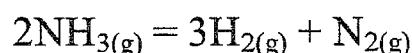


## 國立聯合大學 101 學年度碩士班考試招生

## 材料科學工程系 入學考試試題

科目：普通熱力學 第 1 頁共 1 頁

1. An ideal gas ( $C_p/C_v = 5/3$ ) Carnot cycle rejects 1000 kW of heat to an energy reservoir at  $0^\circ\text{C}$ , and increases the pressure to 10 times larger during the isentropic compression process. What is the power produced by this Carnot cycle? (15%)
2. A piston/cylinder device contains 2 kg steam at 100 kPa and  $320^\circ\text{C}$ . It is now undergoes an isothermal reversible process to a final pressure of 600 kPa. Determine the heat transfer of this process. (15%)
3. Calculate the entropy change (J/K) for 1 mole Fe as which is changed from state 1 (298 K, 1 atm) to state 2 (298 K, 50 atm)? The atomic mass of Fe is 55.85, the density is  $7.87 \text{ g/cm}^3$ , and the thermal expansion coefficient is  $3.0 \times 10^{-5} \text{ K}^{-1}$  at 298 K. Assume these values are independent on the pressure in the range 1 ~ 100 atm. (15%)
4. A piston/cylinder device contains 6.8 kg Helium (He) at 300 K and specific volume  $3.0 \text{ m}^3/\text{kg}$ . It is now undergoes a reversible compression process to a final state (366 K and  $0.6 \text{ m}^3/\text{kg}$ ). (a) Determine the entropy change of this reversible process. (b) If the compression process is irreversible. What is the entropy change for this process? (gas constant  $R_{\text{He}} = 2.0769 \text{ kJ/kg-K}$ ; average constant volume specific heat of He  $C_v = 3.1156 \text{ kJ/kg-K}$ ) (20%)
5. To prove that it is impossible to construct an engine which is more efficient than a reversible engine operating between the same two given reservoirs. (15%)
6. For the dissociation of ammonia gas according to



$$\Delta G^\circ = 87,030 - 25.8 T \ln T - 31.7 T \quad (\text{joules})$$

Calculate the equilibrium partial pressure of  $\text{N}_2$  in the system at  $400^\circ\text{C}$  and a total pressure of 1 atm. (20%)