Week 9
CHE 3331- Organic Chemistry

This week is Week 9 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: Alkenes, Elimination Reactions, E1, E2, E and Z Designations, Alkene Nomenclature

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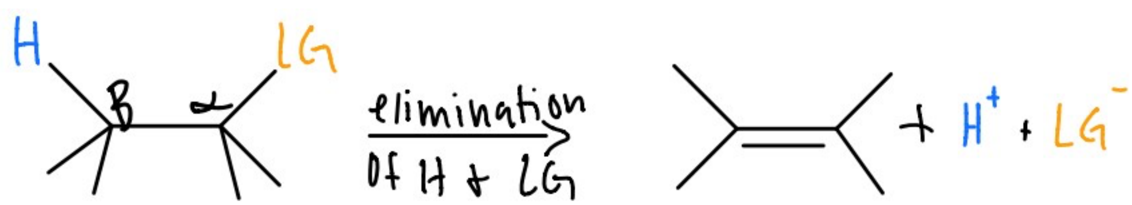
TOPIC OF THE WEEK: SUBSTITUTION REACTIONS

- What is an elimination reaction?
  - Elimination Reactions are exactly what they sound like. You are eliminating a leaving group and, in the process,, this produces a double bond (AKA alkene!)
    - This happens due to the elimination of the leaving group as well as a beta proton
    - The reagent is a **BASE NOT A NUCLEOPHILE**
    - Non-sterically hindered leaving groups react better for elimination!

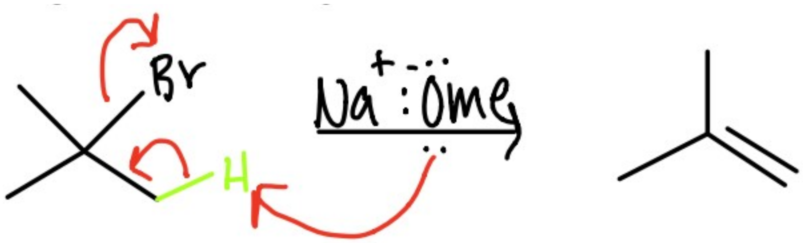


STEPS IN ORDER for E2 v E1 E2

- E2
  - Loss of leaving group and proton transfer at same time

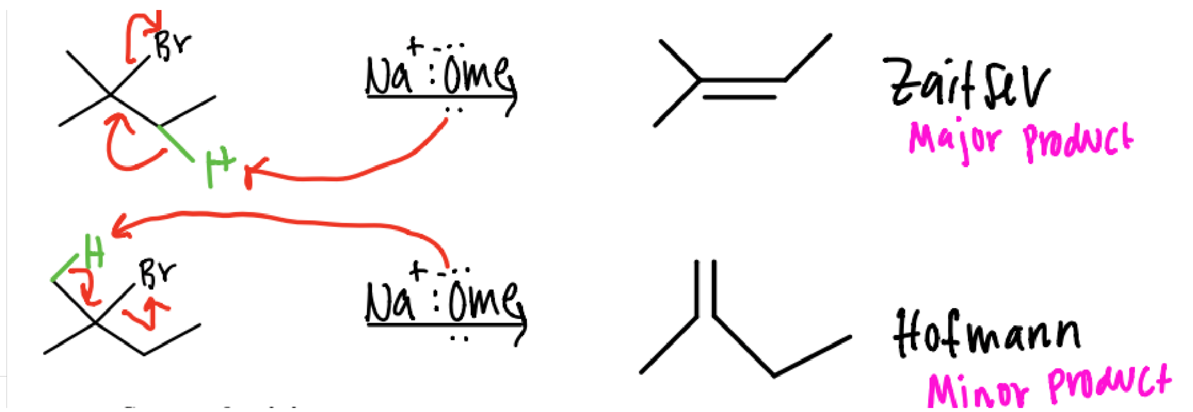
- E1
  - Proton transfer - if bad leaving group ○ Loss of leaving group ○ Possible carbocation rearrangement
  - Proton transfer

Details of E2 ○ Similar to SN2 in the fact that it is a concerted process: the proton transfer and loss of leaving group happens at the same time ○ Needs a strong base in order to take place

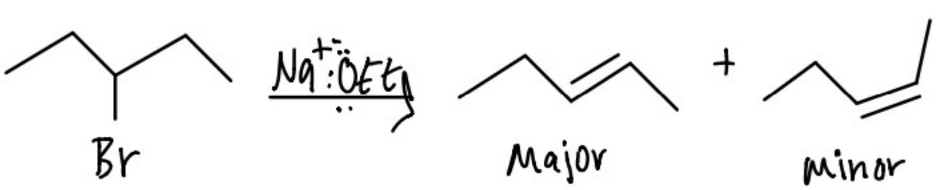


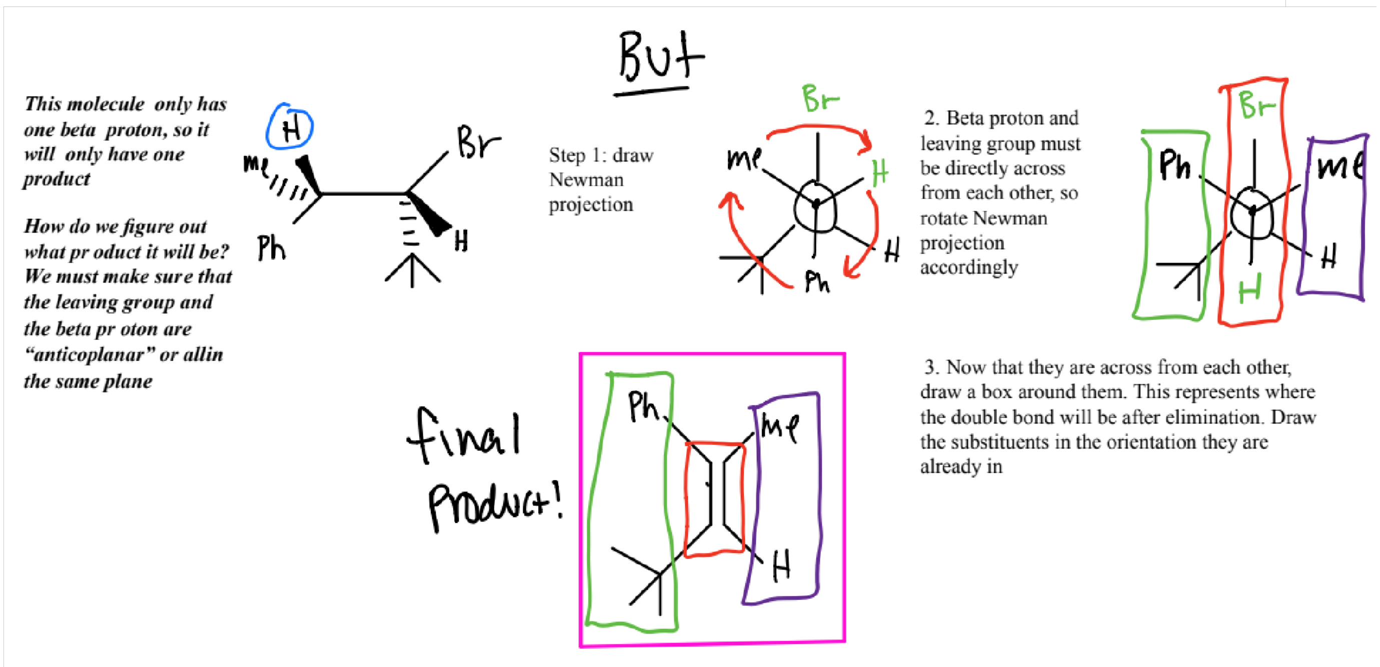
○ Regioselectivity – which beta proton do I choose?

- Zaitsev (more substituted product) vs Hofmann (less substituted product)
  - Which one winds depends on size of base – bulky base= hofmann

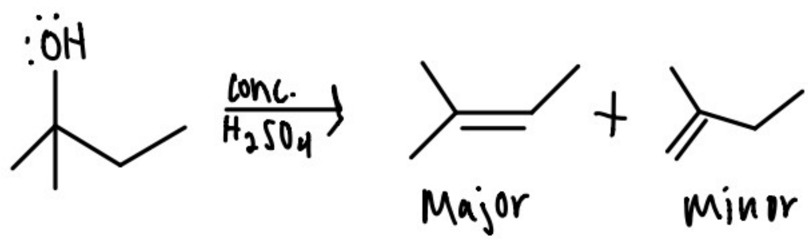


- Stereoselectivity ○ Trans wins! Unless…. You only have one beta proton choose from





- Details of E1 ○ Similar to SN1 in the fact that it is a step wise process ○ CAN HAVE CARBOCATION REARRANGEMENT ○ Zaitsev wins and trans wins! Simple
  - Substrate is usually concentrated H2SO4

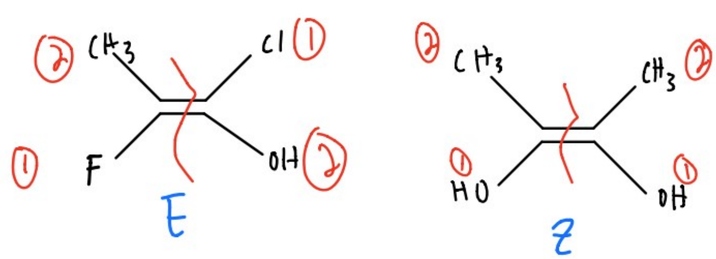


HIGHLIGHT #1: Alkenes and Alkene Stability – and E/Z Designations

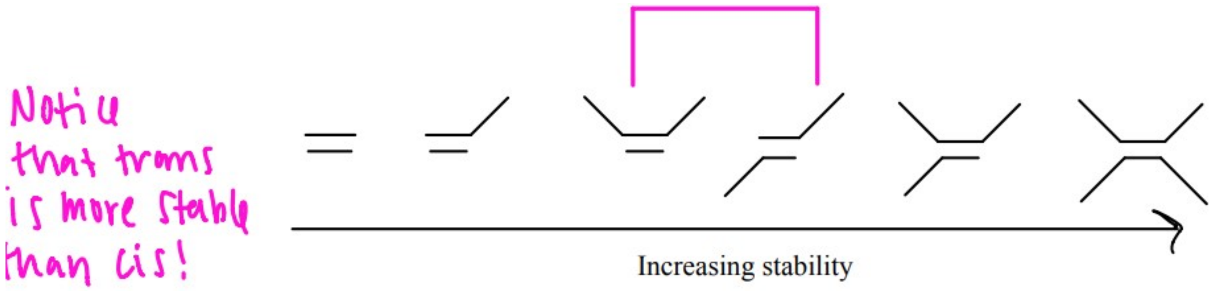
- Alkenes have a double bond! ○ TRANS IS MORE STABLE (E and Z designation)

Z= Cis E= trans

1. split double bond down the middle
2. number each substituent on either sided with a 1 or 2 using the same priority system as stereochemistry
3. if the number 1 priorities on either side are on the same side, the molecule is E. if they are opposite, it is E

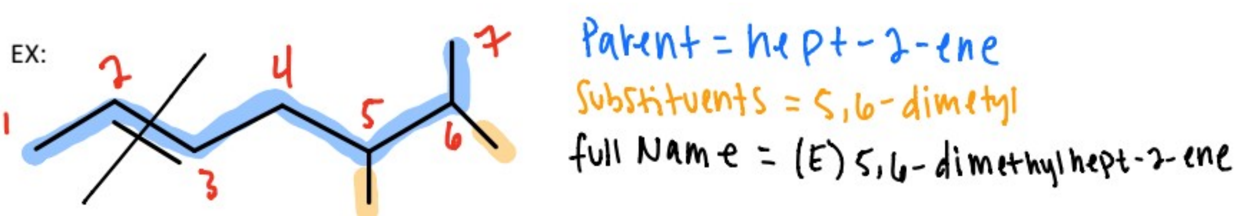


- MORE SUBSTITUTENTS IS MORE STABLE



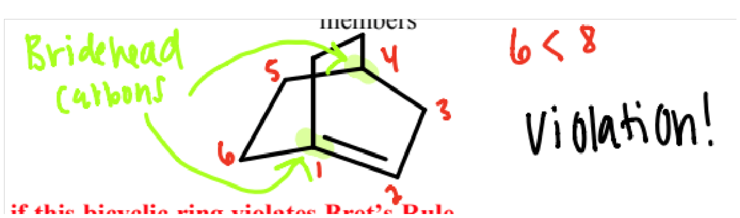
HIGHLIGHT #2: Alkene Nomenclature

- This is very similar to alkane nomenclature
- The parent name is the same BUT the it will now end in -ene (parent chain must include double bond) ○ You must add WHERE the location of double bond is in parent name
- Substituents are the named the same ○ Add E/Z designation to beginning just like you would stereochemistry



HIGHLIGHT #3: Bredt's Rule

Bredt's Rule: In a bicyclic ring, you cannot have a double bond on a bridgehead carbon if the ring is less than 8 members.

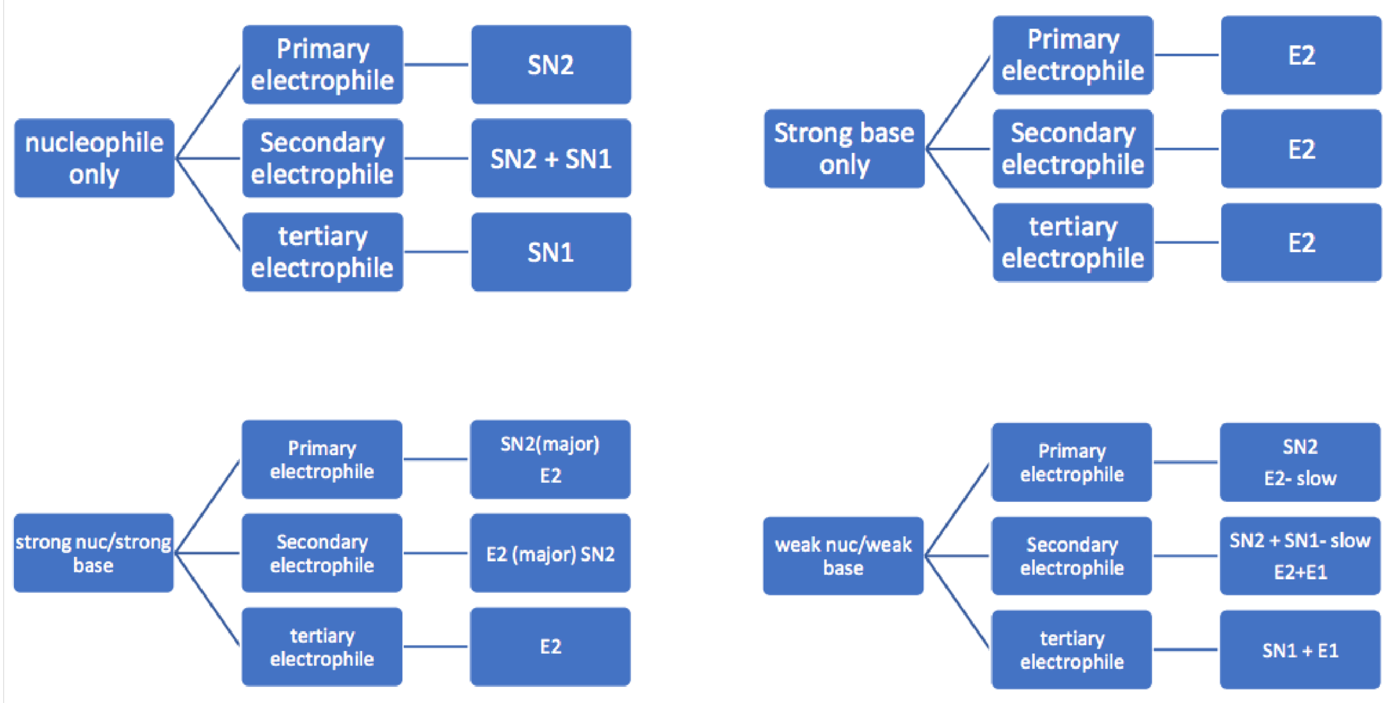


HIGHLIGHT #4: Substitution vs. Elimination Summary Chart

Sometimes it can be difficult to determine if a reaction will be a substitution or elimination if you are not told beforehand. Here is a chart to hopefully clarify some things and help keep you organized.

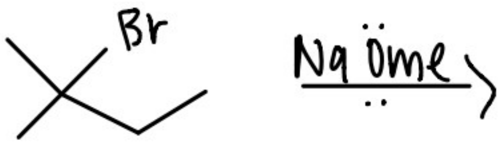
To start off here are the 4 groups of nucleophiles and bases. **You NEED to memorize these.**

Nucleophile Only: Cl^-, Br^-, I^-, HS^-, H_2S,
RSH, RS^- Base Only: H^-, DBN, DBU
Strong Nucleophile/Strong Base: HO^-, MeO^-, EtO^-, tert butoxide
Weak Nucleophile/Weak Base: H_2O, MeOH, EtOH

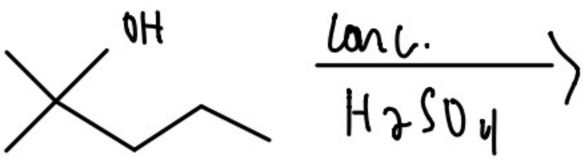


CHECK YOUR LEARNING:

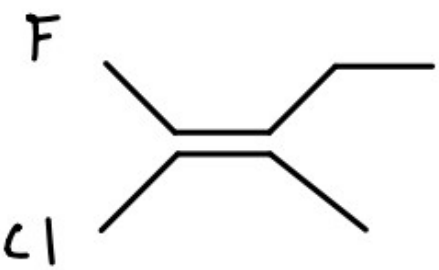
1. Draw the full mechanisms of the following:
    a.



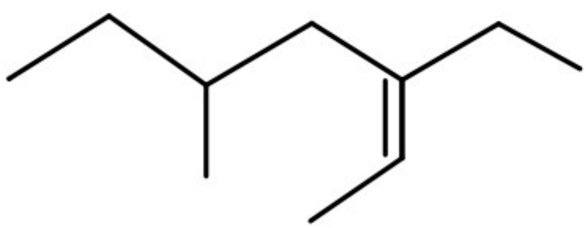
    b.



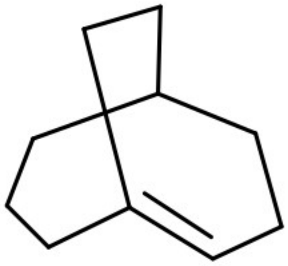
2. Is this molecule in the E or Z configuration?



3. Give a systematic name for the following



4. Determine if this bicyclic ring violates Bredt's Rule



THINGS YOU MAY STRUGGLE WITH:

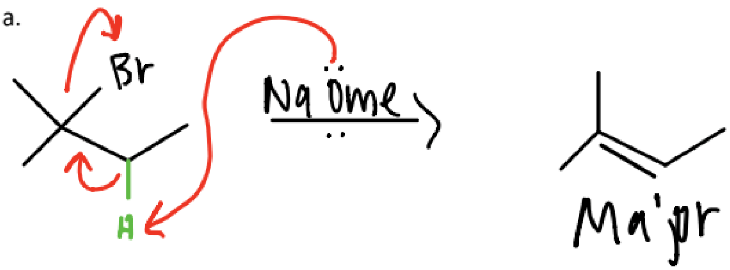
- The biggest thing that most people struggle with is determining whether the reaction will be a substitution or elimination reaction. Following the flow charts above will help eliminate some of this confusion.
- Another big thing that people struggle with is remembering that when there is one beta proton, there will only be one product!

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:

1.

a.



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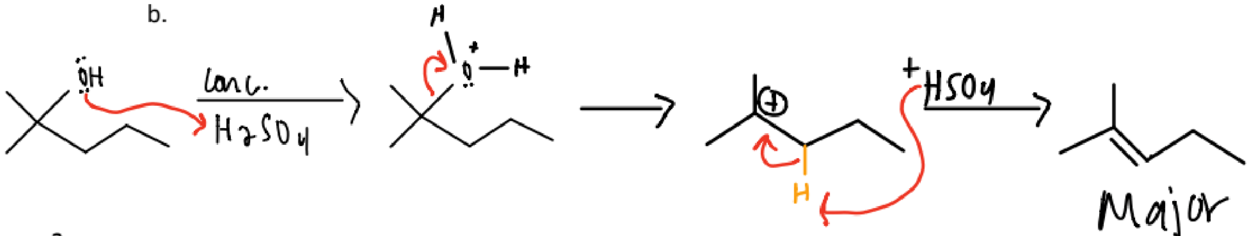
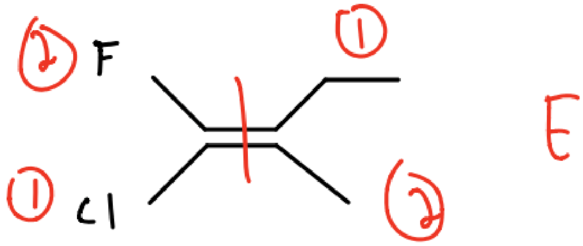
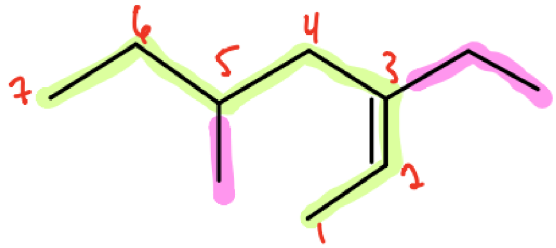


2.

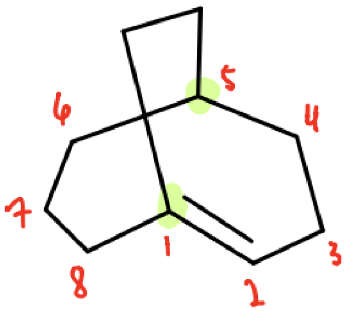


3.



(Z)- 3- ethyl-5-methylhept-2-ene

4.



No!