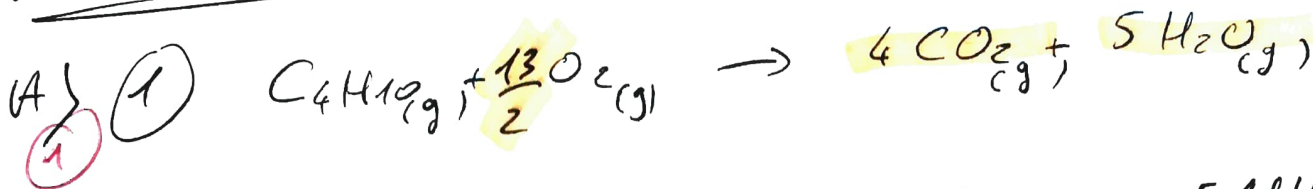


DST 2021

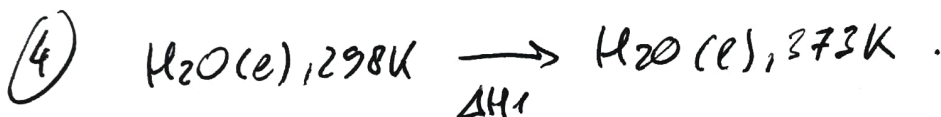


(1) (2) $\Delta_r H_{298}^\circ = \Delta_{comb} H_{298}^\circ = 4 \Delta_f H_{298}^\circ(CO_2(g)) + 5 \Delta_f H_{298}^\circ(H_2O(g)) - \Delta_f H_{298}^\circ(C_4H_{10}(g)) - \frac{13}{2} \times 0 = -2655,8 \text{ kJ/mol}$

(1) (3) $m_{butane} = \cancel{2,31g} 2,61g$
 $\rightarrow n_{butane} = \frac{2,61}{58} = 0,045 \text{ mole}$

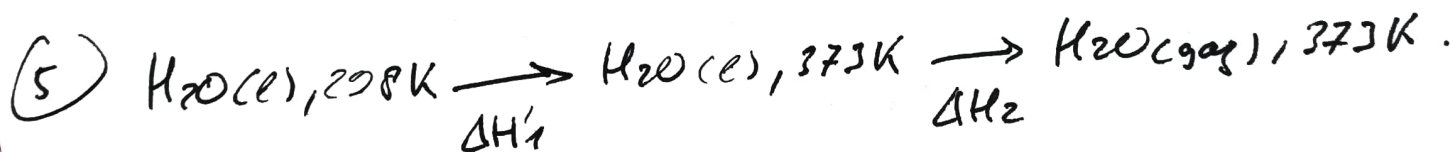
$Q_p = n_{butane} \times \Delta_{comb} H_{298}^\circ(C_4H_{10}(g)) = \cancel{-119,51 \text{ kJ}}$

$Q_p = -119,51 \text{ kJ}$



$-Q_p = \Delta H_1 = \frac{m_{H_2O}}{M_{H_2O}} \times C_p^\circ(H_2O(l)) \times \Delta T$

AM $m_{H_2O} = \frac{119,51 \times 18}{75,2 \cdot 10^{-3} \times 75} = 381,42 \text{ g}$



$-Q_p = \Delta H_1 + \Delta H_2$

$= \frac{m_{H_2O}}{M_{H_2O}} (C_p^\circ(H_2O(l)) \times \Delta T + \Delta H_{vap}(H_2O, 373))$

AM $m_{H_2O} = \frac{119,51 \times 18}{75,2 \cdot 10^{-3} \times 75 + 40,62} = 46,50 \text{ g}$



$$\left. \begin{array}{l} P = 1 \text{ atm} \\ T = 300 \text{ K} \end{array} \right\} \rightarrow \alpha = 0,2$$

$$\begin{array}{l} t=0 \quad n_0 \quad 0 \\ t+dt \quad n_0(1-\alpha) \quad 2n_0\alpha \quad n_{\text{tot}} = n_0(1+\alpha) \end{array}$$

$$(1) \quad K = \frac{a_{\text{NO}_2}^2}{a_{\text{N}_2\text{O}_4}} = \frac{(P_{\text{NO}_2}/P^\circ)^2}{(P_{\text{N}_2\text{O}_4}/P^\circ)} = \frac{P_{\text{NO}_2}^2}{P_{\text{N}_2\text{O}_4}} \cdot \frac{1}{P^\circ}$$

$$\text{avec } P_{\text{N}_2\text{O}_4} = \frac{n_0(1-\alpha)}{n_0(1+\alpha)} \cdot P_{\text{tot}} = \frac{1-\alpha}{1+\alpha} P_{\text{tot}}$$

$$P_{\text{NO}_2} = \frac{2n_0\alpha}{n_0(1+\alpha)} P_{\text{tot}} = \frac{2\alpha}{1+\alpha} P_{\text{tot}}$$

$$(2) \Rightarrow K = \frac{4\alpha^2}{1-\alpha^2} \frac{P_{\text{tot}}}{P^\circ}$$

$$(2) \quad \text{AM} \quad K = \frac{4 \cdot 0,2^2}{1-0,2^2} \frac{101325}{100000} \rightarrow K = 0,1689$$

$$(3) \quad \frac{4\alpha^2}{1-\alpha^2} = \frac{K P^\circ}{P_{\text{tot}}} = 0,1689 \times \frac{100000}{0,05 \times 101325} = 3,3333 = C$$

$$(1) \Rightarrow 4\alpha^2 = (1-\alpha^2) \cdot C \Rightarrow \alpha = \sqrt{\frac{C}{4+C}} \Rightarrow \alpha = 0,6742$$

$$\underline{Rq} \quad P \downarrow \rightarrow \alpha \uparrow$$

$$(4) \quad n_0 = \frac{46}{92} = 0,5 \text{ mole}$$

$$(1) \quad P_0 = \frac{n_0 R T}{V} \Rightarrow P_0 = 62355 \text{ Pa} = 0,6154 \text{ atm}$$

$$P_{tot} = n_0(1+d) \frac{RT}{V} = (1+d) P_0$$

$$K = \frac{4d^2}{1-d^2} \frac{P_{tot}}{P^0} = \frac{4d^2}{1-d^2} \frac{(1+d) P_0}{P^0} = \frac{4d^2}{1-d} \frac{P_0}{P^0} = \frac{0,1689}{K}$$

Done $\frac{4d^2}{1-d} = \frac{K P^0}{P_0} = 0,2745 = C$

$$\Rightarrow 4d^2 + dC - C = 0 \quad \Delta = 4,4675$$

$$d = \frac{-C + \sqrt{\Delta}}{8}$$

$$\Rightarrow d = 0,2298 \approx 0,23$$

1

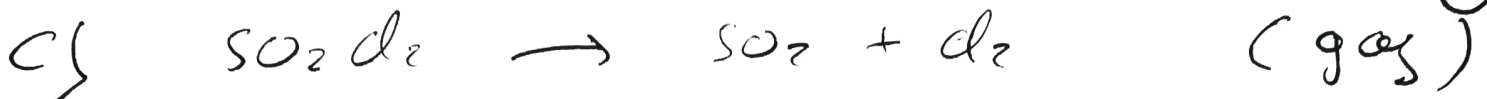
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$$P_{tot} = (1+d) P_0 = 76689,7 \text{ Pa} = 0,7569 \text{ atm}$$

$$P_{H_2O} = \frac{1-d}{1+d} P_{tot} = (1-d) P_0 = 48025,8 \text{ Pa} = 0,4740 \text{ atm}$$

$$P_{NO_2} = \frac{2d}{1+d} P_{tot} = 2d P_0 = 28658,4 \text{ Pa} = 0,2829 \text{ atm}$$

<u>Ra</u>	T = 300K	P = 1 atm	d = 0,2	K = 0,1689
		" 0,61 atm	" 0,23	
		" 0,05	" 0,67	



$$n \begin{cases} t=0 & n_0 & 0 & 0 \\ t+dt & n_0 - \xi & \xi & \xi \end{cases}$$

$$c \begin{cases} t=0 & n_0/V & 0 & 0 \\ t+dt & (n_0 - \xi)/V & \xi/V & \xi/V \end{cases}$$

(1) à $t=0$ $P_0 = n_0 \frac{RT}{V}$
à $t+dt$ $P = (n_0 + \xi) \frac{RT}{V}$
à $t \rightarrow \infty$ $P_{\infty} = 2 n_0 \frac{RT}{V}$ car $\xi_{max} = n_0$ (réaction totale)

(2) $\Rightarrow P_{\infty} = 2 P_0 \Rightarrow P_0 = P_{\infty} / 2 = 0,693 \text{ atm}$

(2) à tout instant :

$$P_{SO_2 d_2} = (n_0 - \xi) \frac{RT}{V} \quad \text{et} \quad P = (n_0 + \xi) \frac{RT}{V}$$

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

$$= 2 P_0 - P$$

(3) à $t = 40$ minutes $P_{SO_2 d_2} = 2 \cdot 0,693 - 1,008$
 $= 0,378 \text{ atm}$

(4) à $t = 40$ min $P_{SO_2 d_2} = \frac{n_{SO_2 d_2} RT}{V} \Rightarrow [SO_2 d_2] = \frac{n_{SO_2 d_2}}{V} = \frac{P_{SO_2 d_2}}{RT}$
 $\Rightarrow [SO_2 d_2] = 7,4 \frac{\text{mol}}{\text{m}^3} = 7,4 \text{ mmol/l}$

(5) Cinétique d'ordre 1 $v = - \frac{dC}{dt} = k_2 C^1$ avec $C = [SO_2 d_2]$
 $\Rightarrow \ln \frac{C_0}{C} = k_2 t$ et $\frac{C_0}{C} = \frac{P_0}{P_{SO_2 d_2}} = \frac{P_0}{2P_0 - P}$

(2) $\Rightarrow k_2 = \frac{1}{t} \ln \left(\frac{P_0}{2P_0 - P_{total}} \right)$

(6) Calcul de $k_2 \Rightarrow k_2 = 0,015 \text{ min}^{-1}$ Vt cgd.