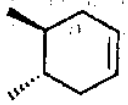
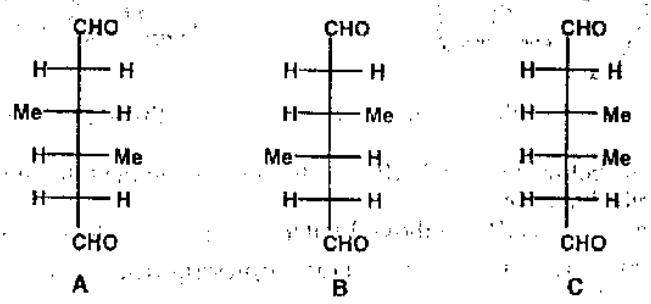
1. Consider the ozonolysis of *trans*-4,5-dimethylcyclohexene having the configuration shown:

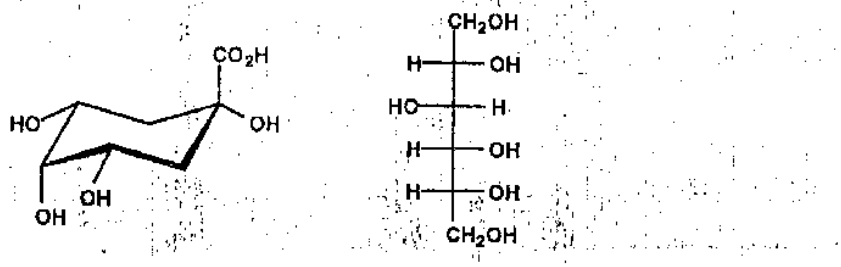


Structures A, B. and C are **three stereoisomeric forms of the reaction product.**

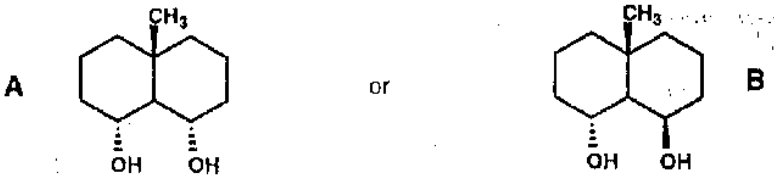


(a) Which, if any, of the compounds A, B. and C are **chiral**? (4 pts)
(b) What **product** is formed in the reaction? (3 pts)
(c) What **product** would be formed if the methyl groups were ***cis*** to each other in the starting alkene? (3 pts)

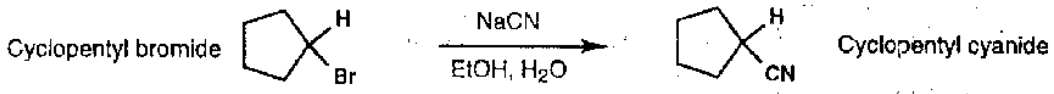
2. A certain natural product having $[\alpha]_D + 40.3°$ was isolated. Two structures have been independently proposed for this compound. **Which one** do you think is more likely to be correct? Draw the structure to indicate your answer. ***Why?*** (5 pts)



3. In each pair below, *one* of the glycols is virtually inert to periodate oxidation. **Which** glycol is **inert? Explain why.** (5 pts)

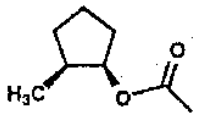


4. The reaction of cyclopentyl bromide with sodium cyanide to give cyclopentyl cyanide



proceeds faster if a small amount of sodium iodide is added to the reaction mixture. Can you suggest **a reasonable mechanism** to **explain** the catalytic function of sodium iodide? (10 pts)

5. (a) Suggest **a** reasonable **series** of synthetic transformations for converting *trans*-2-methylcyclopentanol to *cis*-2-methylcyclopentyl acetate. (5 pts)

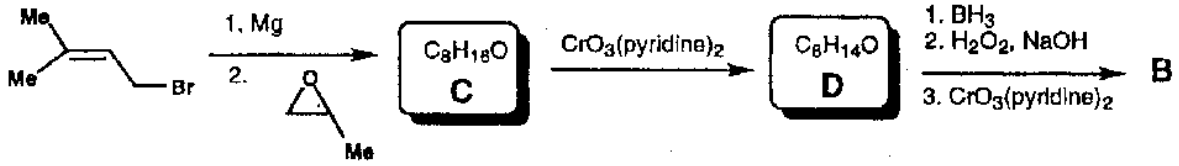


cis-2-methylcyclopentyl acetate

(b) How could you prepare *cis*-2-methylcyclopentyl acetate from 1-methylcyclopentanol? (10 pts)

注：背面有試題

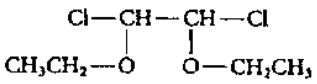
6. Oil of marjoram contains a pleasant, lemon-scented substance, $C_{10}H_{16}$ (**compound A**). Upon ozonolysis, A forms two products. ***One*** of them, ***B***, has the formula $C_8H_{14}O_2$ and can be independently synthesized in the following way:



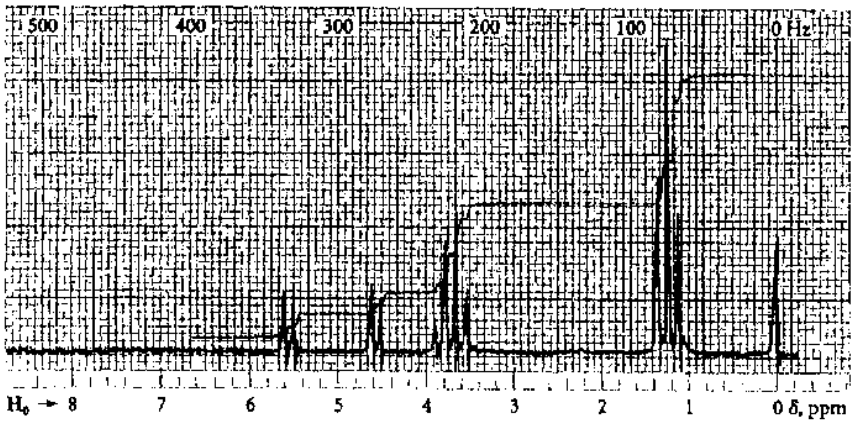
From this information, propose reasonable structures for **compound A through compound D**. (12 pts)

7. To which of the compounds below does the NMR spectrum shown in the following figure belong? **Explain your choice carefully.** (8 pts)

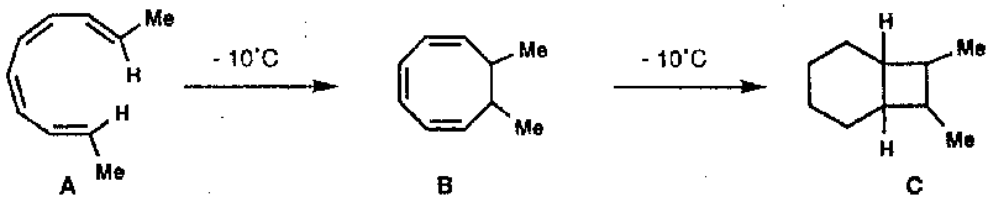
(1) *cis*-3-hexene (2) (Z)- 1-ethoxy-1-butene (3) 2-ethyl-1-butene

(4) 

(5) $Cl_2CH—CH(OCH_2CH_3)_2$

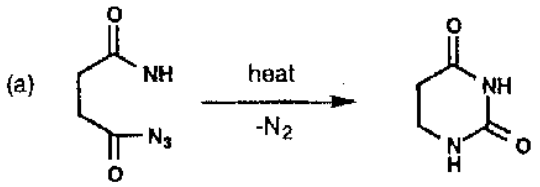


8. (a) Predict the **stereochemistry** of compounds B and C. (6 pts)

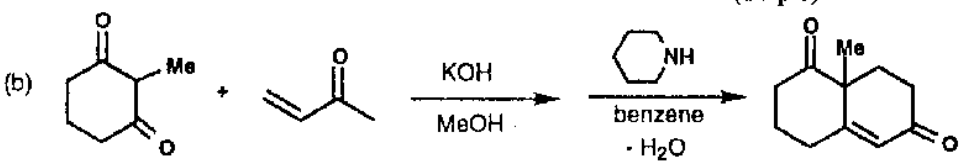


(b) What stereoisomer of A also gives compound C on heating? (4 pts)
(c) Show the transfomation of **B** to **C** by a frontier orbital analysis. (5 pts)

9. Suggest a mechanism for the each of the following reactions.



(10 pts)



(10 pts)