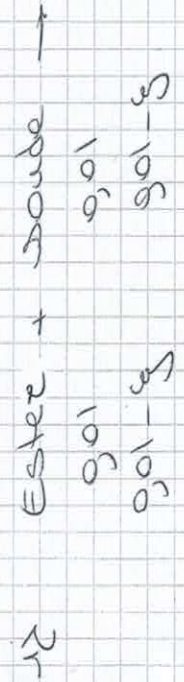


DM2

Exercices supplémentaires de cinétique

Exercice 1



$V_t \quad [\text{ester}] = [\text{soude}]$

$v = k[\text{ester}][\text{soude}]$
 $= k[\text{soude}]^2 = -\frac{d[\text{soude}]}{dt}$

$\frac{1}{[\text{soude}]} - \frac{1}{[\text{soude}]_0} = kt$

3/4 saponifié \Rightarrow il reste $1/4 \times 0,01$

$\frac{4}{0,01} - \frac{1}{0,01} = kt = 3/4$
 $\frac{3}{0,01} = k \times 2$

$k = \frac{3}{0,02} = 150 \text{ h}^{-1} \text{ mol}^{-1} \text{ L}$

$t_{1/2} = \frac{1}{k[A]_0} = \frac{1}{150 \times 0,01} = 0,66 \text{ h}$
 $= 40 \text{ minutes}$

$2 \quad k' = 4k = 4 \times 150 = 600 \text{ mol}^{-1} \text{ L h}^{-1}$
 $t_{1/2} = \frac{1}{600 \times 0,01} = 0,16 \text{ h} = 10 \text{ minutes}$

$\ln k'(400) - \ln k(300) = \frac{E_a}{R} \left(\frac{1}{400} - \frac{1}{300} \right)$
 $(\ln 4) \times \frac{8,31}{300 - 400} = \frac{E_a}{R} = 13,8 \text{ kJ mol}^{-1}$

Exercice 2

Ordre 2 $t_{1/2} = \frac{1}{k[A]_0}$

12 temps de fin de réaction $[A]_0 = 0,01 [A]_0$

$\frac{1}{0,01[A]_0} - \frac{1}{[A]_0} = \frac{99}{[A]_0} = k t_f$

$t_f = \frac{99}{k[A]_0}$ et $t_{1/2} = \frac{1}{k[A]_0}$

$t_f = 99 t_{1/2} = 99 \text{ h}$

22 On veut $t_f = 1 \text{ h} = \frac{99}{k[A]_0}$

$k(T') = \frac{99}{[A]_0}$

et $k(300) = \frac{1}{[A]_0}$

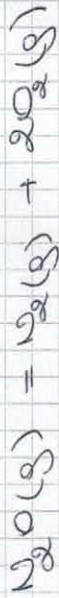
$\ln k(T') - \ln k(300) = \frac{E_a}{R} \left(\frac{1}{T'} - \frac{1}{300} \right)$

$-\frac{R}{E_a} (\ln 99) + \frac{1}{300} = \frac{1}{T'}$

$\Rightarrow -\frac{8,31}{23000} \ln 99 + \frac{1}{300} = \frac{1}{T'}$

$\frac{1}{T'} = 0,00327 \text{ mol}^{-1} \Rightarrow T' = 307,7 \text{ K}$

Exercice 3



n_0

$n_0 - \xi$

ξ

2ξ

$n_T = n_0 + 2\xi$

Ordre 1 $\ln [N_2O] - \ln [N_2O]_0 = -kt$

$$\ln \frac{n_0 - \xi}{n_0} = -kt$$

$$\xi = n_0 (1 - e^{-kt})$$

$$P_T = n_T \frac{RT}{V}$$

$$= (n_0 + 2\xi) \frac{RT}{V}$$

$$= P_0 + 2P_0 (1 - e^{-kt})$$

$$= 3P_0 - 2P_0 e^{-kt}$$

$$\frac{3P_0 - P_T}{2P_0} = e^{-kt}$$

$$-kt = \ln \left(\frac{3P_0 - P_T}{2P_0} \right)$$

Calcul de k : $k = -\frac{1}{26,5} \ln \left(\frac{3 \times 37,43 - 41,5}{2 \times 37,43} \right)$

$$= 2,13 \times 10^{-3} \text{ h}^{-1}$$

$$t_{1/2} = \frac{\ln 2}{k} = \frac{\ln 2}{2,13 \times 10^{-3}}$$

$$= 325,3 \text{ h}$$