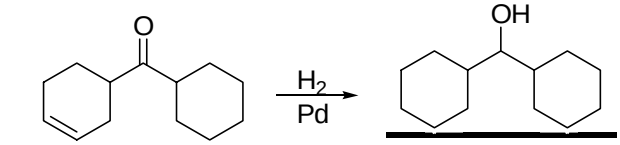
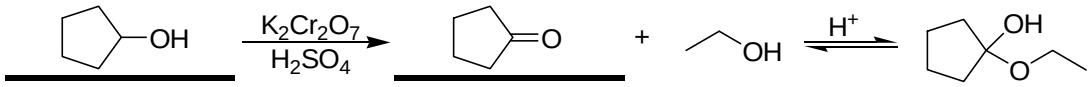
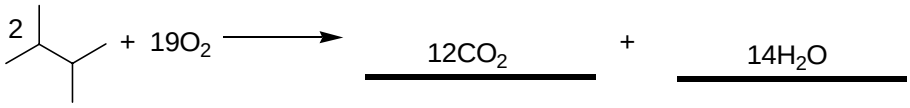
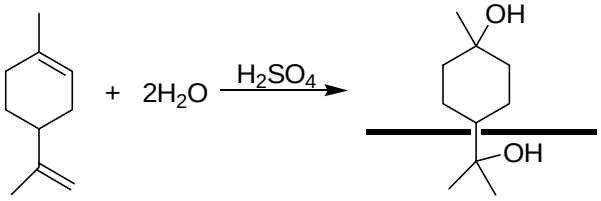
Chemistry 11 Spring 2008
Examination #4 **ANSWER KEY**

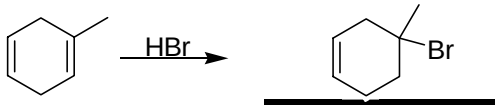
1. (20 pts. total; 2 pts. each) **SEQUENCES!** Complete each reaction sequence below by providing the reagents or structures as indicated by the "?". *ONLY ANSWERS BY THE "?" WILL BE GRADED.*



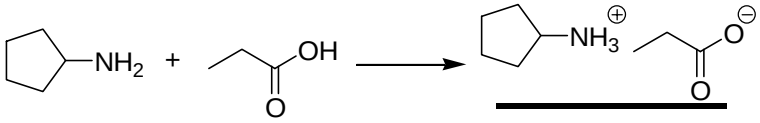



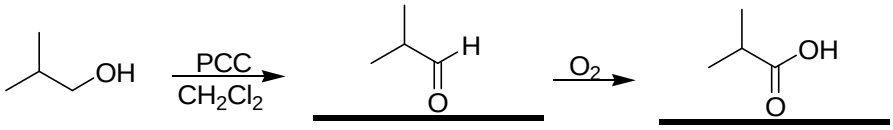



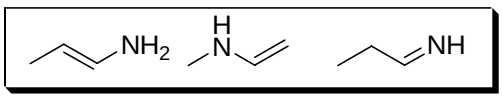




(hint: only 1 equivalent HBr added)



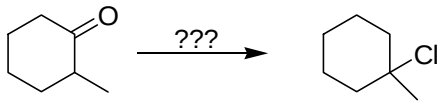



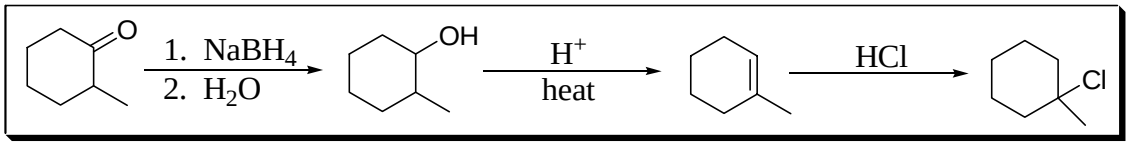

2. (9 pts.) Draw THREE possible structures for compounds with a molecular formula $C_3H_7N$ using bond-line notation.



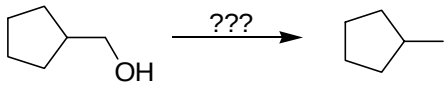
3. (12 pts. total; 6 pts. each) **SYNTHESIS!** Design a synthetic sequence using the properly ordered and appropriate reagents on the cover page of this examination to account for the following chemical transformations.

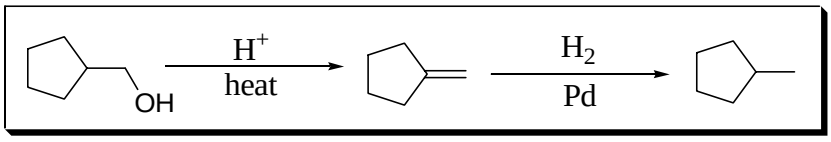
A.



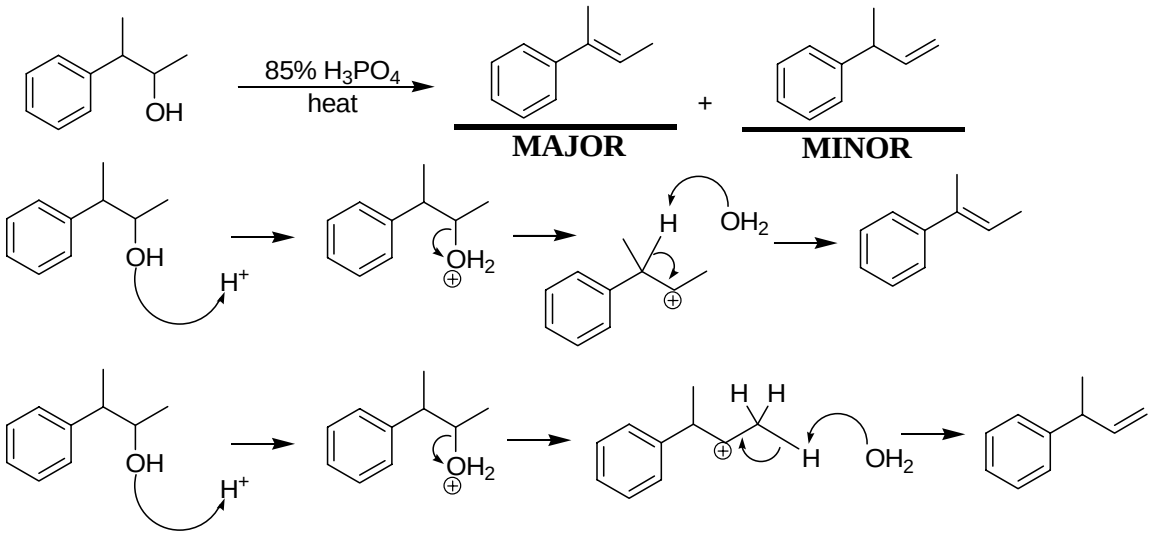




B.



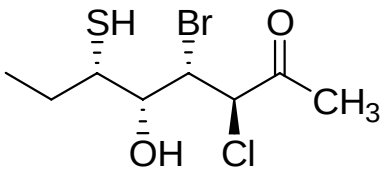




4. (10 pts.) Predict the *expected* MAJOR and MINOR products for the reaction listed below AND give the appropriate curved arrow notation for formation of each final product.



5. (17 pts. total) **STRUCTURE REVIEW!** Answer each of the questions below related to your knowledge of organic structures.

A. (4 pts.) Draw a Fischer projection on the right to correspond to the provided structure.

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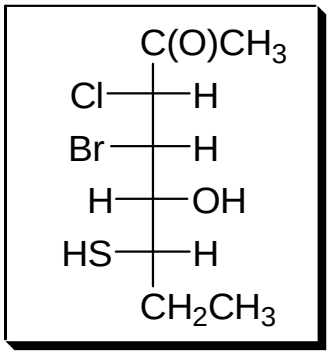
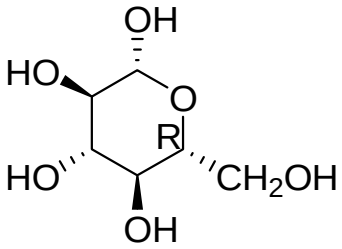
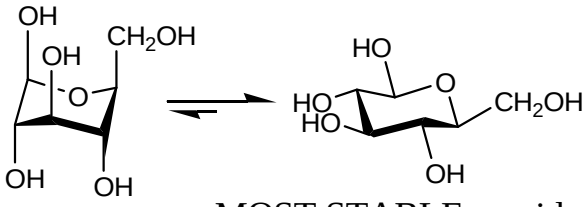



B. (13 pts. total) Consider the carbohydrate shown, a class of compounds that we will study in biochemistry shortly.

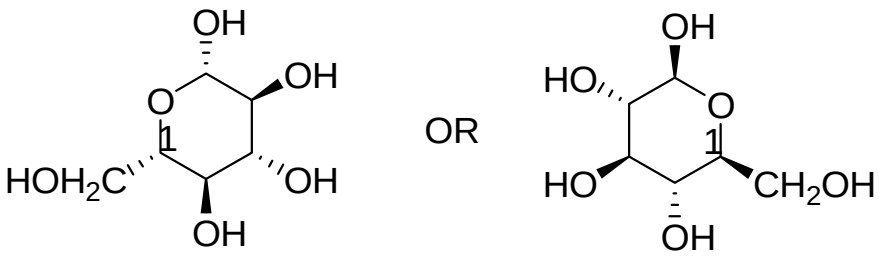



1) (4 pts.) Draw BOTH chair conformations of the carbohydrate shown, beginning with carbon 1 assigned. Which conformation is the most stable? Briefly explain.




MOST STABLE; avoids 1,3-Diaxial interactions

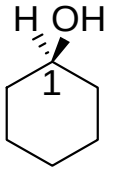
2) (2 pts.) Draw an enantiomer of this carbohydrate.



3) (2 pts.) Now draw one diastereomer of this carbohydrate.

***Multiple possibilities here; one or more stereocenters from the original structure retains its same absolute configuration, and at least one stereocenter must possess the OPPOSITE configuration!***

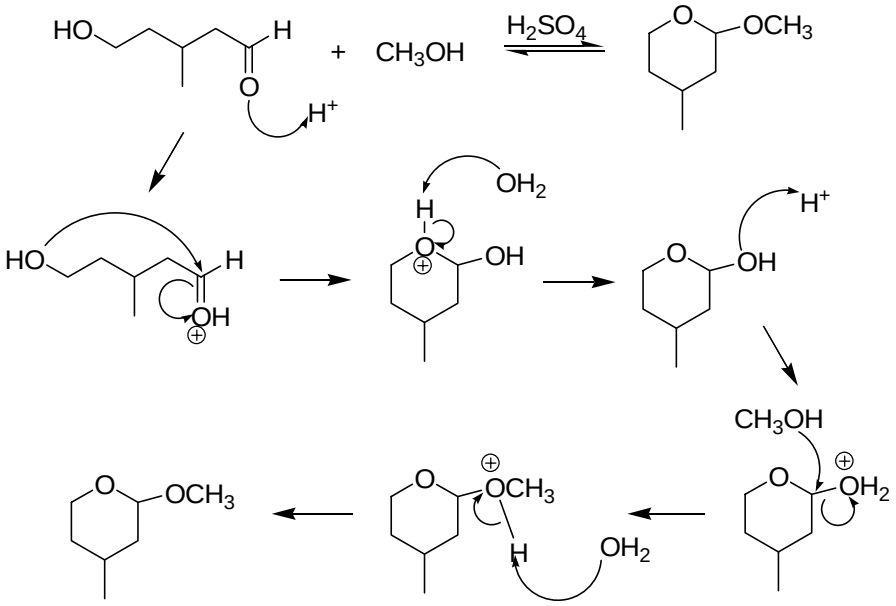
4) (5 pts.) Determine the absolute configuration at the carbon labeled "1" by assigning an R or S. Then consider a derivative molecule below. Is there a chiral center present? Briefly explain why or why not. **See structure**



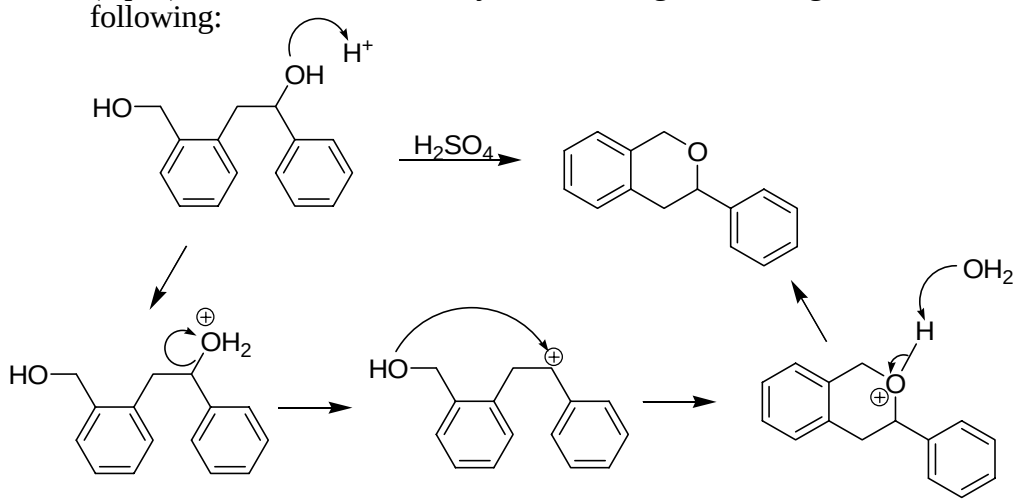

**There is NO chiral center present as branching away from the first carbon results in two sets of identical bonding groups.**

6. (18 pts. total) **MECHANISMS!** Provide the appropriate curved arrow notation for formation of the final products shown.

A. (10 pts.)



B. (8 pts.) **CHALLENGE!** Use your knowledge base to figure out the following:




7. (14 pts. total) **SHORT ANSWERS!** Respond to the last set of questions below.

A. (4 pts.) Describe the uses of Tollen's Reagent and Benedict's Reagent in the laboratory setting. What experimental distinctions/results are observed with respect to each reagent?

**Tollen's reagent contains $AgNO_3$ and $NH_3$ in water which combine to form the complex ion $[Ag(NH_3)_2]^+$ and solid silver (i.e. silver mirror) in the presence of an aldehyde, but NOT a ketone.**

**Benedict's reagent contains $Cu^{+2}$ (blue color) used to oxidize aldehydes into carboxylic acids WITHOUT affecting alcohols. The formation of a red precipitate ($Cu_2O$) signals the presence of an aldehyde.**

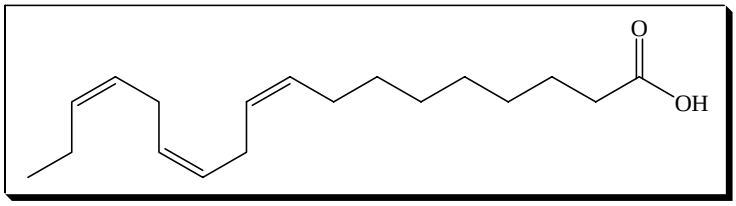
B. (3 pts.) Is an aldehyde or ketone *generally* considered more reactive? Justify your answer with TWO chemically relevant points.

**In general, aldehydes are MORE REACTIVE than ketones because: (1) the carbonyl carbon is more positive in aldehydes; and (2) the presence of two alkyl groups in ketones makes it more difficult for a molecule to form bonds with the carbon in the carbonyl group.**

C. (3 pts.) What is a fatty acid? Give one plausible example of an unsaturated fatty acid. Is it more likely to exist in the *cis* or *trans* form? Briefly explain.

**Fatty acids are long, unbranched carboxylic acids that consist mainly of 12 to 20 carbons. They are derived from the hydrolysis of animal fats, vegetable oils, or the phospholipids of biological membranes. Nearly all fatty acids have an even number of carbon atoms in an**

**unbranched chain. In most unsaturated fatty acids, the *cis* isomer predominates over the *trans* isomer. Below is an example of an unsaturated fatty acid:**




D. (2 pts.) What is Zaitsev's rule?

**If more than one alkene can form, the most highly substituted double bond predominates.**

E. (2 pts.) Which of the following has a greater melting point: an unsaturated fatty acid or saturated fatty acid? Briefly explain your choice.

**A saturated fatty acid has a higher melting point due to the greater number of London dispersion forces present.**