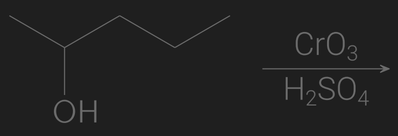
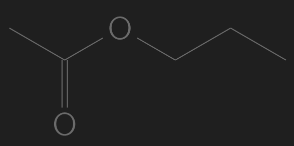
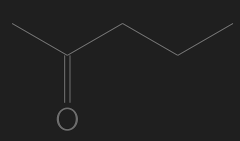
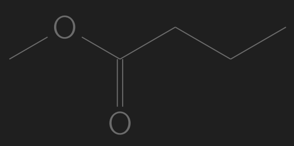
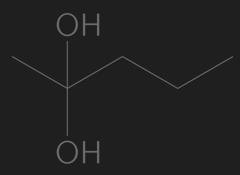
Mini Quizzes

Week 3 — Chapter 16

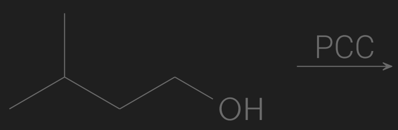
1. What is the major product for the following reaction.

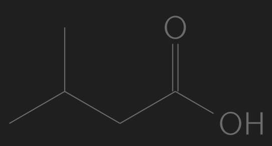
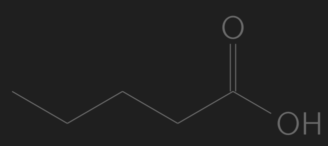
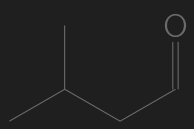


- 
- 
- 
- 

- CrO_3 is an oxidizing agent, which means electron density will be pulled away from the carbon to form a double bonded oxygen.
- Oxygen does not insert itself into the chain.

2. Give the major product for the following oxidation.



- 
- 
- 
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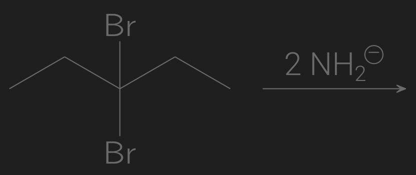
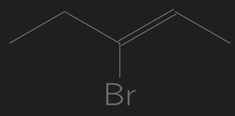
- PCC is a mild oxidizing agent that is commonly used for selective oxidation of alcohols to aldehydes or ketones.
- In this case we started with a terminal enol, which would produce an aldehyde.
- The carbonyl group is not affected, it should not change.

3. What is the major product from the following reaction?



- 

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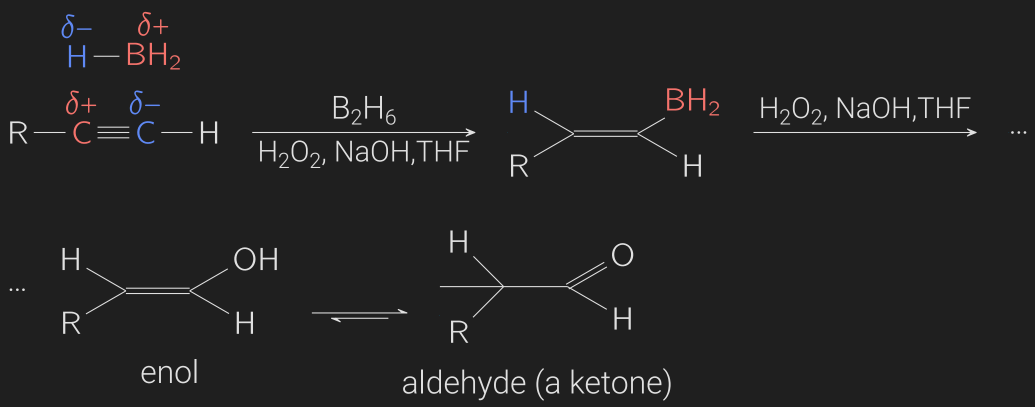
- This looks like dihaloalkane elimination. I took this quiz a week early, so this explanation might not be the best, but looks like NH_2^- is acting as a reducing agent(?); causing the elimination of bromine, leaving the carbon to form a triple bond.

4. The major product of a hydroboration oxidation reaction on a terminal alkyne is

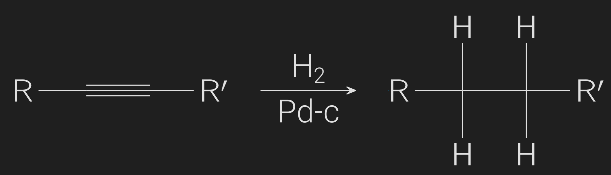
- a carboxylic acid
- alkane
- ketone
- aldehyde

- Example of an alkyne undergiong a hydroboration-oxidation reaction:

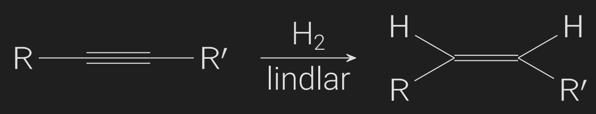


Week 2 — Chapter 15

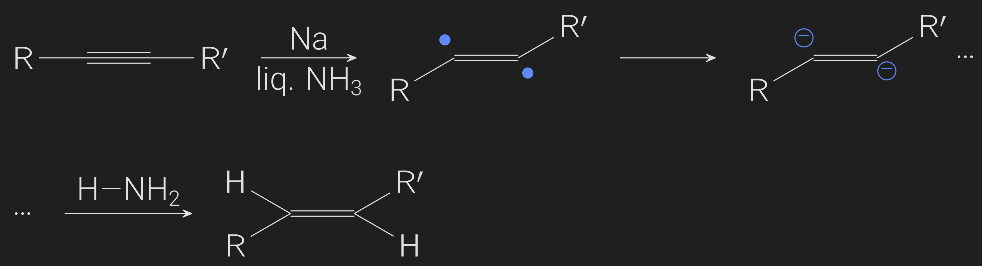
1. The reagent needed to convert 2-butyne to cis-2-butene is
    - H_2/Pd−C
    - Li/NH_3
    - Na/NH_3
    - H_2/LindlarCatalyst
    - Complete hydrogenation of an alkyne:



    - Alkyne → cis-alkene; use of lindlar catalyst (Pd-c poisoned with lead) limits further reduction by controlling hydrogens available:

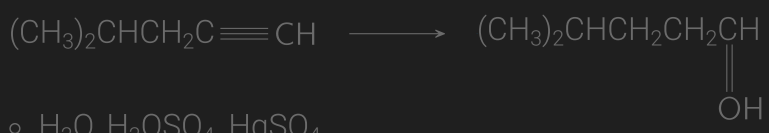


    - Alkyne → trans-alkene; using generation of free radicals (•, single electron) that pair up with another electron generated by the dissociation of Na → Na^+ + e^- to create a free pair of electrons that then receive a hydrogen from NH_3:



2. A mixture of 1-heptyne, 2-heptyne, and 3-heptyne was hydrogenated in the presence of a palladium catalyst until hydrogen uptake stopped. If one assumes that the hydrogenation went to completion for all the reactants present in the mixture, how many distinct seven-carbon isomers were produced?
    - Only 1
    - 2
    - 4
    - 6
    - H_2/Pd−c (palladium catalyst) generates completely saturated alkenes, thus the location of the double bond in a heptyne will make no difference overall.

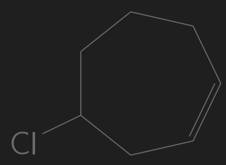
3. Give the best reagents for the reaction



   - H_2O, H_2OSO_4, $HgSO_4$
   - BH_3, H_2O_2, NaOH
   - $K_2Cr_2O_7$
   - H_2, Lindlar Catalyst
   - First, this is a hydration reaction, so that limits just the first two options.
   - Hydration using H_2O and H_2OSO_4 or $HgSO_4$ does have difference, but both follow Markovnikov's rule and end produce internal enols and thus internal ketones.
   - Hydroboration-oxidation reaction follows anti-Markovnikov rule and produces a terminal enol and thus an aldehyde, which is the desired product.
4. Which of the alkyne addition reactions below involves an enol intermediate?
   - Hydroboration/oxidation
   - dil. H_2SO_4 in $HgSO_4$
   - Hydrogenation
   - Both hydroboration/oxidation and dil. H_2SO_4 in $HgSO_4$
   - See question three, both hydroboration/oxidation and dil. H_2SO_4 in $HgSO_4$ are used in hydration, which have enol intermediates.
   - Hydrogenation only has to do with adding hydrogens to saturate the alkyne through elimination reactions, which question one covers.

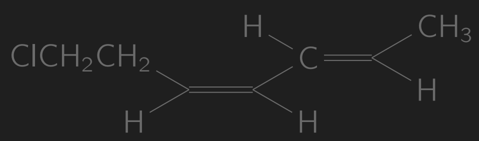
Week 1 — Chapter 14

1. Name the structure:



   - 1-chloro-3-cycloheptene
   - 4-chloro-1-cycloheptene
   - 4-chloro-1-cyclohexene
   - 6-chloro-1-cycloheptene
     - When numbering the parent chain, the double bond should receive the lowest number possible; k=1
       - Note: define the location *k* of the double bond as being the number of its first carbon, not at the end.
     - The locant (*k*) of the double bond should be placed right before the suffix of "ene," though, it was previously recommended before the parent (both are acceptable), e.g., 2-pentene = pent-2-ene; 1-cycloheptene
     - Name and the side groups (other than hydrogen) according to the appropriate rules; chloro
     - Define the position of each side group as the number of the chain carbon it is attached to; 4-

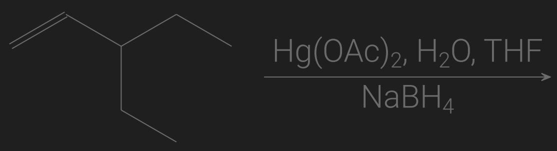
2. Name the structure:



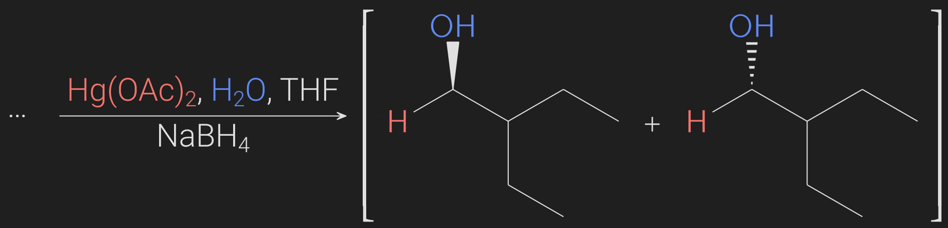
   - (2E,4E)-7-chloro-2,4-heptadiene
   - (2Z,4Z)-7-chloro-2,4-heptadiene
   - (2Z,4E)-7-chloro-2,4-heptadiene
   - (2E,4Z)-7-chloro-2,4-heptadiene
     - **E-Z notation**: recommended instead of *cis* and *trans* in order to account for cases that has more than two different groups attached to the double bond by first determining the priority using the Cahn-Ingold-Prelog System.
       - E, entgegen, "opposite".
       - Z, zusammen, "together"; "on ze zame zide."

- When numbering the parent chain, the double bond should receive the lowest number possible; k=2
  - The two highest priority groups are on opposite sides; 2E
- There is more than one double bond; $k_2 = 4$
  - The two highest priority groups are on zame side; 4Z

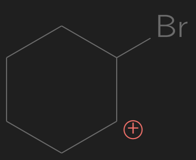
3. How many stereoisomeric product(s) do you get in the reaction below.

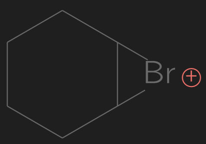


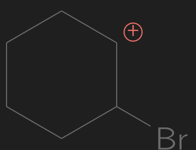
- Oxymercuration-demercuration reactions follow Markovnikov's rule, i.e., H^+ is added to the carbon with the greatest number of hydrogen atoms while the X^- component is added to the carbon with the fewest hydrogen atoms.
- Drawing the intermediate is not necessary, and no chiral centers are found in the products:



4. Which reaction intermediate is formed when Br2/CCl4 reacts with cyclohexene?

i


iv


ii


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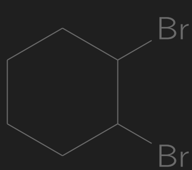
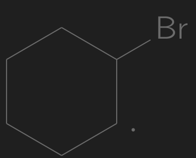


iii


- **Halogenation**: a reaction that involves the addition of one or more halogens to a compound or material.
  - The addition of halogens to alkenes proceeds via intermediate halonium ions.

- **Halonium ion**: any onium ion containing a halogen atom carrying a positive charge. This cation has the general structure: $\mathrm{R} - {}^{+}\mathrm{X} \cdot \mathrm{R}'$
- **Onium ion**: a cation formally obtained by the protonation of mononuclear parent hydride of a pnictogen (group 15 of the periodic table), chalcogen (group 16), or halogen (group 17); $Br^{\oplus}$ in our case.