

冶金熱力學
UNREGISTERED

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1. A person with a body mass of 70 kg owns a pair of ice skates, each of which has a knife edge 0.5 mm wide and 20 cm long. Calculate the minimum temperature of the ice on which the person can go skating. At 0 °C and 1 atm pressure, the densities of ice and liquid water are 0.917 g/cm³ and 0.9998 g/cm³, respectively. (For water, $\Delta H_{s \rightarrow l} = 6000 \text{ J/mol}$) 。 (15%)
 2. 請計算 $\text{H}_2\text{O}(\ell, -10^\circ\text{C}) \rightarrow \text{H}_2\text{O}(\text{s}, -10^\circ\text{C})$ 之自由能變化(ΔG)。 $\text{H}_2\text{O}(\ell, 0^\circ\text{C}) \rightarrow \text{H}_2\text{O}(\text{s}, 0^\circ\text{C})$, $\Delta H = -1436 \text{ cal/mol}$ 。 For H_2O , $C_{p(\ell)} = 18 \text{ cal/mol}$, $C_{p(\text{s})} = 8.7 \text{ cal/mol}$ 。 (15%)
 3. A steel casting [$C_p = 0.12 \text{ (Btu)/(lb}_m\text{)}^\circ\text{F}$] weighing 75 lb_m and having a temperature of 800 °F is quenching in 300 lb_m of oil [$C_p = 0.6 \text{ (Btu)/(lb}_m\text{)}^\circ\text{F}$]。 If there are no heat losses, what is the change in entropy of (a) the casting, (b) the oil, and (c) both consider together? (15%)
 4. 在二元成份系統中，請以 ΔG^M 對 X(成份分率)作圖來說明固溶度(solid solubility)對 molar Gibbs free energy of mixing 之影響。(10%)
 5. 在絕熱系統中，請推導出理想氣體的體積與壓力的關係式。(10%)
 6. 1 mol Ar 從 25 °C 加熱到 500 °C，其分別經歷(I)等容過程，(II)等壓過程，求 ΔH ， ΔU ， Q ， W 。假設 Ar 是理想氣體。(15%)
 7. 對理想氣體而言，請證明 $(\partial H / \partial V)_T = 0$ 。(10%)
 8. Show that $(\partial S / \partial P)_V = (C_p \beta) / (T \alpha) - V \alpha$ 。 β is isothermal compressibility， α is isobaric thermal expansivity。(10%)

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