

Chapter 08 Worksheet 02

Alkene Reactions

Give the name of the reaction and describe what the following reactions do. Also, state whether the resulting product follows Markovnikov's rule, if it is syn or anti addition, and whether or not a carbocation is formed during the reaction (which could lead to rearrangement).

1. $\xrightarrow{\text{H-X}}$

Name: Hydrogen Halide addition
 Description: Adds H and X across double bond
 Markovnikov / Anti-Markovnikov: Markovnikov
 Syn / Anti-Addition: NEITHER
 Carbocation formed? YES, w/ possibility for rearrangement
2. $\xrightarrow{\text{HBr/ROOR (peroxide)}}$

Name: Anti-Markovnikov
 Description: Adds H and Br ANTI-MARK across alkene
 Markovnikov / Anti-Markovnikov: Anti-Markovnikov
 Syn / Anti-Addition: NEITHER
 Carbocation formed?
3. $\xrightarrow{\text{X}_2/\text{CCl}_4}$

Name: Halogenation
 Description: Adds halides across alkene, anti-addition
 Markovnikov / Anti-Markovnikov: NEITHER
 Syn / Anti-Addition:
 Carbocation formed? NO, forms halonium ion.
4. $\xrightarrow{\text{X}_2/\text{H}_2\text{O}}$

Name: Halohydrin formation
 Description: Adds halide and OH across alkene, anti-add,
 Markovnikov / Anti-Markovnikov: Markovnikov The halide acts like H so halide goes to side w/ more H's.
 Syn / Anti-Addition:
 Carbocation formed? NO
5. $\xrightarrow{\text{H}_2/\text{Pd, Pt, or Ni}}$

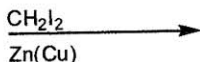
Name: catalytic Hydrogenation
 Description: Adds H's to reduce alkene
 Markovnikov / Anti-Markovnikov: NEITHER
Syn / Anti-Addition:
 Carbocation formed? NO
6. $\xrightarrow{\text{H}_3\text{O}^+}$

Name: ACID catalyzed Hydration
 Description: Adds H and OH across alkene,
 Markovnikov / Anti-Markovnikov: Markovnikov
 Syn / Anti-Addition: NEITHER
 Carbocation formed? YES, w/ possibility for rearrangement
7. $\xrightarrow{\begin{array}{l} 1. \text{BH}_3 \text{ THF} \\ 2. \text{H}_2\text{O}_2/\text{OH}^- \end{array}}$

Name: Hydroboration oxidation
 Description: Adds H and OH across double bond
 Markovnikov / Anti-Markovnikov:

8. $\xrightarrow[2. \text{NaBH}_4]{1. \text{Hg}(\text{OAc})_2/\text{H}_2\text{O}}$
- Syn / Anti-Addition:
 Carbocation formed? NO
 Name: Oxymercuration, demercuration
 Description: Adds H and OH across alkene
 Markovnikov / Anti-Markovnikov:
 Syn / Anti-Addition:
 Carbocation formed? NO
9. $\xrightarrow[2. \text{NaBH}_4]{1. \text{Hg}(\text{OAc})_2/\text{ROH}}$
- Name: Alkoxymercuration, demercuration
 Description: Adds H and R-O across alkene
 Markovnikov / Anti-Markovnikov:
 Syn / Anti-Addition:
 Carbocation formed? NO
10. $\xrightarrow[\text{cold, OH}^- (\text{basic})]{\text{KMnO}_4}$
- Name: Potassium Permanganate Hydroxylation
 Description: Syn Hydroxylation, forms syn diols
 Markovnikov / Anti-Markovnikov: N/A
 Syn / Anti-Addition:
 Carbocation formed? NO
11. $\xrightarrow[\text{H}_2\text{O}_2]{\text{OsO}_4}$
- Name: Osmium Tetroxide Hydroxylation
 Description: syn hydroxylation; forms syn diols
 Markovnikov / Anti-Markovnikov: N/A
 Syn / Anti-Addition:
 Carbocation formed? NO
12. $\xrightarrow[\text{warm (conc.)}]{\text{KMnO}_4}$
- Name: permanganate cleavage
 Description: oxidative cleavage of alkenes to form ketones, carboxy acids, $\text{CO}_2 + \text{H}_2\text{O}$
 Markovnikov / Anti-Markovnikov: N/A
 Syn / Anti-Addition: N/A
 Carbocation formed? N/A
13. $\xrightarrow[2. \text{DMS}]{1. \text{O}_3}$
- Name: Ozonolysis cleavage
 Description: Ox. cleavage of alkenes to aldehydes + ketones
 Markovnikov / Anti-Markovnikov: N/A
 Syn / Anti-Addition: N/A
 Carbocation formed? N/A
14. $\xrightarrow{\text{H}-\ddot{\text{C}}-\text{H}}$
- Name: Addition of carbenes
 Description: cyclopropanation
 Markovnikov / Anti-Markovnikov: N/A
 Syn / Anti-Addition:
 Carbocation formed? N/A

15.



Name: Simmons-Smith rxn

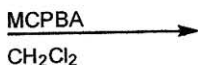
Description: cyclopropanation across alkenes

Markovnikov / Anti-Markovnikov: N/A

Syn / Anti-Addition:

Carbocation formed? N/A

16.



Name: Epoxidation of alkenes

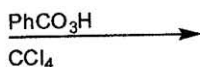
Description: forms epoxides across alkenes

Markovnikov / Anti-Markovnikov: N/A

Syn / Anti-Addition:

Carbocation formed? ND

17.



Name: Epoxidation of alkenes

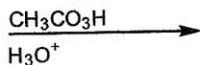
Description: forms epoxides across alkenes

Markovnikov / Anti-Markovnikov: N/A

Syn / Anti-Addition:

Carbocation formed? NO

18.

Name: Epoxidation \rightarrow trans-diols

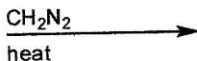
Description: forms epoxides then immediately opens to trans-diols

Markovnikov / Anti-Markovnikov: N/A

Syn / Anti-Addition: SYN \rightarrow ANTI

Carbocation formed? N/A

19.



Name: Addition of carbenes

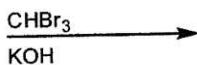
Description: forms cyclopropane across double bond

Markovnikov / Anti-Markovnikov: N/A

Syn / Anti-Addition:

Carbocation formed? N/A

20.



Name: Addition of carbenes

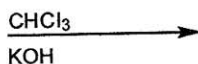
Description: Dibromocarbene cyclopropanation

Markovnikov / Anti-Markovnikov: N/A

Syn / Anti-Addition:

Carbocation formed? N/A

21.



Name: Addition of carbenes

Description: Dichlorocarbene cyclopropanation

Markovnikov / Anti-Markovnikov: N/A

Syn / Anti-Addition:

Carbocation formed? N/A