科目：綜合化學(II)　　　　系所：應用化學系　　　　是否使用計算機：是
考試時間：100 分鐘　　　　本科原始成績：100 分

1. Why does the minimum in a plot of plate height versus flow rate occur at lower flow rate with LC than GC?　(10%)

2. Compare SFC with other column chromatographic methods.　(10%)

3. Differentiate between controlled-potential coulometry and constant-current coulometry. (10%)

4. Why are stripping methods more sensitivity than other voltammetric procedures?　(10%)

5. Why is spectrofluorometry potentially more sensitivity than spectrophotometry?　(10 %)

6. Briefly state the first, second, and third laws of thermodynamics.(6%)

7. An ideal solution is made of 1 mole of benzene and 2 moles of toluene. Write down the equations of ΔG_{mixing} at 298 K and 1 bar pressure. (No calculation is needed) Is mixing a spontaneous process, why?　(6%)

8. Using the Gibbs-Helmholtz equation to alculate K_p for the dissociation reaction $Cl_2(g) \rightarrow 2\ Cl$ at 800 K. ($\Delta G_f°(Cl)$ = 105.7 kJ mol^{-1} and$\Delta H_f°(Cl)$ = 121.3 kJ mol^{-1} at 298.15 K) (6%)

9. Brief explain the following terms: (a) Hund's rule, (b) Franck-Condon principle, (c) Heisenberg uncertainty principle, (d) Experimentally, how to apply rate constants from measurements to the Arrhenius equation, rate = Aexp(-Ea/RT), to derive A and Ea?　(8%)

10. Construct atomic terms for np^2, and specify the corresponding degeneracy of each term. Which of the possible terms has the lowest energy? (6%)

11. Starting from $\Psi = c_a\phi_{H1s_a} + c_b\phi_{H1s_b}$ for H_2^+, generate two molecular orbitals from the two atomic orbitals. (Denote S_{ab} as the overlap integral.)　(6%)

12. To derive the reaction order for reaction A $\rightarrow$ P, you measure [A] as a function of the reaction time t. Briefly describe how to analyze your data by plotting $[A]_t$ in a certain form as a function of time t. You can verify whether the reaction is a zeroth, first, or second order reaction by such a way. (6%)

13. The vibrational frequency of I_2 is 208 cm^{-1}, and the rotational constant is 0.0374 cm^{-1}. Evaluate the vibrational and rotational partition function of I_2 at 25°C. (6.626x10^{-34} J s, 1.38x10-23 J K^{-1}, kT, σ hcB) (6%)