S6 CHEMISTRY LESSON 1
6/01/2026

TOPIC: ORGANIC CHEMISTRY

Sub Topic: alkenes

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OVERVIEW

- The structure and reactivity of alkenes
- Describe the structure of alkenes including what is meant by a pi bond
- Describe why alkenes are reactive molecules.

Discussion

a) What are Alkenes?

b) Why are they classified as unsaturated?

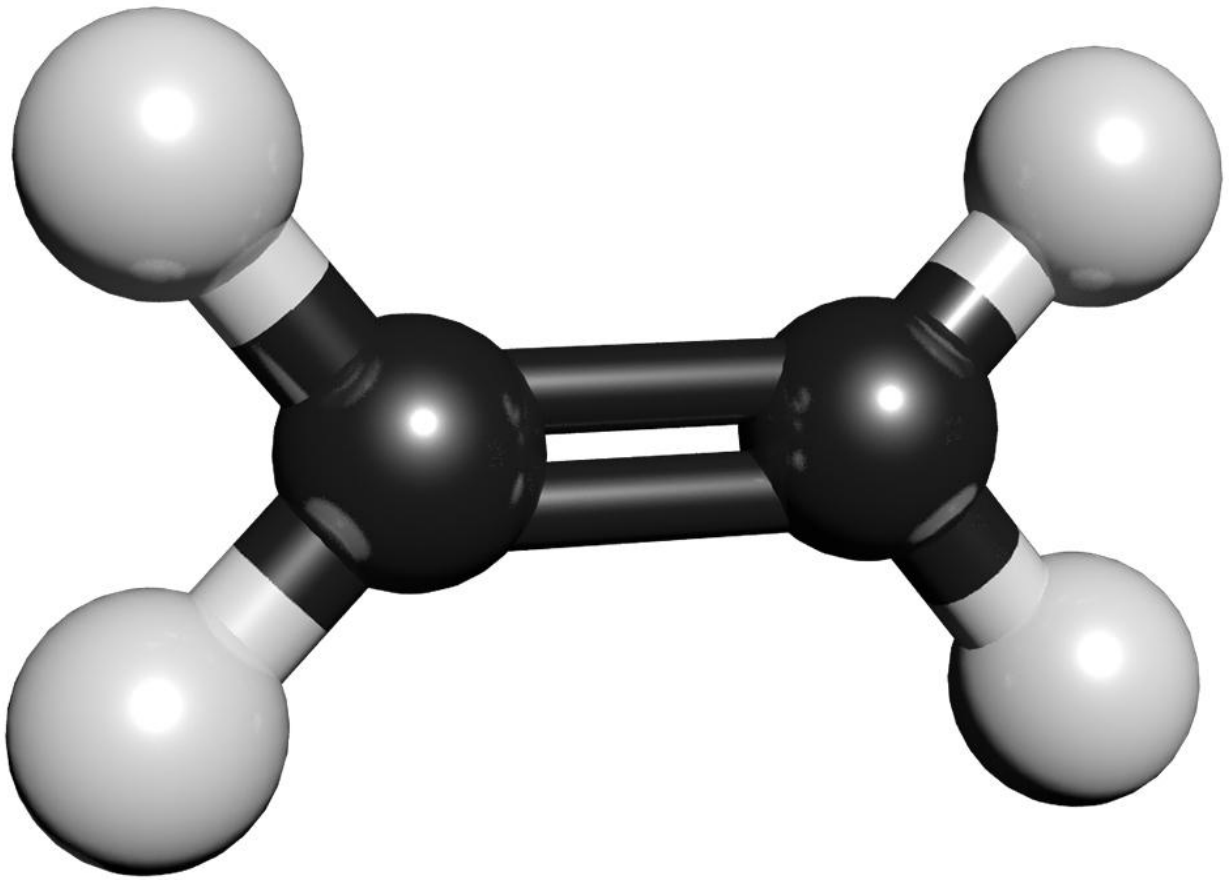
C) Describe the structure of alkenes

ALKENES

- Alkenes are ***unsaturated aliphatic hydrocarbons*** containing ***at least one carbon–carbon double bond (C=C)***.

General formula

- C_nH_{2n}



Ethene C_2H_4

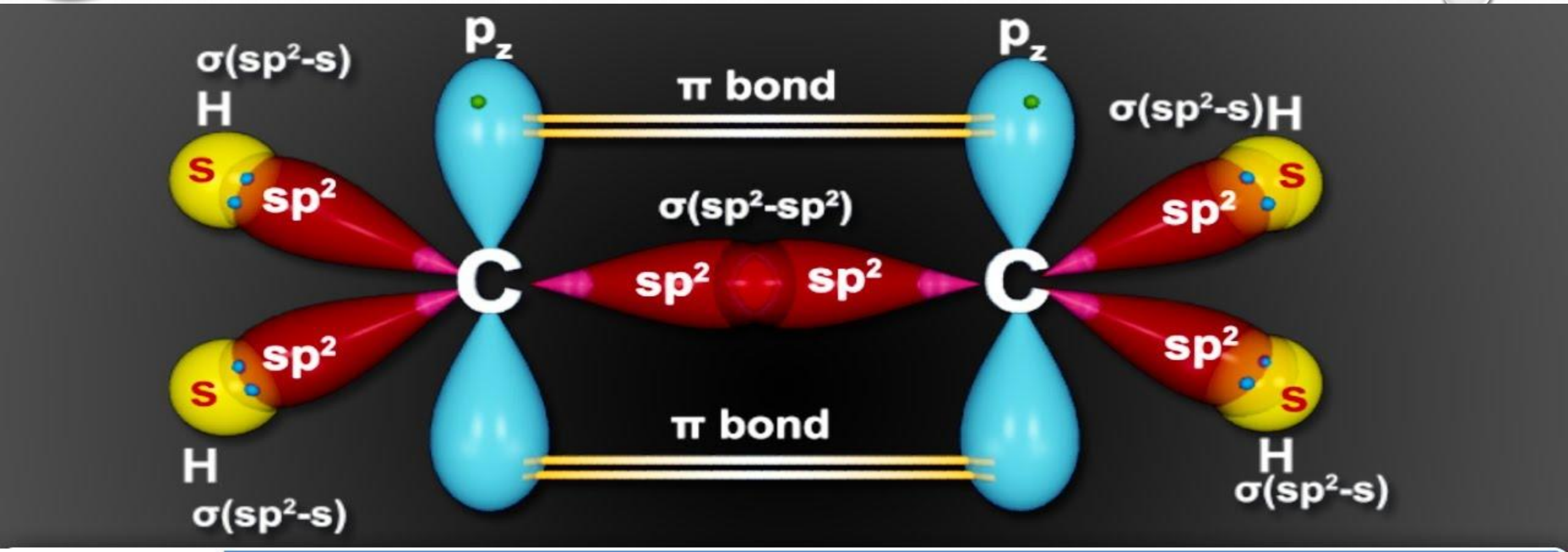
SHAPE

- Double bonds are planar (Flat)
- Ethene = Planar
- 3D Clearly shows the bond angle =120°
- They are fixed (Restricted rotation)

Why alkenes have a Restricted rotation?

RESTRICTED ROTATION

Due to the second bond(Sigma Bond)



ACTIVE
The Joy Of Happy Learning

SP2 HYBRIDIZATION

Nomenclature of Alkenes

IUPAC Rules

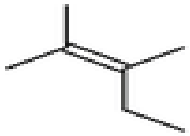
- Choose the **longest carbon chain** containing the C=C bond.
- Number the chain to give the **double bond the lowest possible number.**
- Replace **–ane** with **–ene.**
- Indicate the **position of the double bond.**
- Name and number side chains if present

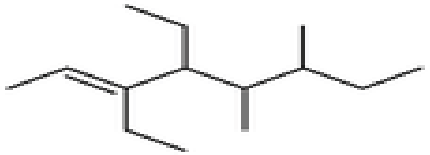
For each alkene write the correct IUPAC name

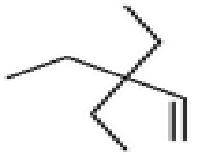
1.  _____

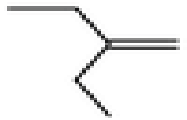
2.  _____

3.  _____

4.  _____

5.  _____

6.  _____

7.  _____

8.  _____

ISOMERISM IN ALKENES

- **ISOMERISM**: Compounds with the same molecular formula but different arrangements of atoms.

TYPES IN ALKENES:

- Structural isomerism
- Geometrical (cis–trans) isomerism

STRUCTURAL ISOMERISM:

- **Chain isomerism** – different carbon skeletons. C4H8

- **Position isomerism** – different position of C=C bond. (C4H8)
- Example: but-1-ene and but-2-ene

GEOMETRICAL (CIS–TRANS) ISOMERISM IN ALKENES

Conditions:

- Presence of a C=C double bond
- Each carbon bonded to two different groups

Example: but-2-ene

- Cis-but-2-ene: similar groups on the same side
- Trans-but-2-ene: similar groups on opposite sides

Key points:

- Cis isomer: higher boiling point, less stable
- Trans isomer: lower boiling point, more stable

CHEMICAL PROPERTIES OF ALKENES

- Alkenes are unsaturated hydrocarbons containing a C=C double bond.
- The double bond consists of:
- *One sigma (σ) bond – strong*
- *One pi (π) bond – weak and easily broken*

NB: The π-bond is responsible for the high reactivity of alkenes, especially addition reactions.

ADDITION REACTIONS OF ALKENES

- Addition reactions occur when two or more substances combine to form a single product.
- No atoms are lost
- The C=C double bond breaks
- New single bonds are formed

CHEMICAL REACTIONS OF ALKENES

1. Addition reaction of Alkenes
    a) *Addition of Hydrogen(Catalytic hydrogenation)*
    b) *Halogenation*
    c) *Hydration*
    d) *Addition of Hydrogen Halide*
2. Polymerization
3. Combustion
4. Oxidation

a) Addition of Hydrogen (Catalytic hydrogenation)

b) Addition of Hydrogen Halide (HX)

HYDROHALOGENATION OF ALKENES

Definition:

- Addition of hydrogen halides (HCI, HBr, HI) across the C=C bond.

Markownikoff's rule:

- Hydrogen attaches to the carbon with more hydrogen atoms.
- Example:
- $CH_3–CH=CH_2$ + hbr $\rightarrow$ $ch_3–chbr–ch_3$

NB: in presence of a peroxide, then its anti **markownikoffs**

C) Addition of Halogen(Halogenation)

d) Addition of Water (Hydration) H^+/H_2O

NEXT LESSON

1. Halohydrin formation
2. Combustion of alkenes
3. Polymerization of alkenes
4. Ozonolysis
5. Introduction to Alkyl Halide