

注意：考試開始鈴響前，不得翻閱試題，
並不得書寫、畫記、作答。

國立清華大學 114 學年度碩士班考試入學試題

系所班組別：生醫工程與環境科學系
丙組(應用化學組)

科目代碼：2901

考試科目：有機化學

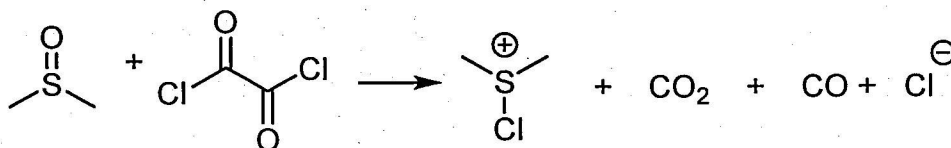
—作答注意事項—

1. 請核對答案卷(卡)上之准考證號、科目名稱是否正確。
2. 考試開始後，請於作答前先翻閱整份試題，是否有污損或試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 考生限在答案卷上標記「由此開始作答」區內作答，且不可書寫姓名、准考證號或與作答無關之其他文字或符號。
4. 答案卷用盡不得要求加頁。
5. 答案卷可用任何書寫工具作答，惟為方便閱卷辨識，請儘量使用藍色或黑色書寫；答案卡限用 2B 鉛筆畫記；如畫記不清(含未依範例畫記)致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
6. 其他應考規則、違規處理及扣分方式，請自行詳閱准考證明上「國立清華大學試場規則及違規處理辦法」，無法因本試題封面作答注意事項中未列明而稱未知悉。

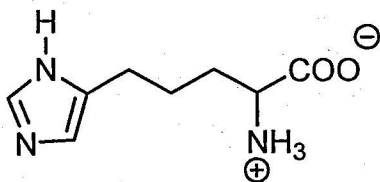
考試科目 (代碼): 有機化學(2901)

*請在【答案卷】作答

1. Propose a mechanism to explain how dimethyl sulfoxide and oxalyl chloride react to form the dimethylchlorosulfonium ion used as the oxidizing agent in the Swern oxidation. (5%)



- b. Which nitrogen is least apt to be protonated?



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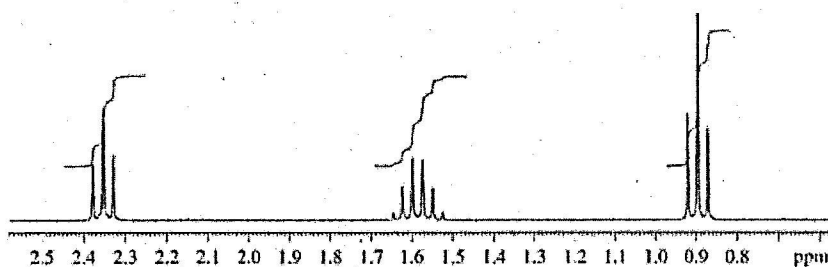
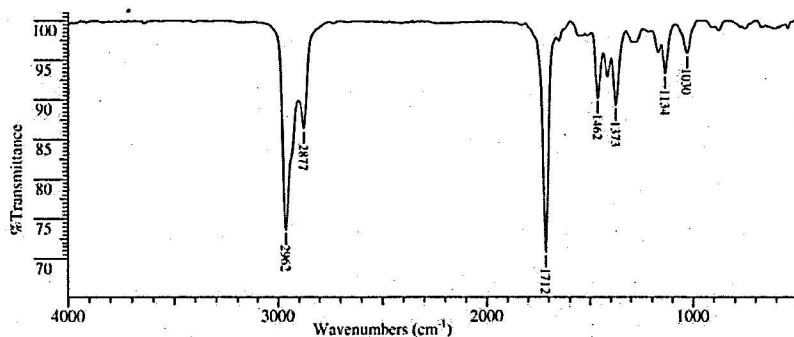
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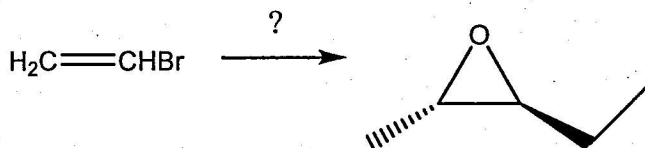
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*請在【答案卷】作答

3. An unknown compound, A, has the formula $C_7H_{14}O$. Elucidate the structure of A by scrutinizing its IR and 1H NMR spectra, shown below. (4%)



4. Please use the molecular orbital to explain why the back-side attack rather than front-side attack is favored by the S_N2 reaction. (5%)
5. Show how the following compound can be prepared from the given starting material. Draw the structure of the compound that is formed in each step of the synthesis. (6%)



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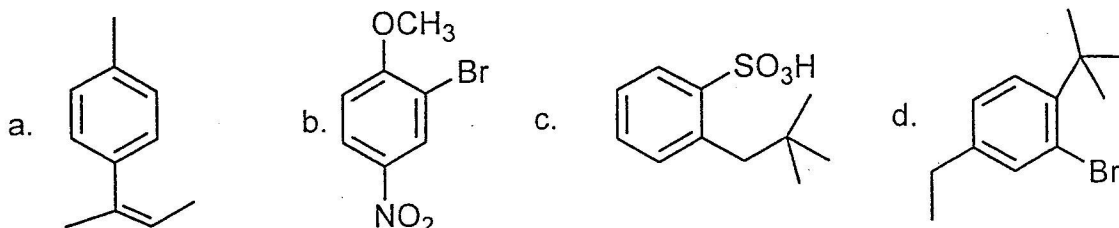
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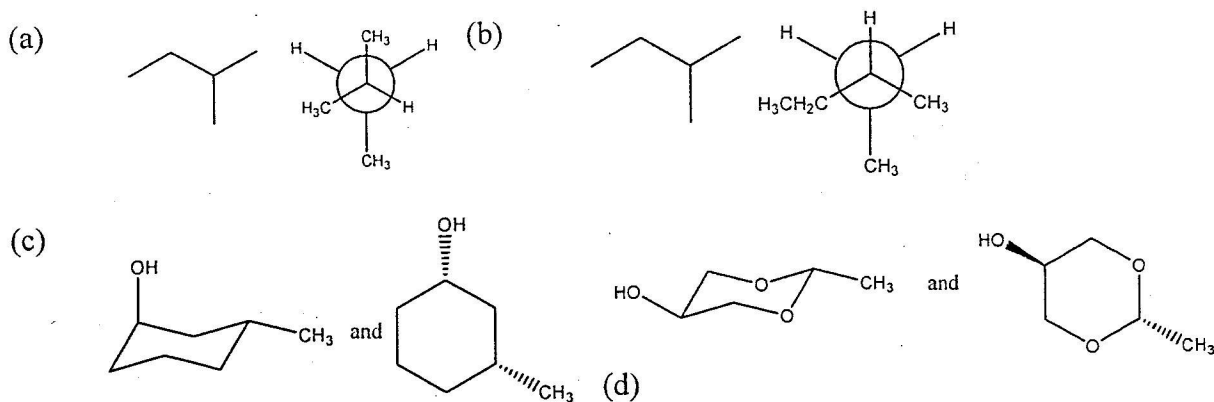
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6. Starting with benzene, outline a synthesis of each of the following: (12%)



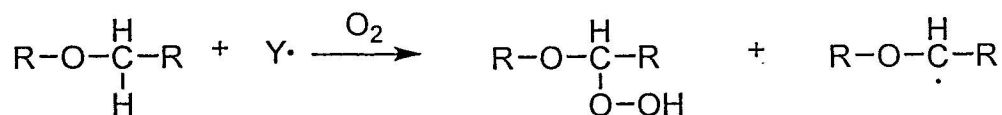
7. Does each of the following pairs of structures show the same molecule or different molecules? (6%)



8. Draw the most stable conformation of each of the *cis* and *trans* isomers of the following: (6%)

- (a) 2-phenylcyclohexanol (b) 2-bromo-4-chlorocyclohexane
(c) 1-*t*-butyl-2-methylcyclohexane (d) 1-isopropyl-4-methylcyclohexane

9. Provide the mechanism for the following formation of the explosive peroxide. 4%



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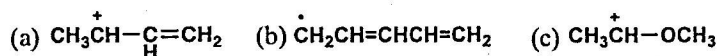
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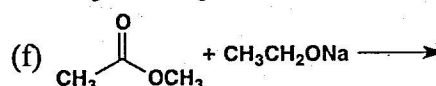
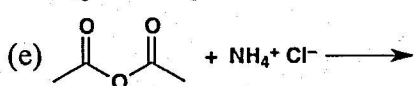
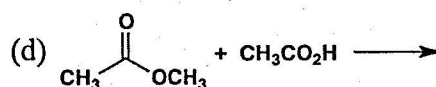
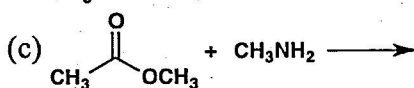
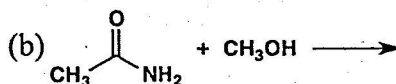
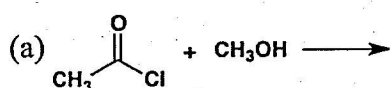
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*請在【答案卷】作答

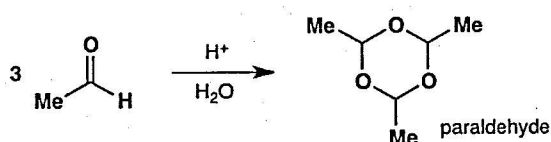
10. Draw alternative resonance forms for each of the following and explain which is the most important contributor to the resonance hybrid. (6%)



11. What are the main products, if any, of the following reactions? For those where you think there will be no reaction, give your reasons. (6%)



12. Ethanal gives a cyclic trimer called paraldehyde in the presence of a catalytic amount of acid and moisture. Propose a mechanism for this reaction. (6%)



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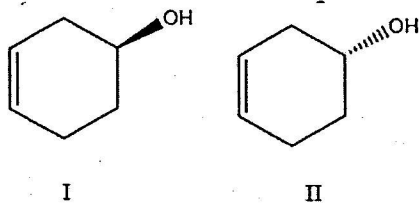
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共 2 頁，第 5 頁

*請在【答案卷】作答

Part 2 單選題 (30%, 2% each)

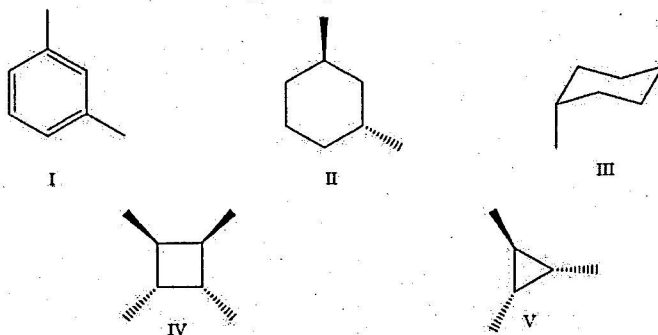
1. What is the relationship between alcohols I and II?



They are:

- A) different conformations of the same compound.
- B) constitutional isomers.
- C) enantiomers.
- D) diastereomers.

2. Which of the following compounds are chiral?



- A) I, IV, and V
- B) II only
- C) II and III
- D) III only

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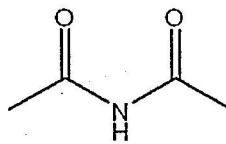
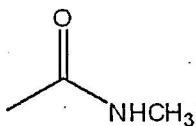
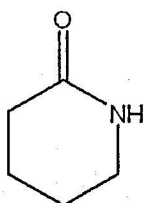
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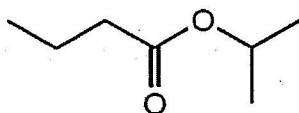
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*請在【答案卷】作答

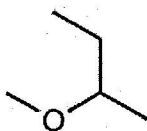
3. What is the correct assignment of the functional groups in the following compounds?



- A) 1 = amide; 2 = imide; 3 = nitrile
B) 1 = lactam; 2 = amide; 3 = imide
C) 1 = lactam; 2 = imide; 3 = amide
D) 1 = imide; 2 = amide; 3 = lactam
4. What alkyl group is attached to the oxygen in the following ester?



- A) Ethyl
B) Propyl
C) *sec*-propyl
D) isopropyl
5. What alkyl groups make up the following ether?



- A) Isobutyl and methyl
B) Methyl and butyl
C) Ethyl and isopropyl
D) Methyl and *sec*-butyl

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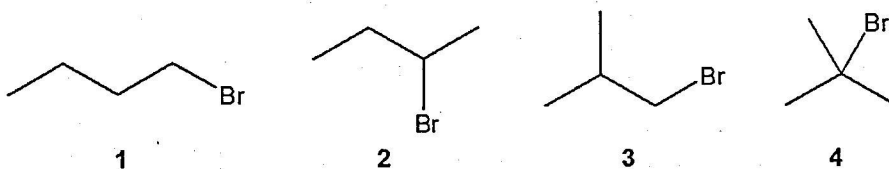
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考試科目 (代碼)：有機化學(2901)

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*請在【答案卷】作答

6. Which C_4H_9Br compound gives a triplet at approximately 3.5 ppm in the 1H NMR spectrum?

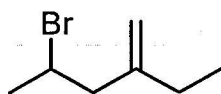


- A) 1
- B) 2
- C) 3
- D) 4

7. Diastereomers are:

- A) stereo isomers that have no mirror image.
- B) molecules that have at least one stereogenic center.
- C) non-superposable molecules.
- D) non-superposable molecules that are mirror images of each other.

8. The correct IUPAC name for the following compound is:



- A) 2-Bromo-4-methylenehexane
- B) 2-(2-Bromopropyl)-1-butene
- C) 4-Bromo-2-ethyl-1-pentene
- D) 2-Bromo-4-ethyl-1-pentene

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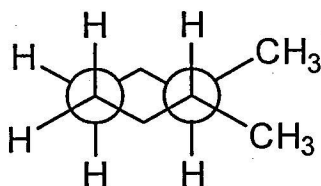
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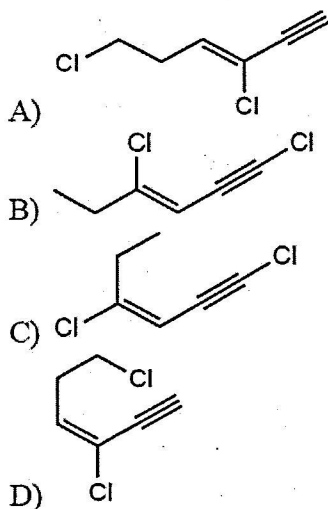
*請在【答案卷】作答

9. The IUPAC name of the following compound is

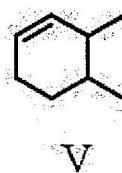
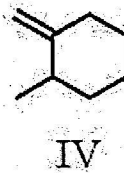
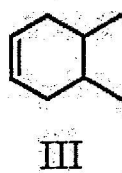
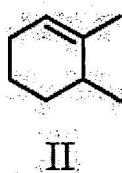
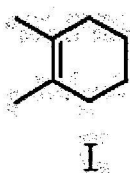


- A) *cis*-1,2-dimethylcyclohexane.
- B) *trans*-1,2-dimethylcyclohexane.
- C) 1,1-dimethylcyclohexane.
- D) *cis*-1,3-dimethylcyclohexane.

10. Which structure represents (Z)-1,4-dichlorohex-3-en-1-yne?



11. Which molecule would have the lowest heat of hydrogenation?



- A) I
- B) II
- C) III
- D) IV
- E) V

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*請在【答案卷】作答

12. Which is a *meso* compound?

- A) (2R,3R) -2,3-Dibromobutane
- B) (2R,3S) -2,3-Dibromopentane
- C) (2R,4R) -2,4-Dibromopentane
- D) (2R,4S) -2,4-Dibromopentane

13. What is the index of hydrogen deficiency (or degree of unsaturation) of compound with the molecular formula of $C_{14}H_{14}Cl_4$?

- A) 3
- B) 4
- C) 5
- D) 6

14. Which of the following would have a trigonal planar (or triangular) structure?



I



II



III



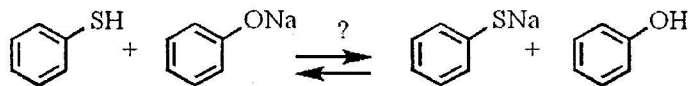
IV



V

- A) I, II, and IV
- B) II and IV
- C) IV
- D) II, IV, and V

15. To which side, if any, would the reaction below lie?



- A) to the right.
- B) to the left.