BACCALAUREAT DE L'ENSEIGNEMENT GENERAL – MADAGASCAR
Série : **C - SESSION 2005**

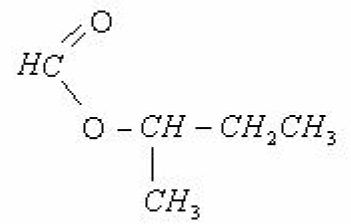
CHIMIE ORGANIQUE.

1° Formule brute de l'ester Ester : $C_nH_{2n}O_2$

$M_{ester} = 102 = 14n + 32$ $\Rightarrow n = \frac{102-32}{14} = 5$

$C_5 H_{10} O_2$

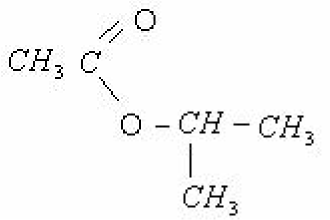
D'où la formule semi- développée de E :



:méthanoate de methyle 1 propyl

2°

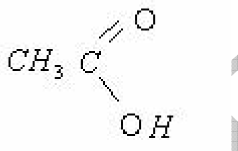
F:



a) Formule semi- développée de A et B :

$B : CH_3 \; CHOH \; CH_3$

A:



b) Rendement de cette hydrolyse basique

$$Z = \frac{N_{ester réagi}}{N_{ester initial}} \times 100$$

$$N_{ester initial} = \frac{5{,}1g}{102 g/mol} = 0{,}05 mol$$

$$N_{ester restant} = \frac{2{,}3g}{102 g/mol} = 0{,}0225 mol$$

$$N_{ester réagi} = 0{,}05 - 0{,}025 = 0{,}0275 mol$$

$$N_{ester réagi} = \frac{0{,}0275}{0{,}05} \times 100 = 55\%$$

CHIMIE MINERALE :
1) Concentrations molaires des différentes espèces chimiques :

Espèces chimiques, $H_2O,\ H_3O^+,\ OH^-,\ C_2H_5NH_3^+ . C_2H_5NH_2$

$$[H_3O^+] = 10^{-pH} = 10^{-10,8} = 1,58.10^{-11} mol\,l^{-1}$$

$$[OH^-] = \frac{10^{-14}}{[H_3O^+]} = \frac{10^{-14}}{1,58.10^{-11}} = 0,63.10^{-3} mol\,l^{-1}$$

Electroneutralité : $[OH^-] = [C_2H_5NH_3^+] + [H_3O^+]$

$$[H_3O^+] << [OH^-] \Rightarrow [OH^-] \approx [C_2H_5NH_3^+] \approx 0,63 10^{-3} mol\,l^{-1}$$

$$pk_A = pH - \log\frac{[C_2H_5NH_2]}{[C_2H_5NH_3^+]}$$

$$pk_A = pH - \log\frac{[C_2H_5NH_2]}{[C_2H_5NH_3^+]} \Rightarrow \frac{[C_2H_5NH_2]}{[C_2H_5NH_3^+]} = 10^{-(pK_A - pH)}$$

$$= 10^{0,2}$$

$$= 1,58$$

$$[C_2H_5NH_2] = 1,58\,[C_2H_5NH_3^+]$$

$$= 1,58 \times 0,63 10^{-3} mol\,l^{-1} = 0,99 10^{-3} mol\,l^{-1}$$

2° Valeurs de V_A et V_B

$V_A + V_B = 30$ ml

$$pk_A = pH - \log\frac{[C_2H_5NH_2]}{[C_2H_5NH_3^+]} = pH - \log\frac{V_B}{V_A}$$

$$\Rightarrow \frac{V_B}{V_A} = 10^{-(pk_A - pH)} = 10^{0,4} = 2,51$$

$$V_B = 2,51 V_A$$

$$V_A + 2,51 V_A = 30$$

$$V_A = \frac{30}{3,51} mol = 8,54 ml$$

$$V_B = 2,51 \times 8,54 = 21,45 ml$$

3° Concentration C'_A de l'acide chlorhydrique :

$$pH = 10,8 = pk_A \Rightarrow [C_2H_5NH_2] = [C_2H_5NH_3^+]$$

$$[Cl^-] = \frac{C'_A V'_A}{V'_B + V'_A}$$

$$[C_2H_5NH_3^+] = [Cl^-] = \frac{C'_A V'_A}{V'_B + V'_A}$$

Conservation de la matière :

$$[C_2H_5NH_3^+] + [C_2H_5NH_2] = \frac{C_B V'_B}{V'_B + V_A}$$

$$2[C_2H_5NH_3^+] = \frac{C_B V'_B}{V'_B + V_A}$$

$$[C_3H_5NH_3^+] = \frac{C_B V_B'}{2(V_B' + V_A)} + \frac{C_A' V_A'}{V_A' + V_B'}$$

$$\Rightarrow C_A' = \frac{C_B' V_B'}{2V_A'}$$

$$C_A' = \frac{10^{-1} \times 20}{2 \times 20} = 0{,}510^{-1}\,mol\,l^{-1}$$

PHYSIQUE NUCLEAIRE

1) Equation de désintégration :

$${}^{40}_{19}K \longrightarrow {}^{40}_{18}Ar + {}^{0}_{+1}e$$

Particule émise : position

2) Constante radioactive :

$$\lambda = \frac{\ln 2}{T} = \frac{0{,}69}{1{,}510^{9} \times 365 \times 24 \times 3600} s^{-1} = 1{,}458\ 10^{-17} s^{-1}$$

3) age de ces cailloux :

$${}^{40}_{19}K \longrightarrow {}^{40}_{18}Ar + {}^{0}_{1}e$$

masse du potassium ${}^{40}_{19}K$ restant $m(t) = 1{,}66.10^{-6} g$ nombre de mol d'Arg on formé :

$$\frac{8210^{-6}}{22{,}410^{3}} mol$$

$$= 3{,}66\ 10^{-7} mol$$

Nombre de mol de potassium désintégré : $3{,}66\ 10^{-7} mol$

Nombre des noyaux de potassium ${}^{40}_{19}K$ restant $= \frac{1{,}6610^{-6}}{40} \times 6{,}0210^{23}$

$$= 0{,}249.10^{17}\ noyaux$$

$$\frac{N_O - N_O e^{-\lambda t}}{N_O e^{-\lambda t}} = \frac{3{,}6610^{-7} \times 6{,}0210^{23}}{0{,}249\,10^{17}} = 8{,}848$$

$$(e^{-\lambda t} - 1) = 8{,}848$$

$$e^{-\lambda t} = 1 + 8{,}848$$

$$e^{-\lambda t} = 9{,}848$$

$$t = \frac{\ln 9{,}848}{\lambda} = \frac{\ln 9{,}848}{\ln 2} \times T = 4{,}9710^{9} ans$$

OPTIQUE GEOMETRIQUE

1° Montrons que $AA' = 4f_1$

$$\gamma = \frac{\overline{OA'}}{\overline{OA}} = -1 \Rightarrow \overline{OA'} = -\overline{OA}$$

$$\overline{AA'} = \overline{AO} + \overline{OA'} = \overline{AO} - \overline{OA}$$

$$\overline{AA'} = -2\overline{OA}$$

$$\frac{1}{f'} = \frac{1}{\overline{OA'}} - \frac{1}{\overline{OA}} = -\frac{1}{\overline{OA}} - \frac{1}{\overline{OA}} = \frac{-2}{\overline{OA}} \Rightarrow \overline{OA} = -2f'$$

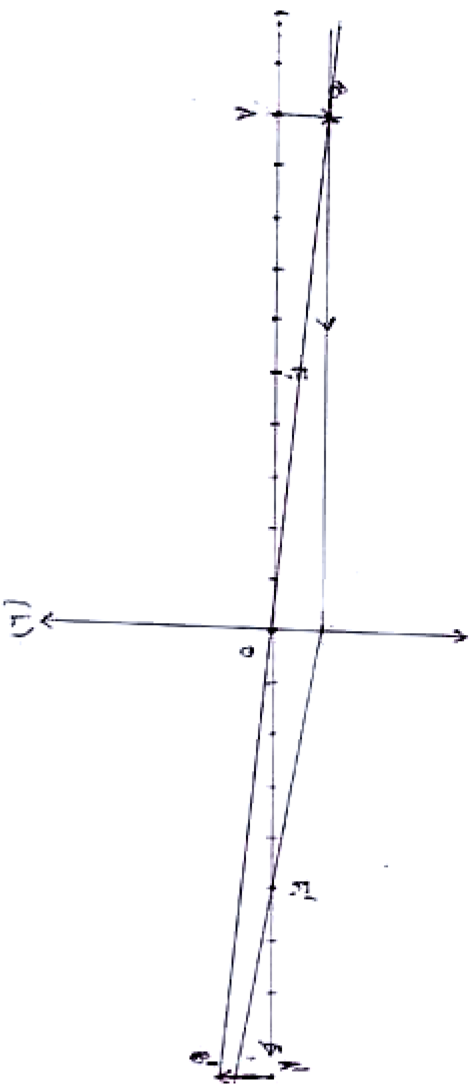
$$\overline{AA'} = -2\overline{OA} = -2(-2f') = 4f'$$

2) Construction géométrique

$$f_1 = \frac{\overline{AA'}}{4} = \frac{1}{4} = 0{,}25m = 25cm$$

$$\overline{OA} = -\frac{\overline{AA'}}{2} = -0{,}5 = -50cm$$

Echelle $\frac{1}{5}$



$$\gamma = \frac{\overline{A'B'}}{\overline{AB}} = \frac{\overline{OA'}}{\overline{OA}} - 1 \Rightarrow \overline{OA'} = -\overline{OA}$$

$$\overline{AA'} = 2{,}5m = \overline{AO} + \overline{OA'} = \overline{AO} - \overline{OA}$$

$$= -2\overline{OA} =$$

$$\Rightarrow OA = -\frac{\overline{AA'}}{2} = \frac{-2{,}5}{2} = -1{,}25m$$

$$\frac{1}{f'} = \frac{1}{\overline{OA'}} - \frac{1}{\overline{OA}} = -\frac{1}{\overline{OA}} - \frac{1}{\overline{OA}} = \frac{-2}{\overline{OA}}$$

$$f' = -\frac{\overline{OA}}{2} = -\frac{(-1{,}25)}{2} = 0{,}625m$$

$$C' = \frac{1}{f'} = C_1 + C_2$$

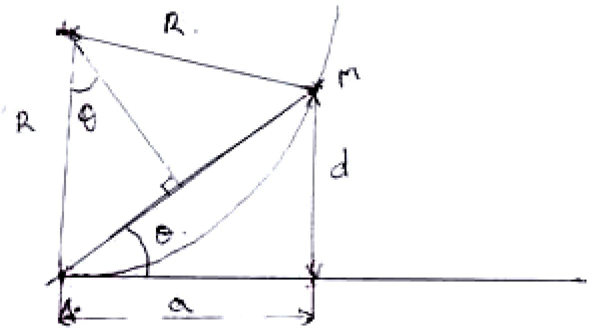
$$\frac{1}{f'} = \frac{1}{f_1} - \frac{1}{f_2} \quad \Rightarrow C_2 = \frac{1}{f'} - C_1$$

$$= 1{,}6 - 4 = -2{,}4\delta$$

$$\boxed{C_2 = -2{,}4\delta}$$

ELECTROMAGNETISME

A 1) Montrons que $R = \dfrac{d^2 + a^2}{2d}$



$$AM^2 = AO^2 + OM^2 = a^2 + d^2$$

$$\sin\theta = \frac{d}{AM} = \frac{AM}{2R} \Rightarrow AM^2 = 2Rd$$

$$2Rd = a^2 + d^2$$

$$R = \frac{a^2 + d^2}{2d}$$

2) Détermination de charge massique : $\dfrac{|q|}{m}$

Rayon de la trajectoire : $R = \dfrac{mV}{eB} = \dfrac{a_2 + d_2}{2d}$

$$\frac{m}{e} = \frac{a_2 + d_2}{2d} \times \frac{B}{V} \Rightarrow \frac{|q|}{m} = \frac{2dV}{B(a_2 + d_2)}$$

D'où $\dfrac{|q|}{m} = \dfrac{2 \times 0{,}1 \times 2 \times 10^7}{0{,}32(0.5^2 + 0.1^2)} = 4{,}80.10^7 C/kg$

Identification de cette particule :

Électron : $\dfrac{|q|}{m_e} = \dfrac{1{,}6 10^{-19}}{9.1 10^{-31}} = 1{,}75 10^{11}$

particule α $\dfrac{|q|}{m_\alpha} = \dfrac{3{,}2 10^{-19}}{6{,}64 10^{-27}} = 4{,}8 10 10^7 C/kg$

Donc cette particule est $\alpha = {}^4_2He$

$U(t) = U\sqrt{2}\cos(\omega t + \varphi)$

$u = 100v$ $I = 0{,}5A$

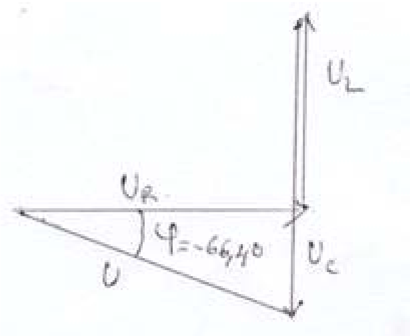
$U_C = 120V$

1° Calcul de Z

$Z = \dfrac{U}{I}$ $Z = \dfrac{100}{0{,}5}\Omega = 200\Omega$

$Z_C \succ U_B$

2° Calcul de la phase φ



$$\cos\varphi = \frac{U_R}{U} = \frac{RI}{U} = \frac{80 \times 0{,}5}{100} \approx 0{,}4$$

$$\cos\varphi = 0{,}4 \Rightarrow \varphi = 66{,}42°$$

$$\varphi = -66{,}42° = 0{,}369\pi\, rad$$

$$\boxed{\varphi = -0{,}369\pi\, rad}$$

3° Valeur de φ_B

$$U^2 = U_R + (U_C - U_L)^2$$

$$U^2 - U_R{}^2 = (U_C - U_L)^2$$

$$U_C - U_L = \sqrt{U^2 - U_R{}^2} = \sqrt{100^2 - 40^2}$$

$$= 91{,}65V$$

$$U_L = U_C - 91{,}65$$

$$U_L = 120 - 91{,}65 = 28{,}348V$$

$$tg\varphi_B = \frac{U_L}{U_R} = \frac{28{,}348}{40} = 0{,}708$$

$$\varphi_B = 35{,}20° = 0{,}19\pi\, rad$$

MECANIQUE

A 1° Expression du moment d'inertie J_Δ

$$J_\Delta = J_D + 2J_S$$

$$J_D = \frac{1}{2}MR^2$$

$$J_S = \frac{2}{5}mR^2 + md^2$$

$$J_\Delta = \frac{1}{2}mR^2 + (\frac{2}{5}mR^2 + md^2)2$$

2) Calcul du moment du couple moteur:

TAA. $\sum M_{Fext/\Delta} = J_\Delta\ddot{\theta}$

$$\Gamma m = J_\Delta\ddot{\theta}$$

Calcul de $\ddot{\theta}$:

$$\dot{\theta} = \ddot{\theta}t + \dot{\theta}_0 = \ddot{\theta}t \;\; dont \;\; \dot{\theta}_0 = 0$$

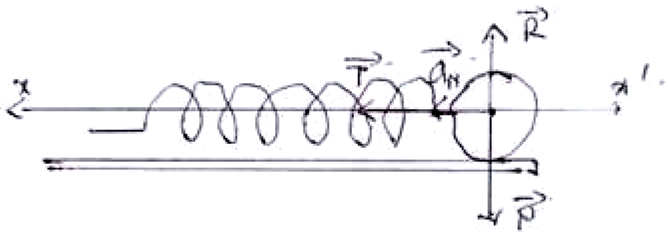
$$\ddot{\theta} = \frac{\dot{\theta}}{t} = \frac{9 rad\, s^{-1}}{4{,}5s} = 2 rad\, s^{-1}$$

D'où $\Gamma m = J_\Delta\ddot{\theta}$ $\quad J_\Delta = \frac{1}{2} \times 2 \times (0{,}2)^2 + \left[\frac{2}{5} \times 0{,}2 \times (0{,}05)^2 + (0{,}05)^2 \times 0{,}2\right]^2$

$$J_\Delta = 0{,}0414 kg\, m^2$$

$$\Gamma m = 0{,}0414 \times 2 = 0{,}0828 Nm$$

3° Détermination de la constante raideur du ressort :



TCI $\vec{T} + \vec{R} + \vec{P} = m\vec{a}$

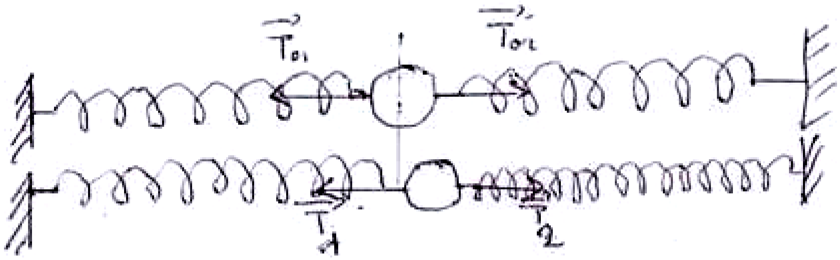
$x'x /$ $T_x + R_x + P_x = m a_N$ dont $P_x = 0$

$k\Delta l_0 = m\dfrac{V^2}{R} = m\omega R$

$k = \dfrac{m\omega^2(l_0 + \Delta l_0)}{\Delta l_0}$

AN $k = \dfrac{0{,}2 \times 5^2 (0{,}08 + 0{,}02)}{0{,}02}$

B $\boxed{k = 25 N/m}$



1° a) Equation différentielle du mouvement :

Système $\{sphère + 2ressort\}$ système conservatif

$E_m = constante$

$E_m = E_C + Ep_P + Ep_{élast}$

$E_C = \dfrac{1}{2}mV^2 = \dfrac{1}{2}m\dot{x}^2$

$Ep_P = 0$ (Energie potentielle de pesanteur)

$Ep_{élast} = \dfrac{1}{2}k(\Delta l_0 + x)^2 + \dfrac{1}{2}k(\Delta l_0 - x)^2$

$E_m = \dfrac{1}{2}mv^2 + \dfrac{1}{2}k(\Delta l_0 + x)^2 + \dfrac{1}{2}k(\Delta l_0 - x)^2$

$$\frac{dE_m}{dt} = 0 = \frac{1}{2}m2V\frac{dV}{dt} + \frac{1}{2}k2(\Delta l_0 + x)\dot{x} + \frac{1}{2}k2(\Delta l_0 - x)\dot{x}$$

$$mV\ddot{x} + k(\Delta l_0 + x)V - k(\Delta l_0 - x)V = 0$$

$$m\ddot{x} + k\Delta l_0 + kx - k\Delta l_0 + kx = 0$$

$$m\ddot{x} + 2k\,x = 0$$

$\ddot{x} + \frac{2k}{m}x = 0$ Posons $\omega^2 = \frac{2k}{m} = \frac{2\times 25}{0,2} = 250$

$\omega = 15,81$

$$\ddot{x} + \omega^2 x = 0$$

C'est une équation différentielle de 2^{nde} ordre à coefficient constant $\omega^2 = \frac{2k}{m}$

b) Equation horaire :

La solution générale est de la forme : $x(t) = x_m \sin(\omega t + \varphi)$

à t = 0 $x(t) = x_m \sin(\omega t + \varphi) = x_m = 2cm$

$\sin\varphi = 1 \Rightarrow \varphi = \frac{\pi}{2}$

$$x(t) = 2\sin(\sqrt{\frac{2k}{m}}t + \frac{\pi}{2})$$

$$x(t) = 2\sin(15,81t + \frac{\pi}{2}),\ x\,en\,cm$$

2° a) Equation différentielle de mouvement de S

T.C.I $\vec{T}_1 + \vec{T}_2 + \vec{P} + \vec{R} + \vec{F} = m\vec{a}$

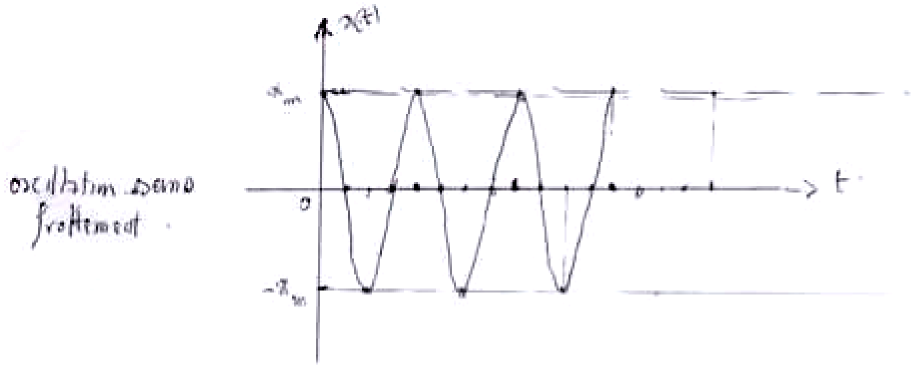
$$-k(\Delta l_0 + x) + k(\Delta l_0 - x) - \alpha\,\dot{x} = m\,\ddot{x}$$

$$-2k\,x - \alpha\,\dot{x} = m\ddot{x}$$

$$\ddot{x} + \frac{\alpha}{m}\dot{x} + \frac{2k}{m}x = 0$$

b) Allure de la courbe :

sans frottement



avec frottement : c’est un régime pseudo périodique