EXAM 2

CHEMISTRY 220a

Friday, October 20, 2000

NAME (print): _____

TA:_____ Day:_____ Time:_____

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

Important items are in **bold**.

There is a **BDE Table** on the last page (page 12) of the exam. A **Periodic Table** is on page 11.

Do all **preliminary** drawing or computations on the **work sheets** (pgs. 8-10). The work sheets will not be graded.

The exam is 55 minutes.

STOP writing and hand in your exam when you are asked to do so.

REMEMBER: Neatness is to your advantage.

1. (26 pts) _____

2. (20 pts) _____

3. (10 pts) _____

4. (20 pts) _____

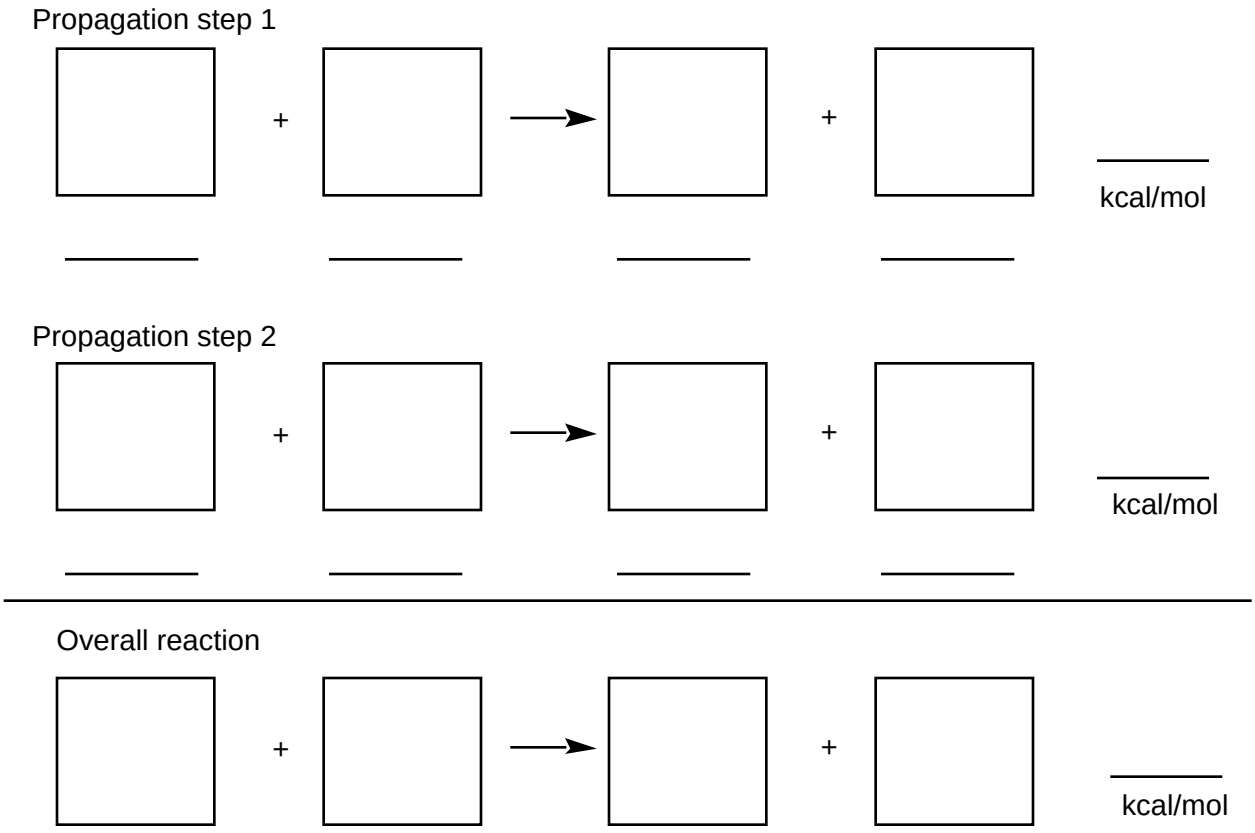
5. (24 pts) _____

_____

Total (100 pts)

1) (26 pts.) Problem 1 of the alkane module of ORGO dealt with the free radical chlorination of 2,2-dimethylpropane (neopentane) to form 1-chloro-2,2-dimethylpropane.

a) (10 pts.) Provide the two propagation steps and the overall reaction for this process. **Place the reactants and products in the appropriate boxes**.



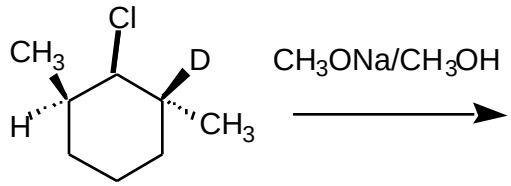
b) (8 pts.) Determine the heat of reaction for each of the propagation steps and for the overall reaction given the typical BDEs in the **BDE Table (page 12, last page)**. Place the values on the appropriate lines **under the boxes and at the end** of each reaction. **Show any calculations below**.

Problem 1 continued:

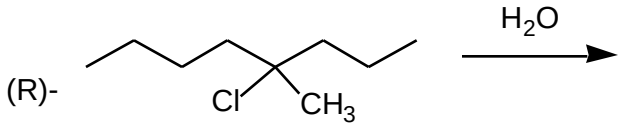
c) (8 pts.) Using Hess's Law and the overall reaction, determine the **heat of formation** of 1-chloro-2,2-dimethylpropane given: ΔH_f^o (neopentane) = -40 kcal/mol; ΔH_f^o (HCl) = -22 kcal/mol. **Show work**.

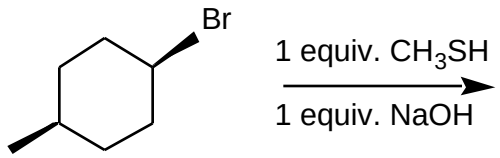
Heat of formation of 1-chloro-2,2-dimethylpropane ---> _____ kcal/mol

2) (20 pts.) Draw the **major product** in each of the following reactions. Give a **very, brief** (a few words) rationale.

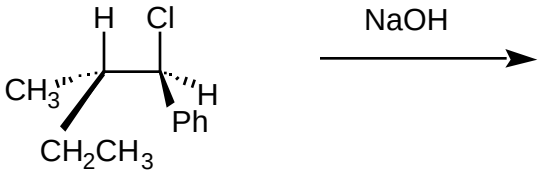
a) 

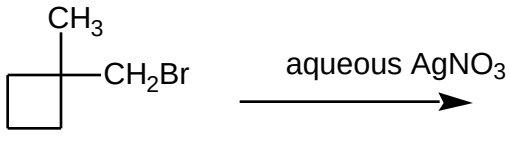
no oxygen in the product

b) 

c) 

not an alkene

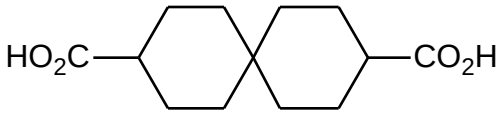
d) 

e) 

$C_6H_{12}O$ think about ring strain

3) (10 pts.) L-Tartaric acid (R,R; "The Natural") has $[\alpha]_D = +12^o$. When equal weights of natural tartaric acid and (±)-tartaric acid are mixed in solution and the rotation is taken, what is the value of $[\alpha]_D$. **Show work**.

4) (20 pts.) The diacid **1** may look achiral as drawn.



1

a) (7 pts.) Given your knowledge of the properties of allene dicarboxylic acid (PS4, #7), **Illustrate and explain** why **1** is capable of resolution.

b) (7 pts.) Present schematically how you would attempt the resolution of this compound? **A few brief words of explanation are welcome.**

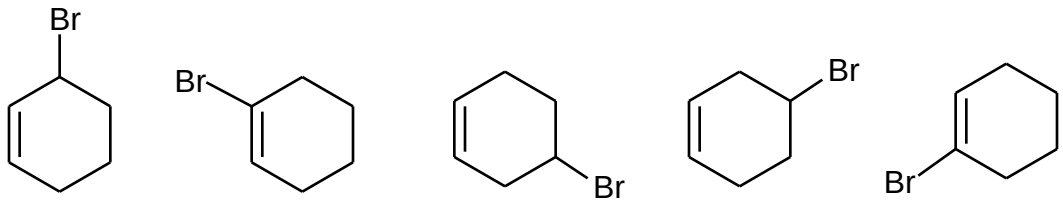
c) 6 pts.) There are no asymmetric carbons in **1** and yet it is capable of resolution. What would be the predicted sign of rotation of the (R)-enantiomer?

5) (24 pts.) Circle the **best answer(s)** in each of the following.

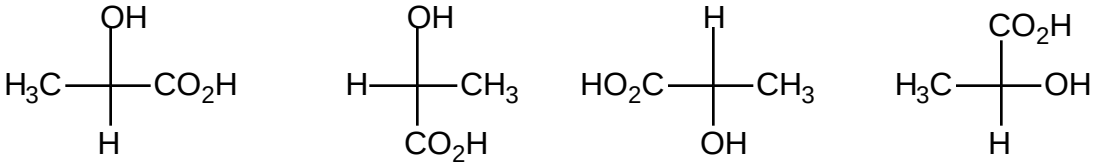
a) A mixture of enantiomers that has an enantiomeric excess (ee) of 40% contains how much of the **minor** enantiomer?

70% 80% 50% 30% 20%

b) The **major** monobromide to be formed from the free radical bromination of cyclohexene:



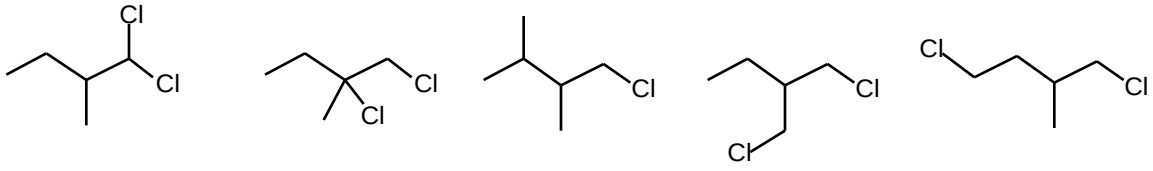
c) "One of these ~~things~~ [lactic acids] is **not** like the others, one of these things **doesn't** belong."



d) A 3/2 mixture of enantiomers displays $[\alpha]_D = -30^o$. The rotation of the **dextrorotatory** enantiomer is:

+ 300° -90° +150° -150° +60° -300°

e) The dichloro compound(s) that will be **achiral** or **racemic** upon free radical chlorination of (S)-1-chloro-2-methylbutane



f) The terms that are associated with an S_N1 reaction:

ionizing solvent rate = k[RX] intermediate

carbocation rearrangement

Work Sheets

Work Sheets

Work Sheets

Periodic Table

Bond Dissociation Energies

http://classes.yale.edu/chem220a/studyaids/thermo/BDE.html