# 淡江大學 101 學年度碩士班招生考試試題

系別：化學學系　　科目：普 通 化 學

考試日期：2 月 26 日(星期日) 第 4 節　　本試題共 6 大題， 1 頁

1. (10 pts) Of the following, which molecule or ion has the largest bond angle?
   (a) $O_3$ (b) $OF_2$ (c) $NH_2^-$ (d) $H_2O$ (e) $C_2H_2$

2. (10 pts) Which of the following molecules or ions has no dipole moment?
   (a) $CO_2$ (b) $NH_3$ (c) $H_2O$ (d) $NO_2^-$ (e) $H_3O^+$

3. (15 pts) There are two types of isotopes for Cl, $^{35}Cl$ (35.0 amu, 75%) and $^{37}Cl$ (37.0 amu, 25%).
   (a) In the mass spectrum of $Cl_2$, how may peaks should be observed?
   (b) For the answers in (a), what are the mass numbers?
   (c) For the answer in (a), what the relative intensities?

4. (20 pts) The allene molecule has the following structure:

   $H_2C{=}C{=}CH_2$

   Draw all σ and π orbitals of the molecule. Are all four hydrogen atoms in the same plane? Explain.

5. (25 pts) Draw energy plots (reaction coordinate) for a catalyzed and an un-catalyzed pathways for an exothermic reaction. Label positions of reactants and products, $\Delta E$s, $E_a$s, and transition states.

6. (20 pts) What are the electron configurations for the transition metal ion in each of the following compounds?
   (a) $K_3[Fe(CN)_6]$ (b) $[Ag(NH_3)_2]Cl$ (c) $[Ni(H_2O)_6]Br_2$ (d) $[Cr(H_2O)_4(NO_2)_2]I$