國立臺灣大學 104 學年度碩士班招生考試試題

※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之部份及題號。

1. Please show that for an ideal gas,

   $\left(\frac{\partial C_V}{\partial V}\right)_T = 0$, $\left(\frac{\partial C_P}{\partial V}\right)_T = 0$ (10%)

2. Please find expressions for $(\partial S/\partial \rho)_T$, $(\partial S/\partial P)_T$, and $(\partial H/\partial P)_T$ for the Redlich-Kwong equation of state, that is

   $$P = \frac{RT\rho}{1-b\rho} - \frac{a\rho^2}{(1+b\rho)T^{1/2}}$$

   Where ρ is the density, a and b are two parameters for the equation of state. (15%)

3. Please show that for the ideal solution, $\Delta H_{mix} = 0$. You may derive it from the Gibbs free energy change of mixing. (10%)

4. Please explain Debye-Hückel theory for the electrolyte solution in detail. (15%)

5. The excess Gibbs free energy of a certain binary mixture containing A and B two components is equal to $gRTx_A(1-x_A)$ where g is a constant. Find an expression for the chemical potential of A component in the mixture. (10%)

6. Please show that, for a transition between two incompressible solid phases, ΔG is independent of the pressure. (10%)

7. The volume of a newly synthesized polymer was found to depend exponentially on the pressure as $V = V_o e^{-p/p^*}$ where p is the excess pressure and p* is a constant. Please derive an expression for the Gibbs free energy of the polymer as a function of excess pressure. (10%)

8. Please prove the following relations:

   (a) $\left(\frac{\partial S}{\partial P}\right)_V \left(\frac{\partial T}{\partial V}\right)_P - \left(\frac{\partial T}{\partial P}\right)_V \left(\frac{\partial S}{\partial V}\right)_P = -1$

   (b) $\left(\frac{\partial H}{\partial V}\right)_T = -V^2 \left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial}{\partial V}\left(\frac{T}{V}\right)\right)_P$

   (20%)

試題隨卷繳回