EXAM 2

Organic Chemistry

Chemistry 220a

Friday, October 15, 1999

NAME (print): _____

TA:_____ Day:_____ Section Time:_____

Important points are in **bold**.

Complete the section above and put your **name** on pages 2-6.

Take a few moments to look over the exam. Answer each question on the exam paper.

Do all **preliminary** drawing or computations on the **Work Sheets** at the end of the exam. **They will not be graded.**

A **Periodic Table** is on page 8 of the exam should you need it.

The exam is 55 minutes.

STOP writing when you are told to do so.

REMEMBER: Neatness is to your advantage.

1. (25 pts) _____

2. (20 pts) _____

3. (25 pts) _____

4. (30 pts) _____

_____

Total (100 pts)

1) (25 pts) Dr. Know-It-All attempts to prepare ethyl iodide by the free radical chain iodination of ethane. After all, he knows that it works for chlorination and bromination. However, he notices that the red color of iodine never disappears and no ethyl iodide is being formed. Using propagation steps, BDEs, heats of reaction for each propagation step and the overall reaction, and an energy diagram that uses these heats and obeys the Hammond Postulate, provide a brief explanation for Dr. Know-It-All's dilemma. **Bond dissociation energies are on page 7.**

(5 pts) propagation step 1:

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ΔH^o = _____ kcal/mole

(5 pts) propagation step 2:

--->

ΔH^o = _____ kcal/mole

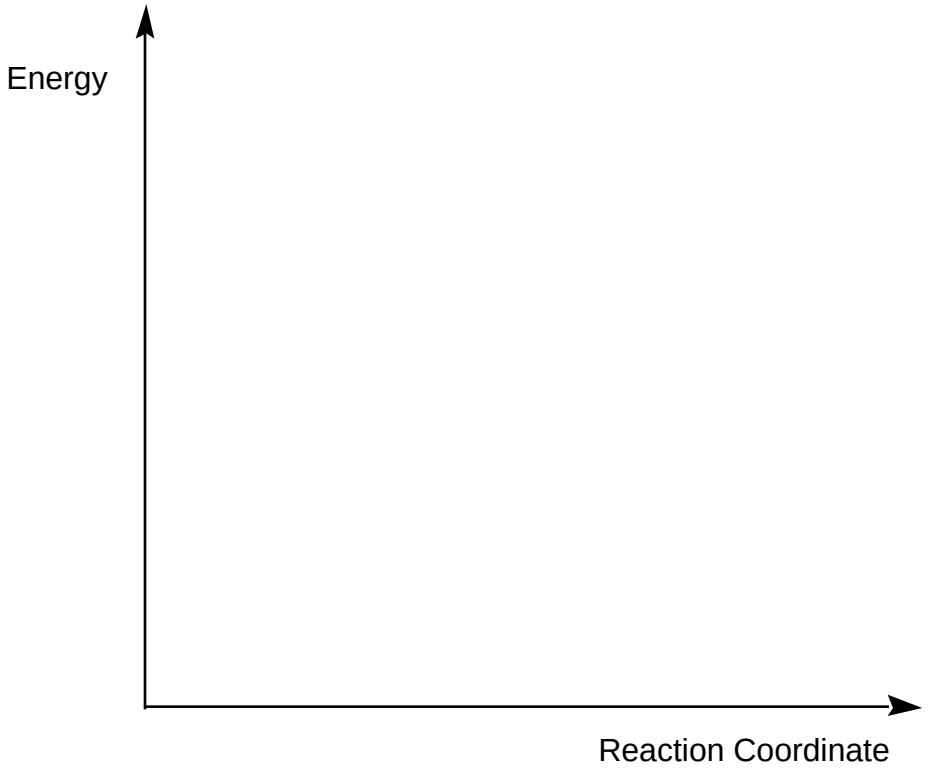
(5 pts) overall reaction:

--->

ΔH^o = _____ kcal/mole

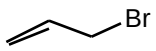
The energy diagram goes on the next page.

Problem 1 continued. Energy diagram (5 pts)



Brief Explanation (5 pts):

2) (4 x 5 pts = 20 pts) Allyl bromide **1** is a lachrymator. Exposure of allyl bromide vapors to the **moist** eye creates tearing and a burning sensation. 1-Bromopropane does not have this property.



1

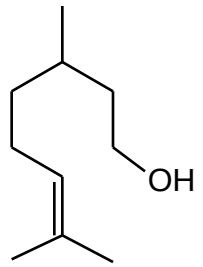
a) Use your knowledge of the S_N1 reaction to explain briefly why **1** exhibits this property and 1-bromopropane does not.

b) With the aid of p-orbitals and lines for single bonds, draw the structure of the reactive intermediate formed from **1**. Give a reason for its stability.

c) Write a balanced equation for the reaction of **1**.

d) What do you think causes the burning sensation?

3) (25 pts) Citronellol **1** appears in Ceylon and Java citronella oil as the enantiomer with $[\alpha]_D^{20} = +5.22^o$. The other enantiomer is present as a constituent in rose and geranium oil with a reported specific rotation of $[\alpha]_D^{20} = -4.76^o$. Assume that the dextrorotatory enantiomer is pure and that it contaminates the levorotatory enantiomer.



1

a) (10 pts) How much of each enantiomer is present in the contaminated sample? Show work.

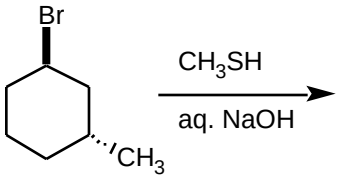
b) (5 pts) What is the optical purity (enantiomeric excess) of the contaminated sample? Show work.

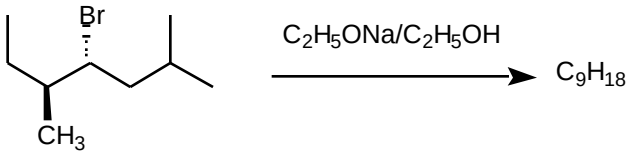
c) (5 pts) Draw the (R)-enantiomer.

d) (5 pts) Is the (R)-enantiomer the dextro- or the levorotatory enantiomer? Explain briefly.

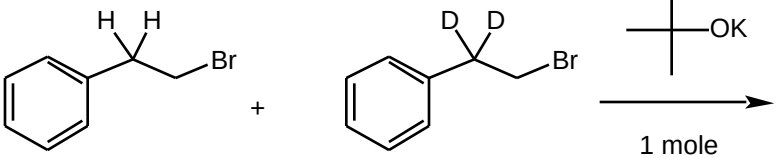
4) (6 x 5 pts = 30 pts) Predict the **major product** in each of the following reactions. Comment **very** briefly.

a) propane $\xrightarrow[h\nu]{Cl_2}$ monochlorination product

b) 

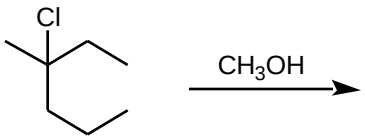
c) 

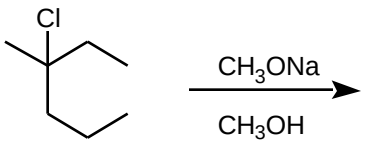
as a single enantiomer

d) 

1 mole 1 mole 1 mole

not an ether

e) (R)- 

f) (S)- 

Bond Dissociation Energies

Periodic Table

Work Sheets --- They will not be graded

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