

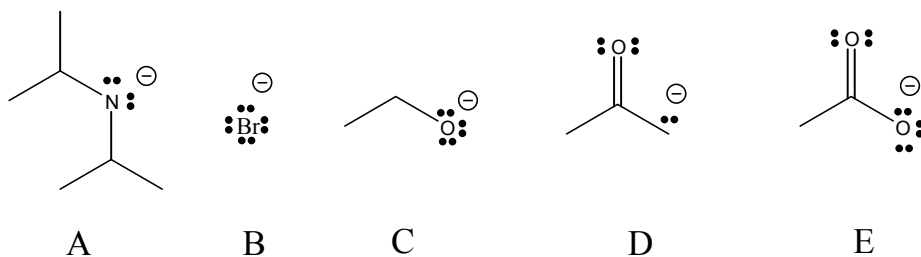
Name: _____

Organic Chemistry - CHEM 231A

Final Exam

December 13, 2001

1. Consider the following molecules: (30 points)



- 1a. What is a base? What factors are involved in making a base a strong base? (8 points)

- 1b. Circle the MOST basic atom(s) for each molecule. (2 points)

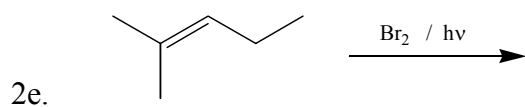
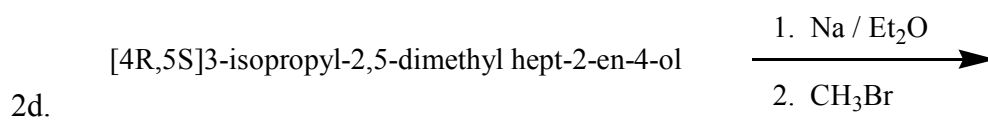
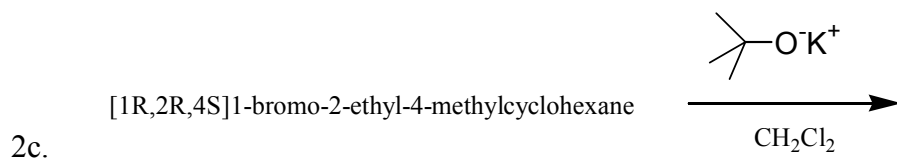
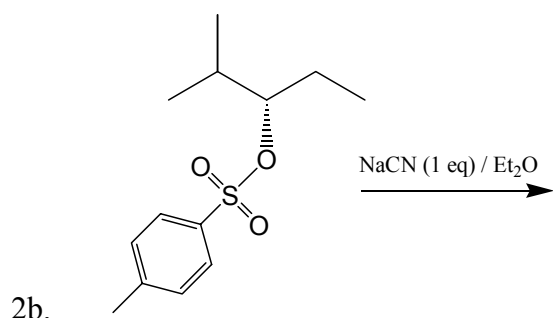
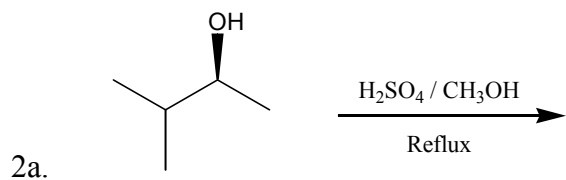
- 1c. Arrange the molecules in the order from most basic to least basic. (4 points)

Most Basic _____ > _____ > _____ > _____ > _____ Least Basic

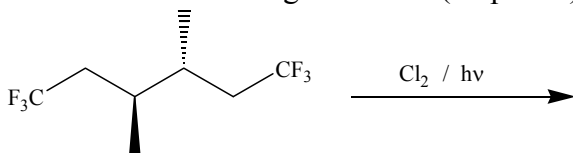
- 1d. Thoroughly explain your reasoning behind the ordering of the molecules. Include a discussion of why the characteristics for each specific molecule help us understand the basicity for EACH molecule. Discussing them in order may be appropriate. (10 points)

- 1e. Which of the above molecules are also nucleophiles? Explain Briefly. (6 points)

2. Predict the **MAJOR** product for the following reactions and briefly explain your answer.
(5 @ 8 pts = 40 points)



3. Consider the following reactions: (40 points)



3a. As drawn, is the starting material, racemic, enantiomerically pure, achiral, diastereomerically pure, chiral, optically pure or meso? More than one may apply. Explain briefly. (4 points)

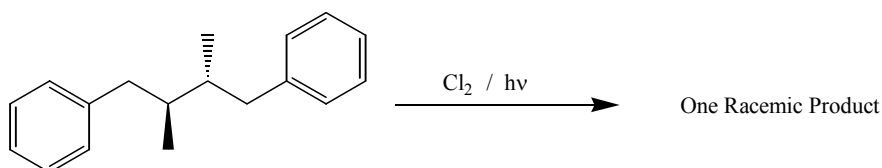
3b. What are the products for the reaction? Include any relevant stereochemistry. (9 points)

3c. Label the products as enantiomerically pure, racemic or achiral. (4 points)

3d. Choose one product and propose a mechanism that explains the formation of this product? (10 points)

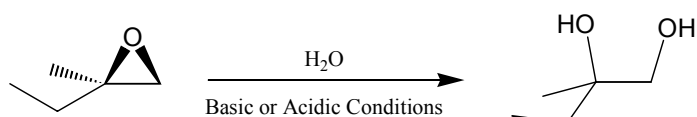
3e. Draw an energy diagram which represents this mechanism. (6 points)

- 3f. If the reaction is changed to investigate the following molecule, only one racemic product is formed:



What is the product? Explain briefly why it is the only product formed. (7 points)

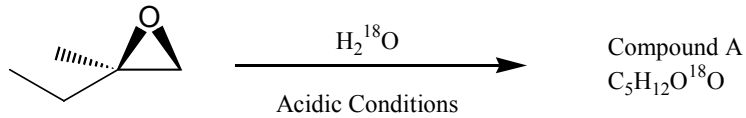
4. Consider the following problem: (40 points)



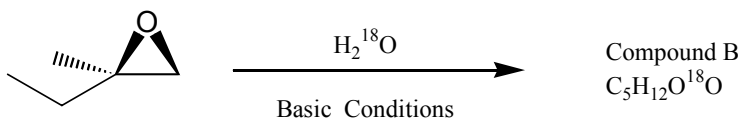
Optical Rotation = + 75

- 4a. The optical rotation of pure [2R] 2-methyl butanoxirane is +98°. What is the optical purity of the starting material in the above reaction? How much of each enantiomer is present? Show your work. (7 points)
- 4b. The above reaction occurs rapidly at pH 3 and at pH 10, but not at all at pH 7. Explain these results. (8 points)

- 4c. If the reaction is conducted using oxygen-18 water instead of normal oxygen-16 water, the product formed under acidic conditions (Compound A) is different than the product formed under basic conditions (Compound B). Both molecules have the same molecular formula. What are the two different products? (8 points)



Optical Rotation = + 75



Optical Rotation = + 75

- 4d. Write a mechanism that accounts for the formation of each product. (12 points)

- 4e. What is the optical purity for the product formed under acidic conditions? For the product formed under basic conditions? Explain briefly. (5 points)