逢甲大學九十四學年度轉學生招生考試試題

科目	材料熱力學	適用系別	材料系三年級	時間	八十分鐘

1. Derive the equation of state of ideal gases by using the following basic laws: Boyle's law, Charles' law, volume of an ideal gas, V=f(T,P) and Avogadro's hypothesis. (15%)

2. Lead, supercooled to 317℃ in a crucible, is allowed to solidify. Calculate $\Delta S_{(Pb+crucible)}$=? Given the heat of melting of Pb, $\Delta H_{(m)}$=4810 J/mole at its normal melting point of 327. The heat capacities of solid and liquid Pb are, $C_{p(s)}$=23.6+(9.8 x10^{-3}T), $C_{p(l)}$=32.4-(3.1 x10^{-3}T) J/mole. (20%)

3. For the reaction: $CO + 1/2\ O_2 \rightarrow CO_2$ ΔH_{298}= - 283 kJ/mole, (a)A fuel gas, with composition 50% CO, 50% N_2 is burnt using the stoichiometric amount of air. What's the composition of the flue gas? (b)If the fuel and the air enter the burner at 298 K, what's the highest temperature the flue gas may attain? Given: the heat capacity, C_p: (J/mol.K) for CO_2 = 57, N_2 = 33 . (15%)

4. The variation, with composition, of G^{XS} for liquid Fe-Mn alloys at 1727 °C is listed below.

X_{Mn}	0.1	0.2	0.3	0.4	0.5
G^{XS} joules	423	753	988	1129	1176

   a. Does the system exhibit regular solution behavior?
   b. Calculate $\overline{G}^{XS}_{Fe}$ and $\overline{G}^{XS}_{Mn}$ at X_{Mn} =0.7.
   c. Calculate ΔG^M at X_{Mn} = 0.3.
   d. Calculate the *activities of Mn and Fe* in the alloy of X_{Mn} = 0.3.
   e. The saturated vapor pressures of liquid Mn and liquid Fe are given by

$$\ln P^{\circ}_{Mn}(atm) = -\frac{33{,}440}{T} - 3.02\ln T + 37.68$$

$$\ln P^{\circ}_{Fe}(atm) = -\frac{45{,}390}{T} - 1.27\ln T + 23.93$$

   Calculate the *partial pressures of Mn and Fe* exerted by the alloy of X_{Mn} = 0.3. (35%)

5. When SO_3 is decomposed at the constant pressure P and T = 1100 K, the partial pressure of O_2 in the equilibrium gas is 0.1 atm. What is the pressure P? If the pressure of this equilibrated gas is increased to 2 atm, to what value must the temperature be decreased to produce a gas mixture in which P_{O2} = 0.1 atm? (15%) Given:

$$SO_{2(g)} + 1/2\ O_{2(g)} = SO_{3(g)} \qquad \Delta G^0 = -94{,}600 + 89.37\ T \quad \text{Joules (298-2000 K)}$$