國立清華大學 105 學年度碩士班考試入學試題

系所班組別：工程與系統科學系　甲組(0524)

考試科目（代碼）：材料熱力學 (2402)

1. (20%) Ten liters of monatomic ideal gas at 25^{o}C and 10 atm pressure are expanded to final pressure of 1 atm. The molar heat capacity of the gas at constant volume, Cv is 1.5R and is independent of temperature. Calculate the work done W, the heat absorbed Q, and the change in U and in H for the gas if the process is carried out

   (1) Isothermally and reversibly. (W,Q,U,and H?)
   (2) Adiabatically and reversibly. (W,Q,U,and H?)

2. (20%) The vapor pressure of crystalline Ag from 298-1234K may be represented by the following equation:
   ln P (atm)=21.37-34315/T-0.85ln T

   (1)Calculate the enthalpy of sublimation at its melting temperture 1234K (1cal=4.2J)

   (2)The enthalpy of melting of Ag at its melting point, 1234K, is 11300J/mole. What is the enthalpy of vaporization of Ag at 1234K

   (3)What is $\Delta C_p=C_{p(g)}-C_{p(c)}$, where $C_{p(g)}$ and $C_{p(c)}$ are the specific heats of gasous Ag and Crystalline Ag

3. (20%) For a binary solution containing elements A and B. The melting temperatures of A and B are denoted as $T_{m.A}$ and $T_{m.B}$. $T_{m.B}>T_{m.A}$. If the composition of element A and B in the solid solution and liquid solution are denoted as $x^{(s)}_A$, $x^{(s)}_B$, $x^{(l)}_A$ and $x^{(l)}_B$. If both of the solid and liquid solutions are ideal solution. (Hint: $\Delta H^{(s)}_M=\Delta H^{(l)}_M=0$)

   (1).Please write down the free energy of solid solution $\Delta G^{(s)}_M$ and liquid solution $\Delta G^{(l)}_M$

(2).Draw the phase diagram for this binary solution, and plot free energy vs. composition and activity vs. composition for $T_{m.A} < T < T_{m.B}$

4. (20%) compute the entropy difference between 12kg of water at 40°C and 12kg of ice at -10°C

Data: $C_{p(water)}$=4.184J/g.K

$C_{p(ice)}$=2.1J/g.K

Heat of melting of ice is 336KJ/kg

5. (20%) Calculate ΔU, ΔH, ΔS, ΔA and ΔG in expanding 1mole of ideal gas at 25°C from 10 to 100 cm^3.