國立臺北科技大學104學年度碩士班招生考試

系所組別：1203 製造科技研究所

第三節　熱力學　試題（選考）

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。

Problem 1. (25%)

The two air flow streams adiabatic mixing ,which one stream1 is dry bulb temperature T_{DB1} absolute humidity ω_1, the mass dry air flow rate m_{a1} the other stream 2 is dry bulb temperature T_{DB2} ,absolute humidity ω_2,the mass dry air flow rate m_{a2} . The mixing stream is stream 3. we neglect the kinematic energy and the potential energy.

a) (15%) Please derive the equation to prove the "level law" in the Psychrometric chart by the air condition design.

b) (10%) Please specify the mixing dry bulb temperature T_{DB3} , wet bulb temperature T_{WB3} and relative humidity ϕ_3 by the corresponding equations.

Problem 2. (25%)

Consider ideal gas Carnot Refrigeration Cycle by the isentropic volume expansion ratio γ_v , the specific heat ratio k and the isentropic pressure ratio γ_p .

a) (15%) Please derive the C.O.P (coefficient of performance) for the Heat Pump by γ_v or γ_p .

b) (10%) Interpret the a) result is independent of close and open system and the working medium.

Problem 3. (25%)

a) (15%) Please derive the thermodynamic relation of $\left(\frac{\partial C_p}{\partial P}\right)_T = -T\left(\frac{\partial^2 v}{\partial T^2}\right)_P$

where the C_p is specific heat of constant pressure, v is specific volume.

b) (10%) One liquid at 1 atm 40°C, the isobar expansion coefficient

$\beta_p = 2.0 \times 10^{-4}(°C)^{-1}$, $(\frac{\partial \beta_p}{\partial T})_T = 1.0 \times 10^{-6}(°C)^{-2}$ and the specific volume

$v = 1.5\ cm^3/g$. Please compute $\left(\frac{\partial C_p}{\partial P}\right)_T$ =?

Problem 4. (25%)

Please write down the following equations and interpret the physical meaning for each terms in the corresponding equations.

a) (5%) Thermodynamic Transformation Law for the general conservation equation.

b) (5%) The unsteady Entropy equation for the open system.

c) (5%) The Irreversibility equation for the Isolated system.

d) (5%) Van der Waals state equation of the fluid and the a, b constant.

e) (5%) Ideal gas state equation and the assumptions.