國　立　宜　蘭　大　學

１０１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. 本試卷共有六題，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. Nitrogen gas is maintained at 152 Kpa in a 2.00-dm^3 vessel at 298.15 K. If its molar mass is 28.0134 g/mol calculate:

a. The amount of N_2 present.

b. The number of molecules present.

c. The root-mean-square speed of the molecules.

d. The average translational kinetic energy of each molecule.

e. The total translational kinetic energy in the system. (15%)

2. Two moles of oxygen gas, which can be regarded as ideal with Cp = 29.4 $JK^{-1}mol^{-1}$ (independent of temperature), are maintained at 273 K in a volume of 11.35 dm^3. Suppose that the gas is heated reversibly to 373 K at constant volume:

a. How much work is done on the system ?

b. What is the increase in internal energy, $\triangle U$?

c. How much heat was added to the system ?

d. What is the final value of PV ?

e. What is the increase in enthalpy, $\triangle H$? (15%)

3. Two moles of water at 50℃ are placed in a refrigerator which is maintained at 5℃. Taking the capacity of water at 75.3 $JK^{-1}mol^{-1}$ and independent of temperature, calculate the entropy change for the cooling of the water to 5℃. Also calculate the entropy change in the refrigerator, and the net entropy change. (20%)

4. In the binary system, prove that the vapor contains relatively more of the more volatile component than does the liquid that is in equilibrium with it. (Hint：assumed ideal gas and ideal solution) (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. Calculate E° for the process $Cu^+ + e^- \rightarrow Cu$

Making use of the following E° values:

(I) $Cu^{2+} + e^- \rightarrow Cu^+$ $E_1° = 0.153$ V

(II) $Cu^{2+} + 2e^- \rightarrow Cu$ $E_2° = 0.337$ V (15%)