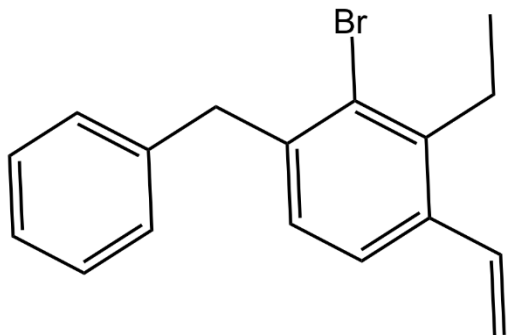


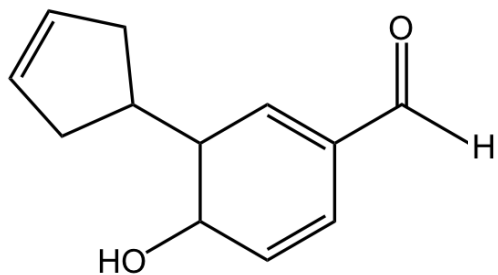
A. Nomenclature

Give an acceptable IUPAC name for each of the following compounds. Be sure to note **stereochemistry** where appropriate.

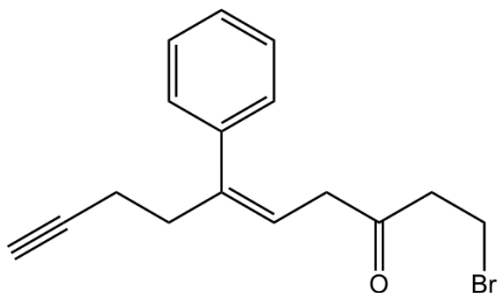
1.



2.

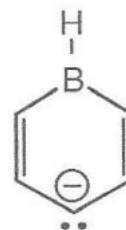
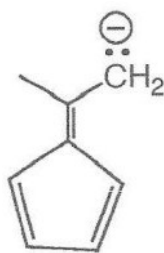
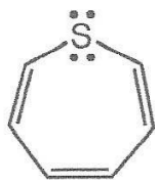


3.

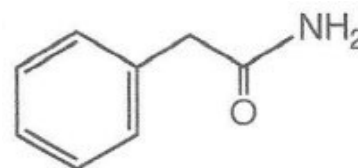
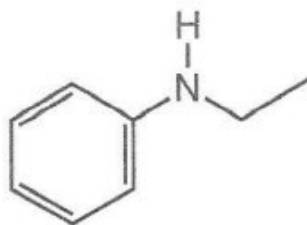
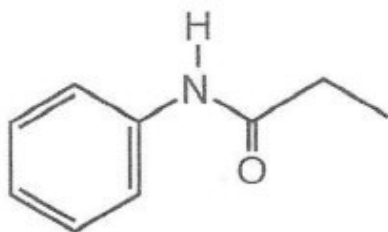


B. Facts

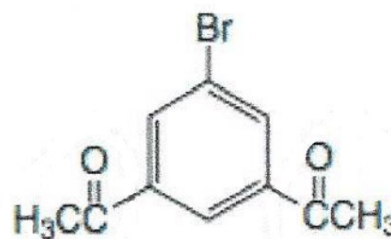
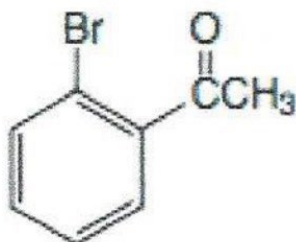
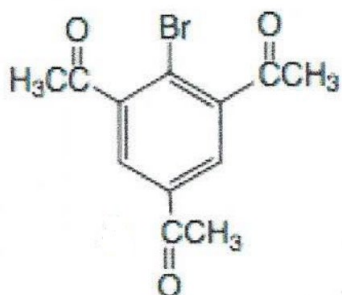
1. Label the molecules below as aromatic(**AR**), antiaromatic(**AA**), or nonaromatic(**NA**). Please assume all are planar.



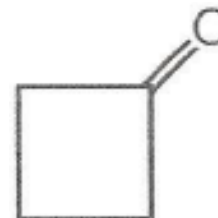
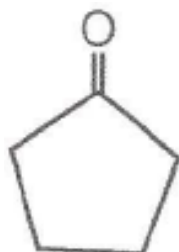
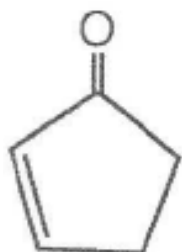
2. Rank the following substituted benzene compounds in order of increasing reaction rate with $\text{CH}_3\text{CH}_2\text{COCl}$ and AlCl_3 (1=slowest, 3=fastest)



3. Rank the following compounds in order of increasing reaction rate in a nucleophilic aromatic substitution reaction.

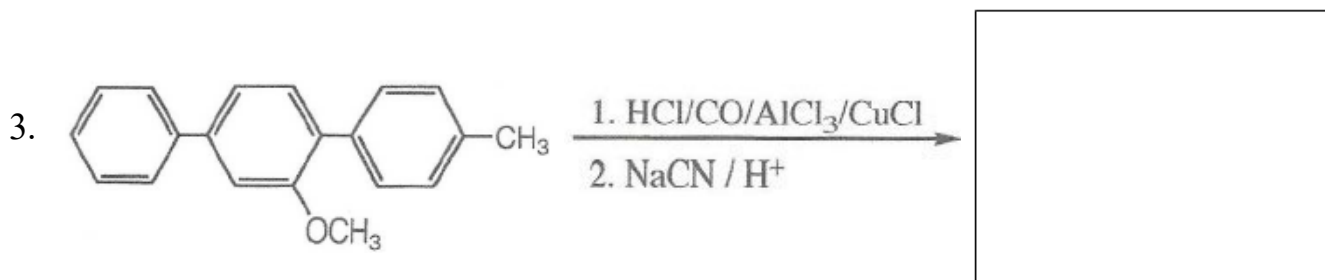
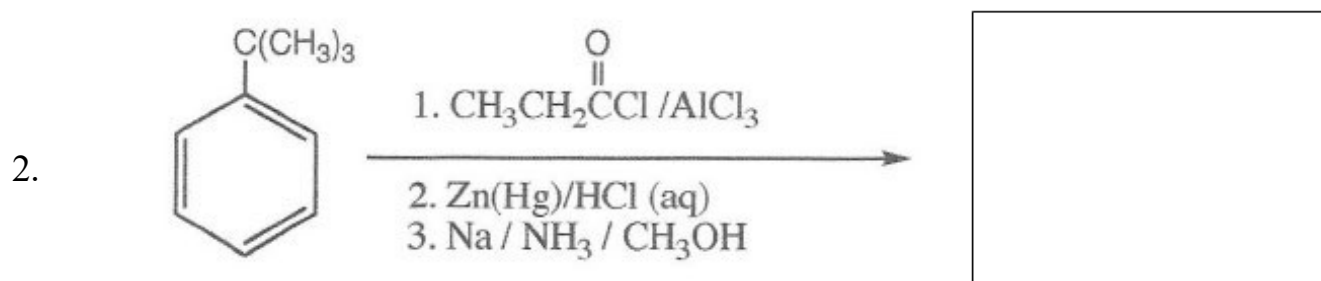
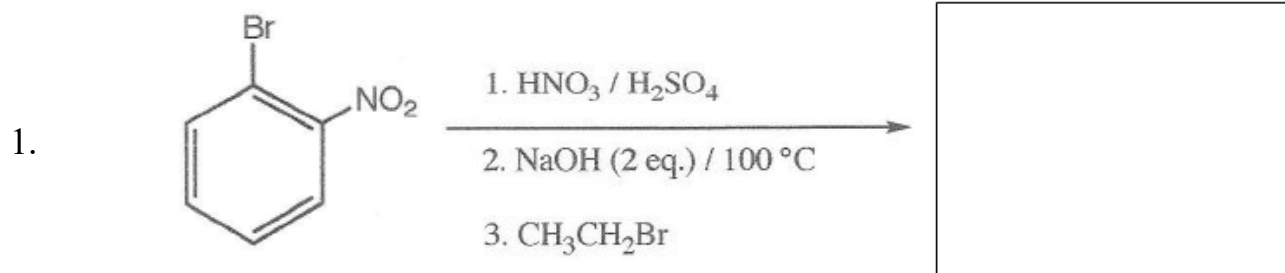


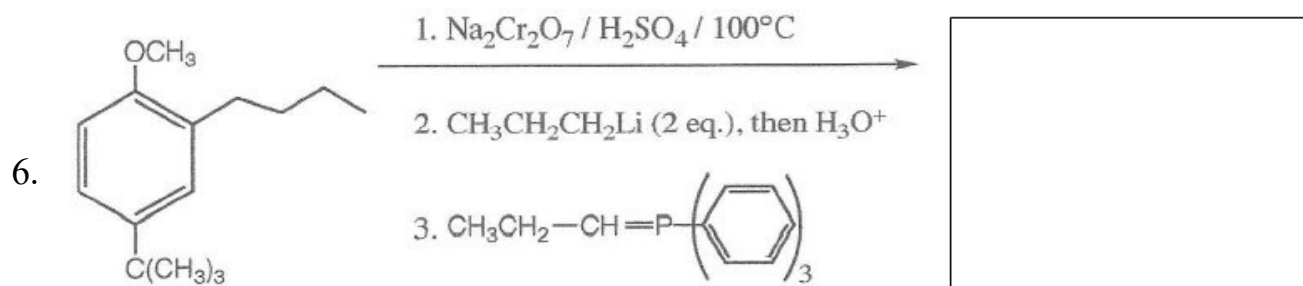
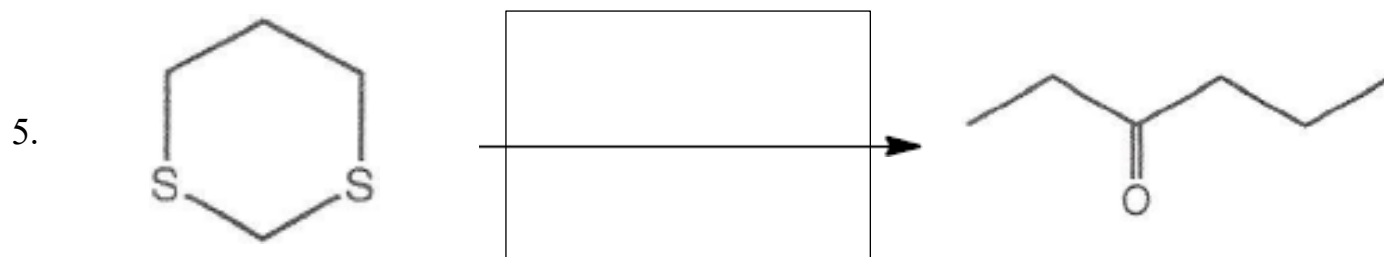
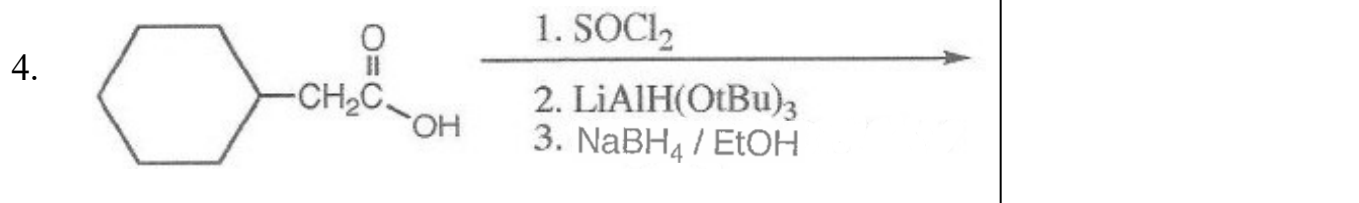
4. Rank the following compounds in order of increasing frequency of the $\text{C}=\text{O}$ stretch in its infrared spectrum. (1=lowest, 3=highest)



C. Reactions

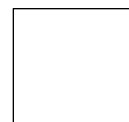
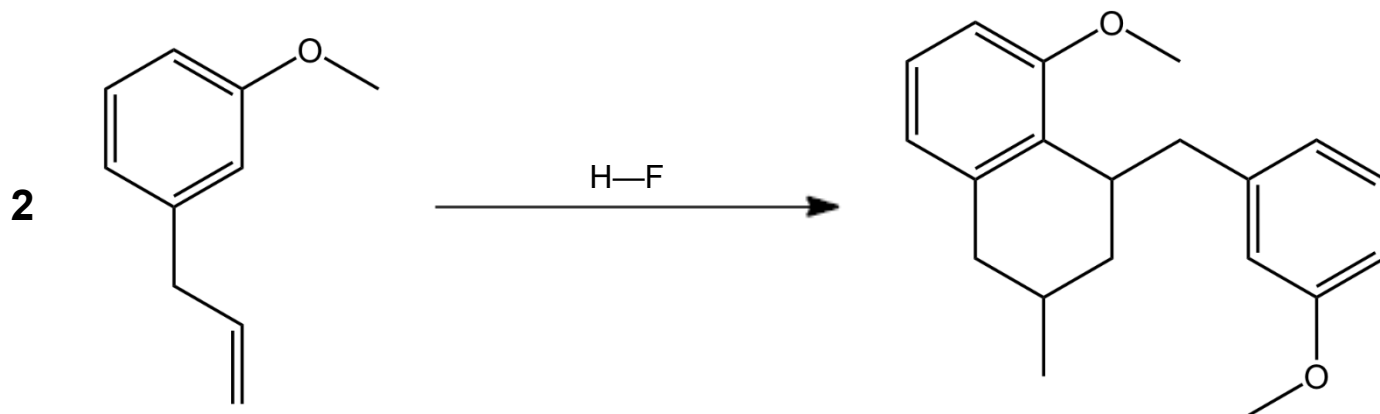
Please provide the reagents or the major products in the answer box. Indicate **stereochemistry** if applicable. **Full credit is awarded only when the product of each step in a multi-step reaction is shown below the reaction.**





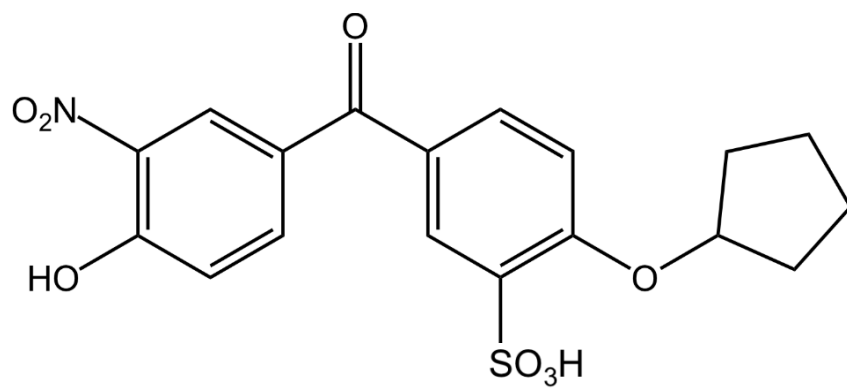
D. Mechanism:

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.



E. Synthesis:

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



F. Spectroscopy:

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

