

$t_{\infty}$ , plus de méthane et éthane

A-3)

$$\rightarrow \begin{cases} \xi_1 = n_0^m \\ \xi_2 = n_0^e \end{cases}$$

$$179,959 \text{ g de O}_2 \text{ (g)} \Leftrightarrow 5,623 \text{ mole} = 2n_0^m + \frac{7}{2}n_0^e$$

$$226,473 \text{ g de produit} \Leftrightarrow \text{~~226,473 g~~}$$

$$\begin{aligned} 226,473 \text{ (g)} &= (n_0^m + 2n_0^e) \underbrace{M_{\text{CO}_2}}_{44 \text{ g/mol}} + (2n_0^m + 3n_0^e) \underbrace{M_{\text{H}_2\text{O}}}_{18 \text{ g/mol}} \\ &= 80n_0^m + 142n_0^e \\ &= 40 \left( 5,623 - \frac{7}{2}n_0^e \right) + 142n_0^e \end{aligned}$$

$$\Rightarrow 2n_0^e = 226,473 - 40 \times 5,623$$

1)

$$\Rightarrow \boxed{n_0^e = 0,7765 \text{ mole} = \xi_2}$$

1)

$$\Rightarrow \boxed{n_0^m = 1,4526 \text{ mole} = \xi_1}$$

A-4)

0,5
$$M_{\text{CH}_4} = n_0^m \times M_{\text{CH}_4} = 1,4526 \times 16 = 23,242 \text{ g}$$

0,5
$$M_{\text{C}_2\text{H}_6} = n_0^e \times M_{\text{C}_2\text{H}_6} = 0,7765 \times 30 = 23,295 \text{ g}$$

5pts

1

$$\begin{cases} m_1 = 200g \\ T_1 = 298K \end{cases}$$

$$\begin{cases} m_2 = 300g \\ T_2 = 353K \end{cases}$$

$$\rightarrow T_{ideal} = ?$$

2

$$\Delta H_1 + \Delta H_c + \Delta H_2 = 0$$

$$\Leftrightarrow Q_1 + Q_c + Q_2 = 0$$

$$\Leftrightarrow m_1 C_p^e (T_{ideal} - T_1) + C (T_{ideal} - T_1) + m_2 C_p^e (T_{ideal} - T_2) = 0$$

$$\Rightarrow T_{ideal} = \frac{C_p^e (m_1 T_1 + m_2 T_2)}{C_p^e (m_1 + m_2)}$$

$$= \frac{200 \times 298 + 300 \times 353}{200 + 300} = 331 K$$

1

$$3) T_{exp} = 323 K < T_{ideal} = 331 K$$

1<sup>re</sup> méthode \*  $\Rightarrow C = \frac{C_p^e [-m_2 (T_{exp} - T_2) - m_1 (T_{exp} - T_1)]}{T_{exp} - T_1}$

$$= \frac{4185 (-0,3 \times (323 - 353) - 0,2 \times (323 - 298))}{323 - 298}$$

$$= 669,6 J \cdot K^{-1}$$

1

2<sup>de</sup> méthode (Calorimétrie)  $\Rightarrow$  500g H<sub>2</sub>O  $\frac{331K \rightarrow 323K}{298 \rightarrow 323K}$   $\Delta T = 8K$ .

$$Q_c = C \times \Delta T = -Q_{H_2O} = m_{H_2O} C_p^{H_2O} \Delta T //$$

$$= C (323 - 298) = 0,5 \times 4185 \times (323 - 331)$$

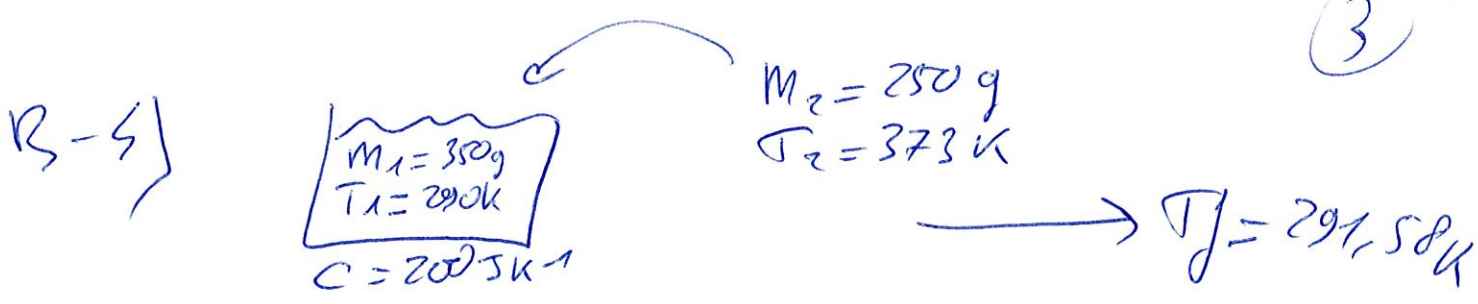
$$\Rightarrow C = 669,6 J \cdot K^{-1}$$



1 2

$$\Delta E = m_{H_2O} C_p^{H_2O} (331 - 323) = 16740 J$$

3



$$-Q_1 + Q_C + Q_2 = 0$$

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

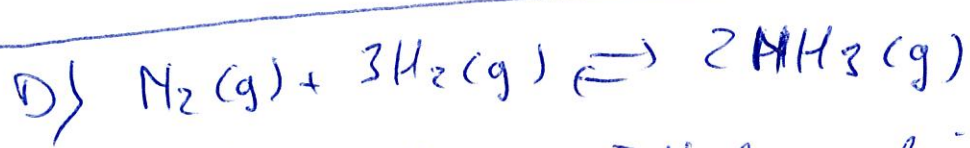
$$\Rightarrow C_p^{Au} = \frac{(0,350 \times 4185 + 200)(290 - 291,58)}{0,250 \times (291,58 - 373)}$$

~~1~~ 1 = 0,129 J · g<sup>-1</sup> · K<sup>-1</sup>

= 129,2 J · kg<sup>-1</sup> · K<sup>-1</sup>

↓ x M<sub>Au</sub>

~~1~~ 1 = 25,41 J · mol<sup>-1</sup> · K<sup>-1</sup>



3pts

1 D-1)  $\Delta_r H_{298K}^\circ$  : Enthalpie molaire standard de réaction à 298 K. '0' → P = P<sub>0</sub> standard.

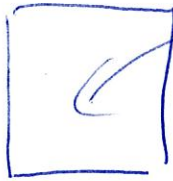
1 D-2) Enthalpie associée à la formation de NH<sub>3</sub> à partir des corps simples qui le compose.  
 →  $\Delta_f H_{NH_3(g), 298K}^\circ$

1 D-3)  $\Delta_r H_{298K}^\circ = 2 \Delta_f H_{NH_3(g), 298K}^\circ - \Delta_f H_{N_2(g), 298K}^\circ - 3 \Delta_f H_{H_2(g), 298K}^\circ$   
 →  $\Delta_f H_{NH_3(g), 298K}^\circ = -46 \text{ kJ/mol}$

6pts



4



1 mole de  $CH_4(g)$

$V = 50\text{L}$   
 $T = 850^\circ\text{C}$

(1)  $P = \frac{nRT}{V}$  AM  $P = \frac{1 \times 8,314 \times (273,15 + 850)}{50 \cdot 10^{-3}}$

$P = 186757,4 \text{ Pa}$   
 $= 1,84 \text{ atm}$   
 $= 1,86 \text{ bar}$

$n_g = 1 + \xi$   
 $P(\xi) = (1 + \xi) \frac{RT}{V}$   
 $= (1 + \xi) P_{t=0}$   
 $\xi = 0 \Rightarrow P = P_{t=0}$   
 $\xi = 1 \Rightarrow P = 2 \times P_{t=0}$

1



$n_0 = 1$	0	0
$(n_0 - \xi)$	$\xi$	$2\xi$
$1 - \xi$		

$P_{t=0} = 1,86 \text{ bar}$   
 $P_f = 3,2 \text{ bar}$

$n_g^f = 1 - \xi + 2\xi = 1 + \xi$

$P_f = n_g^f \frac{RT}{V} = n_g^f \frac{P_{t=0}}{n_0} \Rightarrow n_g^f = n_0 \frac{P_f}{P_{t=0}}$

$\Rightarrow 1 + \xi = 1 \times \frac{3,2}{1,86}$

(1)  $\Rightarrow \xi = \frac{3,2}{1,86} - 1 = 0,7135 \text{ mole}$

- (3)  $n_{CH_4(g)}^f = 1 - \xi = 0,2865 \text{ mole}$
- (1)  $n_{C(s)}^f = \xi = 0,7135 \text{ mole}$
- $n_{H_2(g)}^f = 2\xi = 1,427 \text{ mole}$

(4)  $P_{CH_4} = \frac{n_{CH_4}}{n_T} P_f$   
 $= \frac{1 - \xi}{1 + \xi} \times 3,2$

(1)  $P_{CH_4} = 0,535 \text{ bar}$   
(1)  $P_{H_2} = \frac{2\xi}{1 + \xi} P_f = 2,665 \text{ bar}$

(5)  $\xi_{max} = 1 \Rightarrow P_{f,max} = (1 + \xi_{max}) P_{t=0}$   
 $= 2 \times P_{t=0}$   
 $= 3,72 \text{ bar}$

1