

## 國立臺北科技大學 112 學年度碩士班招生考試

系所組別：3520 化學工程與生物科技系化學工程碩士班乙組

## 第二節 有機化學 試題

第 1 頁 共 1 頁

## 注意事項：

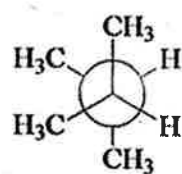
1. 本試題共兩大題，每題 50 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

## 一 選擇題 (單選 每題 2 分共 50 分)

1. The carbon-carbon single bond in the following is formed by the overlap of which two orbitals?

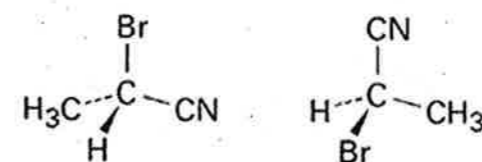


- (A)  $sp-sp$  (B)  $sp^2-sp$  (C)  $sp^2-sp^2$  (D)  $sp^2-sp^3$
2. Which of the following molecules would you expect to be nonpolar?  
I.  $\text{CH}_2\text{Cl}_2$  II.  $\text{CO}_2$  III.  $\text{CCl}_4$  IV.  $\text{CH}_3\text{OCH}_3$   
(A) I and II (B) I and III (C) I and IV (D) II and III (E) II, III, and IV
3. Which one of the following is the strongest base? (A)  $\text{CH}_3^-$  (B)  $\text{NH}_2^-$  (C)  $\text{OH}^-$  (D)  $\text{Cl}^-$
4. One of the functional group classifications is characterized by the presence of an  $sp^2$  hybridized carbon atom. This functional group could be:  
(A) alkyl halide (B) sulfide (C) alcohol (D) ketone (E) alkyne
5. What is the IUPAC name of the compound shown in the following Newman projection?



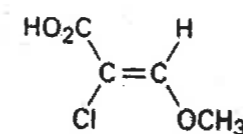
- (A) 1,1,2,2-tetramethylethane  
(B) 1,2-dimethylethane  
(C) 2,2,3,3-tetramethylbutane  
(D) 2,3-dimethylbutane
6. The most stable chair conformation of *cis*-1-*tert*-butyl-4-chlorocyclohexane occurs when  
(A) both *tert*-butyl and chlorine are equatorial (B) both *tert*-butyl and chlorine are axial  
(C) the *tert*-butyl is equatorial and the chlorine is axial  
(D) the *tert*-butyl is axial and the chlorine is equatorial
7. Which of the following statements is true regarding pairs of enantiomers?  
(A) have identical melting points  
(B) have identical boiling points  
(C) rotate plane-polarized light in opposite directions  
(D) all of these

8. Which reaction is likely to be the most exergonic (釋放能量), one with  
(A)  $K_{eq} = 0.001$  (B)  $K_{eq} = 0.001$  (C)  $K_{eq} = 1$  (D)  $K_{eq} = 100$  (E)  $K_{eq} = 1000$
9. What is the relationship between the following pair of structures?



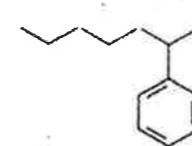
- (A) They are enantiomers  
(B) They are diastereomers  
(C) They are constitutional isomers  
(D) They are identical

10. The following structure has

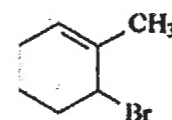


- (A) a *cis* configuration  
(B) a *trans* configuration  
(C) a *Z* configuration  
(D) an *E* configuration
11. The stereochemical pathway for the hydrogenation of an alkene with a metal catalyst, such as platinum, occurs *via* (A) *syn* addition. (B) *anti* addition. (C) Markovnikov addition. (D) *anti*-Markovnikov addition.

12. What type of reactive intermediate is involved in the bromination of an alkene?  
(A) carbocation (B) carbanion (C) radical (D) cyclic bromonium ion (E) carbene
13. What is the IUPAC name of the following compound?

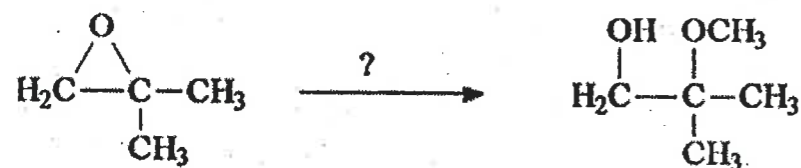


- (A) 6-phenylheptane  
(B) 2-benzylheptane  
(C) 2-heptylbenzene  
(D) 2-phenylheptane
14. Which of the following groups are *ortho/para* directors?  
I.  $-\text{NO}_2$  II.  $-\text{OCH}_3$  III.  $-\text{CO}_2\text{CH}_3$  IV.  $-\text{Cl}$   
(A) I and III (B) only II (C) II and IV (D) III and IV
15. Which of the following sets of substituents are all deactivating groups in electrophilic aromatic substitution reactions?  
(A)  $\text{Cl}$ ,  $\text{NH}_2$ ,  $\text{CH}_3$  (B)  $\text{CH}_3$ ,  $\text{OCH}_3$ ,  $\text{COCH}_3$  (C)  $\text{CH}_3$ ,  $\text{NH}_2$ ,  $\text{OCH}_3$  (D)  $\text{Cl}$ ,  $\text{CN}$ ,  $\text{NO}_2$
16. What is the IUPAC name of the following compound?

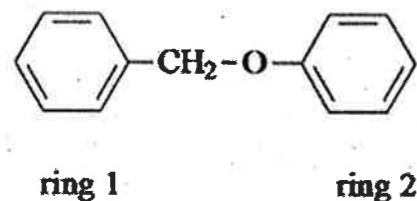


- (A) 3-bromo-2-methylcyclohexene  
(B) 1-bromo-2-methyl-2-cyclohexene  
(C) 6-bromo-1-methylcyclohexene  
(D) 2-bromo-1-methylcyclohexene
17. Which of the following is most reactive with  $\text{HBr}$ ?  
(A)  $\text{CH}_3\text{OH}$  (B)  $\text{CH}_3\text{CH}_2\text{OH}$  (C)  $(\text{CH}_3)_2\text{CHOH}$  (D)  $(\text{CH}_3)_3\text{COH}$
18. Which of the following expressions is the experimentally observed rate law for an  $\text{E}_2$  reaction of an alkyl halide?  
(A)  $\text{rate} = k[\text{RX}]$  (B)  $\text{rate} = k[\text{RX}][\text{base}]$  (C)  $\text{rate} = k[\text{RX}]^2$  (D)  $\text{rate} = k[\text{base}]$

19. How many allylic hydrogens are there in 1-methylcyclohexene?  
 (A) three (B) four (C) five (D) six (E) seven
20. Which one of the following is not readily oxidized by  $K_2Cr_2O_7$  in  $H_2SO_4/H_2O$ ?  
 (A) n-butyl alcohol (B) *sec*-butyl alcohol (C) isobutyl alcohol (D) *tert*-butyl alcohol
21. The reaction of a Grignard reagent with ethylene oxide followed by dilute acid gives  
 (A) a primary alcohol. (B) a secondary alcohol. (C) a tertiary alcohol. (D) methanol.
22. Which of the following ethers *cannot* be prepared by a Williamson reaction?  
 (A) *tert*-Butyl methyl ether (B) Anisole (C) *tert*-Butyl benzyl ether (D) *tert*-Butyl phenyl ether
23. The reaction of a Grignard reagent with an aldehyde followed by dilute acid gives a(n)  
 (A) primary alcohol. (B) secondary alcohol. (C) tertiary alcohol. (D) ester.
24. Which of the followings reagents would be used to carry out the reaction shown below?



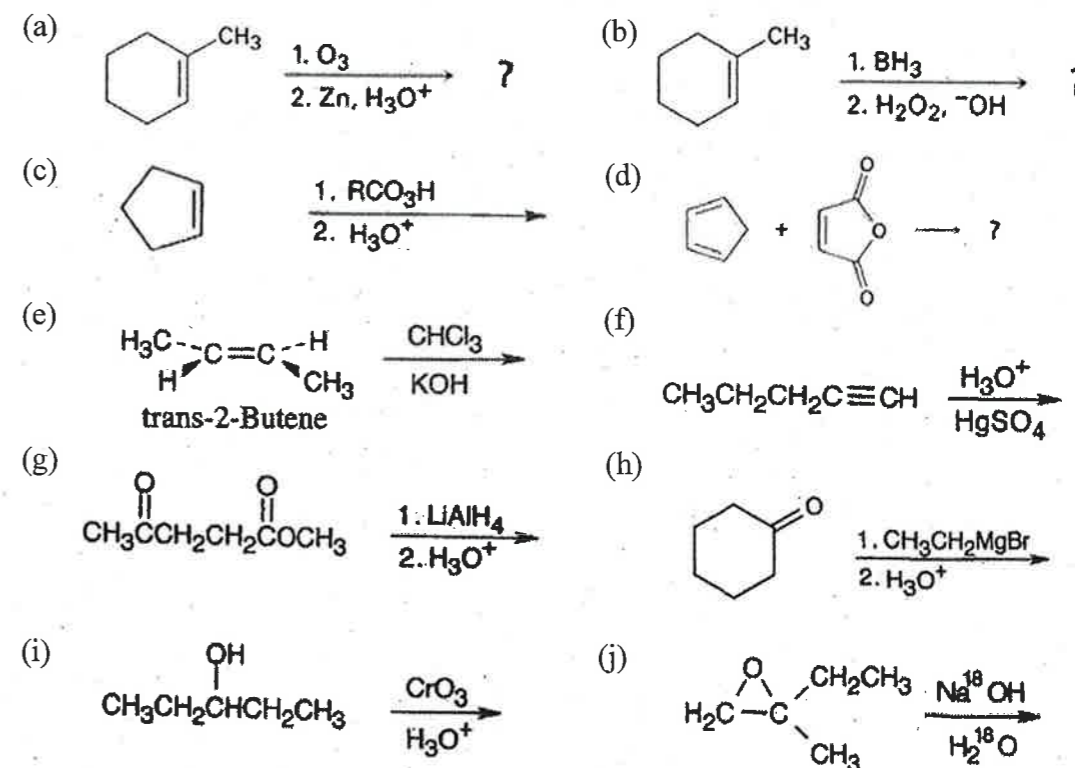
- (A)  $\text{CH}_3\text{OH}, \text{CH}_3\text{O}^-\text{Na}^+$  (B)  $\text{CH}_3\text{OH}, \text{H}_2\text{SO}_4$  (C)  $\text{CH}_3\text{MgBr}$ /ether followed by  $\text{H}_3\text{O}^+$   
 (D)  $\text{H}_2\text{O}/\text{H}_2\text{SO}_4$  followed by  $\text{CH}_3\text{OH}$
25. Identify the preferred site(s) of electrophilic attack on the following compound.



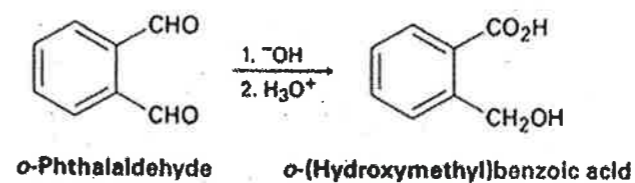
- (A) ortho/para positions on ring 1 (B) meta position on ring 1 (C) ortho/para positions on ring 2 (D) meta position on ring 2

二 問答題 (共 50 分)

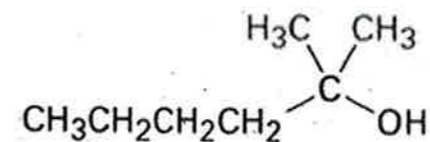
1. Predict the major product(s) of the following reactions (or reaction sequences): (寫出最終產物的化學結構即可, 必要時需標示產物的立體結構) (每小題 3 分 共 30 分)



2. When *o*-phthalaldehyde is treated with base, *o*-(hydroxymethyl)benzoic acid is formed. Show the mechanism of this reaction, using curved arrows to trace the electron flow. (寫出下列反應的反應機制) (6 分)



3. How could you use the reaction of a Grignard reagent with a carbonyl compound to synthesize 2-methylhexan-2-ol? Show all possibilities. (6 分)



4. Outline a scheme for the preparation of cyclohexyl ethyl ether using the Williamson method and using alcohols as the only sources of all the carbon atoms. (8 分)

