國 立 宜 蘭 大 學
102 學 年 度 轉 學 招 生 考 試

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 9 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. Explain the following items: (a) Ideal gas, (b) Boyle's law, (c) Boyle temperature, (d) Phase rule, (e) Arrhemius equation. (10%)

2. A mixture of 2.50×10^{-3} g of O_2, 3.51×10^{-3} mol of N_2, and 4.67×10^{20} molecules of CO are placed into a vessel of volume 3.50 L at 5.20°C. (10%)

    (a) Calculate the total pressure in the vessel.

    (b) Calculate the partial pressures of each gas.

3. 3.00 moles of an ideal gas at 27.0°C expands reversibly and isothermally from an initial volume of 20.0 dm³ to 60.0 dm³. Calculate q, w, ΔH, and ΔU for this process. (10%)

4. Two moles of oxygen gas, which can be regarded as ideal with $C_P = 29.4$ J K⁻¹ mol⁻¹ (independent of temperature) are maintained at 273K in a volume of 11.35 dm³. Suppose the gas is heated reversibly to 373K at constant pressure. (20%)

    (a) What is the final volume?   (b) How much work is done on the system?   (c) How much heat is supplied to the system?   (d) What is the increase in enthalpy?   (e) What is the increase in internal energy?

5. What are ΔH, ΔU, ΔG, and ΔS for a system that mixes 1.00 mol of toluene and 3.00 mol of benzene? Assume ideal behavior and 298 K. (10%)

6. The dimerization of a protein has the following equilibrium constants at the given temperatures: K(4°C)=1.3×10^7, K(15°C)=4.5×10^7. Estimate the standard enthalpy of reaction for this process. (10%)

7. The vapor pressure of mercury at 536 K is 103 torr. Estimate the normal boiling point of mercury, where the vapor pressure is 760 torr. The heat of vaporization of mercury is 58.7 kJ/mol. (10%)

8. The half-life for the first-order decomposition of N_2O_5 is 2.05×10^4 s. Calculate the rate constant of this process. (10%)

9. A copper-nickel alloy with composition of a is isothermal at 1300°C. (a) What is the weight percent of copper in the liquid and solid phase at this temperature? (b) What weight percent of this alloy is liquid and what weight percent is solid? (10%)