

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 113 學年度碩士班考試入學試題

系所班組別：分析與環境科學研究所

科目代碼：2805

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。

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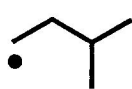
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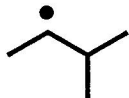
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一、單選題（每題 4 分共 100 分）

1. Which of the following radicals exhibits the highest stability?



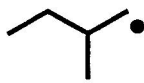
(A)



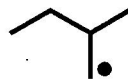
(B)



(C)



(D)



(E)

2. In mass spectrum, the tallest peak ____.

(A) is called the molecular ion

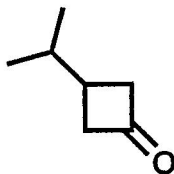
(B) is called the base peak

(C) has the highest charge

(D) has the highest isotopic abundance

(E) is never the molecular ion

3. How many distinctive ^1H NMR signals would be obtained for the following compound?



(A) 3 (B) 4 (C) 5 (D) 6 (E) 7

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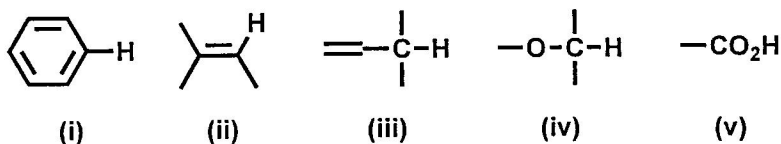
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4. List the proton chemical shifts in order from highest to lowest.



(A) v, iv, iii, ii, i

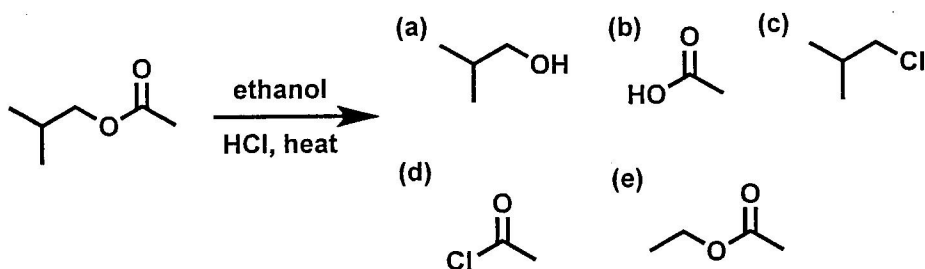
(B) i, ii, v, iv, iii

(C) v, i, ii, iv, iii

(D) v, ii, i, iii, iv

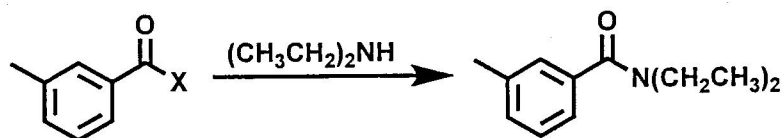
(E) iv, iii, ii, i, v

5. Indicate the expected products of the following reaction.



(A) a, b (B) a, d (C) c, b (D) c, d (E) a, e

6. Which of the following carboxylic acid derivatives (—X) could be used in the reaction below to obtain the desired product?



(A) —Br (B) —Cl (C) —SCH₃ (D) —OCH₃ (E) any of the above

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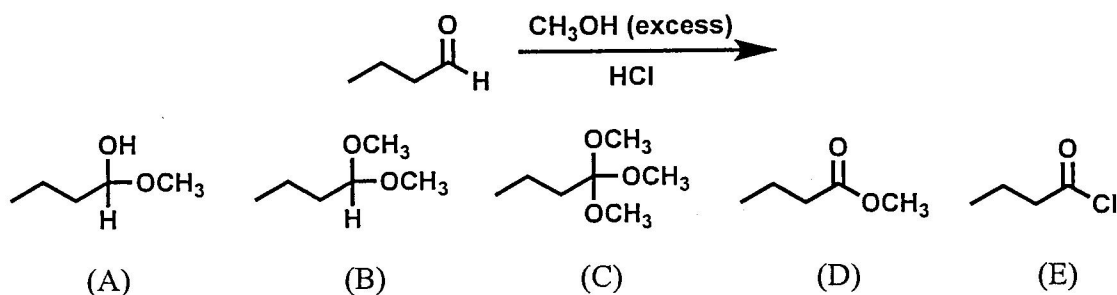
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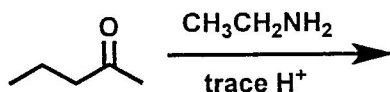
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*請在【答案卡】作答

7. Indicate the final product of the following reaction.



8. Indicate the final product functional group of the following reaction.



(A) Amine (B) Carbinol amine (C) Enamine (D) Imine (E) Amide

9. Which of the following methods cannot be used to form an enolate ion from a ketone?

(A) KOH, ethanol (B) NaOCH₂CH₃/ethanol (C) LDA (D) Na/NH₃ (E) NaNH₂

10. Which of the following is the correct order of decreasing reactivity toward nucleophilic addition?

(i) Acyl halide (ii) Aldehyde (iii) Carboxylate ion (iv) Carboxylic acid (v) Ketone

(A) i > ii > iii > iv > v

(B) i > ii > v > iv > iii

(C) i > v > ii > iv > iii

(D) ii > v > i > iii > iv

(E) v > ii > i > iii > iv

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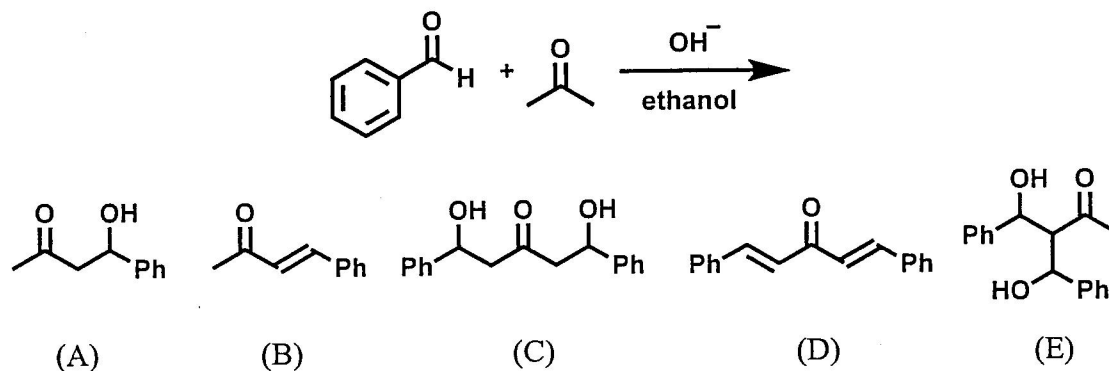
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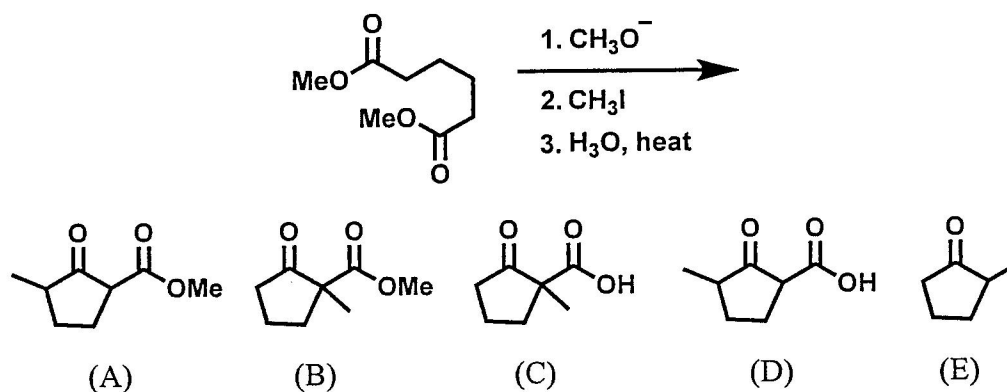
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*請在【答案卡】作答

11. Indicate the major product of the following reaction.



12. Indicate the major product of the following reaction.



13. Which of the following aromatic substituents activates most strongly toward Friedel-Crafts acylation?

- (A) $-\text{NH}_2$ (B) $-\text{OCH}_3$ (C) $-\text{O}-\text{C}(=\text{O})\text{CH}_3$ (D) $-\text{NO}_2$ (E) $-\text{H}$

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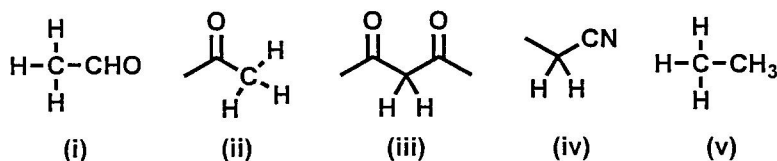
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*請在【答案卡】作答

14. Which of the following shows the correct order of decreasing acidity?



(A) iv > iii > ii > i > v

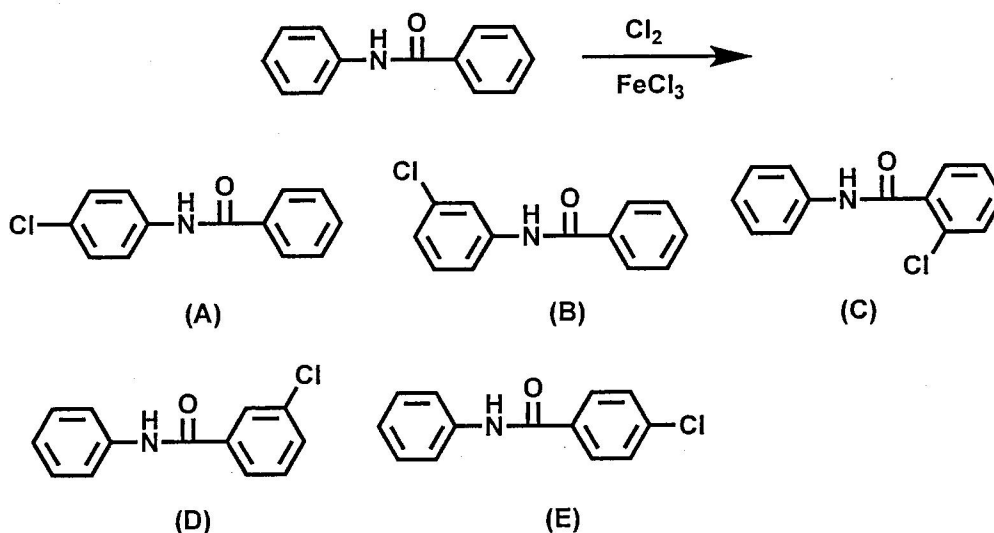
(B) iii > ii > i > iv > v

(C) v > iv > ii > i > iii

(D) i > ii > iii > iv > v

(E) iii > i > ii > iv > v

15. Which of the following compound is the major product of the chlorination?



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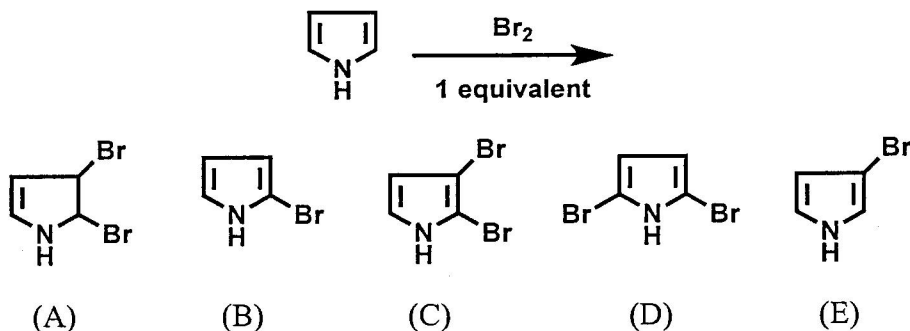
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*請在【答案卡】作答

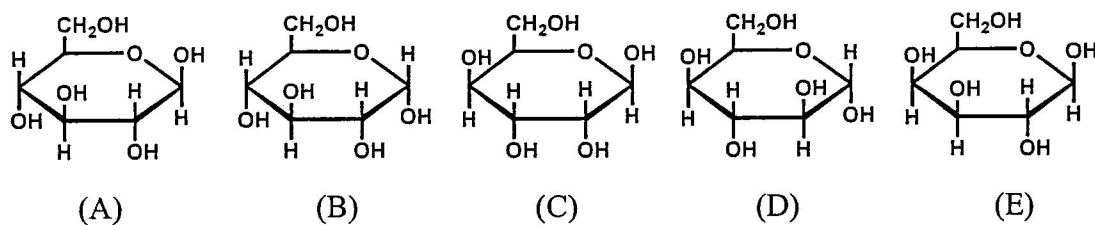
16. Which combination of reagents and reactions is best suited to prepare benzaldehyde (PhCHO)?

- (A) Toluene, (i) CrO_3 , H_2SO_4 (ii) LiAlH_4 (iii) H_2O
- (B) Toluene, (i) CrO_3 , H_2SO_4 (ii) NaBH_4 (iii) H_2O
- (C) Toluene, (i) MnO_2 (ii) LiAlH_4 (iii) PCC
- (D) Toluene, (i) CrO_3 , H_2SO_4 (ii) LiAlH_4 (iii) PCC
- (E) Toluene, PCC

17. Indicate the product of the following reaction.



18. Which of the followings is the Haworth projection of α -D-glucose?



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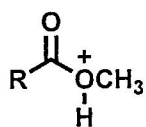
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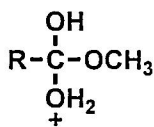
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*請在【答案卡】作答

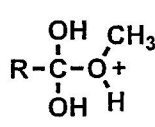
19. Which of the followings is a possible intermediate(s) in the acid-catalyzed hydrolysis of an ester?



(A)



(B)



(C)

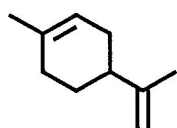
B and C

(D)

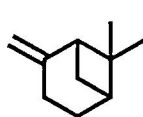
A, B and C

(E)

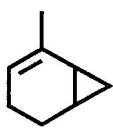
20. Which of the followings is not a terpene or terpenoid?



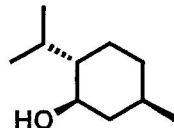
(A)



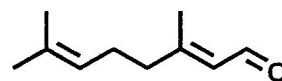
(B)



(C)



(D)



(E)

21. What is the sequence of bases in the DNA strand that is complementary to that shown below?

5'-G-T-C-A-C-3'

(A) 5'-G-T-G-A-C-3'

(B) 3'-G-T-G-A-C-5'

(C) 5'-C-A-C-T-G-3'

(D) 3'-C-A-C-T-G-5'

(E) 3'-C-A-A-T-G-5'

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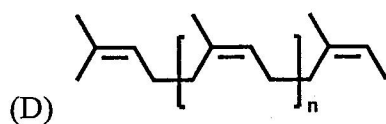
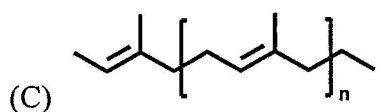
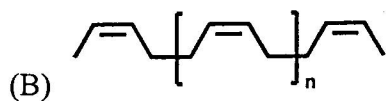
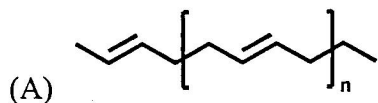
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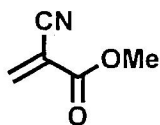
*請在【答案卡】作答

22. Which polymer(s) among the followings is most likely to be indicative of natural rubber?

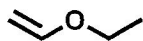


(E) A and B

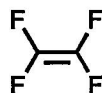
23. Which monomer would most easily undergo cationic polymerization?



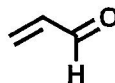
(A)



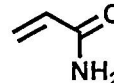
(B)



(C)



(D)



(E)

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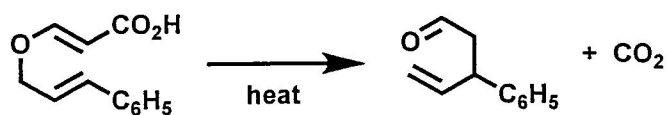
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24. The following reaction is a ____.



- (A) Beckmann rearrangement
- (B) Ene rearrangement
- (C) Diels-Alder reaction
- (D) Claisen rearrangement
- (E) Dieckmann rearrangement

25. What is the product of the following thermal reaction?

