Hydrocarbons Encyclopedia Article

Hydrocarbons

Contents

Hydrocarbons

Hydrocarbons are chemical compounds that are composed entirely of carbon and hydrogen atoms. The simplest hydrocarbon is methane (CH_4), which contains one carbon and four hydrogen atoms, and usually exists as a gas. The largest hydrocarbons can contain hundreds of carbon atoms and larger numbers of hydrogen atoms, and exist as solids.

Hydrocarbons occur naturally in petroleum (also known as crude oil), coal, and natural gas. These materials are known as "fossil fuels," because they are derived from ancient plant biomass that became buried deep in the ground, where chemical reactions occurring in an oxygen-deficient environment and under conditions of extremely high pressure and temperature resulted in the formation of complex mixtures of hydrocarbons. Fossil fuels are mined from deposits in the environment and are used directly as fuels, or are processed in refineries into hydrocarbon fractions which are used as fuels (such as gasoline) or as industrial feedstocks for manufacturing lubricants, plastics, and other materials.

Hydrocarbons can be classified into three groups: aliphatics, alicyclics, and aromatics.

Aliphatic hydrocarbons are compounds in which the carbon atoms occur as an open chain. Saturated aliphatics (or alkanes) have a single bond between all of the adjacent carbon atoms, and they cannot contain any additional hydrogen atoms in their molecular structure (this also means that they cannot react with hydrogen gas). In contrast, unsaturated aliphatics (or paraffins) contain one or more double or triple bonds, and under suitable conditions will react with hydrogen to form saturated compounds. These differences can be illustrated by the following series of twocarbon aliphatic carbons: ethane, H_3CCH_3; ethylene, $H_2C=CH_2$; and acetylene, HC(CH. Unsaturated aliphatics are relatively unstable chemically, and for this reason do not occur naturally in petroleum. They are produced during industrial refining and by photochemical reactions in the environment after crude oil is spilled.

Alicyclic hydrocarbons have some or all of their carbon atoms arranged as a ring structure, which can be saturated or unsaturated.

Aromatic hydrocarbons contain one or more five- or six-carbon rings in their molecular structure. The simplest aromatic hydrocarbon is benzene, with a C_6H_6 ring structure.