Chemistry-4311
October 18, 2013

Quiz #6 **Name** Key

R = 8.314 J/mol-K = 0.08206 L-atm/mol-K = 1.987 cal/mol-K, $N_A = 6.02 \times 10^{23}$

1. Matching (Use a letter only once)

Raoult's Law is h .

ΔH_{mixing} is c for an ideal solution.

The relationship between activity and mole fraction is g .

e is defined as the number of moles of solute divided by the weight of the solvent in kilograms.

For equilibrium between two phases, their f are equal.

a. positive
b. entropies
c. zero
d. $P_1 = n_1RT/V_1$
e. molality
f. chemical potentials
g. $a_1 = \gamma_1 x_1$
h. $P_1 = x_1 P_1^*$
i. molarity
j. $\gamma_1 = a_1 x_1$

2. An ideal solution is made from 5.00 mol of benzene and 3.25 mol of toluene. At 298 K, the vapor pressure of the pure substances are $P^*_{benzene} = 96.4$ torr and $P^*_{toluene} = 28.9$ torr. What is the total vapor pressure of this solution.

Raoult's Law: (+2) $P_i = x_i P_i^*$

$x_{benzene} = \frac{5.00}{8.25} = 0.606$

$x_{toluene} = \frac{3.25}{8.25} = 0.394$

$P_{total} = P_{benzene} + P_{toluene}$ (+1)

$P_{benzene} = 0.606 \times 96.4 = 58.4$ torr

$P_{toluene} = 0.394 \times 28.9 = 11.4$ torr

$P_{total} = 58.4 + 11.4$
$= 69.8$ torr

3. At constant temperature dG = VdP. Starting with this equation, show that one can write $G = G^\circ + nRT \ln(P/P^\circ)$, where $P^\circ = 1$ bar.

$PV = nRT$

$V = \frac{nRT}{P}$

$dG = VdP$

$dG = nRT \frac{dP}{P}$

$G_2 - G_1 = \int_1^2 dG = \int_1^2 nRT \frac{dP}{P} = nRT \int_1^2 \frac{dP}{P} = nRT \ln P_2/P_1$

$G_2 - G_1 = nRT \ln P_2/P_1$

$G_2 = G_1 + nRT \ln P_2/P_1$

$G = G^\circ + nRT \ln P/P^\circ$