Chemical Potentials: Gases

A given closed system contains gas j at temperature T and pressure p.
The chemical potential $\mu_j(g;T;p)$ is given by equation (a) where $p^0$ is the standard pressure and $V_j^*(T,p)$ is the molar volume of the gas j.

$$\mu_j(g;T;p) = \mu_j^0(pfg;T) + R \cdot T \cdot \ln(p/p^0) + \int_0^p [V_j^*(T,p) - (R \cdot T/p)] \cdot dp$$  \hspace{1cm} (a)

$V_j^*(T,p)$ is the molar volume at pressure p and temperature T. In the event that gas j has the properties of a perfect gas, the chemical potential is given by equation (b).

$$\mu_j(pfg;T;p) = \mu_j^0(pfg;T) + R \cdot T \cdot \ln(p/p^0)$$  \hspace{1cm} (b)

If gas j exists at mole fraction $x_j$ as one component of a mixture of k gases the chemical potential of gas j is given by equation (c) where $x_k$ is the set of mole fractions defining the composition of the mixture [1].

$$\mu_j(g;T;p;x_k) = \mu_j^0(g;T) + R \cdot T \cdot \ln(x_j \cdot p/p^0)$$

$$+ \int_0^p [V_j(g;T;p;x_c) - (R \cdot T/p)] dp$$  \hspace{1cm} (c)

Here $V_j(g;T;p;x_c)$ is the molar volume of gas j in the gaseous mixture.

Footnote