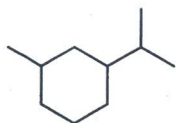


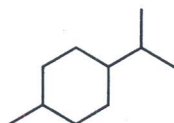
※選擇題請在答案卡內作答，非選擇題請在答案卷內作答

一、單選題 (請選擇一個最適當的答案，每題 3 分，共 60 分)

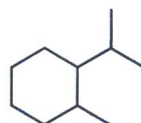
1. For each of the following compound, identify the more stable isomer.



(I)



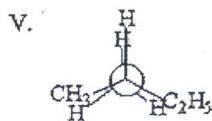
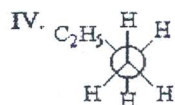
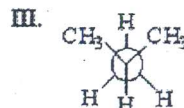
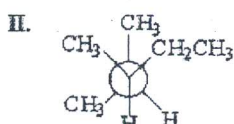
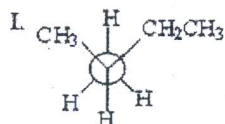
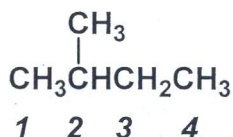
(II)



(III)

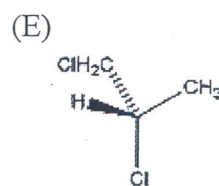
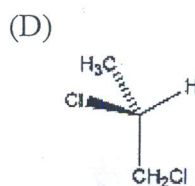
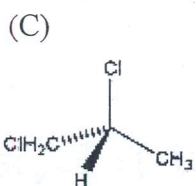
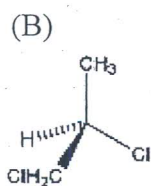
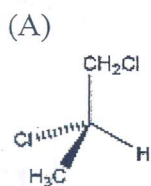
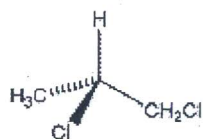
- (A) (I) *cis* (II) *cis* (III) *trans*  
 (B) (I) *trans* (II) *cis* (III) *trans*  
 (C) (I) *cis* (II) *trans* (III) *trans*  
 (D) (I) *trans* (II) *cis* (III) *cis*  
 (E) (I) *cis* (II) *cis* (III) *cis*

2. Which of the following is the staggered conformation about the C<sub>1</sub>—C<sub>2</sub> bond for the following structure?



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

3. Which is the enantiomer of the compound shown below?



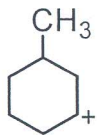
注：背面有試題

參考用

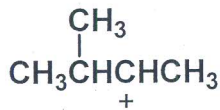
※選擇題請在答案卡內作答，非選擇題請在答案卷內作答

4. Which of the following carbocations would be expected to rearrange?

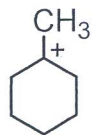
(A)



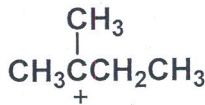
(B)



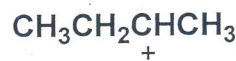
(C)



(D)



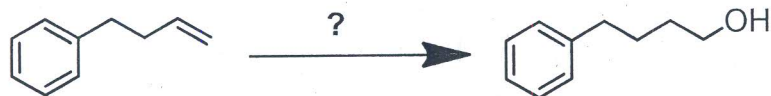
(E)



5. According to the Hammond Postulate, which of the following is correct?

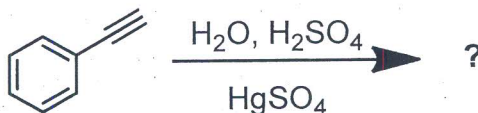
- (A) The transition state of an endothermic reaction step will be more reactant-like than product-like.  
 (B) The intermediate of an endothermic reaction step will be more reactant-like than product-like.  
 (C) The transition state of an exothermic reaction step will be more reactant-like than product-like.  
 (D) All transition states are more product-like than reactant-like.  
 (E) All transition states are more reactant-like than product-like.

6. Which of the following reagents can best be used to accomplish the following transformation?

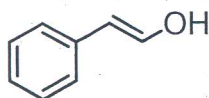


- (A) 1. BH<sub>3</sub>·THF 2. HO<sup>-</sup>, H<sub>2</sub>O<sub>2</sub>  
 (B) H<sup>+</sup>, H<sub>2</sub>O  
 (C) 1. Hg(OAc)<sub>2</sub>, H<sub>2</sub>O/THF 2. NaBH<sub>4</sub>  
 (D) 1. Hg(O<sub>2</sub>CCF<sub>3</sub>)<sub>2</sub>, CH<sub>3</sub>OH 2. NaBH<sub>4</sub>  
 (E) NaOH, H<sub>2</sub>O

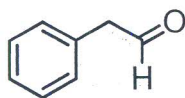
7. Which of the following is the final and major product of this reaction?



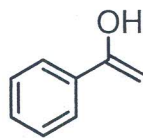
(A)



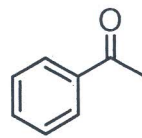
(B)



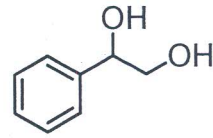
(C)



(D)



(E)



注意：背面有試題

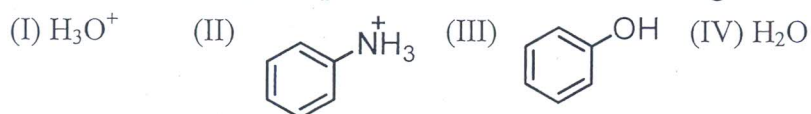
參考用

※選擇題請在答案卡內作答，非選擇題請在答案卷內作答

8. Identify the correctly drawn arrows.



9. Rank the following compounds in order from the strongest acid to the weakest acid:



- (A) I>II>III>IV  
 (B) I>III>II>IV  
 (C) II>I>III>IV  
 (D) II>III>I>IV  
 (E) III>II>IV>I

10. Which of the following compounds will undergo an  $\text{S}_{\text{N}}2$  reaction most readily?

- (A)  $(\text{CH}_3)_3\text{CCH}_2\text{I}$   
 (B)  $(\text{CH}_3)_3\text{CCl}$   
 (C)  $(\text{CH}_3)_2\text{CHI}$   
 (D)  $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CH}_2\text{Cl}$   
 (E)  $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CH}_2\text{I}$

11. If the electron ionization (EI) method is used to bombard pentane, which of the following molecular ion (cation,  $m/z$ ) will be the **weakest** ionic peak in mass spectrum?

- (A) 43 (B) 29 (C) 57 (D) 15 (E) 41

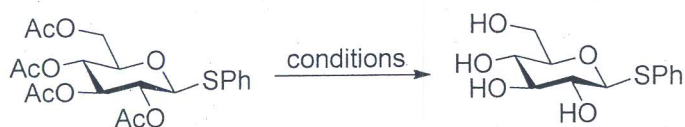
注意：背面有試題

參考用



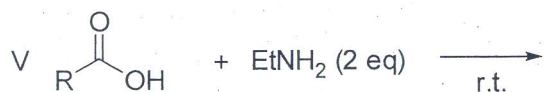
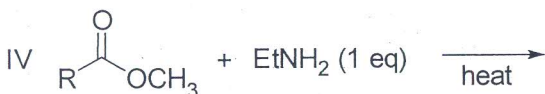
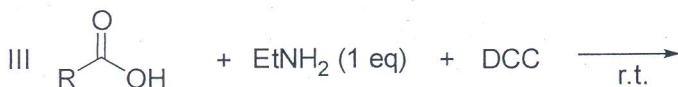
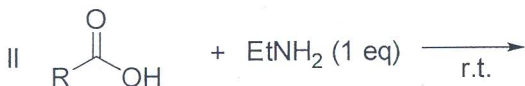
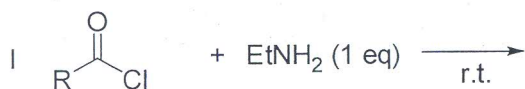
※選擇題請在答案卡內作答，非選擇題請在答案卷內作答

12. Which of the reaction conditions **cannot** be used for the following deacetylation?



- (A) catalytic amount of HCl in MeOH
- (B) catalytic amount of NaOMe in MeOH
- (C) catalytic amount of NaOH in H<sub>2</sub>O
- (D) one equivalent of CH<sub>3</sub>NH<sub>3</sub> in DMF with heat
- (E) two equivalent of CH<sub>3</sub>NH<sub>3</sub> in DMF with heat

13. Which of the following reactions can lead to the formation of an amide with **higher** than 50% yield?



eq = equivalent, rt = room temperature

DCC = dicyclohexylcarbodiimide

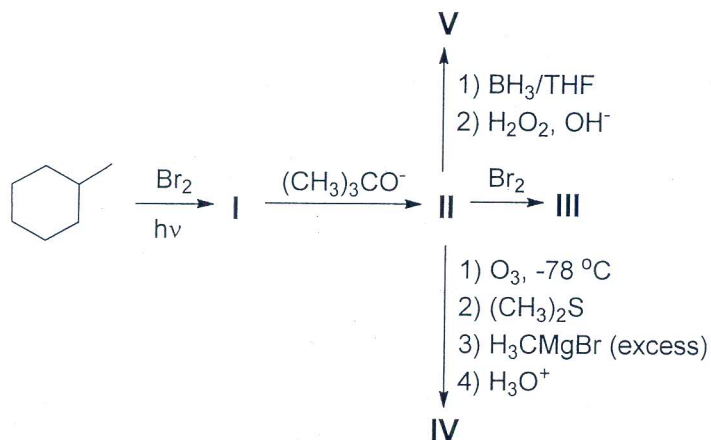
- (A) I, II, III, IV, V (B) I, III, IV, V (C) I, III, IV (D) I, III, V (E) III, IV

注意：背面有試題

參考用

※選擇題請在答案卡內作答，非選擇題請在答案卷內作答

14. How many stereoisomers are formed in the each of the following transformations.



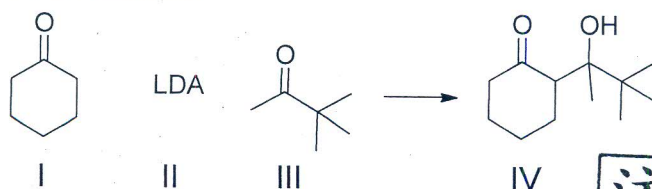
- (A) I:2, II:1, III:2, IV:1, V:2  
 (B) I:2, II:2, III:2, IV:2, V:4  
 (C) I:2, II:2, III:4, IV:4, V:4  
 (D) I:2, II:1, III:4, IV:2, V:4  
 (E) I:1, II:1, III:2, IV:2, V:1

15. Three reagents are proposed to be used for the synthesis of  $\alpha$ -hydroxy acid. Please select the most suitable set of reagents for this transformation.



- |   |  |                                       |
|---|--|---------------------------------------|
| (A) I. $\text{LiAlH}_4, -78^\circ\text{C}$                                    | II. $\text{NaCN}, \text{DMF}$          | III. $\text{HCl}, \text{H}_2\text{O}$ |
| (B) I. $\text{NaBH}_4, 0^\circ\text{C}$                                       | II. $\text{NaCN (excess)}, \text{HCl}$ | III. $\text{KMnO}_4$                  |
| (C) I. $\text{LiAl}[\text{OC}(\text{CH}_3)_3]_3\text{AlH}, -78^\circ\text{C}$ | II. $\text{NaCN (excess)}, \text{HCl}$ | III. $\text{HCl}, \text{H}_2\text{O}$ |
| (D) I. $[(\text{CH}_3)_2\text{CHCH}_2]_2\text{AlH}, -78^\circ\text{C}$        | II. $\text{NaCN}, \text{HCl (excess)}$ | III. $\text{OsO}_4$                   |
| (E) I. $\text{LiAl}[\text{OC}(\text{CH}_3)_3]_3\text{AlH}, -78^\circ\text{C}$ | II. $\text{NaCN}, \text{HCl (excess)}$ | III. $\text{HCl}, \text{H}_2\text{O}$ |

16. You are going to use reagents I, II, and III to prepare IV. Choose the most suitable reaction conditions to achieve the synthesis.



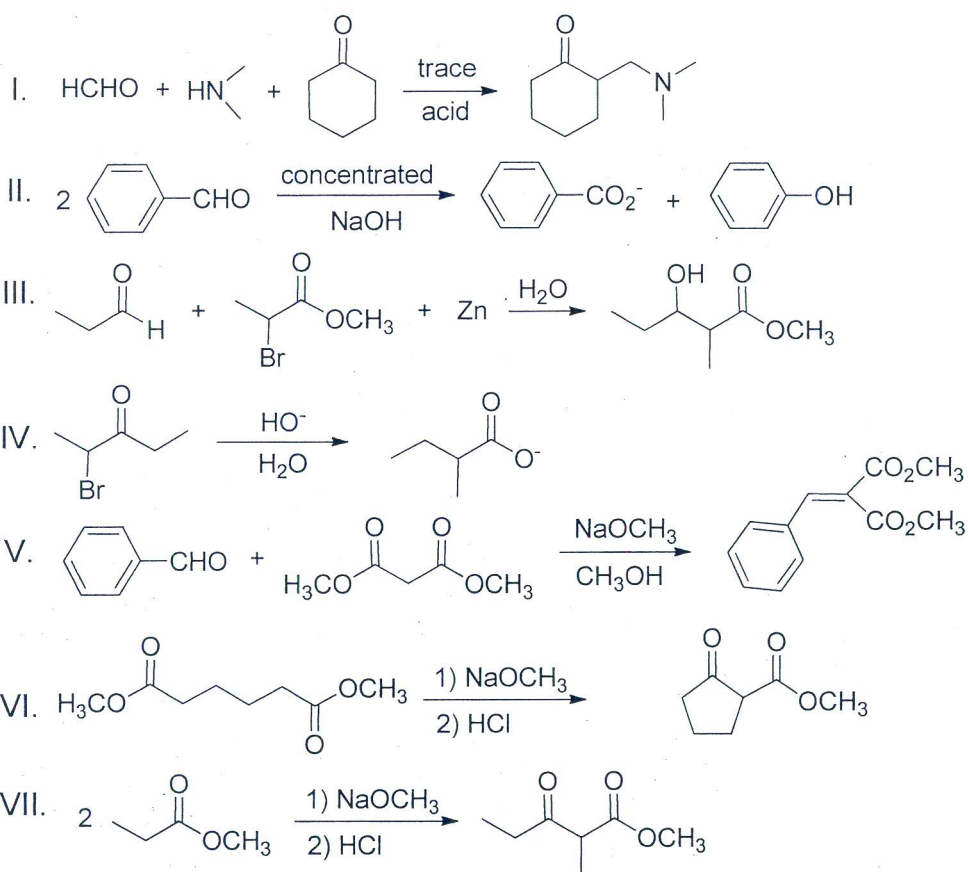
參考用

注意：背面有試題

※選擇題請在答案卡內作答，非選擇題請在答案卷內作答

- (A) I is slowly added to II. Then, III is slowly added to the above mixture.  
 (B) I is slowly added to II. Then, the above mixture is slowly added to III.  
 (C) II is slowly added to I. Then, III is slowly added to the above mixture.  
 (D) II is slowly added to I. Then, the above mixture is slowly added to III.  
 (E) I is slowly added to III. Then, II is slowly added to the above mixture.

17. Each of following reactions represents an example of a name reaction.



Please select above reactions to match the following name reactions (by the same order)

- a. Dieckmann condensation    b. Knoevenagel condensation  
 c. Mannich Reaction        d. Reformatsky reaction
- (A) a:VII, b:V, c:II, d:III  
 (B) a:VII, b:V, c:II, d:IV  
 (C) a:VI, b:V, c:I, d:III  
 (D) a:VI, b:V, c:II, d:IV  
 (E) a:VI, b:V, c:I, d:IV

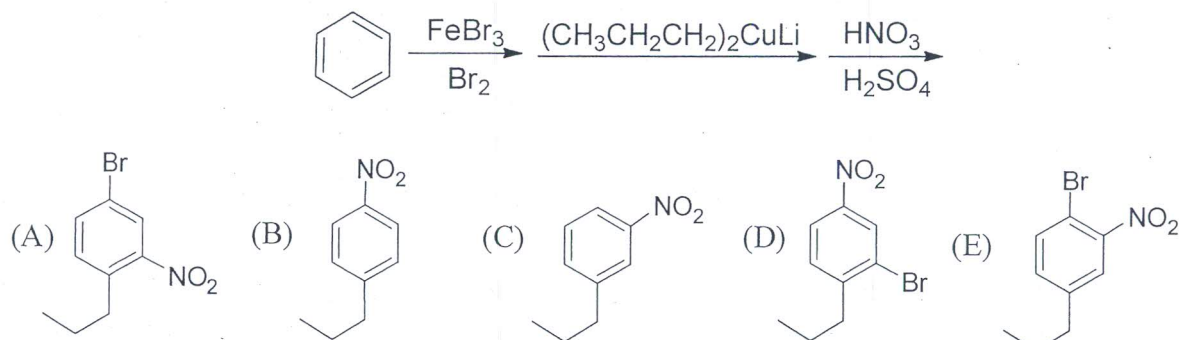
注意：背面有試題

參考用



※選擇題請在答案卡內作答，非選擇題請在答案卷內作答

18. Provide the major product of the following transformation.

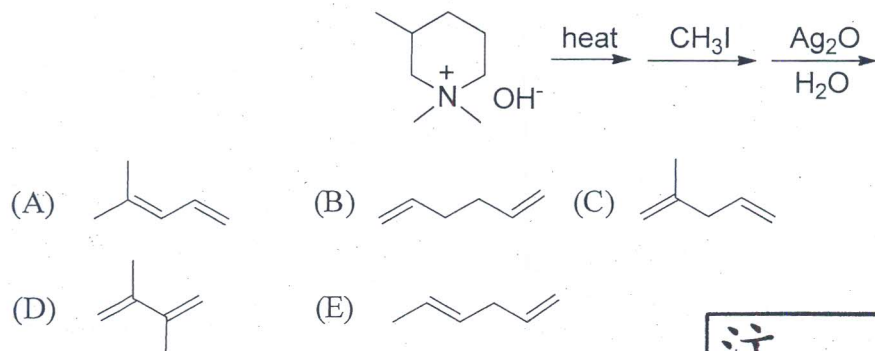


19. Identify the condition(s) that will **not** work for the following reaction



- (A) a. , AlCl<sub>3</sub>    b. H<sub>2</sub>/Pd
- (B) a. , AlCl<sub>3</sub>
- (C) a. , AlCl<sub>3</sub>    b. HS-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>-SH    c. Raney Ni, H<sub>2</sub>
- (D) a. FeBr<sub>3</sub>, Br<sub>2</sub>    b. , PdL<sub>2</sub>, base
- (E) a. HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>    b. NaNO<sub>2</sub>, HCl    c. , AlCl<sub>3</sub>    d. H<sub>2</sub>NNH<sub>2</sub>, OH<sup>-</sup>

20. What is the **major** alkene formed in the following reaction?



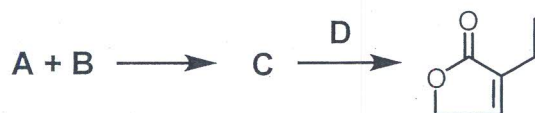
注意：背面有試題

參考用

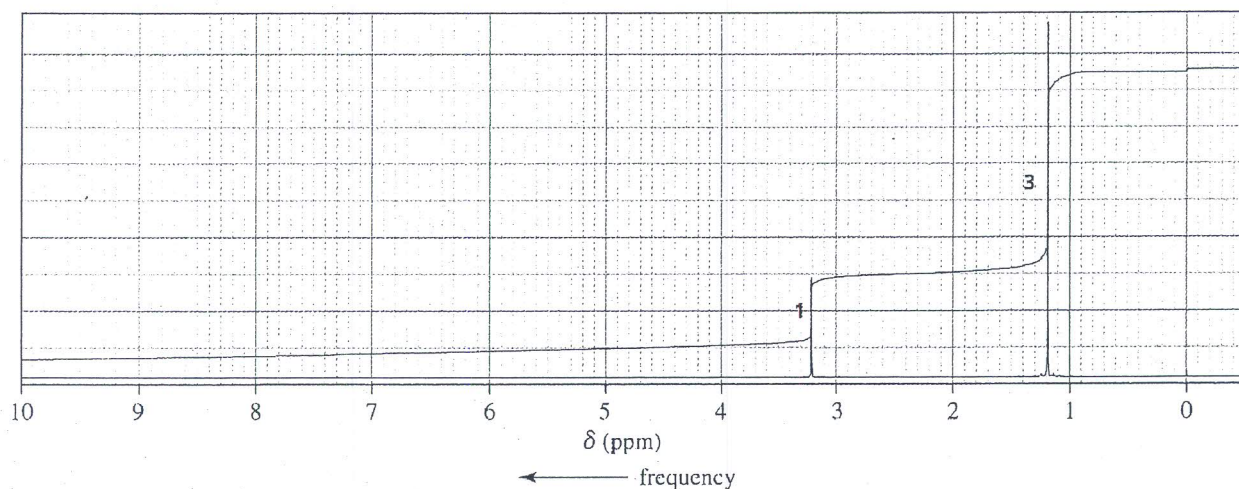
※選擇題請在答案卡內作答，非選擇題請在答案卷內作答

二、非選擇題 (共 40 分)

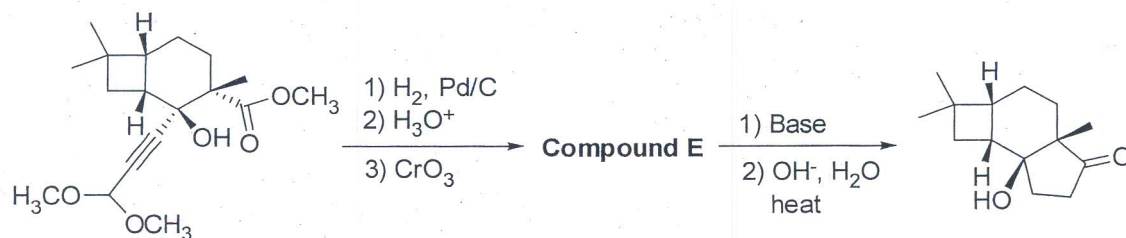
1. Please complete the synthesis of the following compound by providing chemical structures or names of **A**, **B**, **C** and **D**. You should use olefin metathesis reaction in the synthesis. (12%)



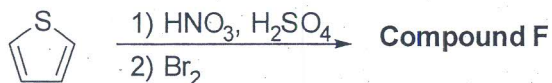
2. An alkyl halide reacts with an alkoxide ion to form a compound whose  $^1\text{H}$  NMR spectrum is shown below. Identify the alkyl halide and the alkoxide ion. (8%)



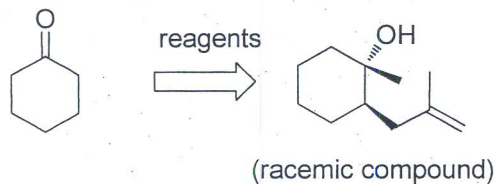
3. Provide the intermediate structure (**Compound E**) of the following transformation. (4%)



4. Provide the major product of the following reaction. (4%)



5. Provide the reagents for the synthesis of target compound. (12%)



注意：背面有試題

參考用