國立成功大學 107 學年度碩士班招生考試試題

系　　所：臨床藥學與藥物科技研究所

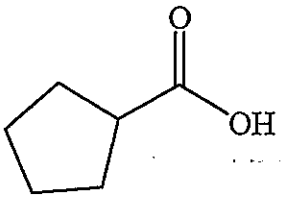
考試科目：有機化學

考試日期：0206，節次：1

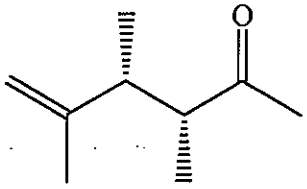
※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Name the following compounds. (each 2 %, totally 10 %)

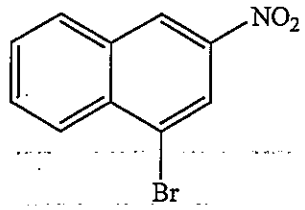
(a)



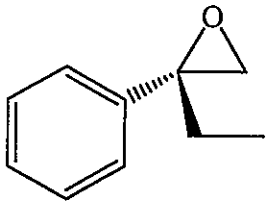
(b)



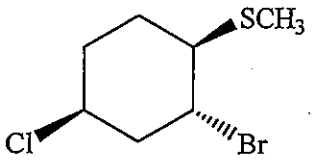
(c)



(d)

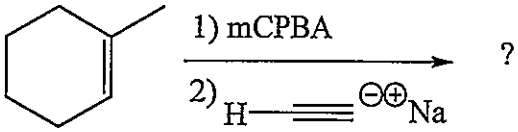


(e)



2. Complete the following reactions. (each 3 %, totally 30 %)

(a)



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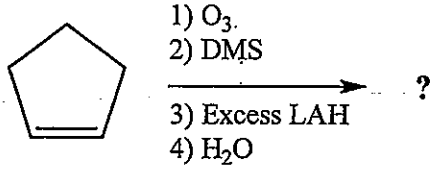

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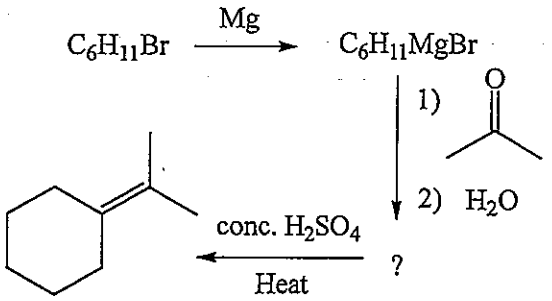
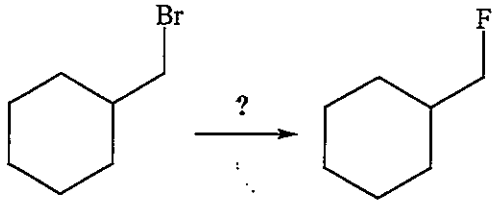
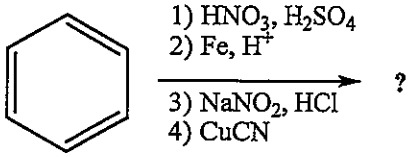


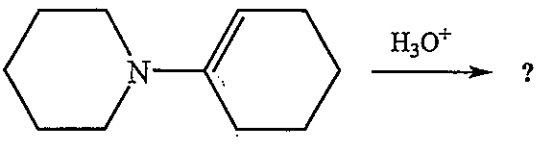
(d)



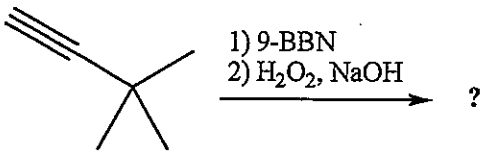
(e)



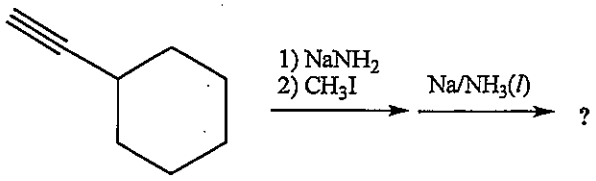
(f)



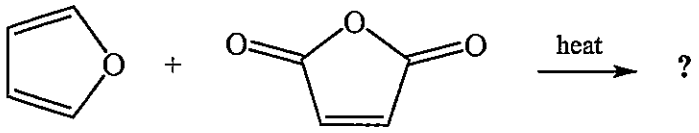
(g)



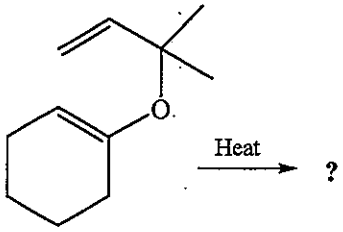
(h)



(i)



(j)

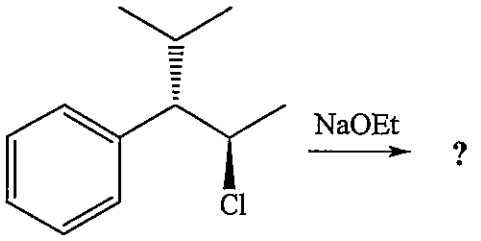


3. When (S)-1-bromo-1-fluoroethane reacts with sodium ethoxide, an S_N2 reaction takes place in which the bromine atom is replaced by a methoxy group (OMe). The product of this reaction is (S)-1-fluoro-1-methoxyethane. How can it be that the starting material and the product both have the S configuration? Shouldn't S_N2 involve a change in the configuration? Draw the starting material and the product of inversion, and then explain the anomaly. (5 %)

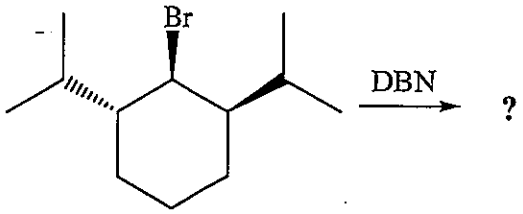
4. Compounds A and B are constitutional isomers with molecular formula C_3H_7Cl. When compound A is treated with sodium methoxide, a substitution reaction predominates. When compound B is treated with sodium methoxide, an elimination reaction predominates. Propose structures for compounds A and B, and explain your answers. (5 %)

5. Predict the major product(s) of the following reactions and explain your answers. (each 3 %, totally 6 %)

(a)

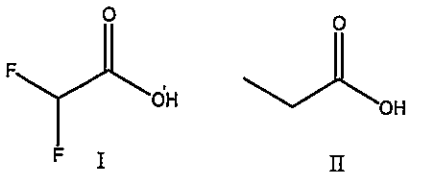


(b)

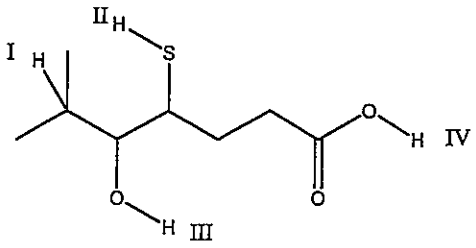


6. Rank the following compounds in decreasing order of pKa and explain your answer. (each 3 %, totally 6 %)

(a)



(b)



7. Draw trans-1,2-dimethylcyclohexane in its more stable chair conformation. Are the methyl groups axial or equatorial? (3 %)

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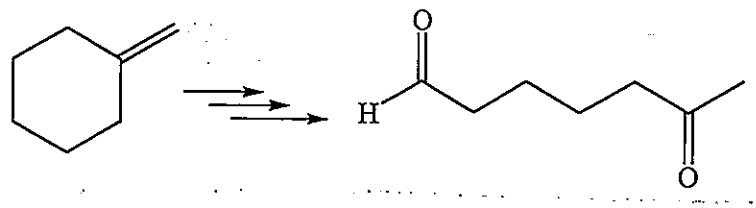
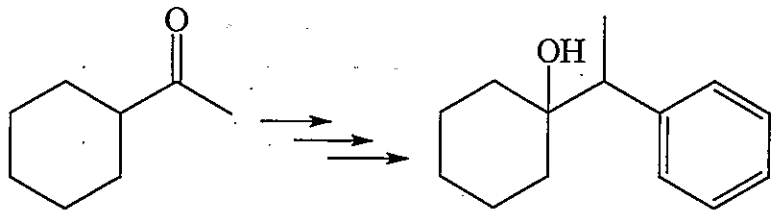
8. Complete the following transformation (each transformation should be more than 3 steps). (each 5 %, totally 15 %)

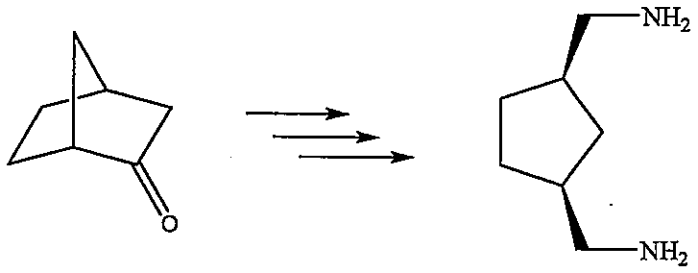
(a)



(b)



(c)



9. A compound with molecular formula C_8H_8O produces an IR spectrum with signals at 3063, 1686, 1646 cm^{-1}. The ^1H NMR spectrum of this compound exhibits a singlet at 2.6 ppm (3H) and a multiplet at 7.5 ppm (5H).

(a) Draw the structure of this compound. (2 %)

(b) What is the common name of this compound? (1 %)

(c) Treating this compound with Na/NH_3 yields a product with molecular formula $C_8H_{10}O$. Draw the product of this reaction. (2 %)

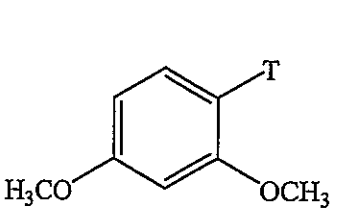
10. Compounds A, B, C, and D are constitutional isomeric, aromatic compounds with molecular formula C_8H_{10}. Deduce the structure of compound D using the following clues and explain your answer (5 %).

(1) The ^1H-NMR spectrum of A exhibits two upfield signals as well as a multiplet near 7 ppm (5H).

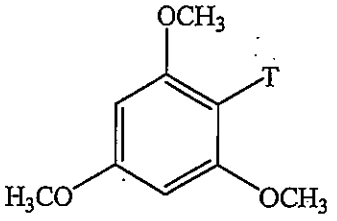
(2) The ^{13}C-NMR spectrum of B exhibits four signals.

(3) The ^{13}C-NMR spectrum of C exhibits only three signals.

11. Compounds **1** and **2** (structures shown below) both contain tritium (T), which is an isotope of hydrogen. Both compounds are stable upon treatment with aqueous base. However, upon prolonged treatment with aqueous acid, compounds **1** and **2** both lose tritium, to give 1,3-dimethoxybenzene and 1,3,5-trimethoxybenzene, respectively.



1



2

(a) Draw a mechanism showing how tritium is removed from compounds **1** and **2**. (3 %)

(b) Use your mechanism to predict which compound is expected to lose tritium at a faster rate and explain it. (2 %)

12. When methyl benzoate bears a substituent at the para position, the rate of hydrolysis of the ester group depends on the nature of the substituent at the para position. Apparently, a methoxy substituent renders the ester less reactive, while a nitro substituent renders the ester more reactive. Explain this observation. (5 %)