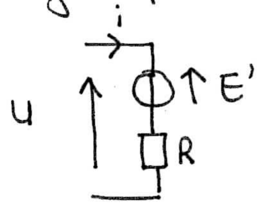
DS3

Ex 1

A. 1) en régime permanent la bobine se comporte comme un fil :



2) $u = E' + Ri \qquad E' = u - Ri = 12 - 0{,}24 \times 2{,}5 = 11{,}4\,V$

3) $u_p = 0\,V \qquad I_p = \frac{E}{R} = 50\,A$

4) $E = Ri + u = Ri + L\frac{di}{dt} \rightarrow \frac{di}{dt} + \frac{R}{L}i = \frac{E}{L}$

5) $\tau = \frac{L}{R} = 6\,ms$

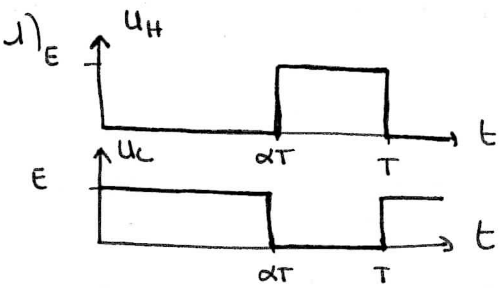
6) $i(t) = A\exp\left(-\frac{t}{\tau}\right) + \frac{E}{R}$ $\qquad i(0) = 0$ par continuité $\Rightarrow A = -\frac{E}{R} = -I_p$

$i(t) = \frac{E}{R}\left(1 - \exp\left(-\frac{t}{\tau}\right)\right)$

7) au bout de $3\tau = 18\,ms$

8) $E_m = \frac{1}{2}L\left(\frac{E}{R}\right)^2 = 1{,}8\,J$

B. 1)

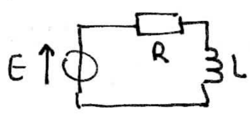


2) $\langle u_c \rangle = \frac{E \times \alpha T + 0 \times (1-\alpha)T}{T} = \alpha E$

3) la diode assure la continuité du courant traversant l'inductance.

C. 1) $u_D = -E < 0 \Leftrightarrow i_D = 0$ non passante

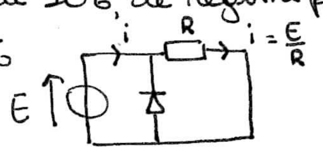
2) circuit étudié dans ce cas :



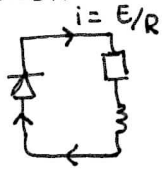
$\rightarrow i(t) = \frac{E}{R}\left(1 - \exp\left(-\frac{t}{\tau}\right)\right)$

3) au bout de 10τ, le régime permanent peut être considéré atteint.

à $t = 10\tau$

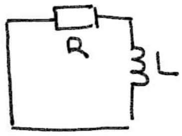


par continuité après ouverture :



la diode est passante pour 1 courant dans ce sens.

4) circuit équivalent pour $t > t_1$

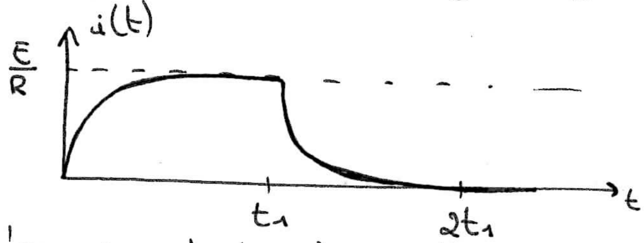


$$Ri + L\frac{di}{dt} = 0 \qquad \tau = \frac{L}{R} \rightarrow i(t) = A\exp(t/\tau)$$

$$i(t_1) = \frac{E}{R} = A\exp\left(-\frac{t_1}{\tau}\right) \qquad A = \frac{E}{R}\exp\left(\frac{t_1}{\tau}\right)$$

$$i(t) = \frac{E}{R}\exp\left(\frac{t_1 - t}{\tau}\right) = \frac{E}{R}\exp\left(\frac{10\tau - t}{\tau}\right)$$

5)



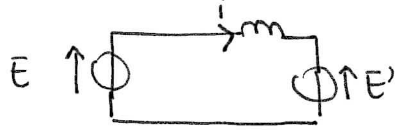
6) L'énergie est dissipée par effet Joule dans R.

D. 1) $\langle u_{moteur} \rangle = \langle E' \rangle = \alpha E = 7{,}2\,V$

$11{,}4\,V \longleftrightarrow 3000\ tr.min^{-1}$
$7{,}2\,V \longleftrightarrow 1{,}9 \times 10^3\ tr.min^{-1}$

2) on peut faire varier la vitesse de rotation du moteur en faisant varier α.

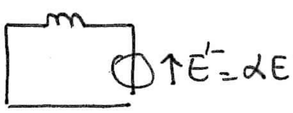
3) . H fermé : diode non passante $\quad 0 \leqslant t \leqslant 0{,}6T$



$$E = E' + L\frac{di}{dt} \qquad \frac{di}{dt} = \frac{E - E'}{L}$$

$$i(t) = \frac{E - E'}{L}t + I_{min} \rightarrow i(t) = \frac{E}{L}(1-\alpha)t + I_{min}$$

4) . H ouvert : diode passante $0{,}6T \leqslant t$



$$E' + L\frac{di}{dt} = 0 \qquad \frac{di}{dt} = -\frac{\alpha E}{L} \qquad i(t) = -\frac{\alpha E}{L}t + Cte$$

à $t = T$ $\quad i(t) = I_{min} \qquad -\frac{\alpha E}{L}T + Cte = I_{min}$

$$Cte = I_{min} + \frac{\alpha E}{L}T$$

$$i(t) = -\frac{\alpha E}{L}t + \frac{\alpha E}{L}T + I_{min}$$

5) $I_{max} = \frac{E(1-\alpha)}{L} \times \alpha T + I_{min} \Rightarrow \Delta I = \frac{E}{L}\alpha(1-\alpha)T \qquad L = \frac{E\alpha(1-\alpha)T}{\Delta I} = 1{,}44\,mH$

6) on peut diminuer l'ondulation en diminuant L : en série les inductances s'ajoutent.

Chimie

Exercice 2

1)

	$N_{2(g)}$	$+ \; 3\,H_{2(g)}$	$= 2\,NH_{3(g)}$
$t=0$	n_0	$3n_0$	0
t	$n_0-\xi$	$3(n_0-\xi)$	2ξ
t_∞	$n_0-\xi_{eq}$	$3(n_0-\xi_{eq})$	$2\xi_{eq}$

2) $\xi_{max} = n_0 \Rightarrow \rho = \dfrac{\xi_{eq}}{n_0}$

3) $\rightarrow n(N_2)_{eq} = n_0(1-\rho)$ $\quad n_{H_2\,eq} = 3n_0(1-\rho)$ $\quad n_{NH_3\,eq} = 2\rho n_0$

$\rightarrow n_{Totale} = n_0(1-\rho) + 3n_0(1-\rho) + 2\rho n_0 = 4n_0 - 2\rho n_0 = 2n_0(2-\rho)$

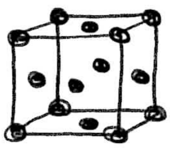
5 et 6) $$K^\circ = \left(\frac{p_{NH_3}^2 \times p^{\circ 2}}{p_{N_2} \times p_{H_2}^3}\right)_{eq} = \frac{\left(\frac{n_{NH_3}}{n_{Tot}} P\right)^2 p^{\circ 2}}{\left(\frac{n_{N_2}}{n_{Tot}} P\right)\left(\frac{n_{H_2}}{n_{Tot}} P\right)^3}$$

6) $$K^\circ = \frac{\left(\frac{\cancel{2}\rho}{\cancel{2}(2-\rho)}\right)^2 \times p^{\circ 2}}{\frac{1-\rho}{2(2-\rho)} \times \left(\frac{3(1-\rho)}{2(2-\rho)}\right)^3 P^2} = \frac{16\rho^2(2-\rho)^2 p^{\circ 2}}{27(1-\rho)^4 P^2}$$

7) $$27(1-\rho)^4 P^2 \times K^\circ = 16\rho^2(2-\rho)^2 P^{\circ 2}$$

$\sqrt{\ }$ $$3\sqrt{3}\,(1-\rho)^2 P \times \sqrt{K^\circ} = 4\rho(2-\rho)P^\circ \rightarrow \rho = 43\%$$

Exercice 1

1) 

2) $N = 8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 4$

3) condition de tangence (diagonale d'1 face) $\Rightarrow 4R = a\sqrt{2} \rightarrow a = \dfrac{4R}{\sqrt{2}}$

$$C = \frac{4 \times \frac{4}{3}\pi R^3}{a^3} = \frac{16\pi \cancel{R^3} \times 2\sqrt{2}}{3 \times 4^3 \cancel{R^3}} = \frac{\pi\sqrt{2}}{6} = 74\%$$

4) $a = 365$ pm

5) $$\rho = \frac{4 \times 55{,}85}{6{,}02 \times 10^{23} \times (365 \times 10^{-12})^3} = 7{,}63 \times 10^6\ g.m^{-3} = 7{,}63 \times 10^3\ kg.m^{-3}$$

6) 1 site octaédrique au centre par exemple

espace restant $= 2R_o = a - 2R_{Fe} = 107$ pm $\rightarrow R = 53{,}5$ pm $< R_C$

7) espace insuffisant : alliage par substitution.