Lecture 16

Topics

Predicting Ionic Reactions (Summary and Examples)
Introduction to Alkenes
E-Z Nomenclature for Alkenes
\[ \text{Br}^- + \text{CH}_3\text{O}^- \xrightarrow{\text{Sn2}} \text{major product} \]

\[ \text{Sn2} \]

\[ \text{K}\text{I} \xrightarrow{\text{CH}_3\text{OH}} \]

\[ \text{Sn2} \]

\[ \text{CH}_3\text{C}-\text{O}^-\text{Na}^+ \xrightarrow{\text{Sn2}} \text{CH}_3\text{CH}_2\text{-OH} \]

\[ \text{Sn2} \]

\[ \text{CH}_3\text{C}-\text{O}^-\text{Na}^+ \xrightarrow{\text{Sn2}} \text{rotation} \]

\[ \text{Br} \xrightarrow{\text{CH}_3\text{OH}} \]

\[ \text{rotation} \]
Using $S_n2$ and $E2$ Reactions in Organic Synthesis.

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH}_3O^- \\
\text{CH}_3-\text{CH}_2-\text{C}-\text{Cl} & \xrightarrow{\text{CH}_3\text{COH}} \quad \text{CH}_3-\text{CH}^=\text{C}^-\text{CH}_3 \\
\quad \text{CH}_3 & \\
\text{major product}
\end{align*}
\]

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH}_3^-\text{H}_2\text{O}^- \quad \text{Na}^-\text{C}^-\text{H}_3-\text{O}^- \\
\text{CH}_3-\text{CH}_2-\text{C}-\text{Cl} & \xrightarrow{(\text{CH}_3)_3\text{COH}} \quad \text{CH}_3-\text{CH}_2-\text{C}^-\text{CH}_3 \\
\quad \text{CH}_3 & \\
\text{major product}
\end{align*}
\]

\[
\begin{align*}
\text{C}_1 & \quad \text{t-BuO}^- \\
\text{C}_1 & \xrightarrow{\text{CH}_3\text{COH}} \quad \text{C}_2
\end{align*}
\]

\[
\begin{align*}
\text{C}_1 & \quad \text{CH}_3\text{O}^- \\
\text{C}_1 & \xrightarrow{\text{CH}_3\text{COH}} \quad \text{C}_3-\text{O}-\text{CH}_3
\end{align*}
\]
Chapter 7: Alkenes and Alkynes
Elimination Reactions of Alkyl Halides

I. Introduction

A. Alkenes are the most commercially important organic compounds in the world.

1. The two simplest alkenes, ethylene (ethene) and propylene (propene) are by far the largest volume organic compounds in the world.

2. U.S. alone produces and uses 50 billion #’s of ethylene and 30 billion #’s of propylene per year.

3. Because of the reactivity of the carbon-carbon double bond and the wide range of addition reactions possible, alkenes serve as the primary building blocks for the world’s chemical industry.
Industrial Uses of Ethylene and Propylene

\[ \text{H}_2\text{C} = \text{CH}_2 \]

\[ \left( \text{CH}_2 - \text{CH}_2 \right)_n \]
\[ \text{CH}_3\text{CH}_2\text{OH} \]
\[ \text{CH}_3\text{C}^\circ\text{H}_3 \]
\[ \text{CH}_3 - \text{C} - \text{OH} \]
\[ \text{CH}_2 - \text{CH}_2 \]
\[ \text{OH} \quad \text{OH} \]
\[ \text{CH}_2 - \text{CH}_2 \quad \rightarrow \quad \text{CH}_2 = \text{C}^\circ \text{H} \]
\[ \text{Cl} \quad \text{Cl} \]

\[ \text{CH}_3 - \text{Cl} \quad \rightarrow \quad \text{CH}_3 - \text{Cl} - \text{CH}_3 \]
\[ \text{CH}_3 - \text{CH} - \text{CH}_2 \]

\[ \left( \text{CH} - \text{CH}_2 \right)_n \]
\[ \text{CH}_3 \]
8. Alkenes play a vital role in the structure and function of the biological world.

1. The type (cis vs trans) and number of double bonds in the hydrocarbon part of biomolecules results in a wide range of structure and function differences for these molecules.

2. Lipids which make up cell membrane structures have different numbers of double bonds which make the membranes more rigid or more fluid depending on the cell function and temperature.

3. The effect of double bonds on lipid properties can easily be seen in the example of edible fats and oils.
a. When no double bonds are present the fat is said to be saturated.

Example: animal fat - solid at room temp. Structure: triacylglycerol ("triglyceride")

\[
\begin{align*}
H_2C - O - H & + 3 CH_3(CH_2)_{14} - C - O - H \\
H_2C & - O - H
\end{align*}
\]

\[
\downarrow - 3 H_2O
\]

Example: vegetable oil

b. When several double bond are present the fat (or oil) is said to be unsaturated or polyunsaturated.

Example: vegetable oil
II. (E)-(Z) System for Designating Alkene Diastereomers

A. cis-trans designation is not sufficient for tri and tetra substituted alkenes.
Example: ① C1
\[ \text{Br} \quad \text{①} \]
\[ \text{C} = \text{C} \]
\[ \text{② H} \]
\[ \text{F} \text{②} \]

B. E-Z system used Cahn-Ingold-Prelog priority system to rank the groups attached to each alkene carbon.
1. if highest priority groups are trans \( \rightarrow \) E
2. if highest priority groups are cis \( \rightarrow \) Z

Example Above: (Z)-1-bromo-2-chloro-1-fluoromethane