Reactions of Alkenes

1) Hydrogenation (adding H₂) or reduction

Reduction of alkenes produces the corresponding alkanes

2) Halogenation (adding Cl₂ or Br₂)

Halogens add across the double bond to produce the dihaloalkane

$$H_2C$$
 \longrightarrow CH_2 $+$ CI CI \longrightarrow CH_2 \longrightarrow CH_2 ethylene 1.2-dichloroethane

3) Hydrohalogenation (adding HCl, HBr)

Addition of hydrogen halides follows "Markovnikov's rule" that says that the hydrogen atom adds to that carbon of the double bond which has the maximum number of hydrogens attached to it

$$H_2C$$
 \longrightarrow H_2C \longrightarrow \longrightarrow H_2C \longrightarrow \longrightarrow H_2C \longrightarrow \longrightarrow H_2C \longrightarrow \longrightarrow \longrightarrow \longrightarrow \longrightarrow \longrightarrow

4) Hydration (adding H₂O)

Follow Markovnikov's rule, the result is an alcohol

5) Polymerization (making polymers)

Polyethylene or Polythene

Reaction of Alkynes

6) Addition of halogens or hydrogen halides

Again, Markovnikov's rule is followed, and "trans" alkenes are formed

Reactions of Alcohols

7) Dehydration of Alcohols

Dehydration of alcohols, at high temperature produces the corresponding alkenes

$$H_3C$$
— CH_2 — OH $\xrightarrow{H^+}$ H_2C — CH_2 + H_2O ethylene

8) Formation of ethers

Ethers form when the dehydration of alcohols occurs at lower temperatures in the presence of an acid catalyst. Then the components of water are removed from two separate molecules: an H from one alcohol and the OH from the other. When the remaining portions of the two alcohols join, and ether is produced

H₃C—OH + HO—CH₃
$$\xrightarrow{\text{H}^+}$$
 H₃C—O—CH₃ + H₂O methanol methanol dimethyl ether

9) Oxidation of primary alcohols

Oxidation of primary alcohols produce aldehydes. Conversely, reduction of aldehydes produces primary alcohols Oxidation of secondary alcohols produces ketones. Conversely, reduction of ketones produces secondary alcohols.

10) Oxidation of aldehydes

Aldehydes are oxidized to form carboxylic acids.

Reactions of carboxylic acids

11) Formation of Esters

12) Acid and Base hydrolysis of Esters

$$H_3C-CH_2-C-O-CH_3$$
 + Na-OH \longrightarrow $H_3C-CH_2-C-O-Na$ + $H_3C-O-Na$ methanol sodium propanoate

13) Reactions of amines

a) Ionization of an amine in water

$$H_3C$$
— NH_2 + H_2O \longrightarrow H_3C — N^+ H + HO^- hydroxide methanaminium

b) Neutralization of an amine

c) Amidation (formation of amides)

$$H_3C-CH_2-C-OH$$
 + H_2N-CH_3 \longrightarrow $H_3C-CH_2-C-NH-CH_3$ + H_2C-CH_3 propionic acid methanamine N -methylpropanamide

14) Reactions of amides

Acid Hydrolysis

$$H_3C$$
 \longrightarrow NH_2 $+$ H_2O $+$ HCI \longrightarrow H_3C \longrightarrow OH $+$ NH_4^+ $+$ CI acetamide \longrightarrow acetamide ammonium chloride

Base hydrolysis

$$H_3C$$
— CH_2 — C — NH_2 + CH_3 + Na — OH \longrightarrow H_3C — CH_2 — C — O — Na + H_2N — CH_3 propionamide sodium propanoate