CHEM 223 (2024) SI Session #15

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

- Predict products and draw mechanisms for addition reactions
- Describe Markovnikov and Anti-Markovnikov additions

Section 1: Addition of HX (Markovnikov and Anti-Markovnikov)

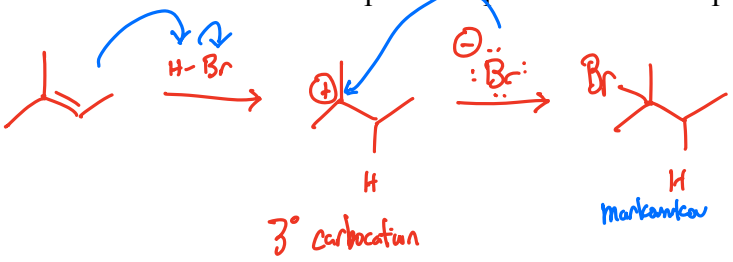
1. Use the following reaction to answer the questions below

5:10

a. Draw the mechanism to explain the production of the product.

FQ: why can a π bond act as a nucleophile/base?

A: e⁻ are far from the nucleus

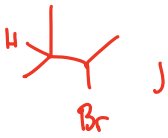


b. Draw the other potential product of this reaction, and explain why it is not produced. Label each product as Markovnikov and Anti-Markovnikov.

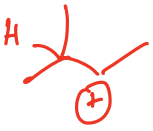
FQ: what's the difference?

A: markovnikov: add functional group to more substituted side

2° carbocation; not as stable as 3°



, comes from this carbocation :

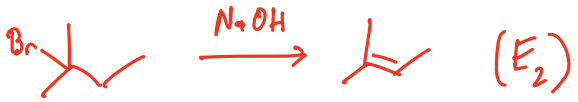


anti-markovnikov

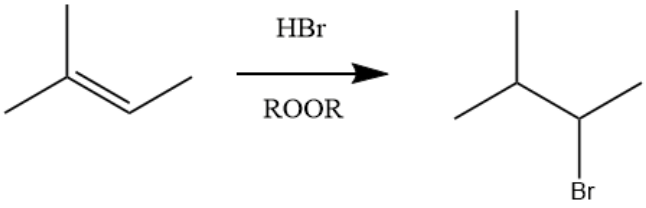
c. Can rearrangements happen in this reaction? Explain.

Yes; all carbocations can rearrange

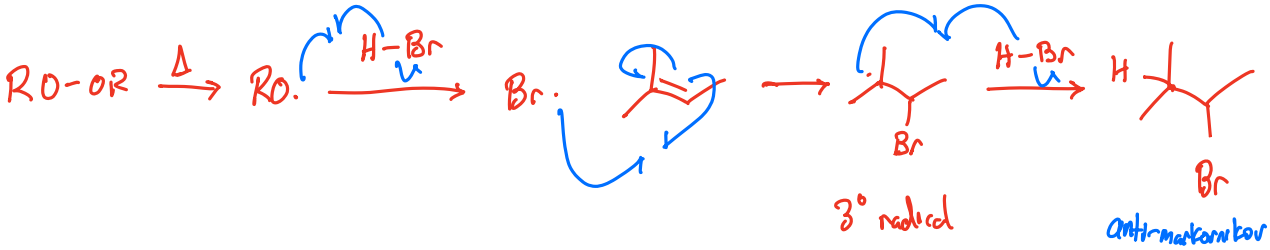
d. Provide reagents to perform the reverse reaction (going from the tertiary bromine to the alkene)



2. Use the following reaction to answer the questions below



a. Draw the mechanism to explain the production of the product.



b. Draw the other potential product of this reaction, and explain why it is <u>not produced</u>. Label each product as Markovnikov and Anti-Markovnikov.

c. Can rearrangements happen in this reaction? Explain.

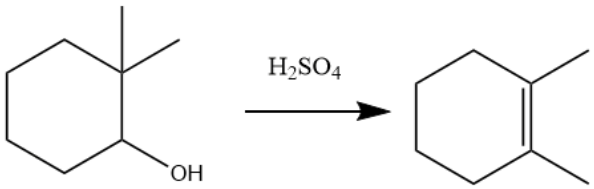
No; no carbocation is produced

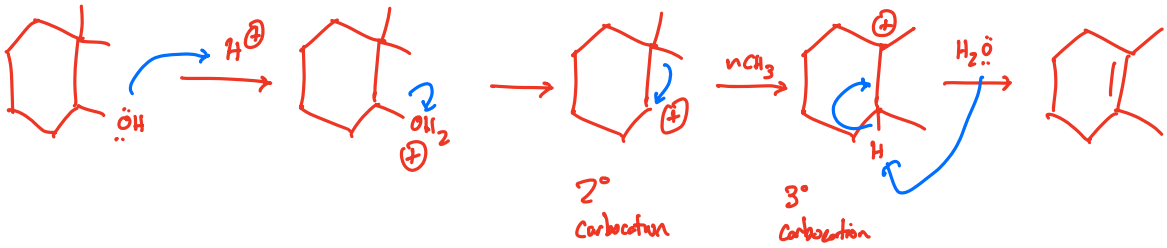
Section 2: Addition of -OH

3. (Review from Chapter 7) Name the reaction below and draw its mechanism of the following reaction.

5:43

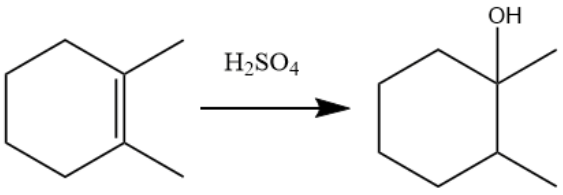
acid-catalyzed dehydration

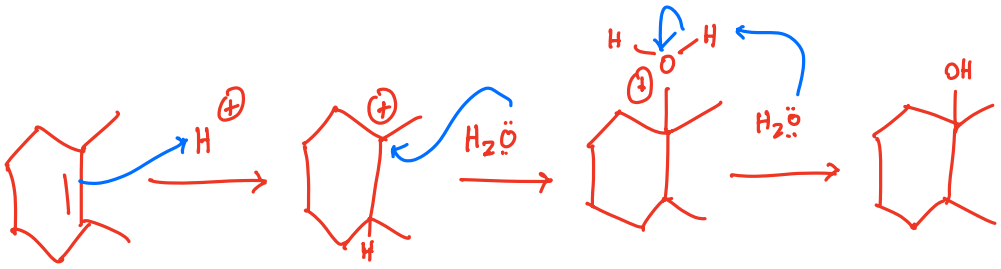




4. Draw the mechanism of the following reaction. Explain why we <u>do not</u> get the same alcohol that we started with.

acid-catalyzed hydration

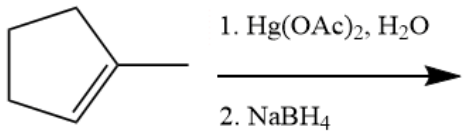




5. Can rearrangements happen in the reaction above? Explain.

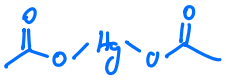
Yes! We have a carbocation intermediate

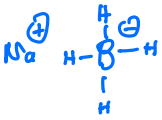
6. Use the reaction below to answer the following questions.



FQ: what do the numbers mean?
A: the ordering of the steps

FQ: Draw $Hg(OAc)_2$ and $NaBH_4$

A: $Hg(OAc)_2$ = 

$NaBH_4$ = 

a. Name the reaction, and draw the product.

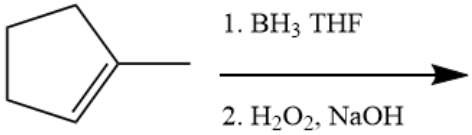
oxymercuration / demercuration

You do not need to know mechanisms for 6 & 7.

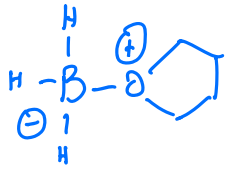
b. Is this reaction Markovnikov and Anti-Markovnikov? Explain.

Markovnikov; OH is added to the 3° position

7. Use the reaction below to answer the following questions.



FQ: draw $BH_3 \cdot THF$

A: 

a. Name the reaction, and draw the product.

hydroboration

b. Is this reaction Markovnikov and Anti-Markovnikov? Explain.

anti-markovnikov; OH added to less-substituted carbon

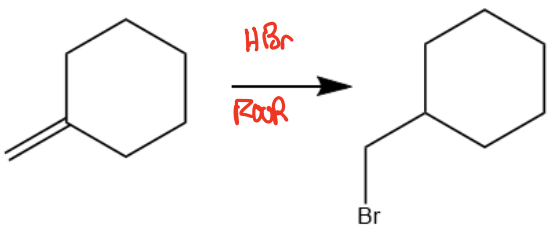
8. Why are the reactions in #6 and #7 more favorable than the one described in #4?

No rearrangements!

Section 3: Reagent Practice

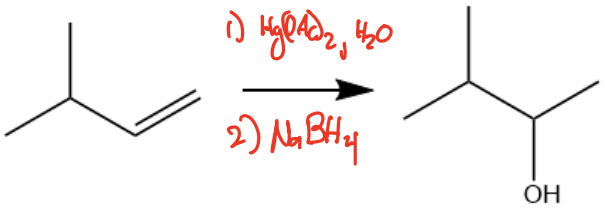
9. Provide the reagents required to perform each of the following reactions.

a.



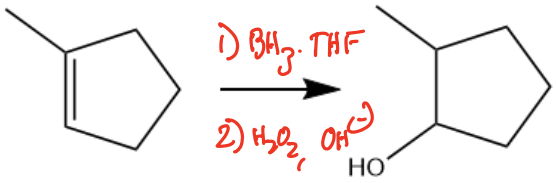
anti-markovnikov bromination

b.



markovnikov hydration

c.



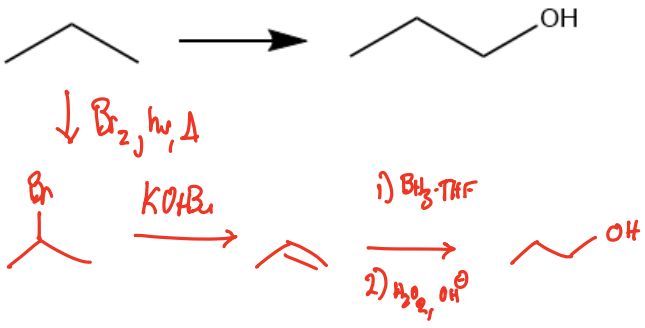
anti-markovnikov hydration

Section 4: Synthesis practice

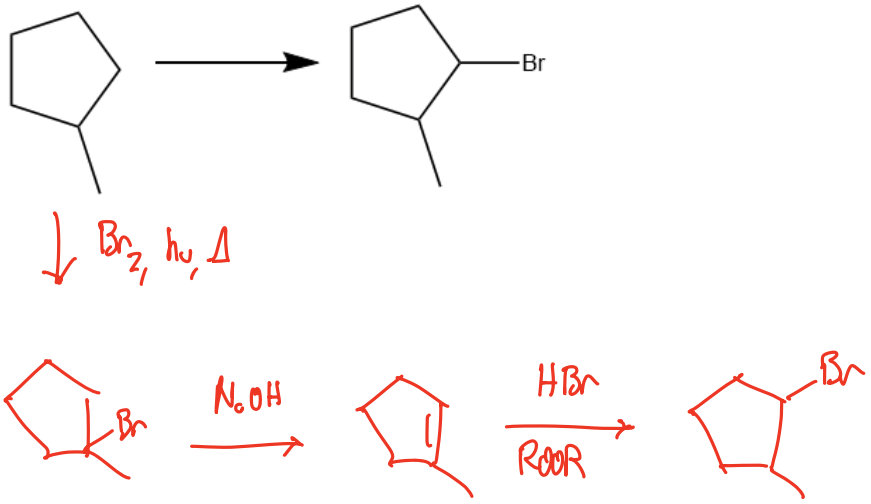
10. Provide synthesis schemes to produce each of the following products.

Practice Retrosynthesis!

a.



b.



c.