

淡江大學九十四學年度碩士班招生考試試題 ⁹⁷⁻¹

系別：化學工程與材料工程學系 科目：物理化學

准帶項目請打「V」

✓ 簡單型計算機

本試題共 / 頁

$$R = 8.314 \text{ J mol}^{-1}\text{K}^{-1}$$

(每一題 20 分)

1. The following data were obtained for the vapor pressures of liquid and solid SnBr_4 at various temperatures. Calculate (a) the triple point ($T = ? \text{ K}$, $P = ? \text{ Pa}$), (b) the molar enthalpy of sublimation (kJ/mol), and (c) the molar enthalpy of fusion (kJ/mol). (20 points)

	Solid		Liquid	
T, °C	9.8	21.0	30.7	41.4
P, torr	0.116	0.321	0.764	1.493

2. A substance decomposes at 800 K with a rate constant of $8.0 \times 10^{-5} \text{ (1/s)}$; at 400 K, the rate constant is $2.0 \times 10^{-5} \text{ (1/s)}$.
- (1) What is the overall order of this reaction? (5 points)
 - (2) Calculate the half-life time (min) of the reaction at 800 K. (5 points)
 - (3) What fraction will remain undecomposed if the substance is heated for 2 hours at 800 K? (5 points)
 - (4) What is the activation energy (kJ/mol) for the decomposition reaction? (5 points)
3. Component A, with a molar mass of 70.0 g and a density of 1.50 g/mL, and component B, with a molar mass of 60.0 g and a density of 1.00 g/mL, form ideal solutions at 25 °C. Calculate ΔV_{mix} , ΔH_{mix} , ΔS_{mix} , ΔG_{mix} per mole with a solution of 30 % in weight of B. (20 points)
4. Given the following standard free energies of formation at 25°C:

	$\text{CO}_{(\text{g})}$	$\text{CO}_{2(\text{g})}$	$\text{H}_2\text{O}_{(\text{g})}$	$\text{H}_2\text{O}_{(\text{liq})}$
$\Delta G_f^\circ \text{ (kcal/mol)}$	-32.807	-94.260	-54.635	-56.69

- find $\Delta G_r^\circ \text{ (kcal/mol)}$ and the equilibrium constant K_p for the reaction $\text{CO}_{(\text{g})} + \text{H}_2\text{O}_{(\text{g})} \leftrightarrow \text{CO}_{2(\text{g})} + \text{H}_2_{(\text{g})}$ at 25°C (8 points)
 - Find the vapor pressure (atm) of H_2O at 25°C. (4 points)
 - If CO , CO_2 , and H_2 are mixed so that partial pressure of each is 1.00 atm and the mixture is brought into contact with excess liquid H_2O , what will be the partial pressure (atm) of each gas when equilibrium is attained at 25°C? The volume is constant. (8 points)
5. (a) Draw a temperature-composition phase diagram for a binary system in which the upper critical solution temperature (partial miscible) is less than the boiling point at all compositions. The mixture forms a low-boiling azeotrope. Label all the phases and degree of freedom. (10 points)
- (b) What is the de Broglie wavelength (nm) of an electron that has been accelerated through a potential of 80V? (electron mass, $m = 9.110 \times 10^{-31} \text{ kg}$; elementary charge, $e = 1.602 \times 10^{-19} \text{ C}$; Planck constant, $h = 6.626 \times 10^{-34} \text{ J s}$). (10 points)