Homework Assignment #5: Group Assignment

Following are group assignments for homework #5. The goals of this activity are to challenge you to work problems that are more complex and to practice working effectively in a group setting with people that you do not necessarily know well. The person with an 'O' after their name will be the organizer of the group and will be required to arrange meeting times and places to complete the assignment. The person with a 'W' after their name will be the person who prepares the final written assignment to be turned in for a grade. Groups will be re-assigned and roles will be changed for other sets of homework to be done in groups, so that you have the opportunity to work with a variety of different people and in different roles throughout the semester.

Submit only one set of answers per group. Please work with your assigned partners to prepare your final draft of answers. You may find it useful to make photocopies of the answer set, so that each group member may have it for reference. You may discuss ideas with other groups, but do not work formally with other groups. You may use your textbooks and any other written references from the library. Do not copy anyone else's work. The honor code pledge is printed below. By signing this page, you are acknowledging that you have read and understand the privileges and responsibilities that this code bestows.

This is due Friday, April 7, at the end of class.

On my honor, I pledge that I have not given, received, nor tolerated others' use of unauthorized aid in completing this work.

Signatures:

_____
Group member #1

_____
Group member #2

_____
Group member #3

_____
Group member #4

_____
Group member #5

Groups are assigned as follows:

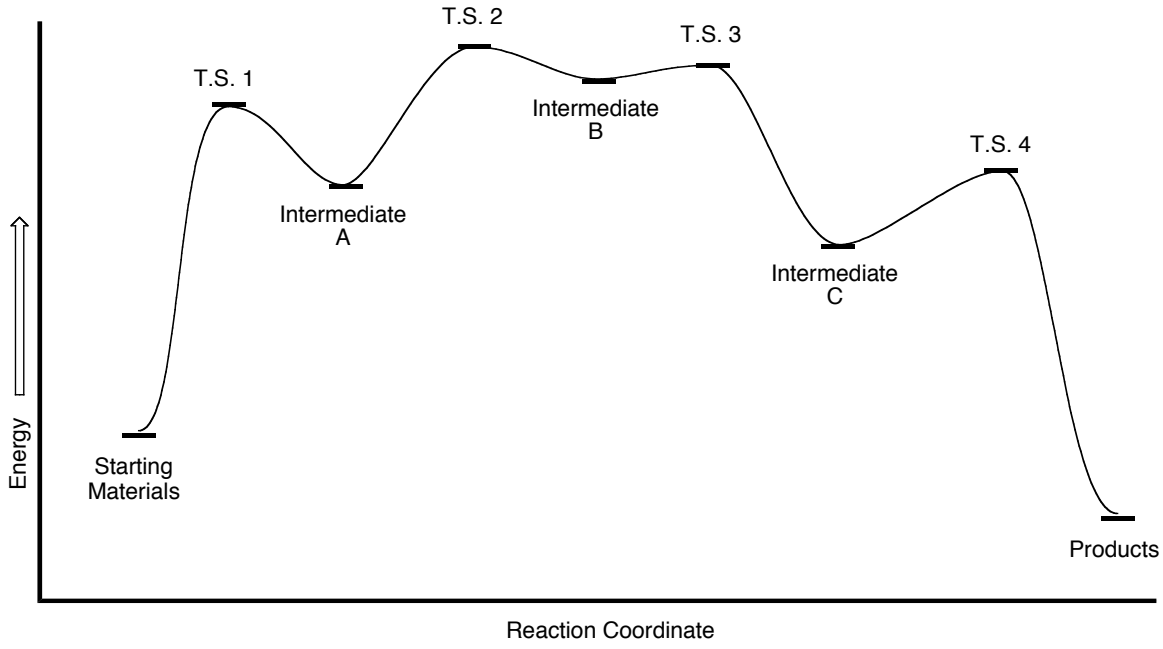
Nate Heggem Britney Manthey (O) Heather Rusk (W) Amanda Latchana Stephanie Caldwell Evan Hill	Katie Halvorsen Brittani Seagren Verronica Taylor Jennifer Stout (O) Cameron Ryan Allison Kise (W)	Josh Jacobsen Amy Veerkamp Nate Ebnet Joy Braband (W) Christopher Stark Luke Rieke (O)	Christine Dornbusch Molly Beernink (W) Kristine McGlennen Joel Rindelaub Jay Ellerbusch Ore Adenle (O)	Kristen Ruser Angela Colvin Jacob Bohnen (O) Brock Tidstrom Andrew Krech (W) Tanner Walen
Colin Schultz Ryan Dobbs (W) Ashok Jethwa Danielle Gergen (O) Ann Titzkowski Scott Engelman	Leanna Marking Nate Erickson (O) Brandon Baartman Lydia Davitt (W) Joel Beachey Daniel Forest	Nate Swenson Stephani Erlandson John Bennetts Carly Ernst (W) Whitney Bartolo (O) Jacob Holsten	Dennis Heaton Kristen Johnson (O) Meredith Carlson Stephanie Kling PJ Bevan Nicole Inglett (W)	Chad Wilshusen (O) Angela Magnusson Andrew Cerenske Tomas Liskutin (W) Asitha Jayawardena
Clement Auyeung Matt Seiffert (W) Ryan Espy Kathleen Coughlin Aileen Crumly (O)	Dave Pearson Lindsay Boldt (O) Brigette Peterson Andrea Janney Carl Johnson (W)	Mallory Richards David Guptill Katie Anderson (O) Michael Klayum Jill Koppelman (W)		

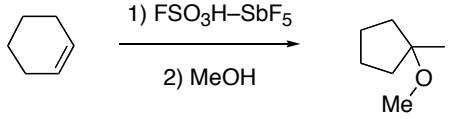
Note: Use the Photo directory to get email addresses. If you can't find an email in the directory, I will help, but don't ask me first.

Hint: It does little good to have everyone work on every problem. Part of effectively working in a group is being able to delegate workload. Assign each person in the group a problem, and then meet again to go over the answers. Make sure that you understand the answers that other group members present. **Remember, you are responsible for knowing all of the material, not just the problem(s) delegated to you.**

Names_____

1) Consider the potential energy diagram for the reaction shown below. Cyclohexene is stirred with a combination of fluorosulfonic acid (FSO_3OH) and antimony pentafluoride (SbF_5) at -60˚ C. Fluorosulfonic acid is a very strong acid, and antimony pentafluoride is a very strong Lewis Acid. Together, they make a powerful "super acid" whose conjugate base is unreactive (it doesn't show up in the organic products) - think of it as just H+. After stirring for a while, intermediate **C** is formed, and then methanol is added. Intermediate **B** is very high in energy. The only thing that makes this work is that intermediate **C** is much, much more stable. What are the structures of intermediates **A**, **B**, and **C**.





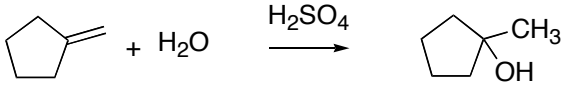
Intermediate A (3 pts):

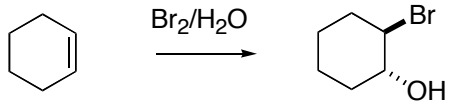
Intermediate B (4 pts):

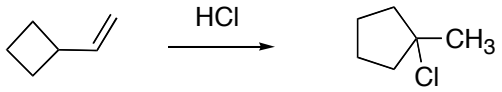
Intermediate C (3 pts):

Names_____

2) (6 pts each) Using curved arrow notation, provide a reasonable mechanism for the following reactions. Be sure to show proton transfers.

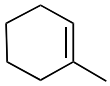
A) 

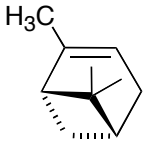
B) 

C) 

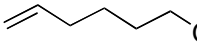
Names_____

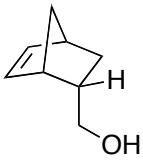
3) (5 pts each) Predict the ***major*** organic products for each of the following reactions. Pay particular attention to regio- and stereochemistry. If a reaction is stereospecific/stereoselective, the products you draw should reflect this. Building models of the starting material may help you determine the proper stereochemistry of the products.

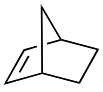
A)  Br_2 →

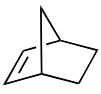
B)  1) BH_3 → 2) H_2O_2, NaOH

Building a model of this one will help

C)  HCl →

D)  1) $Hg(OAc)_2$ → 2) $NaBH_4$

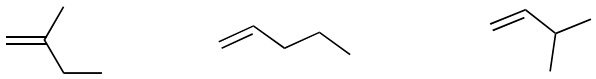
E)  1) O_3 → 2) Me_2S

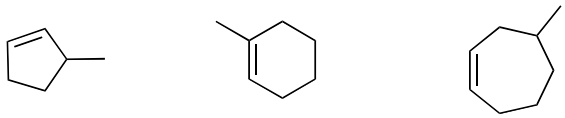
F)  1) OsO_4 → 2) $NaHSO_3$, H_2O

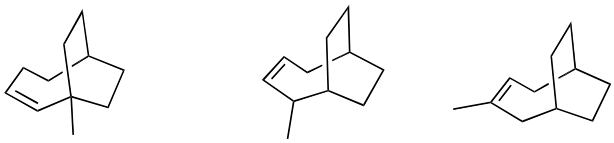
Building a model of this one will help

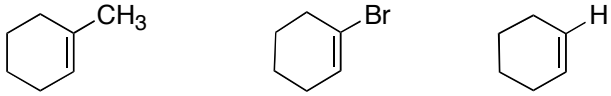
Names_____

4) (3 pts each) For addition of hydrogen halides and the acid catalyzed addition of water to alkenes, the transition states are of similar, but slightly higher, energy to the intermediate carbocations. Given that information, use what you know about energy diagrams to predict which molecule in each of the following sets will react fastest with HBr. Circle the molecule that will react fastest. Hint: consider everything you know about how to stabilize charge.

A) 

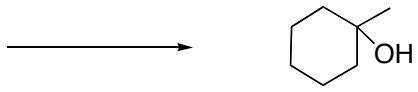
B) 

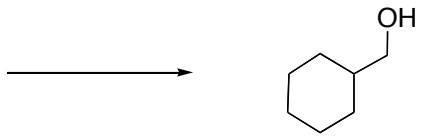
C) 

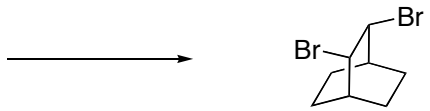
D) 

Names_____

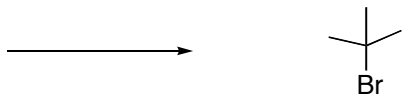
5) (5 pts each) Knowing what products result from the reaction of a given starting material with a given reagent is important information. Knowing how to work backwards to figure out how to make a given molecule is even more important for synthesis. Provide starting materials and reagents to make the following molecules.

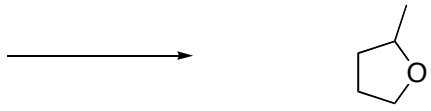
A) 

B) 

C) 

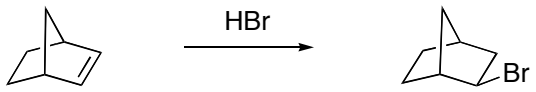
D) 

E) 

F) 

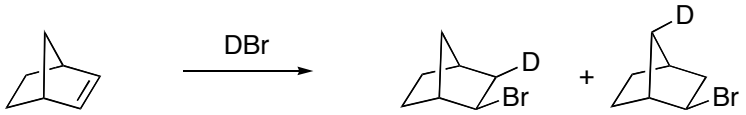
Names_____

Extra Credit (10 pts). Addition of HBr to norbornene (**1**) to get **2** is an interesting reaction because the mechanism is not as straight forward as one might think.



1 **2**

Although it is not apparent in product **2**, two different products are formed. In one of them, the hydrogen from the acid is not on the carbon adjacent to the bromine. By substituting a deuterium (an isotope of hydrogen) for the acidic hydrogen, we can track where the hydrogen actually ends up. For example, reacting **1** with DBr (which reacts just like HBr) provides two different observable products, **3** and **4**, in equal amounts.



1 **3** **4**

Using everything you know about carbocations, explain why you get **two** regioisomeric products. (HINT: Draw the intermediate and think about what all can happen.)