DS / Mars 2024

Exa / 6pts

1) $Q_{eau} + Q_{cal} = 0$

$m_0 C_{p,eau} (49,2-50) + C(49,2-20) = 0$

$\in) -1304,16 + 29,2\,C = 0 \Rightarrow$ **$C = 44,66$ J/K**

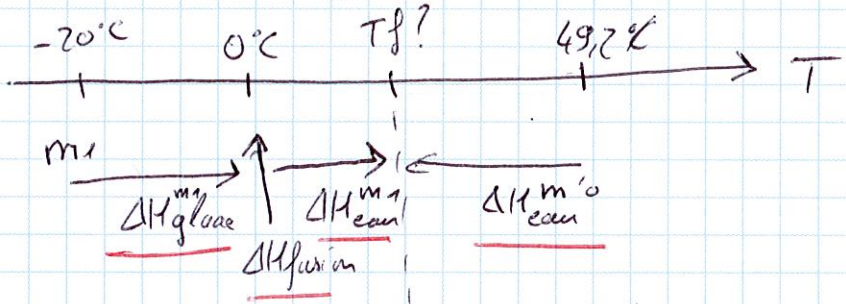
2) Valeur en eau $\mu = \frac{C}{C_{p,eau}}$ unité : $\frac{J}{K}\frac{gK}{J} = g$

AN **$\mu = 10,68$ g.**

3) $m'_0 = m_0 + \mu = 400,68$ g d'eau à 49,2 °C

+ glaçon $m_1 = 150$ g de glace à -20 °C

Schéma :



hypothèse que toute la glace fond.

$\Delta H^{m_1}_{glace} + \Delta H^{m_1}_{fusion} + \Delta H^{m_1}_{eau} + \Delta H^{m'_0}_{eau} = 0$

$m_1 C_{p\,glace}(0+20)$	6090 J
$+ m_1 \Delta H_{fus}$	+ 50 100 J
$+ m_1 C_{p,eau}(T_f - 0)$	+ 627 T_f
$+ m'_0 C_{p\,eau}(T_f - 49,2)$	+ 1674,84 T_f − 82402,24
$= 0$	$= 0$

$\Rightarrow 2301,84\,T_f = 76212,36$

$\Rightarrow$ **$T_f = 11,4$ °C $= 284,4$ K**

B) 1) $\Delta_r H^{\circ(i)}_{298K} = 2\Delta_f H^\circ_{H_2O(g)} + 2\Delta_f H^\circ_{Cl_2(g)} - 4\Delta_f H^\circ_{HCl(g)} - 0$

4pts

$= 2\times(-241,8) + 2(0) - 4\times(-92,3)$

$= \boxed{-114,4 \text{ kJ/mol}}$

2) $\Delta_r H^{\circ(ii)}_{298K} = \Delta_r H^{\circ(i)}_{298K} - 2\Delta_{vap}H^\circ_{H_2O,298K}$

$= -114,4 - 2\times 44$

$= \boxed{-202,4 \text{ kJ/mol}}$

3) $H = U + PV \Rightarrow \Delta H = \Delta U + P\Delta V + V\Delta P$

$\Delta P = 0$ car $P = P_0 = cte$

$\Rightarrow \Delta U = \Delta H - P\Delta V$

$= \Delta H - \Delta n RT$

* $H_2O(g) \Rightarrow \Delta U^{(i)} = \Delta H^{(i)} - (2+2-4-1)RT$

$= -114,4 + 8,314\,10^{-3}\times 298$

$= \boxed{-111,92 \text{ kJ/mol}}$

4) $\Delta U^{(ii)} = \Delta H^{(ii)} - (2-4-1)RT$

$= -202,4 + 3\times 8,314\,10^{-3}\times 298$

$= \boxed{-194,97 \text{ kJ/mol}}$

D) 1) $C(s) + \frac{1}{2}O_2(g) + Cl_2(g) \longrightarrow COCl_2$

3pts

Il s'agit d'une réaction de formation $\Rightarrow \boxed{\Delta_r H^\circ = \Delta_f H^\circ_{COCl_2} = -222,8 \text{ kJ/mol}}$

2) $\Delta_r H^\circ = \Delta_f H^\circ_{CO(g)} + \Delta_f H^\circ_{Cl_2(g)} - \Delta_f H^\circ_{COCl_2(g)}$

$= -110,5 + 0 + 222,8$

$= \boxed{+112,3 \text{ kJ/mol}}$

7 pts

c)

	$CH_4(g)$	$\rightleftharpoons$	$C(s)$	+	$2H_2(g)$	
t_0	1 mole		0		0	$n_0^{tot} = 1$ mole
t_f	$1-\xi$		ξ		2ξ	$n_f^{tot} = 1+2\xi$
						$n_{(g)}^{tot} = 1+\xi$

1) $V = 50\ \ell$
$T = 850°C = 1123,15\ K$

$$P = \frac{nRT}{V} = \frac{1 \times 8,314 \times 1123,15}{50\,10^{-3}} \Rightarrow \boxed{P_{init} = 1,867 \text{ bar} = 186\,757,4 \text{ Pa}}$$

2) $P_f = 3,2 \text{ bar} = 320\,000 \text{ Pa} \Rightarrow n_f^{tot} = \frac{PV}{RT}$

$$\boxed{n_f^{tot} = 1,7134 \text{ mole} = 1+\xi}$$

$$\Rightarrow \boxed{\xi = 0,7134 \text{ mole}}$$

3) A l'équilibre :

$$\boxed{n_{CH_4} = 0,2866 \text{ mole}}$$
$$\boxed{n_C = 0,7134 \text{ "}}$$
$$\boxed{n_{H_2} = 1,4268 \text{ "}}$$

4) $P_f = 3,2 \text{ bar} \Rightarrow x_{CH_4} = \frac{0,2866}{1,7134} 3,2 = \boxed{0,5352 \text{ bar}}$

$$x_{H_2} = \frac{1,4268}{1,7134} 3,2 = \boxed{2,6647 \text{ bar}}$$

5) $P_T = (1+\xi)\frac{RT}{V} = \boxed{(1+\xi) P_{init}}$

6) Avancement max $\xi_{max} = 1 \Rightarrow \boxed{P_T^{\infty} = 2 P_{init} = 3,734 \text{ bar}}$