國立高雄應用科技大學

105 學年度研究所碩士班招生考試

化學工程與材料工程系碩士班

材料熱力學

注意：a. 本試題共 5 題，共 100 分。

b. 作答時不必抄題。

c. 考生作答前請詳閱答案卷之考生注意事項。

(gas constant=8.314 J/mol-K=0.0821 L-atm/mol-K)

1. One mole ideal gas at 1 atm and 300 K undergoes a reversible isothermal compression to a pressure of 10 atm. Calculate:

   (a) the work done by the gas,   (5 pt.)

   (b) the changes in the internal energy,   (5 pt.)

   (c) the heat entering or leaving the system,   (5 pt.)

   (d) the changes in the Gibbs free energy.   (5 pt.)

2. One mole ideal gas A and one mole ideal gas B are mixed at 300 K and 1 atm.

   (a) Calculate the change in the Gibbs free energy for the mixing.   (10 pt.)

   (b) Is this mixing spontaneous? Why? Please give your best answer. (10 pt.)

3. The reaction and the standard Gibbs free energy ($\Delta G°$) for the reduction of a metal can be expressed as follows.

   $AO_{2(s)} = A_{(s)} + O_{2(g)}$ $\Delta G° = 35,000 - 70\ T$ (J/mol)

   (where T is the absolute temperature)

   Calculate the temperature at which the AO_2 reduces to metal when the oxide is heated in air.   (10 pt.)

4. The activity coefficient of A in A-B alloys at 1000 K can be expressed as

   $\ln \gamma_A = 0.1 N_B^2 - 0.2 N_B^3$ (where N_B is the molar fraction of B)

   (a) Derive the corresponding expression of $\ln \gamma_B$ as a function of composition.   (10 pt.)

   (b) Calculate the activity of B in the alloys of N_B=0.5 at 1000K.   (10 pt.)

5. The variation of excess Gibbs free energy (G^{XS}) with composition for a liquid A-B alloy at 1000 K is listed bellow.

N_A	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
G^{XS} (J)	405	720	945	1,080	1,125	1,080	945	720	405

(where N_A is the molar fraction of A in the alloy)

(a) Does the system obey the regular solution mode? Why? Pleas give your best answer. (10 pt.)

(b) Calculate the partial molar Gibbs free energy of A at N_A=0.5. (10 pt.)

(c) Calculate the molar Gibbs free energy of the system at N_A=0.5. (10 pt.)

【試題到此結束】