國 立 宜 蘭 大 學

１０４學年度研究所碩士班考試入學

物理化學試題

（化學工程與材料工程學系碩士班）

准考證號碼：

《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：100 分鐘。

3.本試卷共有 6 題，共計 100 分。

4.請將答案寫在答案卷上。

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.本考科可使用非程式型（不具備儲存程式功能）之電子計算機。

1. Explain the following items: (a) ideal solution, (b) steam distillation, (c) azeotropes, (d) tie line, (e) half-life　　　　　　　　　　　　　　　　　　　(20%)

2. At 100°C　1 mole of liquid water is allowed to expand isothermally into an evacuated vessel of such a volume that the final pressure is 0.5 atm. The amount of heat absorbed in the process was found to be 30 KJ/mole. What are w, ΔU, ΔH, ΔS, and ΔG？($\Delta Hvap = 40.60$ KJ/mole for H_2O: 1 atm, 100°C)　　　　　　　　　(20%)

3. The vapor pressure of mercury at 536 K is 103 torr. Estimate the normal boiling of mercury, where the vapor pressure is 760 torr. The heat of vaporization of mercury is 58.7 KJ/mole.
   Hint: Clausius-Clapeyron equation $\ln(P_2/P_1) = (\Delta H/R)(1/T_1 - 1/T_2)$　　　(15%)

4. Two blocks of the same metal are of the same size but are at different temperatures, T_1 and T_2. These blocks of metal are brought together and allowed to come to the same temperature. Show that the entropy change is given by
   $$\Delta S = Cp \ln [(T_1+T_2)^2/4T_1T_2].$$　　　　　　　　　　　(15%)

5. Consider the consecutive of first order irreversible reactions
   A $\rightarrow$ B (rate constant k1)
   B $\rightarrow$ C (rate constant k2)
   The initial concentration of A is $[A]_0$. Neither B nor C is present initially.
   　(a) Derive the expressions for the variations of [A], [B] and [C] with time.
   　(b) At what time does the concentration of B reach a maximum ?　　　(20%)

6. Using the data, calculate the equilibrium constant for the reaction
   　　　$H_2 + 2Fe^{3+} \leftrightarrow 2H^+ + 2Fe^{2+}$
   where　$2H^+ + 2e- \rightarrow H_2$　　$E^0 = 0$
   　　　$Fe^{3+} + e- \rightarrow Fe^{2+}$　　$E^0 = 0.711$ V　　　　　　(10%)