

國立臺北科技大學 108 學年度碩士班招生考試

系所組別：3720 分子科學與工程系有機高分子碩士班乙組

第二節 化工熱力學 試題

第一頁 共一頁

注意事項：

1. 本試題共二大題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、單、複選選擇題：(總分 40%，每題 4 分) 不倒扣

1. Which of the following statement is always true for a spontaneous process?
(a) The total entropy of the system and surroundings increases (b) The system entropy increases (c) the process does not need any work (d) exothermic reaction
2. Under which of the following condition, the equation $\Delta H = \Delta U + P\Delta V$ is applicable
(a) constant pressure (b) constant temperature (c) constant volume (d) always
3. Which of the followings is NOT a state function?
(a) enthalpy (b) internal energy (c) heat (d) work
4. Which system can exchange energy but not matter with its surroundings?
(a) closed (b) isolated (c) adiabatic (d) open
5. In which process is no heat exchanged between systems and surrounding?
(a) isothermal (b) isolated (c) adiabatic (d) open
6. For the following physical properties, which ones are intensive properties?
(a) temperature (b) volume (c) mass (d) density (e) molar heat of formation (f) heat capacity at constant pressure (g) heat capacity at constant volume
7. The difference between work (w) and $w_{\text{adiabatic}}$ is equal to: (a) PV (b) 0 (c) ΔU (d) q
8. When an endothermic process takes place in an adiabatic container, the system temperature should: (a) increase (b) decrease (c) remain the same
9. Which of the following partial derivatives is equal to zero for an ideal gas?
(a) $(\partial T / \partial P)_S$ (b) $(\partial U / \partial V)_T$ (c) $(\partial S / \partial V)_T$ (d) $(\partial U / \partial T)_V$
10. A reaction is at equilibrium in a closed rigid vessel at constant temperature when:
(a) $\Delta U = 0$ (b) $\Delta H = 0$ (c) $\Delta A = 0$ (d) $\Delta S = 0$

二、簡答題：(總分 60%，每題分數如題前說明)

1. (本題總分 10%) Please describe the molecular interpretation of Boyle's law.
2. (本題總分 10%) Heat capacity at constant pressure (C_p) is larger or smaller than heat capacity at constant volume (C_v)? (5%) Explain your answer. (5%)
3. (本題總分 10%) Calculate the final pressure of a sample of carbon dioxide that expands reversibly and adiabatically from 57.4 kPa and 1.0 dm³ to final volume of 2.0 dm³. Take Heat capacity ratio $C_{p,m}/C_{v,m} = \gamma = 1.6$.
4. (本題總分 10%) We can estimate standard enthalpies of formation from a knowledge of the chemical constitution of the species. Please estimate the standard enthalpy of formation at 298 K of hexane based on the Benson thermochemical groups and the thermodynamic data listed in the table below.

Group	$\Delta_f H^\circ /$ (kJ mol ⁻¹)	$C_{p,m}^\circ /$ (J K ⁻¹ mol ⁻¹)
C(H) ₃ (C)	-42.17	25.9
C(H) ₂ (C) ₂	-20.7	22.8
C(H)(C) ₃	-6.91	18.7
C(C) ₄	+8.16	18.2

5. (本題總分 10%) Can the maximum work done by the system be greater than the decrease of internal energy? (5%) Explain your answer. (5%)
6. (本題總分 10%) Suppose that each diatomic molecule in a solid sample can be arranged in either of two orientations and that there are 1 mol of molecules in the sample. Please use the Boltzmann formula to calculate the statistical entropy of this sample.