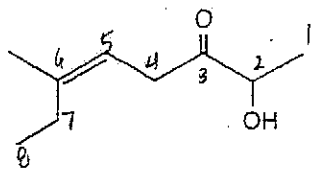
CHEM 3332 - Final EXAM (UH)

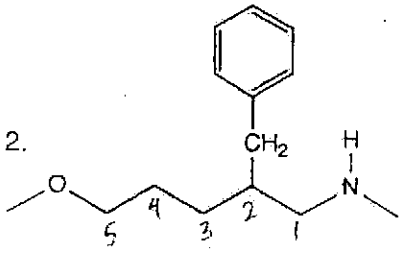
Bean-Cai-4
Chem 3332

A. Nomenclature: Total = 12 points, 4 points each

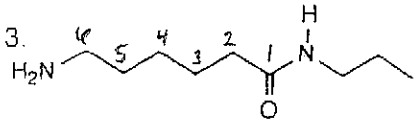
Give an acceptable name for each of the compounds below.

1. 

Z-2-hydroxy-6-methyl-5-octen-3-one

2. 

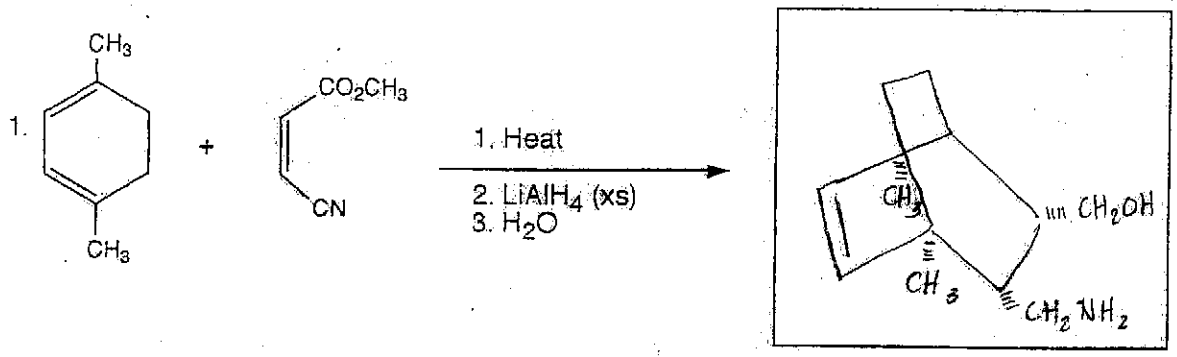
2-benzyl-5-methyl-N-methyl-1-pentanamide

3. 

6-amino-N-propylhexanamide

B. Reactions: Total = 40 points, 8 points each
Please provide the starting material, major product or necessary reagents in the answer box. Be sure your drawing indicates stereochemistry if applicable. Partial credit is awarded only when intermediate products are shown below the reaction.

1.



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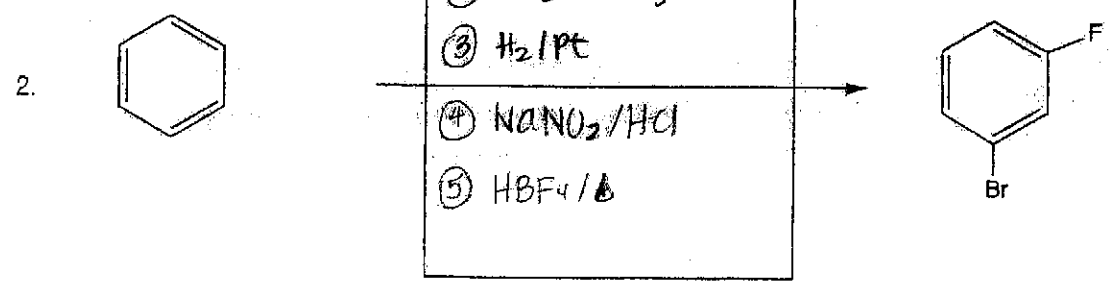

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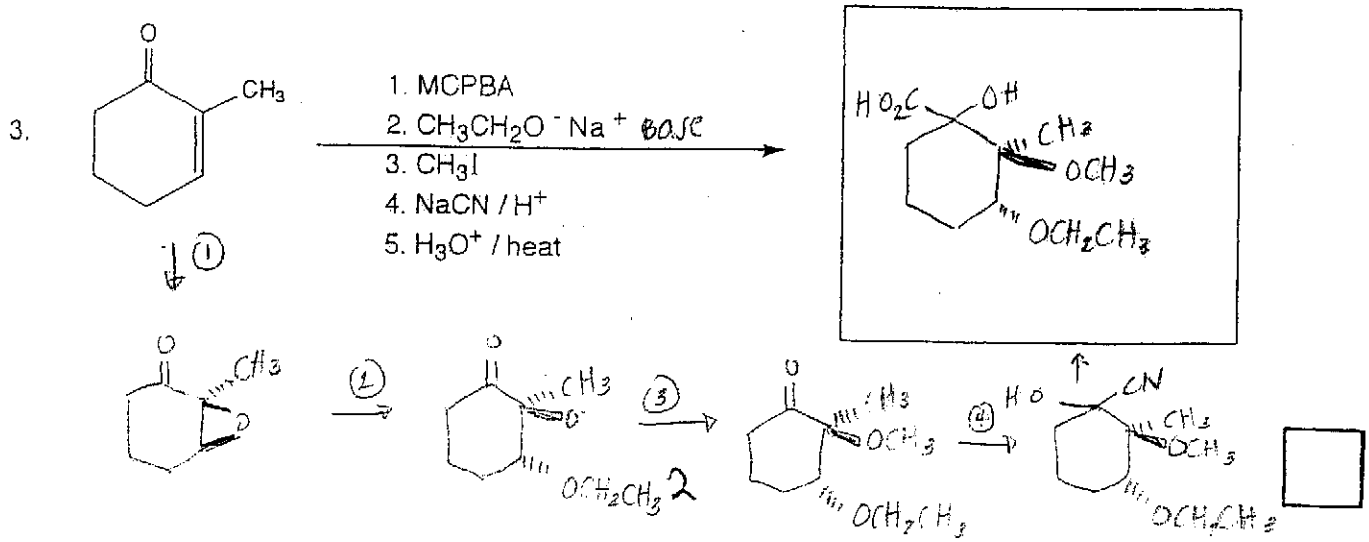
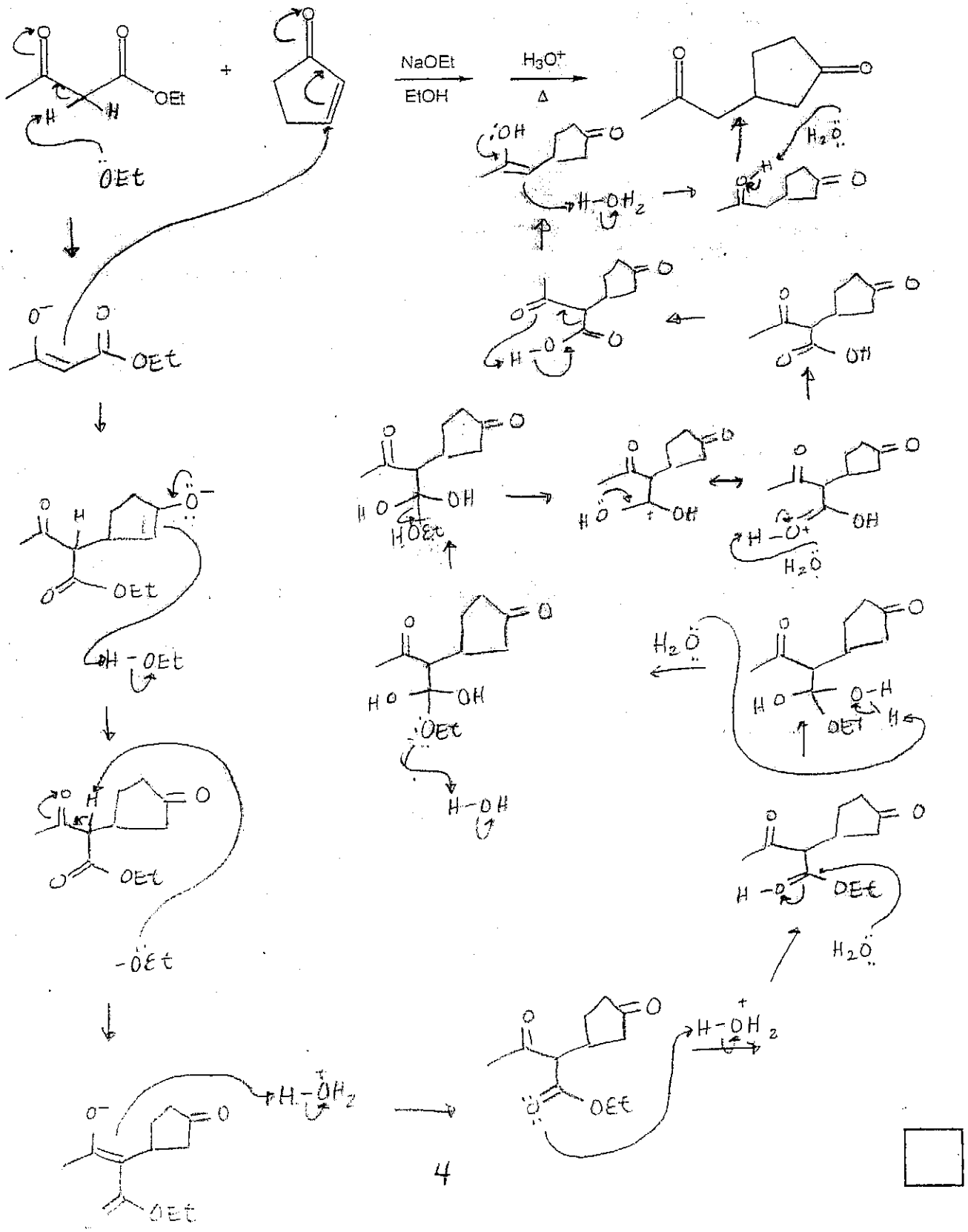


C. Mechanism: (18 points)

Provide reasonable mechanisms for the reaction below. Use curved arrows to indicate "electron flow". **Show all intermediates and all formal charges.** If there is more than one resonance structure, you must show the "best" (i.e., lowest energy) structure.



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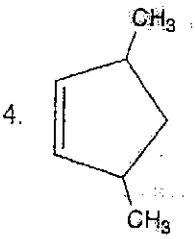
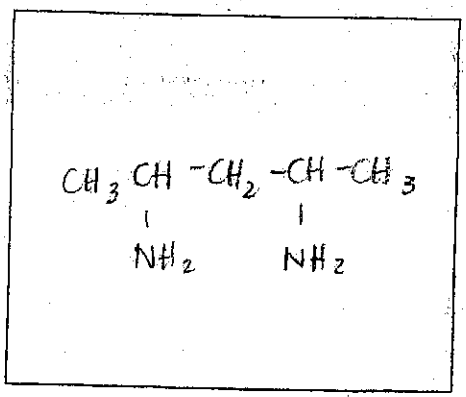
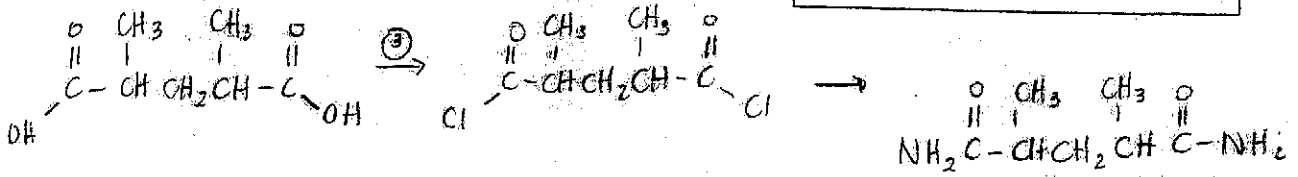
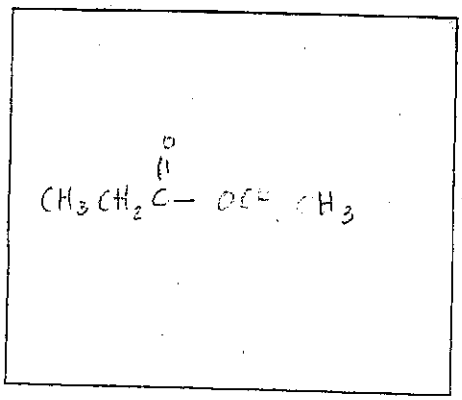


1. $KMnO_4$/ ^-OH / heat
2. H^+
3. $SOCl_2$ (xs)
4. NH_3 (xs)
5. Br_2 / ^-OH/ H_2O (xs)

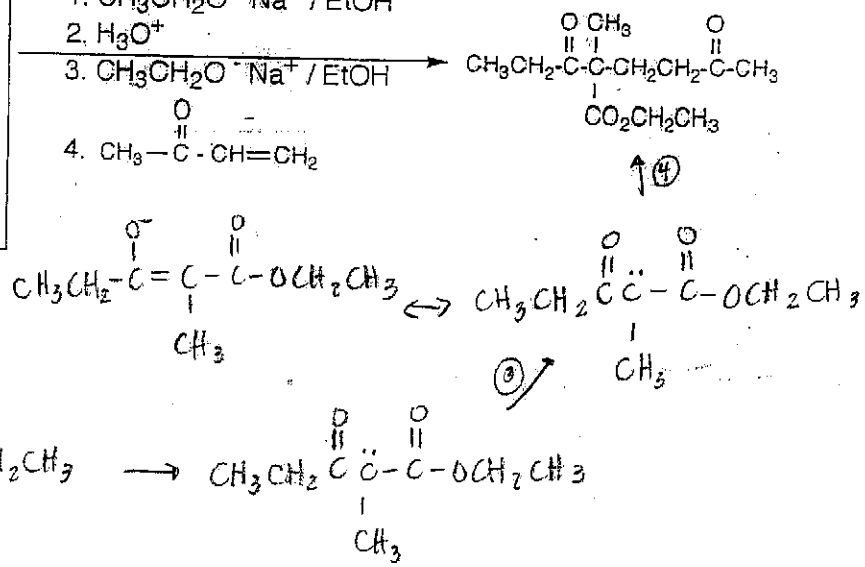




5.

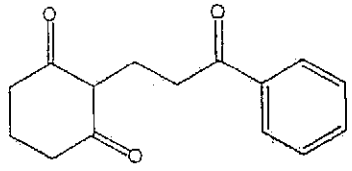


1. $CH_3CH_2O^-Na^+$ / EtOH
2. H_3O^+
3. $CH_3CH_2O^-Na^+$ / EtOH
4. $CH_3-\overset{O}{\overset{\|}{C}}-\overset{-}{C}H=CH_2$

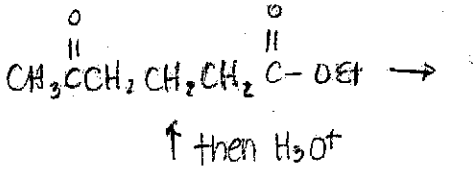


D. Synthesis: (18 points)

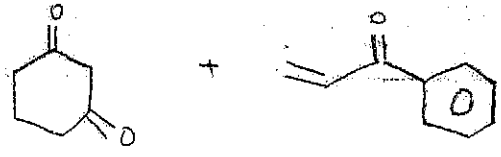
Synthesize the molecule below using any of the following reagents: alkanes, alkenes, alkynes, or alcohols of **two carbons or less**, benzene, any inorganic reagents, any oxidizing or reducing agents, and any peroxyacids.



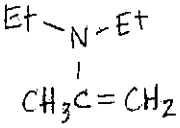
↑ NaOEt / EtOH

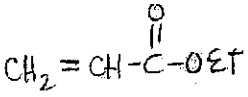


↑ then H_3O^+



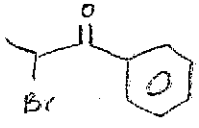
or $^-OK^+$



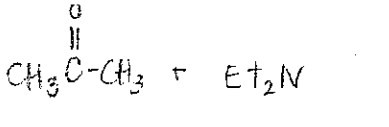


↑ ① $SOCl_2$ ② EtOH

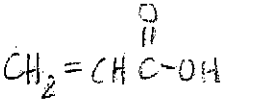
↑ H^+



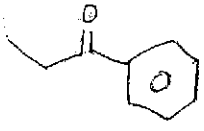
↑ Br_2 / acetic acid

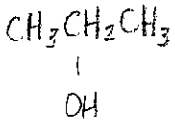


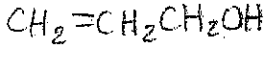
↑ PCC



↑ Jones, 0°C

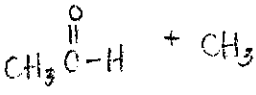


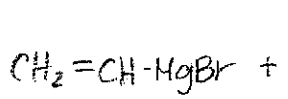


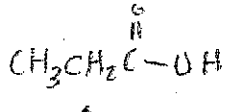


↑ $CH_3CH_2C(=O)Cl$ / $AlCl_3$

↑ $SOCl_2$

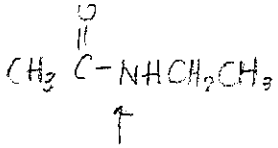


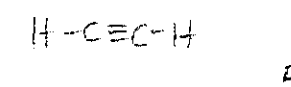


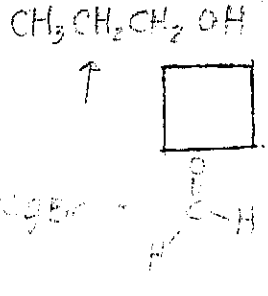


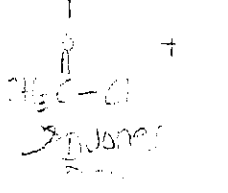
① $LiAlH_4$
② H_2O

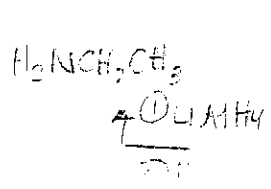
↑ Jones

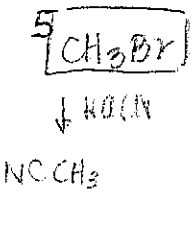






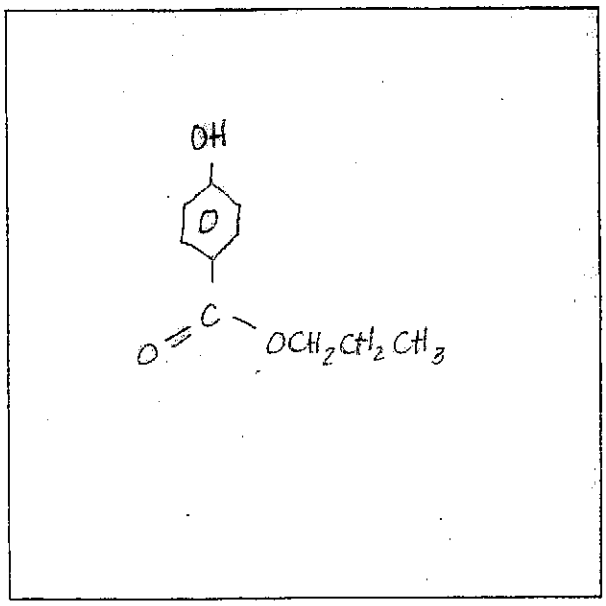






E. **Spectroscopy:** (12 Points)

A compound with the formula $C_{10}H_{12}O_3$ exhibits the IR, ^1H NMR, and proton-decoupled ^{13}C NMR spectra shown on the following page. Please identify this compound and draw the structure in the box provided below.

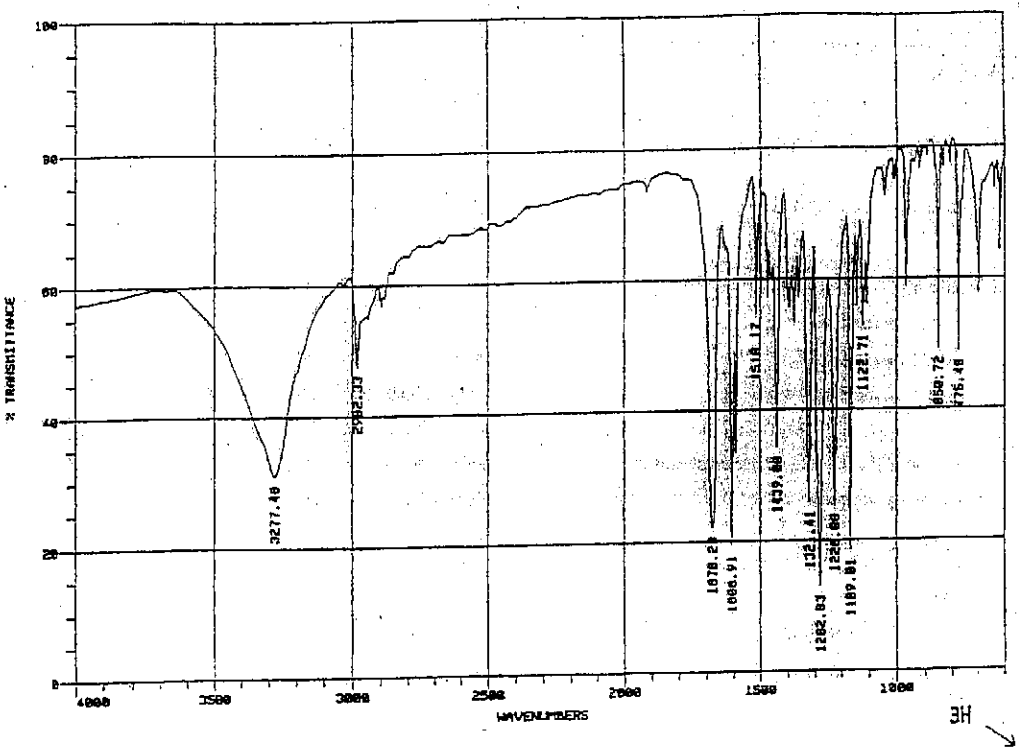


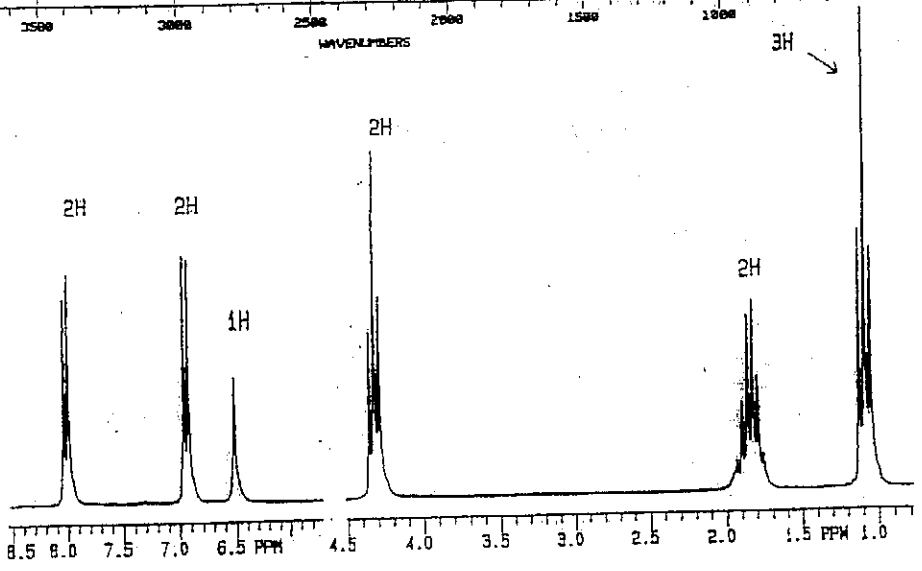
MP $C_{10}H_{12}O_3$

MW 180

%C 66.7

%H 6.7





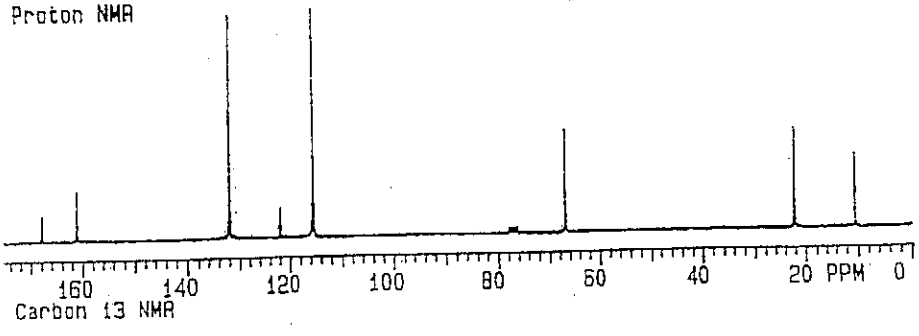


TABLE 13.2 Characteristic infrared absorptions of groups

GROUP		FREQUENCY RANGE (cm^{-1})	INTENSITY[a]
A. Alkyl			
C—H (stretching)		2853–2962	(m–s)
Isopropyl, $-CH(CH_3)_2$		1380–1385	(s)
	and	1365–1370	(s)
tert-Butyl, $-C(CH_3)_3$		1385–1395	(m)
	and	~1365	(s)
B. Alkenyl			
C—H (stretching)		3010–3095	(m)
C=C (stretching)		1620–1680	(v)
$R-CH=CH_2$ (out-of-plane C—H bendings)		985–1000	(s)
	and	905–920	(s)
$R_2C=CH_2$ (out-of-plane C—H bendings)		880–900	(s)
cis-RCH=CHR (out-of-plane C—H bendings)		675–730	(s)
trans-RCH=CHR (out-of-plane C—H bendings)		960–975	(s)
C. Alkynyl			
≡C—H (stretching)		~3300	(s)
C≡C (stretching)		2100–2260	(v)
D. Aromatic			
Ar—H (stretching)		~3030	(v)
Aromatic substitution type (C—H out-of-plane bendings)			
Monosubstituted		690–710	(very s)
	and	730–770	(very s)
o Disubstituted		735–770	(s)
m Disubstituted		680–725	(s)
	and	750–810	(very s)
p Disubstituted		800–840	(very s)
E. Alcohols, Phenols, and Carboxylic Acids			
O—H (stretching)			
Alcohols, phenols (dilute solutions)		3590–3650	(sharp, v)
Alcohols, phenols (hydrogen bonded)		3200–3550	(broad, s)
Carboxylic acids (hydrogen bonded)		2500–3000	(broad, v)
F. Aldehydes, Ketones, Esters, and Carboxylic Acids			
C=O (stretching)		1630–1780	(s)
Aldehydes		1690–1740	(s)
Ketones		1680–1750	(s)
Esters		1735–1750	(s)
Carboxylic acids		1710–1780	(s)
Amides		1630–1690	(s)
G. Amines			
N—H		3300–3500	(m)
H. Nitriles			
C≡N		2220–2260	(m)

[a] Abbreviations: s = strong, m = medium, w = weak, v = variable, ~ = approximately.