TDC-II Paper-IV Solution

Physical Chemistry

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

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

$[n_A] + [n_B] \longrightarrow [n_A + n_B]$

ideal solution

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

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

$= 0 - T\Delta S_{mix}$

$n_A RT \ln X_A + n_B RT \ln X_B$ →

Hence

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

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

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

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