

Nomenclature of Organic Compound

Nomenclature of Alkanes

Definition and Basic Concept:

- Alkanes are saturated hydrocarbons — compounds consisting only of carbon (C) and hydrogen (H) atoms, where all carbon-carbon bonds are single bonds.
- These compounds follow the general formula:

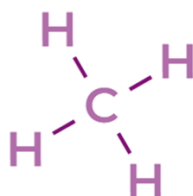


- They are also known as paraffins. The IUPAC system provides a systematic way to name these compounds based on the number of carbon atoms, type and position of substituents, and branching in the carbon chain.

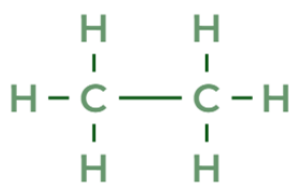
IUPAC Nomenclature Rules for Alkanes:

1. Identify the Longest Continuous Carbon Chain:

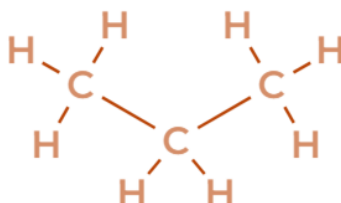
- This is known as the **parent chain** or **root chain**.
- This chain determines the **parent name** (e.g., methane, ethane, propane, etc.).
 - 1 carbon: Methane (CH_4)



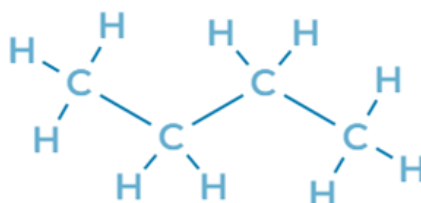
- 2 carbons: Ethane (C_2H_6)



- 3 carbons: Propane (C_3H_8)



- 4 carbons: Butane (C_4H_{10})..and so on.



- It must contain the maximum number of carbon atoms.
- If two chains are of equal length, the one with more substituents (branches) is chosen.

2. Number the Carbon Atoms in the Parent Chain:

- Start from the end nearer to the first substituent group.
- The goal is to assign lowest possible numbers to the substituents.

3. Identify and Name the Substituents:

- Substituents are alkyl groups (like -CH_3 , $\text{-C}_2\text{H}_5$).
- Use prefixes like methyl-, ethyl-, propyl-, butyl-, etc.

4. Assign Numbers to Substituents:

- Based on the position where the branch appears in the main chain.
- **Use lowest locant rule:** The sum of the numbers should be as low as possible.

5. Multiple Substituents of the Same Type:

- Use prefixes: di-, tri-, tetra-, penta-, etc.
- Each substituent must have its own position number, even if they are of the same type.

6. Arrange Substituents Alphabetically:

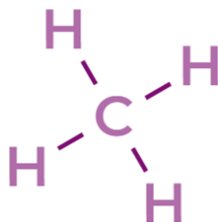
- Prefixes like di-, tri-, etc. are not considered in alphabetizing.
- Only the alkyl name is considered.

7. Combine the Name:

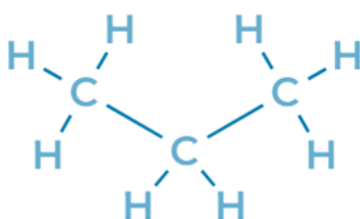
- Positions + substituents (in alphabetical order) + base name of the parent chain.

Examples:

- CH_4 : Methane
 - (Only one carbon, no branches)

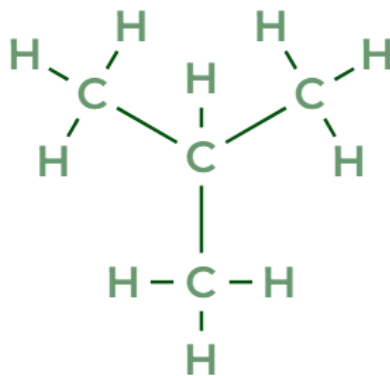


- $\text{CH}_3\text{CH}_2\text{CH}_3$: Propane
 - (Straight chain of 3 carbon atoms)



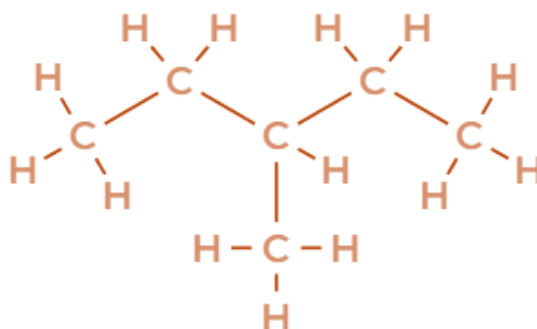
- $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_3$: 2-Methylpropane

- (Longest chain is 3 carbons, with a methyl group on second carbon)



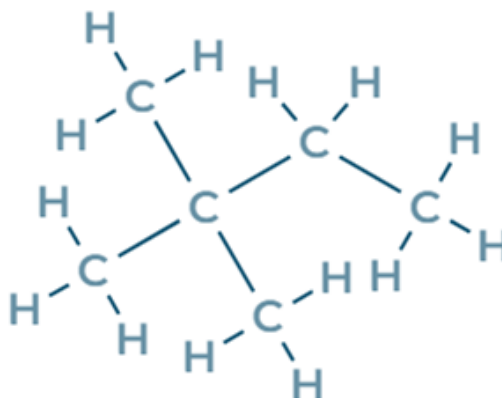
- $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$: 3-Methylpentane

- (Parent chain: pentane, methyl at position 3)



- $(\text{CH}_3)_3\text{CCH}_2\text{CH}_3$: 2,2-Dimethylbutane

- (Two methyl groups on second carbon of a four-carbon chain)



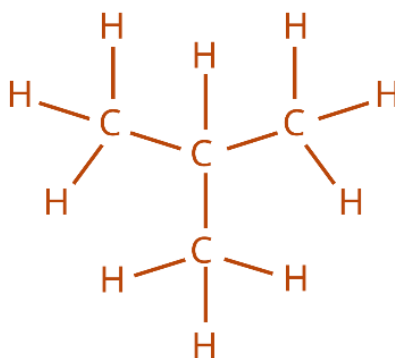
Comparison of nomenclatures for three isomers of C_5H_{12}			
Common name	<i>n</i> -pentane	isopentane	neopentane
IUPAC name	pentane	2-methylbutane	2,2-dimethylpropane
Structure			

Branched and Complex Substituents:

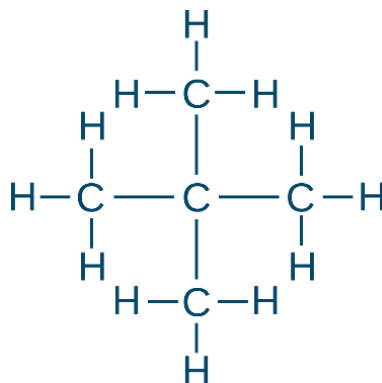
- If a substituent itself is branched, treat it as a mini-alkyl chain.
- Use parentheses to enclose the name of the complex substituent.
- Number within the substituent starting from the carbon attached to the main chain.
- Example:
 - $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_2\text{CH}_3)\text{CH}_3 \rightarrow 3\text{-Ethylpentane}$

Common vs IUPAC Names:

- Some alkanes have trivial (common) names like:
 - Isobutane $\rightarrow$ IUPAC: 2-Methylpropane



- Neopentane $\rightarrow$ IUPAC: 2,2-Dimethylpropane



- These are acceptable in informal contexts, but IUPAC naming is required in formal chemistry.

Nomenclature of Alkenes

Definition and Basic Concept:

- Alkenes are **unsaturated hydrocarbons** containing at least one **carbon-carbon double bond (C=C)**.
- The general formula is:



- Due to the presence of the double bond, **position and geometry (cis/trans or E/Z)** must be considered in naming.

IUPAC Nomenclature Rules for Alkenes:

1. Select the Longest Chain Containing the Double Bond:

- The chain must include the double bond, even if another longer chain is present.

2. Number the Chain from the End Nearest the Double Bond:

- The double bond should get the **lowest number** possible.

3. Indicate the Position of the Double Bond:

- Number the carbon at the **start** of the double bond.
- If multiple double bonds are present, use **di-**, **tri-** prefixes (e.g., diene, triene).

4. Name Substituents and Position Them:

- Follow same rules as alkanes for branches.

5. Add Stereochemistry (cis/trans or E/Z):

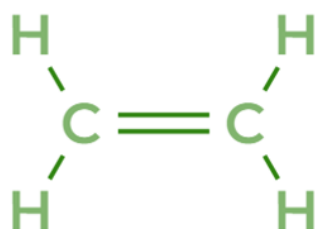
- **Cis:** Same side of double bond
- **Trans:** Opposite side
- For complex molecules, use **E/Z** system based on atomic numbers of attached atoms.

6. Combine Name:

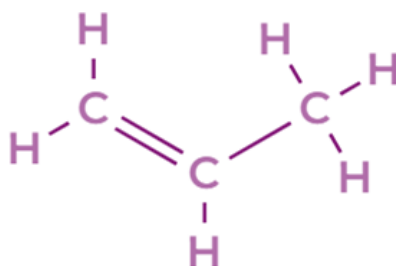
- Positions + substituents + location of double bond + base name + suffix **-ene**

Examples:

- $\text{CH}_2=\text{CH}_2$: Ethene
 - (2 carbons, one double bond)



- $\text{CH}_3\text{CH}=\text{CH}_2$: Propene



- $\text{CH}_3\text{CH}=\text{CHCH}_3$: But-2-ene
 - If both methyl groups are on the same side: **cis-but-2-ene**
 - On opposite sides: **trans-but-2-ene**



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