CHAPTER-2
CLASSIFICATION OF PETROLEUM HYDROCARBONS

Hydrocarbons can be essentially classified into four Categories depending on the structural formula. Two of the categories refer to the structural arrangements of the carbon atoms in the molecule. These are:

-open chain compounds

-ring or cyclic compounds

The remaining two categories refer to the bonds between the carbon atoms. These are:

-saturated or single bond compounds

-unsaturated or multiple bond compounds

Based on the structure, hydrocarbons are divided into two main classes: *aliphatic* and *aromatic*. Aliphatic hydrocarbons are further divided into families: alkanes, alkenes, alkynes and their cyclic analog.

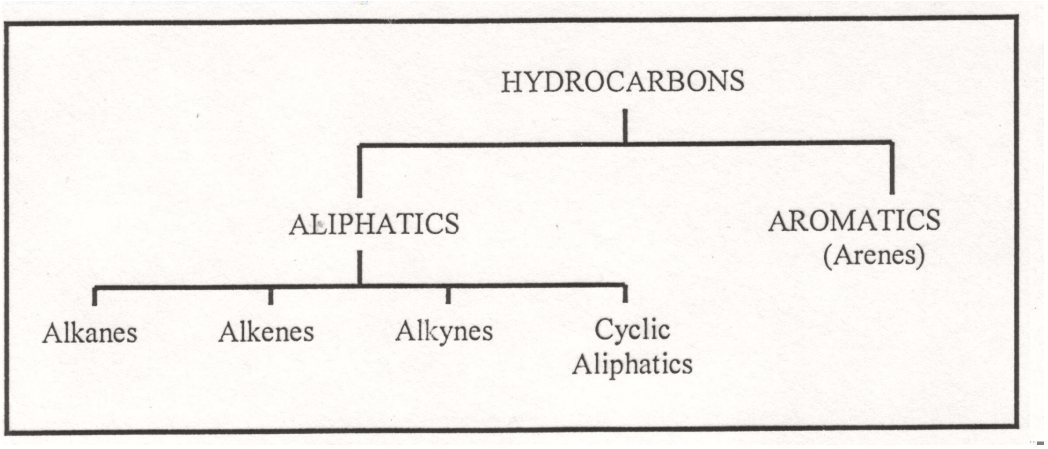

Figure 2-1 Classes and Homologous Series of Hydrocarbons

2.1 Alkanes:

Alkanes have the general formula of C_nH_{2n+2}. The alkanes are named through the combination of the numerical prefix, which denotes the number of carbon atoms,

and the suffix- *ane*, which classifies the compound as an alkane. Compounds of this family are also called "saturated hydrocarbons" or "paraffin hydrocarbons".

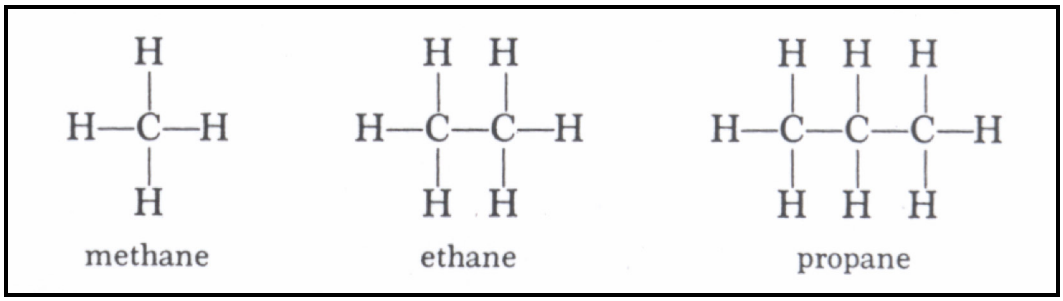

Figure 2-2 Chemical Structure of Methane, Ethane and Propane

2.2 Alkenes:

The family of hydrocarbons known as alkenes is also called "unsaturated hydrocarbons" and occasionally "olefines". The general formula for the alkene family is C_nH_{2n}. The distinguishing feature of the alkene structure is the carbon-carbon double bond. The alkenes are also named through the combination of a numerical prefix, which denotes the number of carbon atoms, and the suffix – *ene,* which classifies the compound as an alkene.

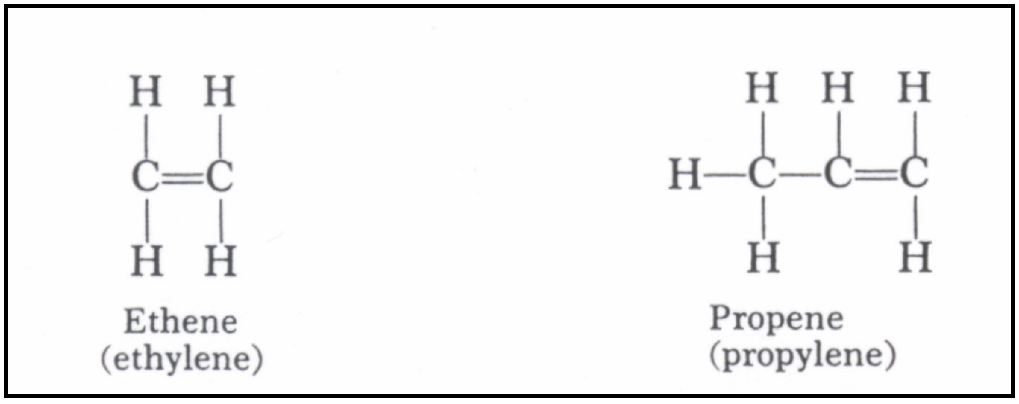

Figure 2-3 Chemical Structure of Ethene and Propene

2.3 Alkynes:

The distinguishing feature of the alkyne structure is the carbon-carbon triple bond. The general formula for the alkynes is C_nH_{2n-2}. The alkynes are named through

the combination of a numerical prefix, which denotes the number of carbon atoms, and the suffix *–yne,* which classifies the compound as an alkyne. Table-1 shows the examples of alkanes, alkenes and alkynes.

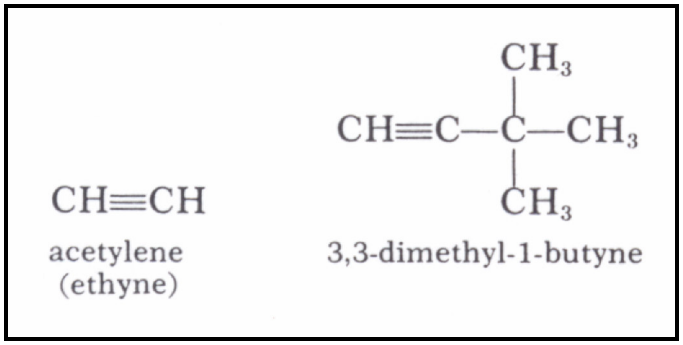

Figure 2-4 Chemical Structure of Acetylene and 3,3 dimethyl-1-Butyne

Table 2-1 Alkanes, alkenes and alkynes

Number of Carbons,	Alkanes Name	Alkanes Chemical Formula	Alkenes Name	Alkenes Chemical Formula	Alkynes Name	Alkynes Chemical Formula
1	Methane	CH_4	-	-	-	-
2	Ethane	C_2H_6	Ethene	C_2H_4	Ethyne	C_2H_2
3	Propane	C_3H_8	Propene	C_3H_6	Propyne	C_3H_4
4	Butane	C_4H_{10}	n-Butene	C_4H_8	1-Butyne	C_4H_6
5	Pentane	C_5H_{12}	n-Pentene	C_5H_{10}	1-Pentyne	C_5H_8
6	Hexane	C_6H_{14}	n-Hexene	C_6H_{12}	1-Hexyne	C_6H_{10}
7	Heptane	C_7H_{16}	n-Heptene	C_7H_{14}	1-Heptyne	C_7H_{12}
8	Octane	C_8H_{18}	n-Octene	C_8H_{16}	1-Octyne	C_8H_{14}
9	Nonane	C_9H_{20}	n-Nonene	C_9H_{18}	1-Nonyne	C_9H_{16}
10	Decane	$C_{10}H_{22}$	n-Decene	$C_{10}H_{20}$	1-Decyne	$C_{10}H_{18}$

2.4 Cyclic Aliphatic Hydrocarbons

The carbon atoms of the compounds are attached to one another to form chains. However, in many hydrocarbon compounds the carbon atoms are arranged to form rings. These are called cyclic compounds. The cyclo-alkanes are also known as "naphthenes". They have saturated rings. The general formula for the ring is C_nH_{2n}. This is the same as the general formula for the alkene series. However, the structural configurations are completely different, and thus, the physical and chemical properties

are not all similar. The most common cyclo-alkanes are cyclohexane and cyclopentane.

2.5 Aromatics

Aromatic compounds include benzene and compounds that resemble benzene in chemical behaviour. Benzene is known to be a flat molecule with six carbon atoms arranged in hexagonal ring. Six hydrogen atoms, one associated with each carbon, radiate out from the ring.

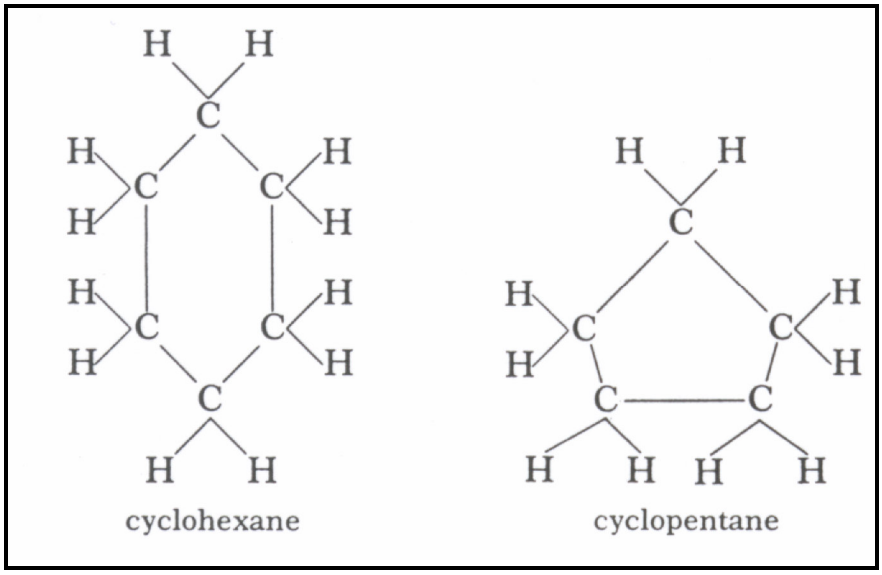

Figure 2-5 Chemical Structure of Cyclohexane and Cyclopentane

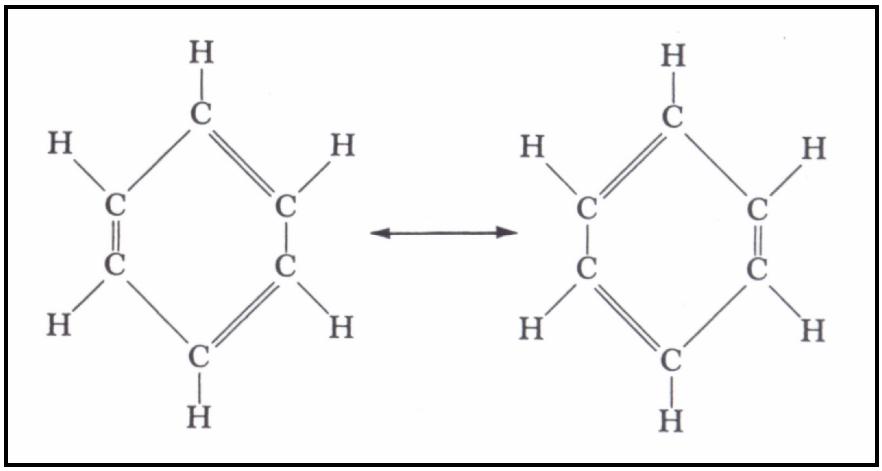

Figure 2-6 Chemical Structure of Benzene Prof.Dr. Mustafa Verşan KÖK