Ministry of Higher Education and Scientific Research

Al-Muthanna University

Organic chemistry

For the 1st year students of the «faculty of Pharmacy»

Lecture (5) Alkenes

Dr. Rusul Alabada

Lecture (6)

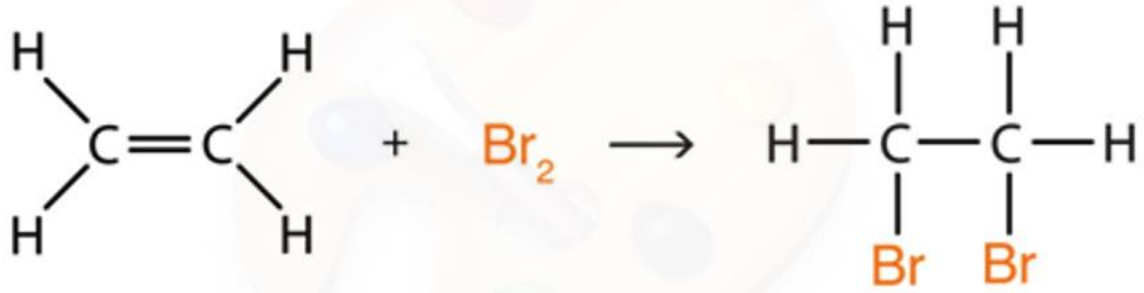
Alkenes

- Alkenes have the doble bonds, they are π- bonds, the strength of π- bond is less than σ- bond therefor the short bond of alkene molecules is easily broken.
- Alkenes are unsaturated and unstable compounds therefor the main reactions of alkenes are addition reactions.
- The general formula for alkanes is CnH_2n.

IUPAC Name	Molecular Formula	Condensed Structural Formula
ethene	C_2H_4	$CH_2=CH_2$
propene	C_3H_6	$CH_2=CHCH_3$
1-butene	C_4H_8	$CH_2=CHCH_2CH_3$
1-pentene	C_5H_{10}	$CH_2=CH(CH_2)_2CH_3$
1-hexene	C_6H_{12}	$CH_2=CH(CH_2)_3CH_3$
1-heptene	C_7H_{14}	$CH_2=CH(CH_2)_4CH_3$
1-octene	C_8H_{16}	$CH_2=CH(CH_2)_5CH_3$

The chemical reactions of alkenes

Halogenation:

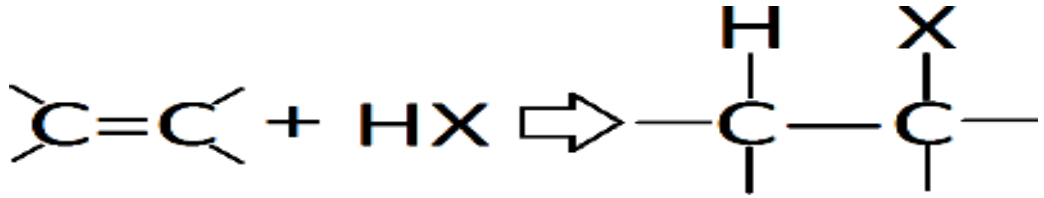


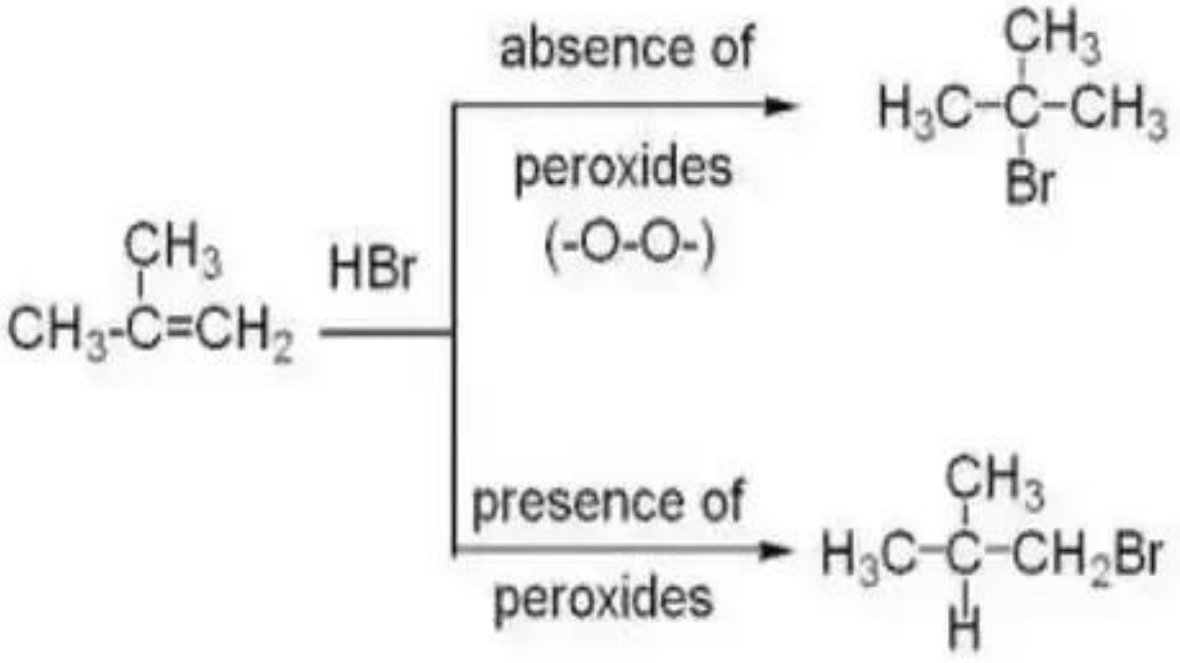
Ethylene Bromine 1,2-Dibromoethane

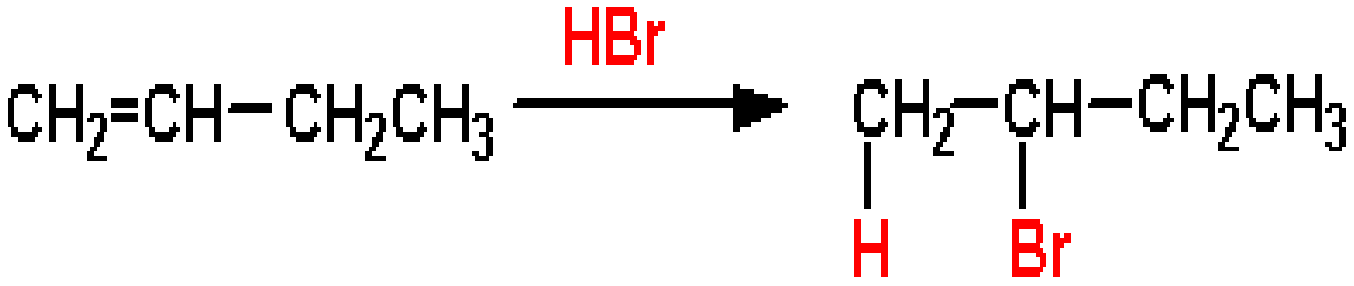
Ethylene **1,2-Dichloroethane (Ethylene dichloride)**

Propene Bromine Dibromopropane

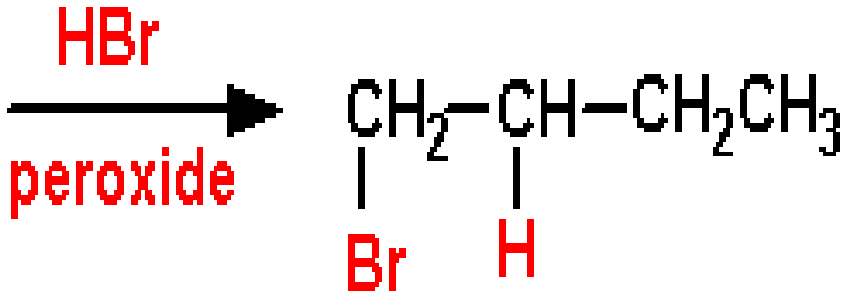
Hydrohalogenation





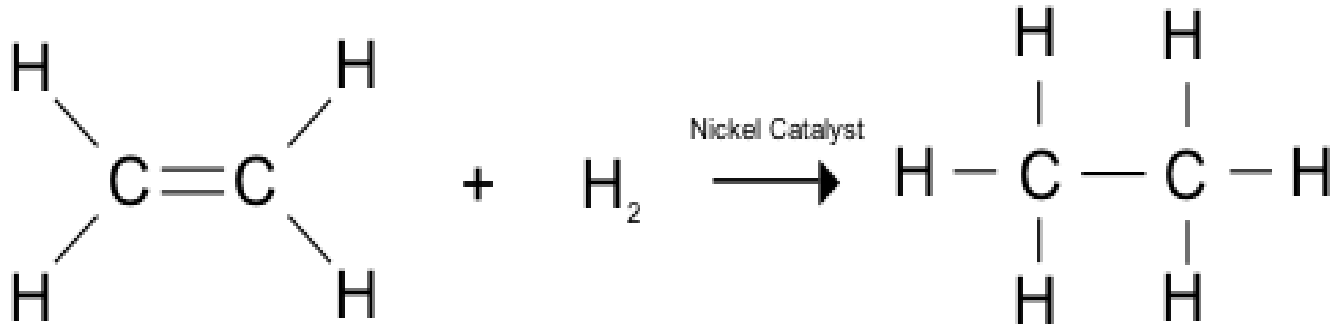


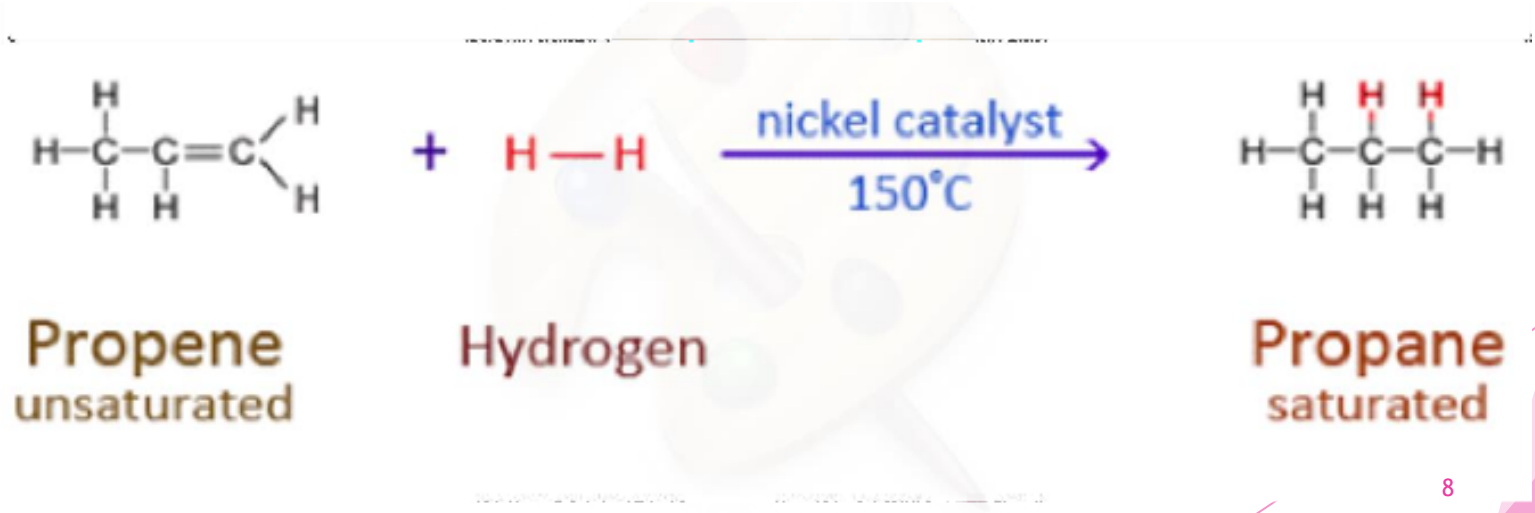
Markovnikov



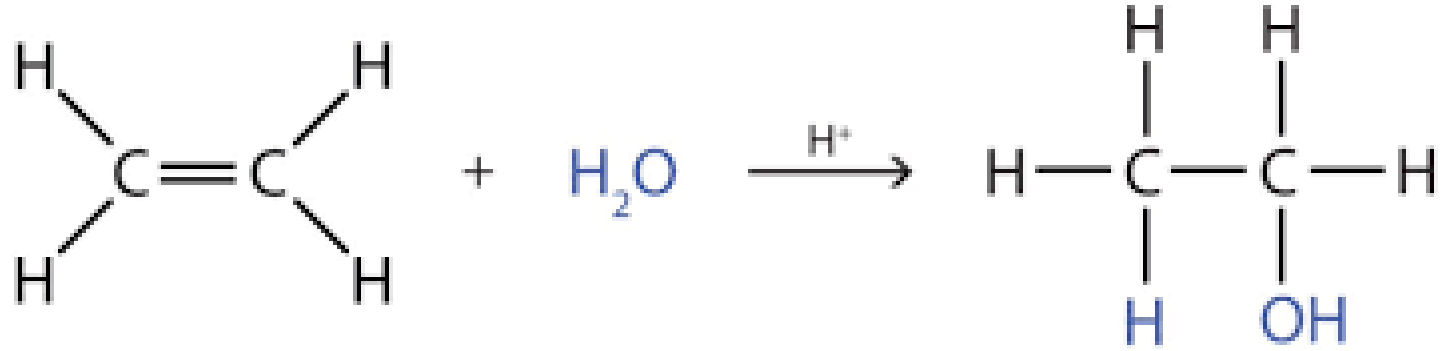
anti-Markovnikov

Hydrogenation

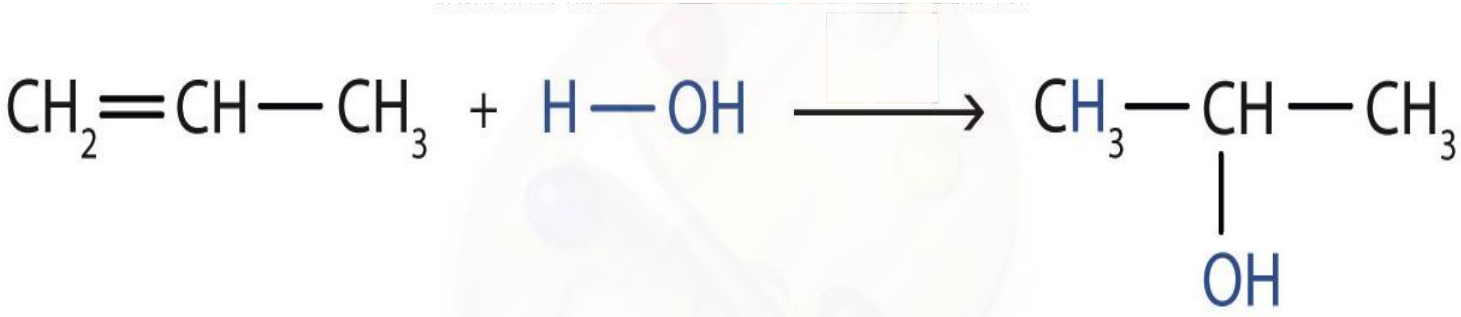




Hydration



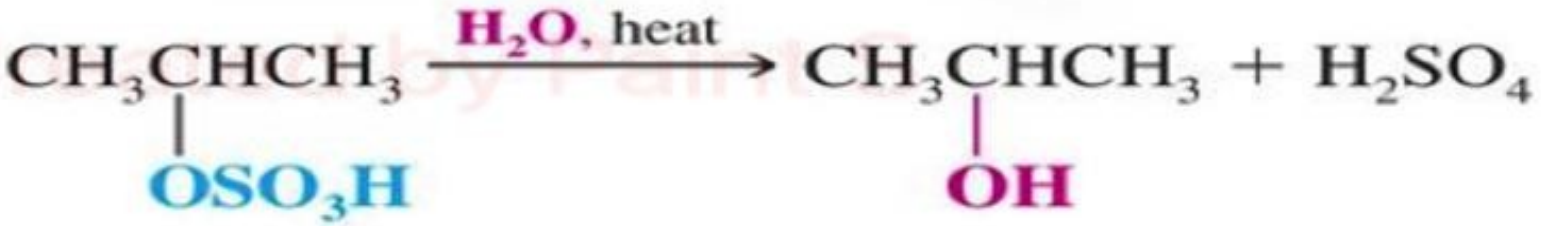
Ethylene + Water → Ethanol



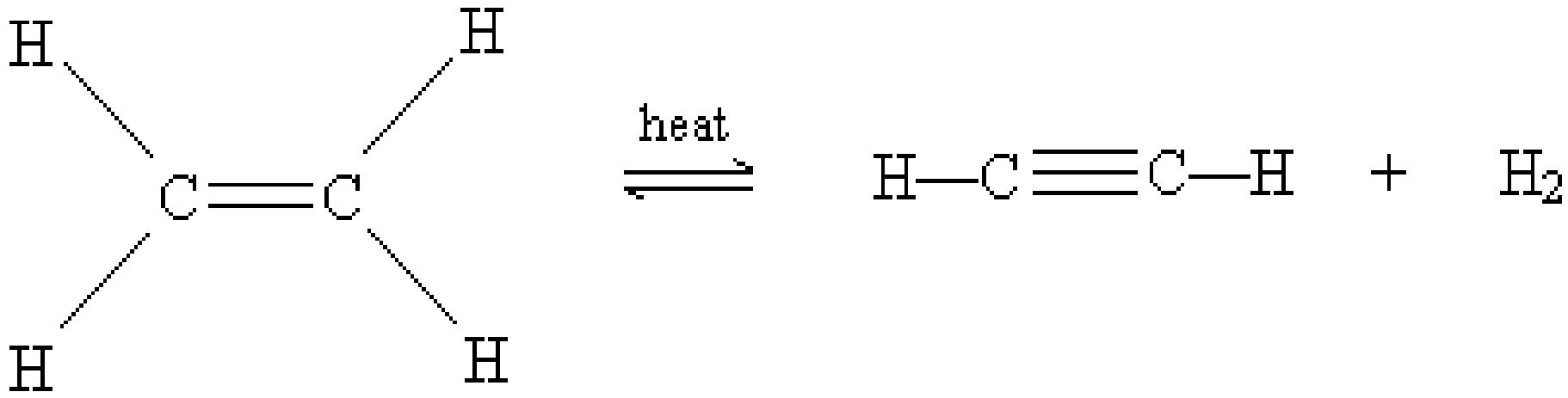
Propylene → Isopropyl alcohol (2-propanol)

Sulfonation

Isopropyl hydrogen sulfate



Dehydrogenation



Oxidation reactions

1. Oxidation by O_2

$$C_nH_{2n} + 1{,}5nO_2 \rightarrow nCO_2 + nH_2O \quad \text{(burning);}$$

$$C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$$

2. Oxidation by $KMNO_4$

a. Natural medium (soft oxidation) $KMnO_4$, H_2O

$$3CH_2{=}CH_2 + 2MnO_4^- + 4H_2O \longrightarrow 3\underset{\displaystyle OH\ \ OH}{CH_2\text{-}CH_2} + 2MnO_2 + 2OH^-$$

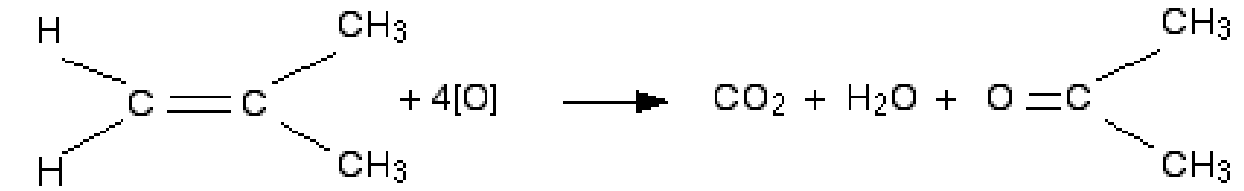
dark brown precipitate

b. Basic medium (soft oxidation) $KMnO_4$, KOH

$$CH_2{=}CH_2 + 2MnO_4^- + 2OH^- \longrightarrow \underset{\displaystyle OH\ \ OH}{CH_2\text{-}CH_2} + 2MnO_4^{2-}$$

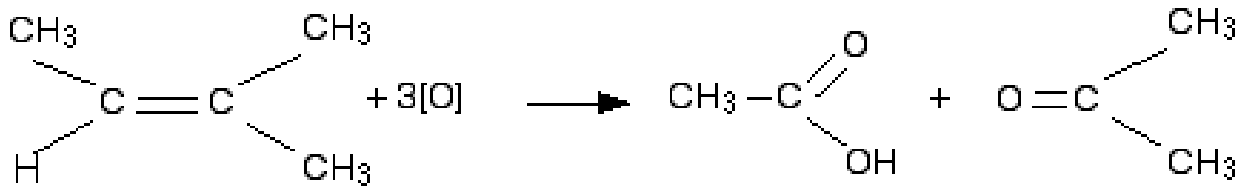
dark green solution

b. Acidic medium (hard oxidation) $KMnO_4$, H_2SO_4



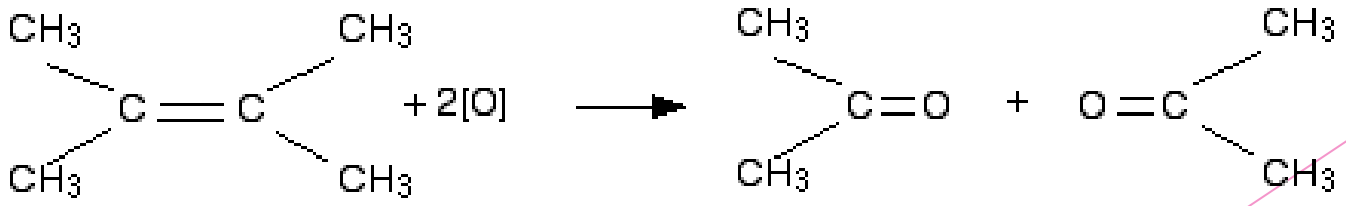
Carbondioxide

ketone



carboxylic acid

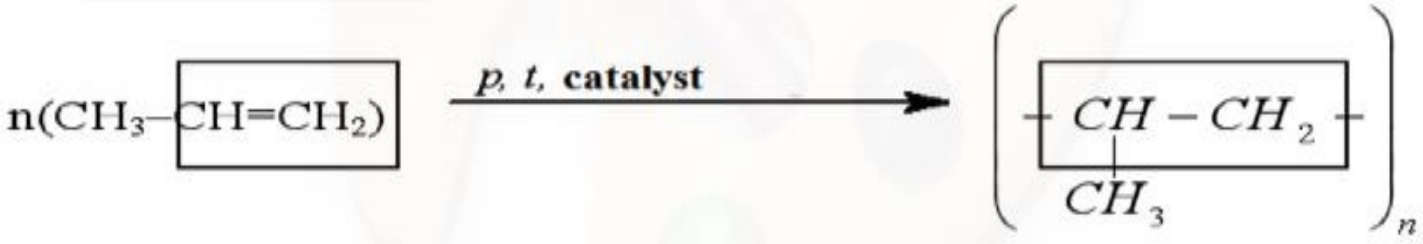
ketone



Ketone

Ketone

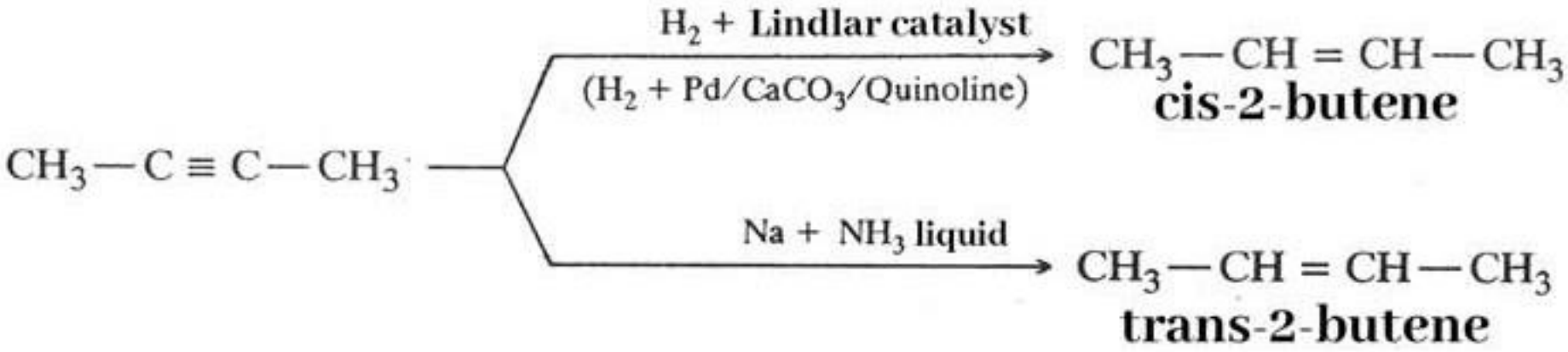
Polymerization



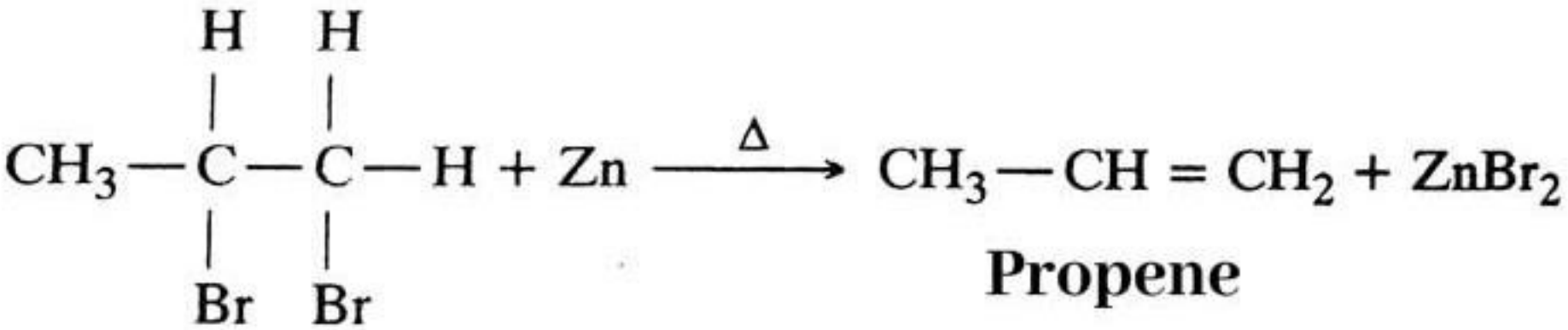
Polymer is a macromolecule consisting of a large number of recurring units called monomers. The number of repetitions of the monomers in the chain (n) is called the "degree of polymerization"). In the polymerization process, a mixture of macromolecules with different degrees of polymerization is usually obtained, so the polymers are not characterized by a fixed melting point, and melt in the temperature range.

The polymerization reactions associated with rupture of the double bonds in the molecules of monomers.

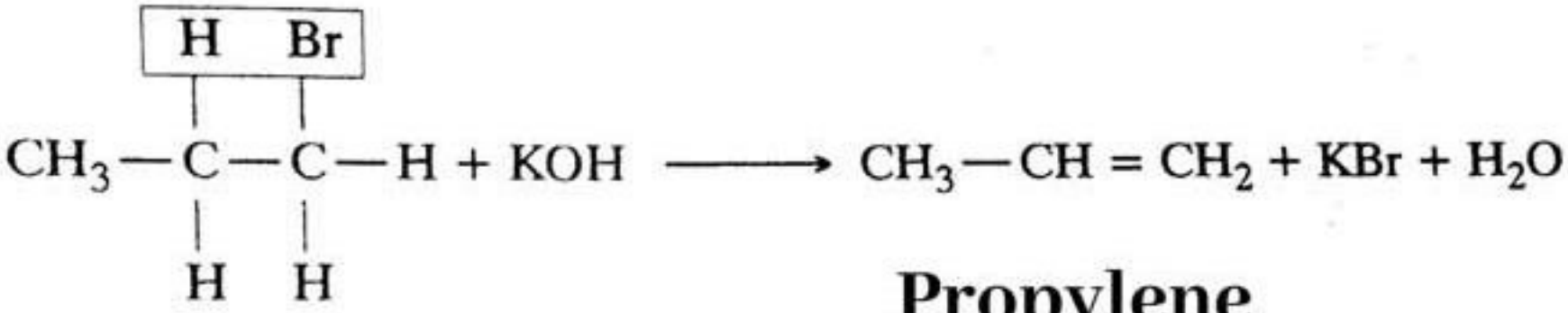
Preparation of Alkenes
1. Partial Reduction of Alkynes



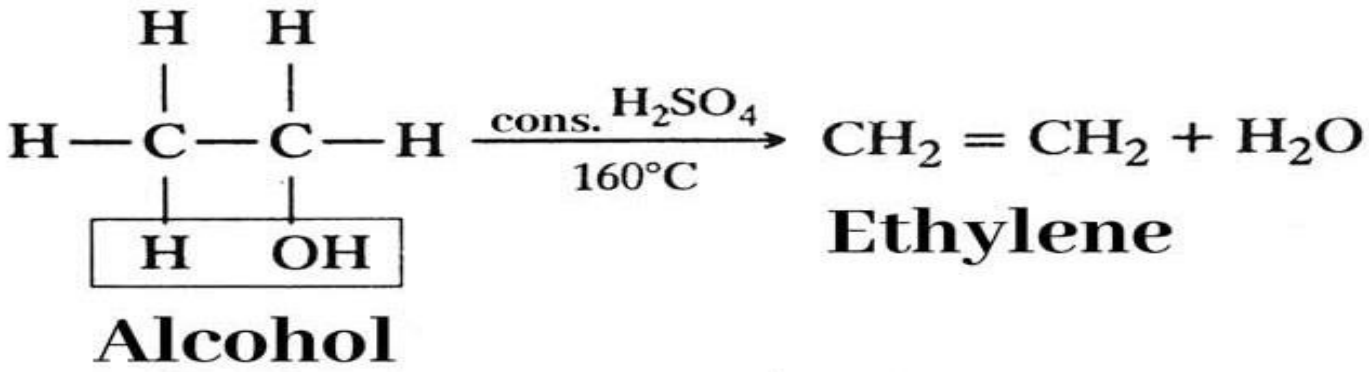
2. Dehalogenation of Dihalo Alkanes



3. Dehydrohalogenation of Alkyl Halides



4. Dehydration of Alcohols



$$CH_3-CH_2-CH(OH)-CH_3 \rightarrow CH_3-CH=CH-CH_3$$

2–Butanol — 2–Butene


Best Regards!
Thank you!