

UCSC, Binder Name _____

Student ID # _____

Survey of Organic Chemistry
EXAM 2 (300 points)

In each of the following problems, you will use your knowledge of organic chemistry conventions to answer the questions in the proper manner. Be sure to read each question carefully. For extra credit, write down your favorite summer location on the last page of the exam. You have the entire class period (2 hours) to complete this exam. Pay attention to point values and problems to skip to use your time wisely.

Keep your eyes on your own paper. Electronic devices of any kind are not allowed, including cell phones and calculators. Any student found using any of said devices, or found examining another student's exam, will be promptly removed from the exam room and at minimum will receive a zero on this exam. Such an incident may also be considered a form of academic dishonesty and reported to the UCSC Judiciary Affairs Committee.

1 (55)	
2 (44)	
3 (40)	
4 (41)	
5 (40)	
6 (40)	
7 (40)	
Total	

1. Fundamentals & Nomenclature

(a) (10 points) Use the information provided below to determine the degrees of unsaturation and molecular formula of **Loratidine**, an allergy medicine that Dr. B used to give to her cat Missy ☺

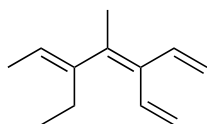
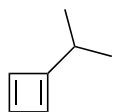
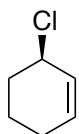
Loratidine has four (4) rings and eight (8) double bonds...

Degrees of Unsaturation _____ **Hydrocarbon Equivalent** (with unsaturation): $C_{22}H$ _____

Formula of a fully saturated C22 molecule: $C_{22}H$ _____

Number of Hydrogens in Loratidine: $C_{22}H$ _____ ClN_2O_2

(b) (15 points) Provide the IUPAC name for the following compounds. Include stereochemistry in the name, where appropriate.



(c) (12 points) **Draw structures** corresponding to the following names.

(3*E*,5*Z*)-2,6-Dimethyl-1,3,5,7-octatriene

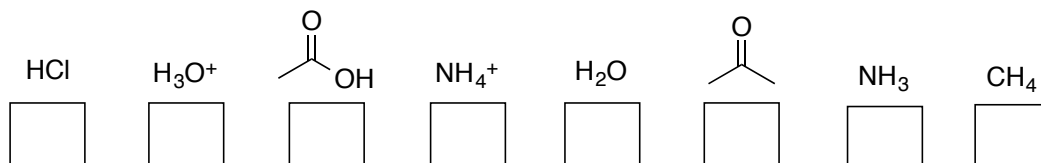
4-Methyl-1,3-pentadiene

(d) (18 points) For each functional group, **draw a simple (3 carbon-containing) example**.

Ketone	Aldehyde	Alcohol	Alkyl Halide	Alkene	Alkyne

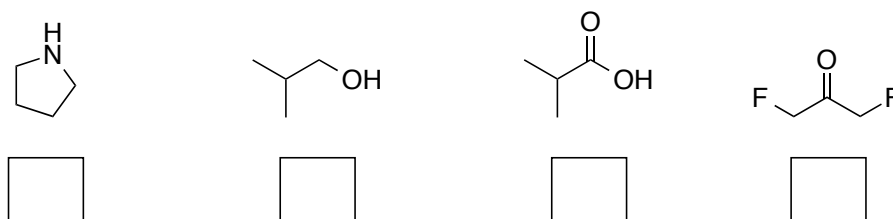
2. Acid-Base Chemistry

(a) (16 points) The following compounds are listed in order of acidity (most acidic on the left). Indicate the approximate **pKa value** that belongs to each compound in the boxes provided.

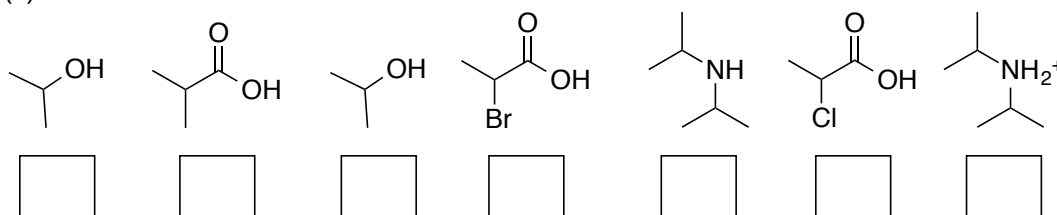


(b) (18 points) Rank the following sets of molecules from **most acidic (1)** to **least acidic (4)**.

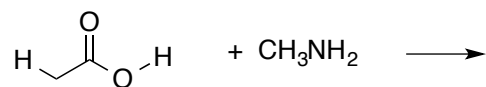
(i)



(ii)



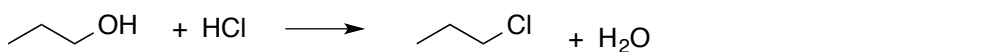
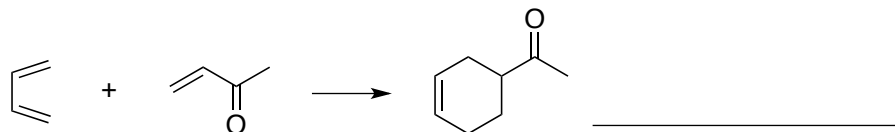
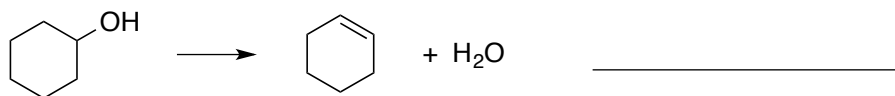
(c) (10 points) Choose the **more acidic proton** and **draw the products** in the following reaction. No arrow-pushing necessary.



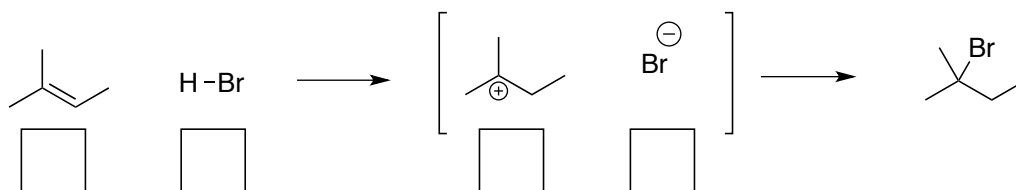
* Circle the more acidic proton.

3. Reaction Warm-up

(a) (9 points) Identify the following reactions as **additions, eliminations, substitutions, or rearrangements**.

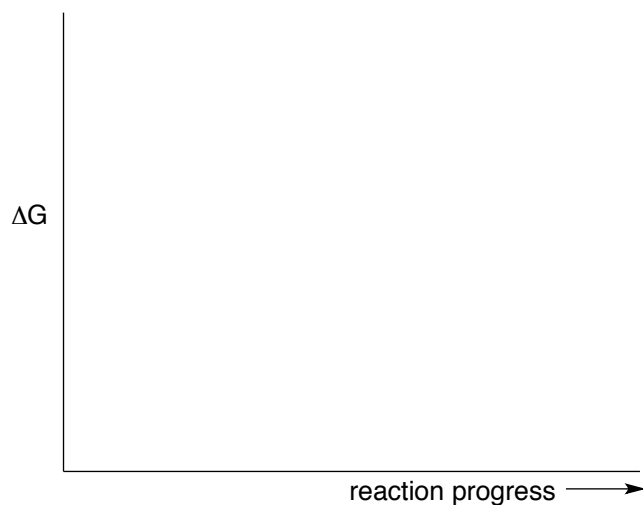


(b) (14 points) **Add curved arrows** to show the mechanism in the following reaction. Clearly label the reactants in both steps as either a **nucleophile (N)** or **electrophile (E)**.



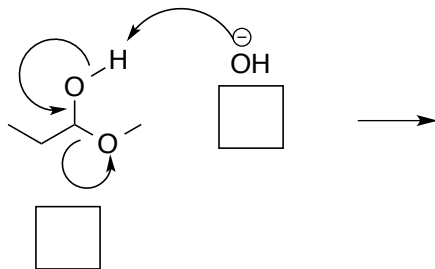
(c) (17 points) **Sketch a reaction energy diagram** for the reaction above. This is an **exergonic reaction** where the **first step is rate limiting**. Be sure to label the following on the diagram:

- Reactant (R)
- Product (P)
- Intermediate (I)
- Transition States (\neq)
- Activation Energies (E_a)

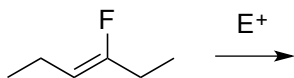
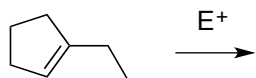


4. More Reaction Warm-Ups

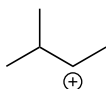
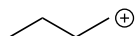
(a) (14 points) Follow the arrows in the reaction and **draw the products**. Clearly label both reactants as either a **nucleophile (N)** or **electrophile (E)**.



(b) (15 points) **Draw the two carbocations** that could theoretically form in the first step of the electrophilic addition to the following alkenes (even though we know only one is actually formed!). **Circle the more stable carbocation** in each case.



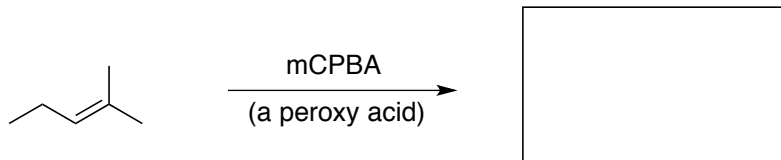
(c) (12 points) Each of the following carbocations can rearrange to a more stable ion. Propose structures for the likely **rearrangement product** in each and use **arrow-pushing** to explain this rearrangement.



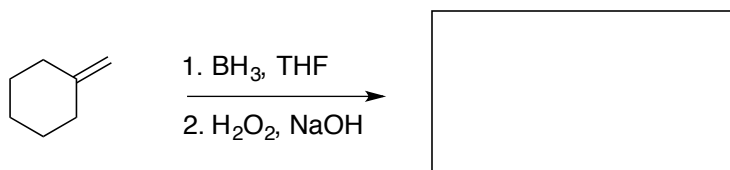
5. Single step reactions – FILL IN THE BOX. **Choose any four** of the five reactions below and fill in the missing reactant, reagent/solvent, or product. Put a large “X” over the problems you are skipping. Otherwise the first four will be graded.

(40 points) Complete any four of the reactions below.

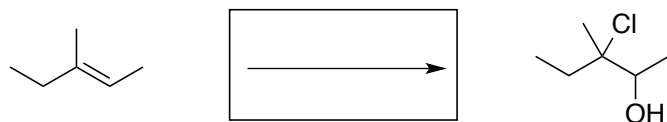
(a)



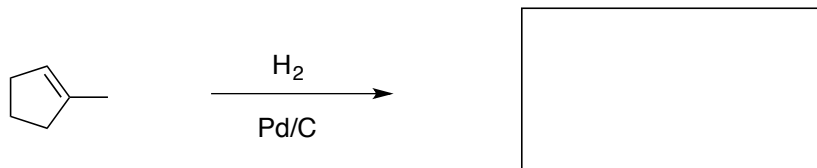
(b)



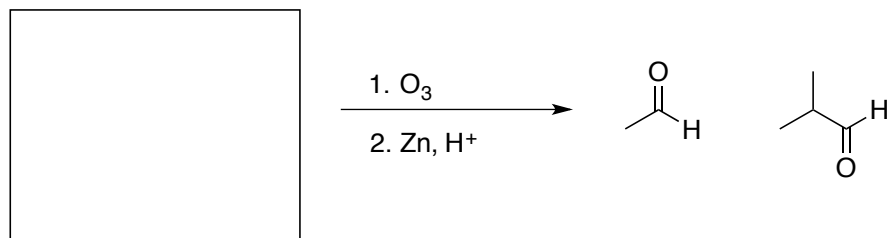
(c)



(d)



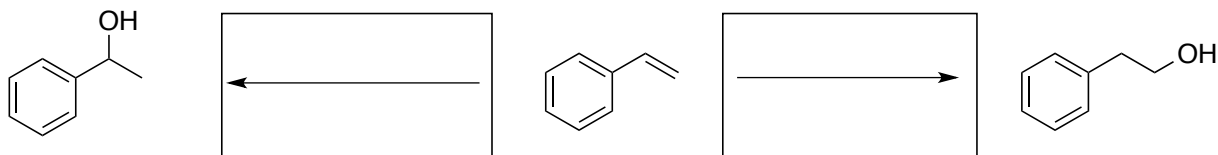
(e)



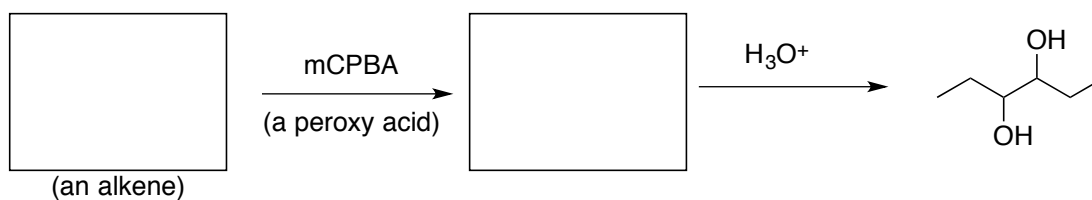
6. Reaction Puzzles

(a) (40 points) Fill in the box with the missing reactants, reagents, or products.

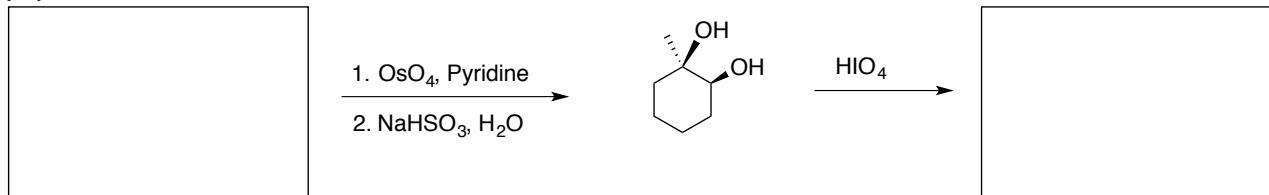
(i)



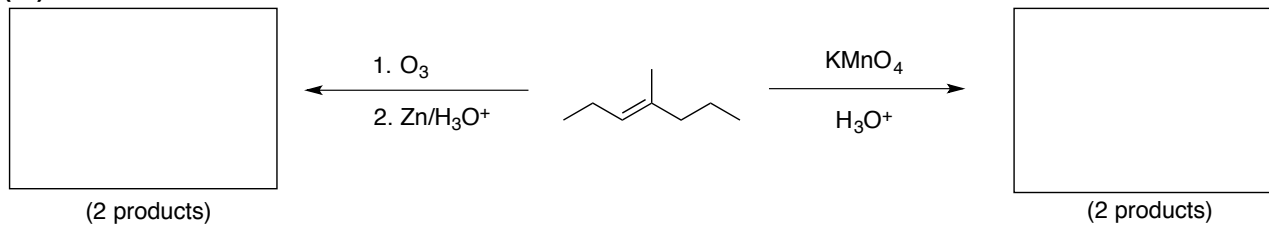
(ii)



(iii)

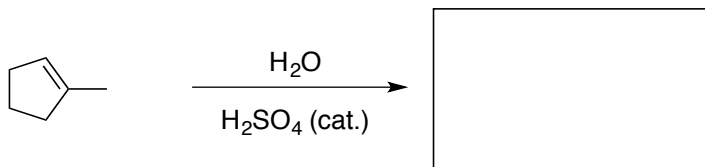


(iv)



7. (40 points) Reaction Mechanisms – Choose one of the following. Draw a large “X” over the part you are skipping, otherwise the first problem will be graded.

(a) The acid-catalyzed hydration of methylcyclopentene provides a single alcohol product. Draw the **step-wise arrow-pushing mechanism** and the **product** of this reaction.



(b) The electrophilic addition of hydrobromic acid to 4-methyl-2-pentene gives an unexpected product due to a rearrangement. Show the **step-wise arrow-pushing mechanism** for this reaction and **briefly explain** why this rearrangement may have occurred.

