國立聯合大學 102 學年度碩士班考試招生

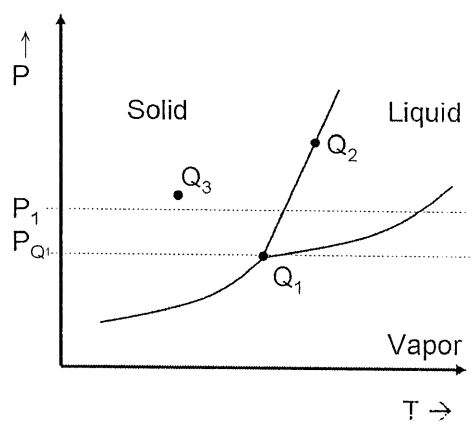
材料科學工程學系 入學考試試題

科　目：材料熱力學　　第 1 頁共 1 頁

1. Please write down expression for 1st and 2nd Laws of Thermodynamics. Label all the symbols you used for description. Above two Laws can be combined into an effective expression for internal energy change, dU, in terms of process parameters. Please write it down and provide necessary conditions. (20%)

2. Consider a Pressure-Temperature curve of a single component material, as shown in the figure. (a) How many phases can be found at Q_1 and Q_2 ?, (b) How much degree of freedom, F, is for Q_2 and Q_3?, (c) Please draw the change in molar Gibbs free energies of solid, liquid, and vapor phases with temperate of this material on a G-T plot at P_1 and P_{Q1} pressures. (d) Which one, the solid or liquid A, has a larger molar volume? Why? (25%)

3. Show the following equations: (20%)
   (a) $(\partial T/\partial P)_H = V(\alpha T-1)/Cp$.
   (b) $(\partial^2 G/\partial P^2)_T (\partial^2 A/\partial V^2)_T = -1$.



4. Provide necessary condition(s) for the following statements to stand? (20%)
   (a) An expansion process of an ideal gas occurred and $PV^{\gamma} = P'V'^{\gamma}$ where $\gamma = C_P/C_V$.
   (b) A system goes from states A to B, then to C, and $\Delta S_{sys, A\rightarrow B\rightarrow C} = 0$.
   (c) The B element in an A-B solution obeys Henry's Law.
   (d) The mixing enthalpy of an A-B solution, $\Delta H^{Mi} = 0$.

5. Glass materials are mostly amorphous in solid state. Please discuss their entropy changes, ΔS, as compared to crystalline materials, when temperature approaches absolute zero. (15%)