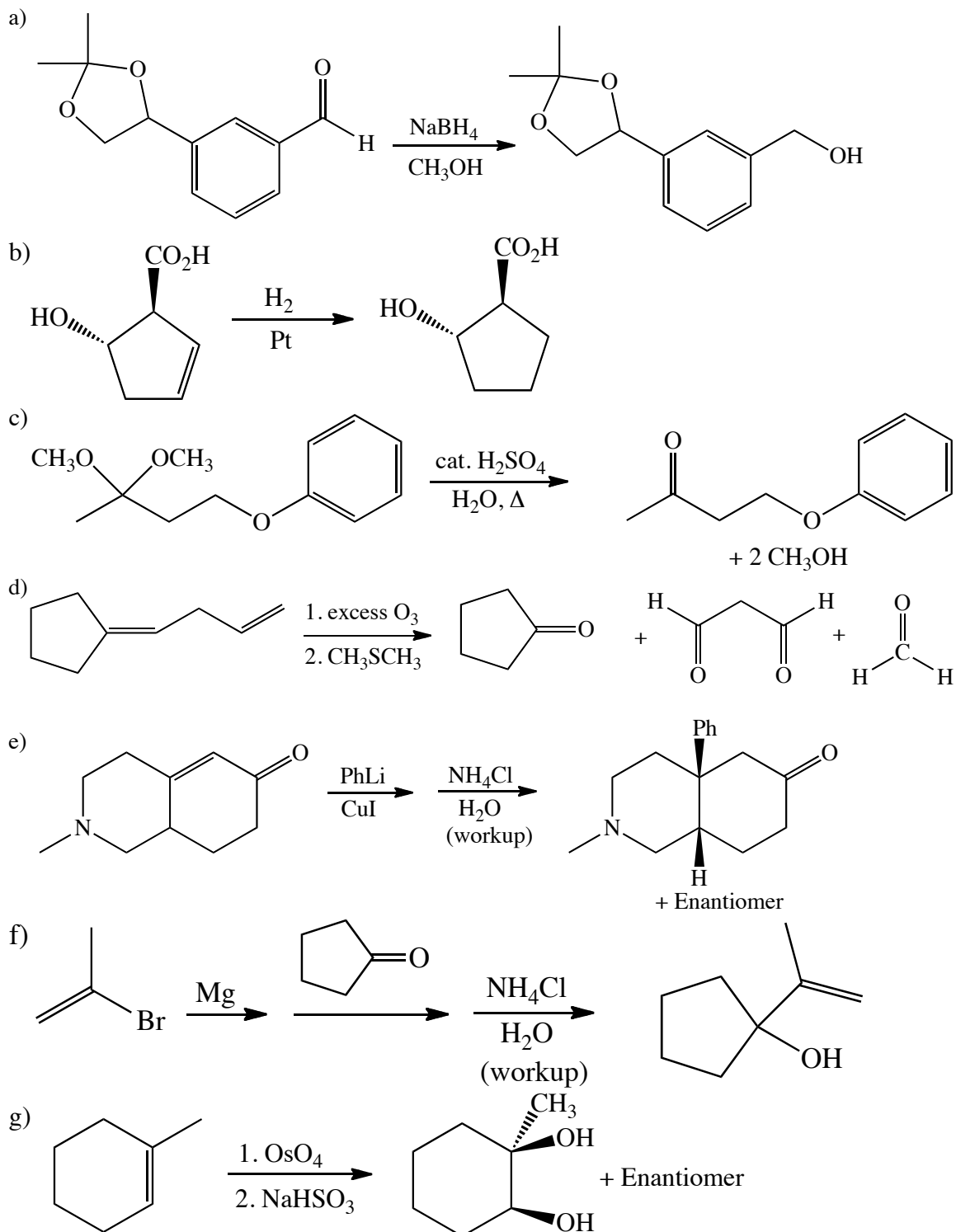


Chemistry 250 -- Exam #4 Answer Key -- December 8, 2009

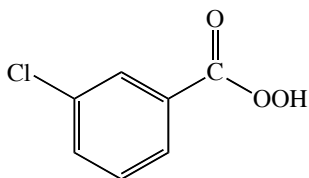
There are 6 pages.

1. (21 pts) Complete the following reactions. Show the stereochemistry of the products where appropriate. Label major and minor products where appropriate. (They all react!)

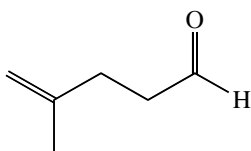


2. (7 pts) Draw structures for the following compounds:

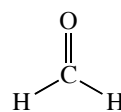
a) MCPBA



b) 4-methyl-4-pentenal

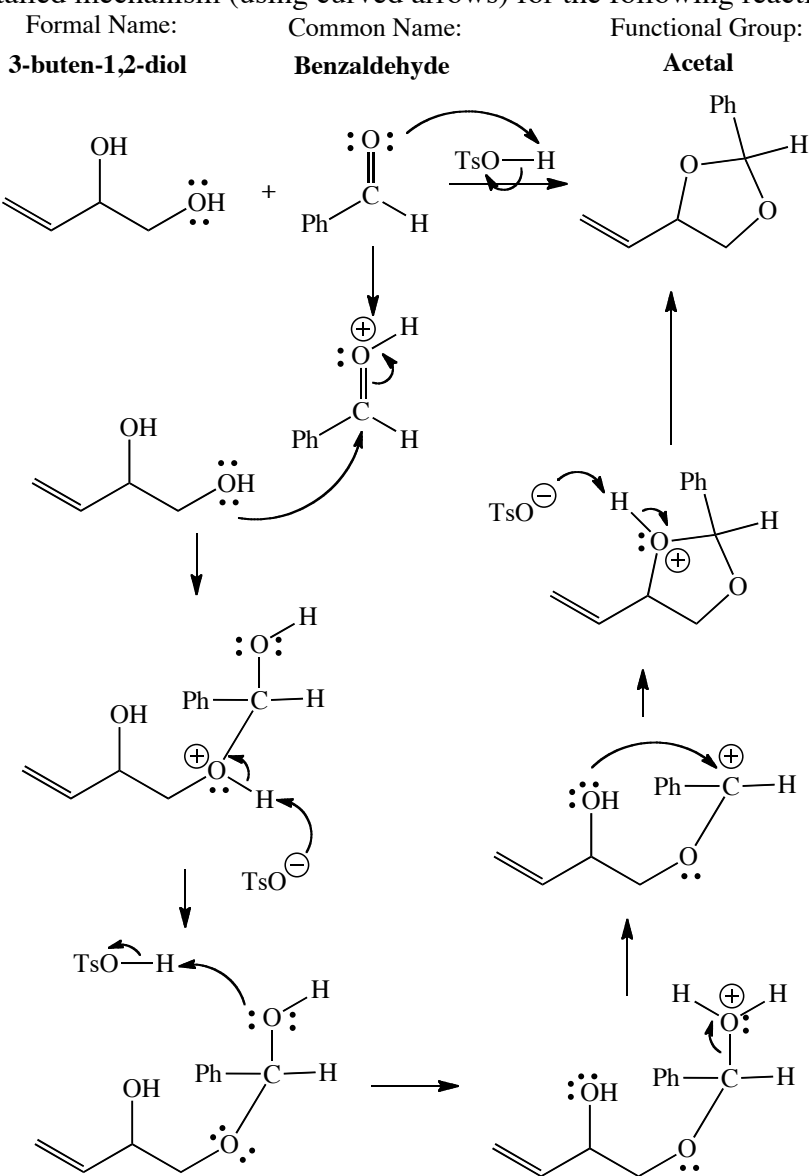


c) Formaldehyde

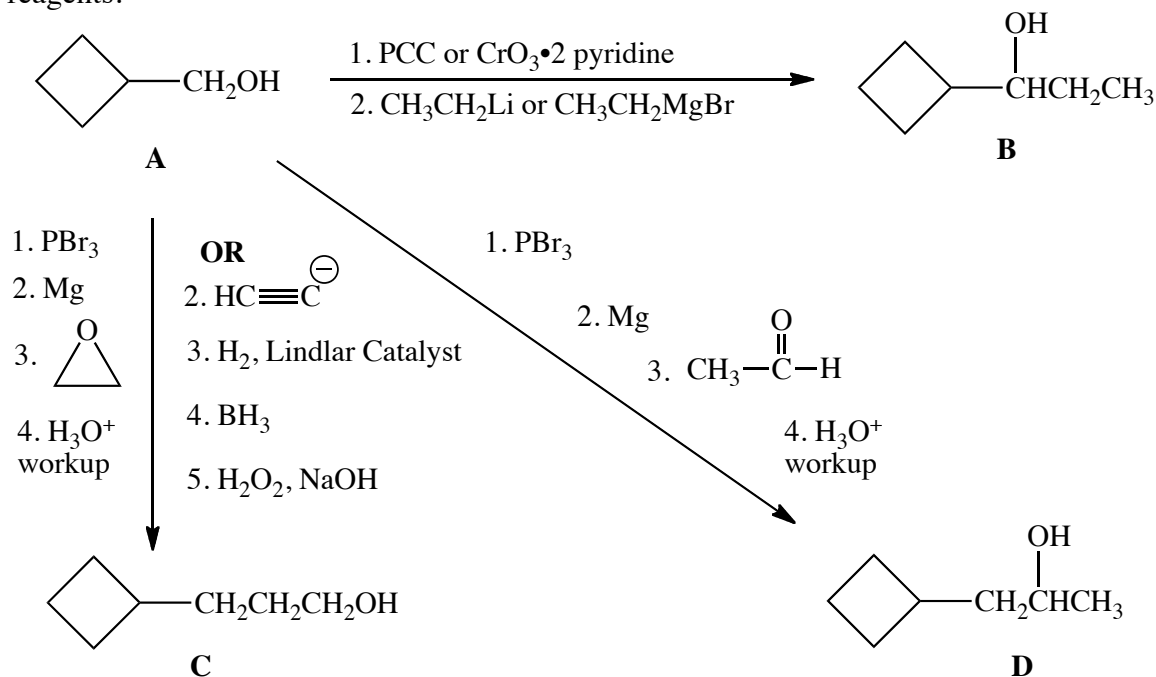


3. (16 pts) a) For the reaction shown below give the formal name of the first reactant, the common name of the second reactant, and the new functional group present in the product.

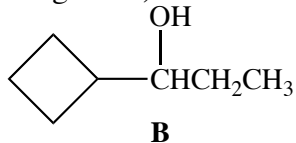
b) Draw a detailed mechanism (using curved arrows) for the following reaction.



4. (21 pts) a) List the reagents necessary to accomplish the following transformations. You may use any two carbon molecules as well as standard organic (or inorganic) reagents.

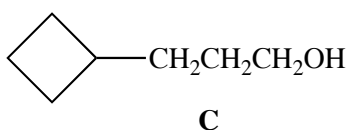


b) Briefly describe how you could tell the 3 compounds **B-D** apart by H-NMR spectroscopy. (You do not need to bother to talk about the cyclobutane ring hydrogens or the OH hydrogens since they will be similar in all of the compounds. Assume that the hydrogen on the oxygen is in rapid exchange and hence does not couple with any of its neighbors.) Provide enough information (chemical shift, splitting pattern, relative integration) to allow someone to tell the compounds apart.



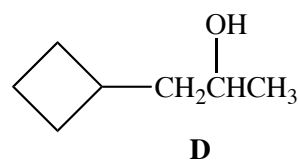
~3.8 ppm, q, 1H
(actually a ddd, but J should be similar)

~0.9 ppm, t, 3H
~1.5 ppm, q, 2H
may be more complex since the 2 H's are diastereotopic.
May also be on top of cyclobutane H's



~3.6 ppm, t, 2H

~1.5 ppm, quintet, 2H
~1.4 ppm, q, 2H
May be on top of cyclobutane H's

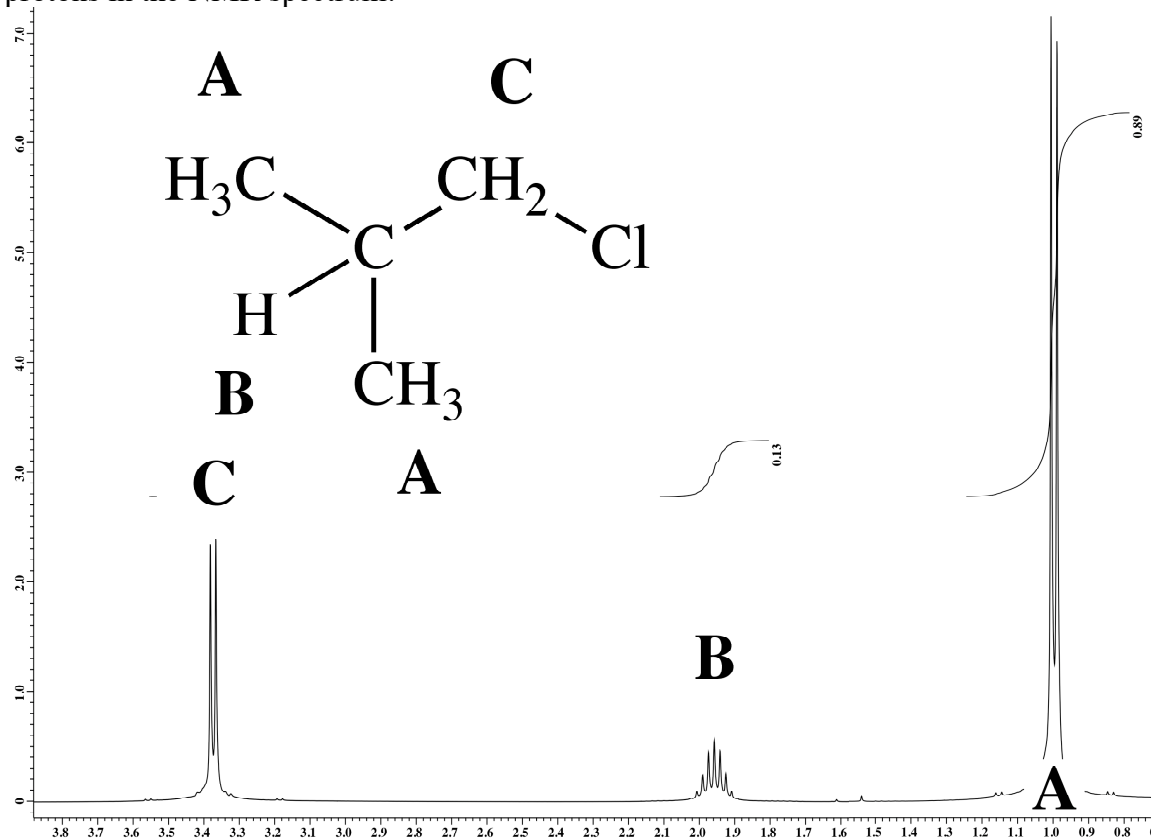


~3.8 ppm, quintet, 1H

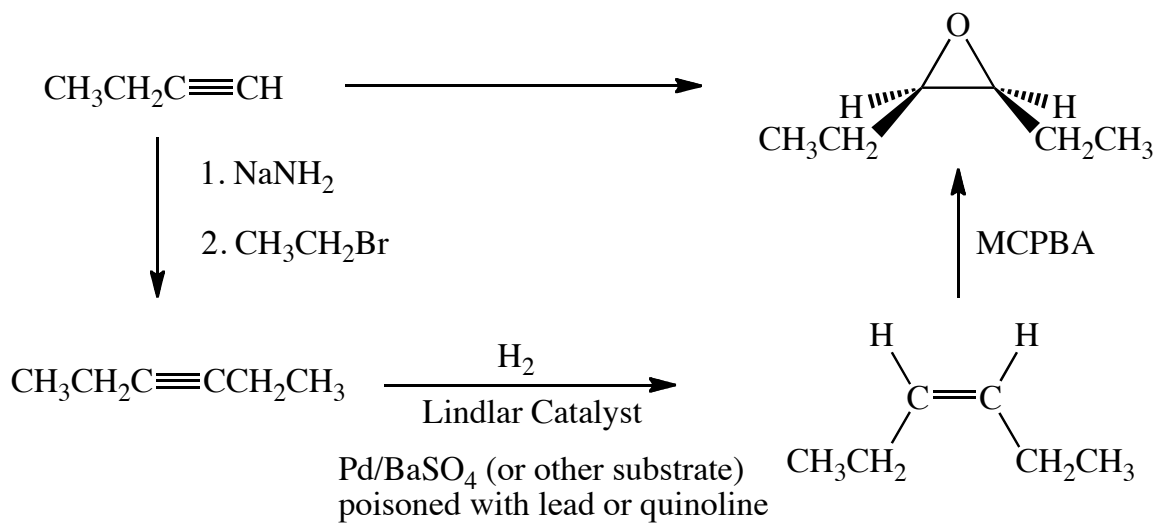
~1.2 ppm, d, 3H
~1.5 ppm, t, 2H
May be on top of cyclobutane H's.
May be more complex since H's are diastereotopic.

Compound C is easily distinguished from the others since it is the only one with 2 hydrogens on the carbon next to the oxygen. These will appear as a triplet, near 3.6 ppm and should be easily recognized. Compounds B and D are more challenging, both will have a 1 hydrogen multiplet around 3.8 ppm. But if you look down around 1 ppm, there should be a 3 hydrogen doublet for D and a 3 hydrogen triplet for B.

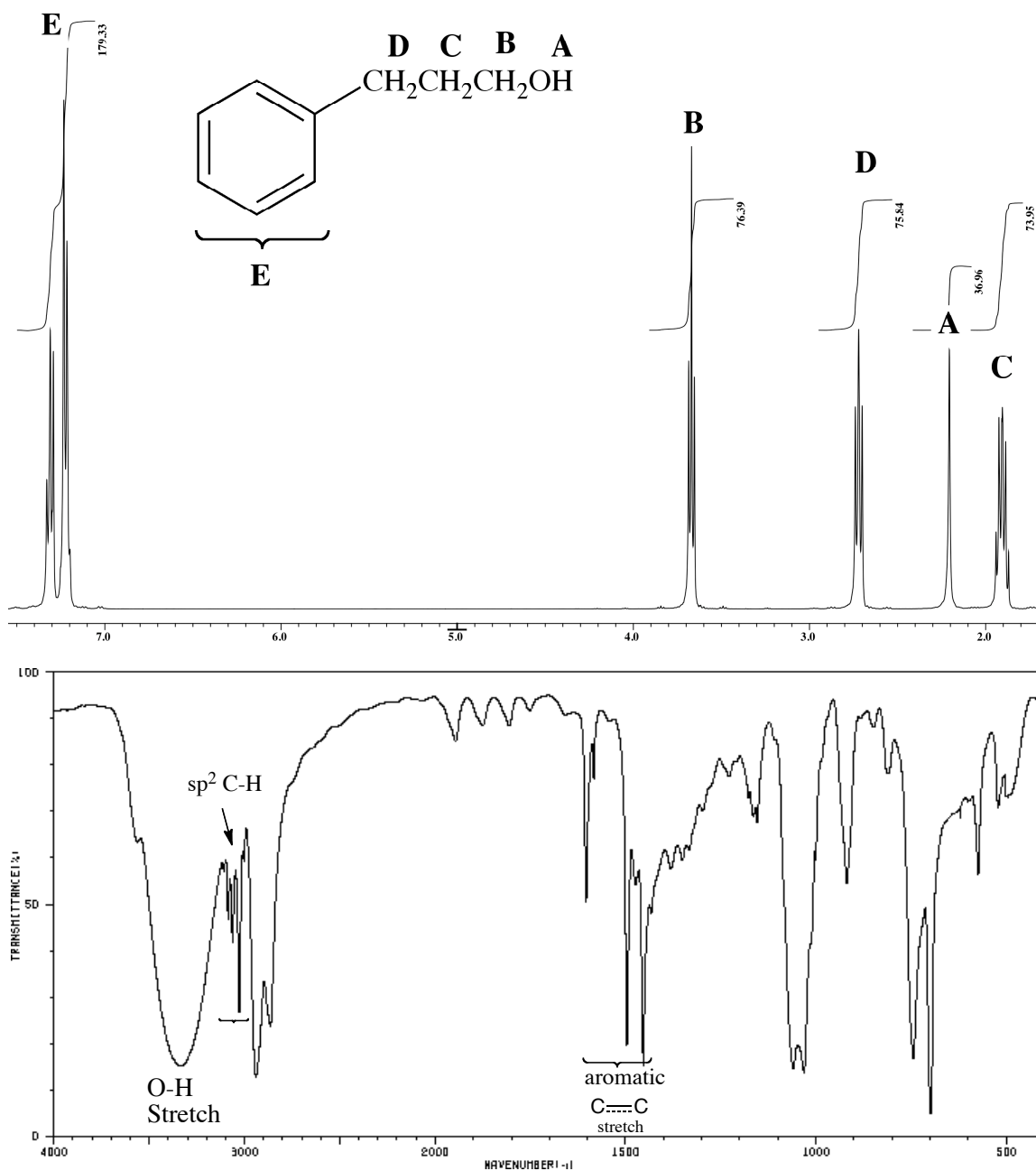
5. (8 pts) An unknown with the molecular formula C_4H_9Cl gave the following 1H -NMR spectrum. Determine the structure and indicate which peaks are associated with which protons in the NMR spectrum.



6. (9 pts) Indicate the reagents necessary to accomplish the following transformation.



7. (9 pts) The H-NMR and IR spectra for a compound with the formula $C_9H_{12}O$ are shown below. Draw the structure of the compound and indicate which hydrogens in your structure are associated with which peaks in the NMR. Also identify the characteristic IR absorptions.



8. (9 pts) Indicate which of the following compounds correspond to each of the IR spectra shown below. *To receive full credit you must indicate the characteristic absorptions in each of the spectra.*

