

Exo 3 (UFC: cap, p, m) Serie n° 2

a) $UFC_{li} \xrightleftharpoons[P_c]{P_c} UFC_{vap}$
 vaporisation
 $X_{UFC} = 1$

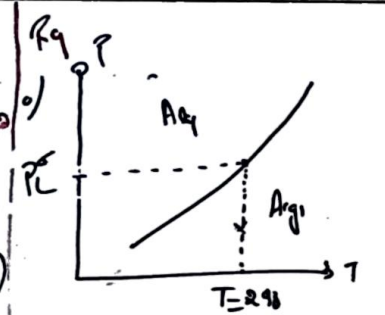
b) $X_{UFC} = 1$

$UFC = 1$

d) $\frac{N_{UFC}^{*,li}(T)}{N_{UFC}^{*,li}(T)} = \frac{P_{UFC}^{*,li}(T)}{P_c} \sqrt{P_c}$
 $\frac{N_{UFC}^{*,li}(T)}{N_{UFC}^{*,li}(T)} = \frac{P_{UFC}^{*,li}(T)}{P_c}$

e) $\frac{N_{UFC}^{*,li}(T)}{N_{UFC}^{*,li}(T)} = \frac{P_{UFC}^{*,li}(T)}{P_c} + RT \ln \frac{P_c}{P_0}$

f) $\frac{N_{UFC}^{*,li}(T)}{N_{UFC}^{*,li}(T)} = \frac{P_{UFC}^{*,li}(T)}{P_c}$
 $\frac{N_{UFC}^{*,li}(T)}{N_{UFC}^{*,li}(T)} = \frac{P_{UFC}^{*,li}(T)}{P_c} + RT \ln \frac{P_c}{P_0}$



b) $\log \frac{P_c}{P_0} = a - \frac{b}{T}$

c) $\frac{N_{UFC}^{*,li}(T)}{N_{UFC}^{*,li}(T)} = \frac{P_{UFC}^{*,li}(T)}{P_c} + RT \ln \frac{P_c}{P_0}$
 $X_i = \left(\frac{P_i}{P_c} \right) \phi$
 $\frac{1}{i} = \left(\frac{P_i}{P_c} \right)$

$T_{sub} = T_{sub} \text{ pour } P_{sub} = P_0$
 $UFC_{li} \xrightleftharpoons[P_c]{P_c} UFC_{vap}$
 $\log P_{sub} = 10,646 - \frac{2889}{T}$
 $\log P_0 = 10,646 - \frac{2889}{T_{sub}}$
 $T_{sub} = \frac{2889}{10,646 - \log P_0}$

$P_0 = 1179,8 \text{ mmHg}$
 $P_0 = 1,1798 \text{ bar}$

2) UFC coexiste avec la vapeur d'eau au point triple $T_0 (T_0, P_0)$
 $T_0 \in \text{à la condensation: } \log P_0 = 10,646 - \frac{2889}{T_0}$
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 $T_0 = \frac{2889}{10,646 - \log P_0}$

$P_0 = 1179,8 \text{ mmHg}$
 $\approx 1,1798 \text{ bar}$

Ex 03 (UFC: cap, pen) Serie n° 2
 $R = 8.314 \text{ J.K}^{-1}\text{mol}^{-1}$
 u/o) $\Delta_{\text{vap}} H_m^{\circ}(\text{UFC})$?
 $\Delta_{\text{vap}} H_m^{\circ}(\text{UFC})$?
 $\text{UFC}_{\text{liq}} \rightleftharpoons \text{UFC}_{\text{g}}$
 $\mu_{\text{UFC}}^{\text{liq}} = \mu_{\text{UFC}}^{\text{g}}$
 $H_{\text{UFC}}^{\text{liq}} - TS_{\text{UFC}}^{\text{liq}} = H_{\text{UFC}}^{\text{g}} - TS_{\text{UFC}}^{\text{g}}$
 ① $\Delta_{\text{vap}} H_m^{\circ} = \frac{D_{\text{vap}} H_m^{\circ}}{T}$
 $d\mu_{\text{UFC}}^{\text{liq}} = d\mu_{\text{UFC}}^{\text{g}}$
 $(N_{\text{UFC}}^{\text{liq}} dP - S_{\text{UFC}}^{\text{liq}} dT) = (N_{\text{UFC}}^{\text{g}} dP - S_{\text{UFC}}^{\text{g}} dT)$
 $(N_{\text{UFC}}^{\text{liq}} - V_{\text{UFC}}^{\text{liq}}) dP = (S_{\text{UFC}}^{\text{g}} - S_{\text{UFC}}^{\text{liq}}) dT$

$$\frac{dP}{dT} = \frac{D_{\text{vap}} S_m^{\circ}}{D_{\text{vap}} V_m^{\circ}} \quad \textcircled{2}$$

① et ②

$$\frac{dP}{dT} = \frac{D_{\text{vap}} H_m^{\circ}}{T D_{\text{vap}} V_m^{\circ}}$$

$$a) D_{\text{vap}} V_m^{\circ} = V_m^{\text{g}} - V_m^{\text{liq}} \approx V_m^{\text{g}} = \frac{RT}{P}$$

$$\frac{dP}{dT} = \frac{D_{\text{vap}} H_m^{\circ}}{RT^2} \cdot P$$

$$\int_{P^0}^P \frac{dP}{P} = \int_{T_0}^T \frac{D_{\text{vap}} H_m^{\circ}}{RT^2} dT$$

$$\ln \frac{P}{P^0} = \frac{D_{\text{vap}} H_m^{\circ}}{RT_{\text{UFC}}} - \frac{D_{\text{vap}} H_m^{\circ}}{RT}$$

$$\log \frac{P}{P^0} = \frac{D_{\text{vap}} H_m^{\circ}}{2.3 RT_{\text{UFC}}} - \frac{D_{\text{vap}} H_m^{\circ}}{2.3 RT}$$

$$\log \frac{P}{P^0} = \left(\log P^0 + \frac{D_{\text{vap}} H_m^{\circ}}{2.3 RT_{\text{UFC}}} \right) - \frac{D_{\text{vap}} H_m^{\circ}}{2.3 RT}$$

or
 $\log P_{\text{UFC}}^0 = 7.138 - \frac{1511}{T}$

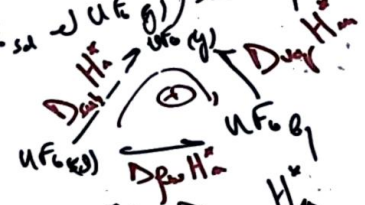
Par identification on:

$$\frac{D_{\text{vap}} H_m^{\circ}}{2.3 R} = 1511$$

$$D_{\text{vap}} H_m^{\circ} = 2.3 R (1511) = 28890 \text{ J mol}^{-1}$$

$$= 28.89 \text{ kJ mol}^{-1}$$

b) $\Delta_{\text{fus}} H_m^{\circ} = ?$
 Au point triple $P^0(T_0, P_0)$; les 3 phases.
 $(\text{UFC}_{\text{liq}}, \text{UFC}_{\text{sol}}, \text{UFC}_{\text{g}})$ sont en équilibre



$$\Delta_{\text{sub}} H_m^{\circ} = \Delta_{\text{fus}} H_m^{\circ} + \Delta_{\text{vap}} H_m^{\circ}$$

$$\Delta_{\text{fus}} H_m^{\circ} = \Delta_{\text{sub}} H_m^{\circ} - \Delta_{\text{vap}} H_m^{\circ} = 20.1 \text{ kJ mol}^{-1}$$

c) $\text{UFC}_{\text{liq}} \rightleftharpoons \text{UFC}_{\text{g}}$; $\Delta_{\text{fus}} V_m^{\circ} = V_m^{\text{g}} - V_m^{\text{liq}}$
 $(P - P^0) = \frac{D_{\text{fus}} H_m^{\circ}}{D_{\text{fus}} V_m^{\circ}} \ln \frac{T}{T_0}$
 $\Delta_{\text{fus}} H_m^{\circ} : \text{J mol}^{-1}$
 $\Delta_{\text{fus}} V_m^{\circ} : \text{m}^3 \text{mol}^{-1}$
 $(P - P^0) : \text{Pa}$

$$T_{\text{fus}} = T_0 \exp \left(\frac{D_{\text{fus}} H_m^{\circ}}{D_{\text{fus}} V_m^{\circ} (P - P^0)} \right)$$

Exercice 3 (UFC: capsaïcine) Série n° 1
 $R = 8,314 \text{ J.K}^{-1}\text{mol}^{-1}$
 3) n à $\theta = 10^\circ\text{C}$, $P = 533,43 \text{ mmHg}$
 n est la courbe de Sublimation

au point n : $\text{UFC}_{sd} \rightleftharpoons \text{UFC}_{vg}$

$$n_{sd} = \frac{V_{UFC}}{V_m^{*sd}}$$

$$n_g = \frac{V_{UFC}}{V_m^{*g}}$$

$$V_m^{*sd} = 7,132 \cdot 10^{-5} \text{ m}^3 \text{ mol}^{-1}$$

$$= 7,132 \cdot 10^{-2} \text{ L mol}^{-1}$$

$$V_m^{*g} = 1,81 \cdot 10^{-2} \text{ m}^3 \text{ mol}^{-1}$$

$$= 18,1 \text{ L mol}^{-1}$$

$$\begin{aligned} n_{sd} + n_g &= 1 \text{ mol} \\ \frac{V_{UFC}}{V_m^{*sd}} + \frac{V_{UFC}}{V_m^{*g}} &= 1 \text{ mol} \end{aligned}$$

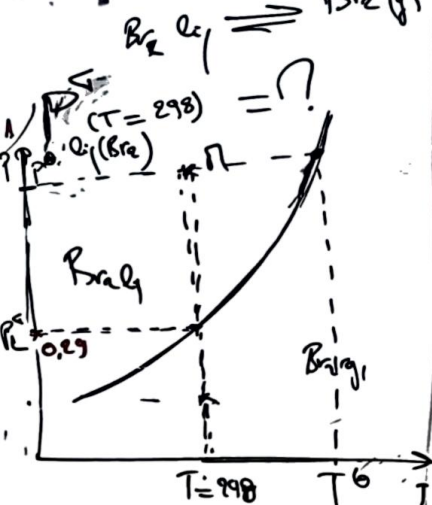
$$V_{UFC}^{sd} + V_{UFC}^g = V_{\text{tot}} = 0,1 \text{ L} = 10^{-4} \text{ m}^3$$

$$V_{UFC}^{sd} = 10^{-4} - V_{UFC}^g$$

$$\frac{10^{-4} - V_{UFC}^g}{V_m^{*sd}} + \frac{V_{UFC}^g}{V_m^{*g}} = 1 \text{ mol}$$

$$\begin{aligned} V_{UFC}^{sd} &= 71,07 \cdot 10^{-6} \text{ m}^3 \\ &= 71,07 \text{ cm}^3 \\ V_{UFC}^g &= 28,93 \cdot 10^{-6} \text{ m}^3 \\ &= 28,93 \text{ cm}^3 \end{aligned}$$

$E_{\text{ex}}^{\text{no}} 4 \text{ (U.F. : cal/g p.m.)}$ Serie n° 2
 $R = 8,314 \text{ J.K}^{-1}\text{mol}^{-1}$



$\log \frac{P_L}{P^0} = a - \frac{b}{T}$

caduca d'equilibre:

$\mu_{\text{Br}_2}^{*l}(T) = \mu_{\text{Br}_2}^{*g}(T)$
 $\mu_{\text{Br}_2}^{*l}(T) + V_m^{*l}(P_L - P^0) = \mu_{\text{Br}_2}^{*g}(T) + RT \ln \frac{P_L}{P^0}$

$\mu_{\text{Br}_2}^{*l}(T) = \mu_{\text{Br}_2}^{*g}(T) + RT \ln \frac{P_L}{P^0}$

$\ln = \ln \left(\frac{P_{\text{Br}_2}^{*l} - P_{\text{Br}_2}^{*g}}{RT} \right)$

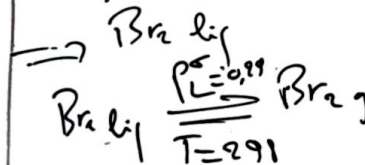
AN. à T=298

$P_L = 1 \exp \left(\frac{-3010}{8,314(298)} \right)$

$P_L(T=298) = 0,29 \text{ bar}$

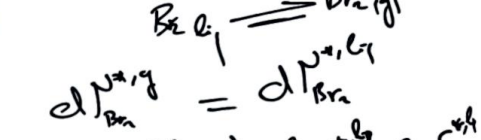
$P = P^0$
 2/ Etat standard de réf de Br2
 à T=298

$P^0 \rightarrow P_L$ à T=298



à S. P ↑ les 2 se déplacent dans le sens qui fait mgi (c-à-d dans le sens inverse des deux le sens qui stabilise Br2 liq

3/ $T_{\text{eq}}(\text{Br}_2) = T_{\text{sup}}(\text{Br}_2)$
 $\mu_{\text{Br}_2}^{*l}$ et $\mu_{\text{Br}_2}^{*g}$ sont indépendants de T ; Dug μ_{Br_2} est indépendante de T

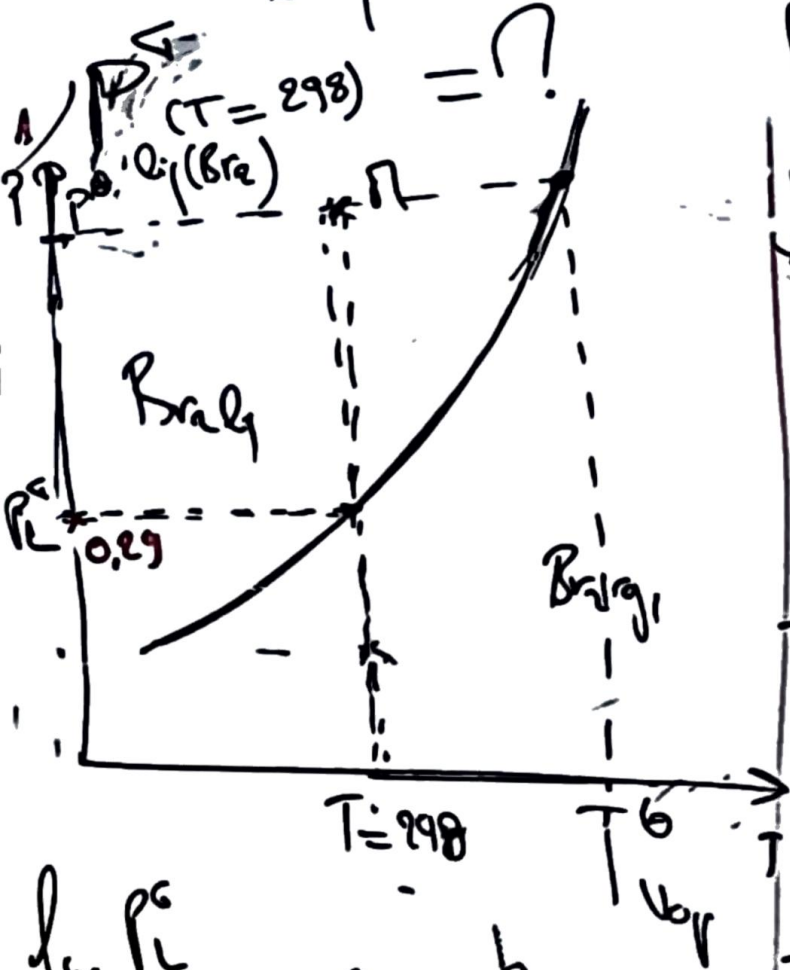


$(V_m^{*l} dP - S_m^{*l} dT) = (V_m^{*g} dP - S_m^{*g} dT)$
 $(V_m^{*l} - V_m^{*g}) dP = (S_m^{*g} - S_m^{*l}) dT$

$\left(\frac{dP}{dT} \right)_{\text{eq}} = \frac{S_m^{*g} - S_m^{*l}}{V_m^{*g} - V_m^{*l}}$

à $D_{\text{ug}} V_m^* = V_m^{*g} - V_m^{*l} \quad \mu_{\text{Br}_2}^{*l} - \mu_{\text{Br}_2}^{*g} = \frac{RT}{P}$

Exm 4 (UFC: cap & pen) Serie n° 1
 $R = 8,314 \text{ J.K}^{-1}\text{mol}^{-1}$



$$\log \frac{P^G}{P^L} = a - \frac{b}{T}$$

$$\frac{dP}{dT} = \frac{\Delta_{\text{vap}} S_m^*}{RT}$$

$$\int_{P^L}^{P^G} \frac{dP}{P} = \int_{298}^{T_{\text{vap}}} \frac{\Delta_{\text{vap}} S_m^*}{RT} dT$$

$$\ln \frac{P^G}{P^L} = \frac{\Delta_{\text{vap}} S_m^*}{R} \ln \frac{T_{\text{vap}}}{298}$$

$$T_{\text{vap}} = 298 \exp \left[\frac{R}{\Delta_{\text{vap}} S_m^*} \ln \frac{P^G}{P^L} \right]$$

$$T_{\text{vap}} = 298 \exp \left[\frac{8,314}{(245,1 - 192,9)} \ln \frac{1}{0,29} \right]$$

$$T_{\text{vap}} = 332$$