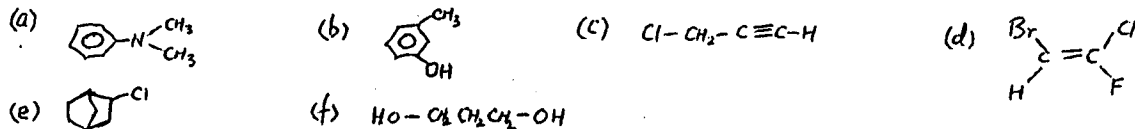


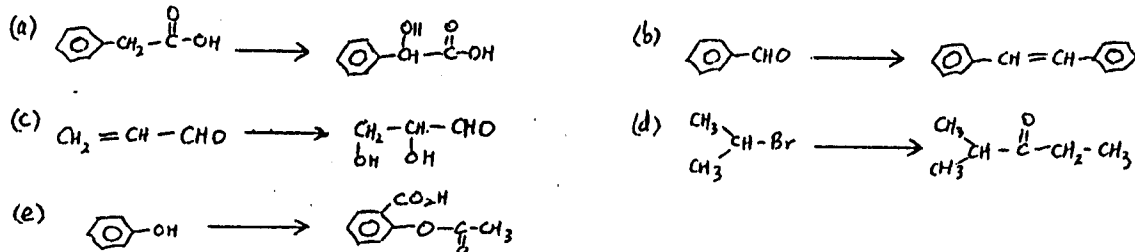
(1) Give structural formulas for each of the following compounds. (4%)

- (a) DMSO      (b) 2,4-D      (c) TMS      (d) 2,3,7,8-tetrachlorodibenzodioxin

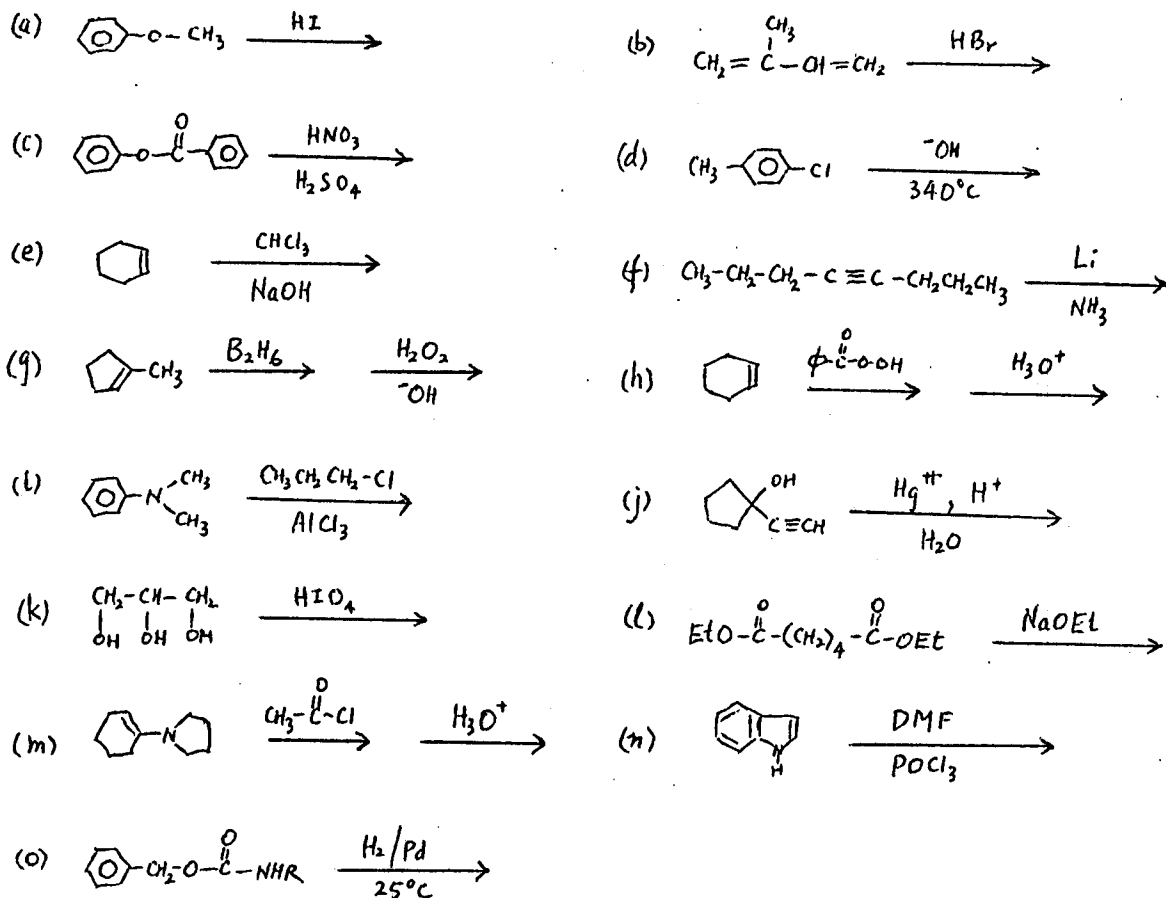
(2) Give common or IUPAC names for each of the following compounds. (6%)



(3) Show how you might carry out each of the following conversions. (10%)



(4) Give structures for the products of each of the following reactions. (30%)



(5) Of the following solvents, which will be the least desirable (最不適當) to be used in the nmr spectroscopy? (2%)

- (a)  $\text{CCl}_4$       (b)  $\text{D}_2\text{O}$       (c)  $\text{CH}_3\text{CH}_2\text{OH}$       (d)  $\text{CD}_3\overset{\text{O}}{\parallel}{\text{C}}\text{CD}_3$       (e)  $\text{CS}_2$

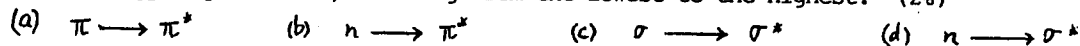
(6) Arrange the proton nuclear magnetic resonance of the following compounds in the order of their increasing shielding, starting from the farthest downfield shift to TMS at the very right. (6%)

- (a)  $\text{R}-\text{CH}_3$       (b)  $\text{Ar}-\text{H}$       (c)  $\text{R}-\text{CHO}$       (d)  $\text{R}-\text{COCH}_3$       (e)  $\text{R}-\text{COOH}$       (f)  $\text{R}-\text{OCH}_3$

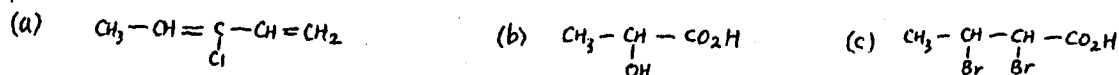
(7) Arrange the stretching vibration frequency of the following functional groups in proper order, starting from the highest to the lowest: (4%)

- (a)  $\text{C}\equiv\text{C}$ ,  $\text{C}=\text{C}$ ,  $\text{C}-\text{C}$       (b)  $\text{C}=\text{C}$ ,  $\text{C}=\text{O}$ ,  $\text{C}\equiv\text{N}$

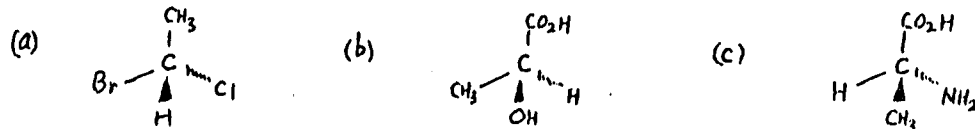
(8) Arrange in ascending order the electronic transition of the following types according to their energy requirements, starting from the lowest to the highest: (2%)



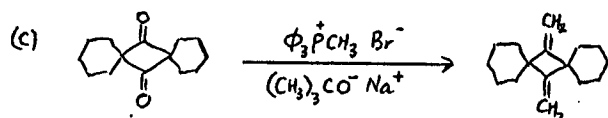
(9) Draw structures of all the stereoisomers possible of each of the following compounds. Classify each pair of isomers as (i) cis, trans isomer (ii) enantiomer (iii) diastereoisomer. (3%)



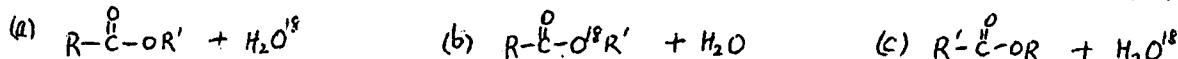
(10) Identify the configurations of each of the following as R or S. (3%)



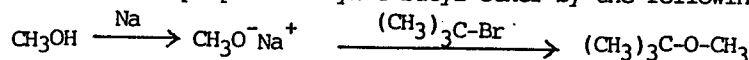
(11) Suggest plausible mechanisms for the following reactions: (6%)



(12) The correct products for the reaction,  $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH} + \text{R}'-\text{O}^\delta-\text{H} \xrightarrow{\text{H}^+}$  is: (3%)



(13) A student tried to prepare methyl t-butyl ether by the following Williamson synthesis:



Did he get the desired product? Why? What did he get? (4%)

(14) For each pair of compounds below, indicate by simple chemical test(s) how you could distinguish the two: (3%)

- (a) cyclopentanone, cyclohexene;      (b) 1-octanol, 2-methylphenol;  
(c) ethyl phenyl ketone, ethyl benzoate;

(15) Construct a flow diagram for the separation of p-cresol ( $\text{pK}_a = 10.2$ ) and 2,4-dinitrophenol ( $\text{pK}_a = 3.96$ ), both of which have slight solubility in water at  $25^\circ$ , but are very soluble in ether. (8%)

(16) Complete the following reaction scheme by giving the correct structural formulas for the materials designated A-F. (6%)

