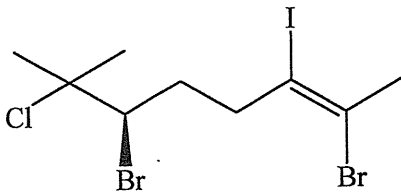


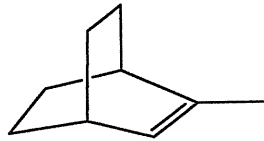
※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Name the following compounds. (each 4 %, totally 20 %)

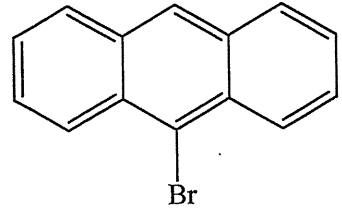
(a)



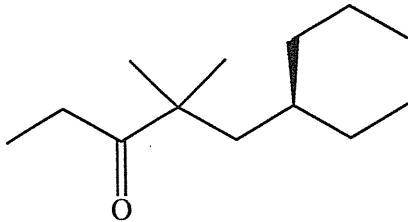
(b)



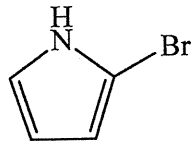
(c)



(d)

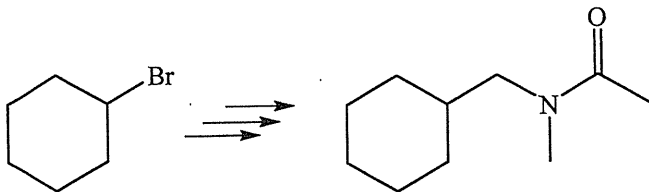


(e)

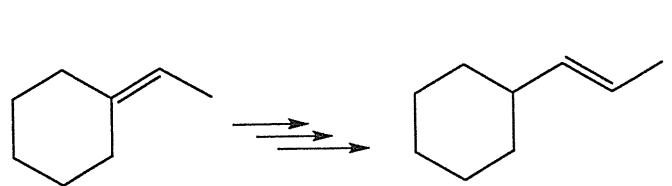


2. Complete the following transformation. (each 6 %, totally 30 %)

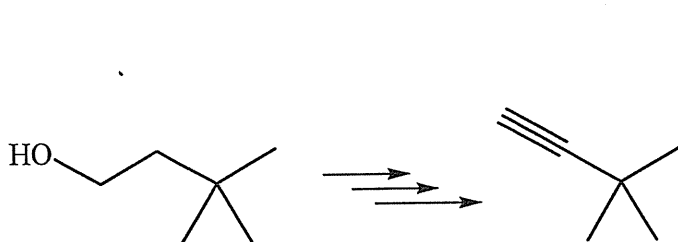
(1)



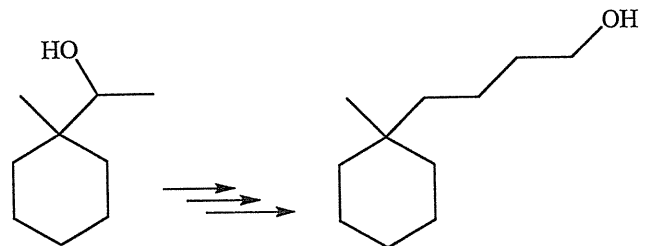
(2)



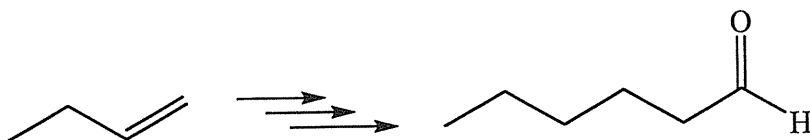
(3)



(4)

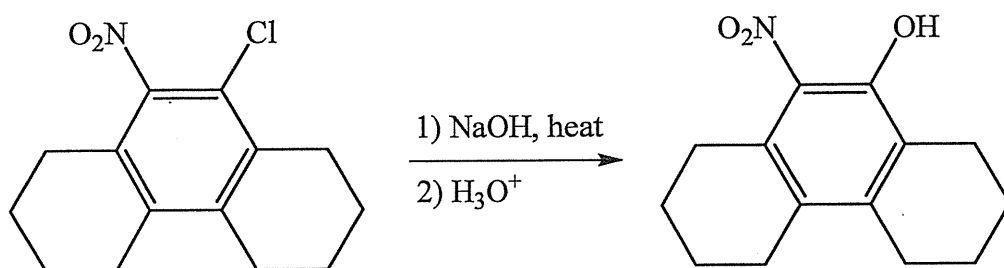


(5)



3. Tetrahydrofuran (THF) can be formed by treating 1,4-butanediol with sulfuric acid. Propose a mechanism for this transformation. (5 %)

4. Draw the most likely mechanism for the following transformation. (5 %)

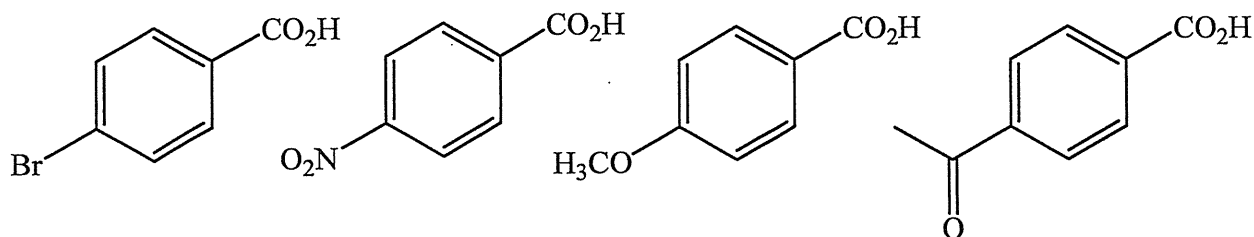


5. An unknown compound with molecular formula C₁₁H₁₄O₂ exhibits the following spectra. The IR spectrum displayed many signals, including 2970 and 1690 cm⁻¹. The ¹H NMR spectrum of this compound exhibits a singlet at 1.4 ppm (9H), a doublet at 7.6 ppm (2H), a doublet at 8.1 ppm (2H), and a D₂O exchangeable broad singlet at 11.5 ppm (1H). The ¹³C NMR spectrum of this compound exhibits signals at 30.9, 34.7, 125.2, 126.4, 130.4, 157.4, and 172.6 ppm. Deduce the structure of the compound. (5 %)

6. An unknown compound with molecular formula C₉H₁₀O exhibits the following spectra. The ¹H NMR spectrum of this compound exhibits two sets of multiplets between 7.4 and 8.0 ppm (totally 5H), a quartet at 3.0 ppm (2H), and a triplet at 1.2 ppm (3H). The ¹³C NMR spectrum of this compound exhibits signals at 7.9, 31.3, 127.7, 128.3, 132.5, 136.7, and 199.9 ppm. Deduce the structure of the compound. (5 %)

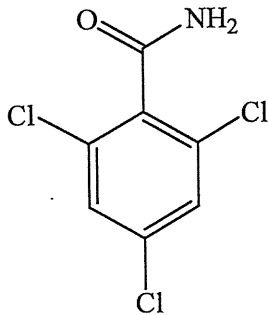
7. A carboxylic acid with molecular formula C₅H₁₀O₂ is treated with thionyl chloride to give compound A. Compound A has only one signal in its ¹H NMR spectrum. Draw the structure of product that is formed when compound A is treated with excess ammonia. (5 %)

8. Rank the following compounds in order of decreasing acidity and explain your answer. (5 %)

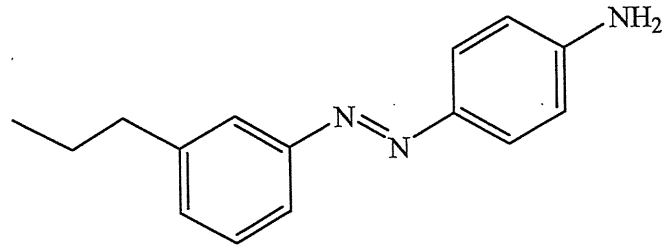


9. Propose syntheses of the following compounds starting from benzene and any reagents with three or fewer carbon atoms (each 5 %, totally 10 %).

(a)



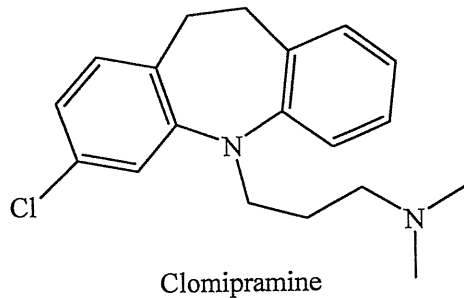
(b)



10. Clomipramine is used in the treatment of obsessive compulsive disorder.

(a) Identify which nitrogen atom is more basic and explain your choice. (3 %)

(b) Draw the form of clomipramine that is expected to predominate at physiological pH. (2 %)



11. Guggul is an herbal extract from the resin of the mukul myrrh tree, and it shows potential for treating high cholesterol. In a reported synthesis of (+)-myrrhanol A presented in guggul, compound 1 was treated with mCPBA, followed by LAH to afford compound 2 as the only diastereomer detected. Explain the stereochemical outcome with respect to the newly formed chirality center. Your answer should include (1) a bond-line drawing that clearly shows the chair conformation adopted by each six-membered ring in the trans-decalin system and (2) a Newman projection that clearly shows the source of the observed stereochemical preference. (5 %)

