Week 14
CHE 3331- Organic Chemistry

This week is Week 14 of class, and typically in this week of the semester, your professors are covering these topics below. If you do not see the topics your particular section of class is learning this week, please take a look at other weekly resources listed on our website for additional topics throughout of the semester.

We also invite you to **look at the group tutoring chart on our website to see if this course has a group tutoring session offered this semester**.

> If you have any questions about these study guides, group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel or any tutoring services we offer, please visit our website www.baylor.edu/tutoring or call our drop in center during open business hours. M-Th 9am-8pm on class days 254-710-4135.

Keywords: Oxidation/Reduction of Alcohols, Chromic Acid, PCC, LAH, Ketone, Aldehyde

TOPIC OF THE WEEK: SYNTHESIS OF ALCOHOLS

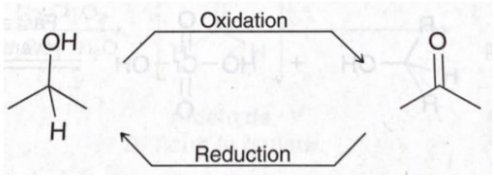
Hello everyone! Welcome back to another week of resources! Last week we covered part 1 of chapter 13, which is Alcohols! This is a dense chapter so if you have any questions about the first half of the chapter, which covered oxymercuration-demercuration, hydroboration oxidation, Grignard reactions, etc., please be sure to look at last week's resource before going onto this one!

A quick recap of last week's material:
We can use alkenes to prepare different kinds of alcohols using many of the reactions we have already seen before!

HIGHLIGHT #1: Oxidation of Alcohols

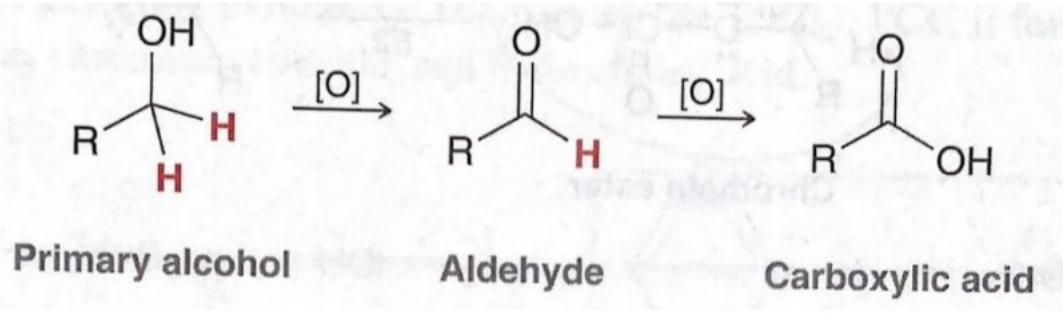
The recap of the first half of chapter 13 discussed different ways to create alcohols. Many of the alcohols we created were substituted differently, some being on a primary, secondary, or tertiary carbon. Now, after we have formed an alcohol group, we can oxidize or reduce it!

Remember, oxidation involves increasing bonds to an oxygen and decreasing the bonds to hydrogens. Reduction involves increasing bonds to hydrogen and decreasing the bonds to oxygen!

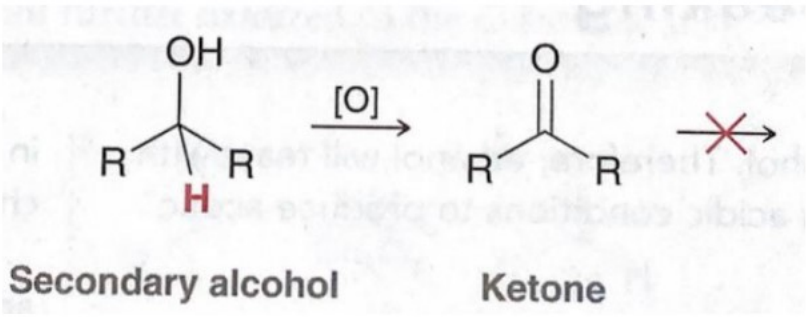


However, like everything in O-Chem, we get different products based on how substituted the product is. Similarly to how we got different Zaitsev and Hoffman products depending on the substitution of the alkene, **we will get different products depending on the substitution of the alcohol.**

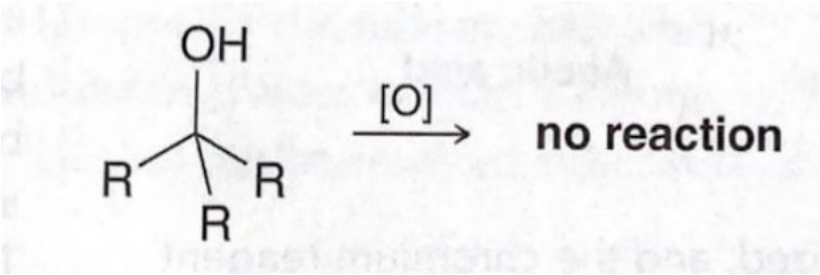
Primary alcohols have two different H groups attached to them, which means they can undergo oxidation twice! The first oxidation of a primary alcohol will yield an aldehyde. Then,
we can oxidize the aldehyde to produce a carboxylic acid.



Secondary alcohols only have one H group attached to them, which means they can only be oxidized once. Because of this, secondary alcohols will ONLY produce a ketone. Since a ketone does not have any more hydrogens, we cannot oxidize any further.

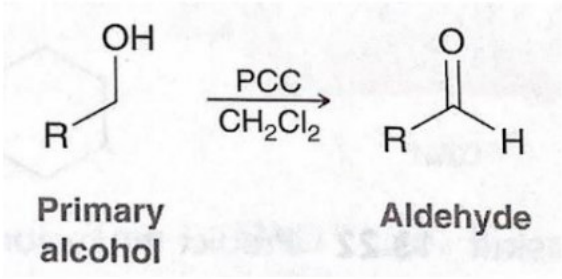


Tertiary alcohols do not have any H groups attached to them, which means they will not undergo any type of oxidation.

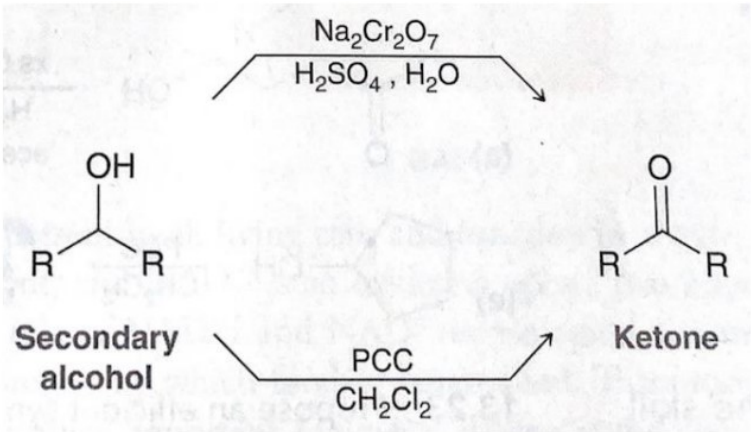


There are many different types of reagents that we can use to oxidize primary and secondary alcohols, but the most common are **chromic acid (H2CrO4), sodium dichromate (Na2Cr2O7), and chromium trioxide (CrO3).**

When any type of chromic/chromium reagent is used on a primary alcohol, it will always yield the carboxylic acid. However, **there is another oxidizing agent, known as PCC**, which when used on a primary alcohol, will produce the aldehyde as a major product! **A primary alcohol oxidation with PCC will NOT yield the carboxylic acid!**



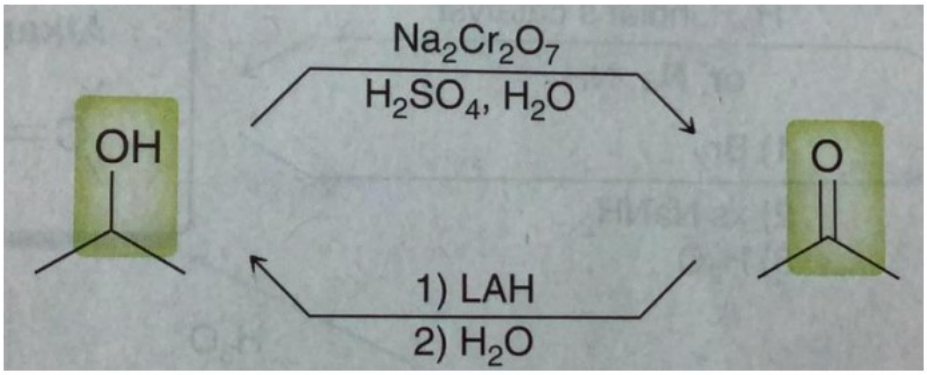
However, if you use PCC on a secondary alcohol, it will still yield the ketone! So when you are trying to get a ketone from a secondary alcohol, you can use either chromic acid or PCC and still obtain the same result.



HIGHLIGHT #2: Reduction of Alcohols

Now that we have learned how to oxidize several types of alcohols, it is also important to learn how to do the opposite reaction: a reduction of an alcohol. Reduction of an alcohol is the exact reverse of what we were doing previously. **Instead of adding more bonds to the oxygen, we are trying to add more bonds to hydrogen now!**

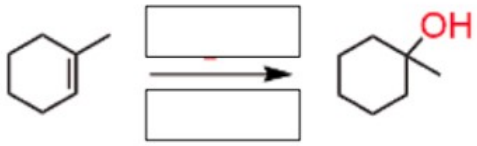
This is where a lot of what we learned in Biology 1 intertwines with Organic Chemistry. Remember the Citric Acid Cycle and the Electron Transport Chain that you learned back freshman year? All the reactions use NADH to donate a hydrogen! So, it served as a reducing agent! However, in Organic Chemistry, we won't see NADH as a reagent. **The most common reducing agent is LAH and water! This will reduce either a ketone or an aldehyde back to a secondary and primary alcohol, respectively.**



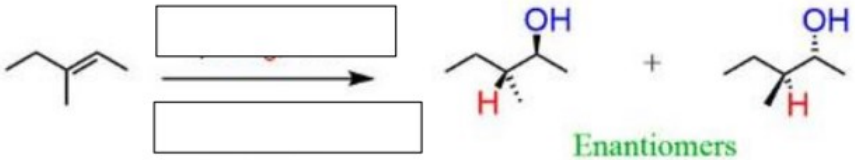
CHECK YOUR LEARNING:

1. Try to identify which reagents were used to achieve the following products! Try to remember as best as you can without using your notes and use this as a gauge to see if you should recap last week's material or move on!

a1.



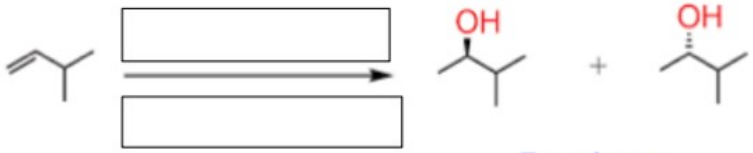
b2.



Enantiomers

syn addition

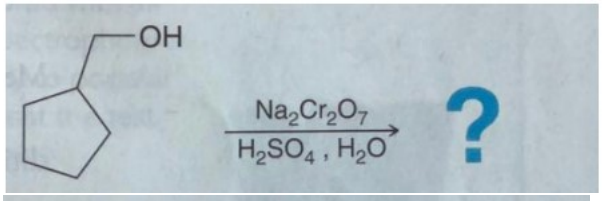
c
3.

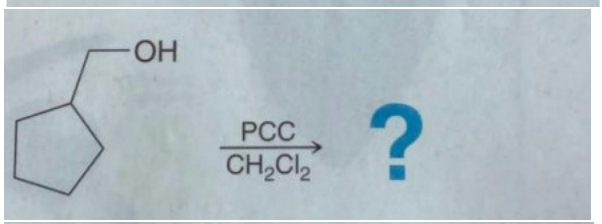


Enantiomers

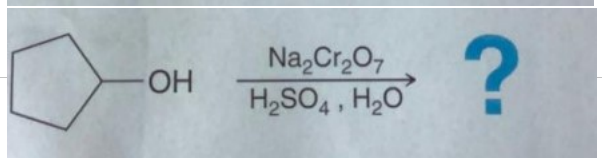
2. Predict the major products of each of the following reactions

a.





b.



c.

THINGS YOU MAY STRUGGLE WITH:

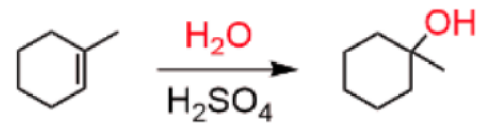
1. Remember that PCC will only convert an alcohol to an aldehyde, NOT a carboxylic acid! It might be a good idea to make flashcards of all the reactions and the reagents used to get those products! Remember to keep these straight in your head!
2. The entirety of Organic Chemistry builds upon itself, especially when we get to synthesis reactions! Do not forget any of what we have already learned: additions to alkenes, reactions with alkynes, etc. This is all important and at some point, you will be asked to make a very complex molecule from scratch, so be sure that you remember all the previous chapters, their reactions and reagents as well!

Thanks for checking out these weekly resources!
Don't forget to check out our website for group tutoring times, video tutorials and lots of other resources: www.baylor.edu/tutoring ! Answers to check your learning questions are below!

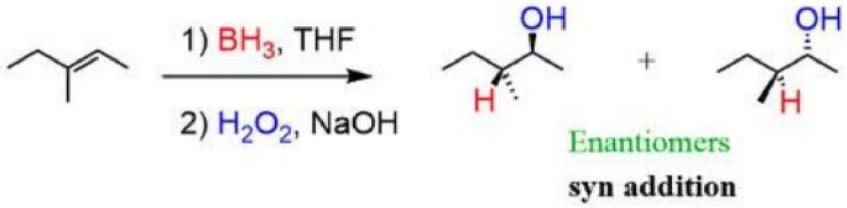
ANSWERS TO CHECK YOUR LEARNING:

Practice #1:

a



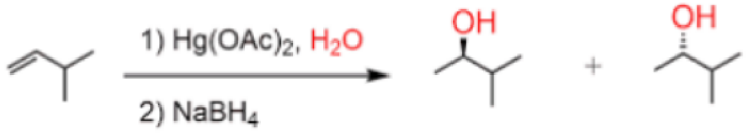
b



Enantiomers

syn addition

c

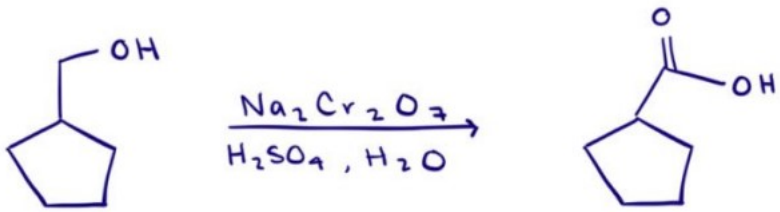


Enantiomers

Practice

#2:

a



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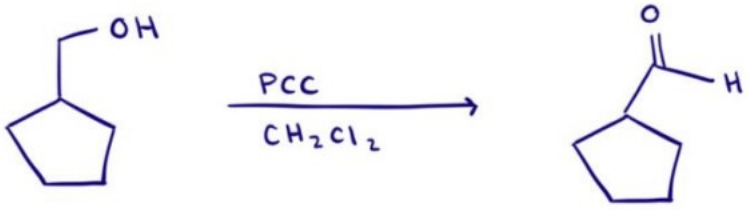

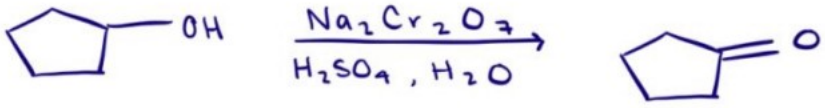

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