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ALKANES

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Abstract:
In organic chemistry, an alkane, or paraffin, is an acyclic saturated hydrocarbon. In other words, an alkane consists of hydrogen and carbon atoms arranged in a tree structure in which all the carbon–carbon bonds are single. This article describes the Alkanes.

Keywords: Alkanes; hydrocarbon; carbon atoms; cycloalkanes; molecule; ethylene; diene; paraffin; nomenclature; propane; butane.

Alkanes with more than three carbon atoms can be arranged in various ways, forming structural isomers. The simplest isomer of an alkane is the one in which the carbon atoms are arranged in a single chain with no branches. This isomer is sometimes called the n-isomer (n for "normal", although it is not necessarily the most common). However, the chain of carbon atoms may also be branched at one or more points. The number of possible isomers increases rapidly with the number of carbon atoms. A hydrocarbon is composed of only carbon and hydrogen atoms. Hydrocarbons can be divided into several classes based on the interconnection of carbon atoms in the molecule, the type of bonds and the ratio of hydrogen atoms bonded to carbon.[1] We will consider the following classes from them:

- Saturated open chain hydrocarbons - Alkanes
- Saturated closed-chain (ring-preserving) hydrocarbons -
- Cycloalkanes
- Ethylene series hydrocarbons - Alkenes
- Diene hydrocarbons - Alkadienes
- Acetylene series hydrocarbons - Alkynes

[1] D. Heydarov. Alkanes. Tashkent. 2020.

If the carbon atoms in the hydrocarbon molecule are connected to each other by a simple σ-bond, and the remaining valences are saturated with hydrogen atoms, they are called saturated hydrocarbons. In saturated hydrocarbons, carbon atoms are in the sp3-hybridized state, and carbon-carbon, carbon-hydrogen atoms form a covalent bond with each other, and their electron cloud is aligned with the bond axes of the atoms. A simple bond (sigma bond) is very strong because the main mass of electron density is located at a small distance between atomic nuclei. Saturated hydrocarbons can be cyclic or non-cyclic (open chain). Open-chain saturated hydrocarbons are called alkanes, and cyclic saturated hydrocarbons are called cycloalkanes.[2]

Alkanes are also called paraffins. The first (typical) representative of alkanes is methane (CH_4). If we add the CH_2 group to methane, the second representative - ethane (C_2H_6) is formed. If we continue to add a CH_2 group to each obtained representative, compounds - homologues - are formed that are chemically similar in structure, and whose composition differs from each other by a CH_2 group. A group of homologues is called a homologous series, and the "CH_2" group difference between them is called a homologous series difference. The general formula of the homologous series of alkanes is CnH_{2n+2}. Here, n is the number of carbon atoms in the molecule, 2n+2 is the number of hydrogen atoms. For example, if n=5, C_5H_2*5+2, i.e. C_5H_{12} pentane formula is derived.

As mentioned above, as a result of many discoveries of organic compounds, trivial (random) names were initially given to most organic substances, for example, the first four representatives of saturated hydrocarbons were trivially named methane, ethane, propane and butane. Starting from alkane containing 5 carbons, the name of alkanes is formed by adding the suffix "an" to the Greek name for the number of carbon atoms in the molecule. Since the 19th century, rational (Latin "ratio" means thinking) nomenclature was used to name organic substances. It is based on the structure of methane for any alkane. When naming, the word methane is added to the end of the name of radicals.

[2] Smith, Michael B.; March, Jerry (2007). Advanced Organic Chemistry: Reactions, Mechanisms, and Structure (6th ed.). New York: Wiley-Interscience. p. 23. ISBN 978-0-471-72091-1.

The structure of rational nomenclature is convenient for naming simple and low-carbon substances, but complex and branched chain organic substances cannot be named. In 1960, a new nomenclature developed by IUPAC (International Union of Pure and Applied Chemistry) was announced. This nomenclature was called systematic nomenclature. To name saturated hydrocarbons according to systematic nomenclature, the longest chain—the main carbon chain—is numbered. Numbering starts from the radical nearest side.[3] When naming, the number indicating which carbon atom of the main chain is attached to the radical is first written, then the name of the radical, and then the name of the alkane corresponding to the number of carbons in the main chain is written.

If the radicals are located twice as far from the two ends of the main chain, in the same amount, the numbering starts from the side where the small - simple radicals are located. If the radicals are located twice as far from the two ends of the main chain as the same radicals are located in different numbers, the numbering starts from the side where the radical is more numerous. If there are a large number of the same radicals, the number of radicals is represented by 2 radicals as di-, three as tri-, four as tetra- and similar prefixes. Alkanes have structural and optical isomers. Structural isomerism is mainly studied.[4]

This type of isomerism starts with butane. If the carbon atoms combine to form a straight chain, they are called normal (n), and if they are branched, they are called iso-compounds. As the number of carbon atoms increases, the number of isomers

[3] Alabugin, Igor V. (2016). Stereoelectronic effects : a bridge between structure and reactivity. Chichester, UK. ISBN 978-1-118-90637-8. OCLC 957525299. IUPAC, Commission on Nomenclature of Organic Chemistry (1993). "R-2.2.1: Hydrocarbons".

[4] A Guide to IUPAC Nomenclature of Organic Compounds (Recommendations 1993). Blackwell Scientific. ISBN 978-0-632-03488-8. Retrieved 12 February 2007.

increases. For example, there are 3 isomers in pentane, 5 in hexane, 9 in heptane, 18 in octane, 35 in nonane, and 75 in decane. Saturated hydrocarbons are mainly obtained from natural gas (90-98% methane, the rest consists of ethane, propane, butane and other hydrocarbons), oil and plants.

References:

1.D. Heydarov. Alkanes. Tashkent. 2020.
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