Alkenes

Def: unsaturated hydrocarbon with

The framework → double bond consists of:

Importance: Pi bond

Elements of unsaturation: due to

- Double bond =
- Ring =
- Triple bond =

Formula: \#EU =

Or simply

Ex: Draw 2 constitutional isomers for \( \text{C}_4\text{H}_8\text{O} \)

\#EU:
**Naming Rules**

1. Longest chain containing

2. Parent names:
   - Alkenes →

3. Number to give multiple bond

4. Number of multiple bond

5. Polyenes:
   - 2 double bonds →
   - 3 double bonds →

**Common Names**

- \( \text{H}_2\text{C} \equiv \text{CH}_2 \)
- \( \text{HC} \equiv \text{CH} \)

**IUPAC**

**Common**

- \( \text{H}_2\text{C} \equiv \text{CHCH}_2 \)
- \( \text{H}_2\text{C} \equiv \text{CH} \)

**IUPAC**

**Common**
Alkene Stereoisomers

Due to \( \rightarrow \)

Cis-Trans System:

\[
\begin{align*}
\text{H} & \quad \text{C} & \quad \text{H} \\
\text{CH}_3 & \quad \text{C} & \quad \text{CH}_3 \\
\end{align*}
\]

\[
\begin{align*}
\text{H} & \quad \text{C} & \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{C} & \quad \text{H} \\
\end{align*}
\]

\( \text{Mp} = -139 \, ^\circ C \quad \text{Mp} = -106 \, ^\circ C \)

\( \text{Bp} = 4 \, ^\circ C \quad \text{Bp} = 1 \, ^\circ C \)

Cis-Trans Isomers:

- Different
- Different
- Trans

E,Z System for

- Priority rules
- “zusammen”
- “entgegen”
Ex. Name the following compounds:

\[
\begin{align*}
&\text{CCl} \\
&\text{H}_3\text{C} \\
&\text{CH}_2\text{CH}_3
\end{align*}
\]

For polyenes \( \rightarrow \) # stereoisomers = 
For cycloalkenes \( \rightarrow \) Cis

**Physical Properties:**
- B. Pt. & M. Pt. \( \rightarrow \)
- Polarity \( \rightarrow \)
- Low Mol. Wt. (\( \leq \) C4) \( \rightarrow \)
- Density \( \rightarrow \)

Commercial uses:
- Ethylene \( \rightarrow \)
  - Polymerization \( \rightarrow \)
  - Synthesis \( \rightarrow \)
Stability of alkenes:

- Cis versus trans
- Saytzeff Rule

Alkene Reactions

**Synthesis of alkenes**

**Reactions of alkenes**

1) Synthesis of alkenes

2) Reactions of alkenes

Elimination Reactions:

1) Of HX

2) Of Water
3) Of Hydrogen

Addition Reactions:

Electrophilic addition: general mechanism

Step 1 → Step 2 →

\[
\text{C} = \text{C} + \text{E}^+ \rightarrow \text{C} = \text{C}^+ + \text{Nu}^-
\]

Carbocation stability

“Things that can add”:

1. Hydrogen

\[
\text{C} = \text{C} + \text{H}_2 \rightarrow
\]
Sample Problems – Predict the Product:

- What is the functional group?
- What are the?
- Are any involved?
- Products: more than?
- Stability?
Sample problem – synthesis:

Ex: Show how you would synthesize 1-bromo-2-methylcyclopentane from methylcyclohexene.
Suggested problems:

Chpt. 7: 31, 32, 33, 34, 36, 38, 40, 41

Chpt. 8: 1, 4, 6, 17, 24, 47 (a, b, e, f, m, n, p), 49 (a, b, c), 69 (a, b, c, d) [ignore stereochemistry for all]