

國立高雄大學一百學年度研究所碩士班招生考試試題

科目：綜合化學(I)  
考試時間：100 分鐘

系所：應用化學系  
本科原始成績：100 分

是否使用計算機：是

一、無機化學 (Inorganic Chemistry) (50 points)

1. Provide a concise but thorough explanation of the following: (10 points) (名詞解釋，請勿只翻譯)  
(a) unit cell                      (b) Lanthanide contraction                      (c)  $\pi$  back-bonding  
(d) Jahn-Teller effect                      (e) Paramagnetism
2. Dr. Chauvin, Professor Grubbs, and Professor Schrock shared the Nobel Prize in Chemistry in 2005 for the development of the metathesis method in organic synthesis. What is the olefin metathesis reaction? Please give an example of the Grubbs catalysts and an example of the Schrock catalysts for these reactions. (8 points)
3. Professor Heck, Professor Negishi, and Professor Suzuki shared the 2010 Nobel Prize in Chemistry for palladium-catalyzed cross couplings in organic synthesis. What is the Suzuki coupling reaction? Please also give a detailed mechanism for this reaction. (8 points)
4. The Nobel Prize in Chemistry 1973 was awarded jointly to Ernst Otto Fischer and Geoffrey Wilkinson for their pioneering work, performed independently, on the chemistry of the organometallic, so called sandwich compounds. What is an organometallic compound? Please give an example of sandwich compounds (draw the correct molecular structure). (4 points)
5. Predict the number of unpaired electrons for a tetrahedral  $d^6$  ion and a square-planar  $d^7$  ion. Explain your answer by sketching crystal field splitting of d-orbitals in the geometric arrangements. (6 points)
6. Prepare a molecular orbital energy level diagram for CO, showing clearly how the atomic orbitals interact to form molecular orbitals. (8 points)
7. Determine the point groups for the following: (4 points total)  
(i)  $H_2O$                       (ii) benzene
8. Write the ground state electron configurations of Li. (1 point total)
9. Based on the VSEPR model, please sketch the shape of  $XeF_2$ . (1 point total)

國立高雄大學一百學年度研究所碩士班招生考試試題

科目：綜合化學(I)  
考試時間：100 分鐘

系所：應用化學系  
本科原始成績：100 分

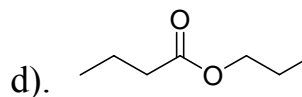
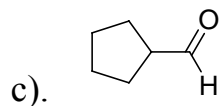
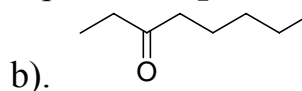
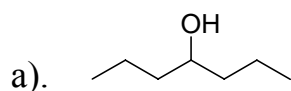
是否使用計算機：是

二、有機化學 (Organic Chemistry) (50 points)

1. Define the following acids and bases. **6 points**

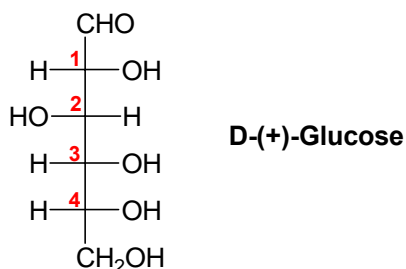
- Arrhenius acid: \_\_\_\_\_
- Arrhenius base: \_\_\_\_\_
- Bronsted-Lowry acid: \_\_\_\_\_
- Bronsted-Lowry base: \_\_\_\_\_
- Lewis acid: \_\_\_\_\_
- Lewis base: \_\_\_\_\_

2. Give the IUPAC name of following organic compounds. **4 points**

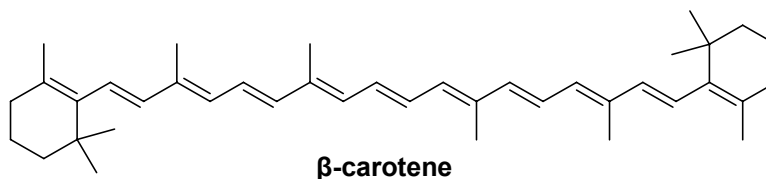
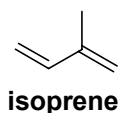


3. Label the R/S configuration of asymmetric carbons in glucose. **4 points**

Carbon 1: \_\_\_\_\_ Carbon 2: \_\_\_\_\_ Carbon 3: \_\_\_\_\_ Carbon 4: \_\_\_\_\_



4. Circle the isoprene units in  $\beta$ -carotene. **4 points**



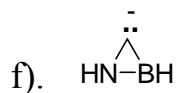
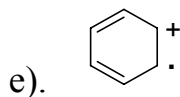
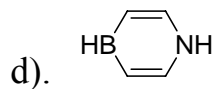
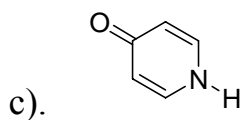
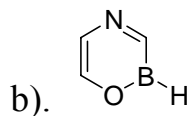
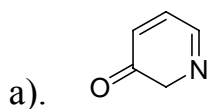
科目：綜合化學(I)  
考試時間：100 分鐘

系所：應用化學系  
本科原始成績：100 分

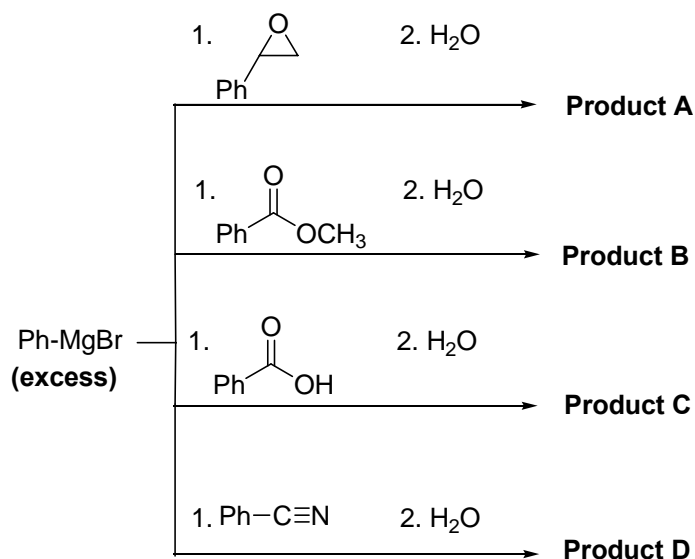
是否使用計算機：是

5. Sketch the  $\pi$ -molecular orbitals of hexa-1,3,5-triene and label the HOMO and LUMO. **4 points**

6. Classify the following compounds as **aromatic**, **antiaromatic** or **non-aromatic**. **6 points**



7. Write down the structures of Product A, B, C, D. **8 points**

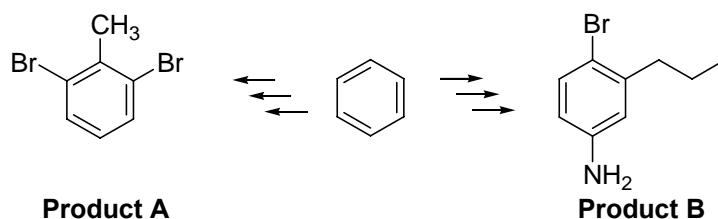


科目：綜合化學(I)  
考試時間：100 分鐘

系所：應用化學系  
本科原始成績：100 分

是否使用計算機：是

8. Propose suitable synthetic route for Product A and B, starting from benzene. **8 points**



9. Propose your analysis of the following  $^1\text{H}$ -NMR spectrum and determine the structure of the molecule. The given numbers in the spectrum are the integration values of each peak. **6 points**

