CHEM 2115 Survey of Organic Chemistry

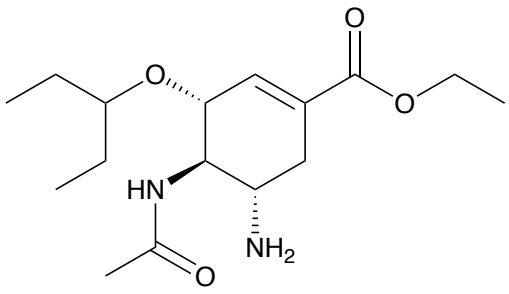
New Mexico State University

Final Exam

May 12th, 2021

Name_____

Question 1. The drug Tamiflu, prescribed to treat the flu, consists of the small organic molecule shown below. Answer the questions below based on this compound.



ethyl (3*R*,4*R*,5*S*)-4-acetamido-5-amino-3-(pentan-3-yloxy)cyclohex-1-ene-1-carboxylate

a. There are 5 functional groups in the molecule above, circle each functional group and label them accordingly (5 points)

b. What is the chemical formula for the drug shown above? (5 points).

c. How many stereocenters are there in the molecule? Pick one, but a star next to it, and label it as *R* or *S* (3 points).

d. Tamiflu is proposed to work by inhibiting the influenza virus enzyme neuroaminidase. It does this by fitting nicely into the 3D conformation of the protein, which level of protein structure would be responsible for this 3D conformation? (2 points)

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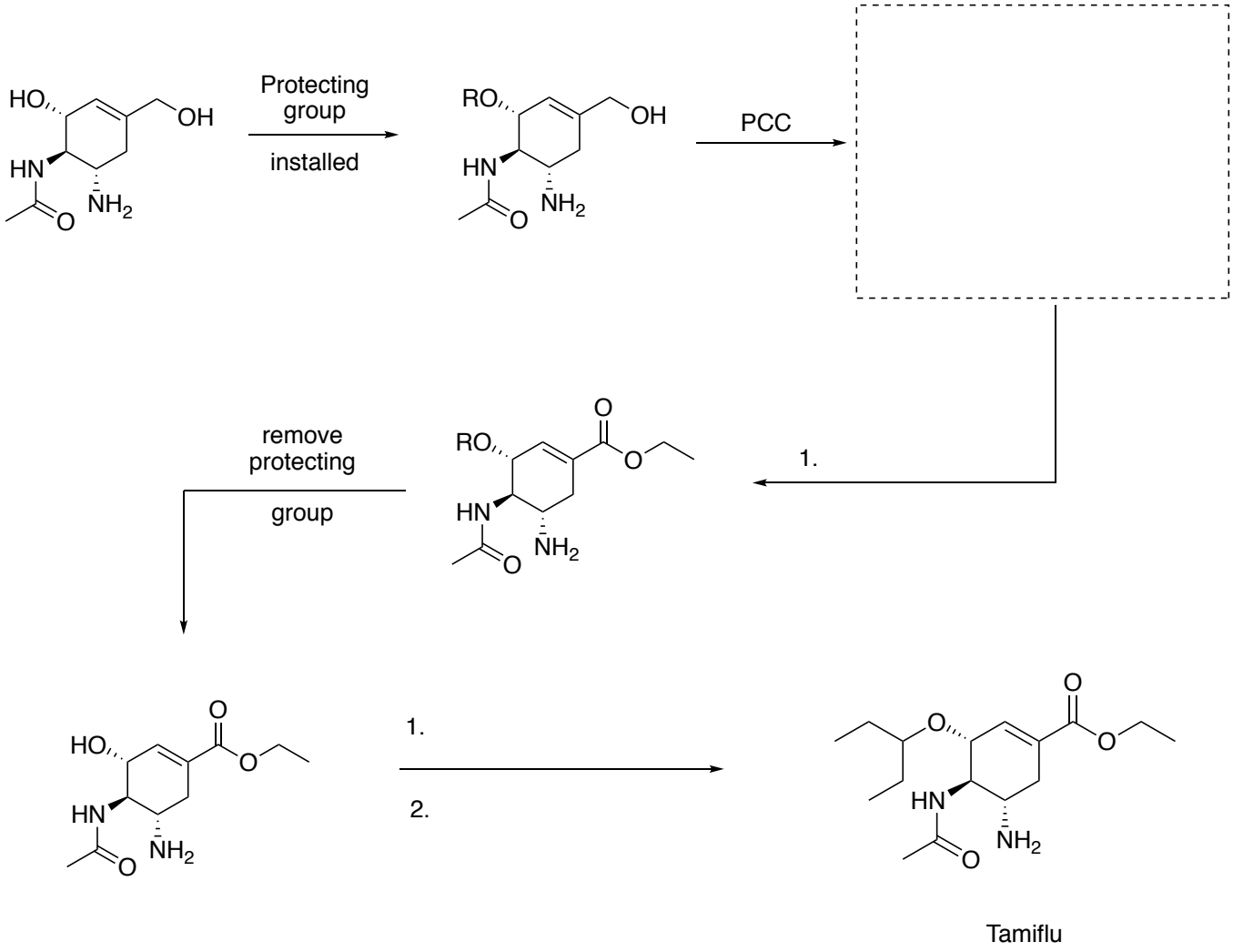
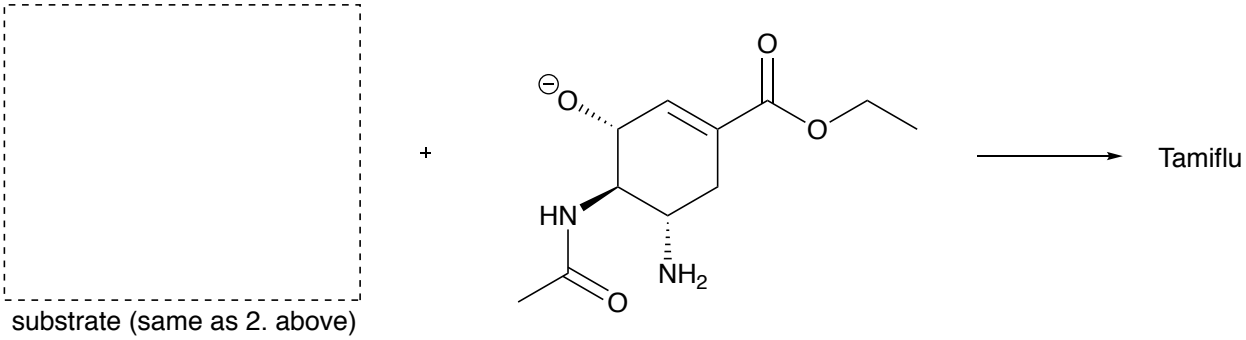
Question 2. As new organic chemists, you have the knowledge and skills to make Tamiflu! I will give you some guidance in doing so, but fill in the missing reagents or structures where prompted. (8 points)



Tamiflu

Question 3. For the final conversion of the alcohol to obtain Tamiflu, draw the substrate needed to complete the reaction, and then draw the neccessary arrows in the mechanism to form the product. (4 points)



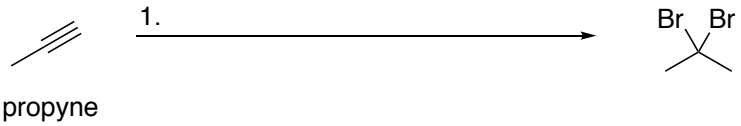
substrate (same as 2. above)

Tamiflu

This mechanism occurs through the pathway of an SN1 SN2 E1 E2 (circle one, 2 point)

Question 4. We recently discussed the synthesis, structures, and dangers of many illegal and recreational drugs. Similar to many recreational drugs “Bath salts” are extremely dangerous due to the unknown purity, chemical structure, and effects, but unlike many of it’s counterparts, Bath salts are made entirely synthetically, and therefore exist as an entire group of potential structures with similarities to MDMA and methamphetamine. Below is a bath salt derivative that could be synthesized from catechol and propyne.

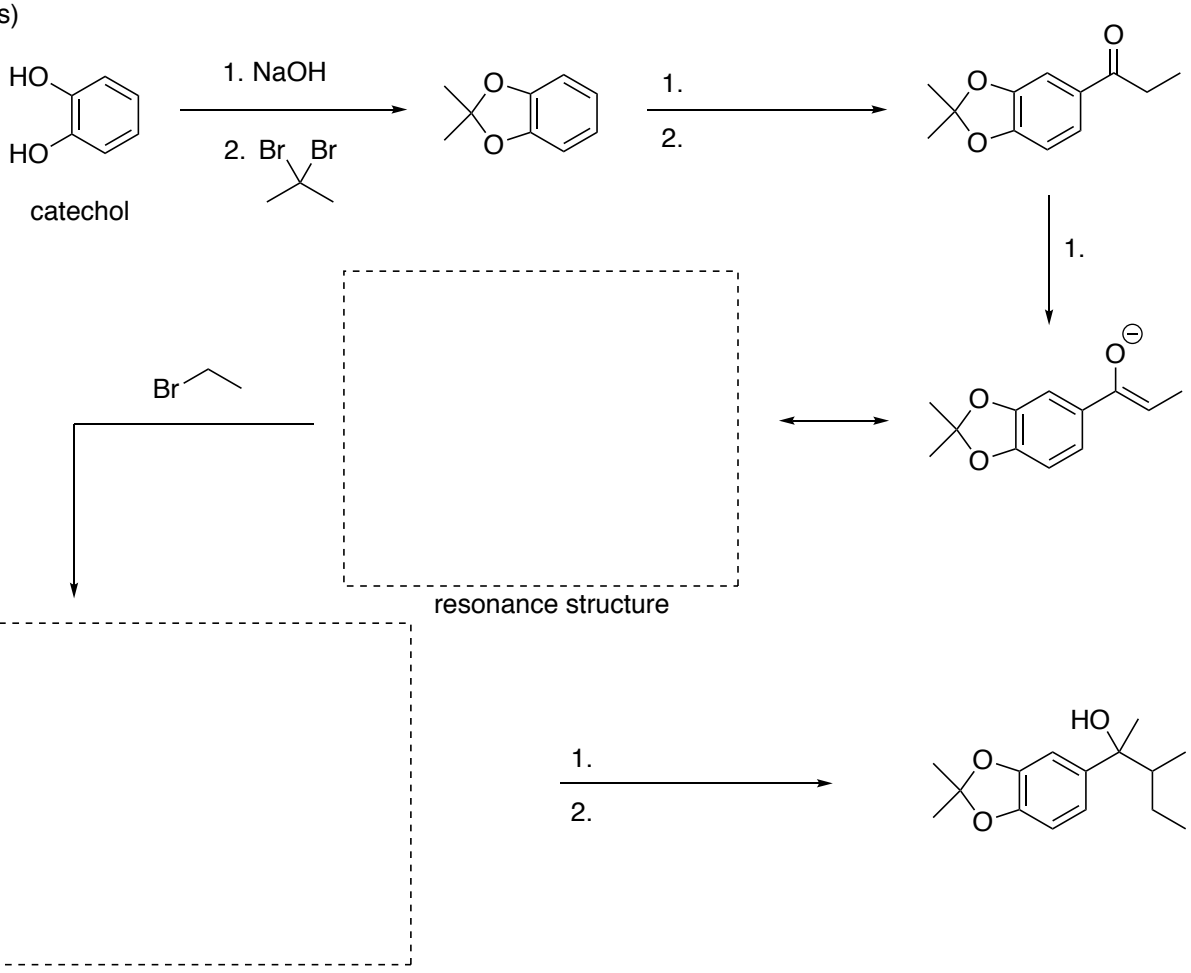
a. Fill in the missing reagent to make the dibromoalkane. (2 points)



propyne

b. Provide the structure of the first carbocation intermediate formed in the reaction above (4 points)

c. Show the expected products, resonance structures, and missing reagents in the reaction pathway shown below. (12 points)



catechol

d. The drug that we made is missing a critical feature responsible for significant activity in most recreational drugs. What is this missing feature or the name of the classification for drugs that contain this feature? (2 points)

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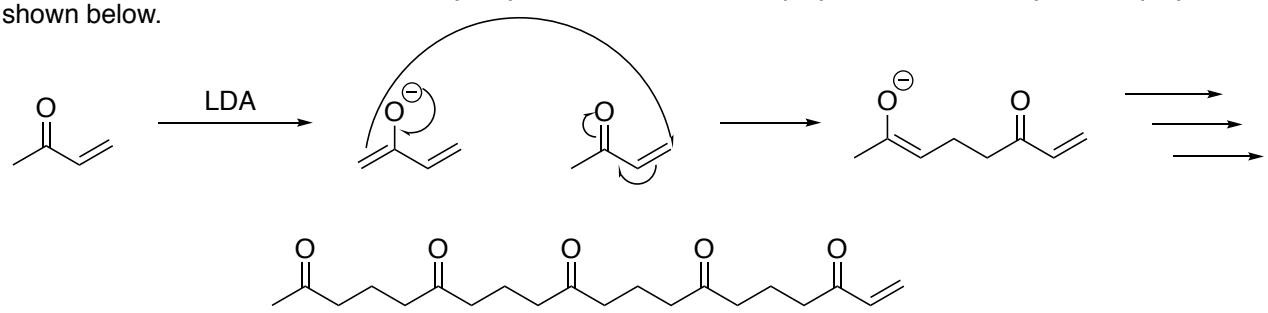
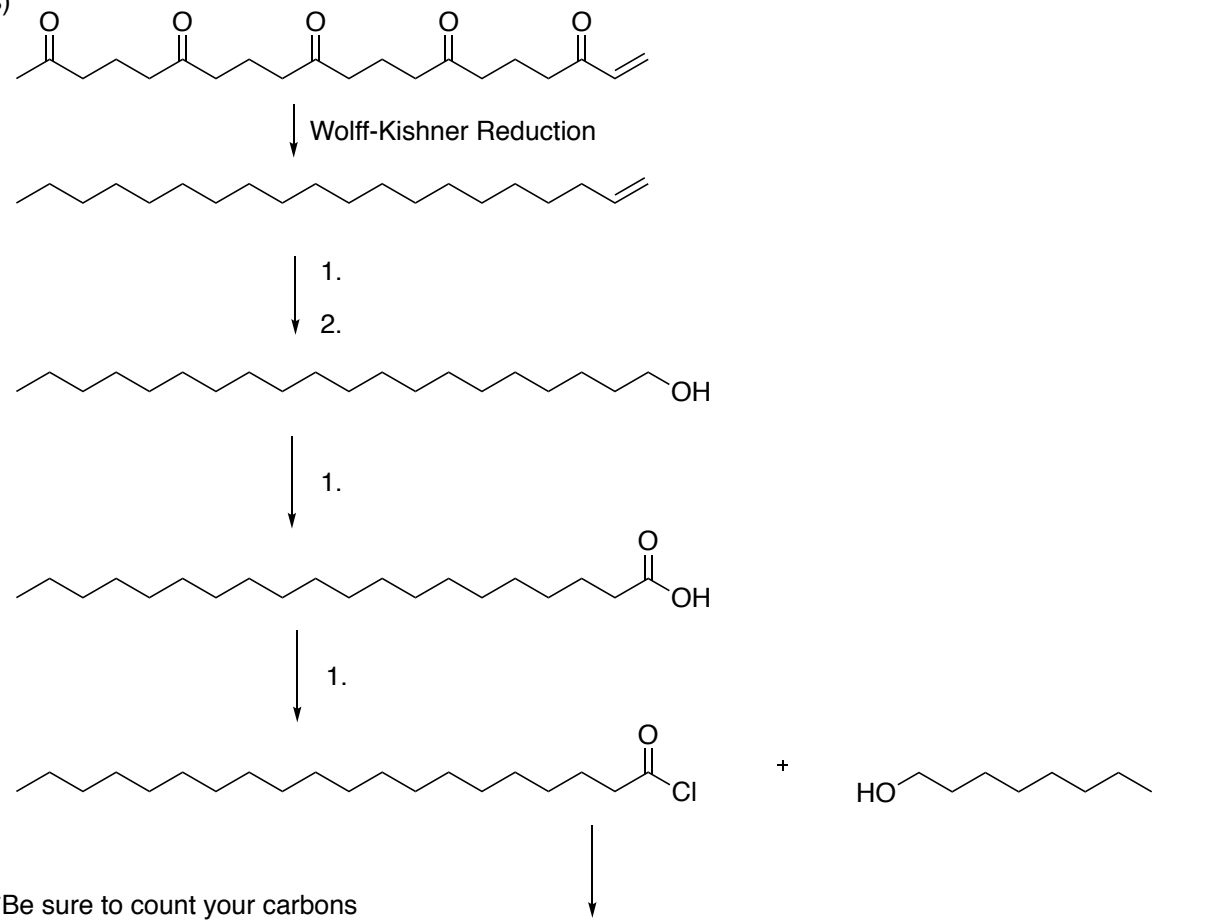
Question 5. When methylvinylketone is reacted with lithium diisopropylamine (LDA), it rapidly forms the enolate, which can react with another molecule of methylvinylketone. The eventual polymerization could yield the polymer product shown below.



a. Based on the mechanism shown, what type of polymerization occurred in order to produce the polymer? (2 points)

b. There is a two-step reaction capable on reducing ketones to alkanes. The resulting alkene can undergo a series of reactions to yield a naturally occuring compound. Fill in the missing reagents and answer the following questions (11 points)



*Be sure to count your carbons

Based on your knowledge of chemistry, what type of molecule would you classify this as? (2 points)

Would you expect this molecule to be soluble in water? (2 points)

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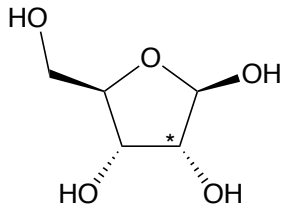
Question 6. The molecule shown below is ribose. Answer the following related questions.



a. What class of chemicals does ribose belong to? Would you expect this molecule to be soluble in water? (4 points)

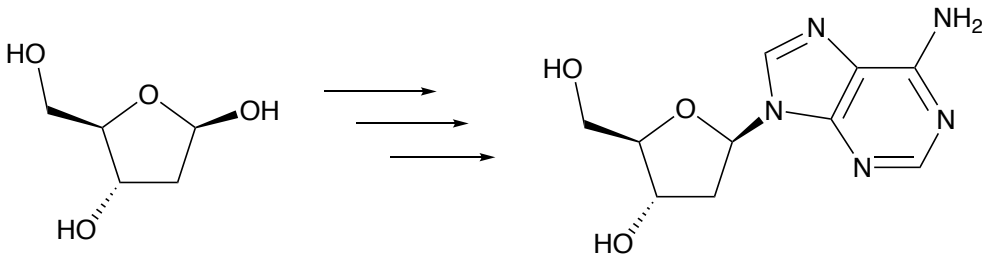
b. How many stereocenters are there in ribose? (2 point)

c. Draw an arrow pointing to the anomeric carbon (2 points)

d. Is this ribose existing as alpha or beta? (2 points)

e. Determine if the carbon marked with an * is R or S (2 points)

f. There is a fancy reaction that can convert ribose to a nuceloside, shown above is the nucleoside adenosine. Based on the structure shown above, is this an example of RNA or DNA? (2 points)



g. What is the complementary base pair to this nucleoside? (2 points)

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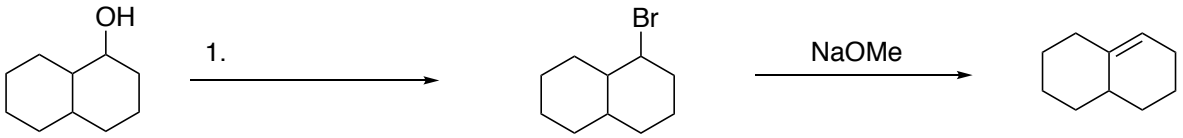
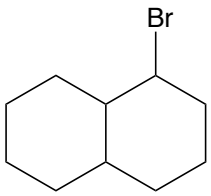
Question 7. The bicyclic molecule shown can undergo reactions just like its less complex relatives. Fill in the missing reagent neccessary to undergo the transformations. (2 points)

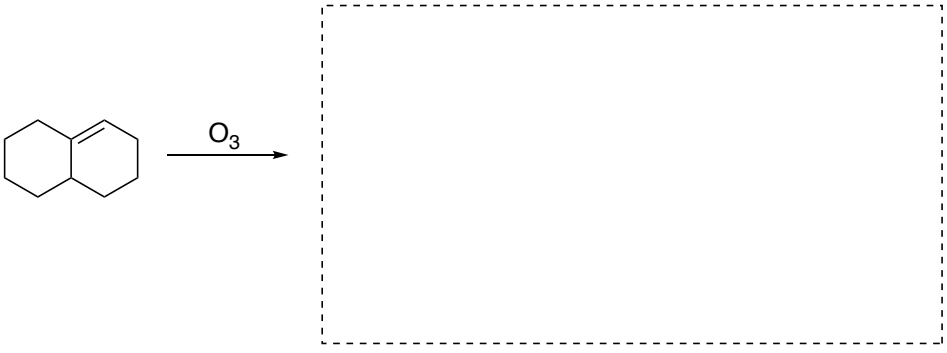


The product shown by the E2 reaction of bromine with Sodium methoxide (NaOMe) is only the major product. On the structure below, draw in the hydrogens that will be abstracted by the NaOME to produce the major and minor products, and label them as such (4 points)



What would be the minor product obtained from the elimination product? Why is this the minor product? (6 points)

Provide the product of the ozonolysis reaction shown below. (2 points)



Question 8. For the final question, briefly tell me your favorite thing you learned in this class. (4 points)

Thank you for your participation, energy, focus, time, and hard work this semester! You have all given me a great first teaching experience and I look forward to seeing you all succeed in the future.

Don’t hesitate to reach out via e-mail (aepaton@nmsu.edu)

- Allie Golliher