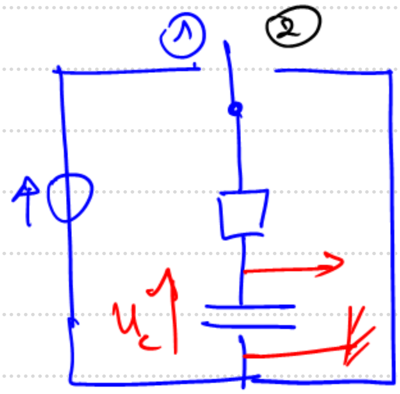
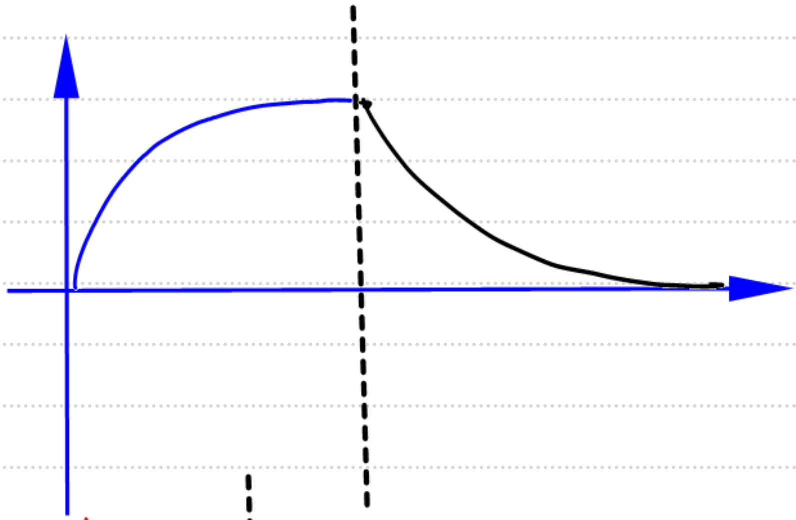
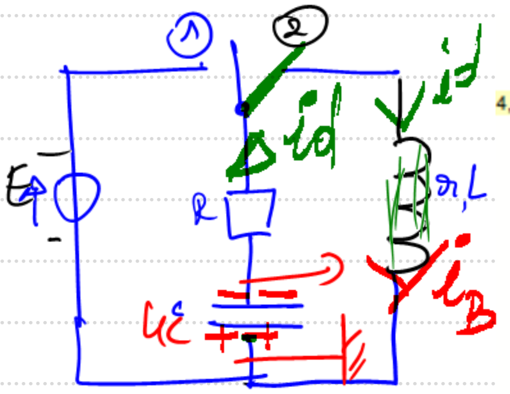
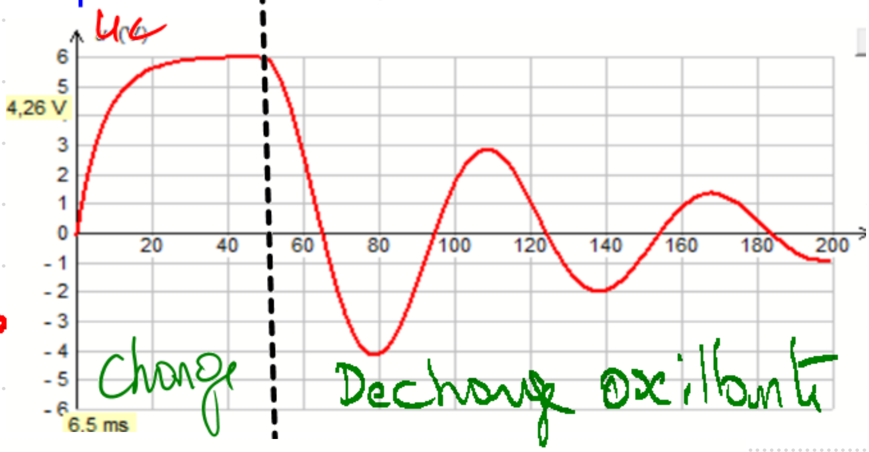
Oscillation libres

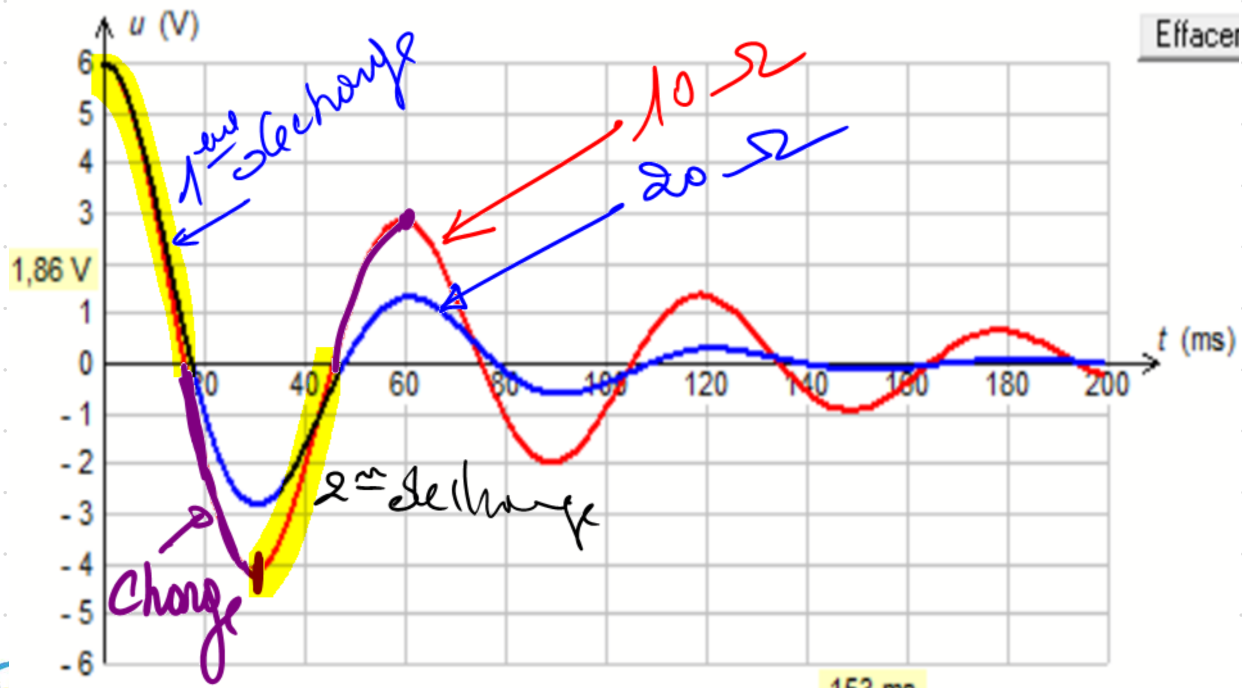
Amortie | Non amorties





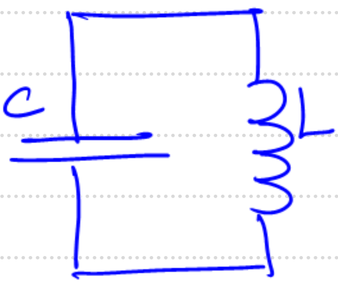


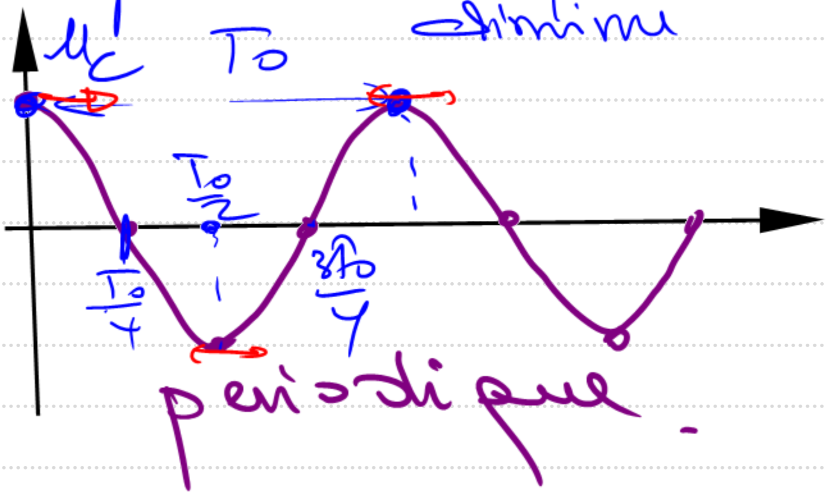


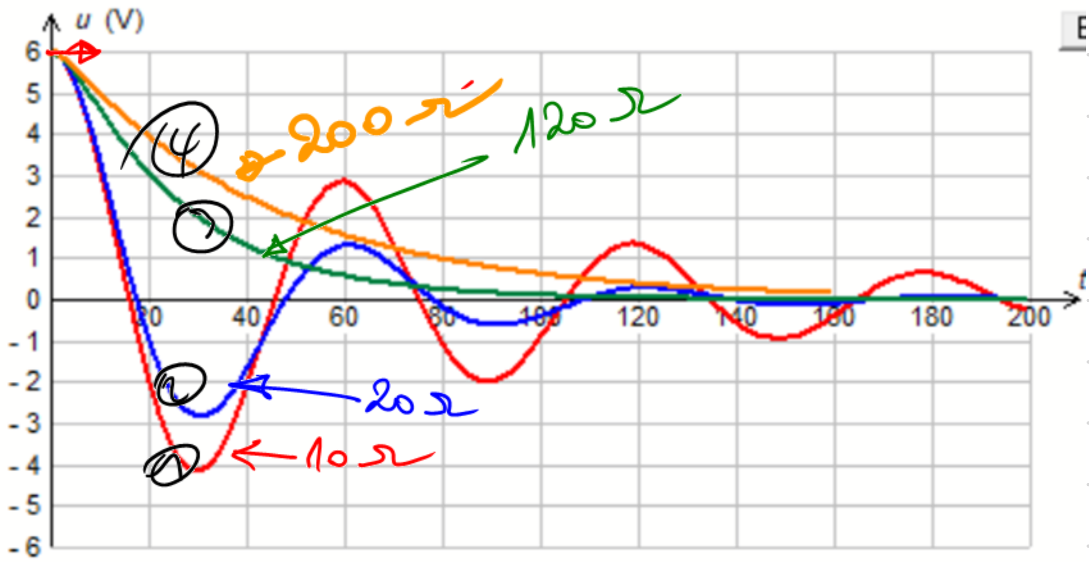


Osillations libre Amortie

sans generateur l'amplitude diminue

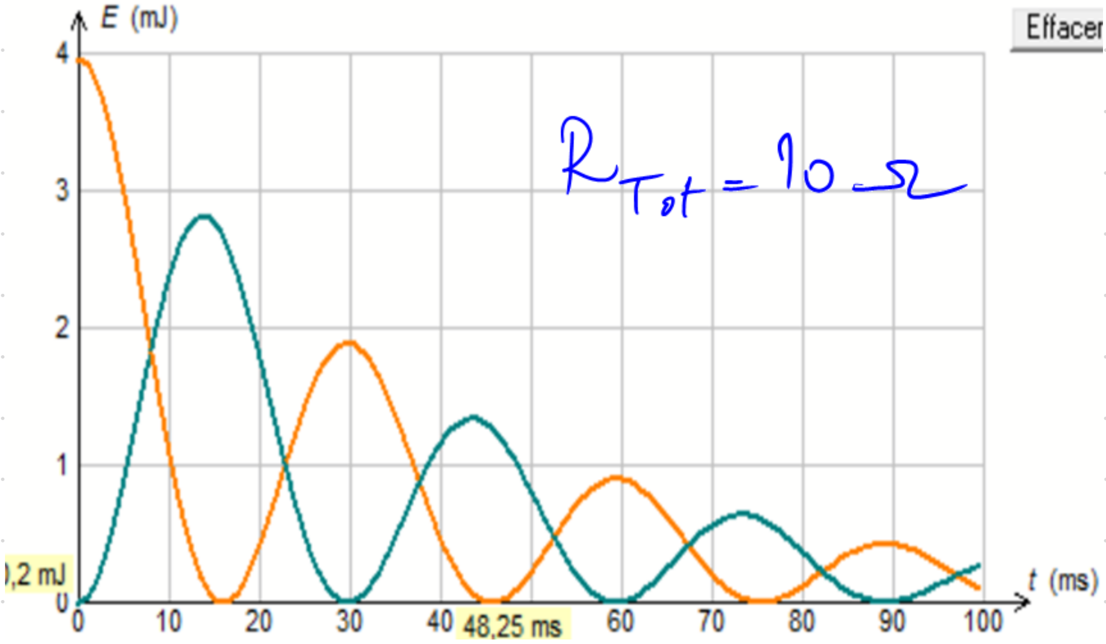


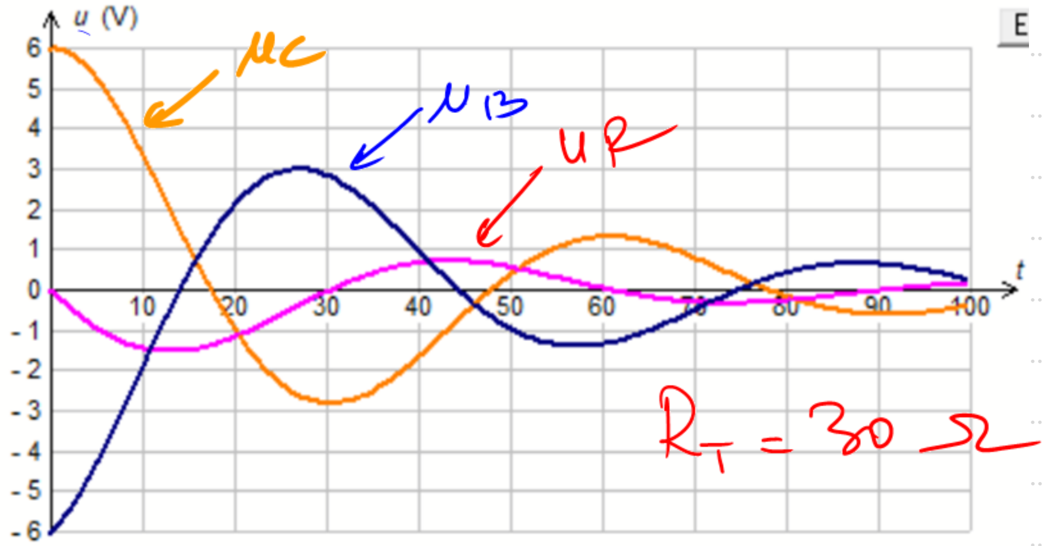




① ② } Regime pseudo-periodique.

③ ④ } Aperiodique


E (mJ)
Effacer
R Tot = 10 Ω
,2 mJ
48,25 ms
t (ms)
0
10
20
30
40
60
70
80
90
100
1
2
3
4


u (V)
uC
uB
uR
R T = 30 Ω
t
6
5
4
3
2
1
0
- 1
- 2
- 3
- 4
- 5
- 6
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20
30
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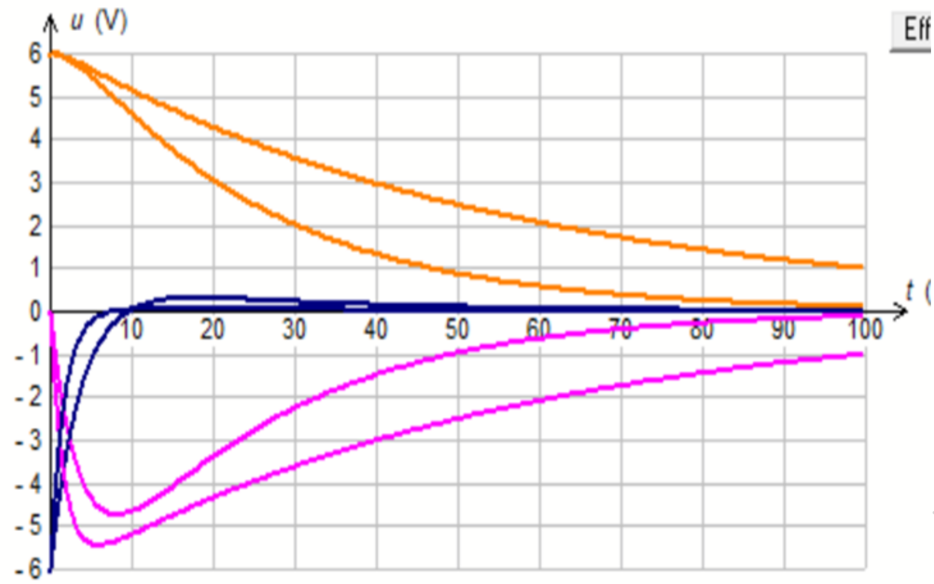
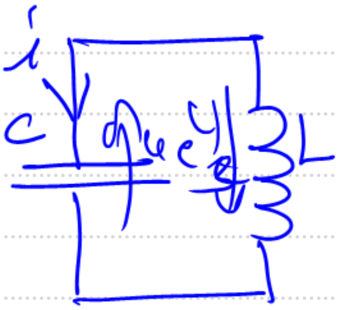
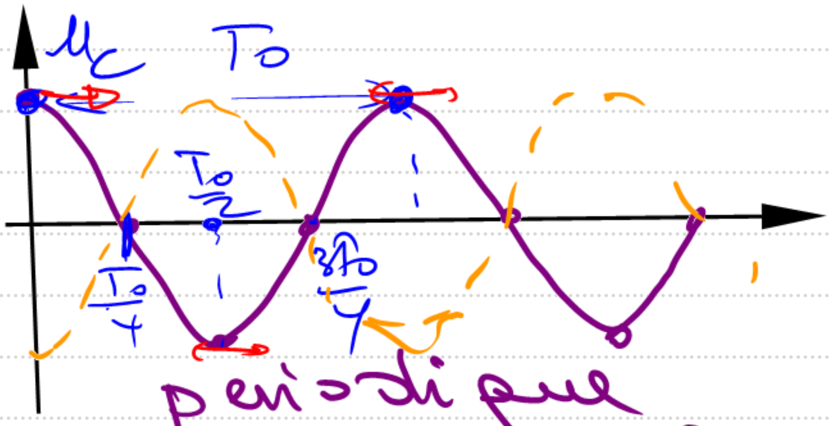
80
90
100


u (V)
Eff
t (
6
5
4
3
2
1
0
- 1
- 2
- 3
- 4
- 5
- 6
10
20
30
40
50
60
70
80
90
100

OS libre non amortie.





périodique.

L.M $u_C(t) + u_B(t) = 0$

$$\boxed{u_C(t) + L\frac{di}{dt} = 0}$$

$\Rightarrow u_C(t) + LC\frac{d^2u_C}{dt^2} = 0$

$$\boxed{\frac{d^2u_C}{dt^2} + \frac{1}{LC}u_C(t) = 0}$$

$$\boxed{\frac{d^2q}{dt^2} + \frac{1}{LC}q(t) = 0}$$

dérivée

$C\frac{du_C}{dt} + LC\frac{d^2i}{dt^2} = 0 \times C$

$i(t) + LC\frac{d^2i}{dt^2} = 0 \rightarrow$

$$\boxed{\frac{d^2i}{dt^2} + \frac{1}{LC}i(t) = 0}$$

$$\boxed{\frac{d^2u_B}{dt^2} + \frac{1}{LC}u_B = 0}$$

$\Rightarrow$ Solution sinusoïdale.

exp : $q(t) = Q_m \sin(\omega_0 t + \varphi_q)$

Exercice

(I) 1) Charge du condensateur.

- Les électrons provenant de la borne négative du générateur s'accumulent sur l'une des armatures (B) qui se charge ⊖ et repoussent les e^- libres de l'autre armature (A) qui se charge ⊕
  ⇒ le condensateur se charge

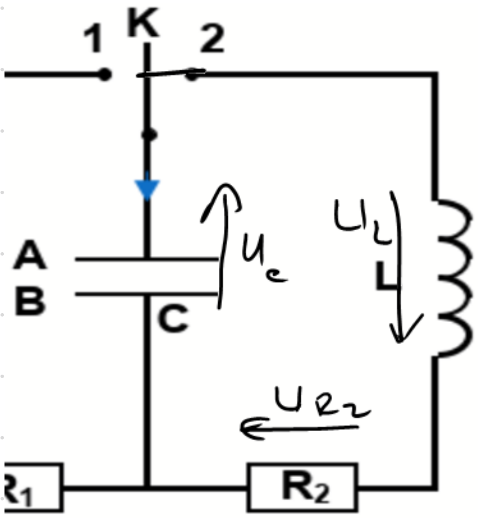
2°) $u_c = U_{cm} = E$

$Q_m = CE \Rightarrow \boxed{Q_m = 2.10^{-5}\,C}$

3°) $E_e = \frac{1}{2}\frac{Q_m^2}{C}$ $\boxed{E_e = 10^{-4}\,J}$

(II) 1°) Régime pseudo-périodique.

2°)



Loi des mailles.

$u_c(t) + u_{R_2}(t) + u_L(t) = 0$

$u_c(t) + R_2\, i(t) + L\frac{di(t)}{dt} = 0$

$$\boxed{u_c(t) + R_2 C\frac{du_c(t)}{dt} + LC\frac{d^2u_c(t)}{dt^2} = 0} \quad (1)$$

$(1)\times C \Rightarrow$ $$\boxed{q(t) + R_2 C\frac{dq(t)}{dt} + LC\frac{d^2q(t)}{dt^2} = 0}$$

3°) a) $E = E_C + E_L = \frac{1}{2} C u_c^2(t) + \frac{1}{2} L i^2(t)$

Math $(f^2(t))' = 2 f' f$

$$\frac{dE}{dt} = \frac{1}{\cancel{2}} C \cancel{2} \frac{du_c}{dt} \cdot u_c + \frac{1}{\cancel{2}} L \cancel{2}\, i \frac{di(t)}{dt}$$

$$= i \left[\underbrace{u_c(t) + L \frac{di}{dt}}_{-R_1 i} \right]$$: loi des mailles

$$\frac{dE}{dt} = -R_1 i^2$$

- $\frac{dE_T}{dt} \neq 0 \rightarrow E_T$ varié au cours du temps
- $\frac{dE_T}{dt} < 0 \rightarrow$ diminution de l'énergie
- cette diminution est due à la presence du Resistor qui dissipe l'energie sous forme de chaleur par effet Joule

b) l'energie electromagnetique diminue. cette diminution entraine une diminution de l'amplitude

c) Variation de l'energie

$$\boxed{\Delta E = E_{final} - E_{initial}}$$

Energie dissipée $= |\Delta E|$

Variation entre $t=0$ et $t=T$

$\Delta E = E(T) - E(0)$

$= (E_e(T) + \underbrace{E_L(T)}_{0}) - (E_e(0) + \underbrace{E_L(0)}_{0})$

or à $t=0$ $\quad i(0)=0 \longrightarrow E_L(0)=0$

à $t=T$ $\quad i(T)=0$ (tangente horizontale)

$\hookrightarrow E_L(T)=0$

$$\boxed{\Delta E = \frac{1}{2}C u_C^2(T) - \frac{1}{2}CE^2 = -6{,}4\,10^{-5}\,J}$$

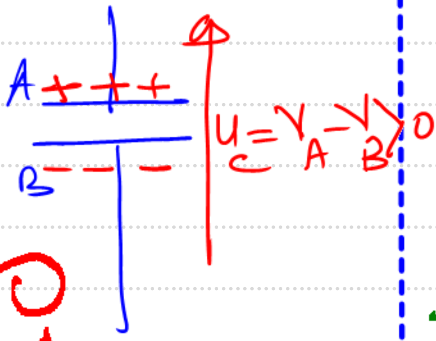
d) A t_1 $\quad u_C(t_1)=0 \longrightarrow E_e(t_1)=0$

d'où $E_T(t_1) = E_L(t_1)$ c'est une energie purement magnetique.

sens conventionnel (générateur)

Au point P_1

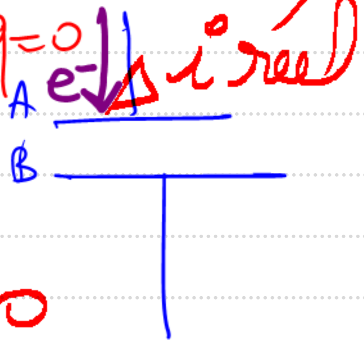
$u_C = U_{Cm} > 0$



$i = C\frac{du_C}{dt} = 0$

au point P_2

$u_C = 0 \Rightarrow q = 0$

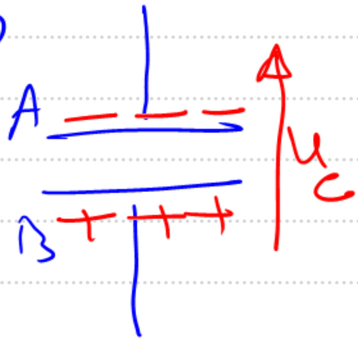


$i = C\frac{du_C}{dt} < 0$

Au point P_3

$u_C - U_{Cm} < 0$

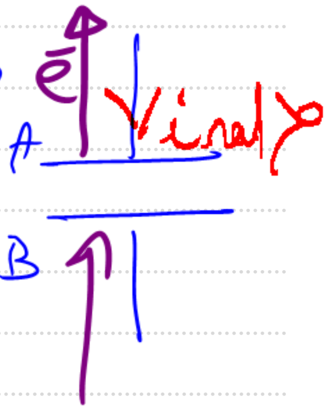
$V_A - V_B < 0$



$i = C\frac{du_C}{dt} = 0$

au point P_4

$u_C = 0 \rightarrow q = 0$



$i = C\frac{du_C}{dt} > 0$

b) ⊙ $P_1 \longrightarrow P_2$: décharge du condensateur
(u_C passe d'une valeur non nulle à une valeur nulle)

⊙ $P_2 \longrightarrow P_3$ charge " " "

⊙ $P_3 \longrightarrow P_4$ décharge " " "

5°) Loi des mailles $u_C(t) + u_{R_2}(t) + L\frac{di(t)}{dt} = 0$

à $t=0$ $u_C(0) = E$ et $u_{R_2}(0) = 0$

donc à $t=0$ $\left(E + L\left.\frac{di}{dt}\right|_{t=0} = 0\right) \times R_2$

$$R_2 E + L \left.\frac{du_{R_2}(t)}{dt}\right)_{t=0} = 0$$

$$\Rightarrow \boxed{\left.\frac{du_{R_2}}{dt}\right)_{t=0} = -\frac{R_2 E}{L}}$$

6°) Régime apériodique