DST 2025

Ex IA

1) $Q_1 + Q_2 = 0$

$m_1 C_p^{eau} (T_f - T_1) + m_2 C_p^{eau} (T_f - T_2) = 0$

(1) → $T_f = \dfrac{m_1 T_1 + m_2 T_2}{m_1 + m_2}$ AN $T_f = 32,35\,°C$ $305,35\,K$

2) $T_{eq} = 21,3\,°C$

$C(T_{eq} - T_1) + (m_1 + m_2) C_p^{eau} (T_{eq} - T_f) = 0$

(1) $\Rightarrow C = \dfrac{m_{eau} C_p^{eau} (T_f - T_{eq})}{T_{eq} - T_1}$ AN $C = 66,35\,J/K$

$C = 55\,J/K$

3) $Q_c + Q_{eau} + Q_m = 0$

$C(T'_{eq} - T'_1) + m'_1 C_p^{eau} (T'_{eq} - T'_1) + m'_2 C_p^{M} (T'_{eq} - T'_2) = 0$

(1) AN $C_p^M = 0,130\,J/g/K$ $C_p^M = 0,127\,J/g/K$

(1+1) 4) Metal = Au → $C_p^{Au} = 0,128\,J/g/K$

$= 25,12\,J/mol/K$ ← TABLE.

Ex 8

1) $V = 1\,\ell$, $P = 0{,}2403$ atm, $T = 20°C$ $\Rightarrow n_{NO} = \frac{PV}{RT} \Rightarrow$ **$n_{NO} = 0{,}01$ mole** (1)

$0{,}80$ gr de BrF_2 $\Rightarrow$ **$n_{BrF_2} = 0{,}005$ mole**

2) $2\,NO(g) + BrF_2(g) \rightleftharpoons 2\,NOBr(g)$

t_0	$0{,}01$	$0{,}005$	0
t	$0{,}01 - 2\xi$	$0{,}005 - \xi$	2ξ

(2) or $P = 0{,}304$ atm $= \frac{nRT}{V} \Rightarrow$ $n_T = 0{,}015 - \xi$; $n_T = \frac{PV}{RT} \Rightarrow n_T = 0{,}01148$ mole

$\xi = 0{,}0035$ mole

3) (1)

$P_{NO} = 0{,}0782$ atm	7923 Pa
$P_{BrF_2} = 0{,}0390$ atm	3951 Pa
$P_{NOBr} = 0{,}1867$ atm	18917 Pa

$\sum P_i = P_T = 0{,}304$ atm

4) (2) $K_T = \frac{a_{NOBr}^2}{a_{NO}^2\, a_{BrF_2}} = \frac{P_{NOBr}^2}{P_{NO}^2\, P_{BrF_2}} \times P_0 \Rightarrow$ **$K_T = 143{,}93$** à $T = 50° = 323$ K

5) (1) $K_T = e^{-\frac{\Delta_r G^\circ}{RT}} \Rightarrow \Delta_r G_T^\circ = -RT \ln(K_T) \Rightarrow$ **$\Delta_r G_T^\circ = -13{,}37$ kJ/mole**

6) à 298 K : $\Delta_r G^\circ = 2\Delta_f G^\circ_{NOBr} - 2\Delta_f G^\circ_{NO} - \Delta_f G^\circ_{BrF_2}$ (1)

$\Rightarrow$ **$\Delta_r G^\circ_{298K} = -11{,}51$ kJ/mole**

7) (1) $K_{298} = e^{-\frac{\Delta_r G^\circ_{298}}{RT}} \Rightarrow$ **$K_{298} = 104{,}6$**

8) (1) $T = 323$ K $\rightarrow$ $T = 298$ K $\Rightarrow P \downarrow \Rightarrow$ déplacement vers la gauche

$2 + 1 \rightleftharpoons 2$

Principe de Le Chatelier

143 Kr 104

Exc

1) $C_3H_8(g) + 5O_2(g) \xrightarrow[1\,bar]{298K} 3CO_2(g) + 4H_2O(\ell)$

2) $\Delta_r H^\circ_{298K} = 3\Delta_f H^\circ_{CO_2(g)} + 4\Delta_f H^\circ_{H_2O(\ell)} - \Delta_f H^\circ_{C_3H_8(g)}$

(1) → $\Delta_r H^\circ_{298K} = -2217,1$ kJ/mole

3) $C_3H_8(g) + 5O_2(g) \xrightarrow{\Delta_r H^\circ_{298K}} 3CO_2(g) + 4H_2O(\ell)$

$\downarrow \Delta H_1$ $\qquad$ $\downarrow \Delta H_2$ $\qquad$ $\Delta T = 202K$

$C_3H_8(g) + 5O_2(g) \xrightarrow{\Delta_r H^\circ_{500K}} 3CO_2(g) + 4H_2O(g)$

$\Delta H_1 = C_p(C_3H_8)\Delta T + 5C_p(O_2)\Delta T = 44\,440$ J/mole

$\Delta H_2 = 3C_p(CO_2)\Delta T + 4C_p(H_2O(\ell))(373-298) + 4\Delta_{vap}H^\circ_{H_2O} + 4C_p(H_2O(g))(500-373)$

$= 22\,482,6 + 22\,620 + 1,62\,10^5 + 17\,068,8 = 224\,651,4$ J/mole

$\Delta_r H^\circ_{500K} = -\Delta H_1 + \Delta_r H^\circ_{298} + \Delta H_2$

(2) → $\Delta_r H^\circ_{500K} = -2036,9$ kJ/mole

Ex D

	an + H_2O	→	ac
t_0	c_0	excès	0
t	$c = c_0 - x$		x

1) ordre 1 $\Rightarrow v = k[an] = kc = -\frac{dc}{dt}$

(2) $\Rightarrow \frac{dc}{c} = -k\,dt \Rightarrow \ln c = -kt + c^{te}$ $\quad t=0 \Rightarrow c^{te} = \ln c_0$

Soit $\ln\left(\frac{c}{c_0}\right) = -kt \Rightarrow \boxed{c = c_0 e^{-kt}}$

2) (1) $\tau \Leftrightarrow c = \frac{c_0}{2} \Rightarrow \frac{c_0}{2} = c_0 e^{-k\tau} \Rightarrow 2 = e^{k\tau} \Rightarrow \boxed{\tau = \frac{\ln 2}{k}}$

3) (1) $\tau = 2{,}45' \Rightarrow k = \frac{\ln 2}{\tau} \Rightarrow \boxed{k = 0{,}283\ min^{-1}}$

$4{,}72\,10^{-3}\ s^{-1}$

4) $\frac{c}{c_0} = e^{-kt}$ à $t = 15\ min$: $\frac{c}{c_0} = 0{,}014 = 1 - \alpha$

$\Rightarrow \alpha = 0{,}985$

(1) $\boxed{t = 2{,}45\ min \quad \alpha = 0{,}5}$
$\boxed{t = 15\ min \quad \alpha = 0{,}985}$

5) (1) $v_0 = k[an]_0 \Rightarrow \boxed{v_0 = 0{,}034\ mol/l/min}$

$5{,}67\,10^{-4}\ mol/l/s$