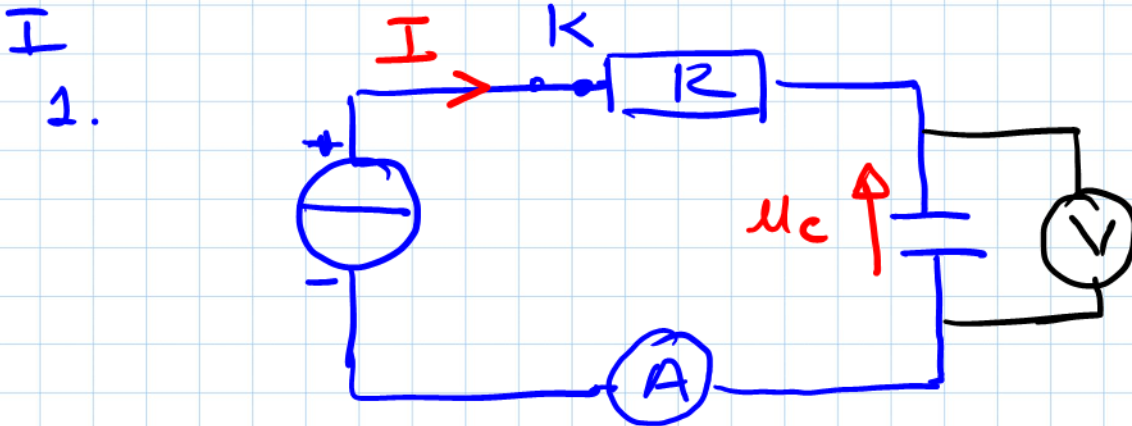


LE DIPOLE RC

Corrigé exercice 6 :



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

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

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

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

LE DIPOLE RC

$$* I = \frac{q}{t} \Rightarrow q = I t \quad (\text{Générateur de courant})$$

$$* q = C u_c \Leftrightarrow I t = C k t$$

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

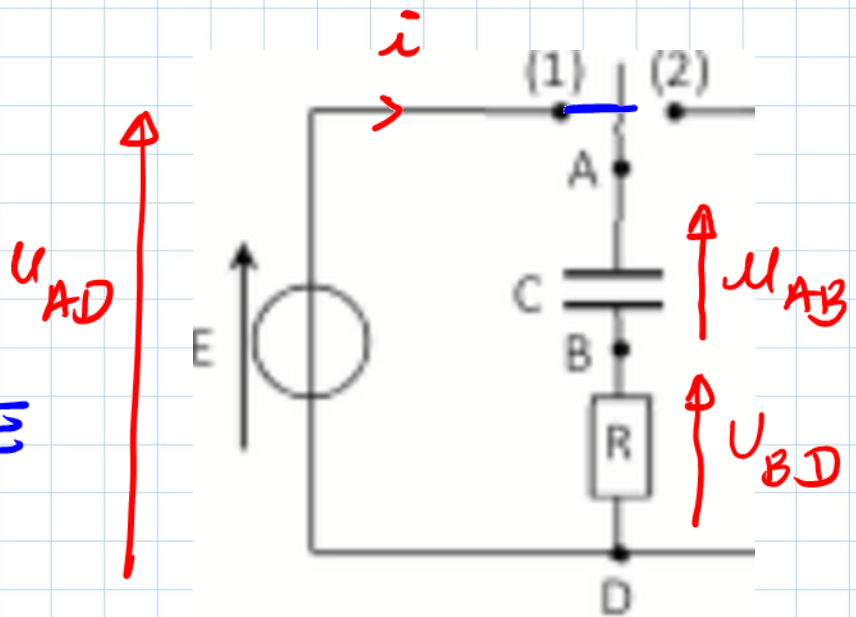
$$C = 10 \mu\text{F}$$

II

$$\bullet u_{AB} = u_c$$

$$\bullet u_{BD} = u_R$$

$$\bullet u_{AD} = u_G = \bar{E}$$



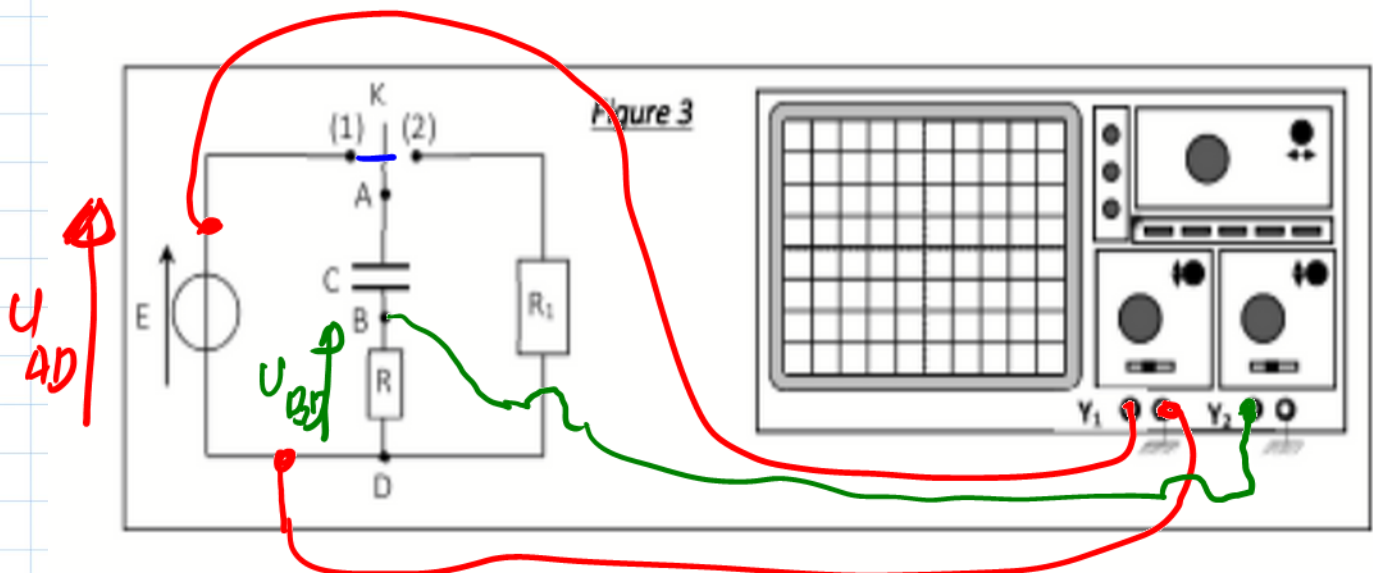
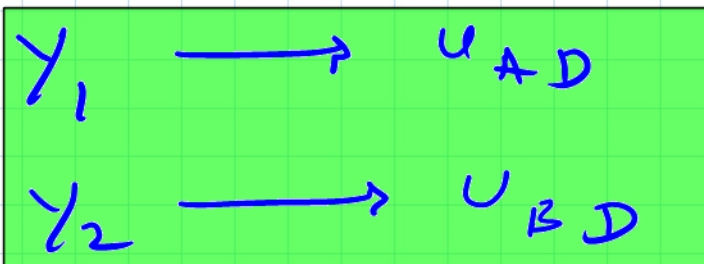
$$* u_{AD} = \bar{E} = C \frac{dq}{dt} \rightarrow \text{Courbe } \gamma_1$$

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

LE DIPOLE RC

jusqu'à atteindre la fem \mathcal{E} du générateur $\Rightarrow u_{BD}$ décroît de \mathcal{E} jusqu'à s'annuler $\rightarrow \gamma_2$.

En conclusion



$$u_{AD} = u_G \rightarrow \gamma_1$$

$$u_{BD} = u_R \rightarrow \gamma_2$$

LE DIPOLE RC

3 a. Loi des mailles :

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

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

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

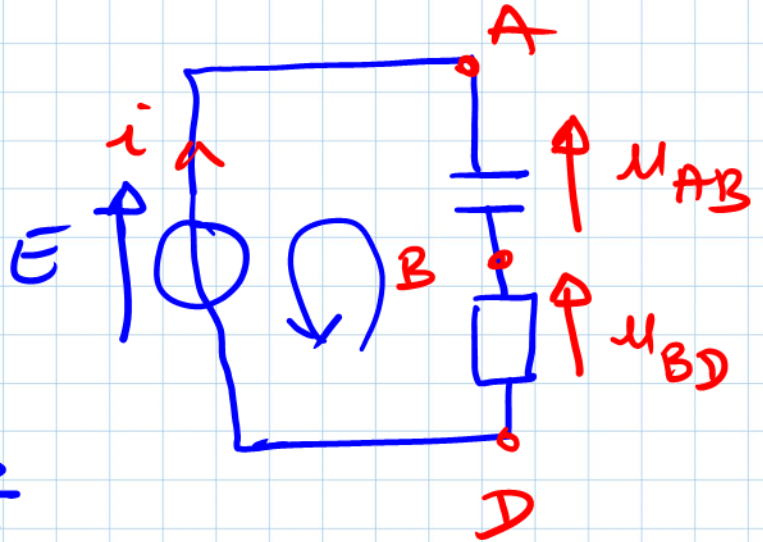
$$RC \frac{dU_{AB}}{dt} + U_{AB} = E$$

$$\frac{dU_{AB}}{dt} + \frac{1}{RC} U_{AB} = \frac{E}{RC}$$

$$\frac{dU_{AB}}{dt} + \alpha U_{AB} = \beta$$

$$\alpha = \frac{1}{RC} \quad \text{or } \alpha = \frac{1}{RC}$$

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



LE DIPOLE RC

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

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

① donne

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

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

$$\begin{cases} \alpha A = \beta \\ \lambda - \alpha = 0 \end{cases} \Leftrightarrow \begin{cases} A = \frac{\beta}{\alpha} = \frac{\frac{R_0 E}{R_0 C}}{\frac{1}{R_0 C}} = E \\ \lambda = \alpha = \frac{1}{R_0 C} = \frac{1}{\tau} \end{cases}$$

En conclusion

$$A = E$$

$$\text{et } \lambda = \frac{1}{R_0 C} = \frac{1}{\tau}$$

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

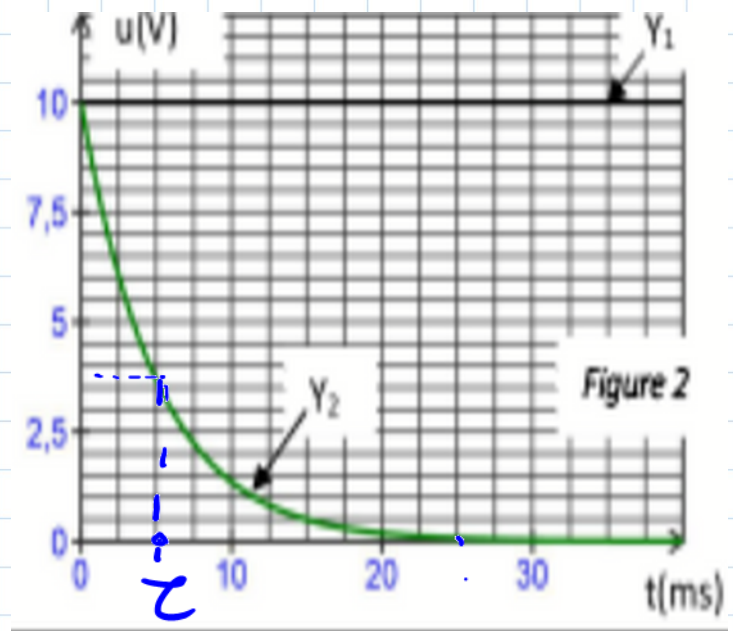
LE DIPOLE RC

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

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

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

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



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

$$R = \frac{5 \cdot 10^{-3}}{10 \cdot 10^{-6}} = 500 \Omega$$

LE DIPOLE RC

c. En régime permanent $u_c = E$

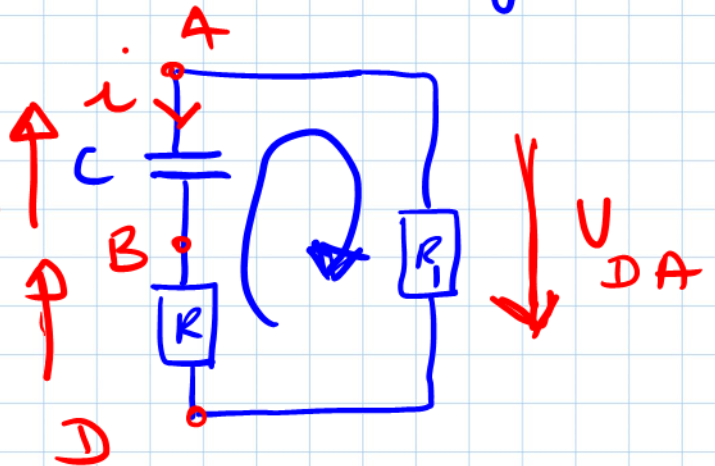
$$E_e = \frac{1}{2} C u_c^2 = \frac{1}{2} C E^2$$

$$E_e = \frac{1}{2} 10 \cdot 10^{-6} \times 10^2 = 5 \cdot 10^{-4} \text{ J}$$

III 1. Loi des mailles:

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

$$Ri + u_{AB} + R_1 i = 0 \quad u_{BD}$$



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

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

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

$$\frac{du_{AB}}{dt} + \frac{1}{R_T C} u_{AB} = 0$$

(2)

avec $R_T = R_1 + R$

LE DIPOLE RC

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

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

② donne

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

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

$= 0$

$$\frac{1}{\tau'} = \frac{1}{R_T C}$$

⊙

$$\tau' = R_T C.$$

LE DIPOLE RC

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

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

$$; \text{ A.M. } R_1 = \frac{15 \cdot 10^{-3}}{10 \cdot 10^{-6}} - 500 = 10^3 \Omega$$