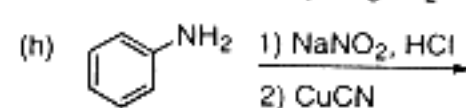
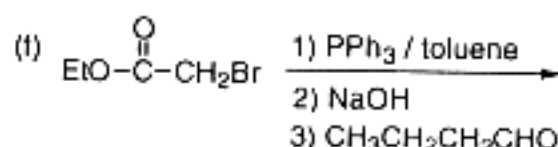
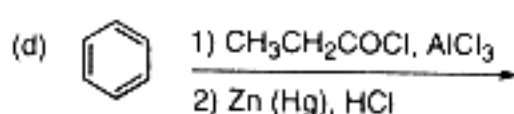
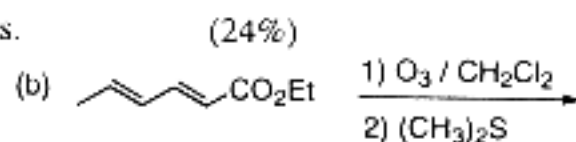
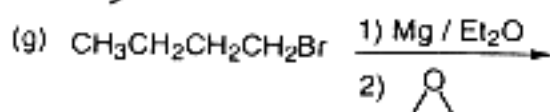
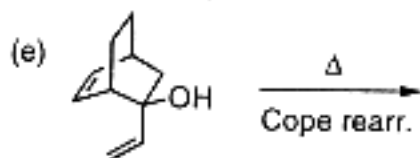
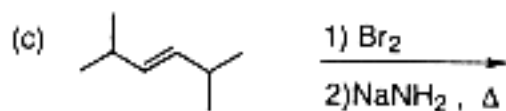
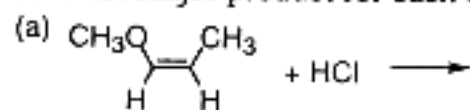


請將您的答案寫在答案紙上

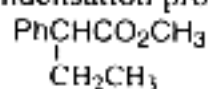
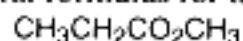
1. Give the major product for each of the following reactions.



2. Suggest a short, efficient reaction sequences suitable for preparing *p*-nitrobenzoic acid from toluene and any other reagents. (4%)
3. The rate of reaction of *cis*-1-bromo-4-*t*-butylcyclohexane with methylthiolate ion (CH_3S^-) is faster than for the *trans* isomer. Suggest a reason for this difference. (4%)
4. What will happen when an alcohol is treated with a strong base, KH? What will happen when an alcohol is treated with a strong acid, HBr? (4%)
5. Give the molecular formula and determine the number of tertiary carbon atom in the following compound. (4%)
-
6. Describe the effect of solvent polarity for the following reaction. (4%)
- $\text{H}_3\text{C}-\text{C}(\text{CH}_3)_2-\text{Br} + \text{H}_2\text{O} \longrightarrow \text{H}_3\text{C}-\text{C}(\text{CH}_3)_2-\text{OH} + \text{HBr}$
7. In the benzoin condensation reaction in CH_3OH is promoting by the addition of sodium cyanide, instead of hydroxide or methoxide ion. Explain. (4%)
- $2 \text{ C}_6\text{H}_5\text{CHO} \xrightarrow[\text{CN}^-]{\text{CH}_3\text{OH}} \text{C}_6\text{H}_5\text{CH}(\text{OH})\text{C}(\text{O})\text{C}_6\text{H}_5$
8. Draw the structure for the stereoisomer of $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}(\text{OH})-\text{CH}_3$ having *E* configuration about the double bond and the *R* configuration at the stereocenter. (4%)
9. Arrange the following quantities in the order of decreasing. (4%)
- (a) Molecular polarity: (1) CH_2Cl_2 (2) CH_3OH (3) CCl_4
- (b) boiling point: (1) $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ (2) $\text{N}(\text{CH}_3)_3$ (3) $\text{HCON}(\text{CH}_3)_2$
10. In acidic aqueous solution, 2-methyl-1-propanol slowly converted into 2-methyl-2-propanol (*t*-butyl alcohol). Explain. (4%)

(背面仍有題目,請繼續作答)

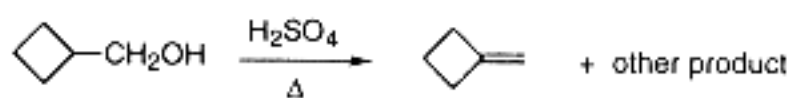
11. One of the following esters is not suitable for the Claisen condensation reaction. Which one? write structural formulas for the Claisen condensation products of the other. (4%)



12. A certain alkylbenzene, $\text{C}_{11}\text{H}_{16}$, was known not to be oxidized by KMnO_4 . Draw the structural formula for this compound. (4%)

13. Aniline ($\text{C}_6\text{H}_5\text{NH}_2$) is prepared by catalytic hydrogenation of nitrobenzene. Devise a chemical procedure to separate aniline from any unreacted nitrobenzene. (4%)

14. A student wanted to make methylenecyclobutane and he tried the following reaction. However, he only got a small amount of methylenecyclobutane. Propose a structure for the major product and give mechanism to account for its formation. (4%)

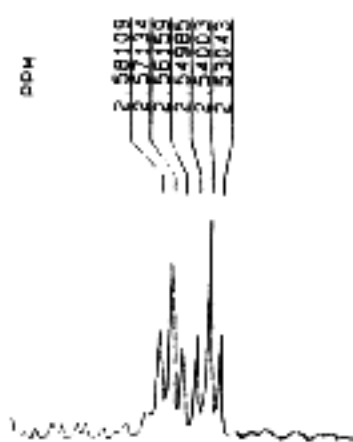


15. There are three dioxane isomers: 1,2-dioxane, 1,3-dioxane, 1,4-dioxane. One of these quickly hydrolyzed in dilute acid. Show which isomer fulfill this property and give a mechanism for the acid hydrolysis. (4%)



16. A compound is either an aldehyde, a ketone, an carboxylic acid, or a nitrile. Identify to which class the compound belongs based on its IR spectrum. (4%)

17. A ^1H NMR peak measured with a 200 MHz NMR spectrometer. Give the chemical shift, multiplicity, and coupling constant for this peak. (4%)



18. A compound containing only C, H, and O, gave 80.0% C and 6.7% H on elemental analysis. From the mass spectrum: m/z (relative intensity) 120 (29), 105 (100), 78 (10), 77 (88), 51 (40), 50 (21), 43 (17), deduce the structure for this compound. (4%)

19. From the ^1H NMR spectrum for a compound, $\text{C}_8\text{H}_{11}\text{N}$: δ 2.2 (6H, s), 3.5 (2H, br s), 6.3 (2H, s), 6.4 (1H, s), deduce the structure for this compound. (4%)

20. The specific rotation of (*S*)-2-iodobutane is $+15.90^\circ$. Determine the percentage composition of a mixture of (*R*)- and (*S*)-2-iodobutane with a specific rotation of -7.95° . (4%)