Herhaling

Gibbs energie

$$G\left(p,T,\{n_j\}\right)=\sum_j n_j\mu_j\left(p,T,\{x_j\}\right)$$

- Standaard chemische potentiaal

$$\mu_j^{\ominus}\left(p,T\right)=\Delta_f G\left(p,T\right)$$

Getabelleerd voor zuivere stoffen bij STP

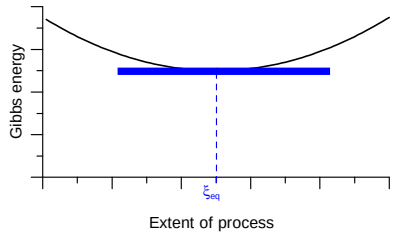
- Chemische potentiaal

$$\mu_j\left(p,T,x_j\right)=\mu_j^{\ominus}+RT\ln x_j$$

Indien gemengd

Gassen

$$\frac{\partial G}{\partial \xi} = \sum_j \nu_j \mu_j \equiv \Delta_r G = 0$$



$$\Delta_r G = \sum_j \nu_j \mu_j^{\ominus} + RT \sum_j \nu_j \ln \frac{p_j}{p^{\ominus}} = 0$$

$$\Delta G_r^{\ominus} = -RT \ln K$$

$$\prod_j \left(\frac{p_j}{p^{\ominus}} \right)^{\nu_j} = K = e^{-\Delta_r G^{\ominus}/(RT)}$$

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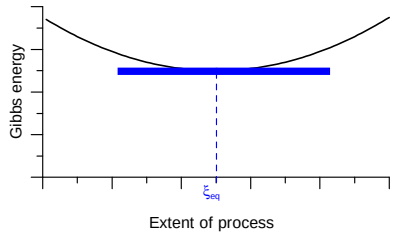

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$$K = \frac{\left(\frac{p_C}{p^{\ominus}} \right)^{\nu_C}}{\left(\frac{p_A}{p^{\ominus}} \right)^{\nu_A} \left(\frac{p_B}{p^{\ominus}} \right)^{\nu_B}} = \left(\frac{p}{p^{\ominus}} \right)^{\nu_C - \nu_A - \nu_B} \frac{x_C^{\nu_C}}{x_A^{\nu_A} x_B^{\nu_B}}$$

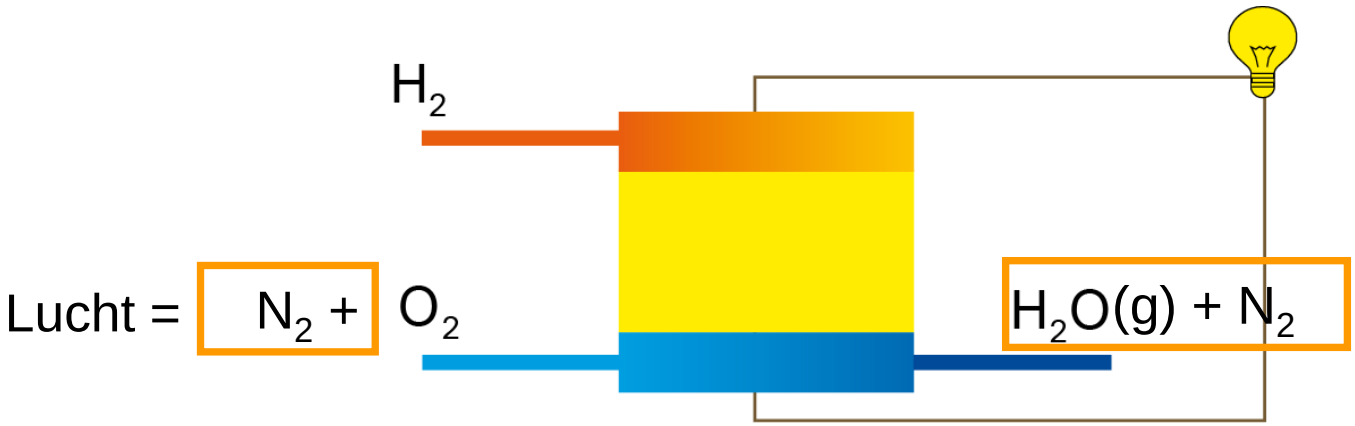
Vb Chemische potentiaal

Voorbeeld: brandstofcel (1)

$$\Delta G\left(358.15\ \mathrm{K}, p^{\ominus}\right) = \left\{\begin{pmatrix} 0 \\ 0 \\ \text{-228,572} \end{pmatrix} - 60\begin{pmatrix} 130.7 \\ 205.2 \\ 188.8 \end{pmatrix}\right\} \cdot \begin{pmatrix} -1 \\ -\frac{1}{2} \\ 1 \end{pmatrix} \text{ J/mol}$$

$$= -225.9\ \text{kJ/mol}$$

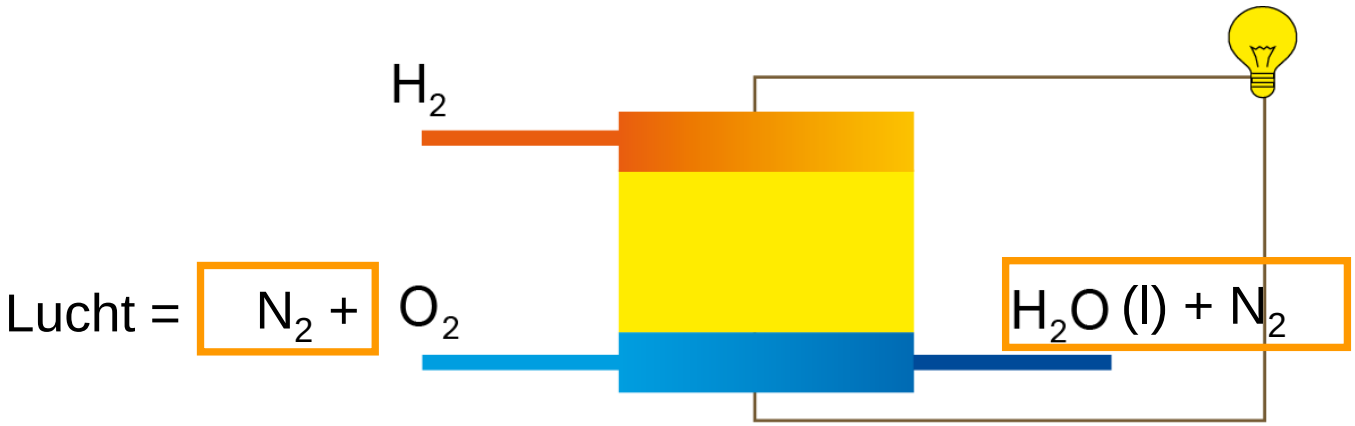
Voorbeeld: brandstofcel (2)



$$\Delta G\left(358.15\ \text{K}, p^{\ominus}\right) = \left\{\begin{pmatrix}0\\0\\-228{,}572\end{pmatrix} - 60\begin{pmatrix}130.7\\205.2\\188.8\end{pmatrix} + 8.314\times 358.15\times \ln\begin{pmatrix}1\\\frac{1}{5}\\\frac{9}{10}\end{pmatrix}\right\}\cdot\begin{pmatrix}-1\\-\frac{1}{2}\\1\end{pmatrix}\ \text{J/mol}$$

$$= -223.8\ \text{kJ/mol}$$

Voorbeeld: brandstofcel (3)



$$\Delta G\left(358.15\ \mathrm{K}, p^{\ominus}\right) = \left\{\begin{pmatrix}0\\0\\-228{,}572\end{pmatrix} - 60\begin{pmatrix}130.7\\205.2\\188.8\end{pmatrix} + 8.314\times 358.15\times \ln\begin{pmatrix}1\\\frac{1}{5}\\1\end{pmatrix}\right\}\cdot\begin{pmatrix}-1\\-\frac{1}{2}\\1\end{pmatrix}\ \mathrm{J/mol}$$

$$= -223.5\ \mathrm{kJ/mol}$$