mm1-1

國立臺北科技大學九十六學年度碩士班招生考試

系所組別：3301、3302 材料科學與工程研究所

第一節 普通熱力學 試題

注意事項：

1. 本試題共八大題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
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、**Identify the following statements as either true or false. Use "O" for true and "X" for false. (If a statement requires some special condition to make it true, label it as false.)** 【15%】

1. **For any adiabatic process, the entropy of the system cannot decrease.**
2. **For isothermal reversible expansion of an ideal gas, the $\Delta H = 0$.**
3. **There is always an entropy decrease on melting process.**
4. **The entropies of all perfectly crystalline substances must be the same at the temperature of absolute zero.**
5. **For the reaction between H_2SO_4 and NaOH in dilute aqueous solution at constant temperature and pressure, the $\Delta U = 0$.**

二、**The solubility of silver chloride in pure water at 25°C is 1.3×10^{-5} mol dm^{-3}. Calculate the ΔG^o for the process.** $AgCl(s) = Ag^+(aq) + Cl^-(aq)$ 【10%】

三、**The volume of a system consisting of an ideal gas decreases at constant pressure. As a result, the temperature of a 1.0 kg water bath in the surroundings increases by 15°C. Calculate the heat flow at constant pressure for the system.** 【10%】

四、**2.0 mol of an ideal gas with $C_{V,m} = 12.47$ J mol^{-1} K^{-1} is expended adiabatically against a constant external pressure of 1.0 bar. The initial temperature and pressure of the gas are 300 K and 2.0 bar, respectively. The final pressure is 1.5 bar. Calculate the (1) final temperature, (2) q, (3) w, (4) ΔU, and (5) ΔH.** 【25%】

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五、**Using the following equation to show that $\mu_{J\text{-}T} = 0$ for an ideal gas.** 【10%】

$$\left(\frac{\partial H}{\partial P}\right)_T = \left[\left(\frac{\partial U}{\partial V}\right)_T + P\right]\left(\frac{\partial V}{\partial P}\right)_T + V$$

六、**Calculate (1) the efficiency and (2) the maximum work that can be done by a reversible heat engine operating between 500 and 150 K if 500 J is absorbed at 500 K.** 【10%】

七、**The equilibrium constant K_c for the reaction** $2SO_3(g) = 2SO_2(g) + O_2(g)$ **is 0.027 mol dm^{-3} at 1100 K. Calculate K_P at that temperature.** 【10%】

八、**At 25°C the equilibrium constant for the reaction** $CO(g) + H_2O(g) = CO_2(g) + H_2(g)$ **is 1.0×10^{-5}, and ΔS^o is 42 J K^{-1} mol^{-1}. Calculate ΔG^o at 25°C.** 【10%】