

Combustion

Complete $\text{C}_x\text{H}_y + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

Incomplete $\text{C}_x\text{H}_y + \text{O}_2 \rightarrow \text{CO} + \text{H}_2\text{O}$

$\text{C}_x\text{H}_y + \text{O}_2 \rightarrow \text{C} + \text{H}_2\text{O}$

Alkane/Ether

Balance Carbon > Hydrogen > Oxygen

Halogenation

Alkene $\text{H}_2\text{C}=\text{CH}_2 + \text{Br}_2 \rightarrow \text{H}_2\text{C}(\text{Br})\text{CH}_2(\text{Br})$

Alkyne same as alkene, but double addition reagent

+Cl₂ or Br₂

Addition of Simple Acids

Alkene $\text{CH}_2=\text{CH}_2 + \text{HCl} \rightarrow \text{CH}_3\text{-CH}_2(\text{Cl})$

Alkyne Same as Alkene, but twice addition reagent

+HBr or HCl

Markovnikov's Rule. Hydrogen goes to Carbon with more Hydrogen; the rich get richer

Hydration

Alkene $\text{H}_2\text{C}=\text{CH}_2 + \text{H-OH} \rightarrow \text{CH}_3\text{-CH}_2(\text{OH})$

Alkyne Same as Alkene, but twice the addition reagent

+H₂O & Acid Catalyst (Pt, Pd, Ni)

Markovnikov's Rule. the rich get richer

Hydrogenation

Alkene $\text{H}_2\text{C}=\text{CH}_2 + \text{H}_2 \rightarrow \text{CH}_3\text{-CH}_3$

Alkyne Same as Alkene, but twice the addition reagent

Aldehyde $\text{CH}_2(\text{O}) + \text{H}_2 \rightarrow \text{CH}_3(\text{OH})$

Ketone $\text{H}_3\text{C}(\text{O})\text{CH}_3 + \text{H}_2 \rightarrow \text{H}_3\text{C-CH}(\text{OH})\text{-CH}_3$

Alkene/Alkyne \rightarrow Alkane

Aldehyde \rightarrow Primary Alcohol

Ketone \rightarrow Secondary Alcohol

Polymerization

Addition $\text{CH}_2=\text{CH} + \text{CH}=\text{CH}_2 \rightarrow \text{CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2$

Condensation $(\text{OH})\text{C}(\text{O})\text{-(O)C}(\text{OH}) + \text{HO-CH}_2\text{-OH} \rightarrow$

Polyamides $(\text{Cl})\text{C}(\text{O})\text{-(O)C}(\text{Cl}) + \text{H}_2\text{N-NH}_2 \rightarrow$

Addition Polymerization: linking together many Alkene molecules through addition reactions

Carboxylic Acid: Condensation

Amide: Polyamide

Substitution

Aromatic Switch 1 Hydrogen with one of the addition reagents

Aromatics = stable/chemically inert

Dehydration

180°C $\text{H}_3\text{C-CH}_2(\text{OH}) \rightarrow \text{H}_2\text{C}=\text{CH}_2 + \text{H}_2\text{O}$

140°C $\text{H}_3\text{C-OH} + \text{H}_3\text{C-OH} \rightarrow \text{H}_3\text{C-O-CH}_3 + \text{H}_2\text{O}$

@180°C Alcohol \rightarrow Alkene

@140°C Alcohol + Alcohol \rightarrow Ether

Requires Acid Catalyst (H₂SO₄)

Oxidation

Primary Alcohol \rightarrow Aldehyde

Secondary Alcohol \rightarrow Ketone

Tertiary Alcohol \rightarrow NR

Aldehyde \rightarrow Carboxylic Acid

Ketone \rightarrow NR

Thiols \rightarrow Disulfide

Oxidizing Agents: K₂Cr₂O₇; KMnO₄

Tollens Reagent: 2Ag(NH₃)₂⁺ \rightarrow 2 Ag

Benedict's Reagent: 2Cu²⁺ \rightarrow Cu₂O (blue) \rightarrow (red precipitate)

Dissociation

Acid: Carboxylic Acid, Phenol

Donate H from -OH to H₂O \rightarrow O⁻ + H₃O⁺

Base: Amine

Steal H from H₂O \rightarrow NH₄⁺ + OH⁻

Acid + H₂O \rightarrow

Base + H₂O \rightarrow

Neutralization

Acid + Base \rightarrow Salt + H₂O

Salt Ex) O⁻K⁺

Base: KOH, NaOH

Acid: Phenol, Carboxylic Acid