國立臺北科技大學 109 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

第一節　化工熱力學　試題

> **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、是非題：(每題 3 分) 不倒扣

Answer "True" or "False":

(U: internal energy; w: work; q: heat)

(1) _____ ("True" or "False") When an exothermic process takes place in an adiabatic system, the temperature should raise up .

(2) _____ ("True" or "False") Work is the transfer of energy that makes use of orderly molecular motion.

(3) _____ ("True" or "False") The unit of dU/dV is same as pressure.

(4) _____ ("True" or "False") $\Delta U = \Delta w + \Delta q$

(5) _____ ("True" or "False") Heating is a path function.

(6) _____ ("True" or "False") Specific heat capacities are extensive properties

(7) _____ ("True" or "False") The change of internal energy is same as the heat (released or absorbed) at constant volume $\Delta U = q_v$)

(8) _____ ("True" or "False") In an adiabatic system, system can exchange energy but not matter with its surroundings

二、簡答題：(每題分數如題前說明)

1. (本題總分 12%) Define the following terms: (a) Internal pressure (6%), (b) Joule-Thomson coefficient (6%).

2. (本題總分 14%) The figure below shows the variation of enthalpy (H) and internal energy (U) as a function of temperature.

   [1] Please designate each curve for temperature dependent H or U. (4%)

   Temperature, T
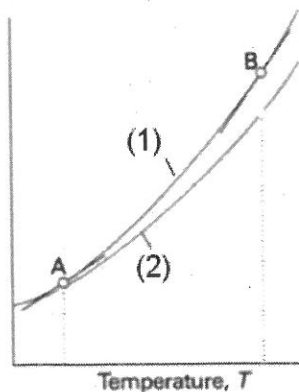
   (1) _____ (H or U curve)

   (2) _____ (H or U curve)

   [2] Based on your answer, C_v is larger or smaller than C_p? (4%)

   [3] Can you give a molecular interpretation of your answer? (6%)

3. (本題總分 20%) (a)A sample consisting of 1.00 mol of perfect gas atoms, for which $C_{V,m} = \frac{3}{2}R$, initially at $p_1 = 1.00$ atm and $T_1 = 300K$, is heated reversibly to 400 K at constant volume. Calculate the final pressure, $\Delta U, q,$ and w.(每項答案各 5%)

4. (本題總分 10%) Can the maximum work done by the system be greater than the decrease of internal energy? (5%)　Please explain your answer. (5%)

5. (本題總分 10%) Please calculate the work done when a sample of 1.00 mol Ar, regarded as a perfect gas, undergoes an isothermal reversible expansion at 20.0 °C from 10.0 L to 30.0 L.

6. (本題總分 10%) Explain third-Law entropies (5%) and residual entropy (5%).

Gas Constant: R= 8.314 JK⁻¹mol⁻¹