淡江大學 109 學年度日間部轉學生招生考試試題

系別：化學工程與材料工程學系二年級　　科目：普通化學　　5-1

考試日期：7 月 22 日(星期三) 第 1 節　　本試題共 6 大題， 1 頁

1. Name the following species in English or write their molecular formulas. *(15%)*

   For examples: H_2SO_4: Sulfuric acid; Water: H_2O

   CO_2: ____(a)____; NaCl: ____(b)____; Ethanol: ____(c)____;

   Hypochlorous acid: ____(d)____; Gallium arsenide: ____(e)____

2. Briefly answer the following questions. *(25%)*

   (a) Describe the Pauli exclusion principle.

   (b) The electron configuration of magnesium can be expressed as [Ne]$3s^2$. Write the similar expression for the electron configuration of copper.

   (c) Define the dipole moment of a molecule.

   (d) Draw the Lewis structure for O_3. Also calculate the respective formal charge for each of the three oxygen atoms.

   (e) Differentiate between the reaction quotient and the equilibrium constant for the following chemical reaction: A + 2B ⇌ 3C + 4D, where A, B, C, and D are chemicals dissolved in an aqueous solution.

3. On a phase diagram of a pure substance, draw the triple point, the normal melting point, and the supercritical fluid region, and indicate a pathway for the sublimation process. *(15%)*

4. (a) In chemical kinetics, the Arrhenius equation can correlate k, the rate constant, E_a, the activation energy, and T, the Kelvin temperature. Write the equation and define the other terms in the equation. *(5%)*

   (b) According to the Arrhenius equation, design an experiment to measure the activation energy of the following chemical reaction: $3H_{2(g)} + N_{2(g)} \rightleftharpoons 2NH_{3(g)}$.
   Include the principle and experimental procedure in your answer. *(10%)*

5. (a) Balance the following redox reaction. *(6%)*

$$I^-_{(aq)} + H^+_{(aq)} + ClO^-_{(aq)} \rightleftharpoons I_3^-{}_{(aq)} + Cl^-_{(aq)} + H_2O_{(l)}$$

   (b) Knowing that the reaction in (a) proceeds to the right spontaneously, indicate the strongest reductant and the strongest oxidant in (a). *(6%)*

   (c) Write the balanced cathode reaction. *(3%)*

6. (a) Calculate the pH value of a buffer solution consisting of 0.50 M HOAc ($K_a = 1.80 \times 10^{-5}$) and 0.25 M NaOAc. *(10%)*

   (b) Propose a method to enhance the buffer capacity of the buffer in (a) without changing its pH value. *(5%)*