

國立臺灣科技大學101學年度碩士班招生試題

系所組別：材料科學與工程系碩士班甲組

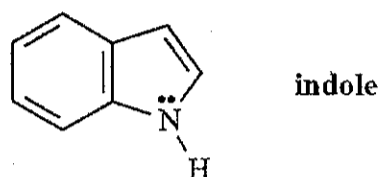
科目：有機化學

(總分為100分)

總分 100 分，共 7 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 descriptions, please show the mechanism and electron flow with arrows.

1-1. The chemical structure of indole is shown below.

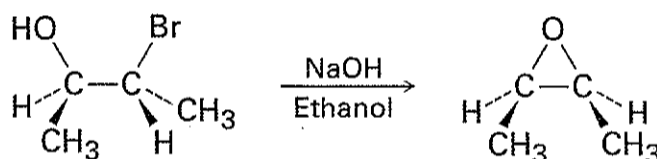


Indole can function as a Brønsted-Lowry acid in the presence of strong bases ($:B^-$). Formulate a reaction, showing electron flow with arrows, that demonstrates this reactivity of indole. (3%)

1-2. Indole can also function as a Lewis base in the presence of strong acid.

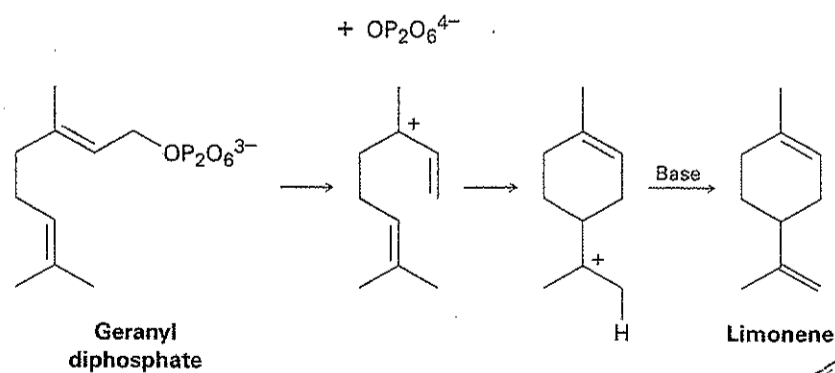
Formulate a reaction, showing electron flow with arrows, that demonstrates this reactivity of indole. (3%)

1-3. Bromohydrins are converted into epoxides when treated with base. Propose a mechanism, using curved arrows to show the electron flow. (4%)

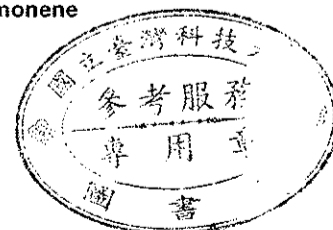


1-4. Show the product that would be obtained by formation of a bromohydrin from *trans*-2-butene, followed by treatment with base. (4%)

1-5. Please add curved arrows to show the mechanism of each step in the following reaction. (The ion $OP_2O_6^{4-}$ is the diphosphate ion, and "Base" is an unspecified base in the enzyme that catalyzes the reaction.) (6%)



2. Identify the reagents a~c in the following scheme. (9%)

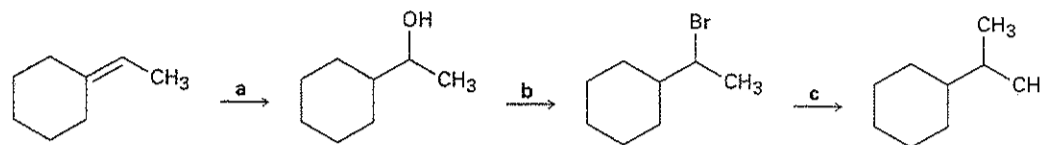


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3. Choose the correct answer:

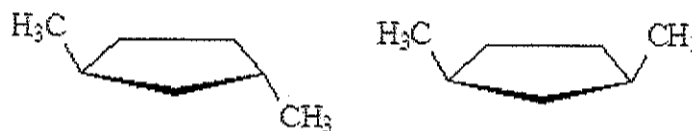
3-1. ___ When methanol (CH_3OH) acts as a base, its conjugate acid is (2%)

- A) $-\text{CH}_2\text{OH}$ B) CH_3O^- C) CH_4OH D) CH_3OH_2^+ E) CH_4O^+

3-2. ___ Choose the term below which best describes the geometry of acetylene (HCCH). (2%)

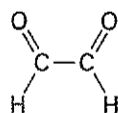
- A) trigonal bipyramidal B) trigonal C) tetrahedral D) square planar
E) linear

3-3. ___ The two structures show below represent (2%)

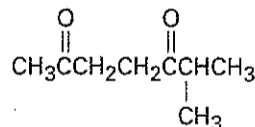


- A. constitutional isomers
B. stereoisomers
C. cis-trans isomers
D. both B and C
E. A, B and C

4. α -Terpinene has a formula, $\text{C}_{10}\text{H}_{16}$. On hydrogenation over a palladium catalyst, α -terpinene reacts with 2 molar equivalents of H_2 to yield a hydrocarbon, $\text{C}_{10}\text{H}_{20}$. On ozonolysis, followed by reduction with zinc and acetic acid, α -terpinene yields two products, glyoxal and 6-methyl-2,5-heptanedione.



Glyoxal



6-Methyl-2,5-heptanedione

- A. How many degrees of unsaturation does α -terpinene have?(3%)
B. How many double bonds and how many rings does it have?(3%)
C. Propose a structure for α -terpinene.(3%)

5. This compound has the molecular formula $\text{C}_5\text{H}_7\text{NO}_2$. Following are their IR, ^1H NMR and ^{13}C NMR spectra. Please solve the chemical structure of this compound. (6%)

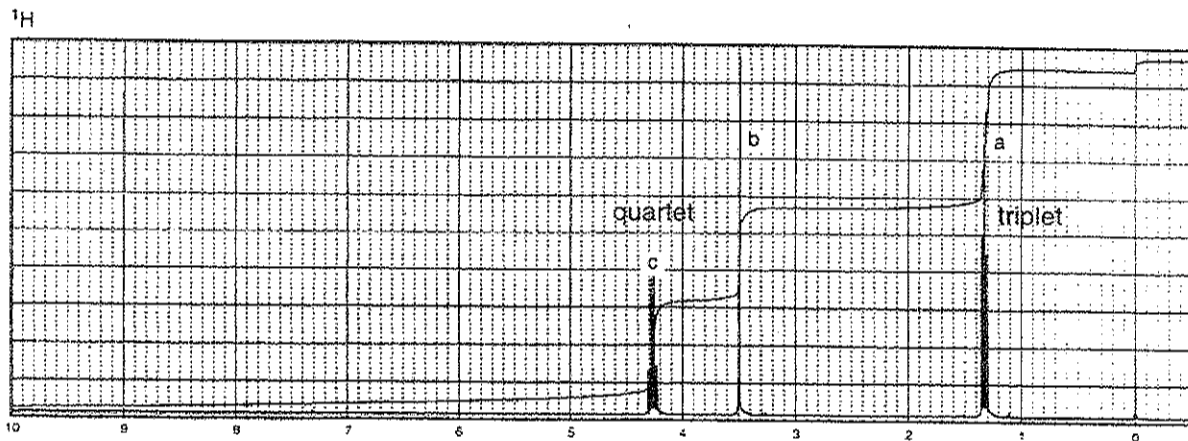
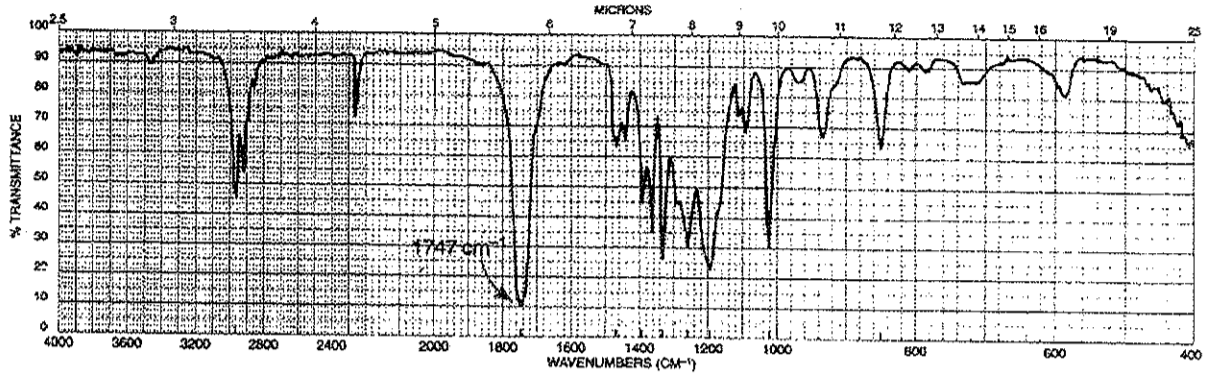


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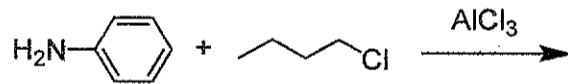
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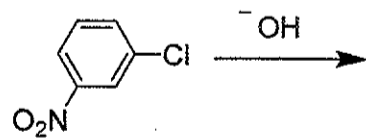
6. Predict the major products of the following reactions. (18%)

(1)



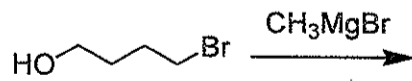
(3%)

(2)



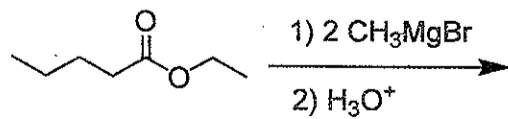
(3%)

(3)

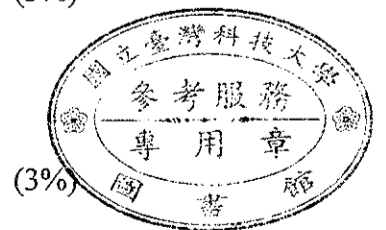


(3%)

(4)



(3%)



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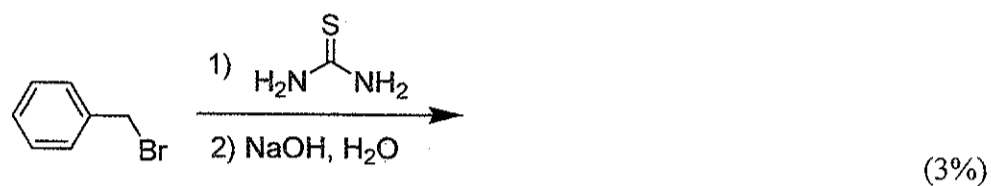
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(5)

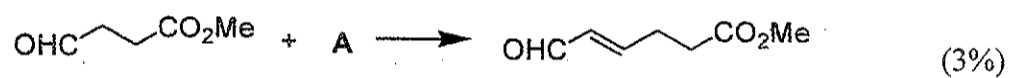


(6)

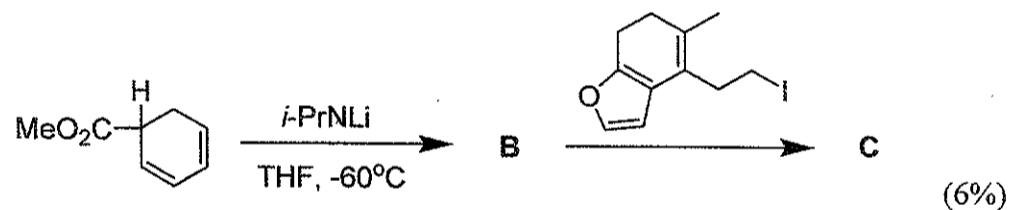


7. Predict the reactants, the intermediates and the major products of the following reactions. (32%)

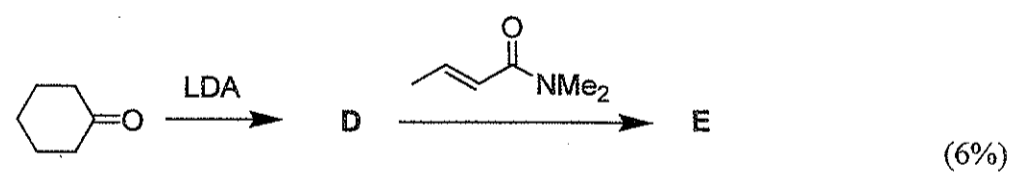
(1)



(2)



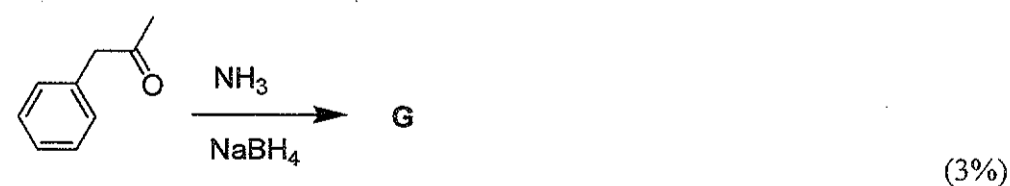
(3)



(4)



(5)



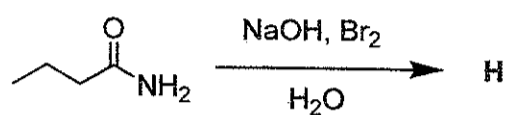
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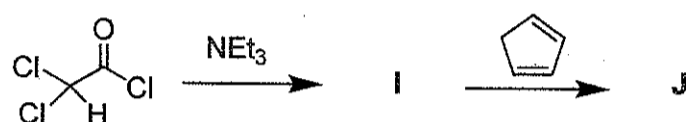
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(6)



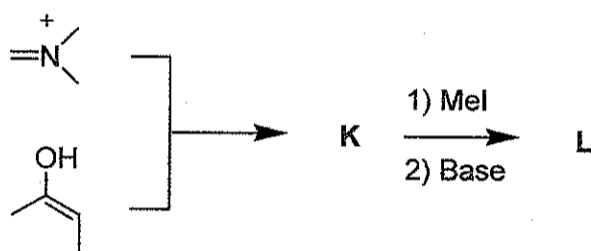
(3%)

(7)



(4%)

(8)



(4%)

