1. Ideal gas A dissociates and forms ideal gas B and C by following this reaction:

$$3A \rightleftharpoons B + C$$

Now, 40% A dissociates at 1 bar when T = 300 K. When T increases by 10 K, 41 % A dissociates at 1 bar.

a) Please calculate the equilibrium constant for T = 300 K. **(5 %)**

b) Please calculate the ΔH of this reaction. **(10 %)**

2. Phase rule: $f = c - p + 2$ for phase diagram:

a) Draw a two-component phase diagram in (temperature-composition) space that generating a eutectic phase diagram at constant pressure. **(10 %)**

b) Use phase rule to explain this phase diagram. (e.g. one-, two-, and three-phase parts) **(10 %)**

3. After mixing 100 dm^3 water and 15 dm^3 methanol, the total volume of the solution is 113 dm^3. Please calculate the partial molar volume of methanol. **(10 %)**

(The density of pure methanol and water is 0.7928 and 0.9982 g/cm^3. Assuming the partial molar volume of water is unchanged.)

4. Starting with the definition of Thermodynamics to derive $dG = VdP - SdT$. **(10 %)**

5. A consequence of the Third Law is described as follows: "It is impossible for any process, no matter how idealized, to reduce the temperature of any closed system to zero K in a finite number of operations" Please elaborate this description. **(10 %)**

6. The Flory-Huggins equation for polymer mixing:

$$\Delta F_{mix} = kT\left[\frac{\phi}{N_A} ln\phi + \frac{1-\phi}{N_B}\ln(1-\phi) + \chi_{AB}\phi(1-\phi)\right]$$

a) What is the physical meaning of χ_{AB}. **(5 %)**

b) Use this equation to explain the effect of molecular weight on ΔF_{mix}. **(10 %)**

7. Why thermodynamics is important to polymer science? Give one example to demonstrate or explain your reason. **(10 %)**

8. Please design an experiment to estimate the enthalpy of fusion of water based on Clausius-Clapeyron equation. **(10 %)**

試題隨卷繳回