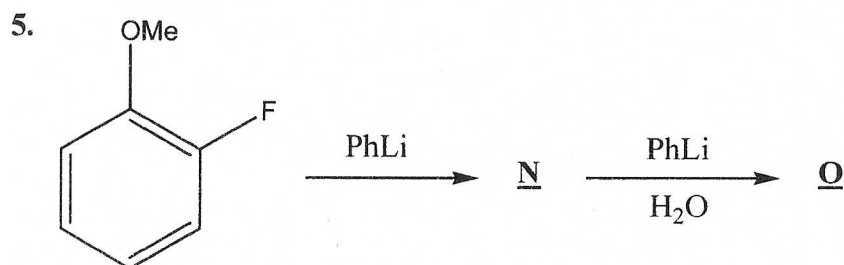
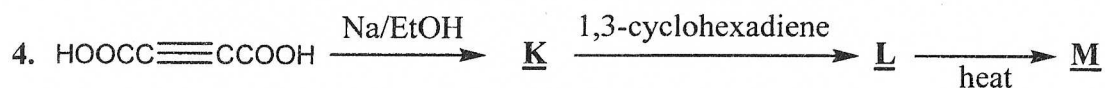
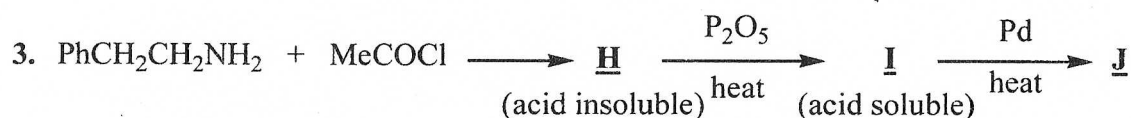
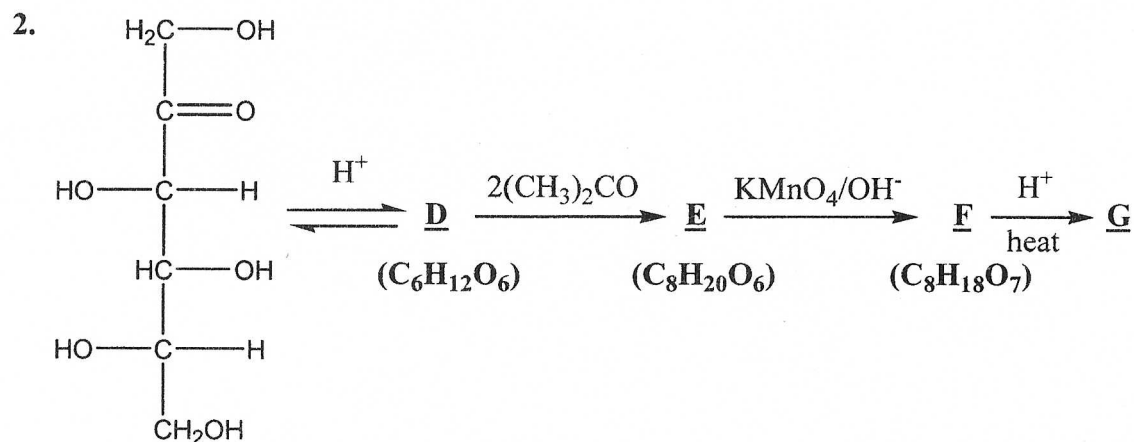
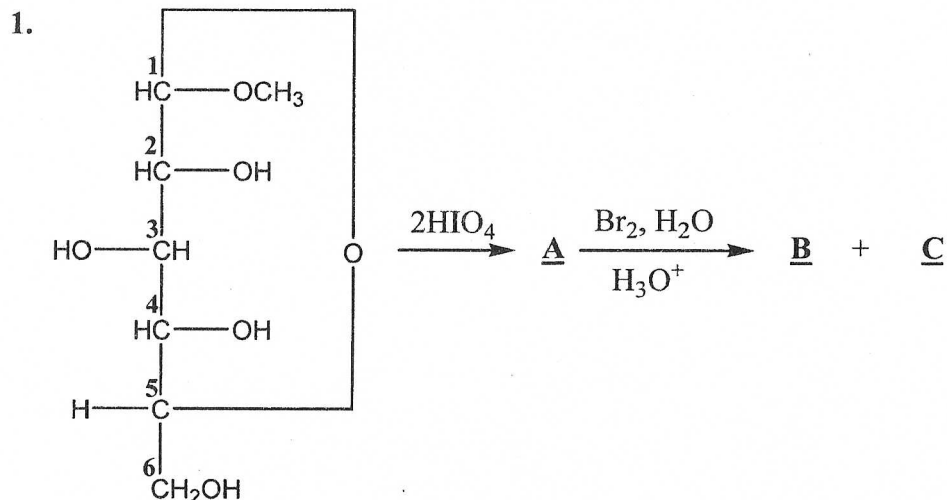


94 學年度\_生命科學院，生命科學院 結構生物學程\_系(所)\_乙組，甲組\_\_碩士班入學考試

科目\_有機化學\_科目代碼\_0902,1106\_共\_5\_頁第\_1\_頁 \*請在試卷【答案卷】內作答

I. Draw the structures of the major product in each of the following chemical reactions.

(30%, 2% each)



94 學年度\_ 生命科學院，生命科學院 結構生物學程\_系（所）\_乙組，甲組\_\_\_\_碩士班入學考試

科目\_有機化學\_科目代碼\_0902,1106\_共\_5\_頁第\_2\_頁 \*請在試卷【答案卷】內作答

## II. Multiple Choice

(36%, 2% each)

- Determine the formal charge on boron in  $\text{H}_2\text{O}:\text{BF}_3$   
(A) 1 (B) 0 (C) -1 (D) 1/2
- In a nitration of benzene, 39 g of benzene gave 24.6 g of nitrobenzene. What is the percentage yield?  
(A) 63% (B) 37% (C) 60% (D) 40%
- Which of the following compounds has valence electrons with the molecular orbital electronic structure as  $12 \text{ electrons}, \sigma_{2s}^2 \sigma_{2s}^{*2} \sigma_{2p}^2 \pi_y^2 \pi_z^2 \pi_y^{*1} \pi_z^{*1}$   
(A)  $\text{C}_2$  (B)  $\text{N}_2$  (C)  $\text{O}_2$  (D) NO
- How many diastereomers of naturally occurring glucose can be isolated from a water solution?  
(A) 2 (B) 4 (C) 8 (D) 16
- Which of the following amino acids have more than one chiral center?  
I. Glycine II. Isoleucine III. Threonine IV. Proline  
(A) I, II (B) II, III (C) II, IV (D) III, IV
- Which of the following pairs about the chemical reagents used to protect the side chain functional groups during peptide synthesis is correct?  
(A) benzyl COOH (B) *p*-toluenesulfonyl, OH (C) acetyl, SH (D) benzyl, OH
- Rank the basicity of the following chemicals in increasing order.  
I. pyrrole II. pyridine III. piperidine  
(A) I<II<III (B) I<III<II (C) II<III<I (D) III<II<I
- Which of the following chemical reagents does not react with *p*-methylphenol?  
I.  $\text{Me}_2\text{SO}_4$ , aq. NaOH II. benzyl chloride, aq. NaOH  
III.  $\text{SO}_2\text{Cl}_2$  IV hot conc. HCl  
(A) I, II (B) II, III (C) II, IV (D) I, III, IV
- Rank the basicity of the following chemicals in decreasing order.  
I. ethylamine II. 2-aminoethanol III. 3-amino-1-propanol  
(A) III>II>I (B) II>III>I (C) II>I>III (D) I>II>III
- Which of the following reactions converts the optically active  $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CHO}$  into racemic products?  
I. aq. NaOH II.  $\text{Br}_2$ , aq. NaOH III. NaOD/ $\text{D}_2\text{O}$   
(A) I, II (B) I, III (C) II, III (D) I, II, III
- Which of the following chemicals proceeds aldol condensation and dehydration to give product containing  $\alpha,\beta$ -unsaturated carbonyl group?  
I. phenylacetaldehyde II. 3-pentanone  
III. cyclohexanone IV. 2,2-dimethylpropanal  
(A) I, II (B) III, IV (C) I, II, III (D) I, II, IV

94 學年度\_生命科學院，生命科學院 結構生物學程\_系（所）\_乙組，甲組\_\_\_\_碩士班入學考試

科目 有機化學 科目代碼 0902,1106 共 5 頁第 3 頁 \*請在試卷【答案卷】內作答

12. Which of the following reactions generally gives products containing enol structure?

I. Claisen condensation                      II. Michael addition  
III. Aldol condensation                      IV. Diels-Alder reaction  
(A) I, II (B) I, III (C) II, IV (D) I, II, III, IV

13. Rank the boiling point of the following chemicals in increasing order.

I.  $\text{MeCONH}_2$       II.  $\text{MeCONHMe}$       III.  $\text{MeCONMe}_2$   
(A)  $\text{I} < \text{II} < \text{III}$  (B)  $\text{I} < \text{III} < \text{II}$  (C)  $\text{III} < \text{I} < \text{II}$  (D)  $\text{III} < \text{II} < \text{I}$

14. Rank the pKa values of the following molecules in increasing order

I.  $\text{HCOOH}$     II.  $\text{CH}_3\text{COOH}$     III.  $\text{CH}_2\text{ClCOOH}$     IV.  $p\text{-NO}_2\text{C}_6\text{H}_4\text{COOH}$   
(A)  $\text{I} < \text{II} < \text{III} < \text{IV}$  (B)  $\text{II} < \text{I} < \text{IV} < \text{III}$  (C)  $\text{III} < \text{IV} < \text{I} < \text{II}$  (D)  $\text{IV} < \text{III} < \text{II} < \text{I}$

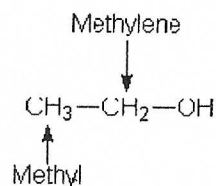
15. Rank the reactivity of the following reactions in the presence of NaOH in decreasing order.

I.  $(\text{CH}_3)_3\text{CCH}_2\text{OH} + (\text{CH}_3)_3\text{CCH}_2\text{Br}$  II.  $\text{ClCH}_2\text{CH}=\text{CH}_2 + \text{HOCH}_2\text{CH}=\text{CH}_2$   
 III.  $\text{ClCH}_2\text{CH}_2\text{CH}_3 + \text{HOCH}_2\text{CH}_2\text{CH}_3$  IV.  $\text{BrCH}_2\text{CH}_2\text{CH}_3 + \text{HOCH}_2\text{CH}_2\text{CH}_3$   
 (A) I>II>III>IV (B) II>IV>III>I (C) III>IV>II>I (D) IV>III>II>I

16. In some atoms (such as  $^1\text{H}$  and  $^{13}\text{C}$ ), the nucleus possesses an overall spin. If the number of neutrons and the number of protons are both even, then the nucleus has

(A) NO spin (B) a half-integer spin (C) an integer spin (D) a negative spin

17. The  $^1\text{H}$  NMR spectrum of ethanol should show the methylene peak split into



(A) doublet (B) triplet (C) quartet (D) multiplet

18. Most absorption spectroscopy of organic compounds is based on transitions of  $n$  or  $\pi$  electrons to the  $\pi^*$  excited state. This is because the absorption peaks for these transitions fall in an experimentally convenient region of the spectrum (200 - 700 nm). What special structure do these transitions need?

(A) a saturated group (B) an unsaturated group (C) a cyclic group (D) a linear group

III. Draw the orbital representation of the following species.

**(4%, 2% each)**

(a) carbocation in  $(\text{CH}_3)_2\text{C}=\underset{\begin{array}{c} | \\ \text{CH}_3 \end{array}}{\text{C}}^+$

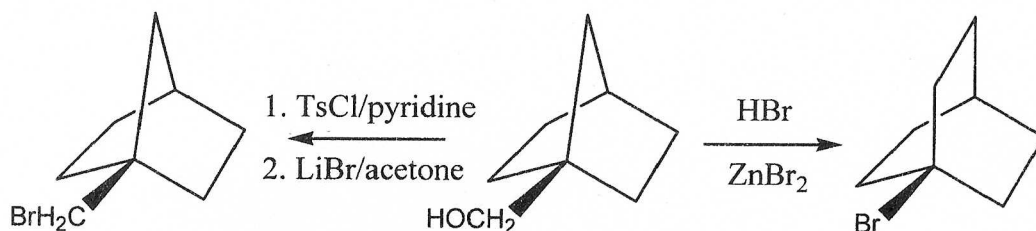
(b) carbanion in  $(\text{CH}_3)_2\text{C}=\underset{\begin{array}{c} | \\ \text{CH}_3 \end{array}}{\text{C}}^-$

- IV. Treatment of (*R*) MeCH(OH)CCl<sub>3</sub> with alkaline NaN<sub>3</sub> followed by H<sub>2</sub>/Pd yields (*S*) alanine. Draw the reaction mechanisms in each step and explain. (5%)

94 學年度\_生命科學院，生命科學院 結構生物學程\_系(所)\_乙組，甲組\_\_碩士班入學考試  
科目\_有機化學\_科目代碼\_0902,1106\_共\_5\_頁第\_4\_頁 \*請在試卷【答案卷】內作答

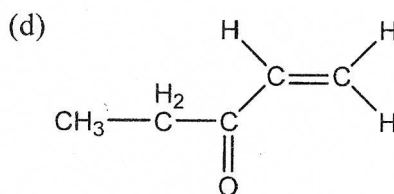
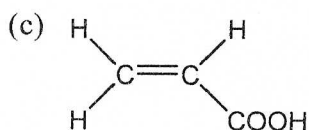
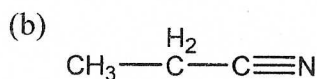
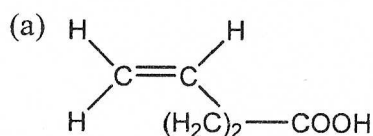
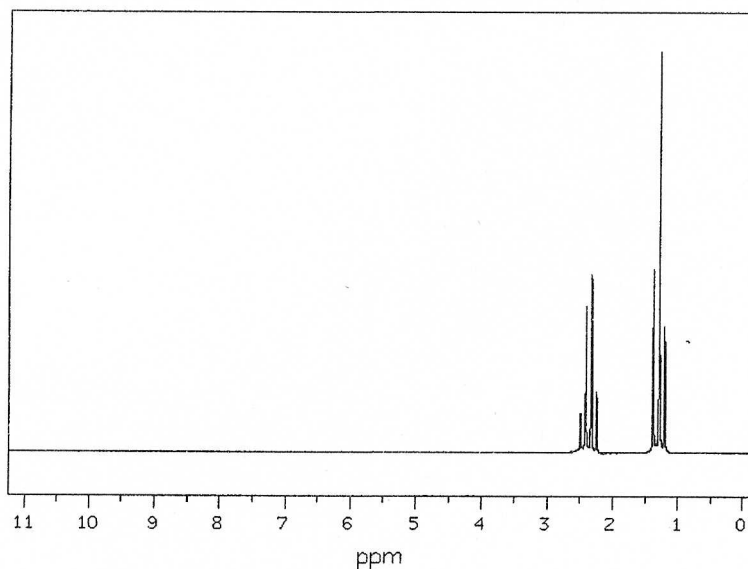
V. An optically active isomer of 5-bromo-2-hexanol reacts with alcoholic KOH to give an optically inactive product X, while another optically active isomer gives optically active Y. Both X and Y are  $C_6H_{12}O$ . Draw the structure of each reactant and product with clear stereochemical assignment in each reaction and explain. (6%)

VI. Explain the difference in products from the following reactions. (4%)



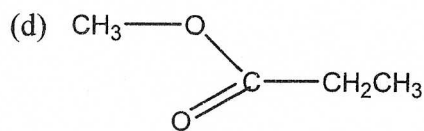
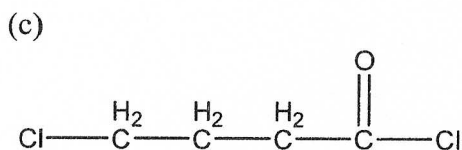
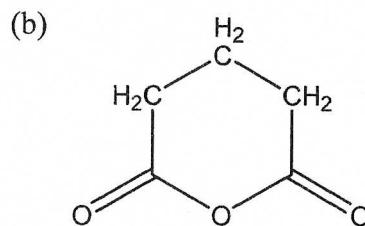
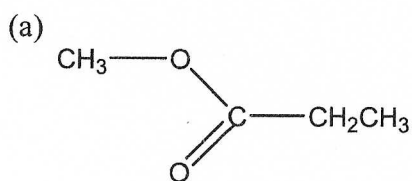
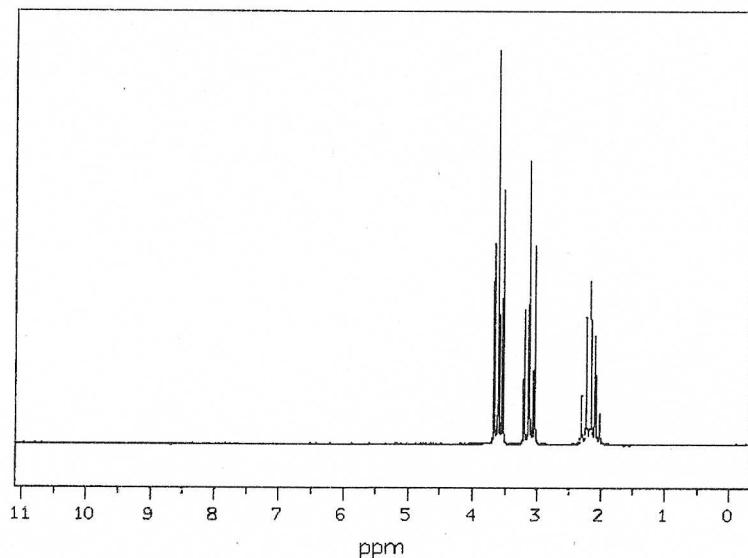
VII. Please identify the following compounds with detailed assignment of atoms according to the spectroscopic properties provided. (10%, 2% each)

(1).



94 學年度\_ 生命科學院，生命科學院 結構生物學程\_系(所)\_乙組，甲組\_\_\_\_碩士班入學考試  
科目\_有機化學\_科目代碼\_0902,1106\_共\_5\_頁第\_5\_頁 \*請在試卷【答案卷】內作答

(2)



VIII. Deduce the chemical structure of a compound  $C_5H_{12}O$  with the Mass spectra shown below. Please show the assignment in detail. (5%)

