國立中山大學100學年度碩士班招生考試試題

科目：熱力學【材光系碩士班乙組】

請於答案卷上依序作答，清楚標明題號，計算題的答案整理標示於題末

1. Describe the meaning of state function and give three thermodynamic properties as state function. (10%)

2. One mole pure liquid copper at 1600 °C mixed with nine mole of pure liquid iron at 1600 °C and formed a homogeneous liquid solution. This is an endothermic reaction. The activity of copper will be greater than atomic fraction of copper or less than; and explain your answer. (10%)

3. According to the following thermodynamic data, calculate the enthalpy, entropy and Gibbs free energy of the reaction $Pb + 1/2\ O_2 = PbO$ at 1000 K. (30%)

   $H_{PbO(298)} = -219{,}000$ J/mole

   $S_{Pb(298)} = 65$ J/K mole

   $S_{PbO(298)} = 66.3$ J/K mole

   $S_{O2\ (298)} = 205$ J/K mole

   $C_{p,Pb(s)} = 23.6 + 9.75*10^{-3}T$ J/K from 298 K to T_m. Pb
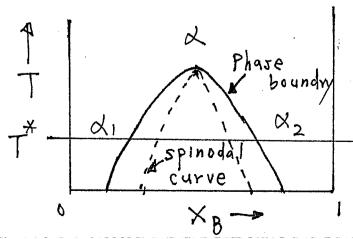
   $C_{p,Pb(l)} = 32.4 - 3.1*10^{-3}T$ J/K from T_m. Pb to 1200 K

   $C_{p,PbO(s)} = 37.9 + 26.8*10^{-3}T$ J/K from 298 K to T_m. PbO

   $C_{p,O2(g)} = 29.96 + 4.18*10^{-3}T - 1.67*10^5\ T^{-2}$ J/K from 298 K to 3000 K

   $\Delta H_{m,\ Pb} = 4810$ J at $T_{m,\ Pb} = 600$ K

   $T_{m,\ PbO} = 1159$ K

4. One mole of N_2 gas is contained at 273 K and a pressure of 1 atm. The addition of 3000 J of heat to the gas at constant pressure cause 832 J of work to be done during the expansion. Calculate (a) the final state of the gas, (b) the values of ΔU and ΔH for the change of state and (c) the values of C_v and C_p for N_2. Assume that nitrogen behaves as an ideal gas, and that the above change of state is conducted reversibly. (25%)

5. According to the following phase diagram, plot the free energy curve at T* and distinguish the regions of stable equilibrium, metastable equilibrium and unstable equilibrium. (25%)

P.S. 4 (a) 8%; (b) 7%; (c) 10%