Topics

cis-trans isomers of alkenes

Addition reactions of alkenes

- HX addition
- H₂O addition
- X₂ addition

carbon-carbon and their relative stabilities

again, alkenes more reactive than alkanes

cis-trans isomers not just found in rings

\[
\text{cis} \quad \text{trans} \quad \text{dimeethylcyclohexane}
\]

both examples of trans

\[
\text{cis} \quad \text{trans} \quad \text{cyclohexane}
\]

trans, 1-butenone cis, 2-butenone

there are stereoisomers, same order of connection but different 3D arrangement
HX addition reactions (HF, HCl, HBr, HI)

\[ \text{CH}_2=CH_2 + \text{Br}_2 \rightarrow \text{CH}_2=\text{CH}-\text{CH}_2=\text{CH}_3 \]

These are negative \( e^- \) pulled toward partial positive \( H \)

\[ \text{Br}_2 \rightarrow \left[ \text{CH}_2=\text{CH}-\text{CH} = \text{CH}_2 \right] \text{intermediate} \]

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Stability of carbenes: $R = \text{alkyl}$

- Methyl: $\text{primary}$
- Primary: $1^\text{st}$
- Secondary: $2^\text{nd}$
- Tertiary: $3^\text{rd}$

Rate-limiting step is formation of carbenes.

Pathway a is favored because the carbocation has more alkyl groups connected to it because they can donate electron density and thus stabilize the positive charge.
**Markovnikov’s Rule**: On addition of $HX$ to an alkenene, $H$ adds to the side with more hydrogens.

### Addition of $H_2O$

$$
\text{CH}_3 - \text{CH}_2 - CH = CH_2 \xrightarrow{H_2O} \text{CH}_3 - \text{CH}_2 - CH - CH_3
$$

### Addition of $X_2$

$$
\text{CH}_3 - \text{CH}_2 - CH = CH_2 \xrightarrow{Br_2} \text{CH}_3 - CH_2 CH - CH_2
$$

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