Mixing and Chemical Potential

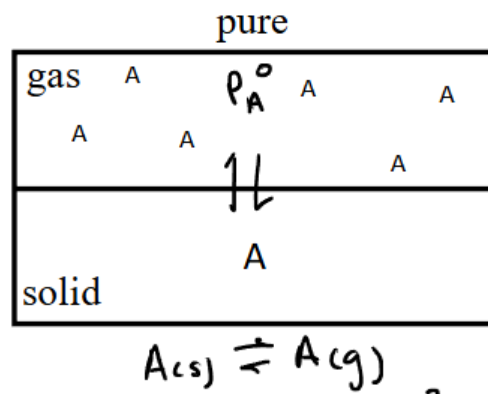# 1 Objectives

1. Distinguish different standards states in terms of Mixing

2. Identify and utilize different mixing terms

   (a) enthalpy of Mixing
   (b) entopy of Mixing
   (c) free enrgy of Mixing
   (d) etc

3. Derive chemical potential from free energy of binary systems

4. calculate the chemical potential from free energy curves for binary systems

2 Mixing standard states

pure

$A_{(s)} \rightleftharpoons A_{(g)}$

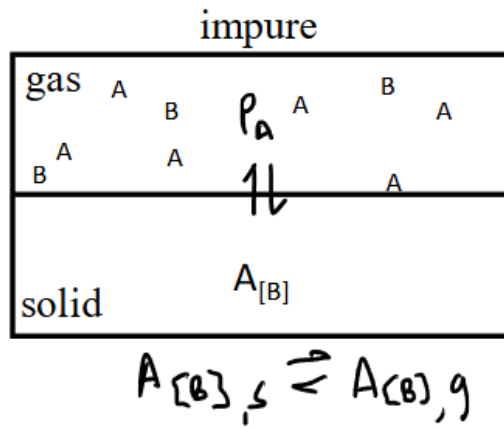$P_A^\circ \equiv$ the partial pressure of A in its standard state
$\Delta G_{A,g}^\circ \equiv$ molar free energy of gas
$\Delta G_{A,s}^\circ \equiv$ molar free energy of solid

Where,
$\Delta G = \Delta G_{A,s}^\circ - \Delta G_{A,g}^\circ = 0$
$\Delta G_{A,g}^\circ = \Delta G_{A,s}^\circ$

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impure

$$A_{[B],s} \rightleftharpoons A_{(B),g}$$

In this case B is dissolved in A, denoted by: $A_{[B]}$

- $\Delta G^{\circ}_{A \rightarrow A[B],g} \equiv$ molar free energy to dissolve B in A in the gas phase

- $\Delta G^{\circ}_{A \rightarrow A[B],s} \equiv$ molar free energy to dissolve B in A in the solid phase

- At equilibrium:

  1. $\Delta G^{\circ}_{A \rightarrow A[B],g} = \Delta G^{\circ}_{A \rightarrow A[B],s}$
  2. $\Delta G_{A[B],g} - \Delta G^{\circ}_{A,g} = RT \ln \frac{P_A}{P^{\circ}_A}$