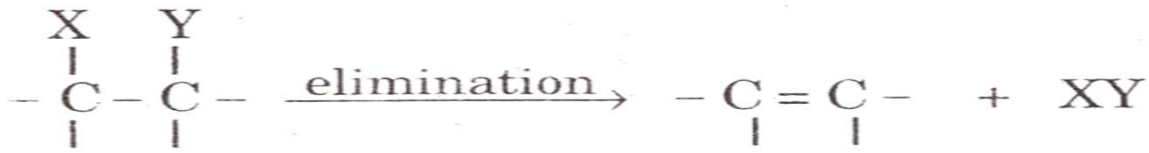
- The unsaturated hydrocarbons that contain a triple bond (-C≡C-) in their molecules are called **alkynes** and are isomeric with alkadienes.
- A triple bond is comprised of one strong σ bond and two weaker π bonds.
- The general formula for alkyne is C_nH_{2n-2}.
- The first and the most important member of the alkyne series is acetylene, HC≡CH, and hence they are also called **Acetylenes**, and the triple bond is often referred to as the **acetylenic linkage**.

Chemistry of Alkenes
Methods of Preparation of Alkenes

Elimination reactions

- Alkenes may be prepared from saturated compounds by the elimintion of atoms or groups from two adjacent (vicinal) carbon atoms. Such reactions are called elimination reactions.
- "Reactions in which two atoms or groups are eliminated from two adjacent carbon atoms of the substrate molecule to form a multiple bond are called elimination reactions".



- There are three common types of elimination reactions
  1. Dehydration of alcohols
  2. Dehydrohalogenation of alkyl halides
  3. Dehalogenation of vicinal dihalides

1. Dehydration of Alcohols

- Alcohols on heating in the presence of a Bronsted acid such as sulphuric acid, phosphoric acid or a Lewis acid such as alumina (Al_2O_3) lose a molecule of water to form an alkene.
- The dehydration of a alcohol involves loss of the -OH group from α-carbon and loss of -H from a β-carbon.

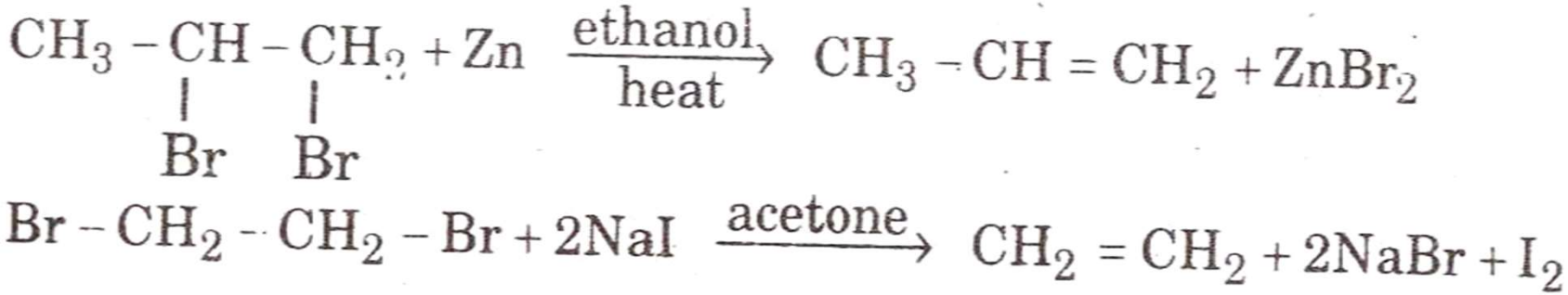
$$CH_3CH_2OH \xrightarrow[180^\circ C]{\text{conc. } H_2SO_4} CH_2 = CH_2 + H_2O$$

$$CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}}\, CH_3 \xrightarrow[100^\circ C]{60\%\ H_2SO_4} CH_3 - CH = CH_2 + H_2O$$

$$CH_3 - \underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}} - CH_3 \xrightarrow[85^\circ C]{20\%\ H_2SO_4} CH_3 - \overset{\displaystyle CH_3}{\overset{|}{C}} = CH_2 + H_2O$$

3. Dehalogenation of Vicinal dihalides

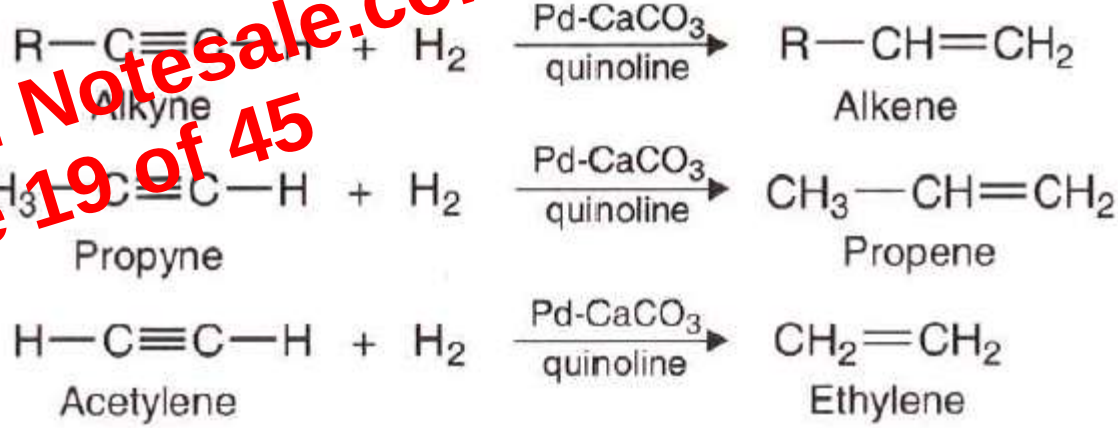
- A compoud having two halogen atoms on adjacent carbon atoms is called Vicinal dihalide (or vic-dihalide).
- Vicinal dihalide on heating with Zn dust in ethanol or NaI in acetone gives alkenes.



- In these reactions no rearrangement of carbon skeleton occurs.

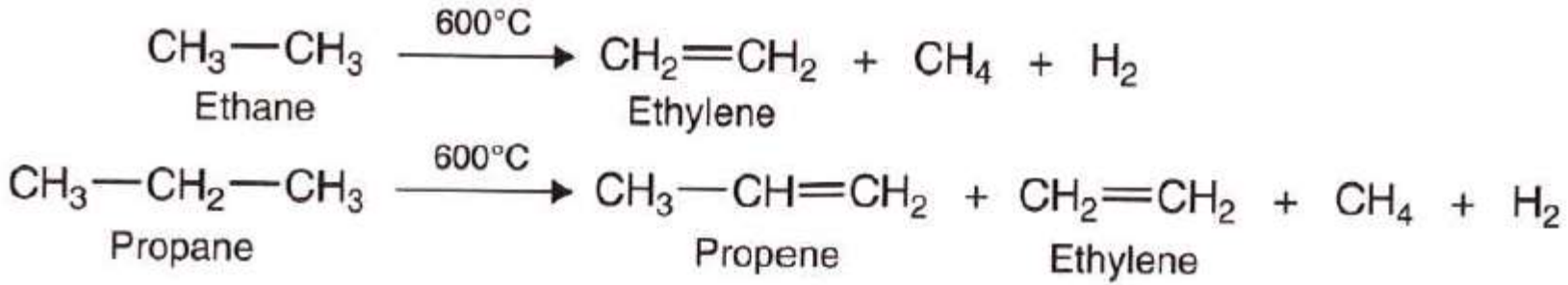
5. By Controlled Hydrogenation of Alkynes

- Alkynes react with hydrogen in the presence of Lindlar's catalyst to give alkenes.
- Lindlar's catalyst is Pd poisoned with $CaCO_3$ plus quinoline.



6. By Cracking of Alkanes

- Alkanes when heated at 500-800°C in the absence of air decompose to yield lower molecular weight alkenes, alkanes, and hydrogen.



(iii) Oxidative cleavage of double bond

- The oxidation of alkenes with hot concentrated $KMnO_4$ solution cleavages (split) the alkene at the double bond to form ketones and/or acids.
- Usually each doubly bonded carbon is oxidized to C=O, while any hydrogen attached to these carbons is oxidized to -OH group.

$$CH_3CH=CH-CH_3 \xrightarrow[KMnO_4,OH^-]{[O]} 2CH_3COOH$$

$$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=CHCH_3 \xrightarrow[KMnO_4,OH^-]{[O]} \begin{matrix} H_3C \\ \diagdown \\ \quad C=O \\ \diagup \\ H_3C \end{matrix} + CH_3COOH$$

Tests for Alkenes

1. Alkenes react rapidly with a dilute solution of bromine in $CC1_4$ and as a result the reddish brown colour of bromine is discharged.

2. Alkenes are oxidized by cold dilute aqueous solution of potassium permanganate and as a result the pink colour of $KMnO_4$ solution disappears.

3. Alkenes dissolve in cold concentrated sulphuric acid and forms a single phase.

An alkane does not dissolve in H_2SO_4 and hence a two phase system results.

4. Alkenes form yellow π-complexes with tetranitromethane.

Tetranitromethane