Midterm 3 – Chem 3A, Fall 2020
Monday, 11/23/2020, 7-9 pm

Time limit: (90 minutes for exam content) + (30 minutes for technology) = 120 minutes

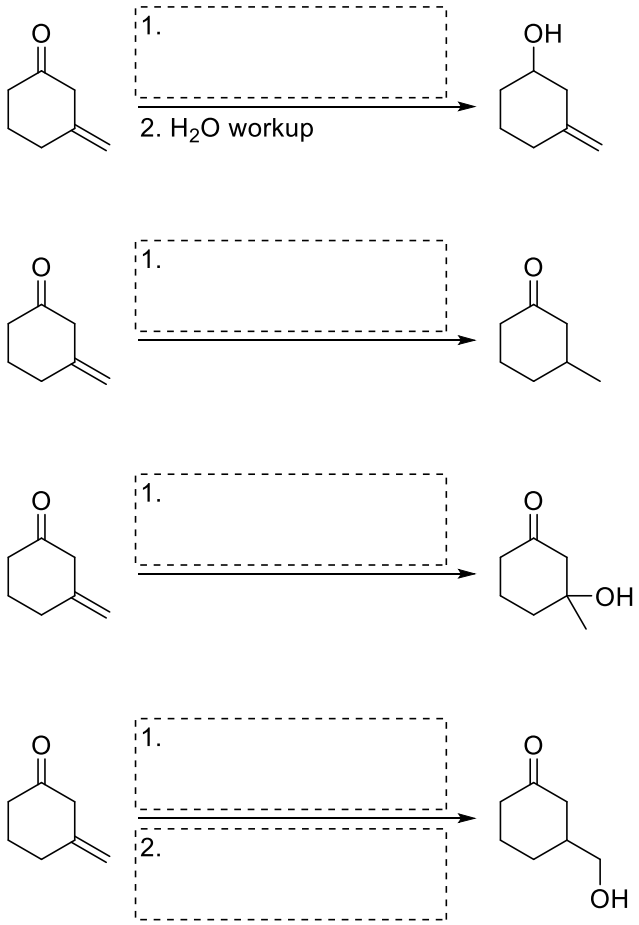
Academic Integrity:
I acknowledge the following academic integrity guidelines for this exam:

- If I submitted an "Exam Notes" assignment on bCourses for this exam, I **AM** allowed to use those notes for this exam.
- I am **NOT** allowed to use any other notes or resources during the exam (including materials posted on the course website or ANY other websites.)
- I am **NOT** allowed to communicate about the questions or content of the exam with anyone other than Chem 3A instructors, directly or indirectly, until **3:00 pm PDT on Wednesday, 11/25/2020.**
- I am **NOT** allowed to post files or images of any part of this exam on ANY website, even after the deadline above has passed, with the exception of the Fall 2020 Chem 3A Piazza site.

Name_____ Student ID #_____

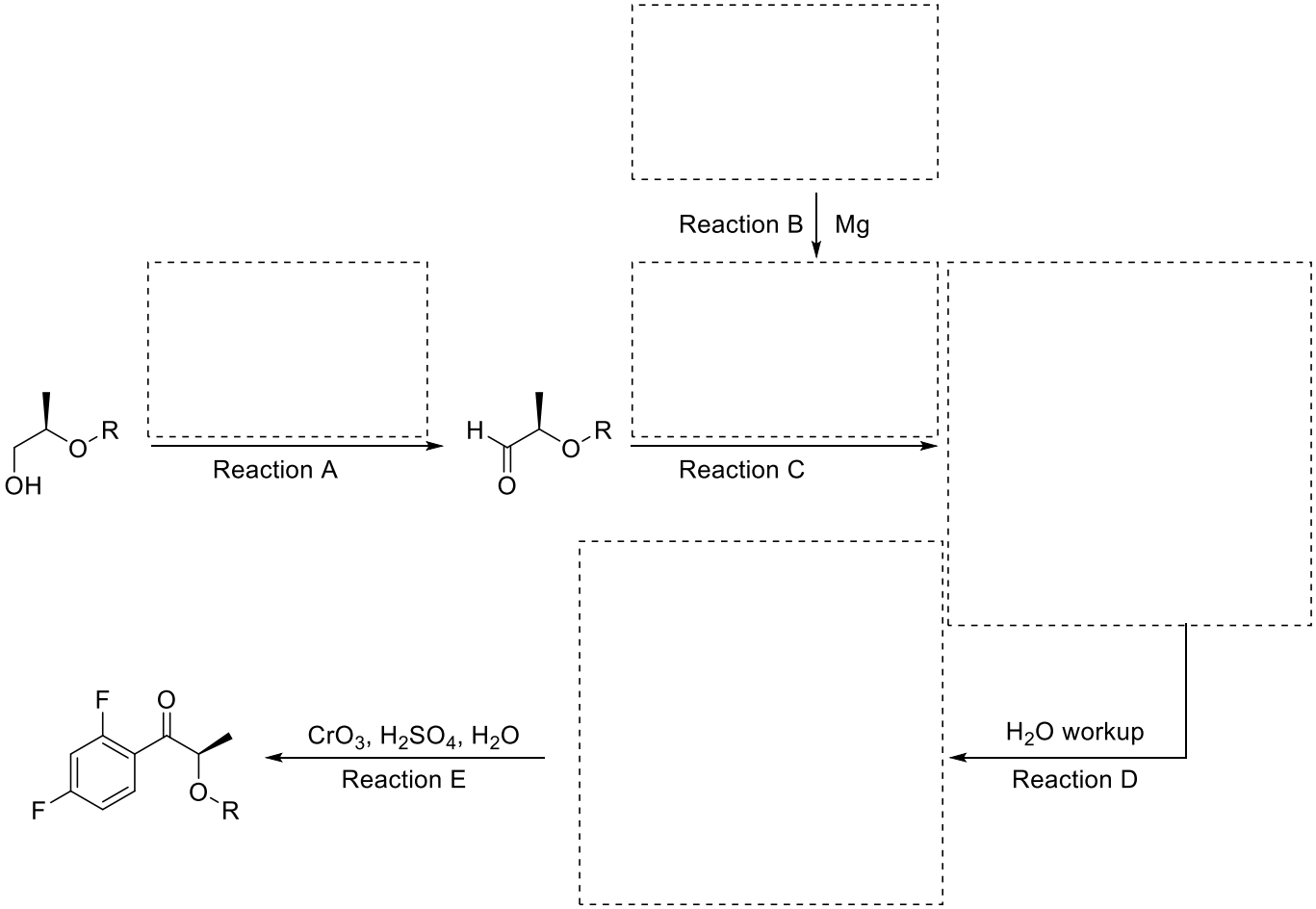
Signature: _____

1. Fill in the missing reaction conditions. Ignore stereochemistry. (12 pt)



2. **Multistep Synthesis**

a. Fill in the boxes in the multistep synthesis scheme. Include stereoisomer(s) if relevant. (12 pt)

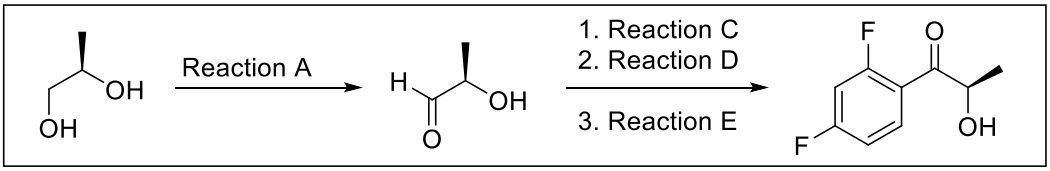


b. Kim and MaryAnn were planning to modify the starting material as shown below, then carry out the same reaction sequence *(using the same conditions as were used for reactions A-E in the scheme above)*. Their students explained to them that it was a bad idea, since **Reaction A** wouldn't work as planned, and even if it did, **Reaction C** wouldn't work as planned either.

What problems did the students identify? **Use structure(s) and a few words to show what might happen instead of each planned reaction.** (6 pt)

MaryAnn and Kim's bad plan:

(see scheme above for reaction conditions)



The problem with **Reaction A** in this plan is:

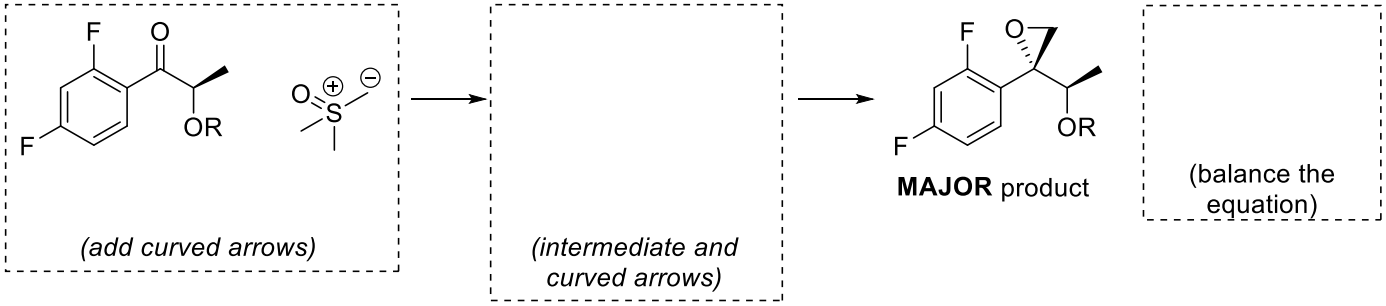
(structure(s) and a few words)

The problem with **Reaction C** in this plan is:

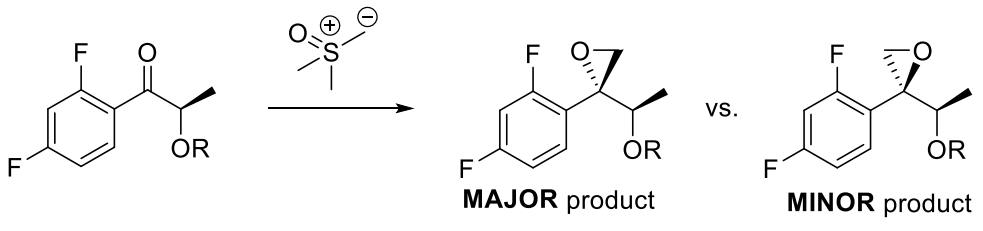
(structure(s) and a few words)

3. The following reaction uses a reactant that has NOT been previously discussed in this class. The mechanism of this reaction has two steps: nucleophilic attack at a carbonyl, followed by an intramolecular substitution (cyclization) reaction step.

a. Draw the curved arrow mechanism (add curved arrows and the missing intermediate) and balance the equation. Include stereochemistry. (9 pt)



b. Researchers who carried out the reaction above optimized the conditions to enhance the selectivity between the MAJOR and MINOR products shown below. This is an example of what type of selectivity? (3 pt)



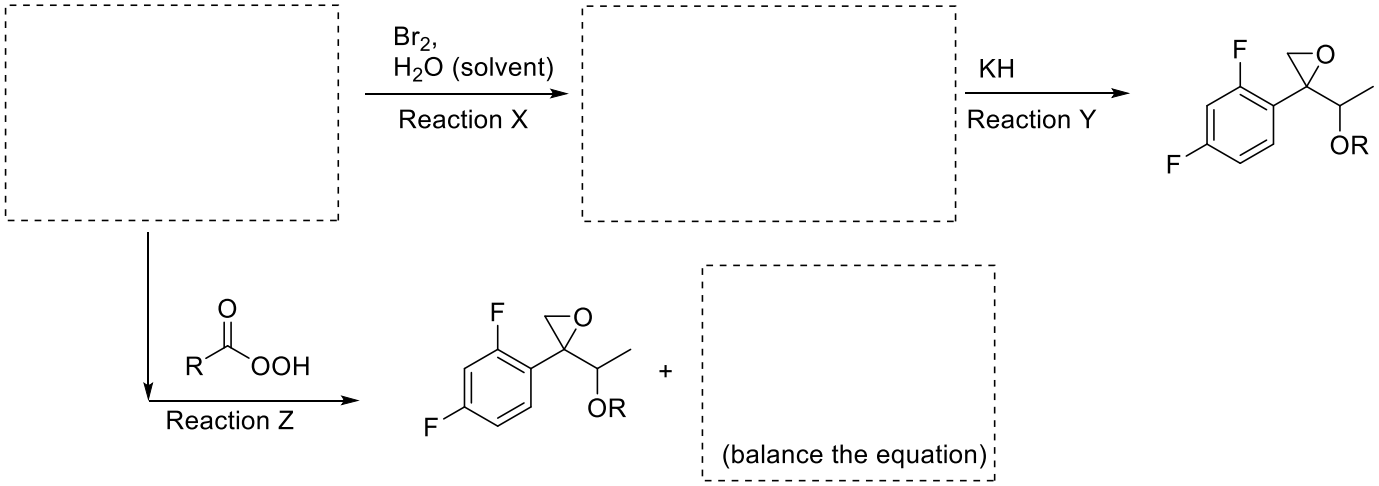
The selectivity between the MAJOR and MINOR products shown is an example of:

- ◯ enantioselectivity
- ◯ diastereoselectivity
- ◯ regioselectivity

4. Two alternative synthesis options (leading to the same product as above) are shown below.

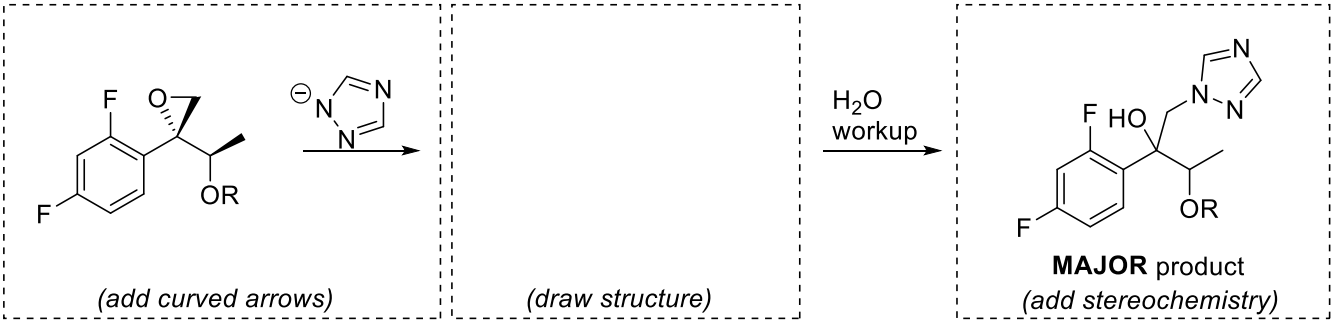
a. Fill in the boxes with one organic structure per box (ignore stereochemistry). (8 pt)

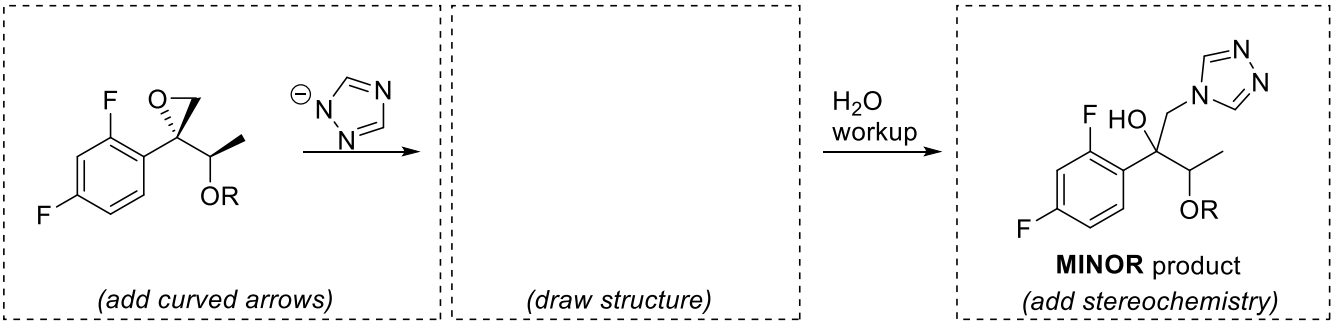
b. Draw the mechanism of Reaction Z. Include the reactants inside the mechanism box. (3 pt)



mechanism of Reaction Z (include the reactants inside this box)

5. The next reaction sequence led to a mixture of two products, labeled "MAJOR" and "MINOR" below.
   a. Add curved arrows and draw the resulting intermediate structure in each row. *(Hint: look carefully at the nitrogens)* (10 pt)
   b. Add stereochemistry to each product. (4 pt)
   c. Classify the selectivity (these products are formed in UNEQUAL amounts). (3 pt)

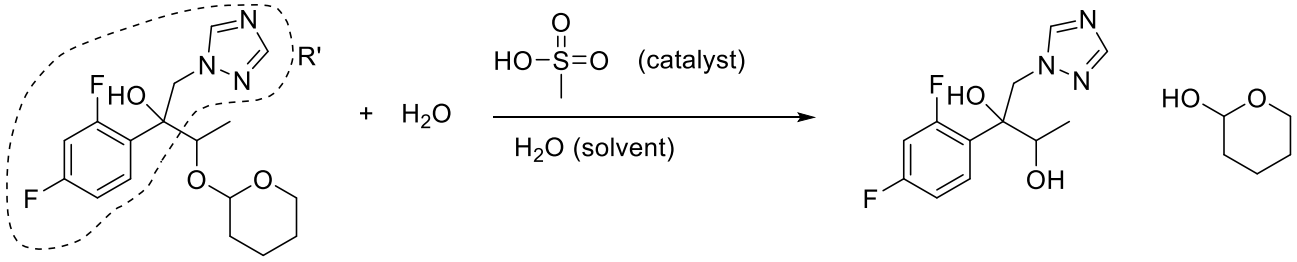




The selectivity between the MAJOR and MINOR products shown is an example of:

○ enantioselectivity ○ diastereoselectivity ○ regioselectivity

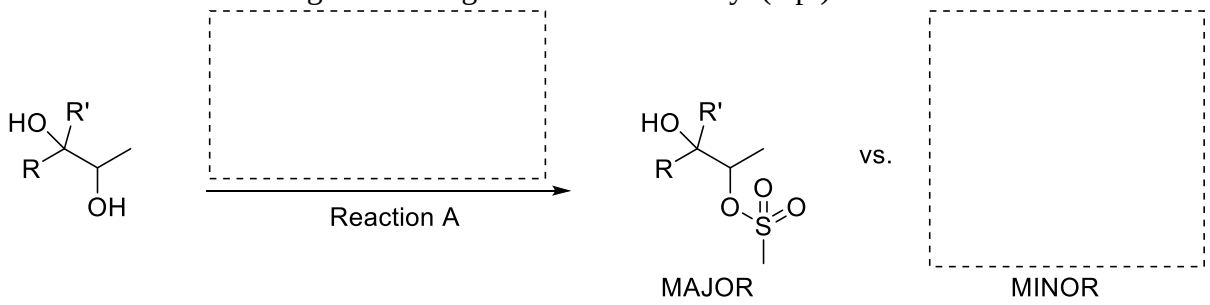
6. Draw a curved arrow mechanism for the following reaction, consistent with the description "**resonance-stabilized S_N1 reaction**". Use the R' abbreviation defined on the starting structure. Include the major resonance contributor of each intermediate where applicable. Ignore stereochemistry. (6 pt)



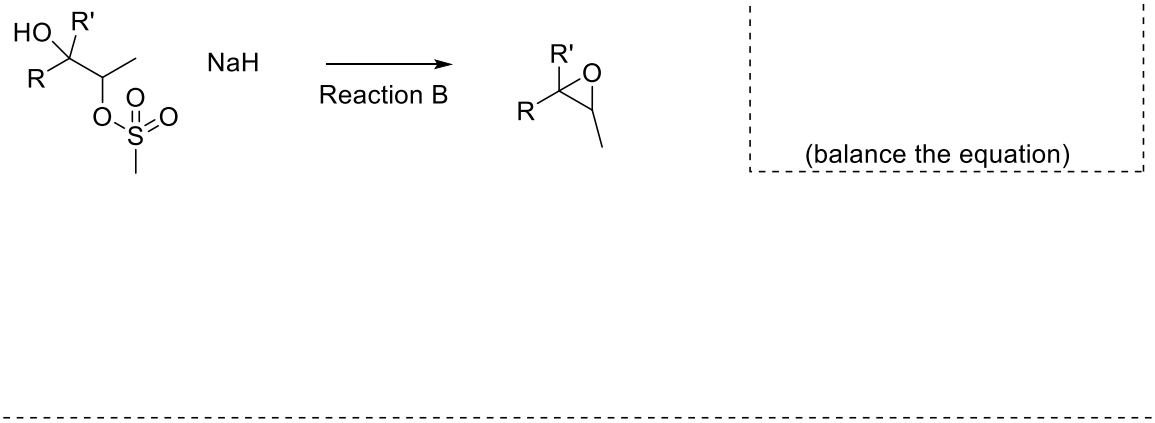
Use the R' abbreviation defined on the structure. Include major resonance contributor(s).

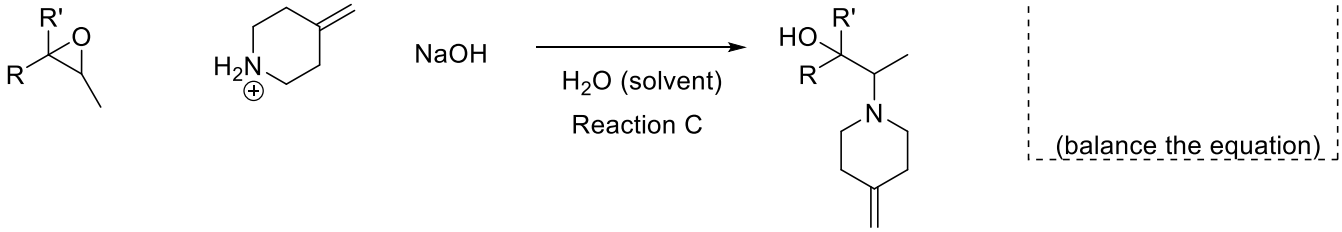
7. The following reaction sequence (Reactions A, B, and C) results in an antifungal drug.

a. In Reaction A, regioselectivity can be achieved based on steric effects. Fill in the missing reaction conditions and minor regioisomer. Ignore stereochemistry. (6 pt)



b. Balance each equation (including inorganic ions) and draw a curved arrow mechanism for each reaction. Ignore stereochemistry. (12 pt)





c. Based on ***Reactions A, B, and C above***, add stereochemistry to the structures below. (6 pt)