

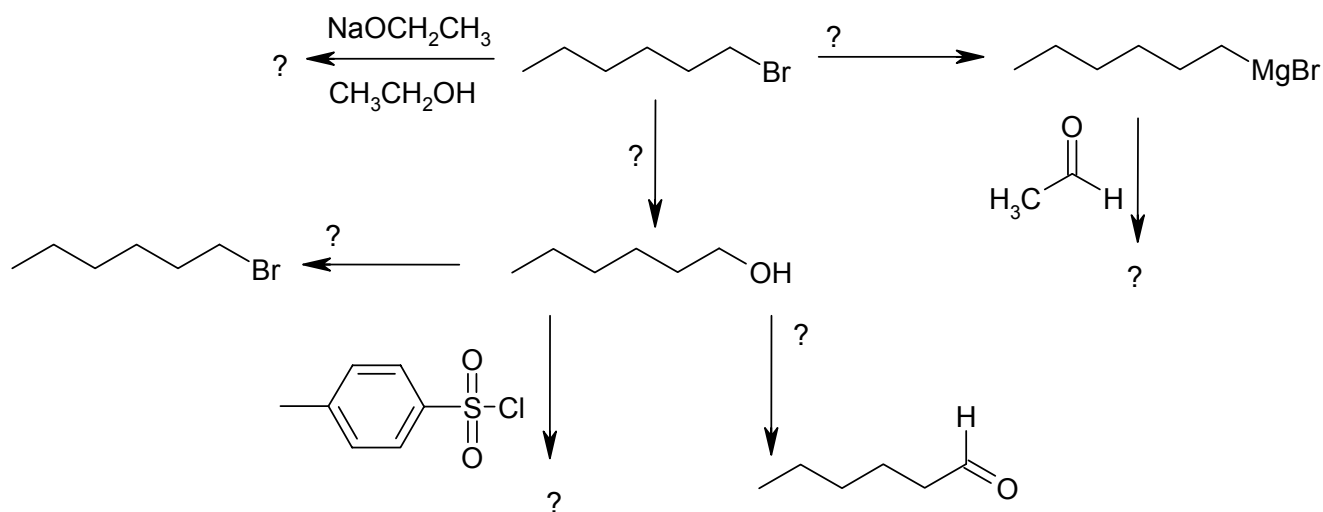
NAME _____

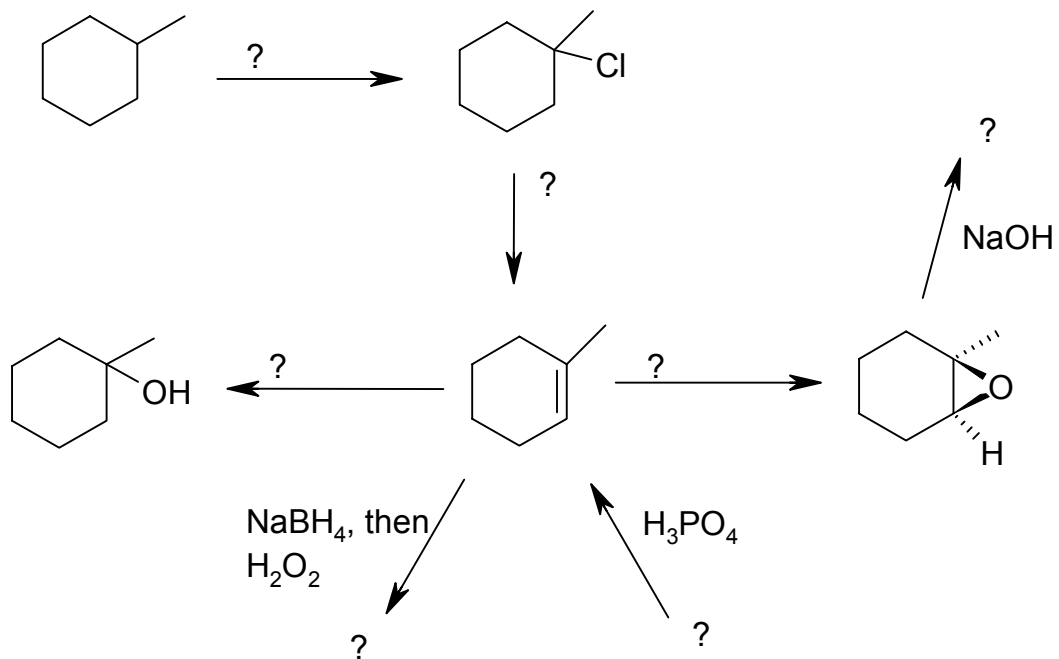
Organic Chemistry I, CHEM 331
 Sections 003 and 004, Dr. Sweeting
 FINAL EXAM, December 19, 2001
 Full credit on this exam is 200 points; in addition, there are 32 BONUS points)

Please attempt all of the questions. Partial credit will be given for partially correct answers. If you give several answers, only one of which is correct, and do not select that one as your response, you will receive the credit earned by the wrong answer. Note that reactions that give two or more products are exempted from this caveat. If you need more space to answer a question, you may write on the back of the page, but you must indicate where your answer is.

Tear off the last 3 pages of the exam and take them with you.

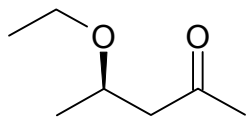
1. Please complete each of the following reactions by adding a missing reagent or product as indicated by the "?". Indicate the product formed in *highest concentration* if more than one is formed (the word "most" will do). For organic compounds, please give the structure, using either stick / polygon or complete line-bond structural formula; for inorganic reagents, condensed formulas are acceptable, as are very common abbreviations for complex reagents (I have used a few abbreviations myself and will be glad to give you the full formula if you need it - free). Show *stereochemistry* in every case where a preference is observed. You do not need to show the neutralization step for reactions done in acid or base. (4 points each, 56 total)



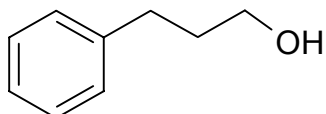
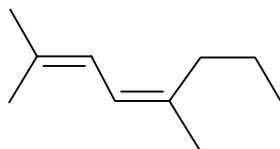
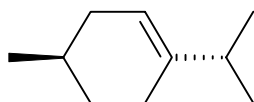


2. a) Please make a graph of the change of energy as a function of angle of rotation (dihedral angle) about the C2-C3 bond for butane. Energy values are not necessary. Label the graph with sketches of the conformations at each energy maximum and minimum and with the angle through which the groups were rotated (you may choose any starting conformation). (18 points)
- b) BONUS: Show the actual values for the energies for the conformations (6 points) on the graph below.

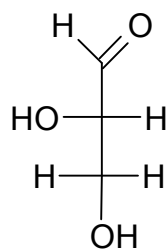
3. Please provide an IUPAC name for each of the following, including the correct name for the *stereochemistry* where appropriate. Note: even if the name is incorrect, points will be given for correct stereochemistry if the site and name are clearly labelled. (equal credit for each correct answer, 40 points total)



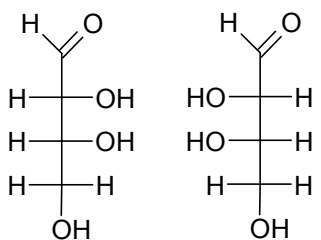
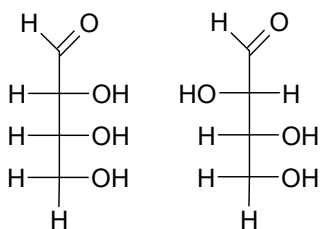
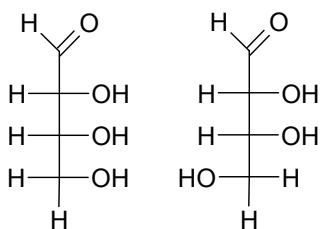
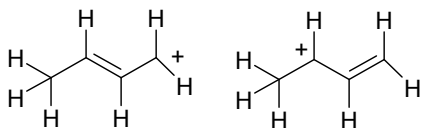
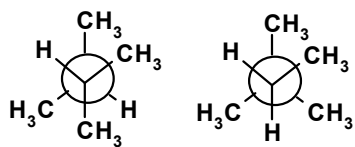
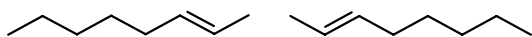
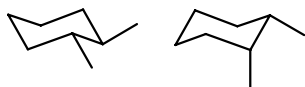
1-menthene



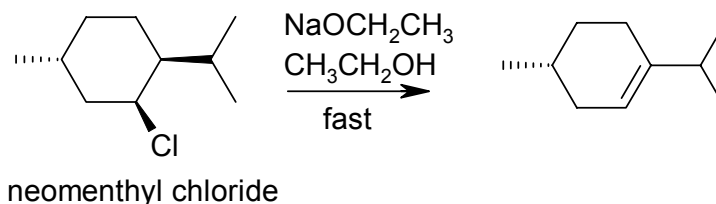
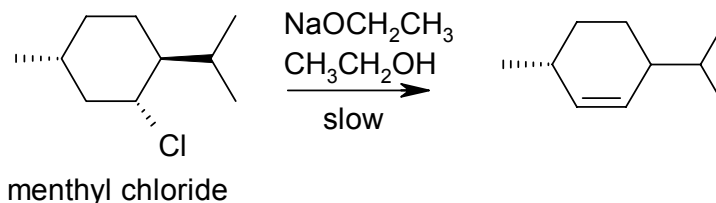
the sugar



4. Please state the relationship between each of the following pairs of structures, e.g. enantiomers, structural isomers. (2 points each, 16 total)



5. Given below are the structures of menthyl chloride and neomenthyl chloride and the dehydration reactions they undergo.



- a. What kind of isomers are menthyl chloride and neomenthyl chloride? (2 points)
 - b. Sketch each in its most stable conformation *to the left* of its structure above. (8 points)
 - c. BONUS: By referring to the mechanism of the reaction of alkyl halides with strong base, please explain both the difference in reactivity of menthyl chloride and neomenthyl chloride, both in the product of the reaction and the rate at which it is formed. (10 points)
6. a) What is the structure of ozone? (2 points)
- b) Briefly - what role the ozone layer does play in life on earth? (4 points)
- c) Briefly describe how chlorinated hydrocarbons cause destruction of the ozone layer. Detailed mechanisms are not necessary to answer this question but you must identify a couple of key chemical species. (4 points)

- d) Ozone is also a pollutant, as indicated by the "ozone alerts" in the summer in Baltimore. Give an example of a reaction with an organic compound that illustrates its destructive power on animal tissue. (4 points)
7. Outline the steps in the mechanism of the reaction of bromine with cyclopentene by writing intermediate structures; show *only* intermediates, not transition states. Label the rate-determining step. (10 points)
8. a) Outline the steps in the mechanism of the dehydration of 2-methylcyclohexanol to 1-methylcyclohexene in concentrated acid by writing intermediate structures; show *only* intermediates, not transition states. Label the rate-determining step. (11 points)
- b) Give the structures of 3 other products of the dehydration in a) (9 points)
9. Please provide an outline of a practical laboratory synthesis of TWO of the following compounds. If a starting compound or functional group is given, you must use it, and you may use any other organic or inorganic compounds needed. You may write the neutral product without showing any neutralization steps; if you do show neutralization, be sure to indicate that it is a separate step. No credit will be given for mechanisms. (8 points each, 16 total) Extra credit for extra syntheses.

