

所別： 材料工程研究所 組別： _____ 科目： 材料熱力學

注意： 不准 一般計算器 工程用計算器，考試時間總計：100 分鐘。試題共 2 頁，第 1 頁

1. Calculate the change in enthalpy and the change in enthalpy and the change in entropy when three moles of SiC is heated from 25°C to 1000°C. The constant pressure molar heat capacity of SiC varies with temperature as:

$$c_p = 50.79 + 1.97 \times 10^{-3} T - 4.92 \times 10^{-6} T^{-2} \quad (\text{J/mole} \cdot \text{K})$$

2. (a) Draw the P-T phase diagram of H₂O at the triple point.
 (b) Draw the G-P diagrams of H₂O at pressure above, at and below the triple-point pressure.
 (c) Draw the G-T diagrams of H₂O at temperature above, at and below the triple-point temperature.
3. About van der Waals equation
 (a) Describe the van der Waals equation and how they are modified from the ideal gas equation of state
 (b) How can you obtain the constants in van der Waals equation from critical temperature (T_{cr}) and pressure (P_{cr}) ?
 (c) When you solve the van der Waals equation at a given temperature, a P-V curve as shown in Figure 1 is obtained. Point out the portion that shows no physical significance and explain how to modify it.

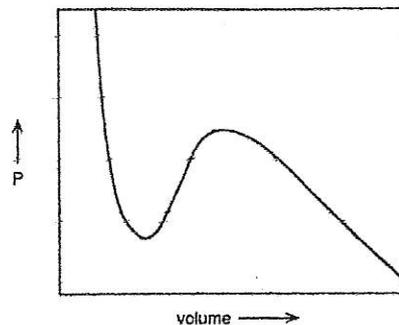


Figure 1

4. Tin obeys Henry's law in dilute solutions of Sn and Cd, and the Henrian activity coefficient of Sn, γ_{Sn}^0 , varies with temperature as
- $$\ln \gamma_{\text{Sn}}^0 = -\frac{840}{T} + 1.58$$
- Calculate the change in temperature when 1 mole of liquid Sn and 99 moles of liquid Cd are mixed in an adiabatic enclosure. The molar constant pressure heat capacity of the alloy formed is 29.5 J/K.

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5. Al_2O_3 , which melts at 2324K, and Cr_2O_3 , which melts at 2538K form complete ranges of solid and liquid solutions. Assuming that $\Delta S_{m,\text{Cr}_2\text{O}_3}^\circ = \Delta S_{m,\text{Al}_2\text{O}_3}^\circ$, and that the solid and liquid solutions in the system $\text{Al}_2\text{O}_3\text{-Cr}_2\text{O}_3$ behave ideally, calculate
- The temperature at which equilibrium melting begins when an alloy of $X_{\text{Al}_2\text{O}_3} = 0.5$ is heated.
 - The composition of the melt which first forms
 - The temperature at which equilibrium melting is complete
 - The composition of last-formed solid.

(每題 20 分)