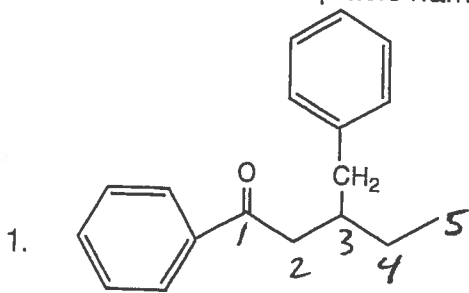
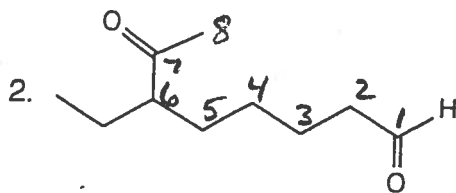


A. Nomenclature (3 points each, 9 total points)

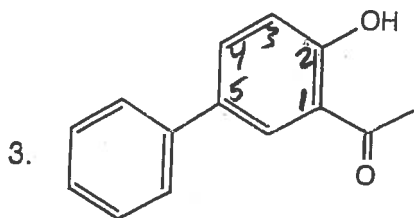
Please provide an acceptable name for each of the following compounds.



3-benzyl-1-phenyl-1-pentanol



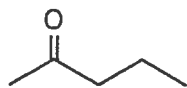
6-ethyl-7-octanal



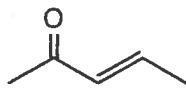
2-hydroxy-5-phenylacetophenone

**B. Facts** (3 points each, 18 total points)

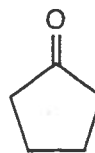
1. Place the following compounds in order of increasing frequency ( $\text{cm}^{-1}$ ) of the C=O stretch. (1=lowest frequency, 3=highest frequency)



2

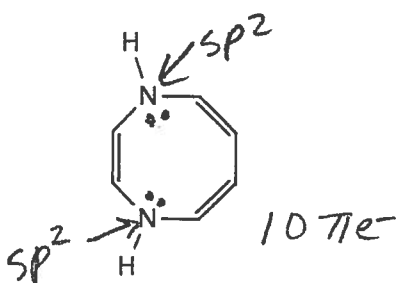


1

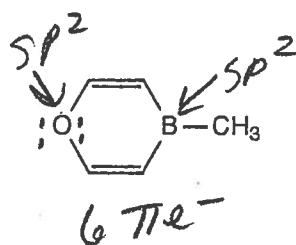


3

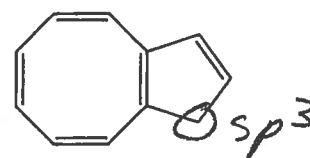
2. Label the compounds below as aromatic, nonaromatic, or antiaromatic. (Assume all are planar.)



aromatic

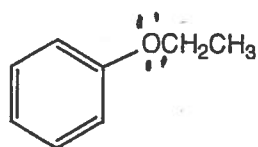


aromatic

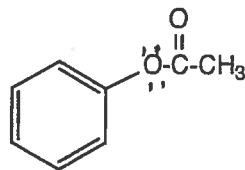


nonaromatic

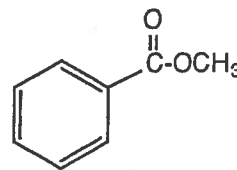
3. Place the following compounds in order of increasing reactivity in an electrophilic aromatic substitution reaction. (1=least reactive, 3=most reactive)



3



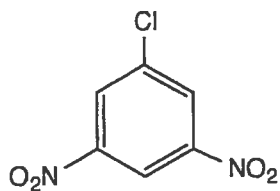
2



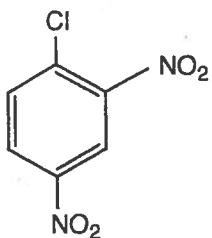
1



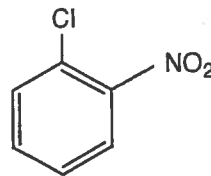
4. Place the following compounds in order of increasing reactivity in an nucleophilic aromatic substitution reaction with hydroxide. (1=least reactive, 3=most reactive)



1

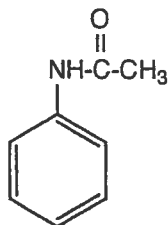


3

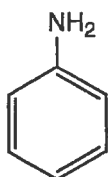


2

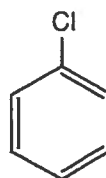
5. Place the following compounds in order of increasing rate of product formation by Friedel-Crafts acylation. (1=slowest, 3=fastest)



3

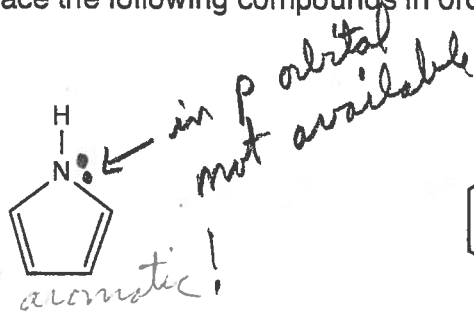


1

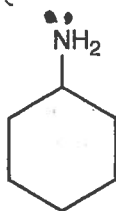


2

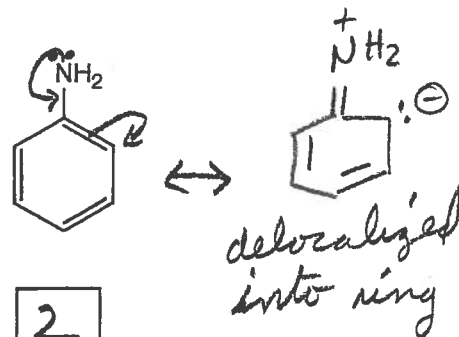
6. Place the following compounds in order of increasing basicity. (1=least basic, 3=most basic)



1



3



2

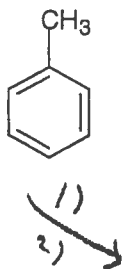


5

C. Reactions (6 points each; 30 points total)

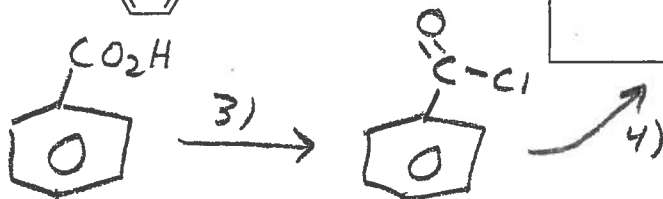
Please provide the major product, or necessary reagents, or starting material in the box provided below. Be sure your drawing indicates stereochemistry if applicable.

1.



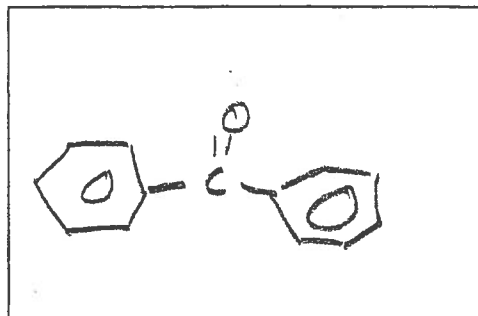
1.  $\text{KMnO}_4$ ,  $\text{HO}^-$ ,  $\text{H}_2\text{O}$ ,  $\Delta$   
 2.  $\text{H}_3\text{O}^+$   
 3.  $\text{SOCl}_2$

4. ,  $\text{AlCl}_3$

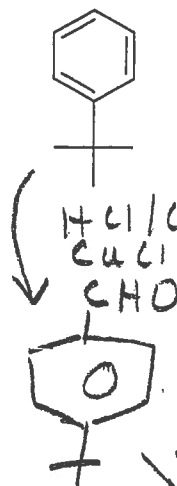


2 pts

2 pts

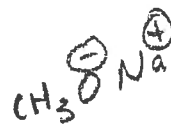
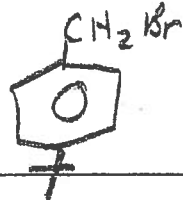
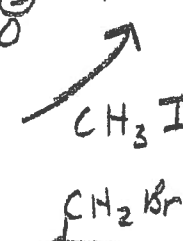
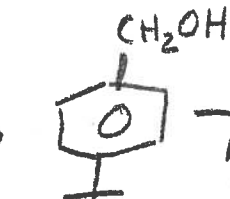
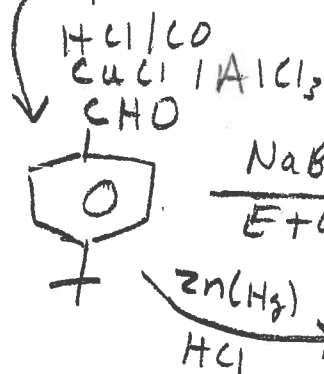


2.

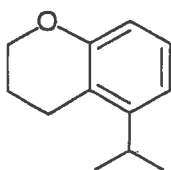


2 pts 1)  $\text{HCl}/\text{CO}/\text{AlCl}_3/\text{CuCl}$   
 1 pt 2)  $\text{NaBH}_4/\text{EtOH}$   
 1 pt 3)  $\text{Na}$   
 1 pt 4)  $\text{CH}_3\text{I}$

OR 2 pts 1) SAME  
 1 pt 2)  $\text{Zn}(\text{Hg})/\text{HCl}$   
 1 pt 3)  $\text{NBS}/\text{Br}_2/h\nu$   
 1 pt 4)  $\text{CH}_3\text{O}^- \text{Na}^+$

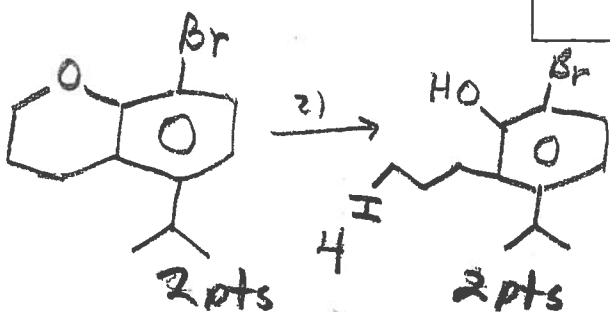


3.



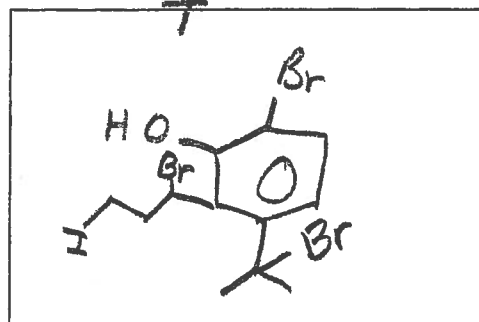
1.  $\text{Br}_2$ ,  $\text{FeBr}_3$   
 2.  $\text{HI}$  (excess)

3.  $\text{NBS}$  (excess),  $h\nu$



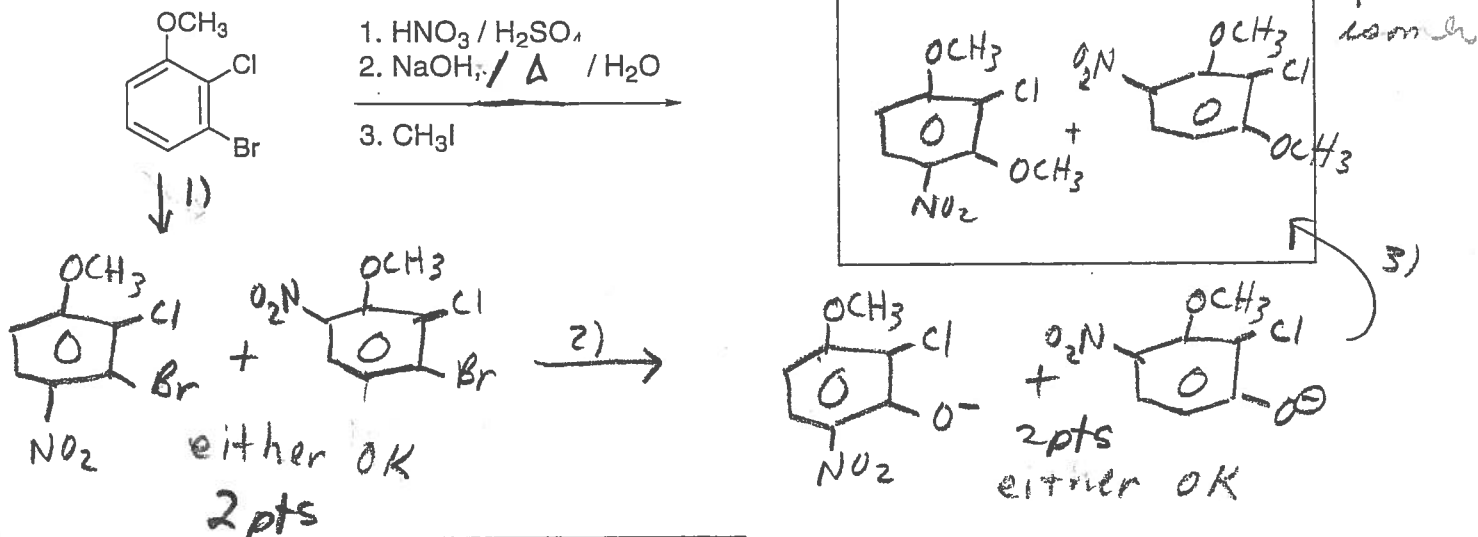
2 pts

2 pts

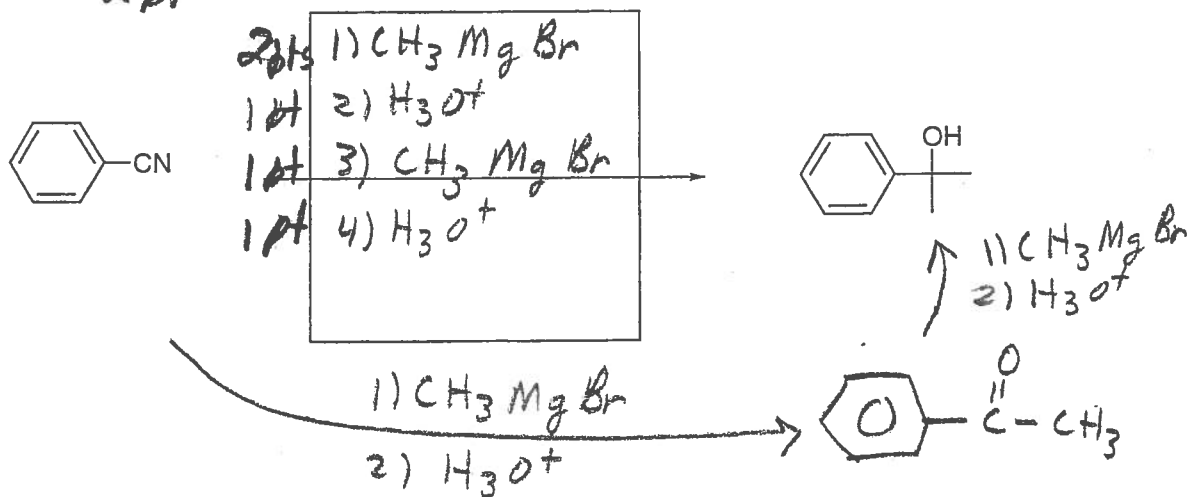


Rxns (continued)

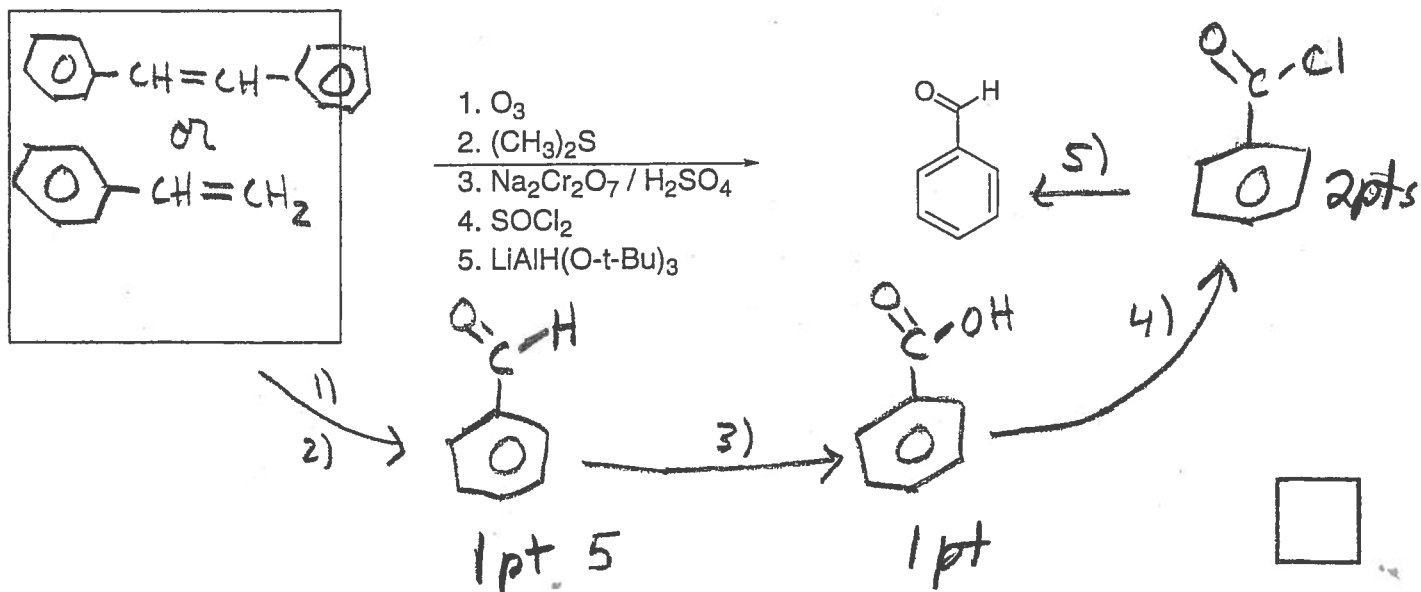
4.



5.



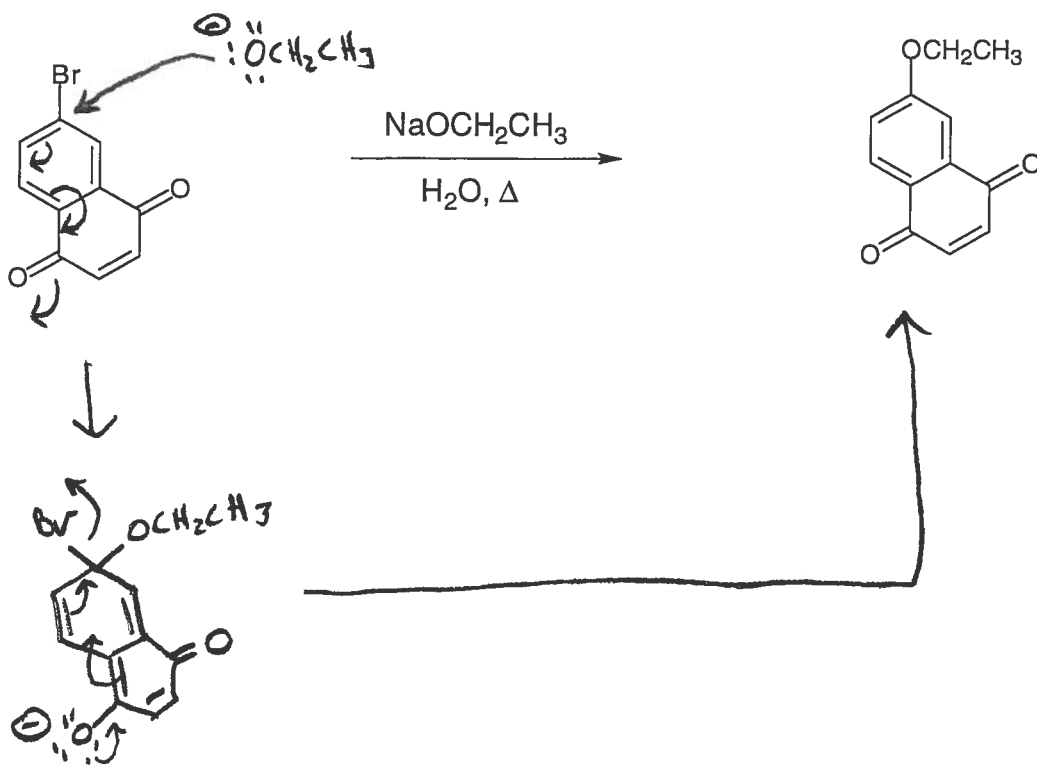
6.



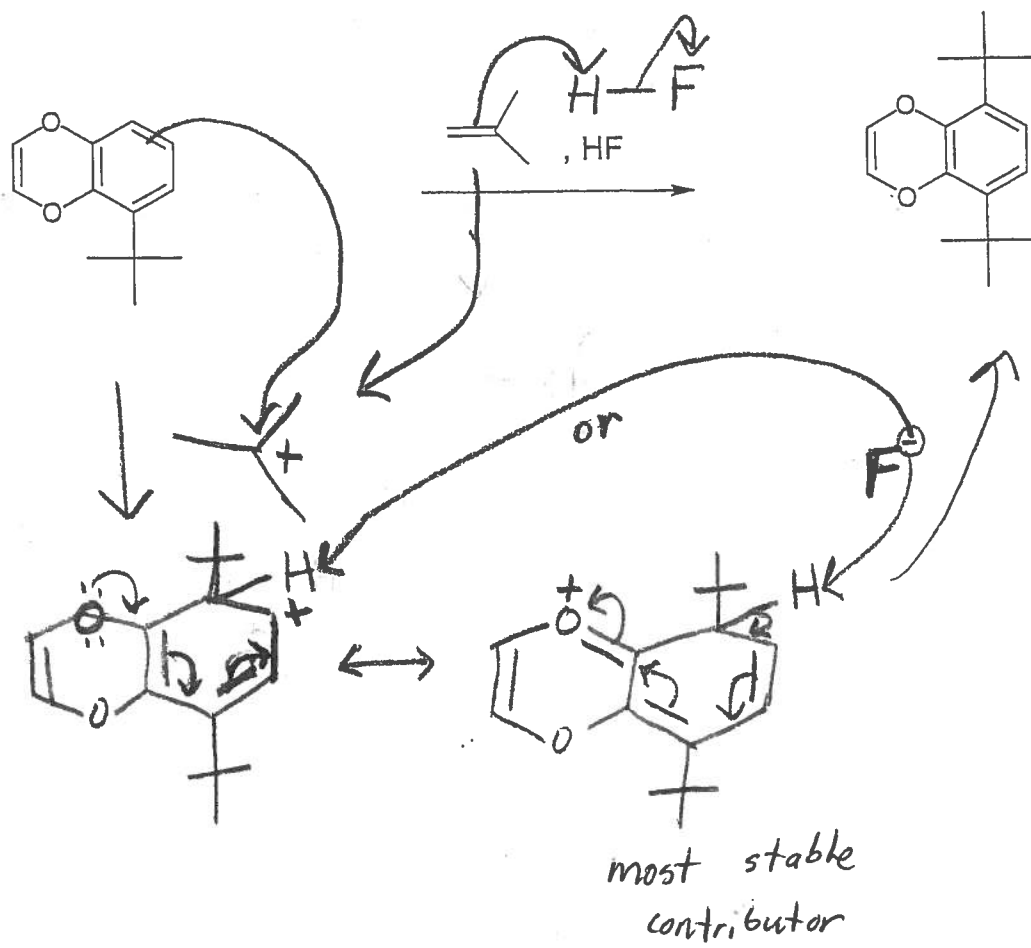
**D. Mechanisms:** (9 points each)

Provide reasonable mechanisms for reactions 1 and 2. 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.

1.

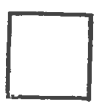
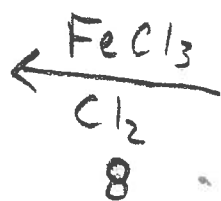
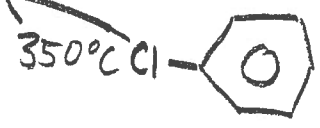
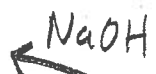
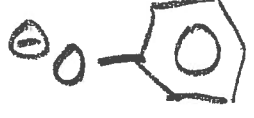
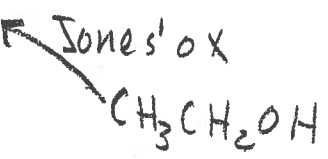
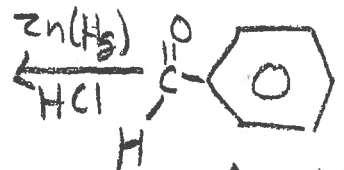
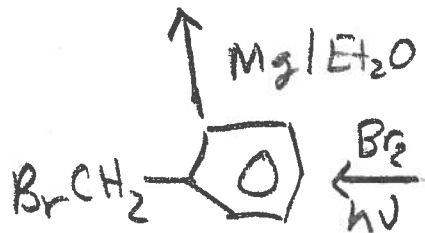
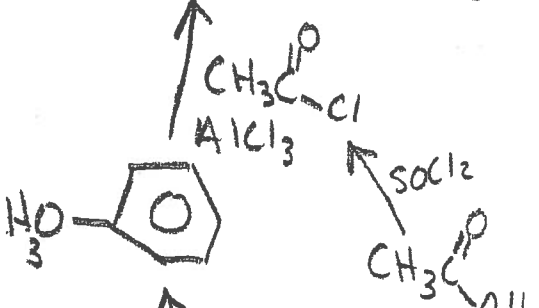
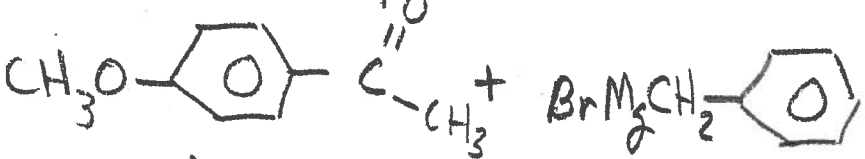
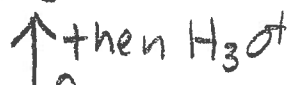
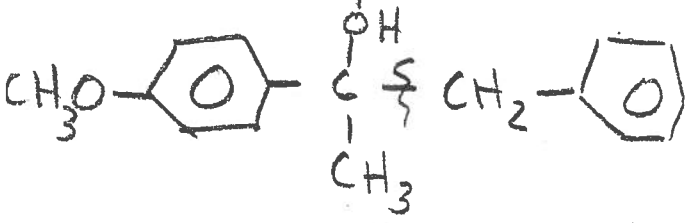
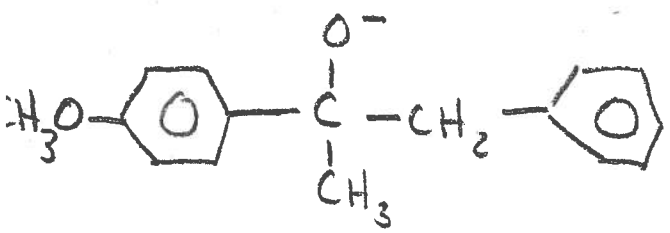
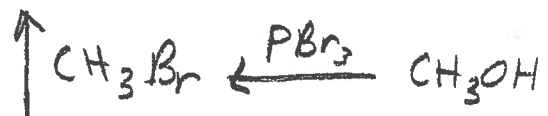
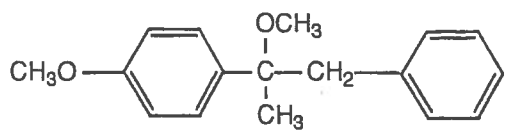


2.



**E. Synthesis:** (15 points)

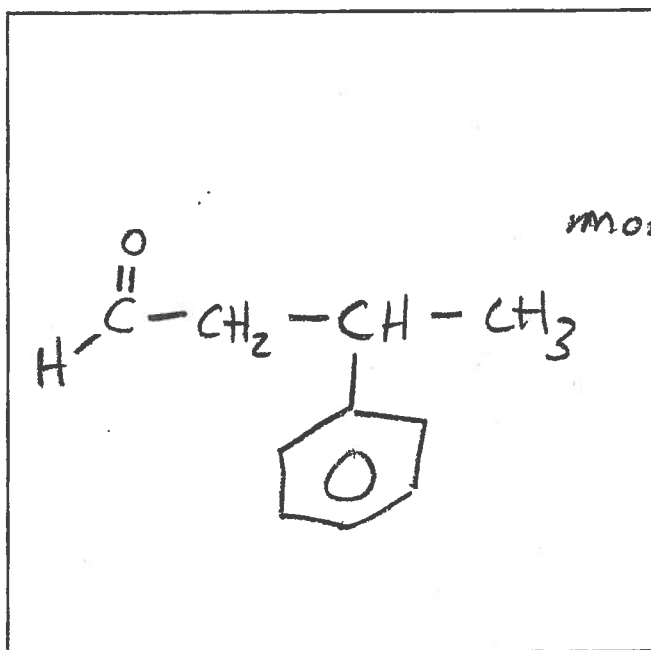
Synthesize the compound below using any of the following reagents: alkanes, alkenes, alkynes or alcohols of **two carbons or less**; benzene; any oxidizing or reducing agents; and any peroxyacids.





F. Spectroscopy: 10 Points

A compound with the formula  $C_{10}H_{12}O$  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.



aldehyde - 3  
monobenzene ring - 2  
 $CH_3$  adj. to  $1H$  - 2

