

東吳大學 110 學年度碩士班研究生招生考試試題

第 1 頁，共 2 頁

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| 系級 | 化學系碩士班 | 考試時間 | 100 分鐘 |
| 科目 | 綜合化學 | 本科總分 | 100 分 |

※一律作答於答案卷上(題上作答不予計分)；並務必標明題號，依序作答。

Part A :

一、

1. Draw structures and predict the molecular geometry for the following molecules: (a) BF_3 (b) CH_4 (c) BeF_2 (d) OH_2 (e) NH_3 (2 % for each)
2. Derive the molecular orbital energy level diagrams for O_2 molecule. (5%) (請標明各能階的記號，例如 σ_{2s} , π_{2p}^* 等)
3. Sketch all isomers, including the geometric and optical, of (a) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ (b) $[\text{Co}(\text{en})_2\text{Cl}_2]$. (10%)

二、

4. Calculate q , w , ΔU , and ΔH for the process in which 2.5 mole of water undergoes the transition $\text{H}_2\text{O} (l, 373\text{K}) \rightarrow \text{H}_2\text{O} (g, 573\text{K})$ at 1 bar of pressure. The Volume of liquid water at 373K is $2.7 \times 10^{-5} \text{ m}^3 \cdot \text{mole}^{-1}$ and the molar volume of steam at 373 and 573K is 4.33 and $6.79 \times 10^{-2} \text{ m}^3 \cdot \text{mole}^{-1}$, respectively. For steam, $C_{p,m}$ can be considered constant over the temperature interval of interest at $33.6 \text{ J} \cdot \text{mole}^{-1} \cdot \text{K}^{-1}$. (8 points)
5. Electrons have been used to determine molecular structure by diffraction based on the same scale. Calculate the speed and kinetic energy of an electron for which the wavelength is equal to 0.225 nm. (4 points)
6. Evaluate the commutator $[d/dx, x^2]$ by applying the operators to an arbitrary function $f(x)$. (6 points)
7. How many molecules strike a 5 cm^2 surface during 30 sec if the surface is exposed to N_2 at 2.0 atm and 323K? And under this situation how many collisions will occur at 10^{-10} torr? (7 points)

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第 2 頁，共 2 頁

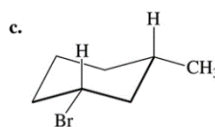
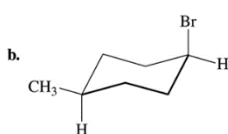
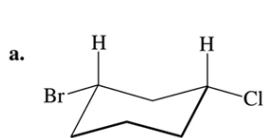
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Part B :

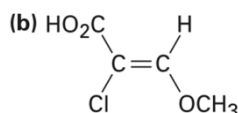
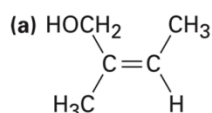
1. Distinguish between the following terms: (9 分，每小題 3 分)
 - a. Precision and accuracy
 - b. Voltammetry and polarography
 - c. Filters and monochromators as wavelength selectors

2. A 50mL sample of 0.05M NaCN is titrated with 0.1M HCl, calculate the pH of the solution after the addition of (a) 0 mL, (b) 10 mL, (c) 25 mL, and (d) 26 mL of acid. (K_a for HCN = 6.2×10^{-10}) (16 分，每小題 4 分)

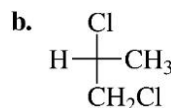
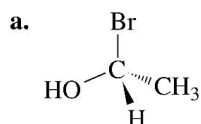
3. Is each of the following a cis isomer or trans isomer? (9 分，每小題 3 分)



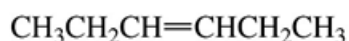
4. Assign *E* or *Z* stereochemistry to the following alkenes: (4 分，每小題 2 分)



5. Assign *R* or *S* configuration to each chirality center in the following molecules: (4 分，每小題 2 分)



6. What products would you expect to obtain when the following compounds react with ozone and then with dimethylsulfide? (3 分)



7. Draw the product that would be obtained from the following compound? (5 分)

