جامعة المستقبل
AL MUSTAQBAL UNIVERSITY
كلية العلوم

Organic Chemistry

1st stage

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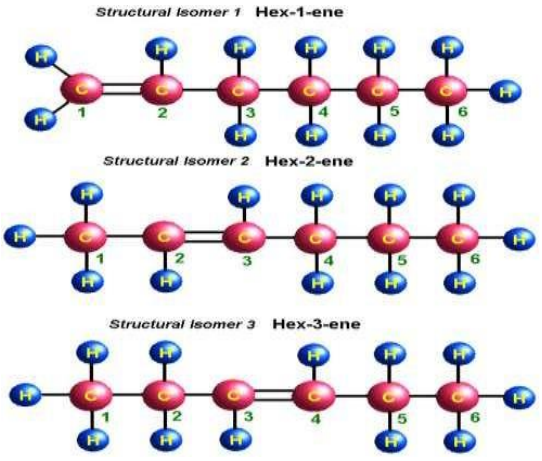
Lecture 3: Alkenes

Department of Medical Physics



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1.1 Alkenes

Molecules of the alkene (also called olefins) series of hydrocarbons are characterized by having two adjacent carbon atoms joined to one another by a double bond. The carbon-carbon double bond **(C=C)** is unsaturated and hence highly reactive toward a wide variety of reagents.

The general formula of alkenes is **C*n*H2*n***, where *n* is the number of carbon atoms. The first nine members of this series are listed in Table

General formula	Structure	Name
C_2H_4	$CH_2 = CH_2$	Ethene
C_3H_6	$CH_2 = CHCH_3$	Propene
C_4H_8	$CH_2 = CHCH_2CH_3$	1-Butene
C_5H_{10}	$CH_2 = CH(CH_2)_2CH_3$	1-Pentene
C_6H_{12}	$CH_2 = CH(CH_2)_3CH_3$	1-Hexene
C_7H_{14}	$CH_2 = CH(CH_2)_4CH_3$	1-Heptene
C_8H_{16}	$CH_2 = CH(CH_2)_5CH_3$	1-Octene
C_9H_{18}	$CH_2 = CH(CH_2)_6CH_3$	1-Nonene
$C_{10}H_{20}$	$CH_2 = CH(CH_2)_7CH_3$	1-Decene

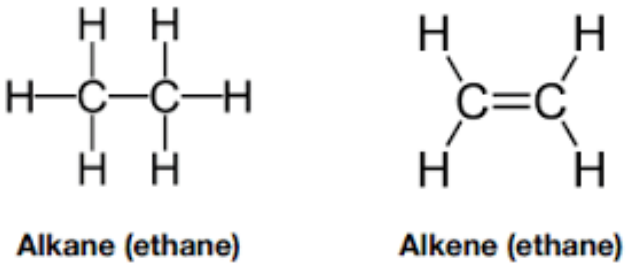
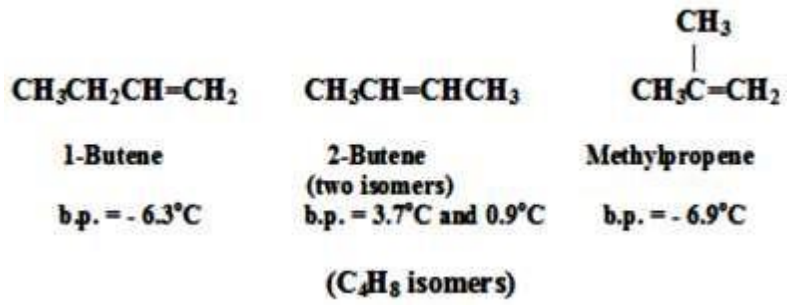


Fig 1. Comparison of an Alkane and Alkene.

1.1.1 Isomerism in Alkenes

Isomeric compounds are also possible in the alkenes. For the molecular formula C_4H_8, there are three different ways of organizing the four carbon atoms and the double bond:



1.1.2 Nomenclature

Common names are seldom used except for three simple alkenes; ethylene, propylene, and isobutylene. Most alkene are named by IUPAC system.

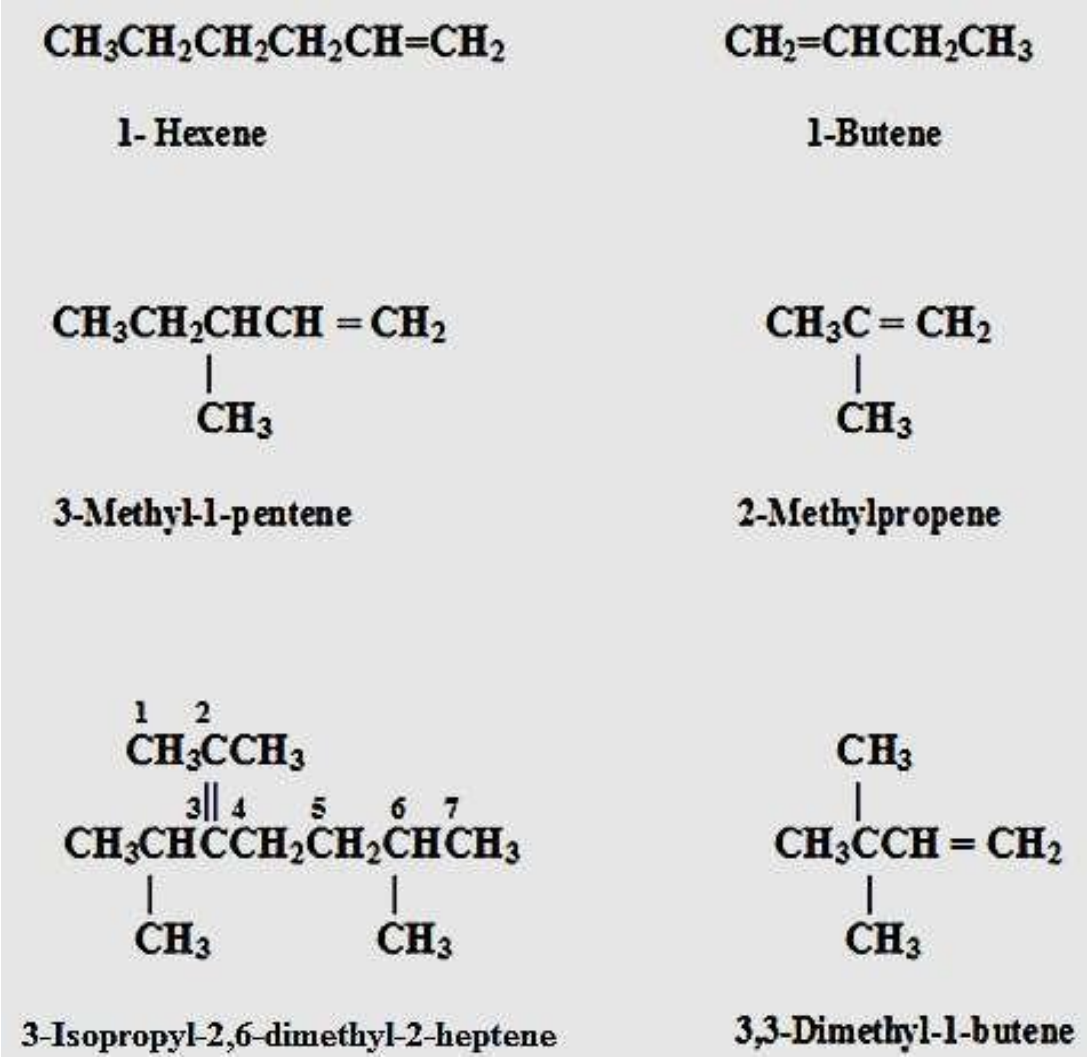
1- The longest continuous chain of carbon atoms containing the double bond serves as the parent compound.

2- The ending ***–ane*** of the corresponding alkane hydrocarbon name is replaced by the ending ***–ene***.

3- The position of the double bond is indicated by the lower number of the numbers of the carbon atoms to which it is attached. The number that represents this position is placed before the parent compound name. Alkyl groups attached to the parent compound are designated as is done for the alkane.

4- If a geometric isomer is designated, the name begins with *cis*- or *trans*-.

Examples



1.1.3 Physical Properties of Alkenes

The alkenes possess physical properties that are essentially the same as those of the alkanes. They are insoluble in water, but quite soluble in non-polar solvents like benzene, ether, and chloroform. They are less dense than water. The boiling point

rises with increasing carbon number; as with alkane, branching lowers the boiling point.

1.1.4 Chemical Properties of Alkenes

1. Addition of dehydrogen

   Alkenes add up on molecule of dihydrogen gas in the presence of finally divided nickle, palladium or platinum to form alkanes

2. Addition of halogen

   Halogens (Cl_2, Br_2) react with alkenes to form dihaloalkanes.

   $CH_2=CH_2 + Br_2 \rightarrow CH_2Br\text{-}CH_2Br$ (1,2-dibromoethane)

3. Addition of halogen halides

   Hydrogen halides (HCl, HBr, HI) add up to alkenes to form alkyl halides

1.1.5 Preparation of alkenes