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國立臺北科技大學九十五學年度碩士班招生考試

系所組別：3721 有機高分子研究所乙組

第二節 熱力學（選考）試題

填 准 考 證 號 碼

注意事項：

1. 本試題共 4 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。

1. Air is to be compressed reversibly from an initial condition of 1(atm)and 60(°F) to a final state of 5(atm) and 60(°F) by three different processes:
   (a)Heating at constant volume followed by cooling at constant pressure
   (b)Isothermal compression
   (c)Adiabatic compression followed by cooling at constant volume
   At these conditions, air may be considered an ideal gas having the constant heat capacities C_v=5 and C_p=7(Btu)/(lb mol)(°F)
Calculate the work required, the heat transferred, and the changes in internal energy and enthalpy of the air for each process.
C_p-C_v=R ，R=1.986(Btu)/(lb mol)(R) 30%

2. 一個化學反應的平衡常數=K 30%

   證明 $\frac{d(\ln K)}{dT}=\frac{\Delta H^{\circ}}{RT^2}$

又証明Clapeyon equation：

二相平衡下 $\frac{dP}{dT}=\frac{\Delta H}{T\Delta V}$

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$$

又証明 $\left(\frac{\partial V}{\partial T}\right)_P = -\left(\frac{\partial S}{\partial P}\right)_T$

$$\left(\frac{\partial H}{\partial P}\right)_S = \left(\frac{\partial G}{\partial P}\right)_T$$

3. 解釋 Fugacity, activity coefficient，熱力學三大定律, excess property, Henry' s Law 30%

4. 解釋 Partial molar quantity, 10%
一溶液由二成份所組成 試証明 $x_1dV_1 + x_2dV_2 = 0$
又 V_1, V_2 爲 Partial molar volume, x_1, x_2 爲摩爾分率