

## 國立臺北科技大學 111 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

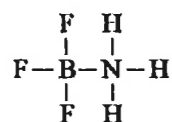
第 1 頁 共 3 頁

**注意事項：**

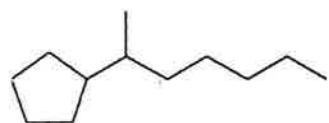
1. 本試題共兩大題，每題 50 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

## 一 選擇題 (單選 每題 2 分共 50 分)

1. What are the formal charges of boron and nitrogen, respectively, in the following structure?

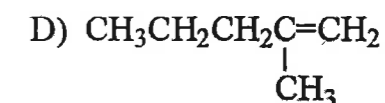
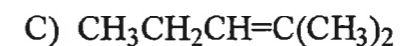
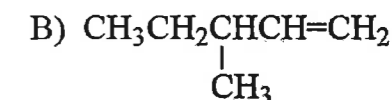
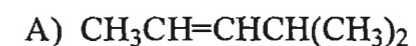


- A) -1 and +1    B) -1 and 0    C) 0 and +1    D) 0 and 0
2. Which one of the following is the conjugate acid of ethanol?
- A)  $\text{CH}_3\text{CH}_2\text{O}^-$     B)  $\text{CH}_3\text{CH}_2\text{O}^+$     C)  $\text{CH}_3\text{CH}_2\text{OH}_2^+$     D)  $\text{CH}_3\text{CH}_2\text{OH}_3^+$
3. The correct IUPAC name of the following compound is

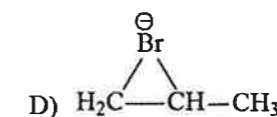
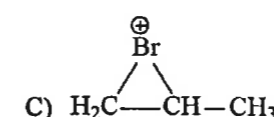
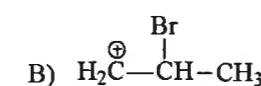
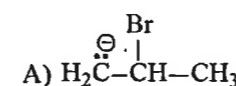


- A) (1-methylhexyl)cyclopentane.    B) (1-pentylethyl)cyclopentane.  
C) 2-cyclopentylheptane.    D) 1-cyclopentyl-2-heptane.
4. The *tert*-butyl group can also be called
- A) 1,1-dimethylpropyl.    B) 1,1-dimethylethyl.    C) 2,2-dimethylpropyl.  
D) 2,2-dimethylethyl.
5. The most stable chair conformation of *cis*-1-*tert*-butyl-3-methylcyclohexane has
- A) both groups equatorial.  
B) both groups axial.  
C) the *tert*-butyl group equatorial and the methyl group axial.  
D) the *tert*-butyl group axial and the methyl group equatorial.
6. Which one of the following compounds cannot undergo an E2 reaction?
- A) 2-bromo-2,3-dimethylbutane  
B) 1-bromo-3,3-dimethylbutane  
C) 1-bromo-2,3-dimethylbutane  
D) 1-bromo-2,2-dimethylbutane

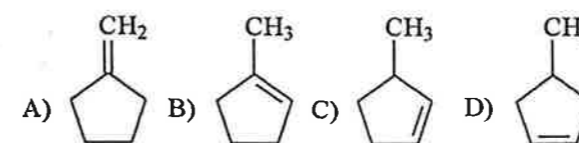
7. Which of the following alkenes gives 1-bromo-2-methyl-2-pentanol upon reaction with  $\text{Br}_2/\text{H}_2\text{O}$ ?



8. Which of the following species is the intermediate in the bromination of propene?



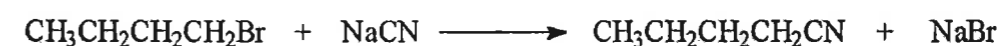
9. Compound X,  $\text{C}_6\text{H}_{10}$ , is optically active. Hydrogenation of the compound gives methylcyclopentane. Which compound below is compound X?



10. How many stereoisomers of 2,4-pentanediol are possible?

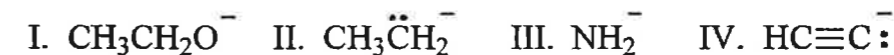
A) 2    B) 3    C) 4    D) 6

11. In which of the solvents below would the reaction shown take place at the fastest rate?



A) ethanol    B) acetic acid    C) dimethyl sulfoxide    D) water

12. Arrange the following in order of decreasing base strength (strongest base first).



A) IV &gt; III &gt; II &gt; I

B) I &gt; II &gt; IV &gt; III

C) II &gt; III &gt; I &gt; IV

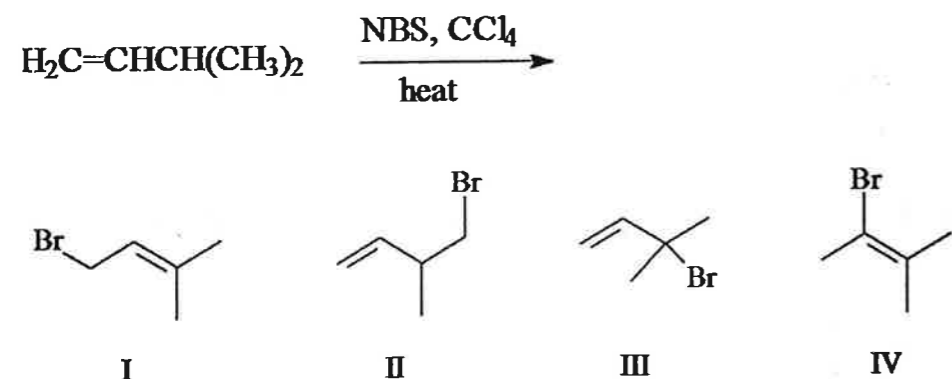
D) II &gt; III &gt; IV &gt; I

13. Which reagent below would be used to convert 2-pentyne to *trans*-2-pentene?

A)  $\text{NaNH}_2, \text{NH}_3$     B)  $\text{Na}, \text{NH}_3$     C)  $\text{H}_2, \text{Lindlar Pd}$     D)  $\text{H}_2\text{O}, \text{HgSO}_4/\text{H}_2\text{SO}_4$ 

注意：背面尚有試題

14. What is(are) the expected product(s) of the following reaction?

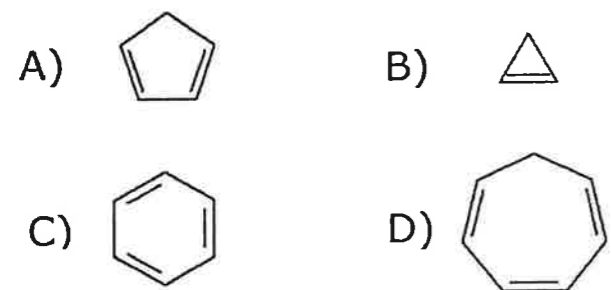


A) only II    B) only III    C) I and III    D) II and IV

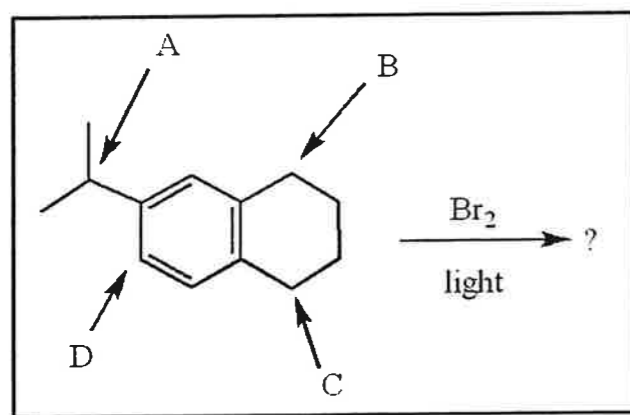
15. Side chain oxidations of alkylbenzenes with  $\text{Na}_2\text{Cr}_2\text{O}_7$  and  $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$  will not work if the alkyl side chain has

A) only one carbon. B) four or more carbons. C) benzylic hydrogens. D) no benzylic hydrogens.

16. Which of the following would most readily react with a strong base, such as  $\text{NaNH}_2$ , to form a carbanion?



17. Where would this reaction occur fastest in this molecule?



A) A    B) B    C) C    D) D

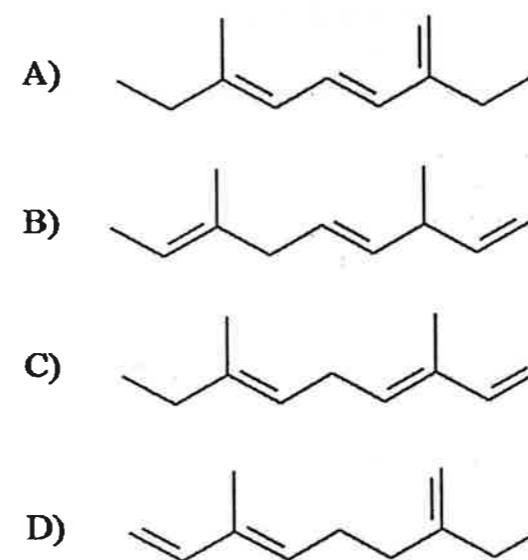
18. Nitration of benzoic acid has a reaction rate which is \_\_\_\_\_ than the nitration rate of benzene and gives primarily the \_\_\_\_\_ product(s).

A) slower, *meta*    B) slower, *ortho/para*    C) faster, *meta*    D) faster, *ortho/para*

19. A large doublet and a small septet pattern in  $^1\text{H}$  NMR is usually indicative of a(n)

A) ethyl group.    B) propyl group.    C) isopropyl group.    D) phenyl group.

20. Which one of the following has a  $\lambda_{\text{max}}$  in its UV-visible spectrum with the longest wavelength?



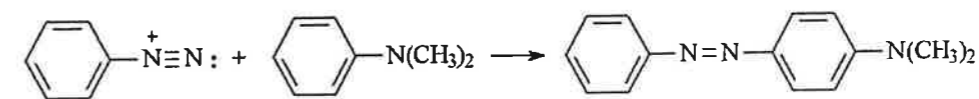
21. The reaction of a Grignard reagent with a ketone followed by dilute acid gives a(n)

A) primary alcohol.    B) secondary alcohol.    C) tertiary alcohol.    D) ester.

22. Which of the following cannot be made by the reduction of a ketone or aldehyde with  $\text{NaBH}_4$  in methanol?

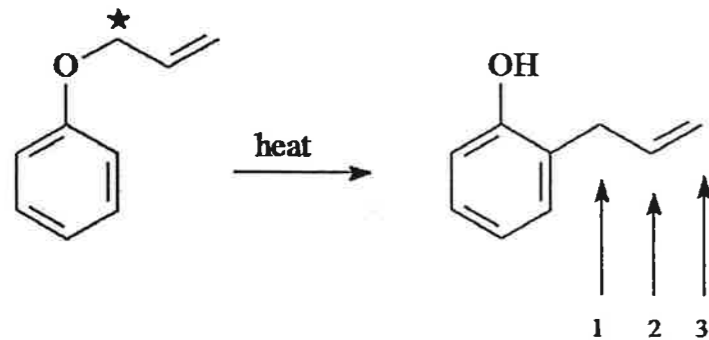
A) 1-butanol    B) 2-butanol    C) 2-methyl-1-propanol    D) 2-methyl-2-propanol

23. What is the mechanism of the following reaction?



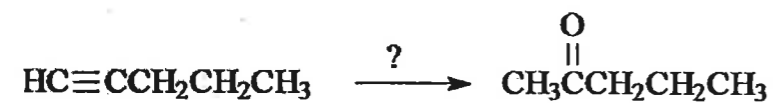
A)  $\text{S}_{\text{N}}1$     B)  $\text{S}_{\text{N}}2$     C) free radical    D) electrophilic aromatic substitution

24. Indicate where the isotopically labeled carbon atom (\*) is located in the product.



- A) #1    B) #2    C) #3    D) equally distributed between #1 and #2

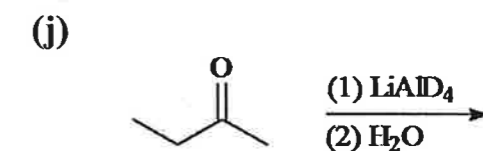
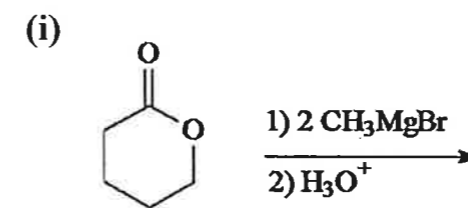
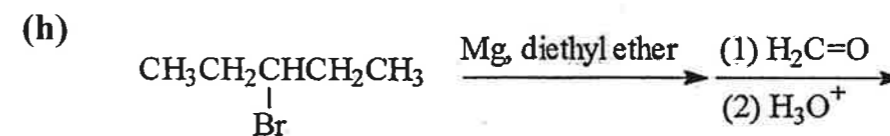
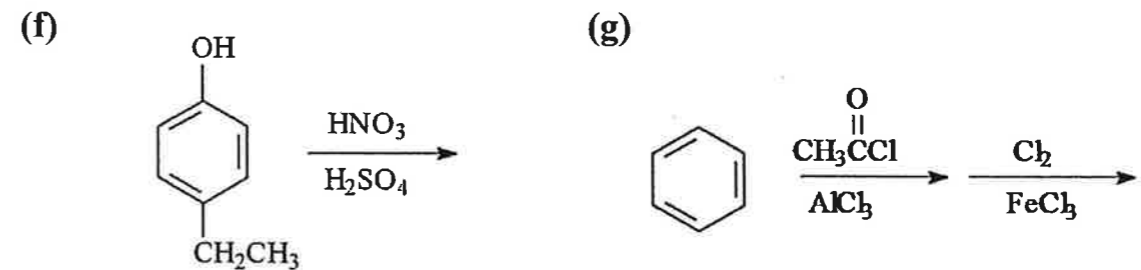
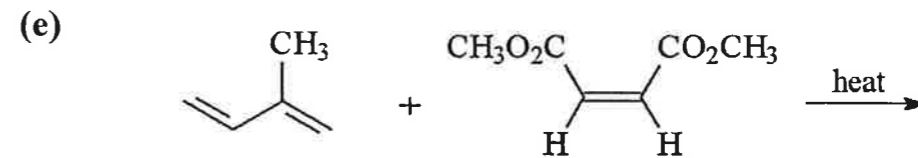
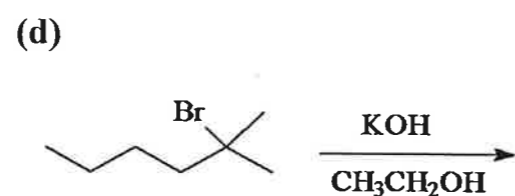
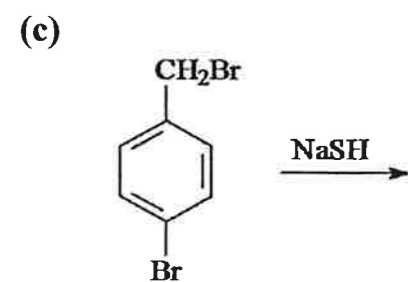
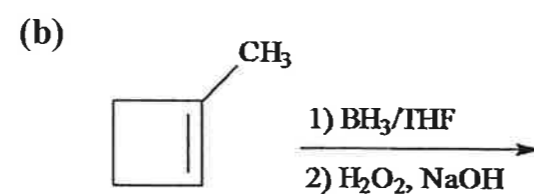
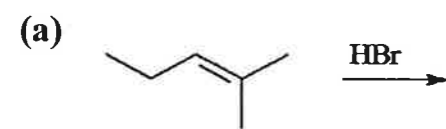
25. Identify the reagents needed to carry out the following conversion.



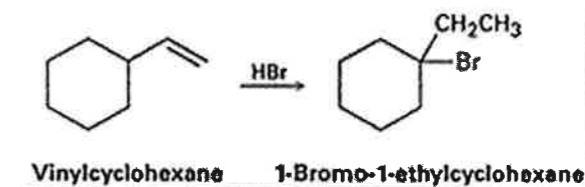
- A)  $\text{H}_2$ /Lindlar Pd followed by  $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$   
 B)  $\text{O}_3$  followed by  $\text{H}_2\text{O}$   
 C)  $\text{H}_2\text{O}$ ,  $\text{HgSO}_4/\text{H}_2\text{SO}_4$   
 D)  $\text{LiAlH}_4$  followed by  $\text{H}_2\text{O}$

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) (每題 3 分 共 30 分)



2. On treatment with HBr, vinylcyclohexane undergoes addition and rearrangement to yield 1-bromo-1-ethylcyclohexane. Using curved arrows, propose a mechanism to account for this result. (6 分)



3. Write the intermediate carbocations and give both 1,2- and 1,4-adducts resulting from reaction of 1 equivalent of HCl with penta-1,3-diene. (6 分)

4. How would you synthesize the following compounds starting from benzene? Assume that ortho and para isomers can be separated.

- (a) *m*-Chloropropylbenzene (4 分)    (b) *p*-Bromopropylbenzene (4 分)