ORGANIC CHEMISTRY I (CHEM 115/CNED 013)

EXAM #2A

October 21, 2002

Name: KEY

Please read each question carefully before you begin. Your exam should have a total of 6 pages. You will have two hours in which to complete this exam; be sure to save time to check your answers after you're finished. The backs of the pages may be used for rough work, but your answers should be written clearly on the front of the page in the spaces provided. Molecular models may be used. Show your work clearly, and you may receive partial credit for partially correct answers. Good luck!

1. (30 pts) For each of the following pairs, specify whether the two molecules are enantiomers, diastereomers, structural isomers, geometric isomers, identical molecules.

- [Images of molecular structures]

enantiomer

- [Images of molecular structures]

enantiomer

identical

- [Images of molecular structures]

identical

identical

identical
2. (5 pts each, 15 total) Provide a name for each of the following molecules. You may use either IUPAC names or common names, where appropriate.

(a) \[
\begin{align*}
\text{3S-ethyl-1-hexene} \\
\text{6-allyl-3-methyl-(E,E)decadiene (or)} \\
\text{6-(2-propenyl)-3-methyl-(E,E)decadiene}
\end{align*}
\]

(b) \[
\begin{align*}
\text{cis-3S-methyl cyclodecene (or)} \\
\text{(Z)-3S-methyl cyclodecene}
\end{align*}
\]

3. (5 pts each, 15 total) Draw a structure for each compound.

(a) \[
\text{meso-3,5-dimethylheptane}
\]

(b) \[
\text{5S-iodo-(2E,7E)decadiene}
\]

(c) \[
\text{bicyclo[3.3.2]dec-1-ene}
\]

(1 bonus point): Is this a Bredt or an anti Bredt compound? Explain.

\[
\text{Double bond @ bridgehead in system with 8 carbon ring}
\]
4. (25 pts total) Draw all of the stereoisomers of the compound below and circle those that you expect to be optically active.

How many diastereomers does the molecule have? \( \underline{2} \)

How many enantiomers does the molecule have? \( \underline{1} \)

Briefly explain how you might go about separating this molecule from a mixture containing all of the other stereoisomers (hint: you may need multiple separation steps, some of which may be easier than others)

2 main points:
- Enantiomers separated either by chiral column chromatography or by conversion to diastereomers.
- Diastereomers can be separated by conventional means (chromatography, solubility, etc.).

Few different ways to separate above molecules,
- React all with chiral amines to form diastereomers, separate by chromatography/solubility properties, etc. Convert back to original molecule.
- Need trans-diastereomeric alignment.

5. (20 pts) Show all possible products from the following two bimolecular elimination reactions.

\[
3S,4S\text{-dibromo-2,2,3-trimethylpentane} \xrightarrow{\text{NaI in acetone}} \text{product}
\]

\[
3S,4S\text{-dibromo-2,2,3-trimethylpentane} \xrightarrow{\text{NaOCH}_2\text{CH}_3 \text{ in acetone}} \text{products}
\]
6. (15 pts) The structure of D-glucose is shown below. Label all chiral centers as either R or S. Draw the lowest energy chair conformation of this molecule. Do you expect the optical rotation of this molecule to be positive or negative? **positive**

NOTE: If you answered the fructose chair-chair flip question correctly on exam #1, mark an X here: __________ You do not need to answer this question. You will receive 15 pts automatically - please leave the question blank and skip ahead to question 7.

7. (20 pts) Propose a detailed step-by-step mechanism for the reaction pathway shown below.
8. (30 pts, 5 each) For each of the following reactions, do you agree (A) or disagree (D) that the product shown is the most abundant (circle A or D)? If you do not agree with the product shown, provide an alternative structure for the most likely product.

(a) A or D

(b) A or D

(c) A or D

(d) A or D

(e) A or D

(f) A or D

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Can't eliminate - Bredt rule.
9. (30 pts, 15 each) Provide multi-step syntheses showing how you would effect the following transformations. You may use any reagents necessary, provided that all of the carbon atoms in the final product originally come from the starting material shown. (hint: each can be done with a minimum of 2 steps)

Best method = 2 $S_N2$ rxns

E.g.

$$\text{CH}_3\text{C}_2\text{H}_5\text{Cl} \xrightarrow{\text{Br}_2, \text{CH}_3\text{CN}} \text{CH}_3\text{C}_2\text{H}_5\text{Br}$$

$$\xrightarrow{\text{KF, 18-crown-6, CH}_3\text{CN}} \text{CH}_3\text{C}_2\text{H}_5\text{F}$$

High yield of chiral product.

Common alternative that gives not as high a yield:

$\xrightarrow{\Delta, \text{CH}_3\text{OH}} \text{CH}_3\text{C}_2\text{H}_5\text{Br}$$

$\xrightarrow{\text{KF, 18-crown-6, CH}_3\text{CN}} \text{CH}_3\text{C}_2\text{H}_5\text{F}

*(mix R,S)*

*Would need to separate*

at least 3 possibilities:

$$\text{CH}_3\text{C}_2\text{H}_5\text{Br} \xrightarrow{\text{NBS, HBr, h}} \text{CH}_3\text{C}_2\text{H}_5\text{Br} \xrightarrow{\text{KI}} \text{CH}_3\text{C}_2\text{H}_5\text{H}_2/\text{Pt}$$

$$\text{CH}_3\text{C}_2\text{H}_5\text{Br} \xrightarrow{\text{KOH}, (S_N2)} \text{CH}_3\text{C}_2\text{H}_5\text{OH} \xrightarrow{\text{H}_2, \Delta} \text{CH}_3\text{C}_2\text{H}_5\text{H}_2/\text{Pt}$$

$$\text{CH}_3\text{C}_2\text{H}_5\text{Br} \xrightarrow{\text{CH}_3\text{OH}, \Delta} \text{CH}_3\text{C}_2\text{H}_5\text{H}_2/\text{Pt}$$

1. ____ /30  
2. ____ /15  
3. ____ /15  
4. ____ /25  
5. ____ /20  
6. ____ /15  
7. ____ /20  
8. ____ /30  
9. ____ /30  
TOTAL: ____/(200)