

八十七學年度 化學工程學 系(所) 乙 組碩士班研究生入學考試
 有機化學 科號 2402 共 8 頁第 1 頁 請在試卷【答案卷】內作答

Problem 1 (16%)

Multiple Choice

(1) Which of each pair of the following would be a better leaving group an S_N2 reaction?

- (a) CH_3OH or (b) CH_3O^- (c) Cl^- or (d) $\text{CH}_3\text{CH}_2\text{CO}_2^-$
 A. a,d B. a,c C. b,c D. b,d

(2) Penicilins contain:

- (a) a β -lactam ring (b) a thioester group
 (c) a β -lactone ring (d) a cyclopentane ring

(3) Which of the following statements are true about $E1$ reactions of alkyl halides (RX).

- (a) $\text{Rate} = k[\text{base}]$ (b) $\text{Rate} = k[\text{base}][\text{RX}]$
 (c) $\text{Rate} = k[\text{RX}]$ (d) The reactions occur in two distinct steps
 (e) Rearrangements do not occur
 A. a,d B. b,e C. c,e D. c,d

(4) Which of the following alcohols would undergo dehydration most rapidly?

- (a) $\text{CH}_3\text{CH}_2\underset{\text{OH}}{\text{CH}}\text{CH}_3$ (b) $(\text{CH}_3)_2\underset{\text{OH}}{\text{C}}\text{CH}_2\text{CH}_3$
 (c) $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$ (d) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

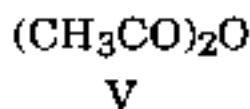
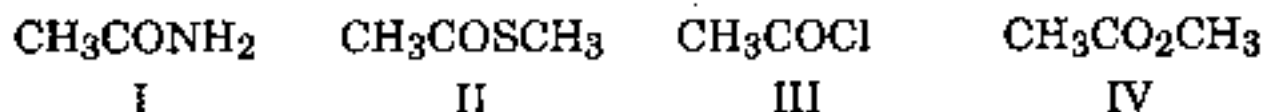
(5) Which of the following allows one to deduce something about the structure of the transition state in a reaction?

- (a) Saytzeff's rule (b) Hammond's postulate
 (c) Baeyer's strain theory (d) Corey-House synthesis

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- (6) the order of decreasing reactivity of the following toward nucleophilic acyl substitution is:



- | | |
|-------------------|-------------------|
| (a) III>IV>V>II>I | (b) III>V>II>IV>I |
| (c) IV>III>V>I>II | (d) III>II>V>IV>I |
- (7) Which of the following alkyl halides would be suitable for formation of a Grignard reagent?
- | | |
|---|---|
| (a) $\text{H}_2\text{NCH}_2\text{CH}_2\text{Br}$ | (c) $\text{CH}_3\text{COCH}_2\text{CH}_2\text{Br}$ |
| (b) $(\text{CH}_3)_2\text{NCH}_2\text{CH}_2\text{Br}$ | (d) $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{C}\equiv\text{N}$ |
- (8) The reaction of phenylmagnesium bromide (PhMgBr) with $\text{CH}_3\text{COCH}_2\text{CH}_3$ gives:
- | | |
|--------------------------------------|--------------------------------|
| (a) an achiral product | (b) a mixture of diastereomers |
| (c) the racemate of a chiral product | |
| (d) a single enantiomer | |

Problem 2 (9%)

Draw structure

- | |
|--------------------------------------|
| (a) bicyclo[3.2.1]octane |
| (b) benzaldehyde phenylhydrazone |
| (c) N-ethyl-N,2-dimethyl propanamide |

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Problem 3 (10%)

Choose the best answer in the following questions

- a) Treatment of cyclopentene with peroxybenzoic acid _____.
- A. results in oxidative cleavage of the ring to produce an acyclic compound
 B. yields a meso epoxide.
 C. yields an equimolar mixture of enantiomeric epoxides
 D. gives the same product as treatment of cyclopentene with OsO_4
- b) Both (E)- and (Z)-3-hexene can be treated with D_2 in the presence of a platinum catalyst. How are the products from these two reactions related to each other?
- A. The (E)- and (Z)-isomers generate the same products in exactly the same amounts.
 B. The products of the two isomers are related as enantiomers.
 C. The products of the two isomers are related as diastereomers.
 D. The products of the two isomers are related as structural isomers.
- c) Addition of Br_2 to (Z)-3-hexene produces _____.
- A. (Z)-3,4-dibromo-3-hexene
 B. a meso dibromide
 C. a mixture of enantiomeric dibromides which is optically active
 D. a mixture of enantiomeric dibromides which is optically inactive
- d) Which of the following alcohols will give a positive chromic acid test?
- A. 2-butanol B. cyclohexanol C. tert-butanol D. both A and B
- e) When (R)-2-butanol is treated with TsCl in pyridine, the product formed is:
- A. an achiral compound. B. a mixture of diastereomers. C. a racemic mixture.
 D. a single enantiomer.
- f) Which of the following is a bridged bicyclic alkane?
- A. cis-decalin B. bicyclo[3.2.0]heptane C. bicyclo[4.1.0]heptane
 D. bicyclo[2.2.1]heptane
- g) Choose the term below which best describes the geometry of acetylene.

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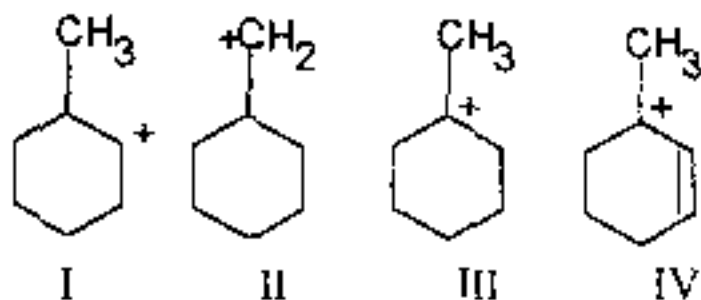
A. tetrahedral B. trigonal C. pyramidal D. linear

b) Which of the following alcohols will react most rapidly with the Lucas reagent?

A. $(\text{CH}_3)_3\text{COH}$ B. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ C. $\text{CH}_3\underset{\text{OH}}{\text{CH}}\text{CH}_2\text{CH}_3$

D. $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$

i) Consider the following carbocations:



The correct order of stability (most stable first) is:

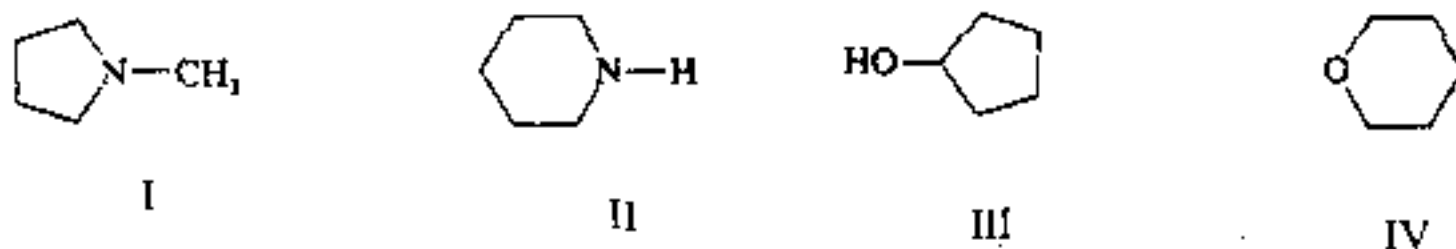
A. I, II, III, IV

B. IV, III, I, II

C. IV, III, II, I

D. III, IV, I, II

j) Consider the following compounds:



The correct order in terms of increasing boiling point (highest last) is:

A. I, II, III, IV

B. III, I, II, IV

C. I, III, II, IV

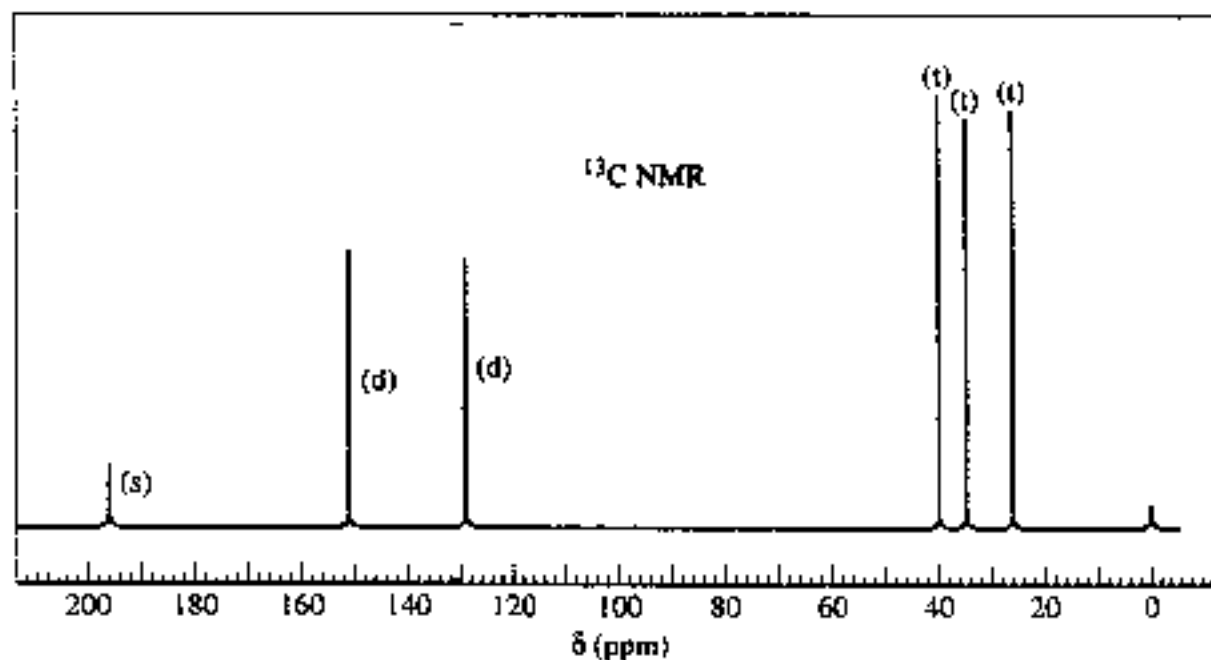
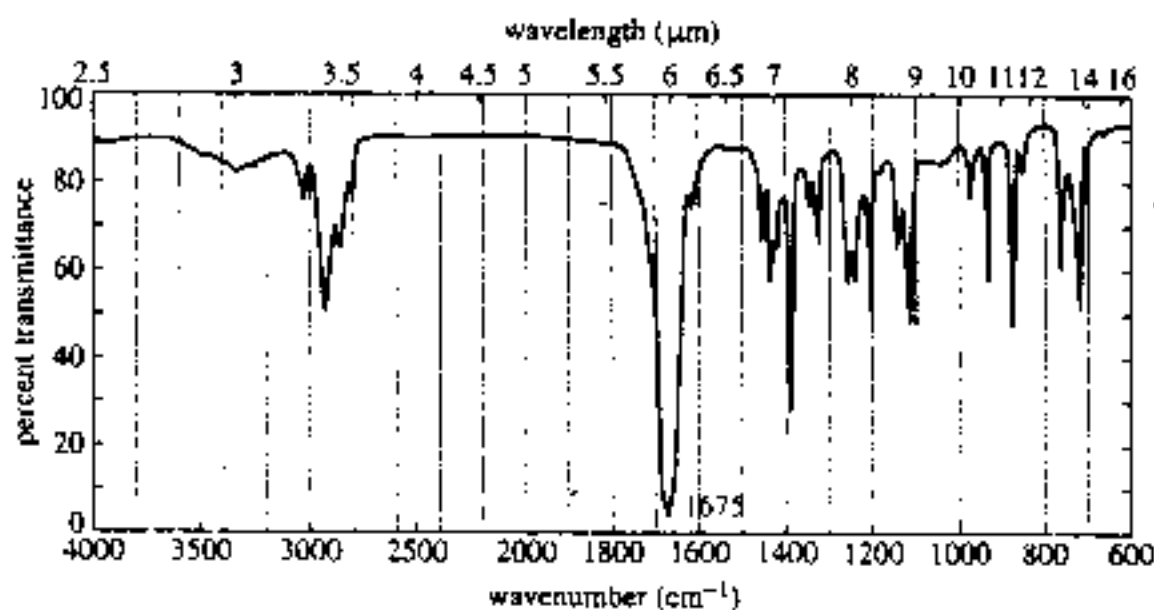
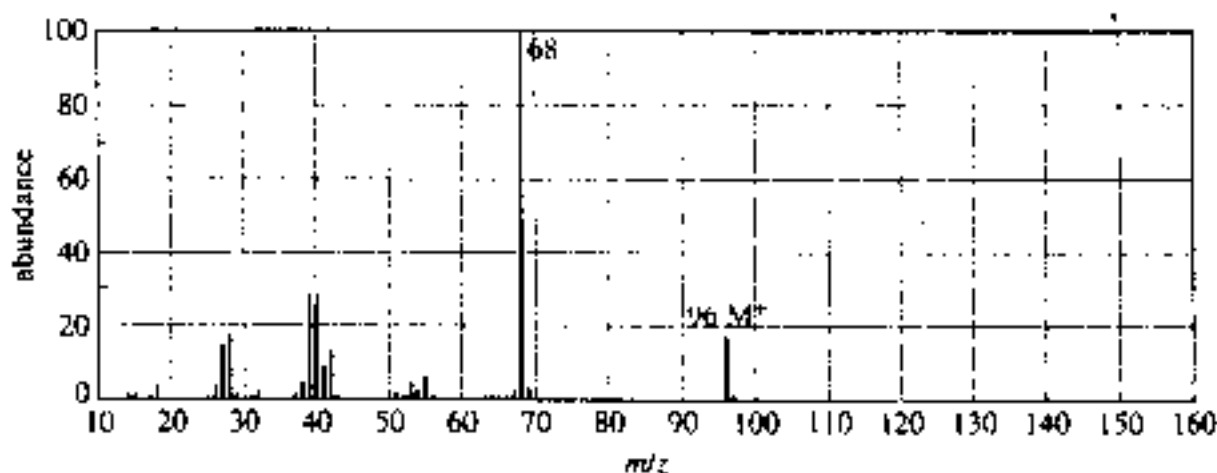
D. II, I, III, IV

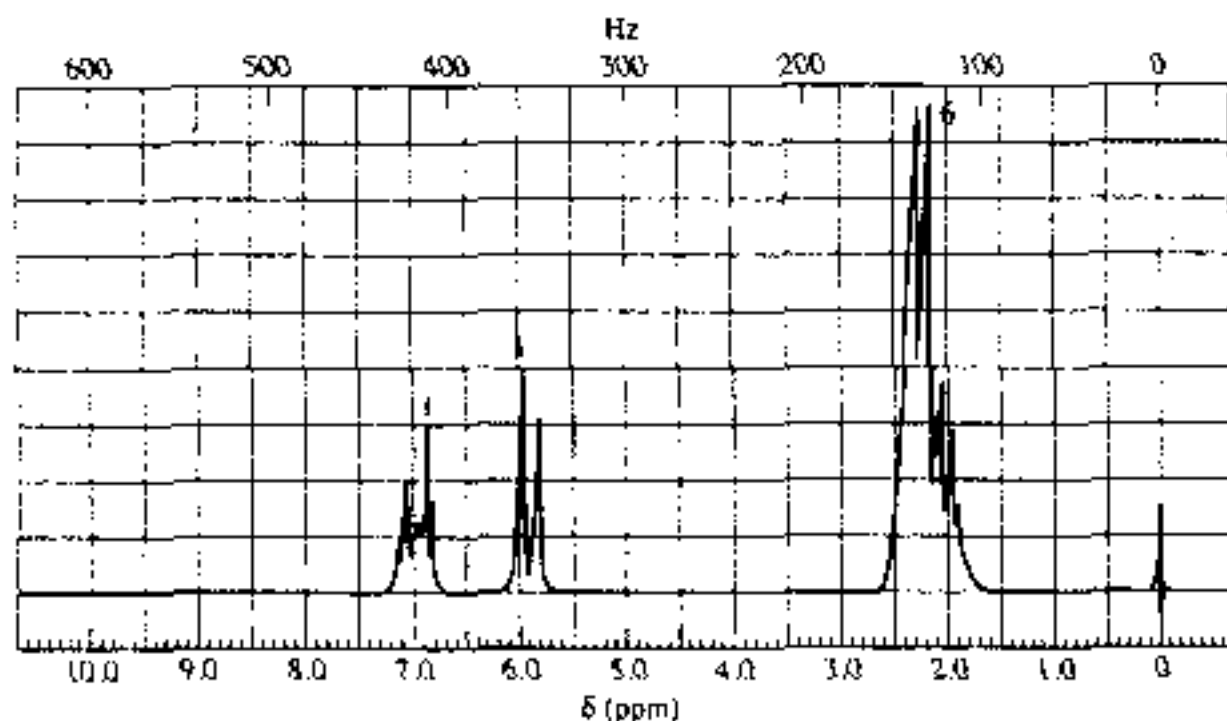
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Problem 4 (15%)

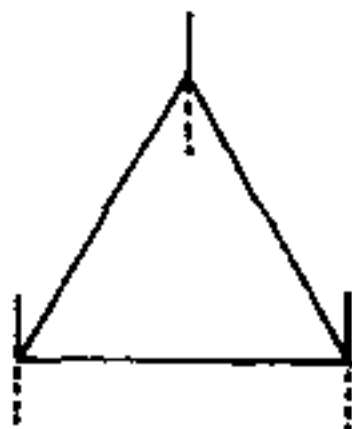
Determine the structure of an unknown compound having UV $\lambda_{\max} = 225 \text{ nm}$ ($\epsilon = 10,000$) and 318 nm ($\epsilon = 40$) on the basis of its mass, IR, ^{13}C NMR and ^1H NMR spectra shown below. Give peak assignment to show that your proposed structure accounts for all the major features of each spectrum.





Problem 5 (10%)

Draw all the isomers of triphenylcyclopropane. Indicate which are enantiomers (mirror images). State the appearance of the upfield portion of the nmr spectrum of each (e.g. two doublets, one singlet). Use first-order analysis of spin-spin splitting.

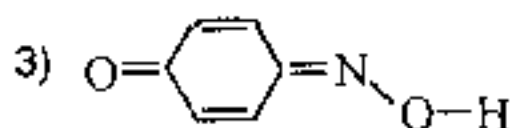
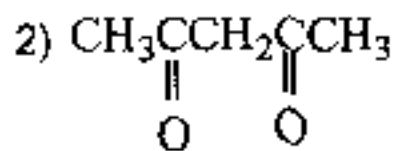
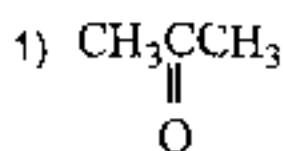


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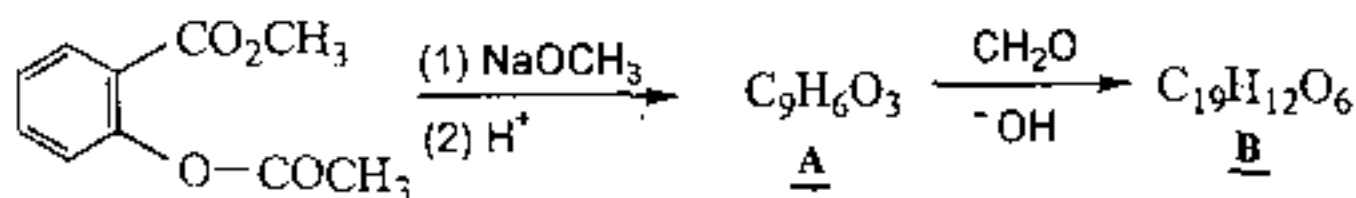
Problem 6 (10%)

Write a structures of the tautomers of the following compounds? And compare the stability of each pair of isomers

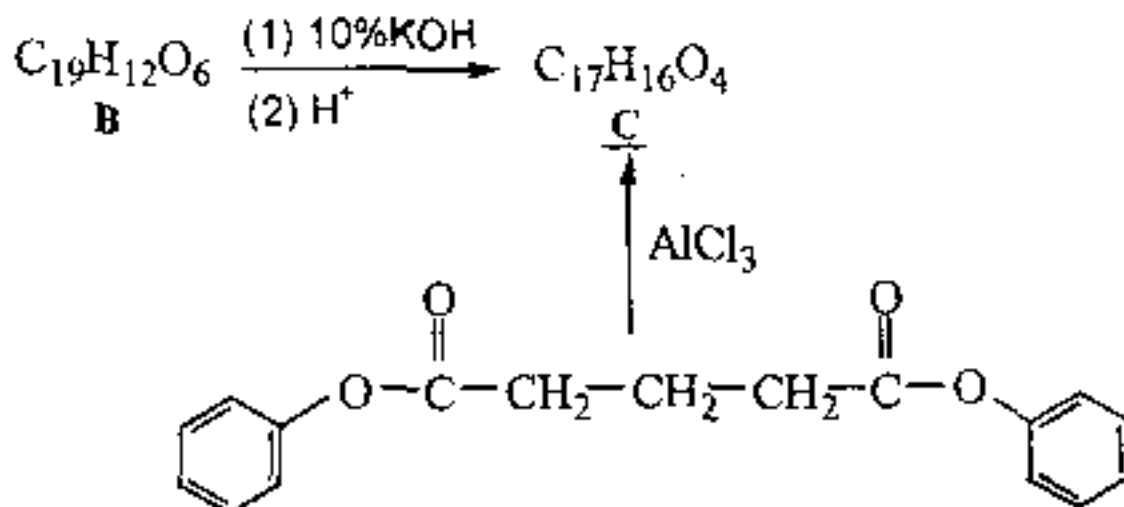


Problem 7 (10%)

A hemorrhagic factor, B, found in fermented hay, has provided useful in controlling some type of heart disease. It is now synthesized as follows:



A and B give positive ferric chloride tests, and B reacts as follows:



Write the structures for A, B and C.

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Problem 8 (20%)

Outline a possible laboratory synthesis of each of the following compounds from benzene and/or toluene, using any needed aliphatic and inorganic reagents. Please indicate the reaction conditions and catalysts required:

- (a) m-cresol
- (b) p-cresol
- (c) o-cresol
- (d) m-bromophenol
- (e) 3-bromo-4-methylphenol