

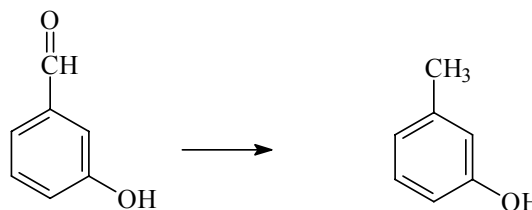
INTRODUCTORY ORGANIC CHEMISTRY II --- PROBLEM SET #2

DISTRIBUTED: Thurs. Nov. 15th. **COMPLETION DEADLINE: Thurs. Nov. 29th @ 10:15am.**

INSTRUCTIONS: Work through all problems thoroughly and write your organized final answers in the space provided. **Your written answers will be handed in;** however, only some questions will be graded. The solutions will be posted after the due date. Keep a photocopy of your assignment (but hand in the original) so you can check your work promptly in preparation for the final exam. You will need to use your textbook for reference - some details may not be explicitly covered in class.

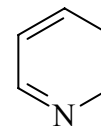
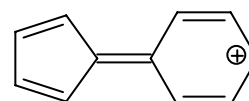
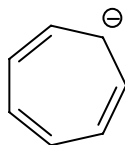
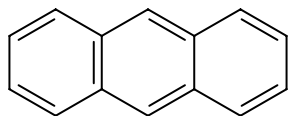
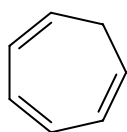
Problem #1 - Consider the following reaction:

- a) What reagents would you use to perform this transformation?

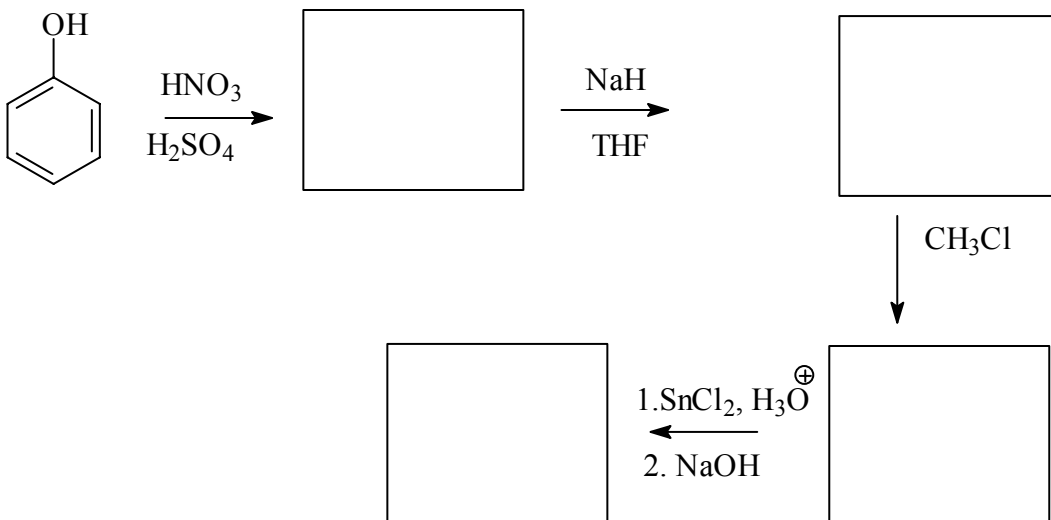
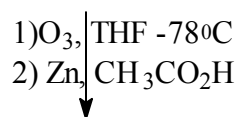
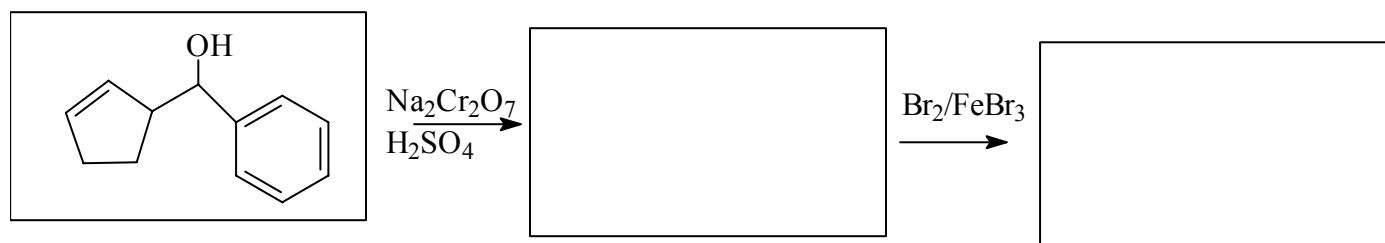
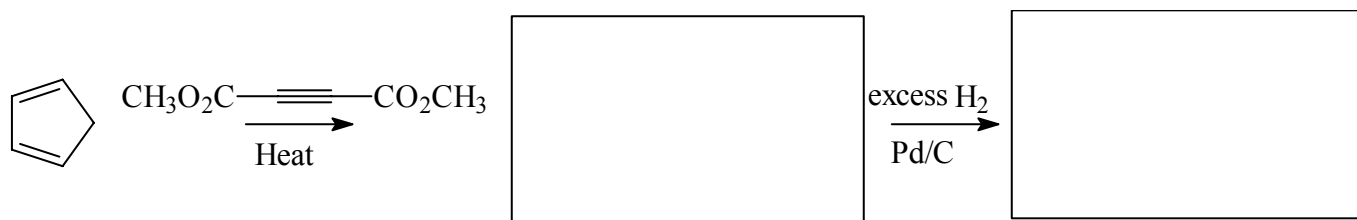


- b) Briefly outline how you could use both IR spectroscopy and NMR spectroscopy to determine whether the reaction had occurred.

Problem #2 - Which of the following molecules are aromatic? If not aromatic, state which part(s) of Hückel's rules is/are not followed.

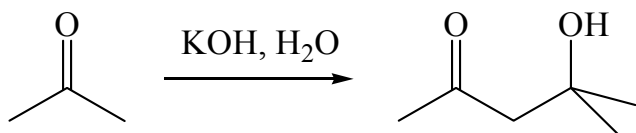


Problem #3 - Draw structures of the organic products expected in each of the following reactions.



Problem #4 - a) Consider acetone under acidic conditions: the O is protonated. Why does reaction with a nucleophile always occur at carbon rather than at the positive oxygen? (1-2 sentences max!).

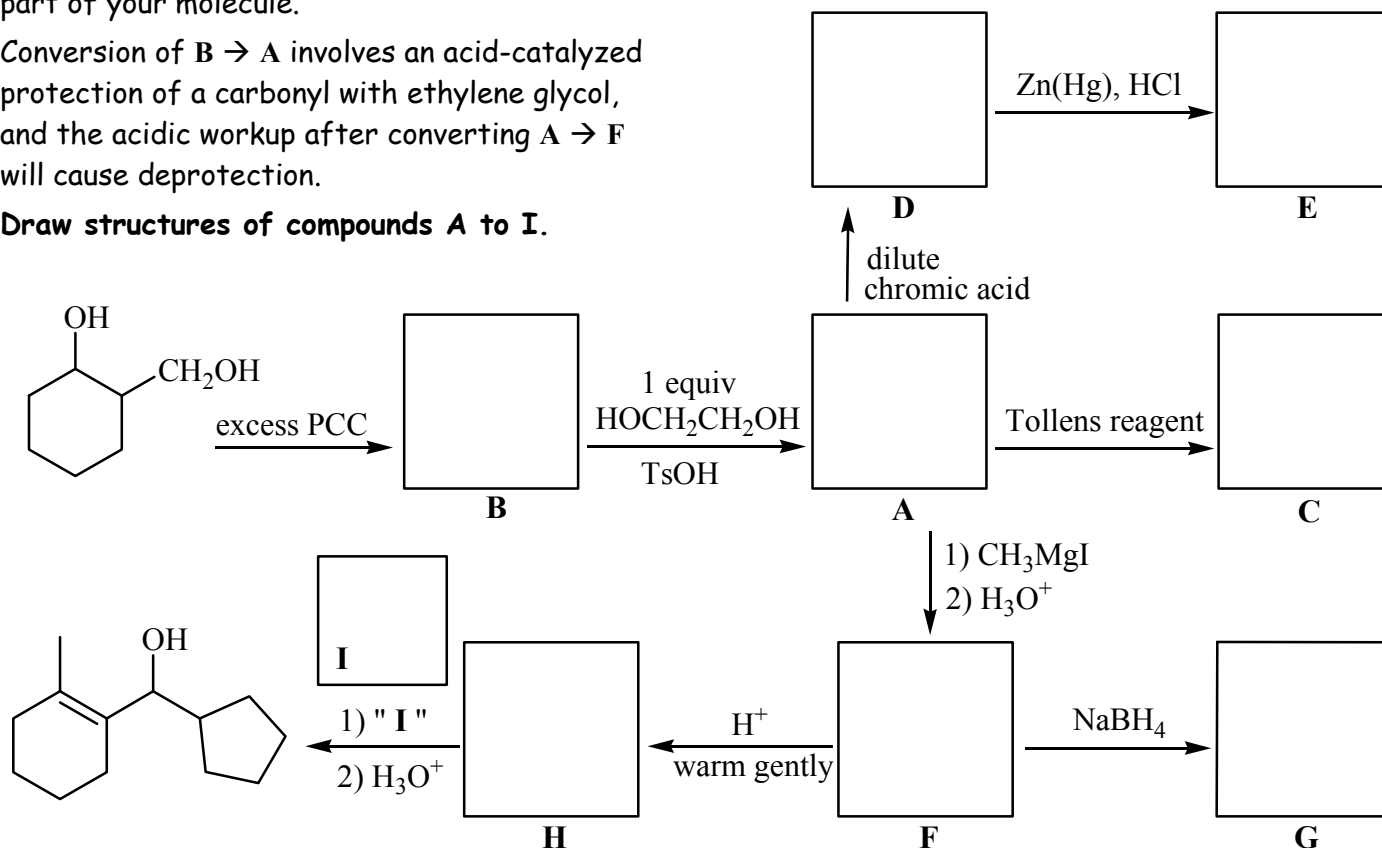
b) Consider acetone again, but this time under basic conditions. Write a full mechanism for the reaction shown (not the only reaction acetone can undergo under these conditions...).



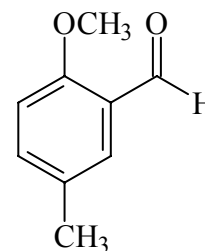
Problem #5 - Carbonyl groups can be temporarily protected by reacting them (reversibly) with a masking reagent to form an *acetal* or a *ketal*. The protecting group can be removed easily later on; *e.g.*, after performing a carbonyl-threatening reaction, such as using a Grignard to attack a *different* part of your molecule.

Conversion of B → A involves an acid-catalyzed protection of a carbonyl with ethylene glycol, and the acidic workup after converting A → F will cause deprotection.

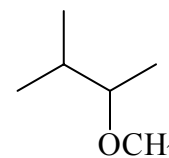
Draw structures of compounds A to I.



Problem #6a - Outline a sequence of reactions to synthesize the compound shown. Indicate the reagents and reaction conditions for each step. You can use benzene and any reagent with a maximum of 1 carbon atom and 1 functional group.
Hint: look in the textbook for conditions required for making benzaldehyde



Problem #6b - Outline a sequence of reactions to synthesize the compound shown. Indicate the reagents and reaction conditions for each step. You can use any reagent with a maximum of 1 carbon atom and 1 functional group.



Problem #7 - An unknown compound gives a molecular ion of m/z 70 in the mass spectrum. It reacts with semicarbazide hydrochloride (PhNHNH_3Cl) to give a crystalline derivative, but it gives a negative Tollens test. The NMR and IR spectra follow. Propose a structure for this compound, and summarize the information learned from each piece of data in the table provided. Briefly explain why the signal at 1790 cm^{-1} appears at an unusual frequency.

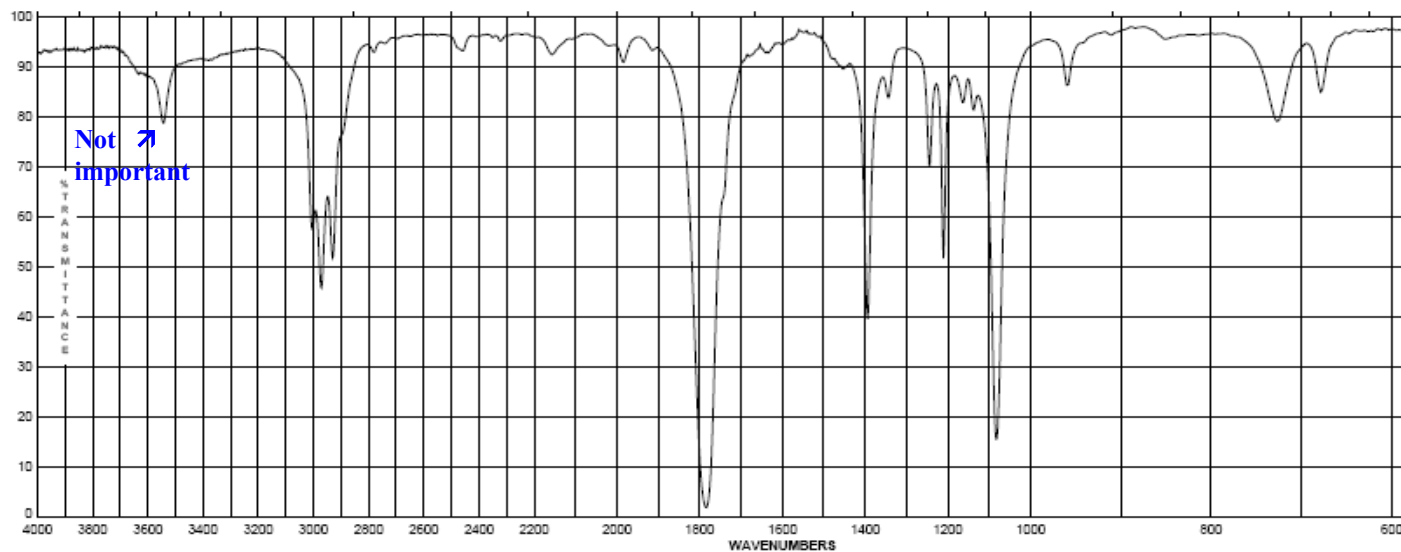
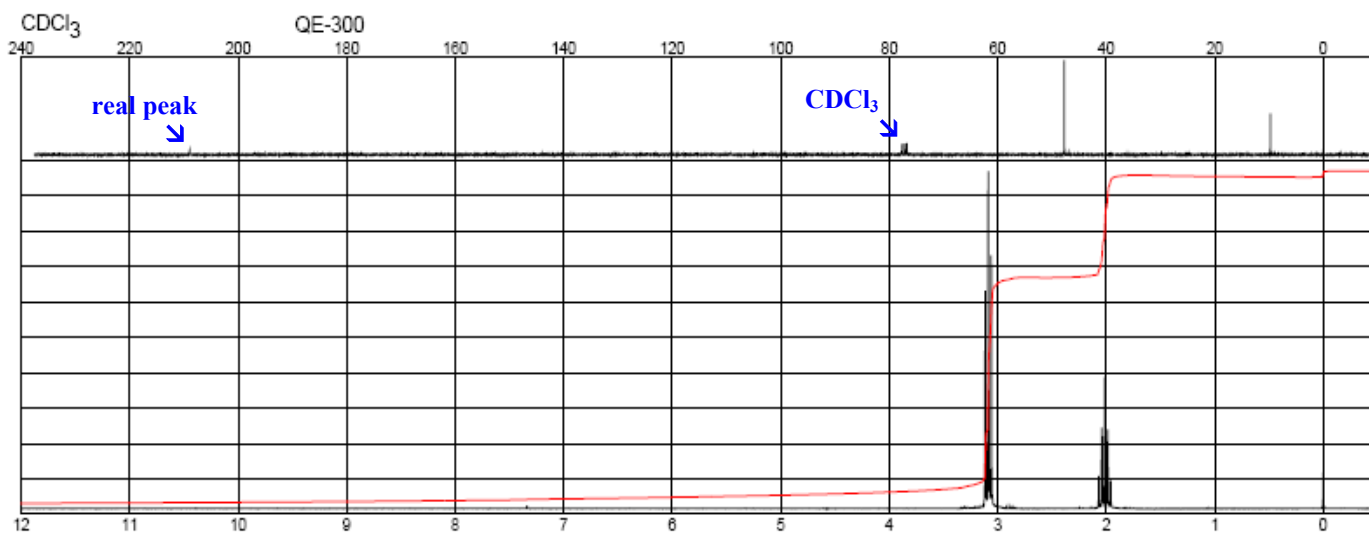
Reactivity data	Mass spectral data	IR data	^{13}C NMR data

^1H NMR data

Proposed structure	& Explanation for unusual frequency of IR peak at 1790 cm^{-1}

Spectral data for Problem #7

IR spectrum:

NMR spectra (top spectrum ¹³C: δ 77ppm = solvent, CDCl₃; bottom spectrum ¹H):Expansion of ¹H NMR multiplets: