南台科技大學 101 學年度研究所考試入學招生考試

系組：化材系　　准考證號碼：□□□□□□

科目： **熱力學(201)**　　(請考生自行填寫)

注意事項	一、 請先檢查准考證號碼、報考系(組)別、考試科目名稱，確定無誤後再作答。 二、 所有答案應寫於答案紙上，否則不予計分。 三、 作答時應依試題題號，依序由上而下書寫，作答及未作答之題號均應抄寫。

1. 下列 4 個敘述都有錯誤，請更改為正確的敘述(不可只把 "=" 改成 "≠")：
   (1) G = U + TS　(2)理想氣體進行絕熱可逆程序，則 $P_1V_1=P_2V_2$　(3)密度、比熱和質量(Mass)是 Extensive property　(4) Heat (Q)、Work (W) 和 Internal energy 的變化(ΔU)是 State Function　(10%)
2. 內含 0.2 mole ideal gas 的圓柱筒/活塞裝置，其壓力與體積為 5 atm 及 1 liter，現以絕熱可逆的方式膨脹至 P_2 及 3 liter，求 P_2 及此程序的 Q 和 W？ [此 ideal gas 的 $\hat{C}_p=(^7/_2)\,R$]　(10%)
3. 水在 180℃ 及 1002.7 kPa 時之內能(相對於任意選取的基準點)為 762.0 kJ / kg，且其比體積為 1.128 cm^3 / g。(a)其焓值為多少？(b)水被改變為 350℃及 1600 kPa 之蒸汽，其內能為 2867.5 kJ / kg，比體積為 174.54 cm^3 / g。計算此程序之 ΔU(內能改變量) 及 ΔH(焓改變量)。 (10%)
4. 若氣體的莫耳體積可表示為
   $V=(RT/P)+b$ ， 其中 b 及 R 皆為正值常數時，導出 1 莫耳氣體在活塞/圓筒裝置中進行可逆恆溫壓縮時，所需功的表示式。 (10%)
5. A tank contains 4 moles of an ideal gas at an initial temperature of 27℃. Then the gas is heated with a constant-volume process to a temperature of 127℃. Calculate the work required (W), heat transferred (Q), and the changes in enthalpy (ΔH) for the process. [$\hat{C}_p$ = 20.8 Joul/(mol·K)] (15%)
6. Water at 300 K is pumped from a storage tank at the rate of 5 kg/s. The motor for the pump supplies work at the rate of 4 kW. The water goes through a heat exchanger, giving up heat at the rate of 100 kW, and is delivered to a second storage tank at an elevation 12 m above the first tank. What is the temperature of the water delivered to the second tank? [1 W = 1 J/s; $\hat{C}_p$ = 4180 J/(kg·K)] (10%)
   能量平衡式可用 $\frac{dU_{acc}}{dt}+\Delta[(\hat{H}+\hat{K}+\hat{P})\dot{m}]_{fs}=\dot{Q}+\dot{W}$ 或其他式子。
7. An ideal gas has a volume of 0.02479 $m^3\cdot mol^{-1}$ at 25℃ and 1 bar. In the following problem, air may be considered an ideal gas with the constant heat capacities C_v = (5/2)R and C_p = (7/2)R, where R = 8.314 J / mol·K. The initial conditions of the air are 1 bar and 25℃. It is compressed to 6 bar and 25℃ by cooling at constant pressure followed by heating at constant volume. Calculate the heat and work requirements and internal energy change ΔU and enthalpy change ΔH of the air for the process. (20%)
8. In a steady-state flow process, 1 $mol\cdot s^{-1}$ of air at 500 K and 1 atm is continuously mixed with 2 $mol\cdot s^{-1}$ of air at 400 K and 1 atm. The product stream is at 350 K and 1 atm. Determine the rate of heat transfer and the rate of entropy generation for the process. Assume that air is an ideal gas with C_p = (7/2)R, that the surroundings are at 300 K, and that kinetic-energy and potential-energy changes are negligible. (R = 8.314 J / mol·K) (15%)