

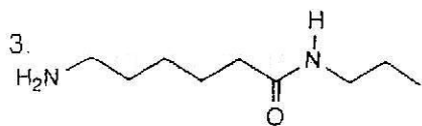
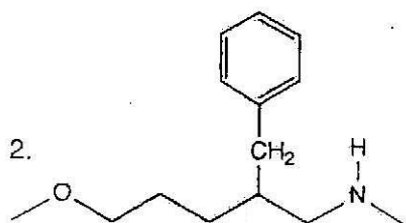
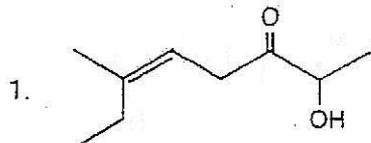
CHEM 3332 - Final EXAM (UH)

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

Bean-Cai-4

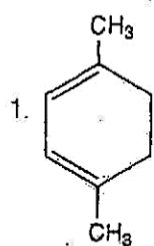
Give an acceptable name for each of the compounds below.

Chem 3332

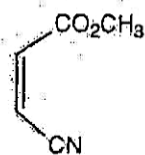


B. Reactions: Total = 40 points, 8 points each

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.



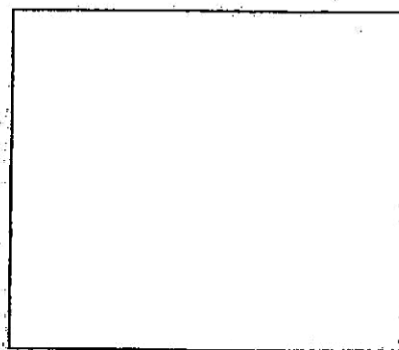
+



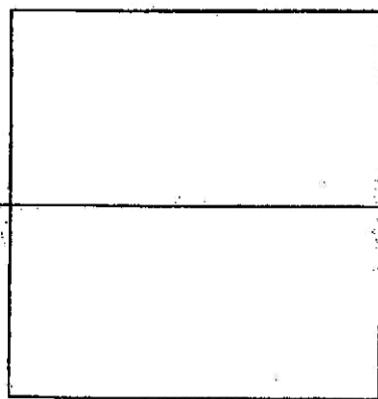
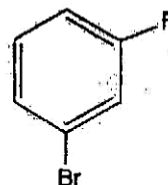
1. Heat

2. LiAlH_4 (xs)

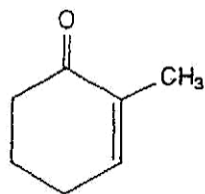
3. H_2O



2.



3.



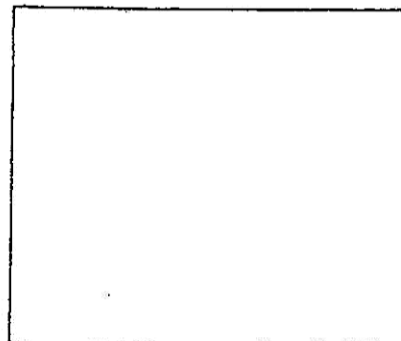
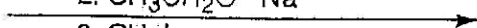
1. MCPBA

2. $\text{CH}_3\text{CH}_2\text{O}^- \text{Na}^+$

3. CH_3I

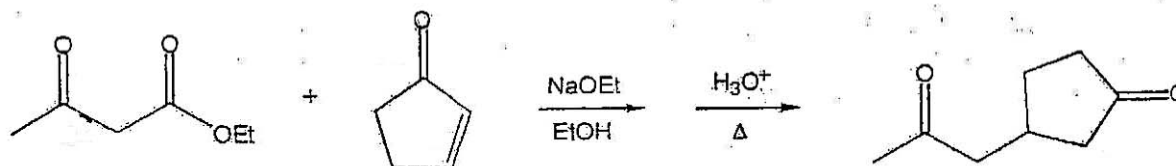
4. NaCN / H^+

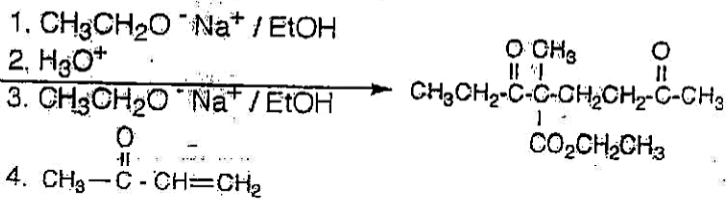
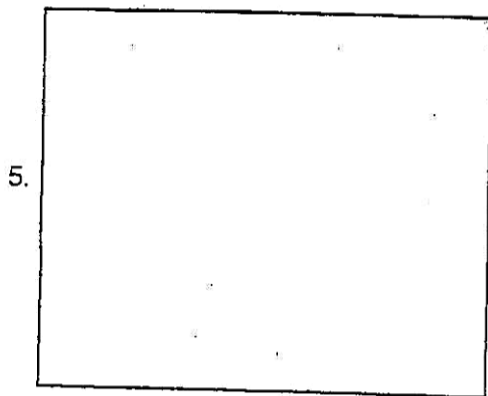
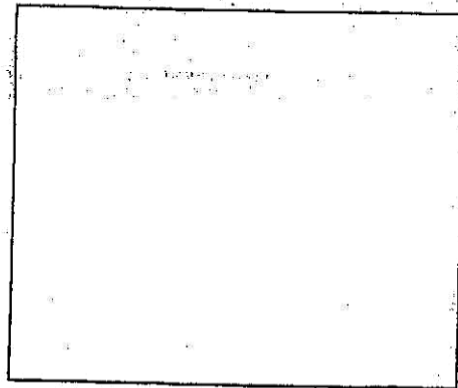
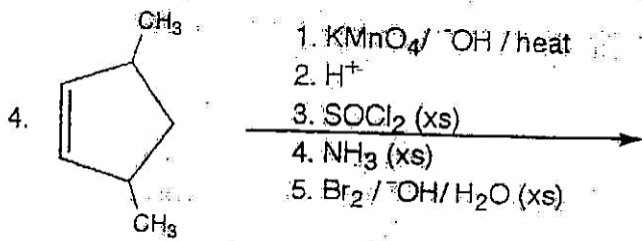
5. $\text{H}_3\text{O}^+ / \text{heat}$



C. Mechanism: (18 points)

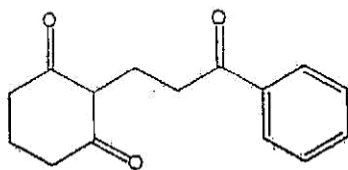
Provide reasonable mechanisms for the reaction below. Use curved arrows to indicate "electron flow". Show all intermediates and all formal charges. If there is more than one resonance structure, you must show the "best" (i.e., lowest energy) structure.





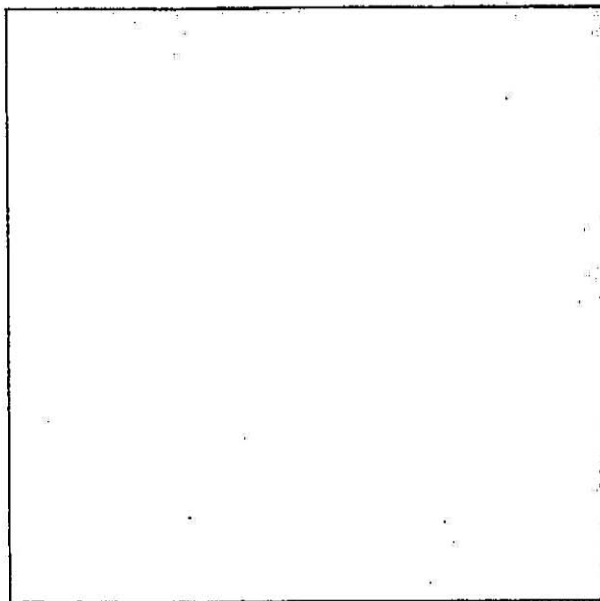
D. Synthesis: (18 points)

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.



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.

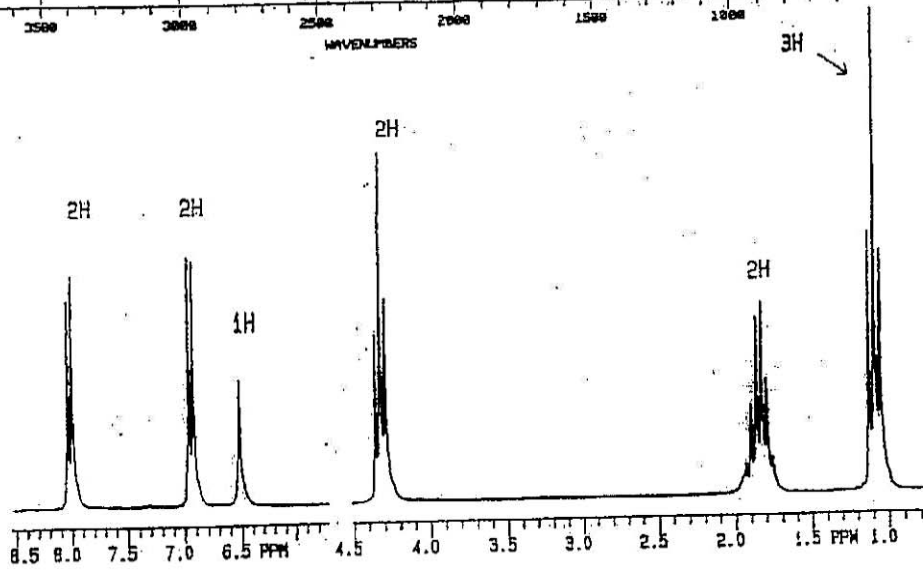
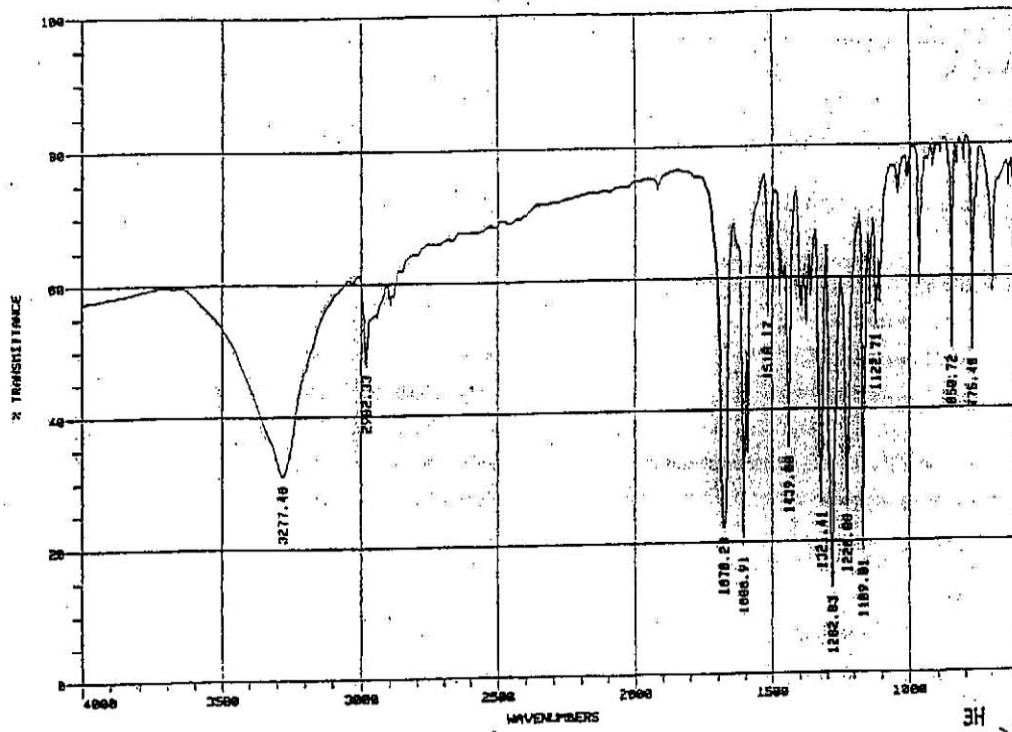


MP C₁₀H₁₂O₃

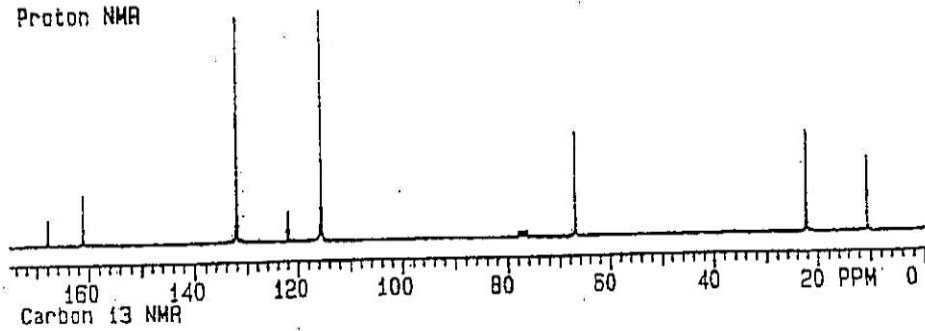
MW 180

%C 66.7

%H 6.7



Proton NMR



Carbon 13 NMR



TABLE 13.2 Characteristic infrared absorptions of groups

GROUP	FREQUENCY RANGE (cm ⁻¹)	INTENSITY*
A. Alkyl		
C—H (stretching)	2853–2962	(m–s)
Isopropyl, —CH(CH ₃) ₂	1380–1385	(s)
	and 1365–1370	(s)
<i>tert</i> -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	985–1000	(s)
	and 905–920	(s)
R ₂ C=CH ₂	880–900	(s)
<i>cis</i> -RCH=CHR	675–730	(s)
<i>trans</i> -RCH=CHR	960–975	(s)
	(out-of-plane C—H bendings)	
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)
<i>o</i> Disubstituted	735–770	(s)
<i>m</i> Disubstituted	680–725	(s)
	and 750–810	(very s)
<i>p</i> 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)

* Abbreviations: s = strong, m = medium, w = weak, v = variable, ~ = approximately.