SIGMA

$\rho = 2{,}08\ g/dm^3$ $P = 1\ atm$ $T = 60°C$ $N_2O_4 \rightleftharpoons 2NO_2$

K_p? α?

$u = \frac{m}{M}$

$\rho = \frac{M}{V}$

$\rightarrow PM = \rho RT \rightarrow M = \rho\frac{RT}{P} = \frac{2{,}08 \cdot 0{,}082 \cdot (60+273)}{1} = 76{,}8\ g/mol$

$M = x_{N_2O_4} M_{N_2O_4} + x_{NO_2} M_{NO_2}$

$M = x_{N_2O_4} \cdot M_{N_2O_4} + (1 - x_{N_2O_4})\frac{1}{2} M_{N_2O_4}$

$M = \left(x_{N_2O_4} + \frac{1}{2} - \frac{1}{2} x_{N_2O_4}\right) M_{N_2O_4}$

$M_{NO_2} = \frac{1}{2} M_{N_2O_4}$

$M_{N_2O_4} = (14 \cdot 2) + (16 \cdot 4) = 92\ g/mol$

$x_{N_2O_4} + x_{NO_2} = 1 \rightarrow x_{NO_2} = 1 - x_{N_2O_4}$

$\frac{M}{M_{N_2O_4}} = \frac{1}{2} + \frac{1}{2} x_{N_2O_4} \rightarrow x_{N_2O_4} = \frac{2 \cdot M}{M_{N_2O_4}} - \frac{2}{2} = \frac{2 \cdot 76{,}8}{92} - 1 = \boxed{0{,}235 = x_{N_2O_4}}$

$1 - 0{,}235 = \boxed{0{,}765 = x_{NO_2}}$

$K_p = \frac{P_{NO_2}^2}{P_{N_2O_4}} = \frac{P_T^2 x_{NO_2}^2}{P_T x_{N_2O_4}} = \frac{0{,}765^2}{0{,}235} = \boxed{2{,}49\ atm = K_p}$

$N_2O_4 \rightleftharpoons 2NO_2$

u_0 0

$u_0(1-\alpha)$ $2u_0\alpha$

$u_T = u_0 - u_0\alpha + 2u_0\alpha = u_0 + u_0\alpha = u_0(1+\alpha)$

$x_{N_2O_4} = \frac{u_0(1-\alpha)}{u_0(1+\alpha)}$

$x_{N_2O_4} + x_{N_2O_4}\alpha = 1 - \alpha$

$\alpha = \frac{1 - x_{N_2O_4}}{1 + x_{N_2O_4}} = \frac{1 - 0{,}235}{1 + 0{,}235} = \boxed{0{,}619 = \alpha}$