Week 11
CHE 3331- Organic Chemistry

This week is Week 11 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**.

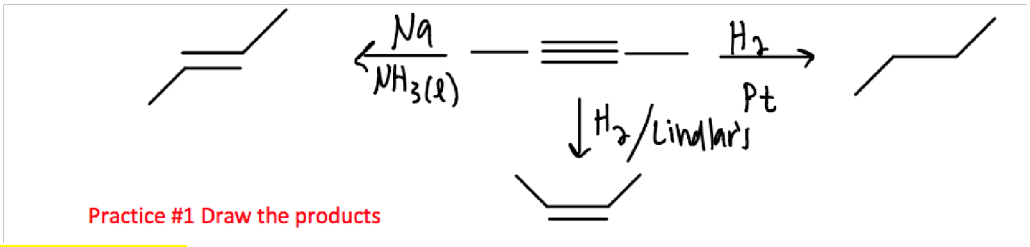
If you have any questions about these study guides, group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel or any tutoring services we offer, please visit our website www.baylor.edu/tutoring or call our drop in center during open business hours. M-Th 9am-8pm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

Keywords: Elimination Reactions, Acetylene and Terminal Alkynes, Addition, Reduction

TOPIC OF THE WEEK: ADDITION REACTIONS OF ALKYNES

You already know most of these reactions from the alkene chapter, but one big difference is that since alkynes have triple bonds, you can perform some of the reactions twice, meaning that you are adding 4 total things across a triple bond to reduce it down to a single bond.

- Reduction of alkynes: Reduction in this sense means addition of hydrogens. There are 3 types of reduction reactions that reduce in specific ways ○ Catalytic hydrogenation: Reduces triple bonds all the way to SINGLE BONDS
    - Reagent: H2/pt ○ Catalytic hydrogenation with Lindlar's catalyst: Reduces triple bonds to CIS DOUBLE BOND
    - Reagent: H2/ Lindlar's ○ Dissolving metal reaction: reduces triple bond to TRANS DOUBLE BOND ▪ Reagent: Na/NH3(l)

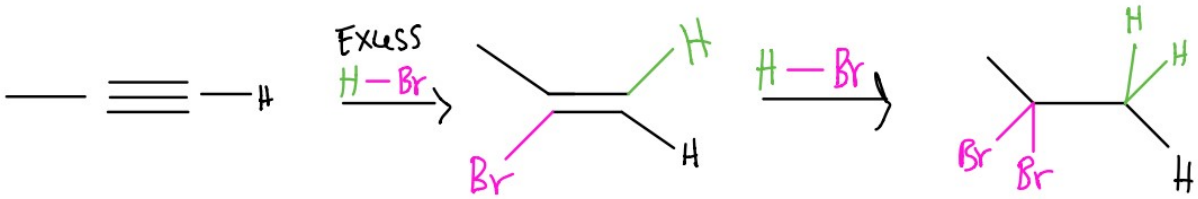


Practice #1 Draw the products

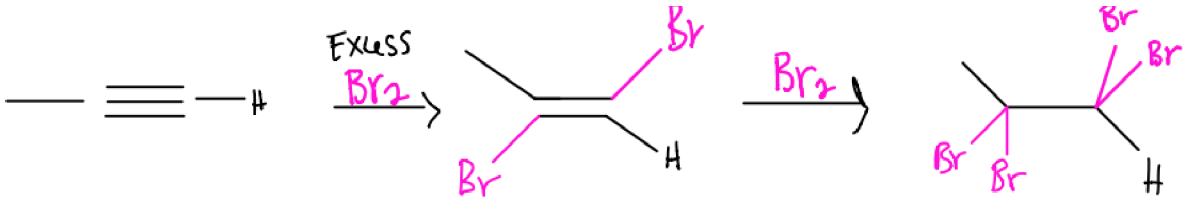
- Hydrohalogenation: DON'T FORGET YOU CAN DO THIS PROCESS TWICE FOR

TRIPLE BONDS

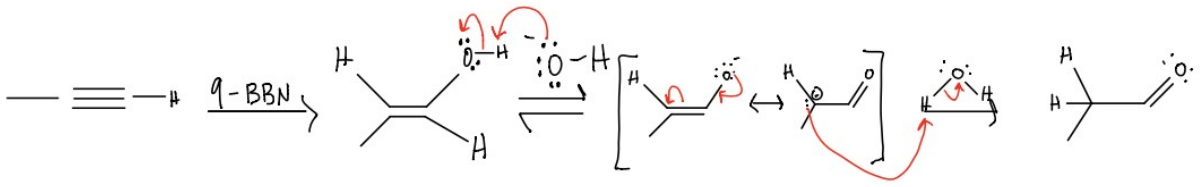
- Reagent: HBr, HCl etc. ○ Adding: H and halogen ○ Regiochemistry Halogen- mark, H- anti-mark (opposite if peroxide is used) ○ Stereochemistry: Racemic



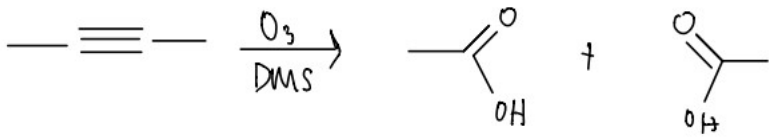
- Halogenation: CAN HAPPEN TWICE ○ Reagent: X2
  - Adds 2 halogens – no regiochemistry ○ Stereochemistry: racemic



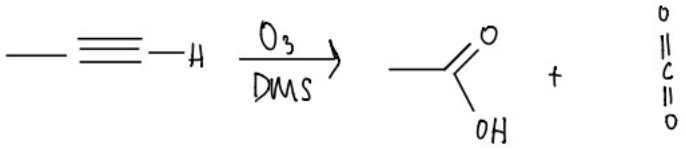
- Hydration Reactions: Add a water molecule across double bond. Hydration reactions in alkynes are the same concept, however they look a little bit different for alkynes than alkenes.
  - Acid catalyzed hydration ○ Reagent: H2SO4, H2O/ HgSO4 ○ End product is a ketone
  - Regiochemistry: ketone on mark position ○ Sterochem: not chiral ○ Fast way to get product: THIS IS NOT THE MECHANISM JUST AN EASY WAY TO GET THE ANSWER
    - Add OH anti-mark and H mark like normal, creating a double bond. Erase double bond and H from hydroxyl. Make bond of oxygen a double bond.
    - Mechanism: Uses base catalyzed tautomerization



- Ozonolysis: Cleaves triple bond ○ If triple bond is substituted, adds a carboxyl group to where molecule was cleaved



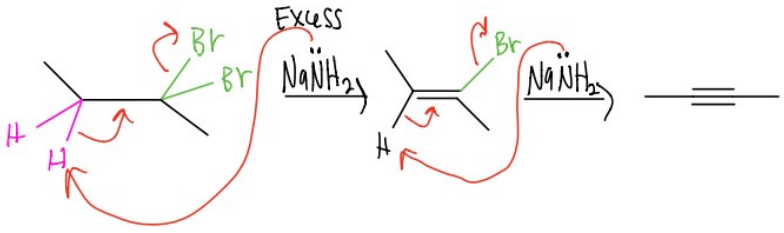
○ If triple bond is terminal, carbon becomes CO2



HIGHLIGHT #1: Preparation of Triple Bonds - Elimination

In order to create a triple bond, we must use elimination, which is similar to creating double bonds. However, we must eliminate 2X, meaning we need the initial molecule to have 2 leaving groups.

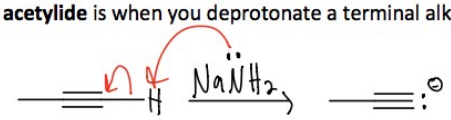
- Base used to eliminate twice is normally NaNH2 • EX:



HIGHLIGHT #2: Preparation of Acetylide - Elimination

A **terminal alkyne** is when the only substituent on one side of a triple bond is a hydrogen

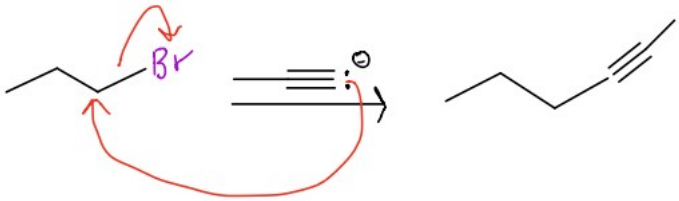
An **acetylide** is when you deprotonate a terminal alkyne



ACETYLIDES ARE GOOD NUCLEOPHILES

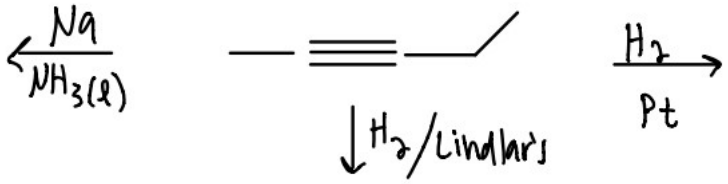
HIGHLIGHT #3: Substitution Reactions with Acetylides

Acetylides are good nucleophiles which means they can be used in substitution reactions. EX:



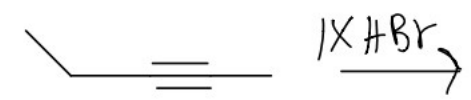
CHECK YOUR LEARNING:

1. Draw the products



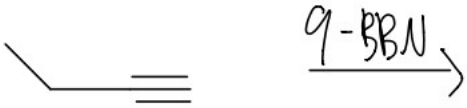
2. Draw the products

a.



b.

c.



THINGS YOU MAY STRUGGLE WITH:

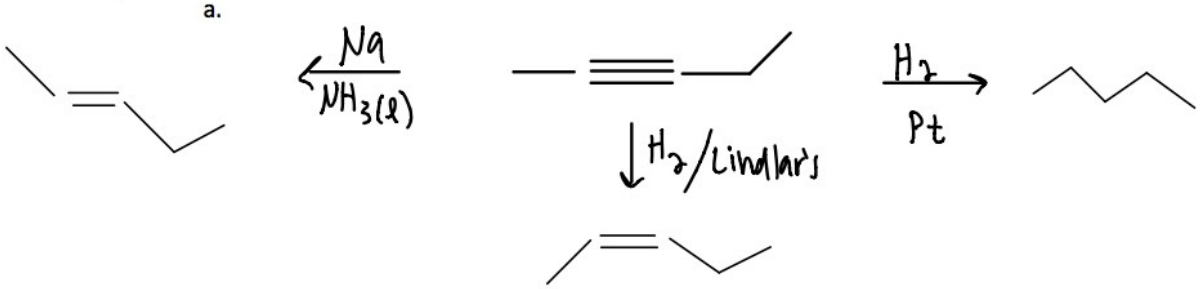
- Tautomerizations in acid catalyzed hydration and hydroboration oxidation seem to be something that many people struggle with, but this is a process that gets easier with practice.
- Using acetylides as nucleophiles is another thing that can be difficult. Just remember that if you see a reaction that is adding carbon atoms and a triple bond, it is probably an acetylide acting as the nucleophile.

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:

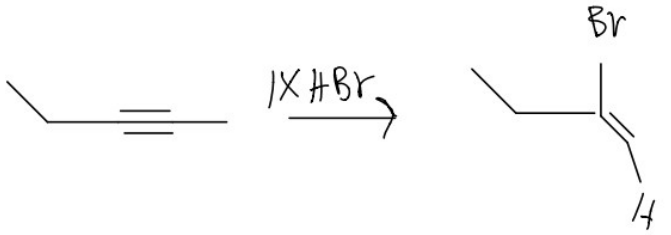
1.

a.

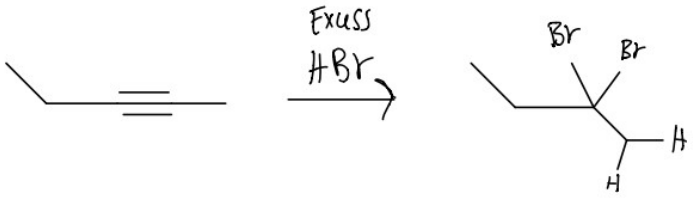


2.

a.



b.



c.