國　立　宜　蘭　大　學

95 學年度轉學招生考試

（考生填寫）
准考證號碼：

物　理　化　學　試　題

《作答注意事項》

1. 請先檢查准考證號碼、座位號碼及答案卷號碼是否相符。
2. 考試時間：80 分鐘。
3. 本試卷共有 5 題非選擇題，一題 20 分，共計 100 分。
4. 請將答案寫在答案卷上。（請用黑、藍原子筆作答）
5. 考試中禁止使用大哥大或其他通信設備。
6. 考試後，請將試題卷及答案卷一併繳交。
7. 本試卷採單面影印，請勿漏答。
8. 考生可自行攜帶使用非程式型（不具備儲存程式功能）之電子計算機（如：CASIO fx-270MS, fx-300MS, fx-350MS, fx-570s..... 等）。

Universal gas constant: $R = 0.082 \frac{atm\ l}{mol\ K} = 8.31 \frac{J}{mol\ K}$

Atomic weights: $H = 1.0$ 、 $C = 12.0$ 、 $N = 14.0$ 、 $O = 16.0$ 、 $Cl = 35.5$

1. The latent heat of vaporization of water at $100^{o}C$ is $40.6 \frac{KJ}{mol}$ and when $1\ mol$ of water is vaporized at $100^{o}C$ and $101 KPa$ pressure, the volume increase is $30.19\ dm^3$. Calculate the work w done by system, the change in internal energy ΔU, the change in Gibbs energy ΔG and the change in entropy ΔS. (20%)

2. Initially at $300\ K$ and $9\ atm$, $56\ g$ of nitrogen gas is operated successive for the following state: State (1), it is heated at constant volume from $300\ K$ to $400\ K$. State (2), it is expand adiabatically against a constant pressure of $4\ atm$ from the state (1) until equilibrium is reached.
Assume the nitrogen gas to be ideal with $C_P = 28.40 + 0.22 \times 10^{-2} T$, where the unit is $C_P(\frac{J}{mol\ K})$ and $T(K)$. Calculate the w 、 q 、 ΔU and ΔH along each state. (20%)

3. The Joule-Thomson coefficient μ is defined as $\mu \equiv \left(\frac{\partial T}{\partial P}\right)_H$

   (a) Show that the Joule-Thomson coefficient μ can be written as $\mu = -\frac{V(1-\alpha T)}{C_P}$, where $\alpha = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_P$ is called the thermal expansivity.

   (b) If equation of state takes the form $P(V-b) = RT$. Show that the μ can be written as $\mu = -\frac{b}{C_P}$. (20%)

4. Consider the irreversible of second-order reaction $2A + B \rightarrow P$. The rate of reaction can be written as $\frac{dx}{dt} = kC_A C_B$, where x is the change of the concentration of P during the reaction ($t > 0$). Suppose that at the beginning of the reaction ($t = 0$) the concentration of A, B and P are $C_{Ao} \neq C_{Bo} \neq 0$ and $C_{Po} = 0$. Derive that the reaction t is given by $t = \frac{1}{k(2C_{Bo} - C_{Ao})} \ln(2 - \frac{C_{Ao}}{2C_{Bo}})$ for $x = \frac{C_{Ao}}{4}$ and $2C_{Bo} > C_{Ao}$. (20%)

5. Determine the mass percentage of carbon tetrachloride (CCl_4) in the vapor phase at equilibrium in a $1:1\ mol$ ideal solution with trichloromethane ($CHCl_3$) at $25^{o}C$. Assuming that the vapor pressure of pure carbon tetrachloride and trichloromethane at $25^{o}C$ are $114.5\ Torr$ and $199.1\ Torr$, respectively. (20%)