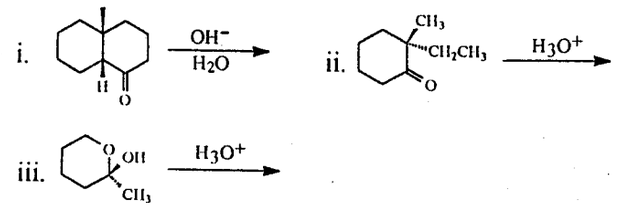
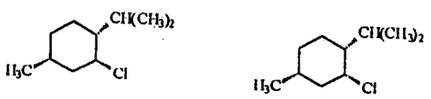
請將您的答案寫在答案紙上

1. For the following compounds indicate whether a) racemization b) epimerization or c) no stereochemical change would occur when they are treated as shown. Please give explanation for each. (9%)



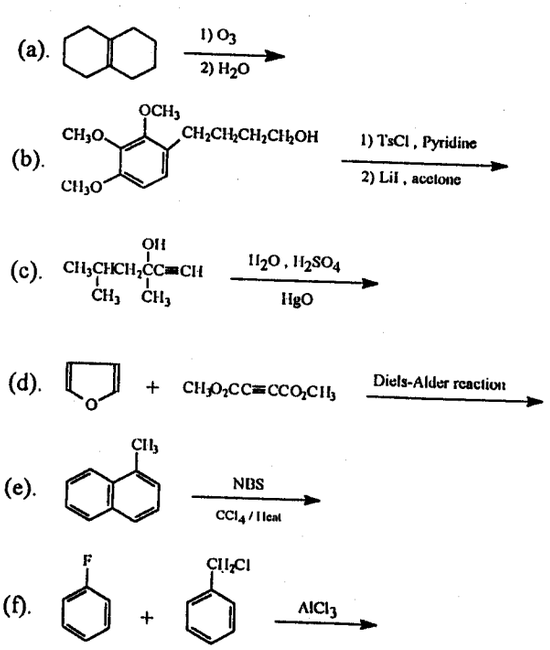
2. The following results was observed in an experiment. An orange solution was added to three beakers containing colorless liquids. The liquid in the first beaker slowly turned blue-gray, the liquid in the second turned green, and the liquid in third remained orange. The orange solution contains potassium dichromate and sulfuric acid. The colorless liquids in the three beakers have the fomula of $C_4H_{10}O$. Please explain this observation. (6%)

3. It is found one of the following two compounds, compound A and B, undergoes reaction with sodium ethoxide in ethanol much readily than the other. Which compound reacts faster ? Please account for your answer. (5%)

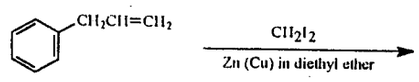


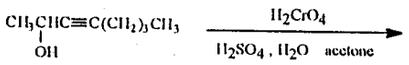
Compound A Compound B

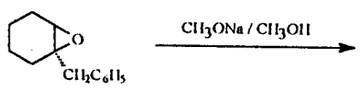
4. Identify the principal product for each of the following reaction. (2% each)

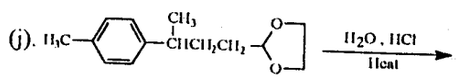


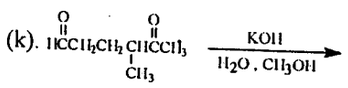
(背面仍有題目,請繼續作答)

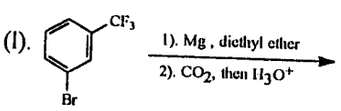
(g) 

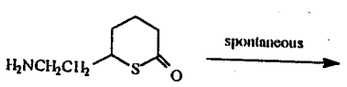
(h). 

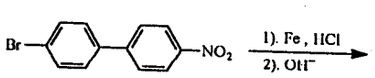
(i). 

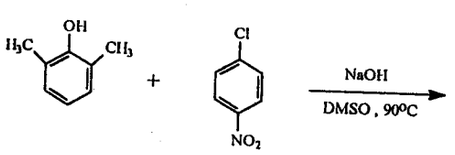
(j). 

(k). 

(l). 

(m). 

(n). 

(o). 

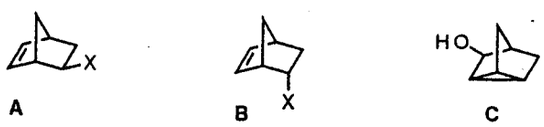
5. Two hypothetical mechanisms for the halogenation of methane have the following propagation steps:

(a) (i) $X\cdot + CH_4 \longrightarrow CH_3\cdot + HX$
(ii) $CH_3\cdot + X_2 \longrightarrow CH_3X + X\cdot$ (4%)

(b) (i) $X\cdot + CH_4 \longrightarrow CH_3X + H\cdot$
(ii) $H\cdot + X_2 \longrightarrow HX + X\cdot$

Which one is the acceptable mechanism? Explain.

6. Halide **A** solvolyzes ten times faster than halide **B**. Both give **C** as the solvolysis product in aqueous ethanol. Explain. (4%)

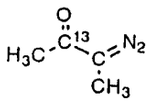


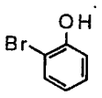
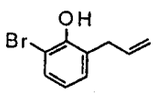
(背面仍有題目,請繼續作答)

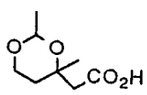
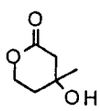
7. Suggest reasonable mechanisms for each of the following reactions. (4% each)

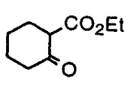
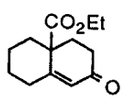
(1) 1,5-dibromopentane + NaOH $\xrightarrow{CH_3OH}$ 

(2)  $\xrightarrow{Na\ in\ NH_3}$ 

(3)  $\xrightarrow[gas\ phase]{h\upsilon}$ $(CH_3)_2C{=}C^{13}{=}O$ + $(CH_3)_2C^{13}{=}C{=}O$

(4)  $\xrightarrow[2)\ \Delta]{1)\ allyl\ bromide,\ K_2CO_3}$ 

(5)  $\xrightarrow{H^+,\ H_2O}$ 

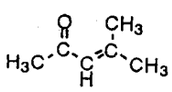
(6)  +  $\xrightarrow{OH^-}$ 

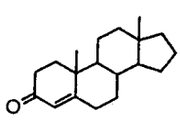
8. Answer the following spectroscopic questions. (4% each)

(1) The MS spectrum of methanol shows peaks at *m/z* 31. Propose a reasonable structure and a formation mechanism for this fragment ion.

(2) How many C^{13} peaks should be seen in the noise-decoupled (broad-band) spectrum of 1,4-dimethylbicyclo[2.2.2]octan-2-one. And draw the structure of this compound.

(3) Are the UV spectra of the following two compounds very similar? How could you distinguish them by spectroscopic method?





9. Spectroscopic data for an ethyl ester are given below. Propose the molecular formula and a reasonable structural formula for this compound. (6%)

^1H NMR ($CDCl_3$): δ 1.3 (*t*, 3H), 1.8 (*d*, 3H), 4.1-4.5 (*m*, 3H)

IR (film): 1739 cm^{-1}

MS *m/z* (relative intensity): 182 (13, M^+), 180 (13), 109 (78), 107 (77), 101 (3), 29 (100).