Aliphatic Hydrocarbons: Alkanes

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Introduction:

- Organic compounds which consists of only Carbon and Hydrogen atoms are known as Hydrocarbons.
- Example:
  1) Methane \((\text{CH}_4)\)
  2) Propane \((\text{C}_3\text{H}_8)\)
  3) Ethene \((\text{C}_2\text{H}_4)\)
  4) Ethyne \((\text{C}_2\text{H}_2)\)
Classification of Hydrocarbons:

- Hydrocarbons can be broadly classified into two types: Aliphatic & Aromatic Hydrocarbons.

- Aliphatic Hydrocarbons can be further classified into Alkanes, Alkenes & Alkynes on the basis of the nature of bond present between the C-C atom.
In aliphatic hydrocarbons if single bond is present between C-C it is known as Alkanes; if double bond is there it is Alkenes & if triple bond is there it is Alkynes.

Ex.

1) Methane (CH$_4$) - Alkane
2) Propane (C$_3$H$_8$) - Alkane
3) Ethene (C$_2$H$_4$) - Alkene
4) Ethyne (C$_2$H$_2$) - Alkyne
I) Alkane:

• The aliphatic hydrocarbon which consist of C-C is known as Alkane.
• The general molecular formula is $C_nH_{2n+2}$
• Simplest example is Methane ($CH_4$) which occurs in nature.
• other members are ethane, propane, butane, pentane, etc.
• Many of these occur naturally & chief source is mineral oil or petroleum.
Higher Alkanes: The Homologous Series

- A set of compounds, in which the members differ in composition from one another by
  \(-\text{CH}_2\) is known as a homologous series and the members of the series are known as homologous.
- This series is observed in all types of organic compounds containing different functional groups.

<table>
<thead>
<tr>
<th>Alkanes</th>
<th>Alcohols</th>
<th>Alkyl Halides</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH\textsubscript{4}</td>
<td>CH\textsubscript{3} -OH</td>
<td>CH\textsubscript{3} –Cl</td>
</tr>
<tr>
<td>C\textsubscript{2}H\textsubscript{6}</td>
<td>C\textsubscript{2}H\textsubscript{5}-OH</td>
<td>C\textsubscript{2}H\textsubscript{5}–Cl</td>
</tr>
<tr>
<td>C\textsubscript{3}H\textsubscript{8}</td>
<td>C\textsubscript{3}H\textsubscript{7}-OH</td>
<td>C\textsubscript{3}H\textsubscript{7}–Cl</td>
</tr>
</tbody>
</table>
Isomerism:

• Compounds having same molecular formula but different structural formula are called as isomers and the phenomenon is known as isomerism.

• Isomers have different physical & chemical properties.

• Example:
  1) n-butane & iso-butane
  2) n-pentane, iso-pentane & neo-pentane
Nomenclature:

A) Trival System: According to this system first four alkanes have special names related to their history. From the fifth member onwards the name is simply derived from the Greek or Latin prefix for the number of carbon atoms in alkane; such as pentane for five, hexnae for six, etc.

<table>
<thead>
<tr>
<th>Name</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>CH(_4)</td>
</tr>
<tr>
<td>Ethane</td>
<td>C(_2)H(_6)</td>
</tr>
<tr>
<td>Propane</td>
<td>C(_3)H(_8)</td>
</tr>
<tr>
<td>Butane</td>
<td>C(<em>4)H(</em>{10})</td>
</tr>
<tr>
<td>Pentane</td>
<td>C(<em>5)H(</em>{12})</td>
</tr>
<tr>
<td>Hexane</td>
<td>C(<em>6)H(</em>{14})</td>
</tr>
</tbody>
</table>

According to this system the alkanes can assign the name by using following simple rules:-

1) Select the longest continuous chain & the compound is named as a derivative of this hydrocarbon.

2) The carbon chain is numbered from one end to another end such that, the side-chain gets the lowest possible numbers.

3) If same alkyl group occurs more than once as a side chain, indicate this by the prefix di-, tri-, tetra- etc.

4) If two alkyl groups appear at the same position then smaller group should be given the lowest number.
Thank You