東吳大學 114 學年度碩士班招生考試試題

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。

1. Draw the Lewis structures for NO_2^-、NO_2^+、NO_2, and decide the bond order of N–O bond. (6 分)

2. Using energy band theory explains insulator, conductor, and semiconductor.
   What are Intrinsic semi-conductor, *p*-type semi-conductor and *n*-type semi-conductor? (6 分)

3. Explain the following terms: (a) Hard Soft Acid Base (b) Hydrogen bond (c) leveling effect of acid and base (d) polarizability. (4 分)

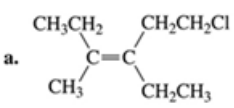
4. 畫出 simple cubic, body-centered cubic (bcc) and face-centered cubic (fcc)之單位晶格，並計算晶格中每個粒子之配位數及單位晶格中含有粒子之個數 (9 分)

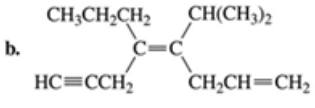
5. A 3 mole sample of NO_2, for which $C_{P,m} = 45.5\ JK^{-1}mol^{-1}$ at 303 K, is expanded reversibly and adiabatically from a volume of 7.5 L and a temperature of 303 K to a final volume of 50.5 L. Calculate the final temperature, *q*, *w*, ΔH, and ΔU. Assume that $C_{P,m}$ is constant over the temperature interval. (8 分)

6. Calculate the frequency and wavelength of the radiation absorbed when a quantum harmonic oscillator with a frequency of $5.2 \times 10^{12}\ s^{-1}$ makes a transition from the $n = 3$ to the $n = 5$ state. (9 分)

7. For O_2 at 273 K, what fraction of molecules has a speed between 150 and 250 m/s? What is this fraction if the gas temperature is 600 K? (8 分)

8. Assign *E* or *Z* stereochemistry to the following alkenes: (6 分，一個答案 3 分)

a. 

b. 

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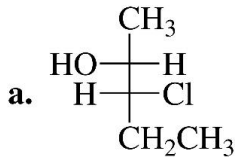
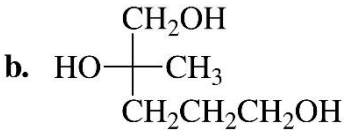
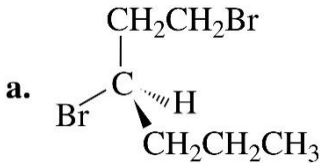
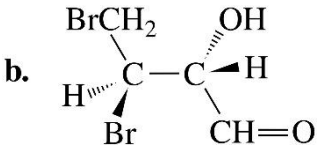
9. Name the following compounds using *R* or *S* designations: (4 分，一個答案 2 分）

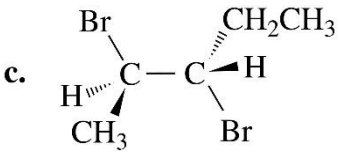




10. Assign *R* or *S* configuration to each chirality center in the following molecules. (15 分，一個答案 5 分）







11. Estimate the absolute standard deviation and round the answers for the question, so that it contains only significant digits. (hint: y=??(±??)) (5 分)

$$y = \frac{187(\pm 6) - 89(\pm 3)}{1240(\pm 1) + 57(\pm 8)}$$

12. (a) Calculate the molar solubility of $Ba(IO_3)_2$ in water. K_{sp} for $Ba(IO_3)_2$ is 1.57×10^{-9}. (3 分)
(b) Calculate the molar solubility of $Ba(IO_3)_2$ in a solution that is 0.0200 M in $Ba(NO_3)_2$. (3 分)
(c) Please describe why the solubility decreased. (2 分)

13. Calculate the pH of the solution that results when 20 mL of 0.175 M formic acid is (a) mixed with 25 mL of 0.14 M NaOH solution; (b) mixed with 25 mL of 0.2 M NaOH solution. (12 分，一個答案 6 分）