

Carbon and it's Compounds

Definition

Bonding in carbon

Carbon has 4 valence electrons. Since, it is difficult to either lose or gain 4 electrons to attain inert gas configuration, carbon does not form ionic compounds. Carbon forms covalent bonds- single, double and triple covalent bond.

Definition

Important point of Hybridisation

Hybridization involves mixing and recasting of atomic orbitals of same element.

The orbitals involving in this process must have nearly same energy.

only the atomic orbitals not electron undergo hybridization.

Number of hybrid orbitals produced= number of hybrid orbitals involved in hybridization.

Definition

Types of hybridisation

sp³, sp², sp, dsp², sp³d, sp³d², sp³d³.

Definition

Allotropes of carbon

Allotropy is the property of an element in which the elements exist in more than one physical form having similar chemical properties but different physical properties. Important allotropes of carbon include diamond, graphite, and fullerene.

Definition

Versatile nature of carbon

The existence of an infinite number of carbon compounds in nature is because of the unique nature of carbon atoms. It can form so many compounds due to its tetravalent nature and catenation property.

Definition

Saturated carbon compounds

Saturated hydrocarbons are molecules that only contain single bonds and a maximum amount of hydrogen atoms bonded to the carbon atom present. eg C₂H₆

Unsaturated carbon compound

Unsaturated hydrocarbons are compounds that consist only of the elements carbon (C) and hydrogen (H) and contain at least one carbon-carbon double or triple bond. eg C₂H₄, C₃H₆.

Definition

Functional group in organic compounds

Functional groups are specific atoms or groups of atoms joined in a specific manner within carbon compounds that are responsible for the characteristic chemical and physical properties of these carbon compounds. eg -OH, -CHO, -COOH.

Definition

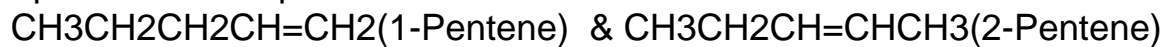
Condensed structural formula of alkyl and functional group

1. Condensed structural formula represent structure of organic compound written in condensed form or short form in which same repeating groups are condensed in one group. Example : CH₃CH₂CH₂CH₃ can be written as following in condensed form CH₃(CH₂)₂CH₃

Isomers

1. Isomers are molecules that have the same molecular formula, but have a different arrangement of the atoms in space.

e.g. 1-pentene and 2-pentene are isomers



Definition

Isomerism

The phenomenon of existence of two or more compounds possessing same molecular formula but different properties is known as isomerism.

Types of isomerism :

1. Structural isomerism 2. Stereo isomerism

Structural isomerism

1. Compounds having same molecular formula but different structures are classified as structural isomers and phenomenon is called as structural isomerism.

2. Example : 1-Pentene $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{CH}_2$



Homologous Series

A Homologous Series is a group of organic chemical compounds, usually listed in order of increasing size, that have a similar structure (and hence, also similar properties) and whose structures differ only by the number of CH_2 units in the main carbon chain.

General characteristics of members of homologous series

Members of the series can be represented by a general formula. Successive members differ from each other by CH_2 . Physical properties change regularly with increasing number of carbon atoms. Members have similar chemical properties because they have same functional group.

Members of the homologous series can be prepared using the same method.

Homologous series of hydrocarbons

Alkanes can be represented by the general formula $\text{C}_n\text{H}_{2n+2}$. Alkenes can be represented by the general formula C_nH_{2n} . Alkynes can be represented by the general formula $\text{C}_n\text{H}_{2n-2}$.

Significance of homologous series

1. Homologous series is the characteristic feature of carbon compounds in which carbon and hydrogen atoms in hydrocarbons varying by single parameter.

2. Homologous series helps in determination of structure of the successive member of the series and the property of that members can also be predicted by their series.

Substitution reaction of carbon compounds

A reaction in which an atom or group of atoms replaces another atom or group of atoms is called substitution reaction. Alkanes undergo substitution reactions. Example: Chlorination of methane in presence of sunlight gives a mixture of products like methyl chloride, methylene chloride, chloroform and carbon tetrachloride.

Nomenclature of a carbon compound

Rules of nomenclature of carbon compounds are given by IUPAC:

According to IUPAC nomenclature longest continuous carbon chain should be taken as the parent chain.

Other than parent chain remaining groups are considered as the substituent

Any functional group present in carbon chain considered as a part of the parent chain

The carbon chain is numbered in a manner so that substituents and functional groups get the least possible number.

The first letter of the name should be capital.

There should be a hyphen between number and letter.

Example: $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ = 1-Propanol(The carbon atom which is attached to OH group is numbered as 1 and there is 3 carbon atoms in the structure hence name is 1-Propanol.)

Combustion of carbon compounds

All carbon compounds react with oxygen to produce heat and light along with carbon dioxide and water. This reaction of carbon with oxygen is called combustion. Aliphatic compounds on combustion produce a non-sooty flame. Aromatic compounds on combustion produce sooty flame.

Oxidation of carbon compounds

1. Oxidation is a reaction in which carbon compounds get oxidized by oxidizing agents into compound with more number of oxygen atom
2. For example : Alcohols undergo oxidation in presence of oxidizing agents like alkaline potassium permanganate or acidified potassium dichromate to form carboxylic acids
3. Ethyl alcohol on oxidation with alkaline potassium permanganate or acidified potassium dichromate gives acetic acid

Addition reaction of carbon compounds

The Addition Reaction in organic chemistry is an Addition Reaction if two substances combine and form a third substance. Unsaturated Hydrocarbons like Alkenes and Alkynes prefer to undergo Addition Reactions.

Hydrochlorination of Propene (an alkene) is an example of Addition Reaction. In addition reactions, molecules add across double bond or triple bond. Hydrogenation reaction involves the addition of hydrogen to unsaturated hydrocarbons in presence of catalyst like nickel or platinum to form saturated hydrocarbons.

Properties of ethanol

Ethyl alcohol is a colorless liquid with boiling point 351 K.

It has a characteristic smell and burning taste.

It is miscible in water.

It is good solvent for fats , oils, paints etc.

Ethyl alcohol is typical monohydric alcohol gives all general monohydric alcohol reactions.