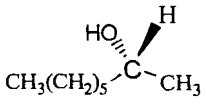
國立台灣科技大學九十七學年度碩士班招生試題

系所組別： 高分子工程系碩士班乙組

科　　目： 有機化學

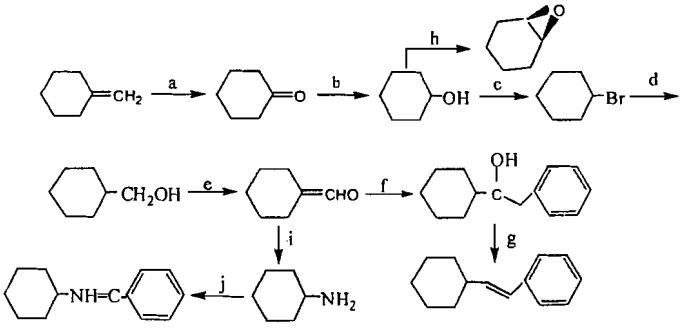
乙組：有機化學；共 12 大題，總分 100 分；請於答案卷內依序作答。

1. What configuration of the products would you expect from SN_2 reaction of the optically active (R)-2-octanol with following sets of reagents? (1) (i) PBr_3/ether, (ii) $CH_3CH_2O^-Na^+$; (2) (i) p-TosCl*/pyridine, (ii) $CH_3CH_2O^-Na^+$.
   (*: p-toluenesulfonyl chloride) (6%)



(R)-2-Octanol

2. Identify the reagents a-j in the following scheme: (10%)



3. Write chemical equations of the following reactions: (you should write all steps of the reaction and any other chemical or reaction condition necessary) (15%)
   (1) Sandmeyer reaction
   (2) Aldol condensation reaction
   (3) Michael reaction
   (4) Fischer esterification reaction
   (5) Claisen condensation reaction

4. Synthesize the following compounds: (In addition to the starting materials, you can use any chemicals needed) (9%)
   (1) from C_6H_6 to m-Cl-C_6H_4COOH
   (2) from CH_3CH_2OH to $CH_3CH_2CH_2CHO$
   (3) from $(CH_3)_3C$-OH to $(CH_3)_3C$-O-CH_2CH_3

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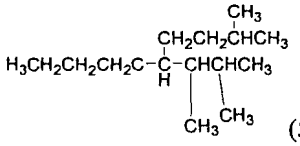
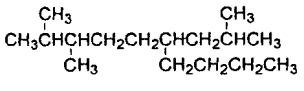
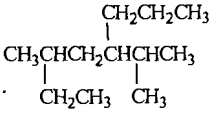
5. Name the following compounds :(6%)

(5a). 

(5b). 

(5c). 

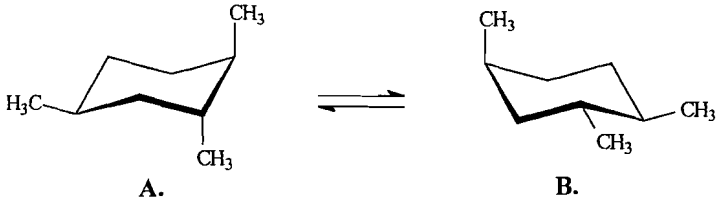
6. Refer to the following equation to answer the questions below. (6%)

(6a). Which is the strongest Brønsted-Lowry acid in the equation?

(6b). Which is the strongest Brønsted-Lowry base in the equation?

(6c). Will this reaction take place as written? Please explain.

7. Below are the two chair conformations of a 1,2,4-trimethylcyclohexane. Estimate the amount of 1,3-diaxial strain in each conformer and predict which conformer is most stable by calculating the energy associated with their conformation. (giving that 1,3-diaxial strain: H-CH_3: 3.8 KJ/mol, CH_3 gauche interaction: 3.8 kJ/mol) (6%)



A. **B.**

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8. Choose the *best* reagent from the list below for carrying out each transformation.(12%)

a. 1. O_3
   2. Zn, H_3O^+

b. 1. BH_3, THF
   2. H_2O_2, NaOH, H_2O

c. $CHCl_3$, KOH

d. H_2O, H_2SO_4, heat

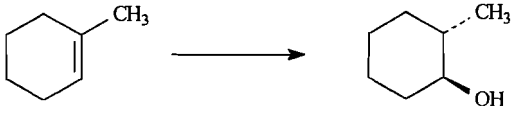
e. 1. OsO_4
   2. $NaHSO_3$, H_2O

f. $KMnO_4$, acid

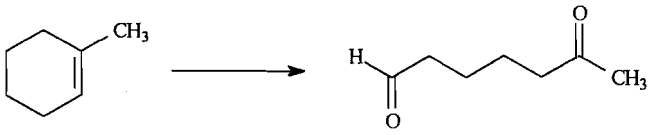
g. CH_2I_2, Zn(Cu)

h. 1. $Hg(OAc)_2$, H_2O
   2. $NaBH_4$

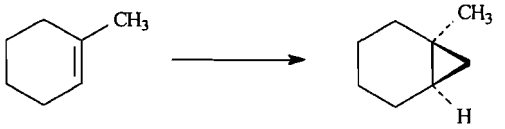
8a.



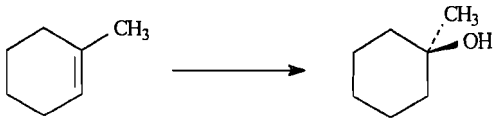
8b.



8c.



8d.



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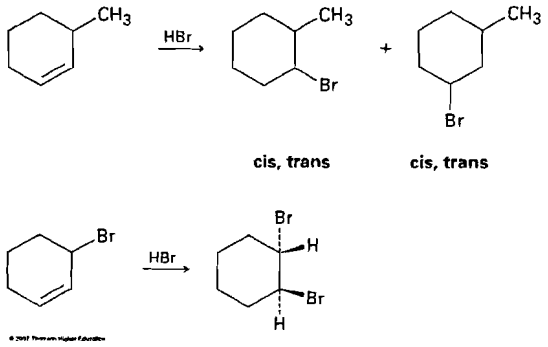
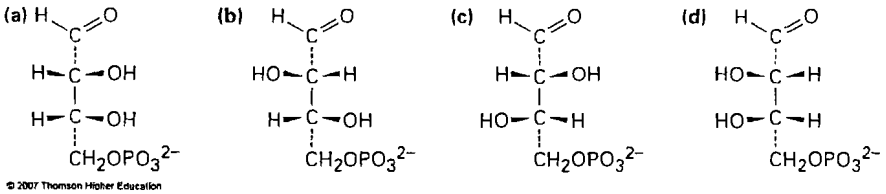
9. Reaction of HBr with 3-methylcyclohexene yields a mixture of four products: *cis*- and *trans*-1-bromo-3-methylcyclohexane and *cis*- and *trans*-1-bromo-2-methylcyclohexane. However, the analogous reaction of HBr with 3-bromocyclohexene yields *trans*-1,2-dibromocyclohexane as the sole product. Draw structures of the possible intermediates, and then explain why only a single product is formed in the reaction of HBr with 3-bromocyclohexene. (4%)



10. One of the following molecules (a)~(d) is D-erythrose 4-phosphate, which has R stereochemistry at both chirality centers. (6a).Which of the structures is it? (6b). Which of the remaining structures is the enantiomer of D-erythrose 4-phosphate? (6c). and which are diastereomers? (6%)



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11. Propose structures for compounds that fit the following descriptions: (12 %)

a) $C_{10}H_{14}$

^{1}H NMR : 7.18 δ (4 H, broad singlet); 2.70 δ (4 H, quartet, J = 7 Hz);
1.20 δ (6 H, triplet, J = 7 Hz)

IR : 745cm^{-1}

(b)$C_{10}H_{14}$

^{1}H NMR : 7.0 δ (4 H, broad singlet); 2.85 δ (1 H, septet, J = 8 Hz);
2.28 δ (3 H, singlet); 1.20 δ (6 H, doublet, J = 8 Hz)

IR : 825cm^{-1}

12. Propose structures for aromatic hydrocarbons that meet the following descriptions :(8%)

a) $C_{10}H_{14}$; gives only one $C_{10}H_{13}Cl$ product on substitution with chlorine

b) C_8H_{10}; gives three C_8H_9Br products on substitution with bromine