Tutorial -1-

Exercise 1

The volume of a binary mixture has a molar volume V that depends on its composition:

$$V = 75x_1 + 95x_2 + 3.7x_1x_2$$

For a mixture with $x_1 = 0.60$, calculate:

1°/ the molar volume of the mixture

2°/ the partial molar volume of the two components cm^3/mol

Exercise 2

Mixtures of methanol (component 1) and potassium iodide component 2) are prepared by adding given quantities of KI to 1000g of CH_3OH at T=298 K and P= 1atm.

The apparent molar volume of KI in these mixtures obeys the empirical relationship:

Φ_2 (mL.mol) = 21.45 + 11.5 $m^{1/2}$

Where m is the molality of the solution.

1°/ Give the definition of an apparent molar property and briefly explain its meaning.

2°/ Express, as a function of m, **the volume of a solution** consisting of m moles of KI and 1000 g of CH_3OH.

3°/ Calculate V, $\varphi_2.\bar{v}_2, \bar{v}_1$ and V, for a solution consisting of 133 g of KI and 1000 g of CH_3OH.

4°/ Consider an infinitely dilute solution of KI in CH_3OH, express m as a function of x_2 (molar fraction of KI) and deduce the expression of V as a function of x_2.

Data: M(KI)=266 g. mol^{-1}; M(CH3OH) = 32 g. mol^{-1};$\rho(CH_3OH)$=786.5 $g.L^{-1}$.

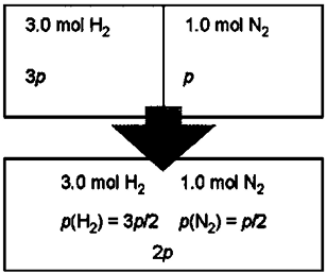
Exercise 3

The molar enthalpy of a binary liquid system of species 1 and 2 at fixed T and P is represented by the following equation: H =$400x_1$+$600x_2$+$x_1x_2(40x_1 + 20x_2)$ where H is in J/mol a. determine expressions for $\overline{H_1}$and $\overline{H_2}$ as functions of x_1

b. Numerical values for the pure species enthalpies $H_1^*$and H_2^*

c. Find the expression of (H^E) d. Numerical values for the partial enthalpies at infinite dilution $\overline{H_1^{\infty}}$ and $\overline{H_2^{\infty}}$

Exercise 4: A container is divided into two equal compartments (figure opposit). One contains 3.0 mol H_2 at 25°C; the other contains 1.0 mol $N2$ at 250C. Calculate the Gibbs energy of mixing when the partition is removed. Assume perfect gas behavior. P^0=1bar



Exercise 5 For a mixture contains 75% H_2 and 25% N_2 (molar basis) estimate the pseudo critical Temperature and pressure ($Ppc\ and\ Tpc$) using Kay's rule. We give: For $N2$: TC=126.2K and PC=33.5atm For $H2$ TC=33+8=41K and PC=12.8+8=20.8 atm