



# Organic Chemistry

2<sup>nd</sup> stage

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**Lecture 5: Dienes**

**Department of Bio Chemistry**

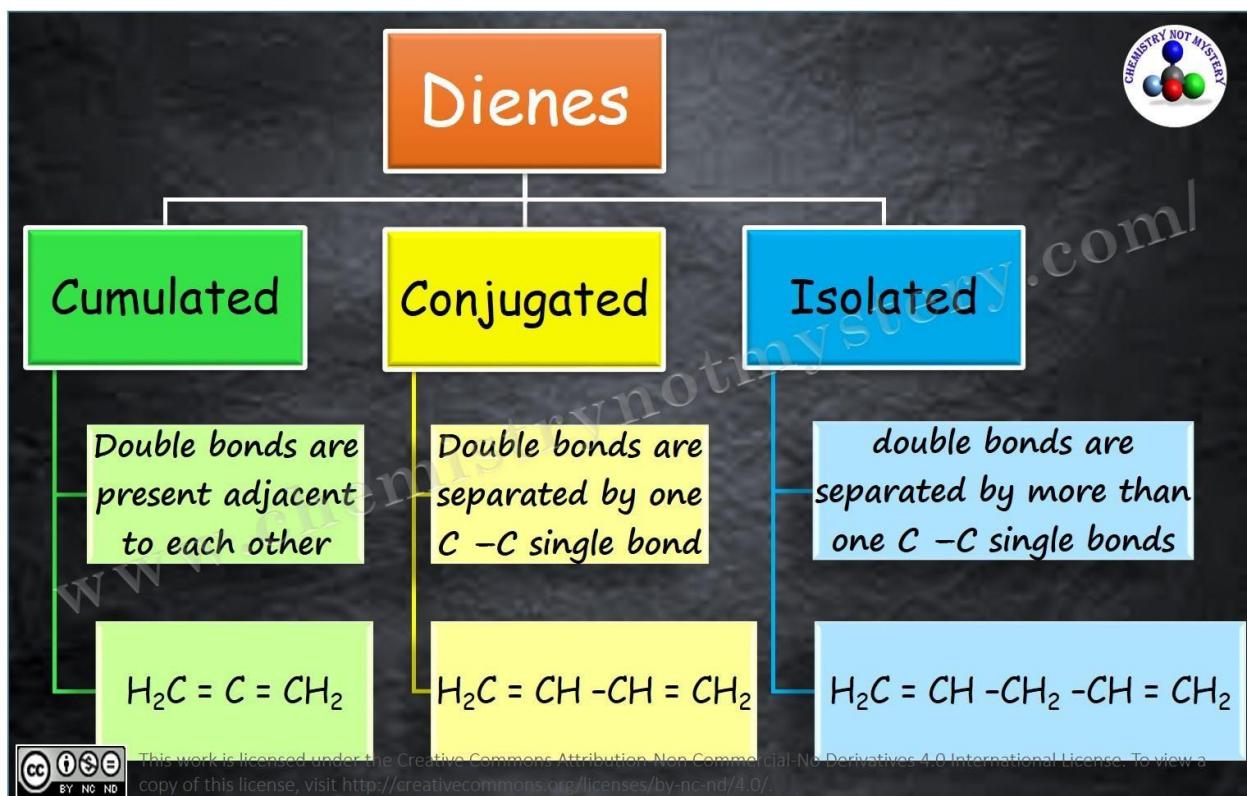
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## Dienes

Are organic compounds that contain two double bonds between carbon atoms.

They are an important class of hydrocarbons and are widely used in chemical industries, especially in the production of rubber and plastics.

### Types of Dienes



#### a. Conjugated Dienes

Conjugated dienes have alternating single and double bonds, allowing interaction between the  $\pi$ -electrons of the double bonds. This makes them more stable.

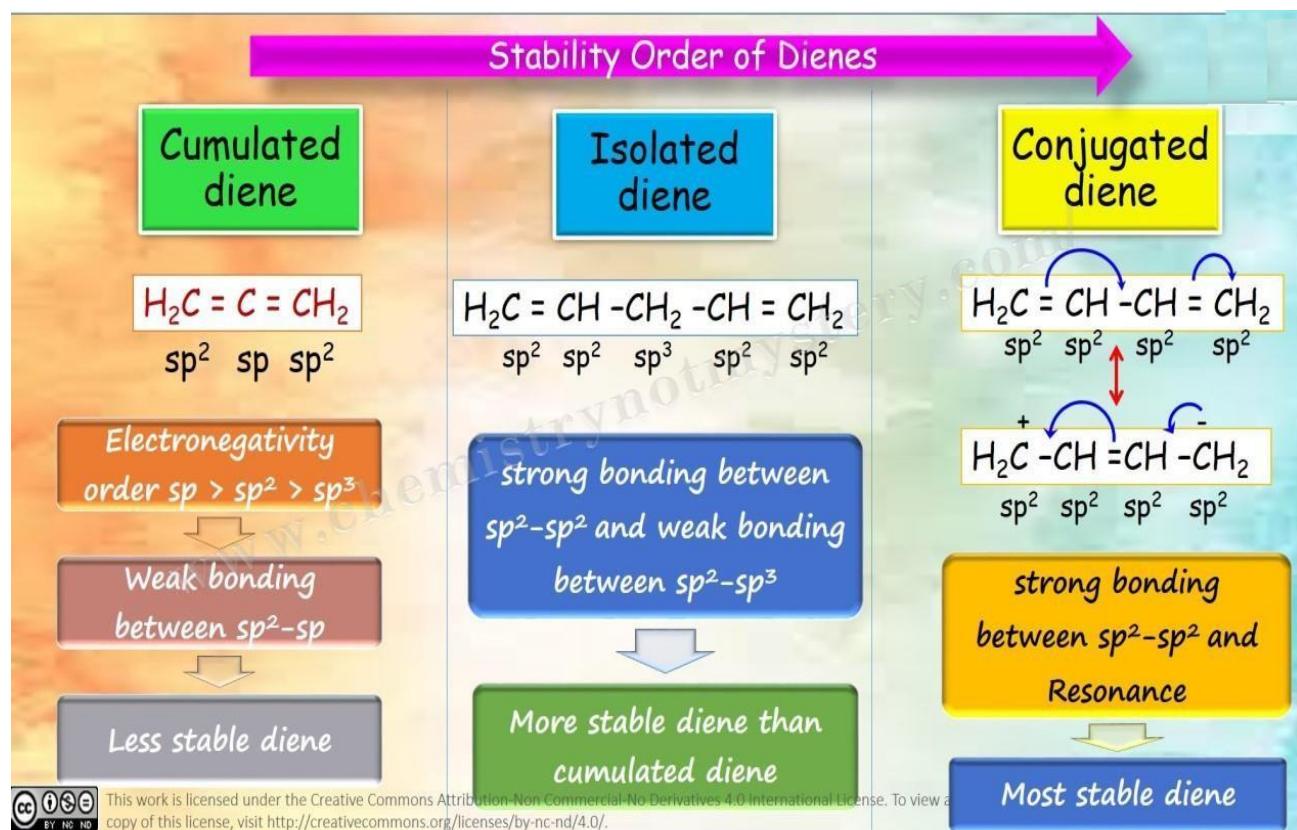
Example: 1,3-butadiene ( $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$ ).

## b. Isolated Dienes

Isolated dienes have two double bonds separated by two or more single bonds, so they do not interact. Example: 1,4-pentadiene ( $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}=\text{CH}_2$ ).

## c. Cumulated Dienes

Cumulated dienes have two double bonds on the same carbon atom. These compounds are usually less stable. Example: 1,2-butadiene ( $\text{CH}_2=\text{C}=\text{CH}-\text{CH}_3$ ).



## **Physical and Chemical Properties**

### **a. Physical Properties**

1. Dienes are generally non-polar compounds.
2. They are insoluble in water but soluble in organic solvents.
3. Their boiling points increase with molecular weight.
4. Conjugated dienes are more stable than isolated and cumulated dienes.

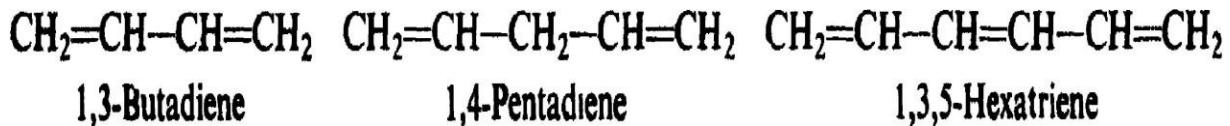
### **b. Chemical Properties**

Dienes undergo various chemical reactions, including:

1. Addition Reactions:Dienes react with hydrogen halides (HCl, HBr) and halogens (Br<sub>2</sub>, Cl<sub>2</sub>).
2. Polymerization:Conjugated dienes like 1,3-butadiene are used to make synthetic rubber.
3. Diels-Alder Reaction:Conjugated dienes react with dienophiles to form cyclic compounds.

## Nomenclature of dienes:

Dienes are named by the ILJPAC system in the **same way as alkenes**, except that the ending **-diene** is used, with two numbers to indicate the positions of the two double bonds. This system is easily extended to compounds containing any number of double bonds.



## Examples of Dienes

1. 1,3-Butadiene ( $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$ ): Used in rubber production.
2. Isoprene ( $\text{CH}_2=\text{C}(\text{CH}_3)-\text{CH}=\text{CH}_2$ ): A natural diene found in plants and used to make natural rubber.