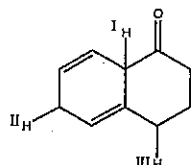


※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

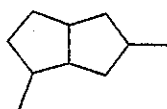
一、選擇題 (20%，每題 2%)

1. Rank the indicated protons in decreasing order (most to least) of acidity.



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

2. What is the IUPAC name of the following compound?

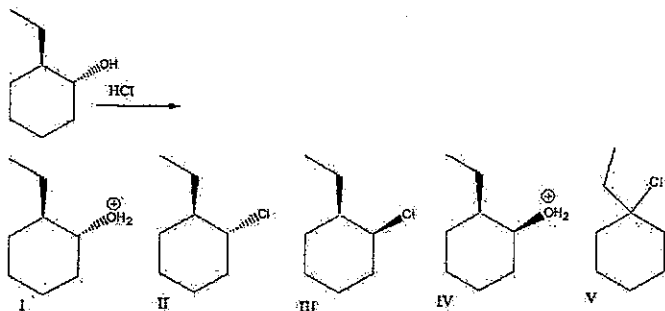


- A) 2,7-dimethylbicyclo[3.3.0]octane    B) 2,4-dimethylbicyclo[3.3.0]octane  
C) 2,6-dimethylbicyclo[3.3.0]octane    D) 3,6-dimethylbicyclo[3.3.0]octane

3. What is the % ee of a sample of carvone that exhibits a specific rotation of  $-40$ , given that the specific rotation of (*R*)-carvone is  $-61$ ?

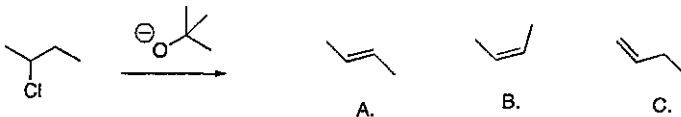
- A) 60%    B) 66%    C) 61%    D) 58%    E) 70%

4. Predict the major product for the following reaction.



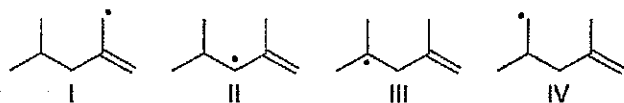
- A) I    B) II    C) III    D) IV    E) V

5. Which of the following is the major product of the following elimination?



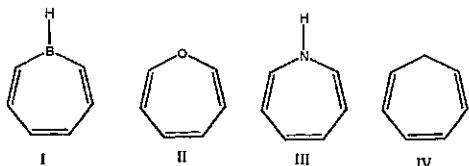
- A) A    B) B    C) C    D) Both A and B    E) Both A and C

6. Rank the following radicals in order of decreasing stability (most stable to least stable).



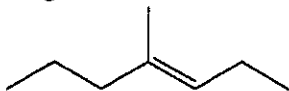
- A) IV > I > II > III    B) III > I > II > IV    C) III > II > I > IV    D) III > IV > II > I    E) II > I > III > IV

7. Which one of the following compounds is aromatic?



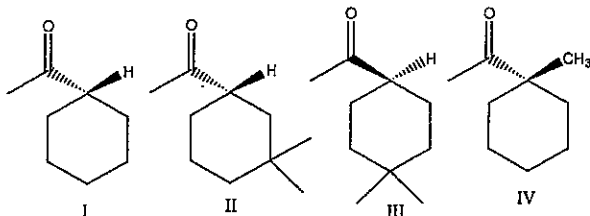
- A) I      B) II      C) III      D) IV      E) All are aromatic

8. Which of the following is the best choice to prepare the following alkene using the Wittig reaction?



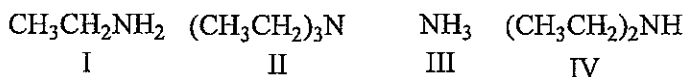
- A) ethanal and 2-bromopentane/ $\text{PPh}_3$       B) propanal and 2-bromopentane/ $\text{PPh}_3$   
 C) 2-pentanone and 1-bromopropane/ $\text{PPh}_3$       D) 2-pentanone and 2-bromopropane/ $\text{PPh}_3$   
 E) butanal and 2-bromopentane/ $\text{PPh}_3$

9. Which of the following compounds would undergo racemization in presence of a base?



- A) I      B) II      C) III      D) IV      E) II and III

10. Arrange the following compounds in decreasing (strongest to weakest) order of basicity.

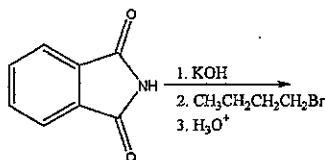


- A) I>III>II>IV      B) II>III>I>IV      C) IV>II>I>III      D) IV>III>II>I      E) II>I>IV>III

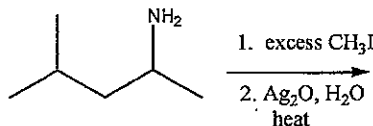
二、簡答題

1. Predict the product(s) of the following reactions. Be showing the stereochemistry if it has. (30%)

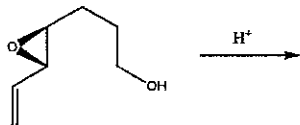
a.



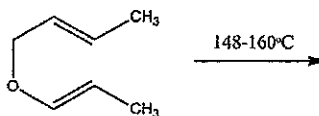
b.

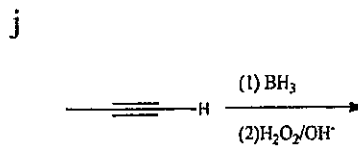
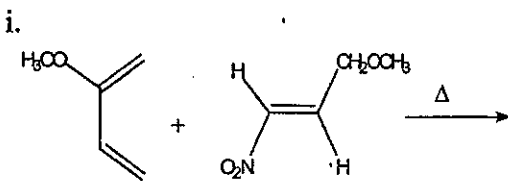
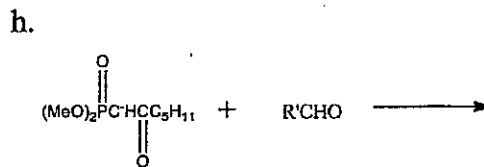
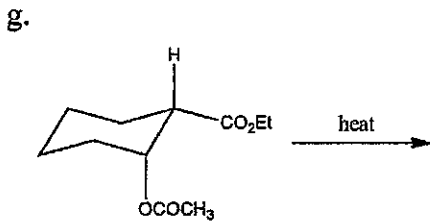
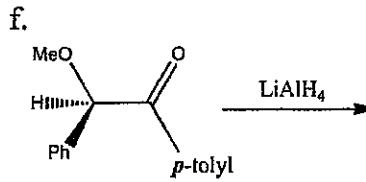
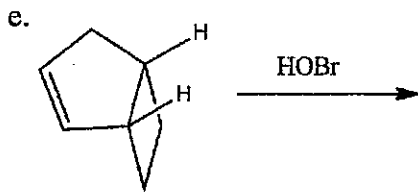


c.

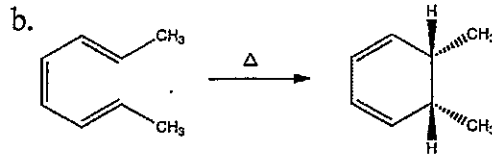
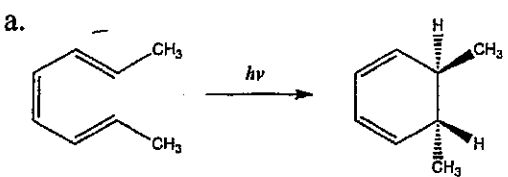


d.

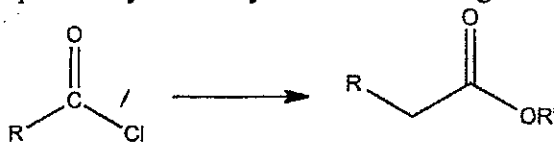




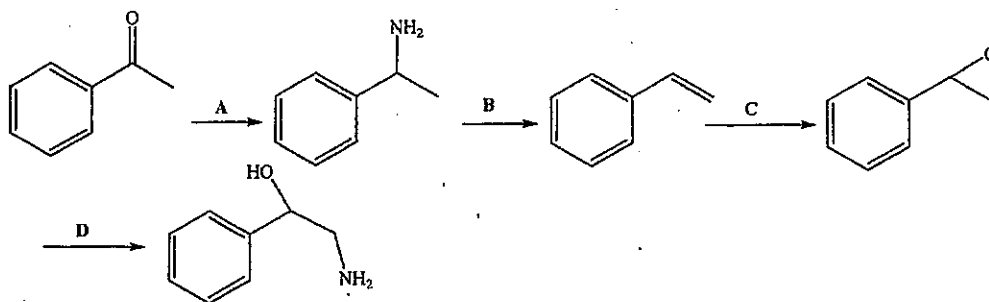
2. Please use the Woodward-Hoffmann rules to explain the following observations. (8%)



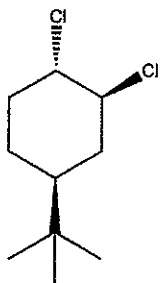
3. Show how to carry out the following synthesis by starting with diazomethane ( $\text{CH}_2\text{N}_2$ ). Write the synthetic sequences step by step with any necessary condition and reagents. (6%)



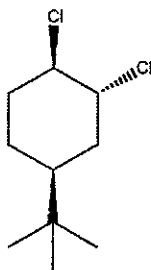
4. Provide the reagents necessary to carry out the following conversion. (8%)



5. Which of the following two structures (A and B) is expected to be more polar? Account for your answer. (6%)

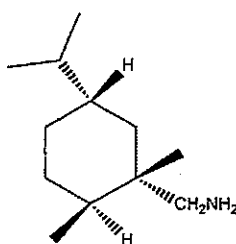
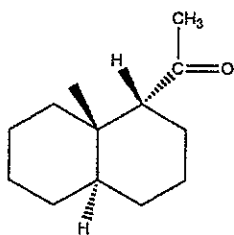


A



B

6. a). Compound A, the left one, was synthesized in racemic form near the beginning of natural product synthesis. In an attempt to effect a resolution,  $(\pm)A$  was converted into a mixture of diastereomers by treating with compound B, the right one. After separation of the diastereomers, they were treated with 50%  $H_2SO_4/H_2O$  to regenerate (+)- and (-)-A. However, it turned out that this method failed to resolve  $(\pm)A$ . Give an explanation for this unsuccessful method. (4%)



b). Suggest a method that might be successful. (4%)

7. Compound A ( $C_7H_{14}O_2$ ) shows having a chiral center with R configuration. The IR spectrum of A shows a strong absorption at  $3400\text{ cm}^{-1}$ . Treatment of A with  $PBr_3$  in  $CH_2Cl_2$  at room temperature gave a product that upon reaction with sodium salt of propyne give compound B ( $C_{10}H_{16}O$ ). Reaction of B with 2 equivalent of lithium metal in liquid ammonia gave a new substance, compound C. Compound C was optically inactive. Reaction of C with ozone, followed by addition of Zn metal and acid ( $Zn/H_3O^+$ ), two compounds were obtained, neither of which was optically active. One of the two products, compound D, was shown to have molecular formula of  $C_6H_{10}O_3$  and the spectral data of D were as followings:

IR: 1728, 1134  $\text{cm}^{-1}$

$^1H$ -NMR:  $\delta$ 9.72 (triplet, 2H)

$\delta$ 3.24 (singlet, 3H)

$\delta$ 3.29 (quintet, 1H)

$\delta$ 2.53 (triplet, 4H)

Provide clearly the structural formula for compounds A, B, C, and D. Be sure to account for your answer and indicate clearly any relevant stereochemistry. (14%)