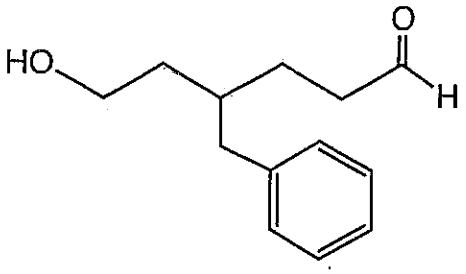
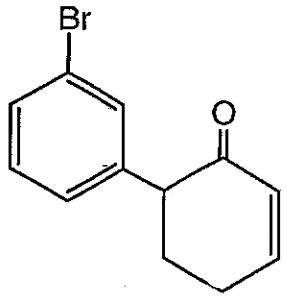
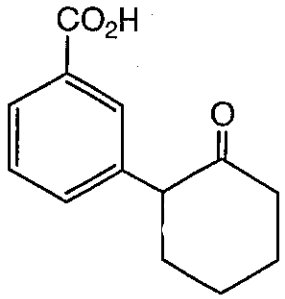
Exam 2, Sp 2019

A. Nomenclature: (12 points)
Give an acceptable name for each of the following compounds. Be sure to indicate the **stereochemistry** where appropriate.

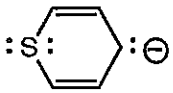
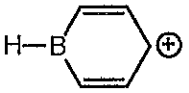
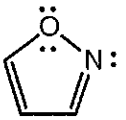
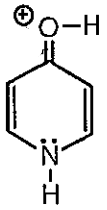
1. 

2. 

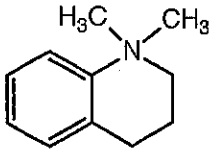
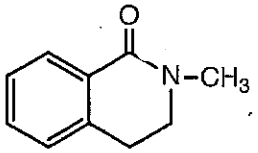
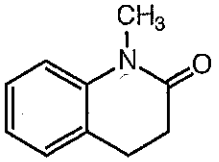
3. 

B. Facts: 20 points

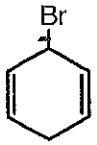
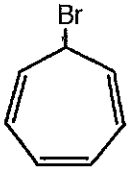
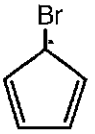
1. Label the molecules below as aromatic(AR), antiaromatic(AA), or nonaromatic(NA). Please assume all are planar. (8 pts.)

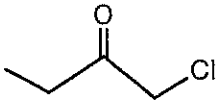
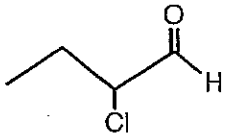
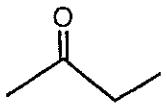
2. Rank the following substituted benzene compounds in order of increasing rate in an electrophilic aromatic substitution reaction. (1=slowest rate, 3=fastest rate) (3 pts.)

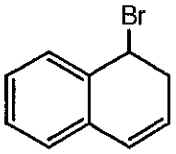
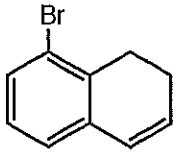
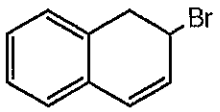
3. Rank the compounds in order of increasing reactivity in an SN1 process. (1= least reactive, 3=most reactive) (3 pts.)

4. Place the following compounds in order of increasing amount of hydrate present at equilibrium in their reactions with water. (1=least amount, 3=greatest amount) (3 pts.)

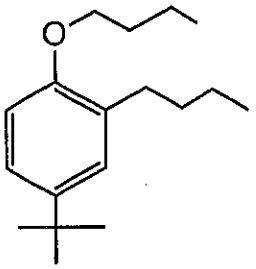




5. Rank the compounds in order of increasing reactivity in an SN2 process. (1= least reactive, 3=most reactive) (3 pts.)

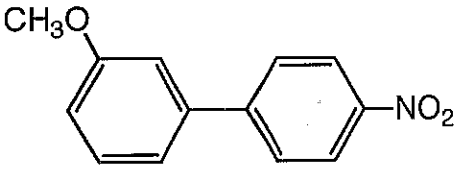
C. Reactions: Total = 36 points, 6 points each
Please provide the reagents or the major product in the answer box. Indicate **stereochemistry** if applicable. **Full credit is awarded only when the product of each step in a multi-step reaction is shown below the reaction.**

1.



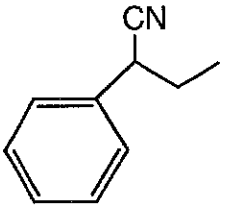
1. $Na_2Cr_2O_7$ / H_2SO_4 / 100°C
2. $SOCl_2$
3. $\left(\text{C}_6\text{H}_5\text{CH}_2\right)_2\text{CuLi}$

2.



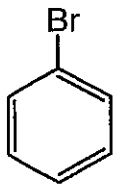
1. HNO_3 / H_2SO_4
2. fuming H_2SO_4

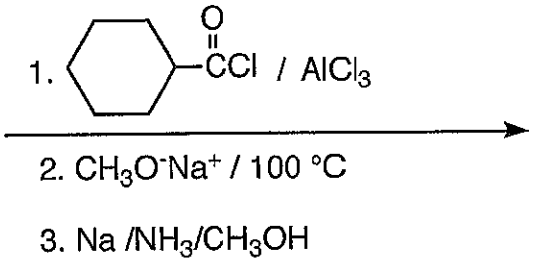
3.

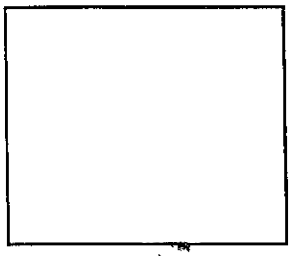


1. CH_3CH_2MgBr
2. H_3O^+
3. $\text{C}_6\text{H}_5\text{CH}{=}\text{P}(\text{C}_6\text{H}_5)_3$

4.

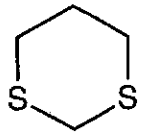

Br

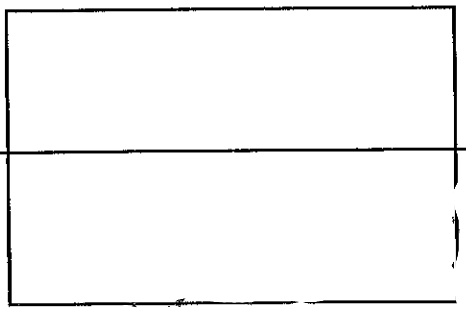

1.
O
CCl / AlCl3
2. CH3O-Na+ / 100 °C
3. Na /NH3/CH3OH

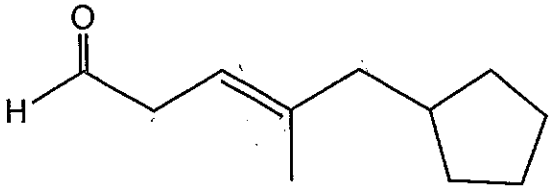


2 pts

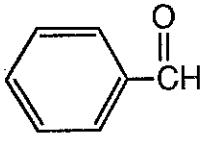
5.

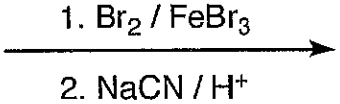

S
S

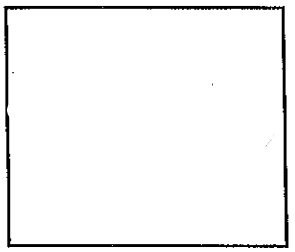



O
H

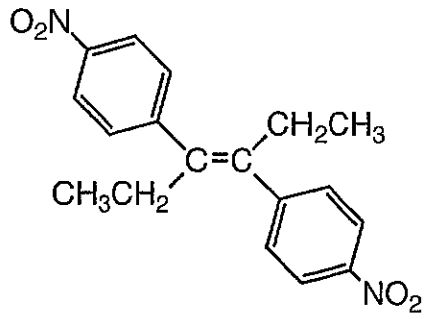
6.


O
CH

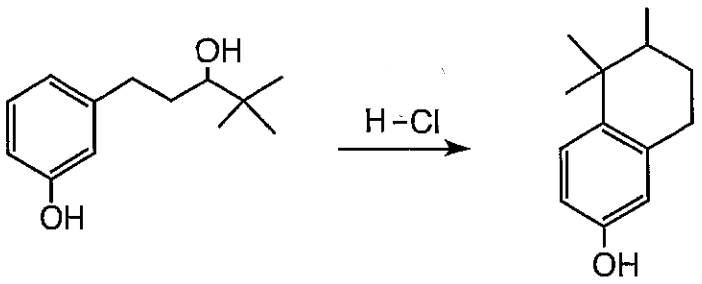

1. Br2 / FeBr3
2. NaCN / H+



E. Synthesis: 11 Points
Synthesize the molecule below using **benzene**, **alcohols of three carbons or less**, any inorganic reagents, and any oxidizing or reducing agents. The stereochemistry of the alkene may be ignored.

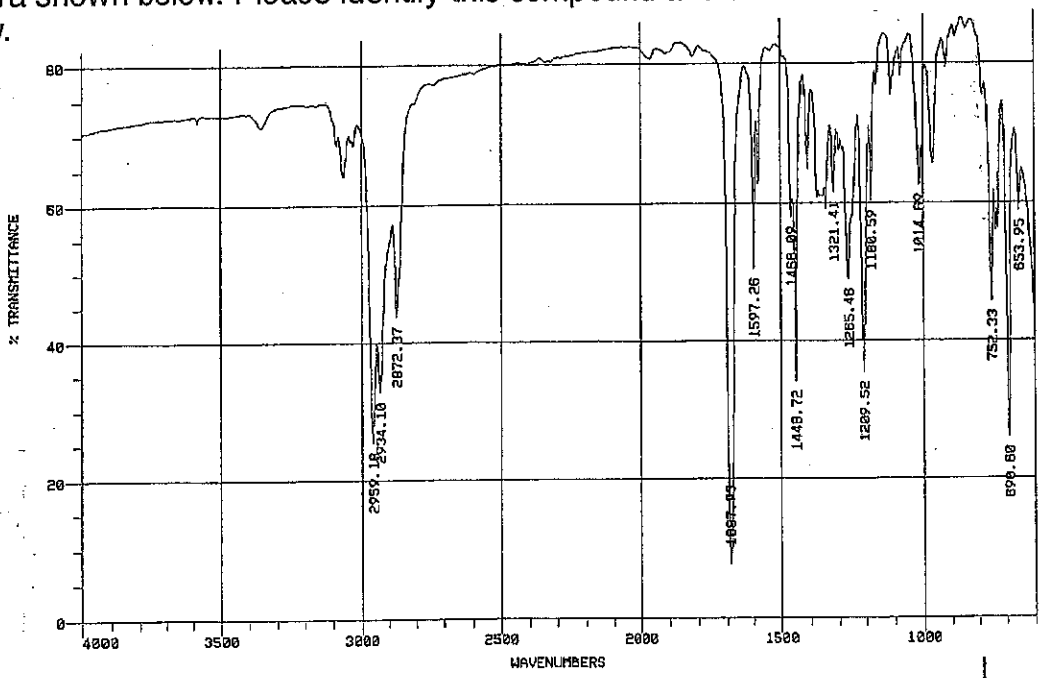


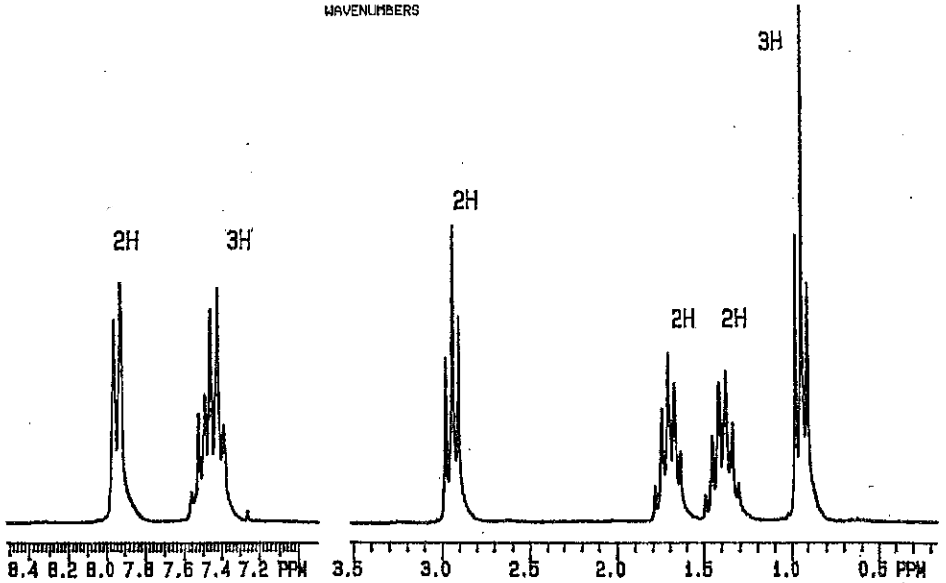
D. Mechanism: (11 points)
Provide a clear mechanism to explain the formation of the product. Use curved arrows to indicate "electron flow". **Show all intermediates and all formal charges. When more than one resonance contributor may be drawn, be sure to draw the most stable contributor.**



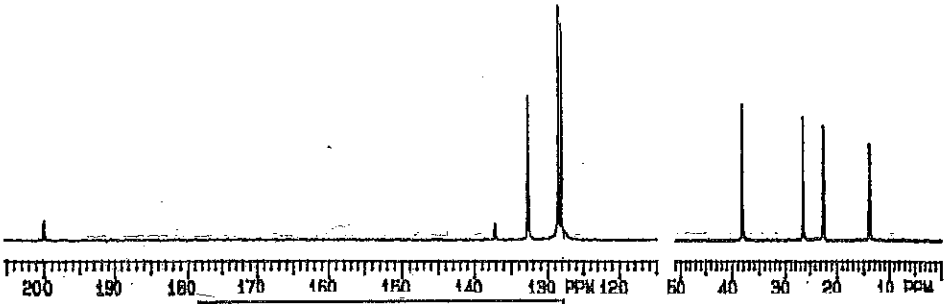
F. Spectroscopy: 10 Points

A compound with the formula $C_{11}H_{14}O$ exhibits the IR, ^{1}H NMR and proton decoupled ^{13}C NMR spectra shown below. Please identify this compound and draw the structure in the box provided below.





Proton NMR



Carbon 13 NMR