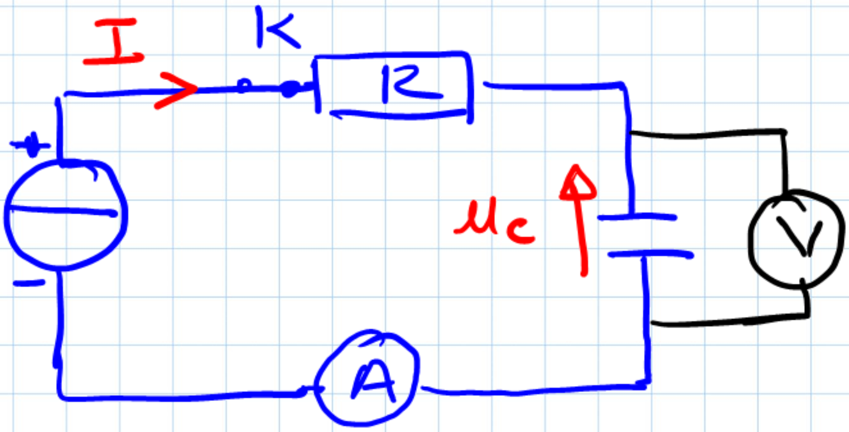
NETSCHOOL1 ACADEMY

LE DIPOLE RC

Corrigé exercice 6 :

I

1.



2. $u_c = f(t)$ est une droite qui passe par l'origine $\Rightarrow u_c = kt$

$k = \dfrac{6}{1\times 60} = 0,1\ V\cdot s^{-1}$; $k = 6\ V\cdot min^{-1}$

$\boxed{u_c = 10^{-1}t}$ avec u_c en V
t en s.

$\boxed{u_c = 6t}$ avec u_c en V
t en min.

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* $I = \frac{q}{t} \Rightarrow q = I t$ (Générateur de Courant)

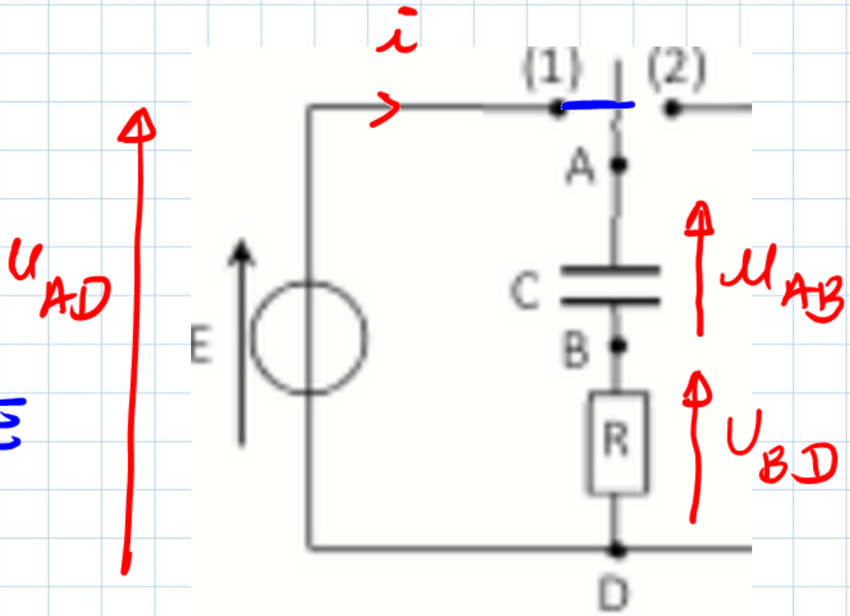
* $q = C\,u_C \Leftrightarrow I \cancel{t} = C\,k\,\cancel{t}$

$C = \frac{I}{k}$; AN $C = \frac{10^{-6}}{10^{-1}} = 10.10^{-6}\ F$

$\boxed{C = 10\,\mu F.}$

II

- $u_{AB} = u_C$
- $u_{BD} = u_R$
- $u_{AD} = u_G = E$



* $u_{AD} = E = c^{te} \longrightarrow$ Courbe Y_1

* $u_{BD} = E - u_{AB}$. Au cours de la charge u_{AB} augmente de 0

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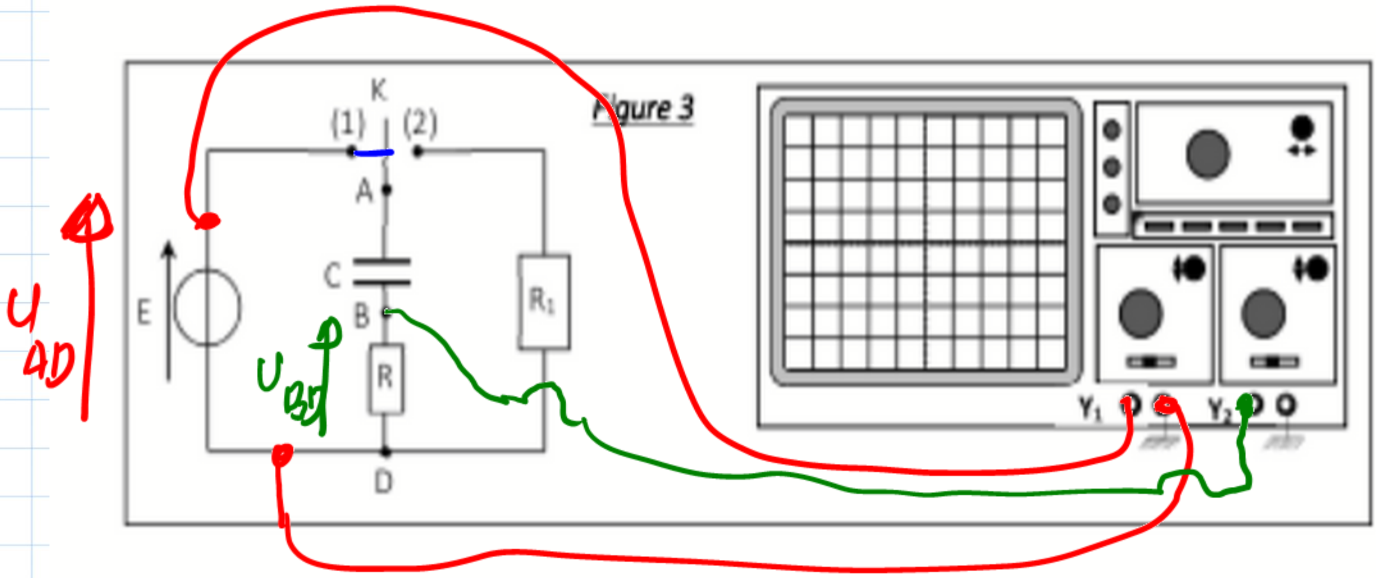
jusqu'à atteindre la fem E du générateur $\Rightarrow u_{BD}$ décroît de E jusqu'à s'annuler $\longrightarrow Y_2$.

En conclusion

$Y_1 \longrightarrow$	u_{AD}
$Y_2 \longrightarrow$	u_{BD}

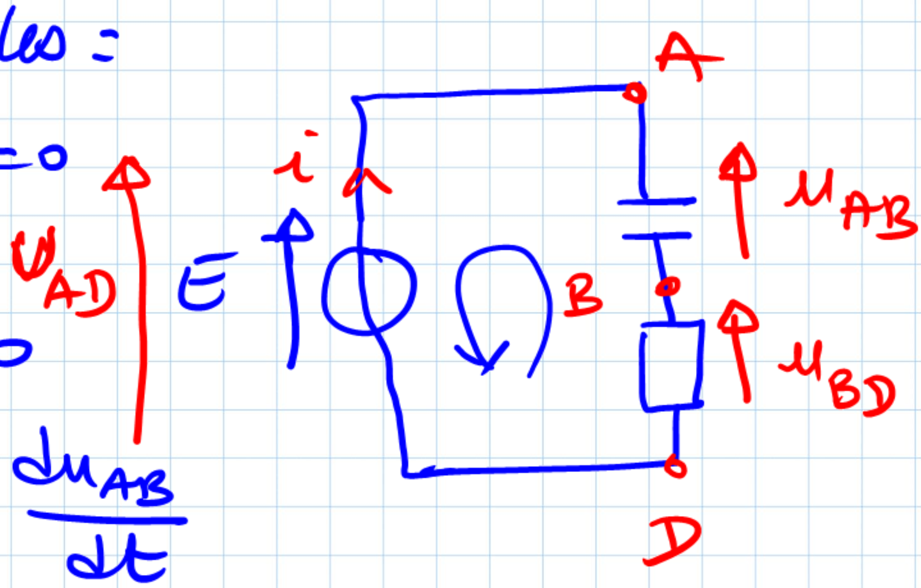


$u_{AD} = u_G \longrightarrow Y_1$

$u_{BD} = u_R \longrightarrow Y_2$

3 a. Loi des mailles :

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



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

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

$$RC\,\frac{du_{AB}}{dt} + u_{AB} = E$$

$$\frac{du_{AB}}{dt} + \frac{1}{RC}\,u_{AB} = \frac{E}{RC}$$

$$\boxed{\frac{du_{AB}}{dt} + \alpha\, u_{AB} = \beta .}$$

(1) avec $\alpha = \frac{1}{RC}$

$\beta = \frac{E}{RC}$

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b. $u_{AB} = A(1 - e^{-\lambda t}) = A - A e^{-\lambda t}$

$$\frac{du_{AB}}{dt} = \lambda A e^{-\lambda t}$$

(1) donne

$$\lambda A e^{-\lambda t} + \alpha A - \alpha A e^{-\lambda t} = \beta .$$

$$A e^{-\lambda t} \underbrace{(\lambda - \alpha)}_{0} + \underbrace{\alpha A} = \underbrace{\beta}$$

$$\begin{cases} \alpha A = \beta \\ \lambda - \alpha = 0 \end{cases} \Leftrightarrow \begin{cases} A = \dfrac{\beta}{\alpha} = \dfrac{\frac{E}{RC}}{\frac{1}{RC}} = E \\ \lambda = \alpha = \dfrac{1}{RC} = \dfrac{1}{\tau} . \end{cases}$$

En conclusion

$\boxed{A = E}$ et $\boxed{\lambda = \frac{1}{RC} = \frac{1}{\tau}}$

$$\boxed{u_{AB} = E(1 - e^{-t/\tau})}$$

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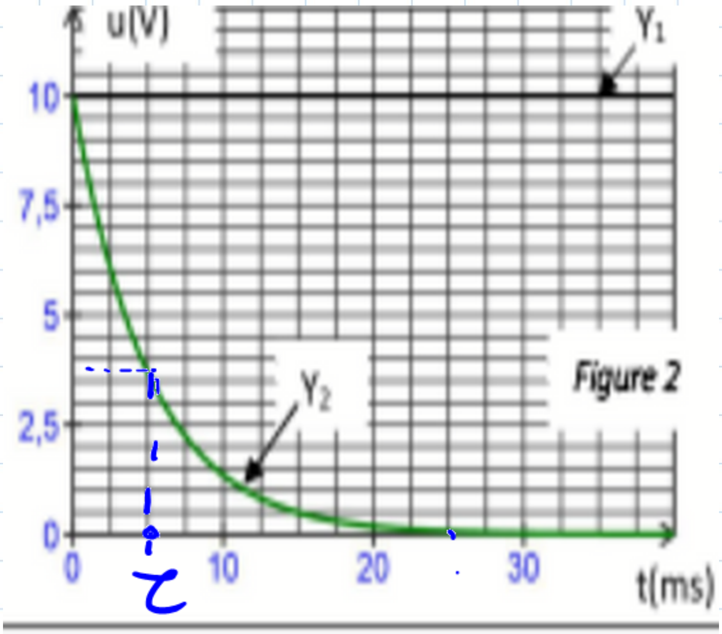
c. $u_{BD} = E - u_{AB} = E - E(1 - e^{-t/\tau})$

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

4a. A $t = \tau \Rightarrow u_{BD} = E e^{-1} = 0{,}37E$

$u_{BD} = 3{,}7V \Rightarrow \boxed{\tau = 5 ms.}$



b. $\tau = RC \Rightarrow R = \frac{\tau}{C}$

$\boxed{R =} \frac{5.10^{-3}}{10.10^{-6}} = \boxed{500\ \Omega}$

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c. En régime permanent $u_C = E$

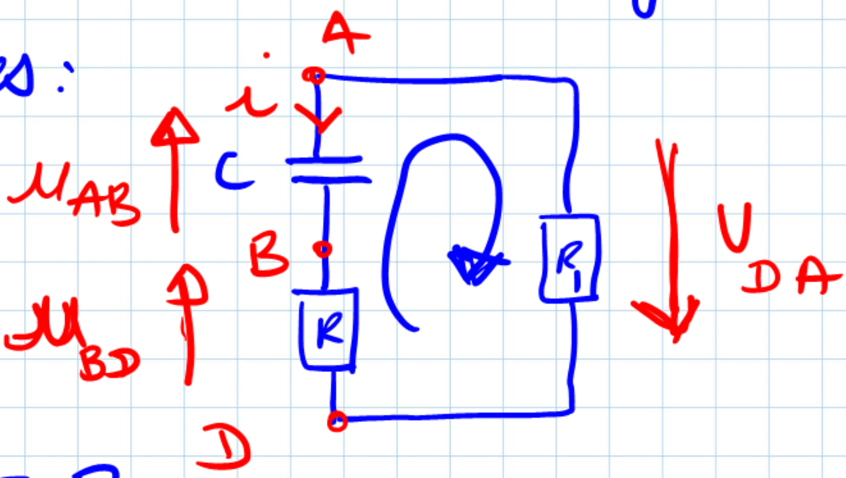
$$E_e = \frac{1}{2} C u_C^2 = \frac{1}{2} C E^2$$

$$E_e = \frac{1}{2} 10.10^{-6} \times 10^2 = 5.10^{-4} J$$

III 1. Loi des mailles :

$$u_{BD} + u_{AB} + u_{DA} = 0$$

$$Ri + u_{AB} + R_1 i = 0$$



$$(R_1 + R)i + u_{AB} = 0$$

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

$$(R_1 + R)C\frac{du_{AB}}{dt} + u_{AB} = 0$$

$$\boxed{\frac{du_{AB}}{dt} + \frac{1}{R_T C} u_{AB} = 0}$$ (2)

avec $R_T = R_1 + R$

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2. $u_{AB} = E e^{-t/\tau'}$

$$\frac{du_{AB}}{dt} = -\frac{E}{\tau'} e^{-t/\tau'}$$

② donne

$$-\frac{E}{\tau'} e^{-t/\tau'} + \frac{E}{R_T C} e^{-t/\tau'} = 0$$

$$E e^{-t/\tau'} \underbrace{\left(-\frac{1}{\tau'} + \frac{1}{R_T C}\right)}_{=0} = 0$$

$$\frac{1}{\tau'} = \frac{1}{R_T C} \Leftrightarrow \boxed{\tau' = R_T C.}$$

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3. $\tau' = R_T \cdot C \Leftrightarrow R_T = \frac{\tau'}{C}$

$$\boxed{R_1 = \frac{\tau'}{C} - R}$$

; $\underline{AN}$ $R_1 = \frac{15.10^{-3}}{10.10^{-6}} - 500 = 10^3 \Omega$