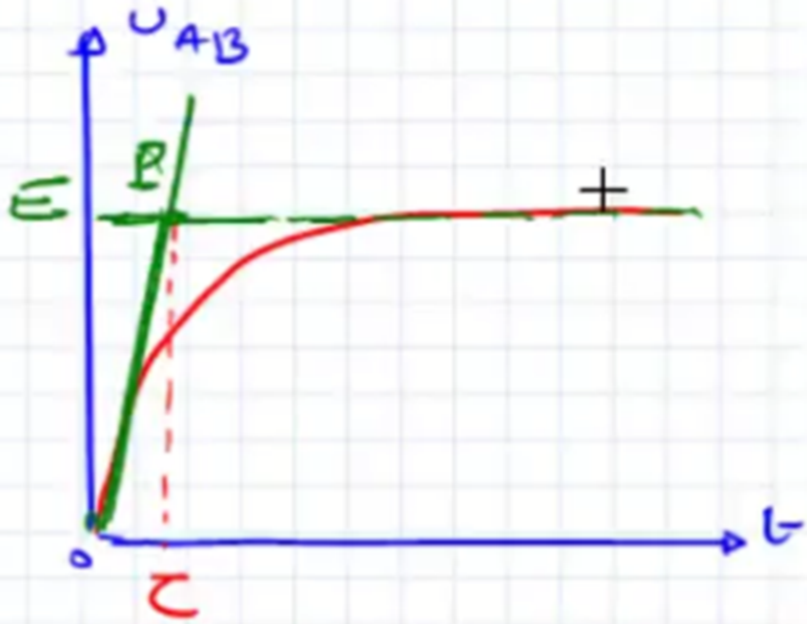
$$\frac{du_{AB}}{dt} = 0 - E\left(-\frac{1}{RC} e^{-t/RC}\right) = \frac{E}{RC} e^{-t/RC}$$

(1) $\cancel{RC}\,\frac{E}{\cancel{RC}}\,\cancel{e^{-t/RC}} + E - E\,\cancel{e^{-t/RC}} = E$

$u_{AB} = E(1 - e^{-t/RC})$ est une solution de l'équation différentielle (1).

4. L'équation de la tgte à l'origine est $u_{AB} = k.t$ avec $k = \left.\frac{du_{AB}}{dt}\right)_{t=0} = \frac{E}{RC}$

$$\boxed{u_{AB} = \frac{E}{RC} t}$$




Au pt P. $u_{AB} = E$

$E = \frac{E}{RC} \cdot t$

$$\boxed{t = RC = \tau}$$

$$\boxed{P(\tau\, ;\, E)}.$$

5. $\boxed{\tau = RC =} 10.10^{3} \times 100.10^{-9} = \boxed{10^{-3}\, s}$.

6. * Lorsque $t_1 = \tau$.

$\boxed{u_{AB} =} E(1 - e^{-1}) = \boxed{0,63\ E}$

* Lorsque $t_2 = 5\tau$

$\boxed{u_{AB} =} E(1 - e^{-5}) = \boxed{0,99\ E}$

* Lorsque $t \to \infty \Rightarrow \boxed{u_{AB} =} E(1 - e^{-\infty}) \boxed{= E}$

7. a. $u_{BD} = E - u_{AB}$

A $t = 0$ $u_{AB} = 0 \Rightarrow \boxed{u_{BD} = E}$

b. $u_{BD} = E - u_{AB} = E - E(1 - e^{-t/RC})$

$\boxed{u_{BD} = E\, e^{-t/\tau}.}$

8. A $t=0$ $u_{BD} = E$

Lorsque $t \to \infty \Rightarrow u_{BD} \to 0$.