Chap 12
Alkenes, Alkynes

1. Show functional groups- specific arrangement of atoms that gives rise to certain reactivity.

2. Alkenes- double bond, alkynes triple bond- show geometry of the bonds, retinol..
   1. Nomenclature-
      1. Parent chain contains both carbons in the alkyne or alkene.
         Replace –ane with –ene (double bond) or –yne (triple bond).
   2. Number nearest to the double or triple bond.
   3. Name the branches. Put the number of the branch in font of the parent.

   a. \[ \text{5-methyl-2-bromo-3-heptyne} \]
   b. \[ \text{2,4,5-trimethyl-3-bromo-3-hexene} \]
   c. \[ \text{1-tertbutyl-4-methylcyclohexene} \]
   d. \[ \text{4-chloro-3-methyl-1-butyne} \]
   e. \[ \text{4-bromo-3-chloro-1-cyclopentene} \]

2. Show structure of double bond- no free rotation in space.
   Can have stereoisomers- same atom-atom connectivity but different arrangement in space.

   Ex.
Same side of the double- cis
Opposite -trans
Two identical groups on 1 carbon neither cis or trans

EX.

cis-3-hexene

trans-6-chloro-3-heptene

Also for cycloalkanes- restricted rotation.

4. Reactions of alkenes-
   1. Addition reactions.

2. Halogenation addition of $X_2$.

Ex. Bromine is colored, disappears as reaction proceeds.

3. Hydration, addition of $H_2O$. 
Ex.

Unsymmetrical

Markovnikov’s rule- The atom with the most hydrogens gets more. The more substituted position gets the addition.

4. Hydrohalogenation, addition of HX.

Mark addition

Ex.
2. Oxidation Reactions-

\[
\text{R} = \overset{\text{Heat}}{\underset{\text{Prssure}}{\text{R}}} + \text{KMnO}_4 \rightarrow \overset{\text{Heat}}{\underset{\text{Prssure}}{\text{R}}} + \text{MnO}_2
\]

Ex.

3. Polymers- are made up of many monomers.

General equation-

\[
\overset{\text{Heat}}{\underset{\text{Prssure}}{\text{R}}} = \left(\overset{\text{Heat}}{\underset{\text{Prssure}}{\text{R}}} \right)_n
\]

1. Polyethylene- can be HDPE

\[
\overset{\text{Heat}}{\underset{\text{Prssure}}{\text{C} = \text{C}}} \rightarrow \left(\overset{\text{Heat}}{\underset{\text{Prssure}}{\text{C} = \text{C}}} \right)_n
\]

ethylene

2. Polypropylene- indoor-outdoor carpeting, packaging, toys.

\[
\overset{\text{Heat}}{\underset{\text{Prssure}}{\text{C} = \text{CH}_3}} \rightarrow \left(\overset{\text{Heat}}{\underset{\text{Prssure}}{\text{C} = \text{CH}_3}} \right)_n
\]
3. Teflon-

\[
\begin{array}{c}
\text{F} - \text{C} - \text{C} \\
\text{F} \quad \text{Pressure} \\
\text{F} - \text{C} - \text{C} \\
\end{array}
\xrightarrow{\text{Heat}}
\begin{array}{c}
\text{F} - \text{C} - \text{C} \\
\text{F} \\
\text{F} - \text{C} - \text{C} \\
\end{array}
\]

4. Aromatic compounds- extra stable
Originally called aromatic compounds because isolated from the resin of tropical trees. Overlapping orbitals.

\[
\begin{array}{c}
\text{C} \\
\text{C} \\
\text{F} \\
\text{F} \\
\text{F} \\
\text{F} \\
\end{array}
\xrightarrow{\text{Pressure}}
\begin{array}{c}
\text{C} \\
\text{C} \\
\text{F} \\
\text{F} \\
\text{F} \\
\text{F} \\
\end{array}
\]

1. nomenclature- Add benzene.

Ex.

\[
\begin{array}{c}
\text{R} \\
\text{O} \\
\text{M} \\
\text{P} \\
\end{array}
\]

phenol aniline toluene

\[
\begin{array}{c}
\text{OH} \\
\text{NH}_2 \\
\text{CH}_3 \\
\end{array}
\]

2,4-dinitrotoluene 2-bromo-5-chlorotoluene isopropyl benzene
2. reactions-

\[
\text{C}_6\text{H}_6 + \text{Cl}_2 \xrightarrow{\text{FeCl}_3} \text{C}_6\text{H}_5\text{Cl} \quad \text{can use Br}_2
\]

\[
\text{C}_6\text{H}_6 + \text{SO}_3 \xrightarrow{\text{CONC. H}_2\text{SO}_4} \text{C}_6\text{H}_5\text{SO}_3\text{H} + \text{H}_2\text{O}
\]

\[
\text{C}_6\text{H}_6 + \text{HNO}_3 \xrightarrow{\text{CONC. H}_2\text{SO}_4} \text{C}_6\text{H}_4\text{NO}_2 + \text{H}_2\text{O}
\]