

Change in Entropy of mixing of ideal solution.

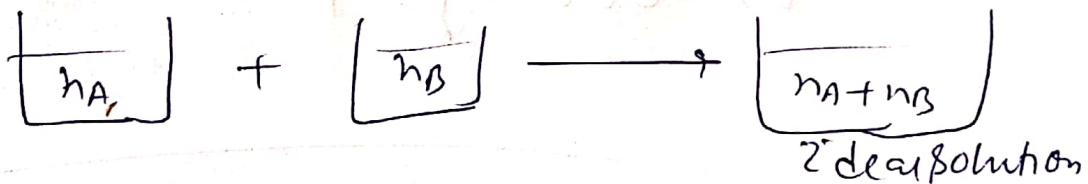
When n_A & n_B be the two volatile miscible liquid component makes ideal solution

Then at certain Temperature change in free energy of mixing is

given by $\Delta G_{mix} = n_A RT \ln X_A + n_B RT \ln X_B$

where $X_A = \frac{n_A}{n_A + n_B}$

$X_B = \frac{n_B}{n_A + n_B}$



The enthalpy change of mixing is

given by $\Delta H_{mix} = 0$

from Thermodynamic relation

$$\Delta G = \Delta H - T \Delta S$$

hence for ideal solution

$$\Delta G_{mix} = \Delta H_{mix} - T \Delta S_{mix}$$

$$n_A RT \ln X_A + n_B RT \ln X_B = 0 - T \Delta S_{mix}$$



Hence

$$\Delta S_{\text{mix}} = - \frac{[n_A R T \ln x_A + n_B R T \ln x_B]}{T}$$

$$\Delta S_{\text{mix}} = - [n_A R \ln x_A + n_B R \ln x_B]$$

$$\Delta S_{\text{mix}} = - R \sum n_i \ln x_i$$

n_i = no. of miscible components which makes ideal solution

x_i = mole fraction of each (i) component in ideal solution

Since x_i is always less than unity

hence ΔS_{mix} for ideal solution is always positive quantity