NAME _____

ID # _____

ORGANIC CHEMISTRY I (2301-003)

1:25 – 2:15 pm, October 22, 2007

Exam 2

When the exam begins, write your name at the top of each page.

You may use pen or pencil. However, re-grades will be considered only for exams completed in pen.

Please write your answers in the boxes/spaces provided. If your answer is not in the appropriate space (say, for example, it's on the back of the page), draw us an arrow and/or note telling us where to look.

NAME _____

Scoring: 1. _____ / 10 5. _____ / 9

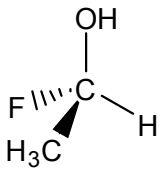
2. _____ / 6 6. _____ / 27

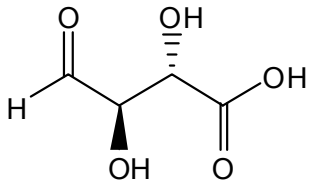
3. _____ / 8 7. _____ / 20

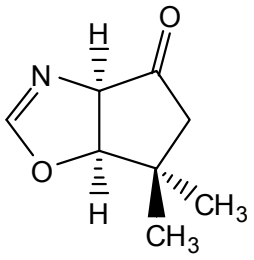
4. _____ / 20

Total Score: _____ / 100

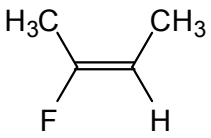
1. (10 pts) On the structures below, label each chiral center with its appropriate Cahn-Ingold-Prelog designation [(*R*) or (*S*)].

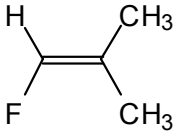


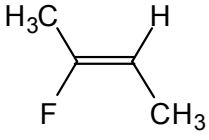




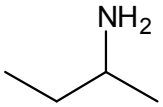
2. (6 pts) Label the stereochemistry at each olefin below as (*E*), (*Z*), or "neither".



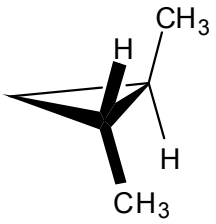




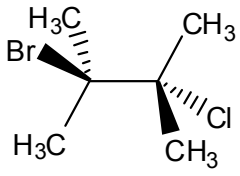
3. (8 pts) Are the following molecules chiral or achiral? For each structure, **circle one answer.**



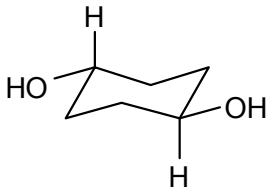
CHIRAL *or* **ACHIRAL** ?



CHIRAL *or* **ACHIRAL** ?

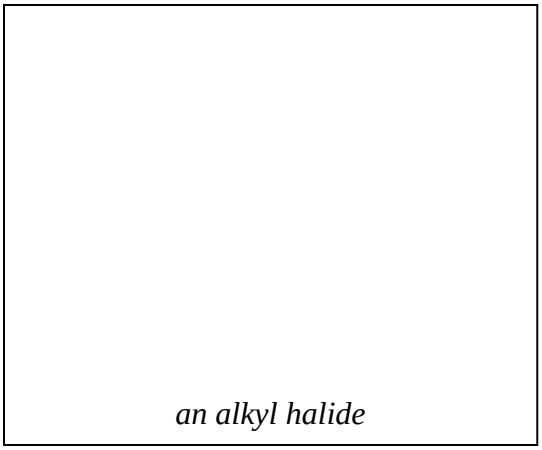


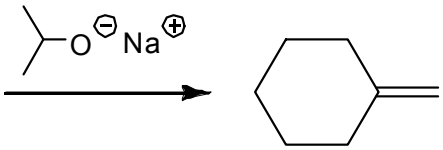
CHIRAL *or* **ACHIRAL** ?



CHIRAL *or* **ACHIRAL** ?

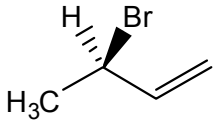
4. (20 pts) Draw the missing reactant or product in the empty boxes. For products, give the predominant, most favored product.



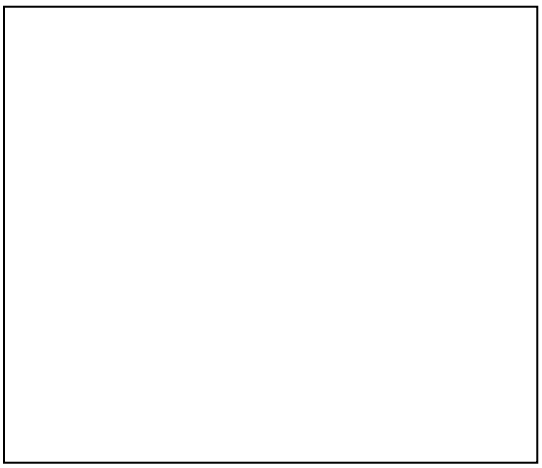


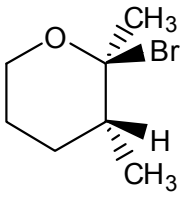
(as the major product)

(Problem 4 continues on next page)



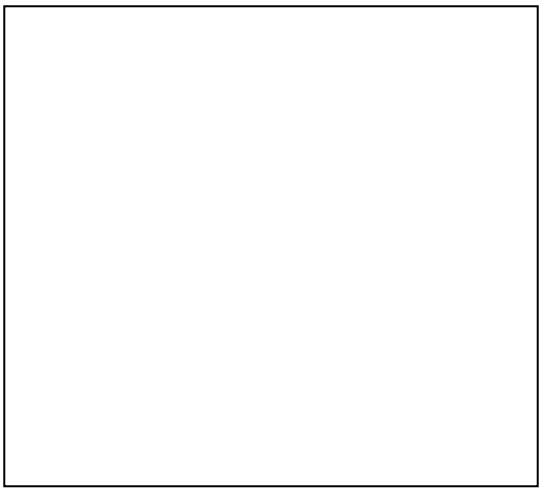
NaN_3

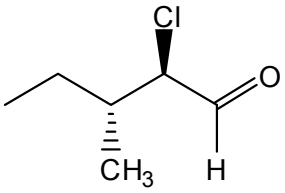




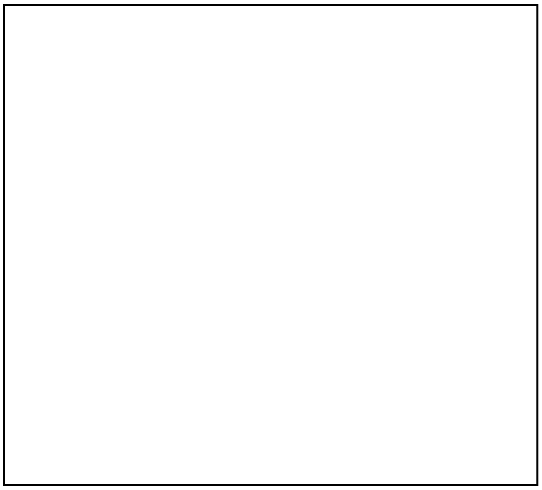
mixture of
$DMSO/H_2O$

Δ

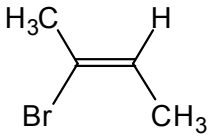


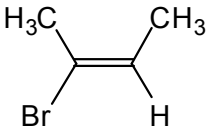


$NaOCH_3$



5. (9 pts) How would you describe the relationship between each of the pairs of structures below? Are they enantiomers or diastereomers, or are they just two ways of illustrating the same molecule? **Circle one answer** for each pair**.**





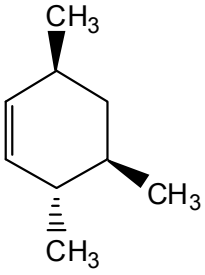
ENANTIOMERS

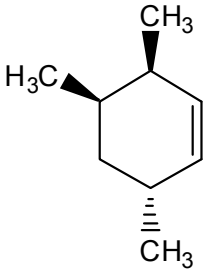
or

DIASTEREOMERS

or

SAME MOLECULE





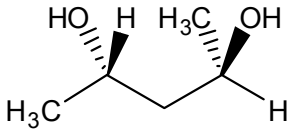
ENANTIOMERS

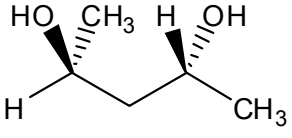
or

DIASTEREOMERS

or

SAME MOLECULE





ENANTIOMERS

or

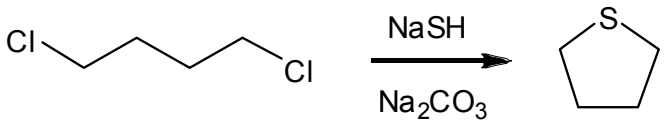
DIASTEREOMERS

or

SAME MOLECULE

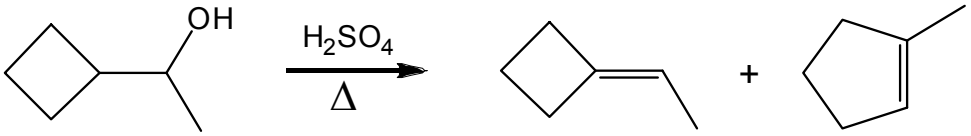
6. (27 pts) For each of the reactions shown below, draw a mechanism that explains how each product is generated from the starting material. In your answers, make sure that you:
    - Draw each step of the mechanism separately;
    - Use "electron pushing" to show where the electrons in each step go.

(a)



(Problem 6 continues on next page)

(b)

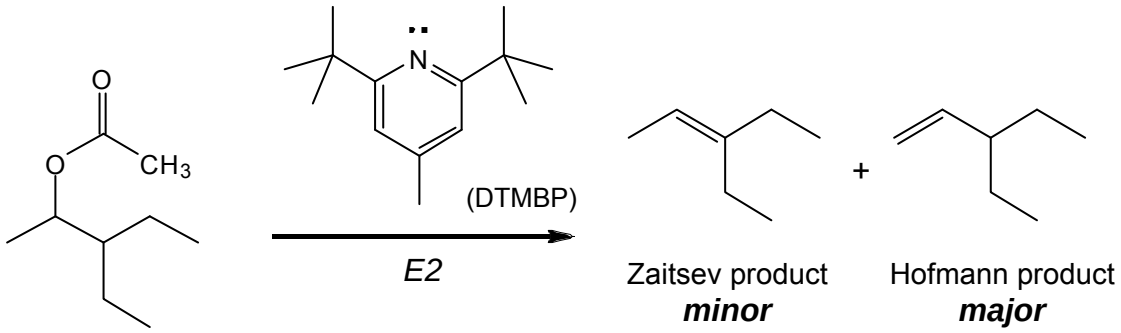


1 **2**

mechanism for product **1**

mechanism for product **2**

7. (20 pts) When the starting material shown below is combined with 2,6-di-tert-butyl-4-methylpyridine (DTBMP), a sterically hindered base, the resulting E2 elimination predominantly yields the *less* substituted (Hofmann) alkene product.



In the space below, explain this preference using a potential energy diagram that illustrates:

- Two potential energy curves, one for each product.
- In the brackets, the structure of the rate-determining transition state for each pathway.
- The relative potential energies of all starting materials, transition states, intermediates (if any), and products. Show which energies correspond to which chemical structures.
- Two overall activation energies, E_a[Zaitsev] and E_a[Hofmann], for the two pathways.