

國 立 宜 蘭 大 學

1 0 5 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 6 題，共計 100 分。
- 4.請將答案寫在答案卷上（於本試題上作答者，不予計分）。
- 5.考試中禁止使用手機或其他通信設備。
- 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。

1. Nitrogen gas is maintained at 152 Kpa in a 2.00-dm³ vessel at 298.15 K. If its molar mass is 28.0134 g/mol calculate:

- The amount of N₂ present.
- The number of molecules present.
- The root-mean-square speed of the molecules.
- The average translational kinetic energy of each molecule.
- The total translational kinetic energy in the system. (15%)

2. Two moles of oxygen gas, which can be regarded as ideal with $C_p = 29.4 \text{ JK}^{-1}\text{mol}^{-1}$ (independent of temperature), are maintained at 273 K in a volume of 11.35 dm³. Suppose that the gas is heated reversibly to 373 K at constant volume:

- How much work is done on the system ?
- What is the increase in internal energy, ΔU ?
- How much heat was added to the system ?
- What is the final value of PV ?
- What is the increase in enthalpy, ΔH ? (15%)

3. Two moles of water at 50°C are placed in a refrigerator which is maintained at 5°C. Taking the capacity of water at 75.3 JK⁻¹mol⁻¹ and independent of temperature, calculate the entropy change for the cooling of the water to 5°C. 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. Two blocks of the same metal are of the same size but are at different temperatures, T₁ and T₂. These blocks of metal are brought together and allowed to come to the same temperature. Show that the entropy change is given by

$$\Delta S = C_p \ln [(T_1+T_2)^2/(4T_1T_2)]. \quad (20\%)$$

6. A substance decomposes at 600 K with a rate constant of $3.72 \times 10^{-5} \text{ s}^{-1}$ (15%)

- Calculate the half-life of the reaction.
- What fraction will remain undecomposed if the substance is heated for 3 h at 600 K ?