

國立台灣科技大學九十九學年度碩士班招生試題

系所組別：材料科學與工程學系碩士班甲組

科目：有機化學

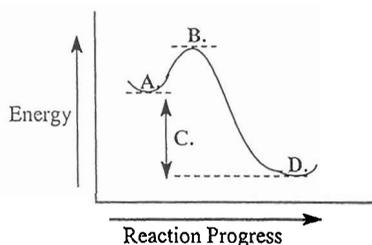
總分 100 分，共 11 大題。選擇題務必於答案卷內依序作答，在試題內作答者不予計分。

1. For the following questions, give the letter of the term that best matches the given definition.(10%)

- | | |
|------------------------|------------------------|
| a. Brønsted-Lowry Acid | f. Ionic Bond |
| b. Brønsted-Lowry Base | g. Covalent Bond |
| c. Lewis Acid | h. Polar-Covalent Bond |
| d. Lewis Base | i. Hydrophobic |
| e. Electronegativity | j. Hydrophilic |

- 1a. Any species that can accept electrons.
 1b. A bond between two atoms differing in electronegativity by 0.5 – 2.
 1c. A term used to describe a “water loving” species.
 1d. A compound that can donate a proton.
 1e. The ability of an atom to attract the shared electrons in a covalent bond.
 1f. A term used to describe a “water fearing” species.
 1g. Any species that can donate electrons.
 1h. A bond between two atoms differing in electronegativity by < 0.5
 1i. A compound that can accept a proton.
 1j. A bond between two atoms differing in electronegativity by > 2

2. Use the reaction energy diagram below to answer the following questions.(10%)



2a. The reaction depicted in this reaction energy diagram can best be described as:

- a slow exergonic reaction
- a fast exergonic reaction
- a slow endergonic reaction
- a fast endergonic reaction

2b. The transition state is found at point _____ on the diagram.

2c. The products are found at point _____ on the diagram.

2d. The free-energy change for the reaction is indicated at point _____ on the diagram.

2e. The reactants are found at point _____ on the diagram.

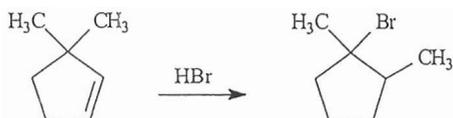


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3. Write the complete stepwise mechanism for the following reaction. Show all intermediate structures and all electron flow with arrows. (6%)

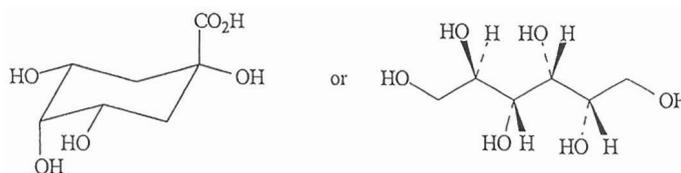


4. A natural product having $[\alpha]_D = +40.3^\circ$ has been isolated and purified (6%)

4a. This information indicates that the natural product:

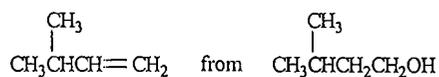
- is racemic.
- does not rotate plane-polarized light.
- is levorotatory.
- is dextrorotatory.

4b. Two structures have been proposed for this natural product. Which structure is consistent with the information presented? Briefly explain your choice.

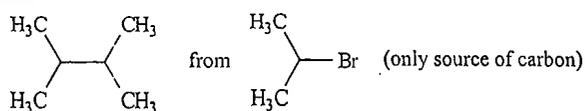


5. Propose a synthesis of each of the following compounds from the given starting material and any inorganic reagents necessary. (8%)

5a.



5b.



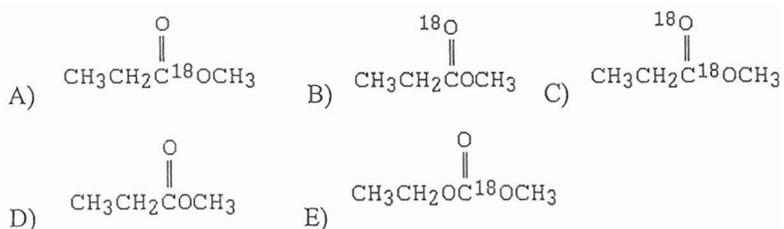
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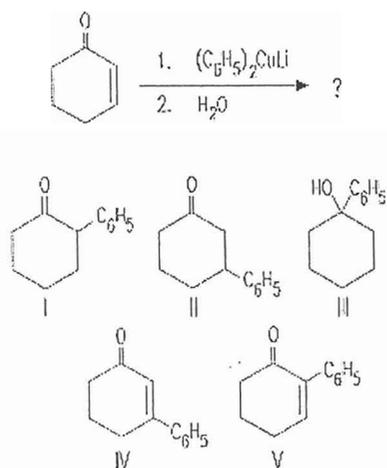
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6. 選擇題(共 9 小題，每題兩分共十八分，答錯不倒扣)

1) The product of the following reaction $\text{CH}_3\text{CH}_2\overset{\text{O}}{\parallel}\text{COH} + \text{CH}_3^{18}\text{OH} \xrightarrow{\text{HA}}$ would be:



2) What is the product of the reaction below?



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

3) The reaction of an aldehyde with hydrogen cyanide is an example of _____ reaction.

- A) a nucleophilic substitution B) an electrophilic addition
C) an electrophilic substitution D) a nucleophilic addition

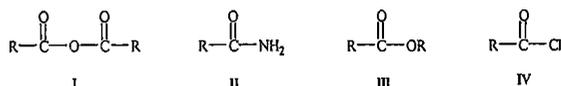


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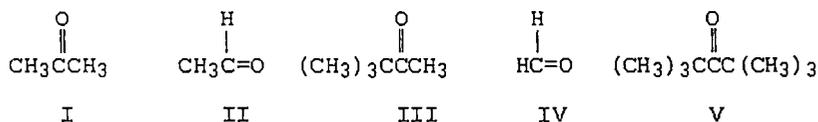
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- 4) What is the order of *decreasing* reactivity towards nucleophilic acyl substitution for the carboxylic acid derivatives? (most reactive first)



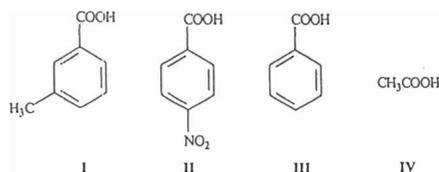
- A) I, III, II, IV B) II, III, I, IV C) III, II, I, IV D) IV, I, III, II

- 5) What, in general, is the order of decreasing reactivity of these carbonyl compounds towards nucleophilic reagents?



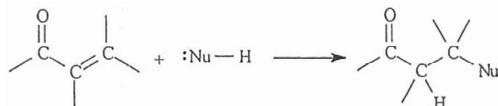
- A) I > III > V > II > IV B) IV > II > I > III > V C) V > III > I > II > IV
 D) II > I > V > III > IV E) III > V > IV > II > I

- 6) What is the order of increasing acidity for the following compounds? (least to most)



- A) II, III, I, IV B) IV, II, III, I C) IV, I, III, II D) I, III, II, IV

- 7) α,β -Unsaturated aldehydes and ketones can undergo reaction with nucleophiles at the β carbon, as shown below.



This reaction is called a _____ reaction.

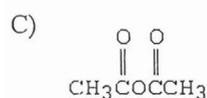
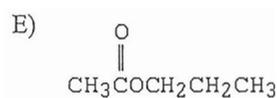
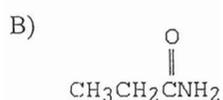
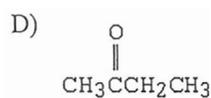
- A) direct addition B) electrophilic addition C) conjugate addition
 D) 1,2-addition.



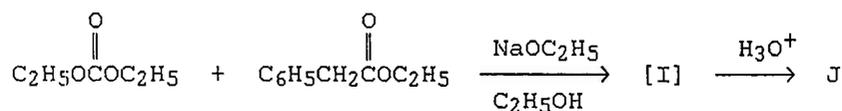
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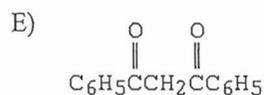
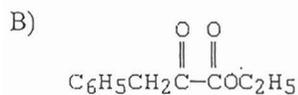
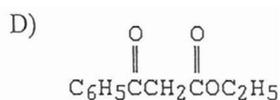
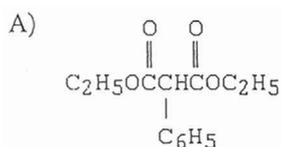
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8) Which of the following will not undergo hydrolysis, whether acid or base is present?

9) The product, J, of the following reaction sequence,



would be:



7. 寫出下列反應之機制(mechanism) (每題三分共十二分)

- 1) Nucleophilic addition reaction of ketone
- 2) Nucleophilic acyl substitution reaction of carboxylic acid derivatives
- 3) Carbonyl α -substitution reaction
- 4) The Claisen condensation reaction



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8. Draw structures corresponding to the following IUPAC names. (8%)

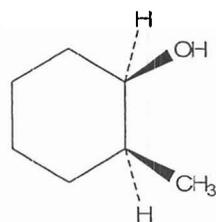
- a) p-Bromochlorobenzene b) p-Bromotoluene
c) m-Chloroaniline d) 1-Chloro-3,5-dimethylbenzene

9. Rank the compounds in each group in order of their reactivity to electrophilic substitution. (6%)

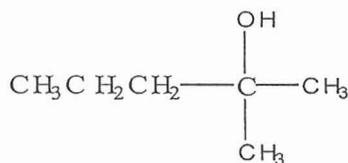
- a) Nitrobenzene, phenol, toluene, benzene
b) Benzene, bromobenzene, benzaldehyde, aniline

10. What product(s) would you expect from dehydration of the following alcohols with POCl_3 in pyridine? Indicate the major product in each case. (8%)

a)



(b)



11. How would you prepare aniline from the following starting materials? (8%)

- a) Benzene b) Benzamide

