CHEM 223 (2024) SI Session #16

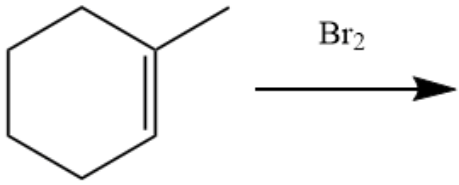
Start c/ recap rxns 1-5

Learning Objectives: By the end of this session, students should be able to:

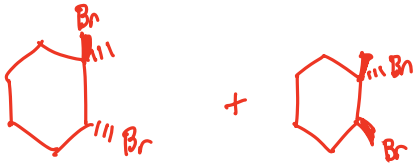
- Predict products and draw mechanisms for addition reactions

Section 1: Halogen Addition

1. Use the following reaction to answer the following questions

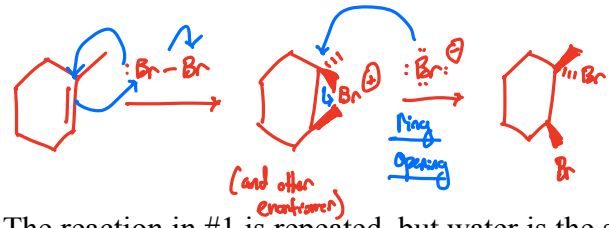


   a. Draw the product(s) of the reaction, being sure to keep stereochemistry in mind.



Br_2 adds anti b/c of ring opening.

   b. Provide a mechanism to explain the production of the product you drew. Use the mechanism to explain the stereochemistry of the product.

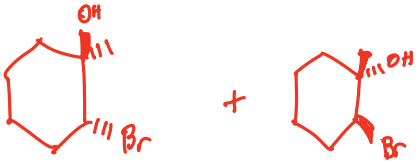


The $Br^{\ominus}$ must attack the 3-membered ring from the back.

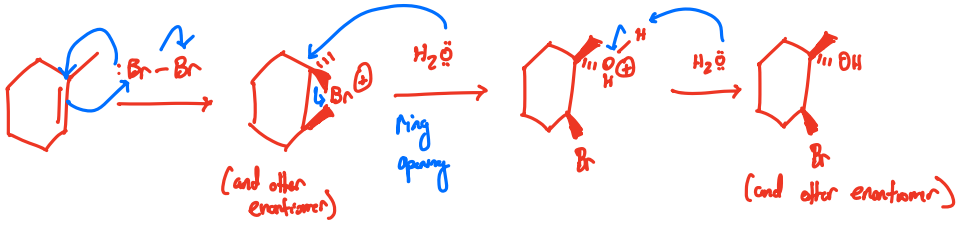
3° carbon is attacked b/c it has the most stable δ^+

2. The reaction in #1 is repeated, but water is the solvent.

   a. Draw the product(s) of the reaction with appropriate stereochemistry



   b. Draw the mechanism of the production of the product.



3° carbon is attacked b/c it has the most stable δ^+ charge.

c. What solvent(s) could we potentially use instead of water if we want the product in #1a?

CCl_4, $CHCl_3$, CH_2Cl_2

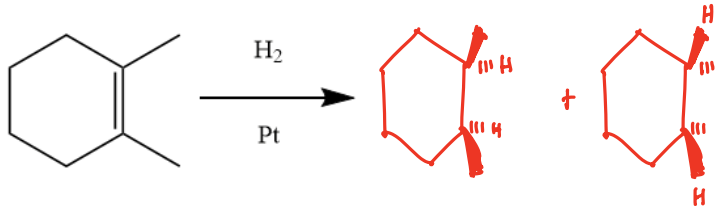
Section 2: Catalytic Hydrogenation

3. Cyclopentene undergoes catalytic hydrogenation
   a. Provide <u>both</u> reagents that can be used for this reaction.

H_2, Pt/Ni/Pd OR H_2, $(Ph_3P)_2Rh(PPh_3)Cl$

Stick to this one

4. For the following reaction below, provide the product(s) with appropriate stereochemistry.

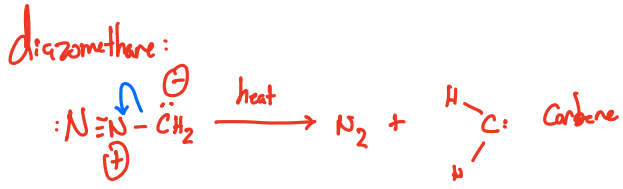


Syn; hydrogens must be cis.

Section 3: Carbene Addition

Draw basic Carbene mechanism

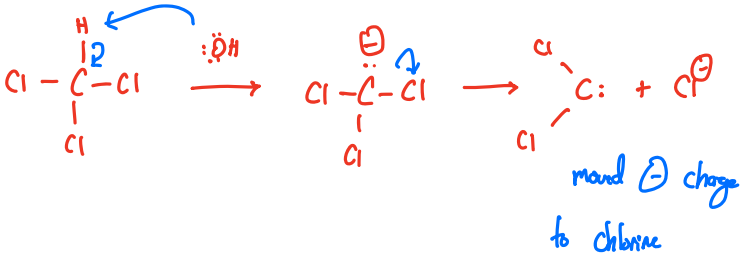
5. There are 3 main ways to make carbenes:
   a. Draw the product of reacting diazomethane with heat or light. Describe any potential problems with this reaction.



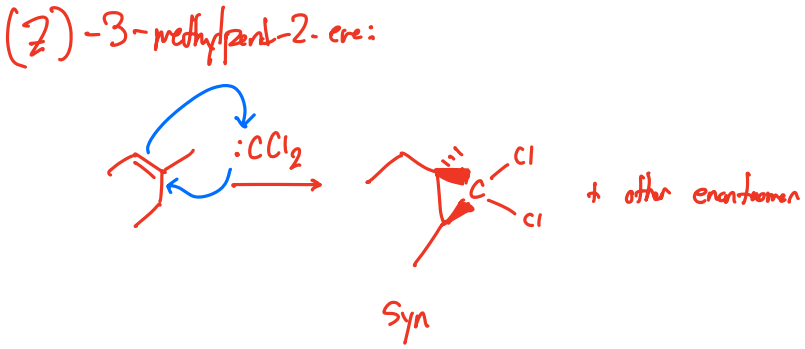
issues: explosive, toxic, and can add to C-H bonds as well as C=C double bonds.

b. Provide the reaction for the preparation of the simmon's smith reagent.

c. Draw the mechanism of the alpha elimination of Chloroform using potassium hydroxide.



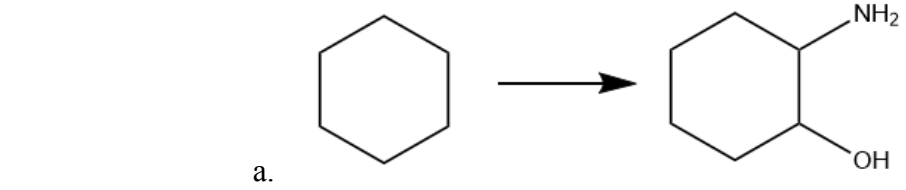
6. The alpha elimination product in #5c reacts with (Z) 3-methylpent-2-ene. Draw the product of the reaction and draw amechanism to explain its production.

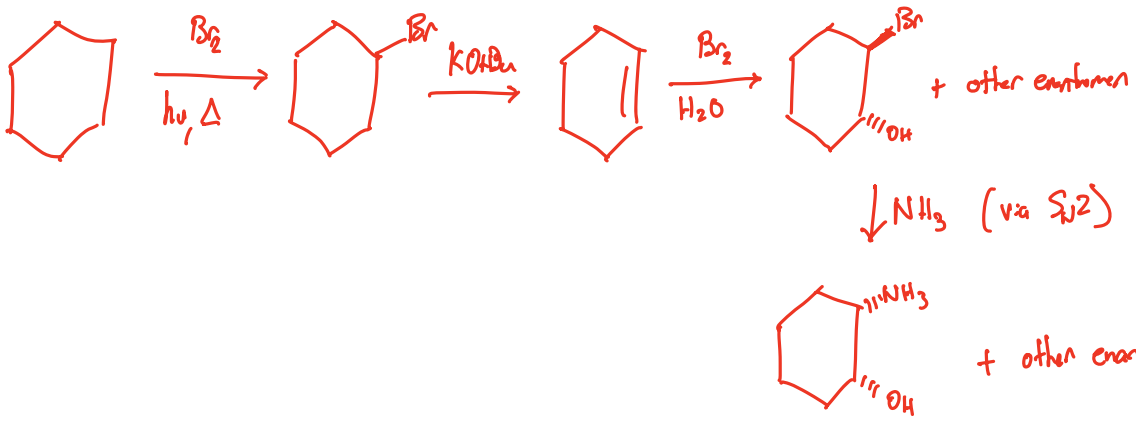


Section 4: Synthesis practice

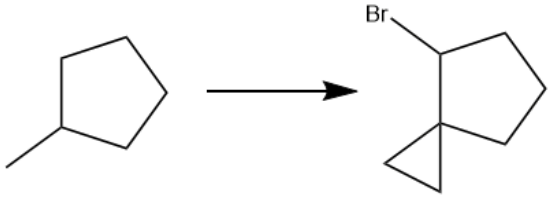
7. Provide a synthesis to produce each of the following products.

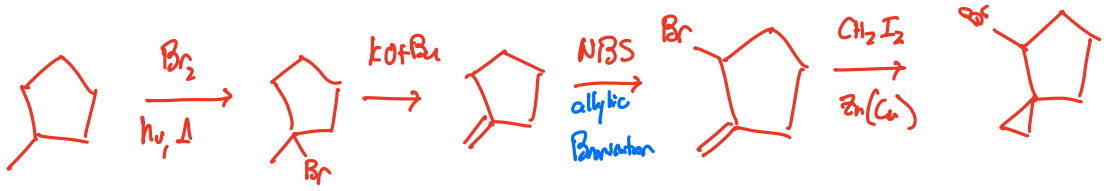
a.



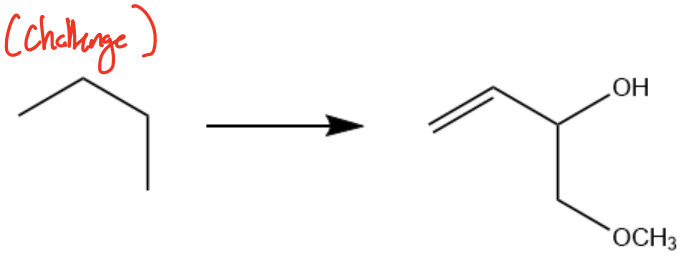


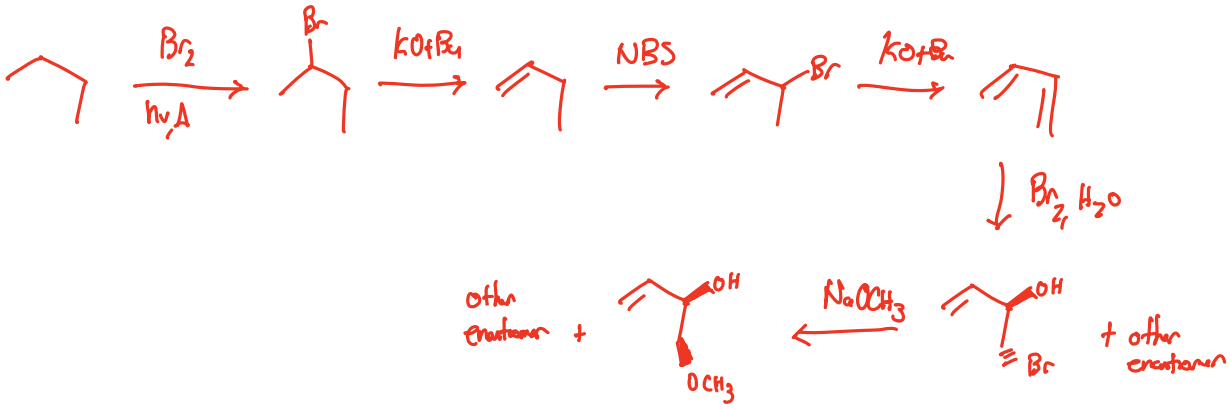
b.


Br


Br2
hν, Δ
KOtBu
NBS
allylic
Bromination
Br
CH2I2
Zn(Cu)

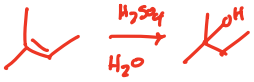
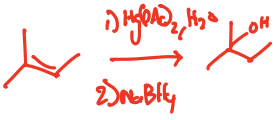
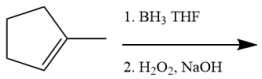
c.


(Challenge)
OH
OCH3

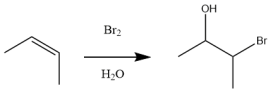
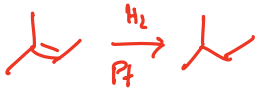
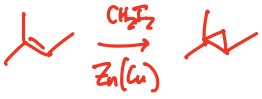
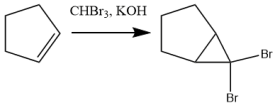

Br2
hν, Δ
Br
KOtBu
NBS
Br
KOtBu
Br2, H2O
other enantiomer +
OH
OCH3
NaOCH3
OH
Br
+ other enantiomer

Lets Recoup

Fill out the table with the appropriate reaction name, reaction stereochemistry (Syn, Anti, or N/A), reaction description, or example reaction based on the information given

Reaction Name	**Reaction Description**	**Reaction Example**	**Reaction Stereochemistry**
Markovnikov HX Addition	Adds an X (halogen) to the more-substituted end of a π bond.		N/A
Anti:- markovnikov H-X addition	Adds an X (halogen) to the less-substituted end of a π bond.		N/A
Acid Catalyzed Hydration	Adds an OH in a Markovnikov fashion; can rearrange		N/A
Oxymercuration / Demercuration	Adds OH in a markovnikov fashion; Cannot rearrange		Anti: (ring opening)
Hydroboration	Adds OH in an anti-markovnikov fashion; Cannot rearrange		Syn

5:06

Halogen addition	Adds 2 halogens across a double bond		Anti (ring opening)
Halohydrin formation	Adds a halogen and OH across a double bond. OH goes to more subst. side.		Anti (ring opening)
Catalytic Hydrogenation	Adds H_2 across double bond.		Syn
Simmon's Smith	Adds a cyclopropane group across a double bond		Syn
	ignore	Hns now	
Alpha Elimination	Adds CX_2 across a double bond.		Syn