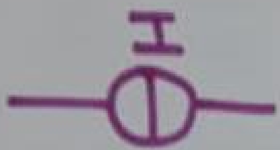
Le dipôle RC

: $u_C = \frac{q}{C}$

: $u_R = R\,i$

: Générateur de tension (i variable)

$$\boxed{i = \frac{dq}{dt}}$$



: Générateur de courant (I = cte)

GOUIDER
ABDESSATAR
METLAOUI

$$\boxed{I = \frac{q}{t}}$$

* $e^0 = 1$; $e^{-\infty} = 0$

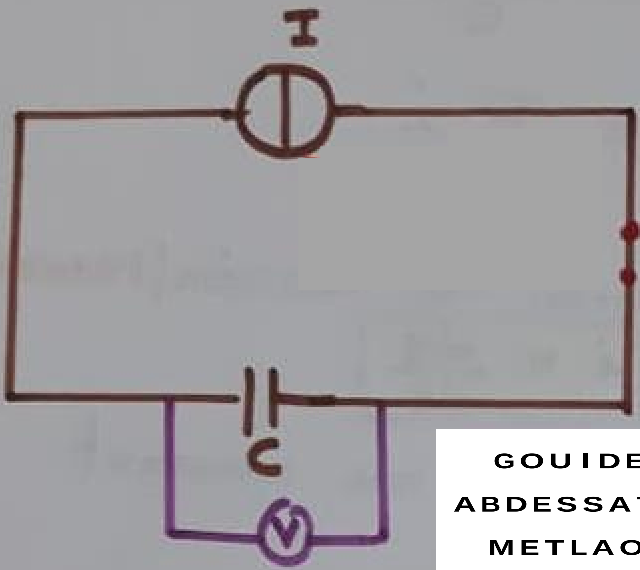
* $e^{-1} = 0{,}37$.

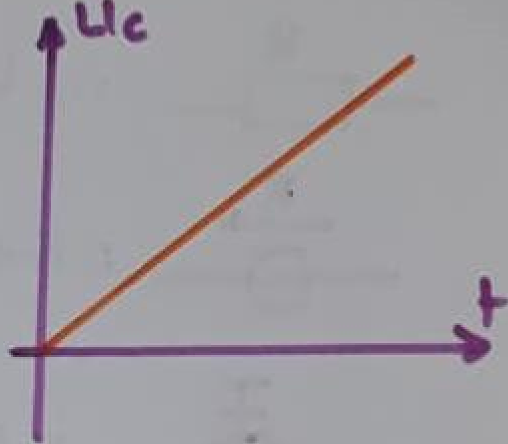
$$\boxed{\tau = RC}$$

$$E_e = \frac{1}{2}\frac{q^2}{C} = \frac{1}{2} C\, u_C^2.$$

fonction	Dérivée
$e^{-\alpha t}$	$-\alpha\, e^{-\alpha t}$
$A(1 - e^{-\alpha t})$	$\alpha A\, e^{-\alpha t}$
$E(1 - e^{-t/\tau})$	$1/\tau\; E\, e^{-t/\tau}$
$A\, e^{-\alpha t}$	$-\alpha A\, e^{-\alpha t}$
$E\, e^{-t/\tau}$	$-\frac{1}{\tau} E\, e^{-t/\tau}$.

I- charge d'un condensateur par un générateur de courant.





$u_c = f(t)$ est une droite linéaire

d'équation : $\boxed{u_c = a\,t}$ → pente

$$u_c = \frac{q}{C}.$$

$$I = \frac{q}{t} \longrightarrow q = I.t.$$

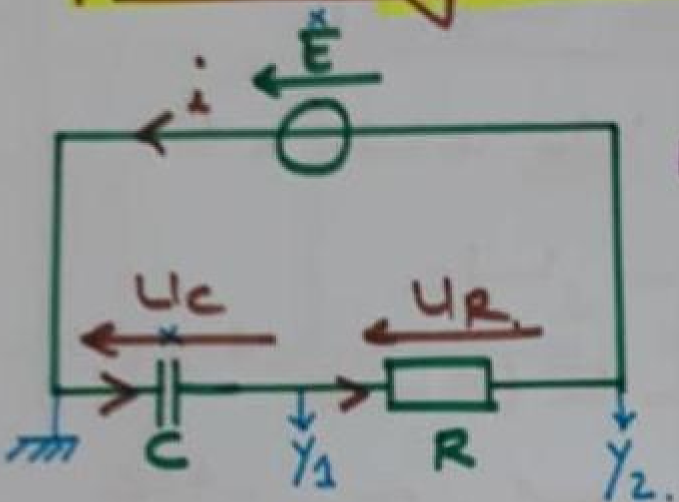
$$\boxed{u_c = \frac{I}{C}.t}$$

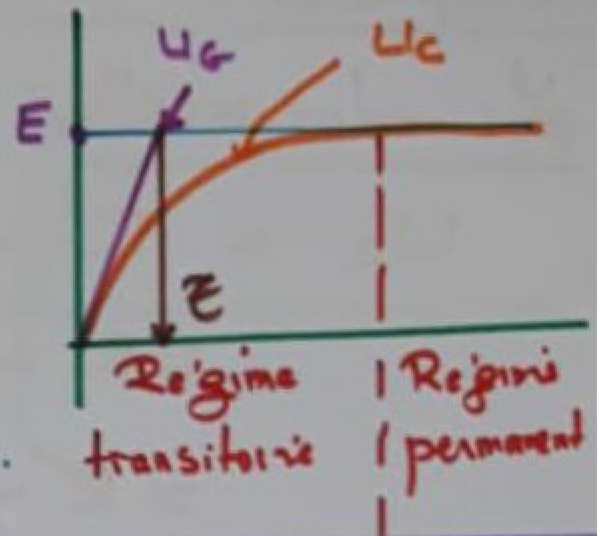
$$\frac{I}{C} = a \longrightarrow \boxed{C = \frac{I}{a}}$$

$1\,mA = 10^{-3}\,A$

$1\,\mu A = 10^{-6}\,A$

II - Charge d'un condensateur par un générateur de tension :





en f^{ct} de u_c	en f^{ct} de u_R
Loi des mailles.	Loi des mailles
$u_R + u_c - E = 0$	$u_R + u_c - E = 0$
$u_R + u_c = E$	$u_R + u_c = E$
$Ri + u_c = E$.	$u_R + \frac{q}{c} = E$
$R\frac{dq}{dt} + u_c = E$	$\frac{du_R}{dt} + \frac{1}{c}\frac{dq}{dt} = 0$
$RC\frac{du_c}{dt} + u_c = E$	$\boxed{\frac{du_R}{dt} + \frac{1}{RC}u_R = 0}$
La sol° est	
$u_c(t) = E(1 - e^{-t/\tau})$.	

GOUIDER
ABDESSATAR
METLAOUI

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

Expression de $u_R(t)$

Loi des mailles $u_R + u_C = E$

$$u_R = E - u_C$$

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

$$= \cancel{E} - \cancel{E} + E\,e^{-t/\tau}$$

GOUIDER
ABDESSATAR
METLAOUI

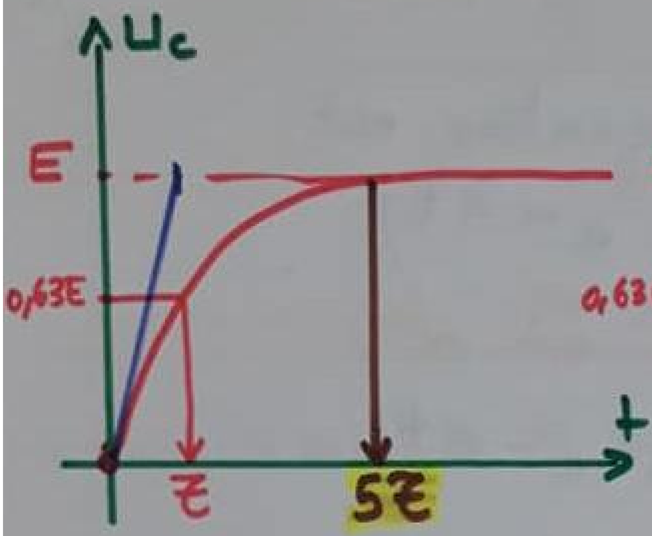
$$u_R(t) = E\,e^{-t/\tau}$$

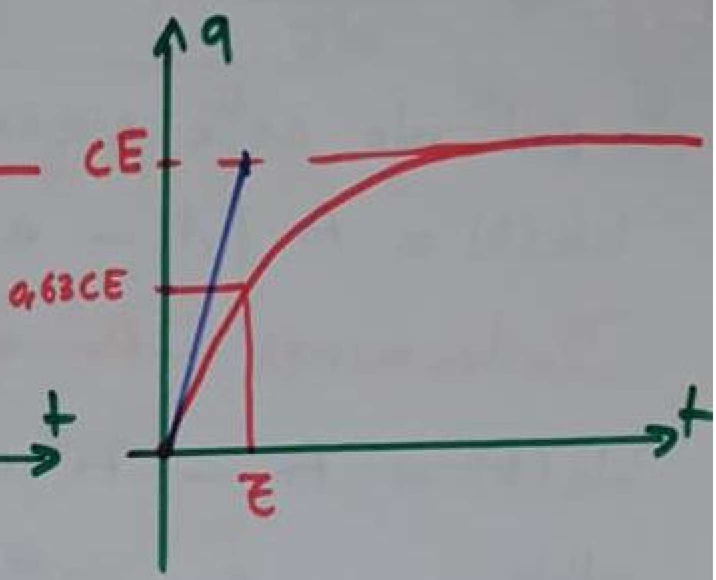
$$u_C(t) = \frac{q(t)}{C} \longrightarrow q(t) = C \cdot u_C(t)$$

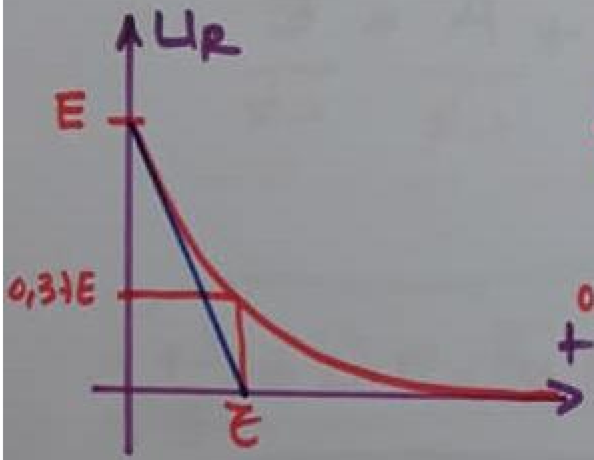
$$q(t) = CE(1 - e^{-t/\tau})$$

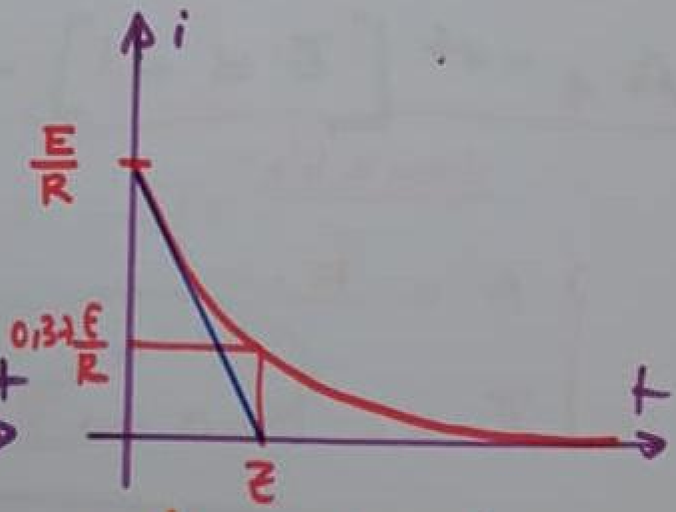
* $u_R(t) = R\,i(t)$

$$i(t) = \frac{E}{R}\,e^{-t/\tau}$$









En régime permanent : le condensateur se comporte comme un interrupteur ouvert !

$$\tau \frac{du_c}{dt} + u_c = E.$$

La sol° de cette équation est.

$$u_c(t) = A\left(1 - e^{-\alpha t}\right)$$

Déterminer A et α :

$$u_c(t) = A - A e^{-\alpha t}.$$

$$\frac{du_c}{dt} = \alpha A e^{-\alpha t}.$$

$$\tau . \alpha A e^{-\alpha t} + A - A e^{-\alpha t} = E$$

$$\underbrace{A e^{-\alpha t}\left[\tau \alpha - 1\right]}_{\text{variable}} + \underbrace{A}_{\text{cte}} = \underbrace{E}_{\text{cte}}$$

$$\begin{cases} A = E. \\ \tau . \alpha - 1 = 0 \rightarrow \tau \alpha = 1 \rightarrow \alpha = \dfrac{1}{\tau}. \end{cases}$$

Donc $\boxed{u_c(t) = E\left(1 - e^{-t/\tau}\right).}$

$$\boxed{\frac{du_R}{dt} + \frac{1}{\tau} u_R = 0}$$

La sol° est $u_R(t) = A\, e^{-\alpha t}$

Déterminer A et α :

- $u_R(t=0) = A = E$.
- $\frac{du_R}{dt} = -\alpha A\, e^{-\alpha t}$.

$$-\alpha A\, e^{-\alpha t} + \frac{1}{\tau} A\, e^{-\alpha t} = 0$$

$$A\, e^{-\alpha t}\left[-\alpha + \frac{1}{\tau}\right] = 0$$

$$-\alpha + \frac{1}{\tau} = 0 \longrightarrow \alpha = \frac{1}{\tau}$$

$$\boxed{u_R(t) = E\, e^{-t/\tau}}$$