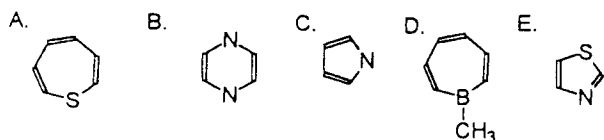
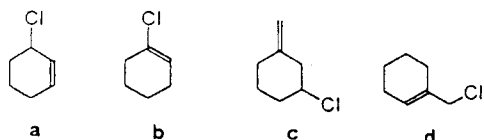


1. Which of the following heteroatom-containing compounds is not an aromatic? (單選, 3%)



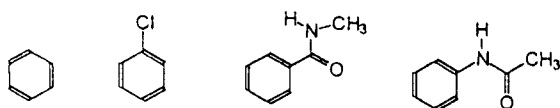
2. Arrange the following compound a, b, c, and d in order of decreasing reactivity toward solvolysis with ethanol. (單選, 3%)



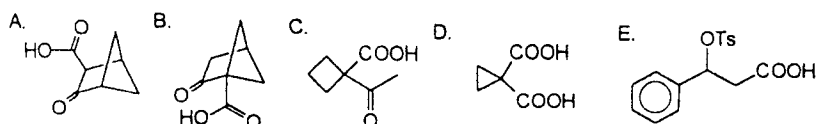
A. b>c>d>a B. b>a>c>d C. a>d>c>b D. a>c>b>d E. c>b>a>d

3. Arrange the following compound a, b, c, and d in order of decreasing reactivity toward sulfonation. (單選, 3%)

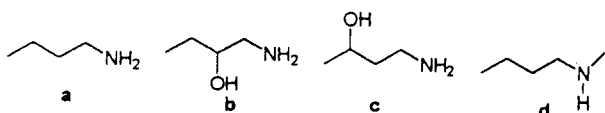
A. a>d>c>b B. d>c>a>b C. b>c>d>a D. d>b>c>a E. d>a>b>c



4. Which one of the following compounds will not undergo decarboxylation on heating. (單選, 3%)



5. Arrange the following compound a, b, c, and d in order of decreasing basicity. (單選, 3%)

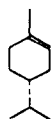


A. a>d>b>c B. a>d>c>b C. d>c>a>b D. d>a>c>b E. c>b>d>a

6. Draw structures of the following compounds.

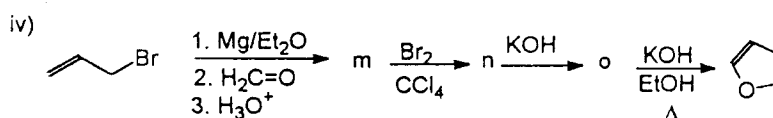
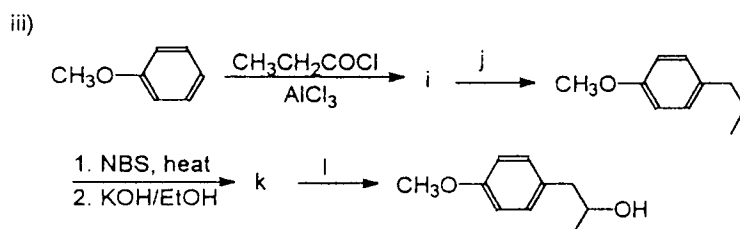
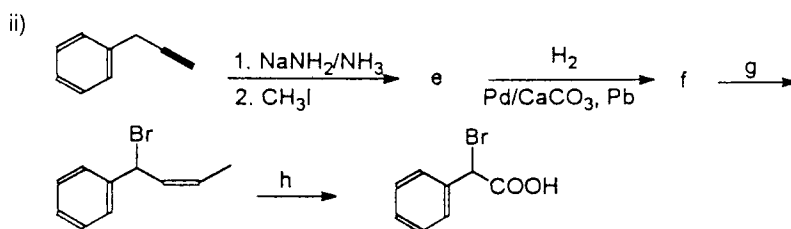
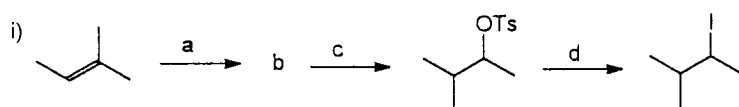
(a) 2-chloroethyl benzoate (3%) (b) trans-3-phenylcyclohexylamine (3%)

7. (a) Draw the major product formed when the optically active compound shown below is treated with  $H_2SO_4/H_2O$ . (3%) (b) Is the product optically active? Why or Why not? (3%)



(背面仍有題目,請繼續作答)

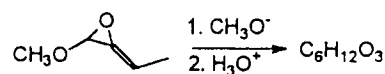
8. Complete the following reactions by adding the appropriate reagents and products. (各3%, 共45%)



9. The  $^1\text{H}$  NMR spectrum of compound A ( $\text{C}_{15}\text{H}_{14}\text{O}$ ) shows only two signals: a multiplet at 7.15 and a singlet at 3.55 ppm in a 5:2 ratio. The IR spectra has no absorption in the  $3200\text{-}4000\text{ cm}^{-1}$  region but a strong peak can be found near  $1700\text{ cm}^{-1}$ . Compound A reacts with  $\text{NaBH}_4$  followed by acidification to give compound B of the molecular formula  $\text{C}_{15}\text{H}_{16}\text{O}$ . The reaction of A with  $\text{CH}_3\text{MgBr}$ , and then with  $\text{H}_3\text{O}^+$  gives C, with a molecular formula of  $\text{C}_{16}\text{H}_{18}\text{O}$ . Suggest structure for A-C. (各3%, 共9%)

10. Compound A of the molecular formula  $\text{C}_{10}\text{H}_{12}\text{O}$  exhibits the following resonances in its  $^1\text{H}$  NMR spectrum: 2.05 (s, 3H), 2.60-2.90 (two overlapping triplets, 4H), 7.20 (multiplet, 5H) ppm. Its  $^{13}\text{C}$  NMR spectrum shows eight distinct signals- three between 20 and 50 ppm, four between 120 and 145 ppm, and a single peak at 207 ppm. Treatment of A with  $\text{I}_2/\text{OH}^-$  gives a yellow precipitate and reaction with  $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4/\text{H}_2\text{O}$  yields benzoic acid. Suggest a structure for A and justify your answer. (6%)

11. When the epoxide shown below was treated with  $\text{CH}_3\text{O}^-$  followed by an acidic workup, a compound of the molecular formula  $\text{C}_8\text{H}_{12}\text{O}_3$  was formed as the major product. Its  $^1\text{H}$  NMR spectrum exhibited signals at 1.07 (t, 3H), 2.60 (q, 2H), 3.41 (s, 6H), 4.50 (s, 1H) ppm, and a strong adsorption was seen at  $1730\text{ cm}^{-1}$  in its IR spectrum. Propose a structure for this molecule and provide a reaction mechanism to account for its formation. (7%)



12. Provide a mechanistic explanation for the reaction. (6%)

