EX03: $A \longrightarrow B + C$, φ gaz, réaction d'ordre 0

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$T = cte$

$P = cte$

Pas d'inerte

$r = k C_A^0 = k$

$\begin{cases} r = k \\ r = \frac{r_A}{\nu_A} \Rightarrow r_A = \nu_A r = -r \end{cases}$

$\boxed{r_A = -r = -k}$

1- montrer que $V = V_0(1 + X_A)$.

φ gaz

$\begin{cases} V = V_0 \beta (1 + \varepsilon_A X_A) \\ V = V_0 \beta (1 + \varepsilon X) \end{cases}$ $\varepsilon_A X_A = \varepsilon X$.

$\Rightarrow \varepsilon_A = \frac{\varepsilon X}{X_A}$.

$n_A = n_A - n_0 X$ car $n_j = n_{j0} + \nu_A n_0 X$

$n_A = n_{A0} - n_{A0} X_A$ car $n_j = n_{j0} + \nu_j \frac{n_{A0} X_A}{-\nu_A}$

$\Rightarrow n_0 X = n_{A0} X_A$.

$\beta = \frac{P_0 T}{P T_0} = 1$ car $\begin{cases} P = cte \\ T = cte \end{cases}$

$\frac{X}{X_A} = \frac{n_{A0}}{n_0} = 1$ car $n_{A0} = n_0$ car A est pur.

$\varepsilon_A = \frac{\varepsilon X}{X_A} = \varepsilon = \frac{\Delta\alpha}{1 + I} = \Delta\alpha$

$\varepsilon_A = \varepsilon = \Delta\alpha = 2 - 1 = +1$

$I = \frac{n_{I0}}{n_0} = 0$ car pas d'inerte

$V = V_0 \beta (1 + \varepsilon_A X_A) = V_0 \cdot 1 (1 + 1 \cdot X_A) = \boxed{V_0 (1 + X_A) = V}$

2- Bilan de matière et $X_f = f(C_{A0}, k, t)$

B.M. $\frac{dn_A}{dt} = r_A V$

$n_A = n_{A0} - n_{A0} X_A \Rightarrow \frac{dn_A}{dt} = -n_{A0} \frac{dX_A}{dt}$

$r_A \cdot V = -k \cdot V_0 (1 + X_A)$.

car $r_A = -k$

et $V = V_0(1 + X_A)$

BM: $\frac{dn_A}{dt} = r_A \cdot V \Rightarrow -n_{A0} \frac{dX_A}{dt} = -k V_0 (1 + X_A)$

$\frac{dX_A}{(1 + X_A)} = \frac{k V_0}{n_{A0}} dt \Rightarrow \int_0^{X_A} \frac{dX_A}{(1 + X_A)} = \frac{k}{C_{A0}} \int_0^t dt$

$\ln(1 + X_A) \Big|_0^{X_A} = \frac{k}{C_{A0}} \cdot t \Rightarrow \ln(1 + X_A) = \frac{k t}{C_{A0}}$

$1 + X_A = \exp\left(\frac{k}{C_{A0}} t\right) \Rightarrow \boxed{X_A = -1 + \exp\left(\frac{k}{C_{A0}} t\right)} = \boxed{\exp\left(\frac{kt}{C_{A0}}\right) - 1}$

3- le temps de la réaction pour que $\underline{A}$ disparait complètement (1)
et pour $k = 1{,}5\ mol/l.s$, $C_{A0} = 1{,}5\ mol/l$.

$\underline{A}$ disparait totalement $\Rightarrow X_A = 1 \equiv 100\%$ (Conversion total).

$\Rightarrow \boxed{\ln(1+X_A) = \frac{k}{C_{A0}} \cdot t} \Rightarrow t = \frac{C_{A0}}{k} \ln(1+X_A) = \frac{1{,}5}{1{,}5} \ln(2) = \ln 2$

$\boxed{t = 0{,}693\ s}$

~~fin~~