جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

كلية العلوم
قسم الادلة الجنائية

المحاضرة الرابعة

Alkene

المادة : عضوية
المرحلة : الثانية
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Alkene

A. IUPAC Names

We form IUPAC names of alkenes by changing the -ane- suffix of the parent alkane to -ene- . CH_2=$CH_2$is named Ethene, and CH_3CH=CH_2 is named Propene. In higher alkenes, where isomers exist that differ in the location of the double bond, we use a numbering system. We number the longest carbon chain that contains the double bond in the direction that gives the carbon atoms of the double bond the lower set of numbers. We then use the number of the first carbon of the double bond to show its location.

Example:

$$H_3C{-}CH_2{-}CH_2{-}CH{=}CH{-}CH_3$$

2-Hexene

If the double bond is equidistant from each end, number so the first substituent has the lowest number.

$$\begin{array}{l} \quad\quad\quad CH_3 \\ \quad\quad\quad\quad | \\ H_3C\text{-}CH\text{-}CH{=}CH\text{-}CH_2\text{-}CH_3 \end{array}$$

2-Methyl-3-hexene

We name branched or substituted alkenes in a manner similar to the way we name alkanes. The process involves:

1. Numbering the carbon atoms.
2. Locating the double bond.
3. Locating and naming substituent groups.
4. Naming the main (parent) chain.

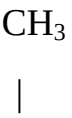
IUPAK Name: $CH_2=CH-CH_2-CH_3$ $CH_2=CH-CH_2-CH_2-CH_3$

1-butene 1-pente

$CH_3CH=CH-CH_3$ $CH_3CH=CH-CH_2-CH_3$

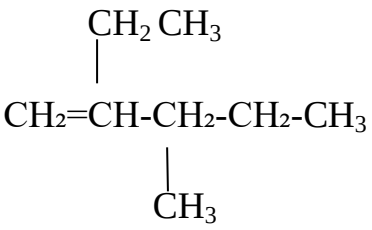
2-butene 2-penten

Another example:



$CH_2=CH-CH_2-CH_2-CH_2-CH_3$ $CH_2=CH-CH_2-CH_2-CH_2-CH_3$

1-hexene 4-methyl-1-hexene

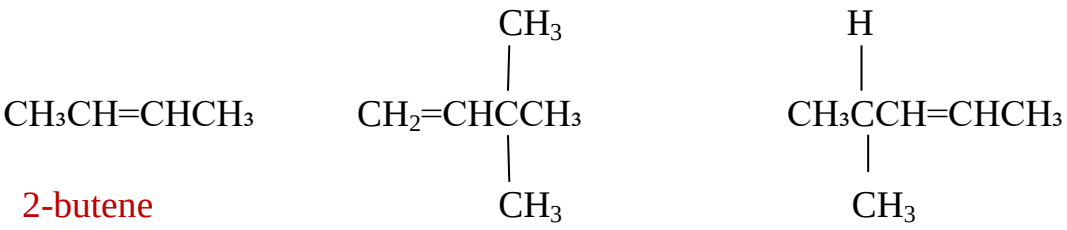


2-Ethyl-3-methyl-1-pentene

B. Common Names

Some alkenes, particularly those with low molecular weight, are known almost exclusively by their common names, as illustrated by the common names of these alkenes:

Structure	IUPAC Name	Common Name
$CH_2=CH_2$	Ethene	Ethylene
$CH_3CH=CH_2$	Propene	Propylene
$(CH3)_2C=CH_2$	2-Methylpropene	Isobutylene



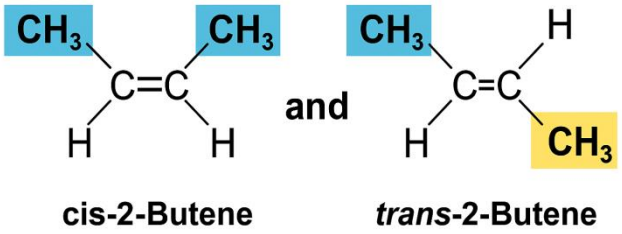
$CH_3CH=CHCH_3$ $CH_2=CHCCH_3$ (with CH_3 above and below the central C) $CH_3CCH=CHCH_3$ (with H above and CH_3 below the central C)

2-butene (cis or trans) 3,3-dimethyl-1-butene 4-methyl-2-pentene (cis or trans)

C. The Cis-Trans System (Geometrical Isomerism / Stereochemistry)

The most common method for specifying the configuration of a disubstituted alkene uses the prefixes **cis** and **trans**. In this system, the orientation of the atoms of the parent chain determines whether the alkene is *cis* or *trans*.

Following are structural formulas for the *cis* and *trans* isomers of **4-methyl-2-pentene**:



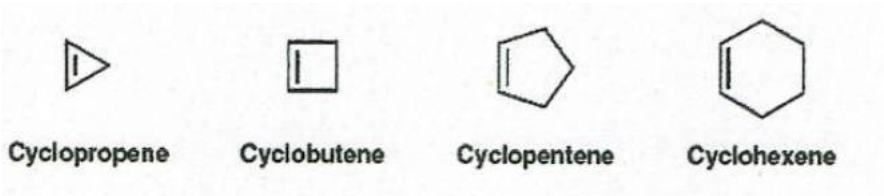
cis-2-Butene ***trans*-2-Butene**

In the cis example, carbon atoms of the main chain (carbons 1 and 4) are on the same side of the double bond. In the trans example, the same carbon atoms of the main chain are on opposite sides of the double bond.

Rotation around the double bond is restricted because the bond would have to be broken to allow rotation. Thus, the double bond is rigid and geometric isomers are formed.

Is there geometric isomers in 1,2-dichloroethene? Why?

D. Naming Cycloalkenes

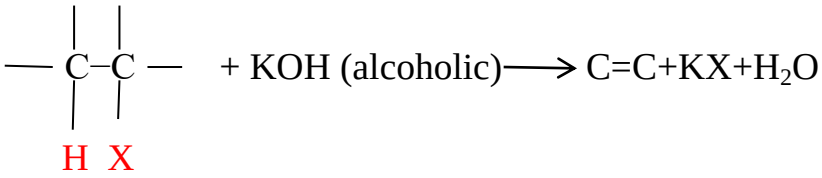


Preparation Of Alkenes

1-Dehydrohalogenation of alkyl halides

Alkyl halides are converted into alkenes by **dehydrohalogenation**: elimination of the elements of hydrogen halide. Dehydrohalogenation involves removal of the halogen atom together with a hydrogen atom from a carbon adjacent to the one.

Dehydrohalogenation: elimination of HX

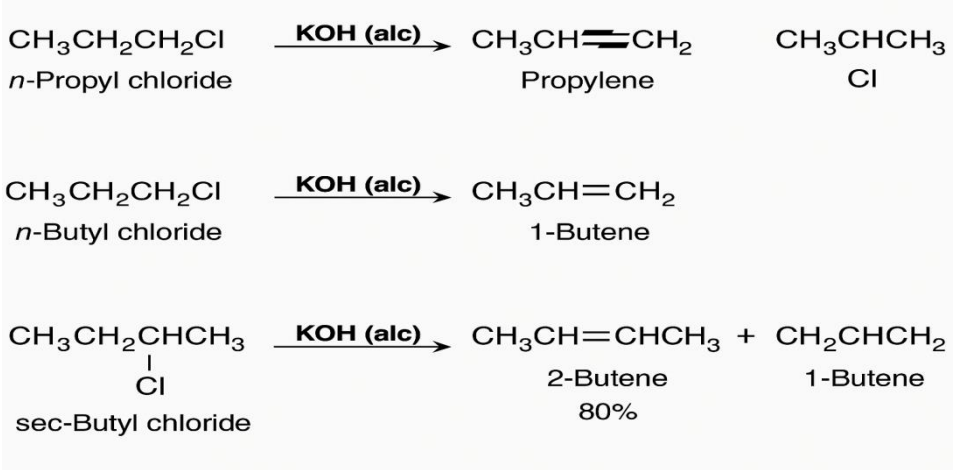


Alkyl halide **Alkene**

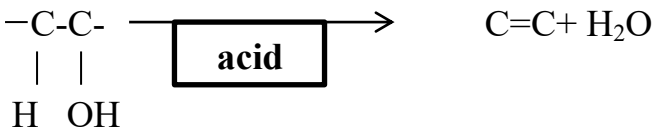
Case of dehydrohalogenation of alkyl halides

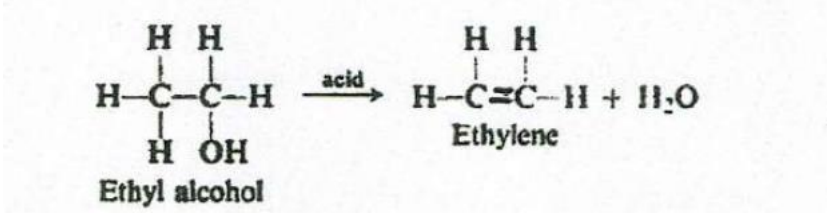
3° > 2° > 1°

Dehydrohalogenation: loss of HX from an alkyl halide to form an alkene



2-Dehydration of Alcohols

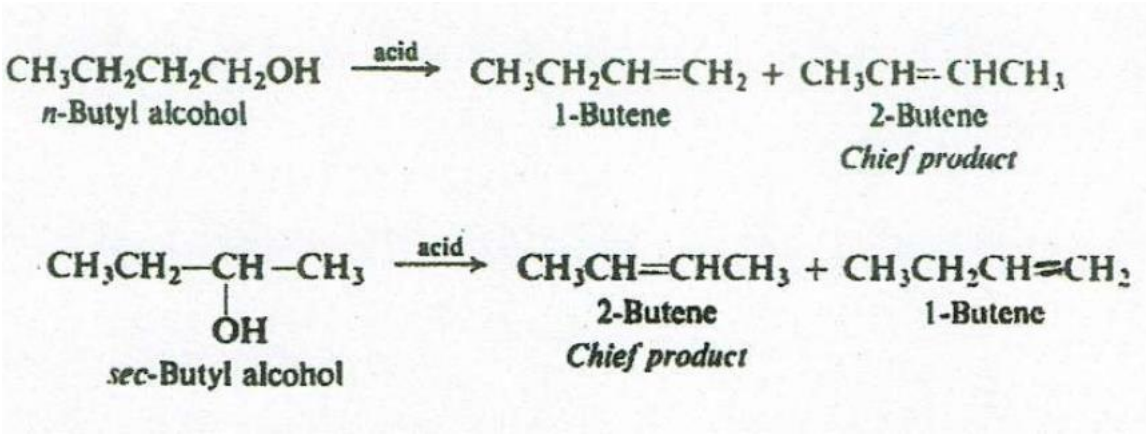




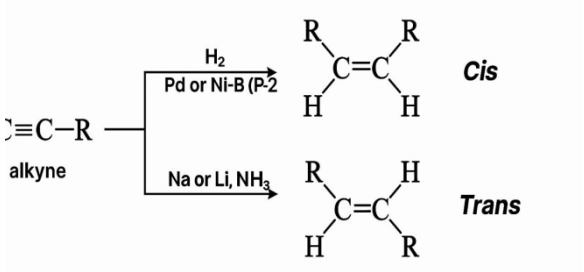
(Base of dehydration of alcohols)

3°>2°>1°

The dehydration (removal of water) of alcohols is a good synthetic route to alkenes. Normally acids like sulfuric or phosphoric acids are used.



3- Reduction of alkenes



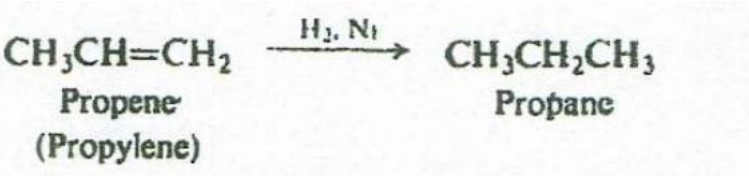
Reaction Of Alkenes

Addition Reaction

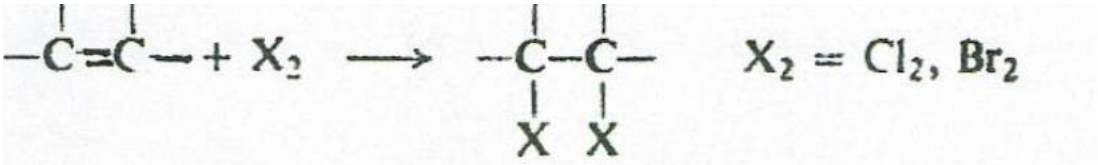
A reaction in which two molecules combine to yield a single molecule of product is called an addition reaction.

1. Addition of Hydrogen: Catalytic Hydrogenation

$$-C{=}C- + H_2 \xrightarrow{\text{Pt,Pd,or Ni}} H-C-C-H$$

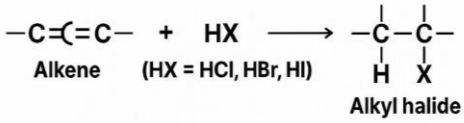


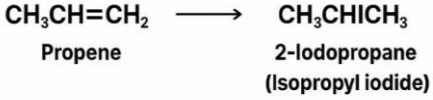
2- Addition of halogens



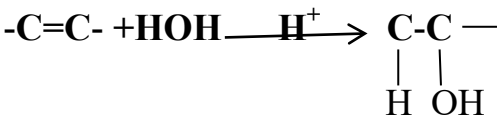
3- Addition of hydrogen halides. Markovnikov's rule

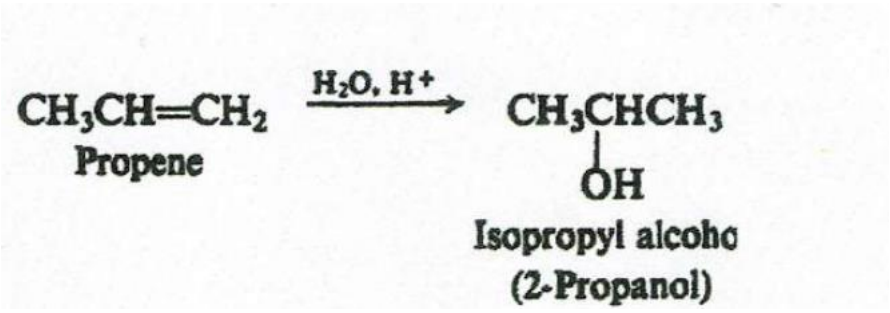
An alkene is converted by hydrogen chloride, hydrogen bromide, or hydrogen iodide into the corresponding alkyl halide.





4-Addition of water, Hydration





Holahydrin formation

Halohydrin formation is an addition reaction where an alkene reacts with a halogen (X_2, usually Br_2 or Cl_2) in the presence of water (H_2O) to form a halohydrin.