AMSE205 Thermodynamics I

1. Determine the values of ΔU, ΔH, ΔS, ΔF and ΔG for the following processes. [In (b), (c), (d), show that the absolute value of the entropy is required.]

   (a) One mole of ideal gas at the pressure P and temperature T expands into a vacuum to double its volume.
   (b) The reversible adiabatic expansion of 1 mole of an ideal gas from P_1, T_1 to P_2, T_2.
   (c) A constant-pressure expansion of 1 mole of an ideal gas from V_1, T_1 to V_2, T_2.
   (d) A constant-volume change of state of 1 mole of an ideal gas from P_1, T_1 to P_2, T_2.

2. Calculate the value of ΔG for the reaction

$$Si_3N_4 + 3\ O_2 = 3\ SiO_2\ (\alpha\text{-quartz}) + 2\ N_2$$

   at 800 K. What percentage error occurs if it is assumed that ΔC_p for the reaction is zero? (Utilize the Tables in the APPENDIX of the textbook.)

3. 1 기압 하 Pb 의 melting point 는 600K 이다. 1 기압 하 590K 로 과냉된 액상 Pb 가 응고하는 것은 자발적인 반응이라는 것을 보이시오.

   ● $\Delta H_{melting} = 4810\ J/mole$
   ● $C_{p(l)} = 32.4 - 3.1 \times 10^{-3} T\ J/mol \cdot K$
   ● $C_{p(s)} = 23.6 + 9.75 \times 10^{-3} T\ J/mol \cdot K$

   (1) Use the maximum entropy criterion
   (2) Use the minimum Gibbs Energy criterion
   (3) Show that the reaction becomes more irreversible at 550K.
   (4) What is the difference between the entropy criterion and Gibbs energy criterion?

4. 위 문제에서 과냉된 액상 Pb 가 만약 단열된 용기에 보관되어 있었다면 용기 내부는 결국 어떠한 (평형)상태가 될 것인지 예측하시오.