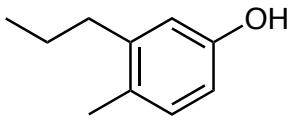
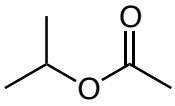
Oakton Community College

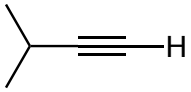
Homework 1
Organic Chemistry II (CHM 222/224) • Prof. Chad Landrie

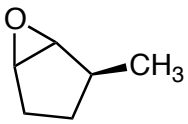
Score (4 pts)		Lectures	1-2	Name	

1. Write the name of the principal functional groups in the following molecules. Spelling counts!









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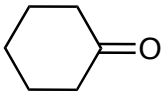

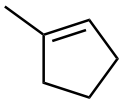

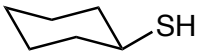

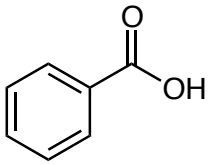

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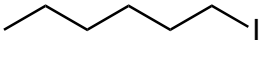
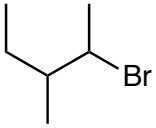
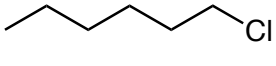
2. Draw an example of the molecule described. Structure should be in bond-line notation (i.e., do not write carbons and hydrogens explicitly).

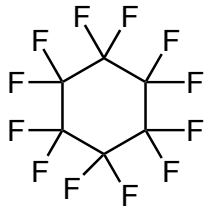
Aldehyde with only 3 carbon atoms	Amide with the molecular formula C_4H_9NO.	Secondary alcohol with only 5 carbon atoms.	Phenol with a methyl group at the *meta* position.

3. First, Rank in order of increasing boling point (1 = lowest boiling point; 4 = highest boiling point). Second, circle the compound that is likely the *most* polar.

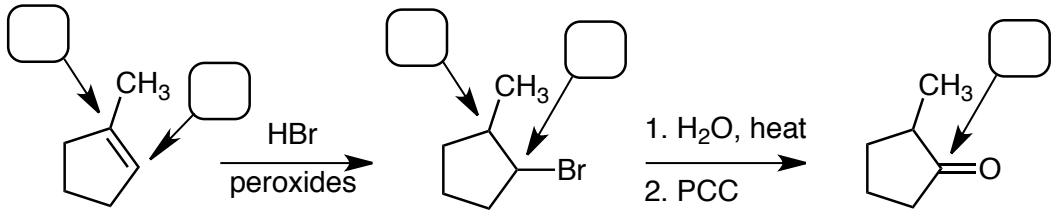






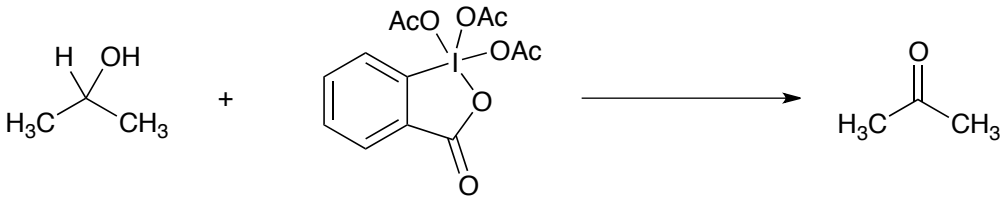


4. Determine the oxidation number for each carbon indicated.

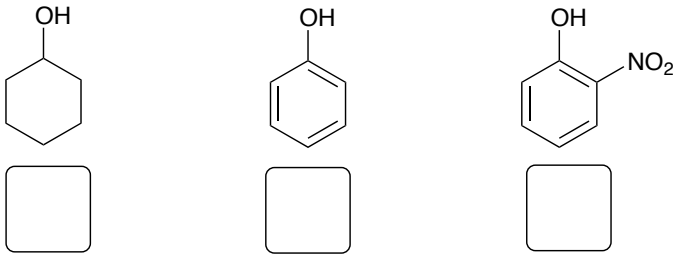


5. Why might the first reaction above be considered an oxidation or a reduction?

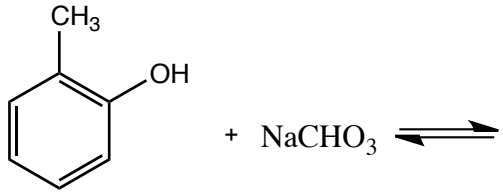
6. The Dess-Martin periodinane oxidation is another common mild method for oxidizing primary alcohols to carbonyls. Draw a mechanism for the reaction below. Hint: Acetate groups (-OAc; -$OCOCH_3$) are good leaving groups and the first step is substitution of an acetate group by the alcohol.



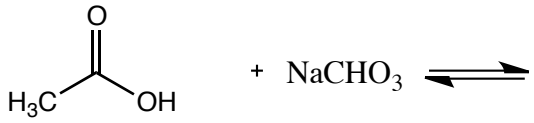
7. First, rank the compounds in order of increasing C–O bond length (1 = shortest; 3=longest). Second, explain your ranking. Discuss hybridization and draw resonance structures to support your conclusions.



8. Sodium bicarbonate ($NaHCO_3$) is the conjugate base of carbonic acid (H_2CO_3, pKa = 6.37). **First**, draw the products of the reaction of sodium bicarbonate with phenol and acetic acid. **Second**, use your book to determine the pKa values of a phenol and a carboxylic acid. **Third**, calculate the *K*eq for each acid-base reaction and determine which of these substances will react significantly (i.e., $K_{eq} > 1$) with sodium bicarbonate. Show your work.

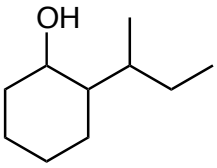


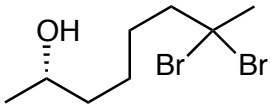
2-methylphenol
a phenol

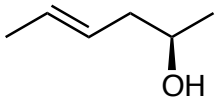


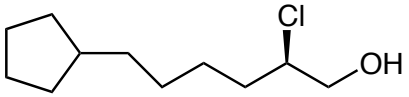
acetic acid
a carboxylic acid

9. Provide IUPAC names for the following structures.





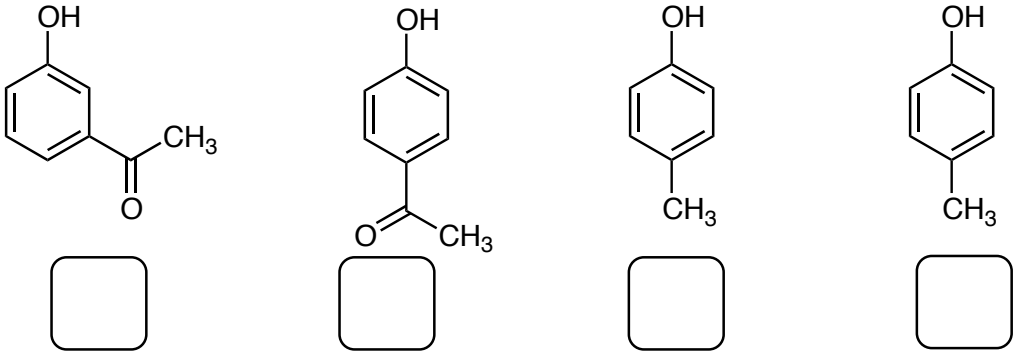




10. When (R)-(+)-2-phenyl-2-butanol is allowed to stand in methanol containing a few drops of sulfuric acid racemic 2-methoxy-2-phenylbutane is formed. Draw a reasonable mechanism then explain.

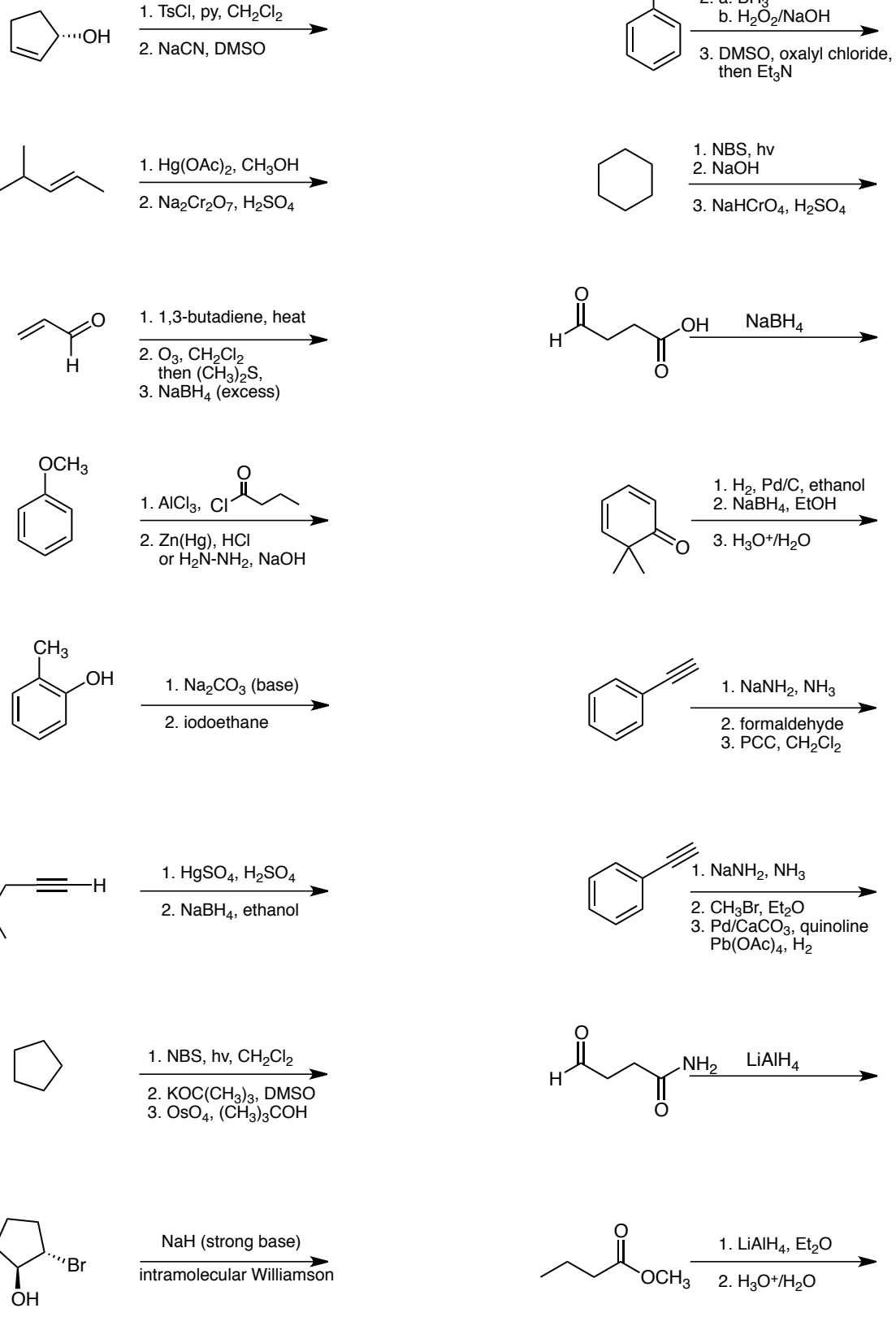
11. Unlike aldehydes and ketones, esters cannot be reduced by $NaBH_4$, but are readily reduced by $LiAlH_4$. Explain this observation. Your reasoning should include a discussion of the ground state energies of $NaBH_4$ vs. $LiAlH_4$ and for ketones vs. esters. Draw resonance structures where appropriate to support your logic.

12. Rank the following phenols in order of increasing acidity (1 = least acidic, highest pKa; 4 = most acidic, lowest pKa).



13. Draw the conjugate base for the two left-most structure in the problem above. Include all lone-pairs and charges. Next, draw all possible resonance structure for each conjugate base that shows delocalization of the negative charge on oxygen.

14. Draw the *major* organic product for each reaction. Include stereochemistry where it is relevant.



15. Devise a synthesis for each of the following. Show the major product after each step in your synthesis.