(….Contd.) ORGANIC CHEMISTRY – SOME BASIC PRINCIPLES

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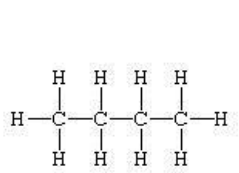
Classification of organic compounds- The organic compounds can be divided into two main classes:

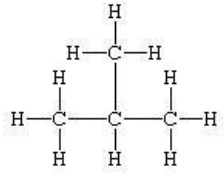
1. Acyclic or open chain or aliphatic hydrocarbon:- these may be either straight chain or branched chain e.g

CH_3-CH_2-CH_2-CH_3

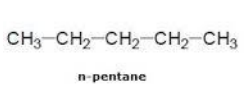
(n-butane)



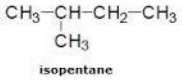
n-butane, $CH_3CH_2CH_2CH_3$



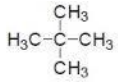
isobutane, $(CH_3)_3CH$



n-pentane



isopentane

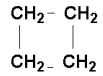


neopentane

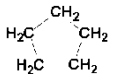
2. Cyclic or closed chain compound:- These compounds contain one or more closed chains or ring of atoms. These are divided into two categories :-

(a) Homocyclic or Carbocyclic compounds: these compounds have rings which are made up of only carbon atoms. e.g

(i) Alicyclic compounds: these resembles aliphatic compounds.



Cyclobutane

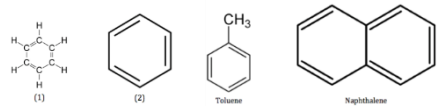


Cyclopentane

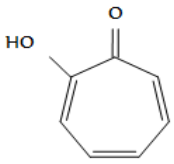
Cyclopropane

Cyclohexane

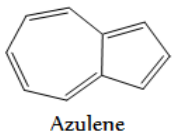
(ii) Aromatic compounds (aroma means pleasant smell) :- organic compounds containing one or more fused benzene rings are called aromatic compounds or benzenoid compounds



(iii) Aromatic compounds having aromatic properties but do not have benzene ring are called non-benzenoid compound



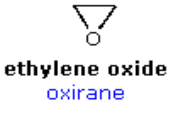
Tropolone



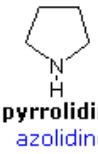
Azulene

(b) Heterocyclic compounds:- cyclic compounds containing one or more atoms except C and H in ring called heterocyclic compounds. These are of two types

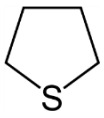
(i) Alicyclic heterocyclic compounds :- these compounds contain one two more hetero atoms in their rings.



ethylene oxide
oxirane



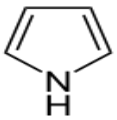
pyrrolidine
azolidine



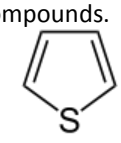
Tetrahydrothiophene

(ii) Aromatic heterocyclic compounds:- the compounds containing one or more hetero atoms in their molecules are called aromatic compounds. E.g

Furan

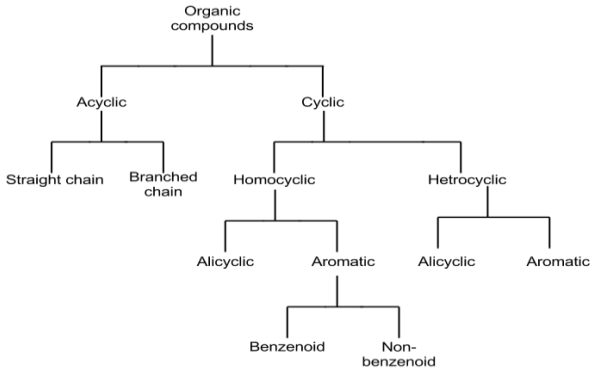


Pyrrole



Thiophene

The above classification may be summarized as follows:



Functional Group:- A functional group may be defined as an atom or a group of atoms present in a molecule which largely determines its chemical properties .

$$R-H \xrightarrow{-H} \xrightarrow[+G]{} R-G$$

R denotes the carbon- hydrogen framework, and G is called functional group.

For example: In R-OH , -OH is the functional group of alcohols and determines the chemical properties of alcohols.

R (remaining part of the molecule) affects the physical properties such as melting point, boiling point, density, solubility etc.

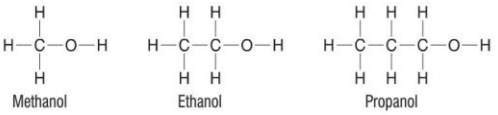
Some of the common functional group present in various organic compounds are listed below.

Class of Compound	Functional Group	General Formula	Example
halide (halocarbon)	—F (fluoro-) —Cl (chloro-) —Br (bromo-) —I (iodo-)	$R—X$ (X represents any halogen)	$CH_3CHClCH_3$ 2-chloropropane
alcohol	—OH	$R—OH$	$CH_3CH_2CH_2OH$ 1-propanol
ether	—O—	$R—O—R'$	$CH_3OCH_2CH_3$ methyl ethyl ether
aldehyde			 propanal
ketone			 2-pentanone
organic acid			 propanoic acid
ester			 methyl propanoate
amine			$CH_3CH_2CH_2NH_2$ 1-propanamine
amide			 propanamide

Note: R represents a bonded atom or group of atoms.

Homologous Series:- A group of similar organic compounds which have same functional group and show regular changes in physical properties and have similar chemical properties. The adjacent compounds differ by $-CH_2$ group. The individual members of such a series are called Homologues and phenomenon is called homology. For example

Name	Formula	Structure	State (at room temp.)
Methane	CH_4		Gas
Ethane	C_2H_6		Gas
Propane	C_3H_8		Gas
Butane	C_4H_{10}		Gas
Pentane	C_5H_{12}		Liquid
Hexane	C_6H_{14}		Liquid



(This homogeneous series is called alcohols.)

Characteristics of a homologous series:-

1. Each homologous series can be represented by a general formula .

   $C_nH_{2n+1}COOH$ Carboxylic acid

   $C_nH_{2n+1}OH$ Alcohols

   $C_nH_{2n+1}CHO$ Aldehydes

2. All the members of series have same functional group e.g alcohols (-OH)
3. The successive members of a homologous series differ by a CH_2 group or by 12+2x1=14 mass units
4. The individual member of a homologous series can be prepared by general method
5. The physical properties such as density, melting point, boiling point of the members of a homologous series show regular change with change of molecular mass
6. The chemical properties of the members of a homologous series are similar.

Assignment

1. The compounds which contain one or more atoms other than carbon such as N, O, S in the ring of C- atoms are called:
   A. Heterocyclic compounds
   B. Alicyclic compounds
   C. Aromatic compounds
   D. Aliphatic compounds
2. Which of the following is not a cyclic compounds ?
   A. Anthracene
   B. Pyrrole
   C. Isobutane
   D. Phenol
3. Which of the following represents a homologous series?
   A. Ethane, Ethylene, Ethyne
   B. Methane, Methanol , Methanol
   C. Methane , Ethane, Propane
   D. 1-hexene, 2-hexene, 3-hexene
4. The members of a homologous series have
   A. Different general formulae
   B. Different molecular weights
   C. Different methods of preparation
   D. Different chemical properties
5. What is the functional group of

A. An aldehyde
B. A nitro compound
C. Thioalcohol

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ANSWERS TO ASSIGNMENT

1. [A] Hetrocyclic; 2. [C] Isobutane; 3. [C] Methane, ethane, propane; 4. [B] Different molecular weight;

5. (i) -CHO, (ii) $-No_2$, (iii) -SH