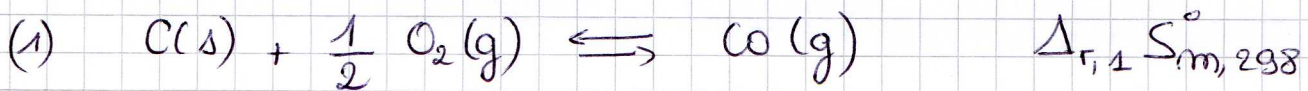
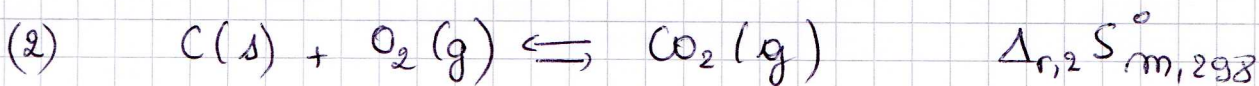


TD3 : Exercice supplémentaire.

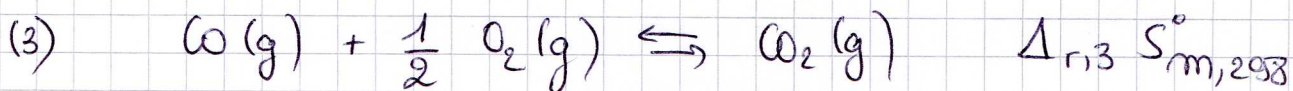
Exercice 8 : Variation d'entropie à 298,15 K



$$\begin{aligned} \Delta_{r,1} S_{m,298}^\circ &= S_{m,298}^\circ(CO,g) - S_{m,298}^\circ(C,s) - \frac{1}{2} S_{m,298}^\circ(O_2,g) \\ &= 197,6 - 5,7 - \frac{205}{2} \\ &= 89,4 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} \end{aligned}$$

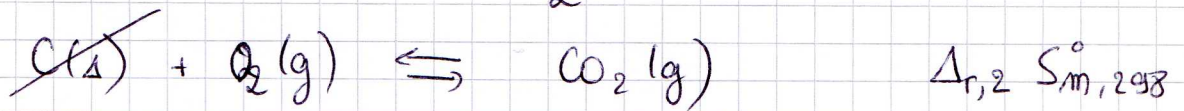
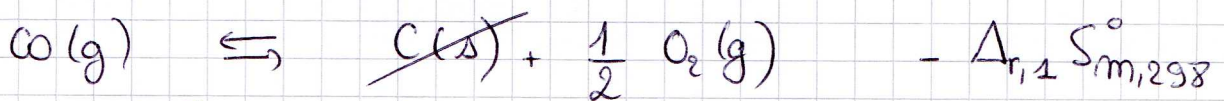


$$\begin{aligned} \Delta_{r,2} S_{m,298}^\circ &= S_{m,298}^\circ(CO_2,g) - S_{m,298}^\circ(C,s) - S_{m,298}^\circ(O_2,g) \\ &= 213,6 - 5,7 - 205 \\ &= 2,9 \text{ J}\cdot\text{K}^{-1} \end{aligned}$$



$$\begin{aligned} \Delta_{r,3} S_{m,298}^\circ &= S_{m,298}^\circ(CO_2,g) - S_{m,298}^\circ(CO,g) - \frac{1}{2} S_{m,298}^\circ(O_2,g) \\ &= 213,6 - 197,6 - \frac{1}{2} \times 205 = -86,5 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} \end{aligned}$$

Vérif. entropie = fonction d'état :



$$\begin{aligned} CO(g) + \frac{1}{2} O_2(g) &\rightleftharpoons CO_2(g) \quad \Delta_r S_{m,298}^\circ = \Delta_{r,2} S_{m,298}^\circ - \Delta_{r,1} S_{m,298}^\circ \\ &= 2,9 - 89,1 = 86,5 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} \\ &= \Delta_{r,3} S_{m,298}^\circ \end{aligned}$$

⇒ l'entropie est donc bien une fonction d'état.

la réaction est spontanée si $\Delta_r G_{m,298}^\circ < 0$

$\Delta G = \Delta H - T\Delta S$ ici $T = 298 \text{ K}$, $P = 1 \text{ atm}$.

$\Delta_r G_{298,m}^\circ = \Delta_r H_{298,m}^\circ - T \cdot \Delta_r S_{298,m}^\circ$

$$\begin{aligned} \Delta_r H_{298,m}^\circ &= \Delta_f H_{m,298}^\circ (\text{CO}_2, g) - \Delta_f H_{m,298}^\circ (\text{C}, s) \\ &\quad - \frac{1}{2} \Delta_f H_{m,298}^\circ (\text{O}_2, g) \quad \begin{matrix} = 0 \\ \text{(cous simple)} \end{matrix} \\ &= 0 \quad \text{(cous simple)} \\ &= -393,5 \text{ kJ}\cdot\text{mol}^{-1} \end{aligned}$$

$$\begin{aligned} \Delta_r G_{298,m}^\circ &= -393,5 \cdot 10^3 - 298 \times 2,9 \\ &= -394,4 \text{ kJ}\cdot\text{mol}^{-1} < 0 \Rightarrow \text{réaction spontanée.} \end{aligned}$$