Define organic chemistry

The branch of science which deals with scientific study of structure, properties and reactions of organic compounds is called as organic chemistry.

Addition reaction of carbon compounds

A chemical reaction is said to be an addition reaction if two substances combine and form a third substance. In general, unsaturated hydrocarbons like alkenes and alkynes prefers to undergo addition reactions. 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.

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.

Physical properties of carbon and its compounds

The physical properties are as follows: low melting points and boiling points, low enthalpies of fusion and vaporization, poor electrical and thermal conductivity.

Chemical properties of carbon compounds

Carbon compounds undergo different types of chemical reactions: substitution reactions, addition reactions, polymerisation reactions, combustion reactions and thermal cracking.

Aliphatic compounds

An aliphatic compound is a compound containing carbon and hydrogen joined together in straight chains, branched trains or non-aromatic rings.

Methane

Methane is the first member of the homologous series of alkanes. Its molecular weight is 16. Methane is also called as marsh gas because methane is formed by the decomposition of animals and plants in the swampy areas. Methane gas is also found in coal mines, gobar gas, bio gas and coal gas.

Properties and uses of methane

It is a colourless, odourless gas. Methane gas is lighter than water.It is insoluble in water but soluble in non-polar solvents like ether, alcohol, carbon tetrachloride. Methane gas also exhibits the green house effect. On combustion methane form carbon dioxide, water vapour and heat. Methane is used as domestic fuel.It is used in rubber industry. It is used in the preparation of organic compounds like chloroform, methanol, formaldehyde, methyl chloride, carbon tetrachloride, etc.

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.

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.

Cyclic compounds

Cyclic compounds are those compounds whose molecules contain a number of atoms bonded together to form a closed chain or ring.

Homocyclic compounds

Cyclic compounds that have only carbon atoms present in the ring are termed as homocyclic compounds.

Heterocyclic compounds

Cyclic compounds that have both carbon and non-carbon atoms present are termed as heterocyclic compounds.

Nomenclature of a carbon compound

Rules of nomenclature of carbon compounds have been given by IUPAC:

According to IUPAC nomenclature longest continuous carbon chain should be taken as the parent hydrocarbon.
Other than parent chain remaining groups are consider as substituent or prefix.
Any functional group present in carbon chain consider as part of parent chain.
The carbon chain is numbered in a manner so that substituents and functional groups get least possible number.
The first letter of the name should be capital.
There should be a hyphen between number and letter.
Example : $CH_3CH_2CH_2OH$= 1-Propanol(The carbon atom which is attached to OH group is numbered as 1 and there are 3 carbon atom in structure hence name is 1-Propanol.)

Parent hydrocarbon

Parent hydrocarbon is the basic hydrocarbon in the given compound. The number of carbons in the longest chain becomes the parent name. In parent hydrocarbon, some hydrogen are replaced by functional group and the final compound is formed.

Trivial system of naming a organic compound

1. The non-systemic name which is not given by any rule is called as Trivial name of organic compound.
2. The trivial names are given on the basis of the source and certain properties of organic

compounds. ex- Ethanoic acid is named as Acetic acid in trival name system as it is obtained from by vinegar.

IUPAC system of naming a organic compound

In 1947, the IUPAC, i.e. International Union of Pure and Applied Chemistry system of naming compounds was first developed. The IUPAC system is a systematic nomenclature in which the name of a compound correlates to its molecular structure. The IUPAC nomenclature system is a set of logical rules devised and used to write a unique name for every distinct compound. According to the IUPAC system, the name of an organic compound consists of a root word, a suffix and a prefix.

General rules for IUPAC nomenclature of organic compounds

1.Identify longest continuous carbon chain , this is called as parent chain.
2.Identify all the substituents.
3.Number the carbon atom in the chain so that the substituents get least possible number.
4.If the substituents occur more than 2 or 3 times the word di,tri , tetra etc are used.
5.If two or more different substituents are present then alphabetical order is used.
6.A cyclic hydrocarbon is given the prefix cyclo.

nomenclature of saturated hydrocarbon

The names of such compounds are based on their chain structure , and end with suffix - ane and carry a prefix indicating the number of carbon atoms present in the chain.
For example : Methane , Ethane.

Nomenclature of alkenes and alkynes

For alkenes The longest continuous chain, considered as a parent chain should include double bond in it and the chain ends with suffix -ene with position of double bond.If more than 1 double bond is their it is named according to the number of carbon in the chain..
For alkynes the longest continuous chain ends with -yne suffix and rest is similar to alkene.

Nomenclature of amides

amides are named by changing the name of the acid by dropping the -oic acid or -ic acid endings and adding -amide.

Nomenclature of primary amines

Primary amines are the functional group prepared by substituting one H atom of ammonia gas by alkyl group.In nomenclature system the longest continuous carbon chain is considered as parent chain in which amine or amino is used as prefix .
For example : Butan-2-amine.in this name butan represents 4 carbon chain , 2 represents the position of attachment functional group to carbon chain.

Nomenclature of isocynides

The functional group in which N triple bond C is present is called as isocynide.In nomenclature the suffix "nitrile" or "carbonitrile" is used for organic cynides (R-CN), names for isocyanides have the prefix "isocyano". IUPAC names become isocyanoalkane.

Nomenclature of branched chain alkanes

1. The longest carbon chain in the molecule is identified
2. The numbering is done in such a way that the branched carbon atoms get the lowest possible numbers
3. The names of alkyl group attached as a branch are then prefixed to the name of the parent alkane and position of the substituents is indicated by the appropriate numbers
4. Numbers are separated by commas
5. Lower numbers is given to the one coming first in the alphabetical listing

Rules for unsaturated hydrocarbon

1. The longest continuous chain containing the carbon atoms involved in the multiple bonds is selected.
2. While writing the name of the alkene or alkyne, the suffix **ane** of the corresponding alkane is replaced by **ene** or **yne** respectively.
3. If the multiple bond occurs twice in the parent chain, the alkene and alkyne are

called **diene** and **diyne**respectively.
4. The numbering of atoms in parent chain is done in such a way that the carbon atom containing the double or triple bond gets the lowest number.
All the rules for naming the side chains or substituents are similar to alkanes.

Nomenclature for compounds containing one fuctional group

1. The longest continuous chain containing the carbon atoms involved in the multiple bond, functional groups or substituents is selected as a parent chain.
2. While writing the name of the alkene or alkyne, the suffix **-ane** of the corresponding alkane is replaced by **-ene** or **-yne** respectively, same for functional group.
3. If the multiple bond occurs twice in the parent chain, the alkene and alkyne containing the double or triple bond gets the lowest number.
All the rules for naming the side chains or substituents are similar to alkanes.

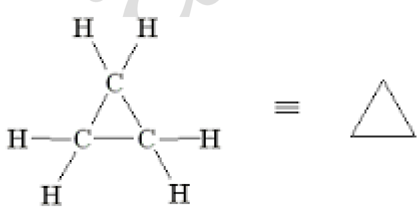
Nomenclature of polyfunctional compounds

1. Although a poly functional organic molecule might contains several different functional groups,we must choose just one suffix for nomenclature purposes.
2. The suffix is chosen by priority order of the fuctional groups.
3.Remaining rules will remain same of alkanes.

Nomenclature of compounds containing more than two carbon containing functional group

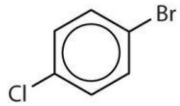
For such type of compound priority order of the functional group is used for selection of suffix. Remaining rules will remain same of saturated compounds.

Alicyclic compounds

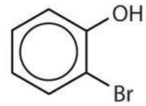


1. For alicyclic compounds the word cyclo is used along with structure type.
2. For example: 3-membered carbon ring is called as cyclo propane.

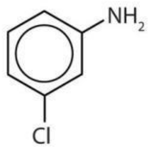
Nomenclature of simple aromatic compounds



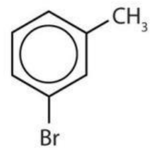
1-Bromo-4-chlorobenzene
p-Bromochlorobenzene



2-Bromophenol
o-Bromophenol



3-Chloroaniline
m-Chloroaniline



3-Bromotoluene
m-Bromotoluene

1. The simple aromatic ring containing six carbon atoms is considered as benzene.
2. All other six membered substituted structures is consider as derivative of benzene.
3. The six carbon atoms of benzene ring is given as numbering from number 1 to 6.
4. The 1,4 position is called as para position.
5. The 2,6 position is called as ortho position.
6. The 3,5 position is called as meta postion.
7. In common name system the words ortho, para and meta is used.
8. In IUPAC name system numbers 1 to 6 to which substituents is attached is used.
9. The substituents are numbered according to priority order.
10. Example is shown in diagram.

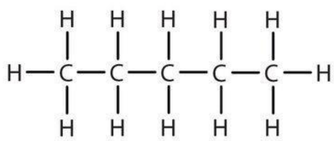
Isomerism

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

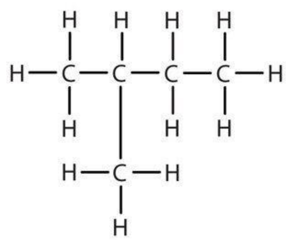
Isomers

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

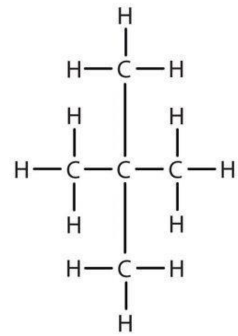
Chain isomerism



Pentane



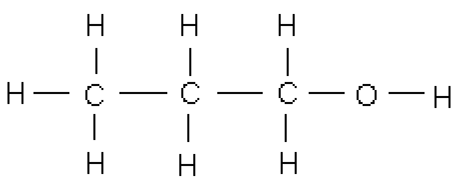
Isopentane



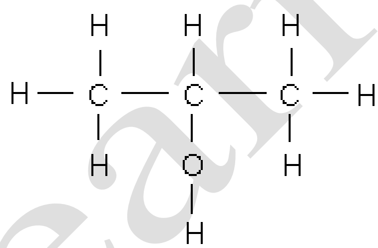
Neopentane

1.When two or more compounds have similar molecular formula but different carbon skeletons, these are referred as chain isomers and the phenomenon is chain isomerism.
Example : Pentane , Isopentane , Neopentane.

Position isomerism



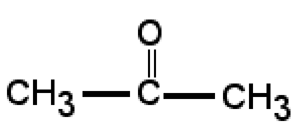
propan-1-ol



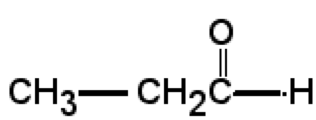
propan-2-ol

The phenomenon in which compounds differ in position of substituents, multiple bond or functional group on the carbon skeleton is called as position isomerism.
Example : Propan-1-ol, Propan-2-ol

Fuctional isomerism



Propanone



Propanal

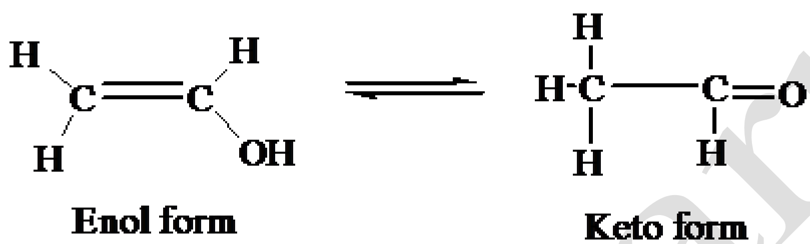
(C_3H_6O)

Functional isomerism, an example of structural isomerism, occurs substances have the same molecular formula but different functional groups.
Example : Propanone and Propanal

Metamerism

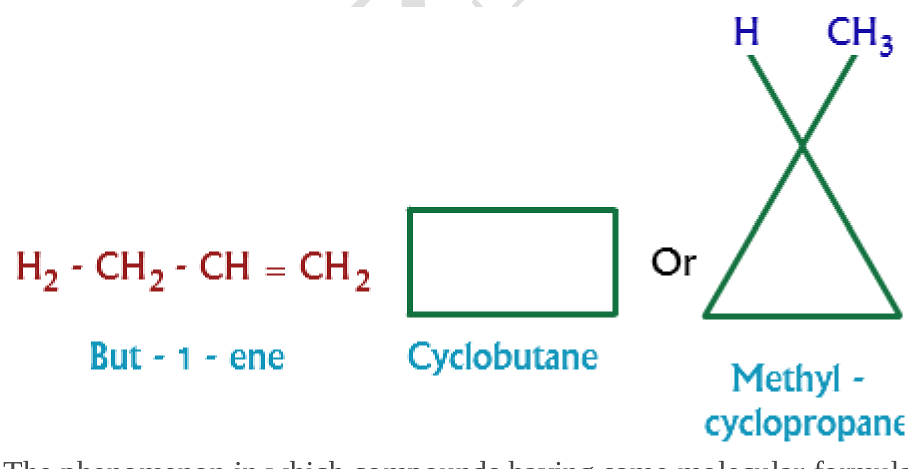
The phenomenon in which different alkyl chain on either side of the functional group present in the molecule is called as metamerism.
Example : Methoxypropane and Ethoxyethane.

Tautomerism



The ability of certain chemical compounds to exist as a mixture of two inter convertible isomers in equilibrium .
Example : Keto and enol forms.

Ring chain isomerism



The phenomenon in which compounds having same molecular formula but open and closed ring structures is called as ring chain isomerism. e.g. Butene and cyclobutane

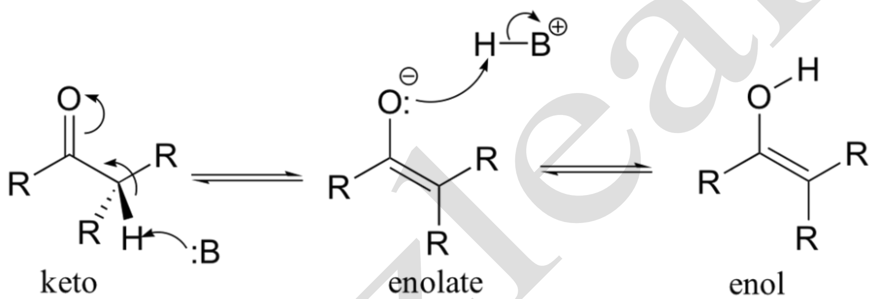
Define and give example of geometrical isomerism

1. The isomerism in which doubly bonded system have restricted rotation along the double bond because of which new type of isomerism develops called as geometrical isomerism.
2. Example : Cis-2-butene and Trans-2-butene.

Condition and causes of geometrical isomerism

This type of isomerism is common in doubly bonded structure in which rotation across double is restricted therefore geometrical isomerism develops.

Keto-enol tautomerism



1. Keto-enol tautomerism refers to a chemical equilibrium between a keto form (a ketone or an aldehyde) and an enol (an alcohol).
2. The enol and keto forms are said to be tautomers of each other.
3. The interconversion of the two forms involves the movement of an alpha hydrogen and the shifting of bonding electrons; hence, the isomerism qualifies as tautomerism.

Stereoisomerism

Stereo isomers are isomeric molecule that have the same molecular formula and sequence of bonded atoms (constitution), but differ in the three-dimensional orientations of their atoms in space. This phenomenon is called as Stereo isomerism.

Steric hindrance

When in organic molecule big size atoms come close, the energy associated with these bulky molecule stops smaller molecule to react. This kind of hindrance in chemical reaction due to big size atoms is called as steric hindrance.

Reaction mechanism

A reaction mechanism is the step by step sequence of elementary reactions by which overall chemical change occurs. A chemical mechanism describes in detail exactly what takes place at each stage of an overall chemical reaction (transformation).

Electron displacement effects in covalent bonds

Inductive effect
Resonance effect
Electromeric effect and
Hyperconjugation

Electron movement in organic compounds

The shifting or movement of electrons in organic compounds is due to the following effects-
Inductive effect
Resonance effect
Electromeric effect and
Hyperconjugation

Electrophiles

An electrophile (electron lover) is a reagent attracted to electrons. Electrophiles are positively charged or neutral species having vacant orbitals that are attracted to an electron rich center. Example : BF_3, $AlCl_3$ etc.

Nucleophiles

A nucleophile is a chemical species that donates an electron pair to an electrophile to form a chemical bond in relation to a reaction. All molecules or ions with a free pair of electrons or at least one pi bond can act as nucleophiles. Because nucleophiles donate electrons, they are by definition Lewis bases.
Example : Cl^-, NH_3

Homolytic fission

The fission of covalent bond such that , one of the electrons of the shared pair in a covalent bond goes with each of the bonded atoms.Thus in this type of cleavage ,the movement of a single electron takes place instead of an electron pair.Homolytic cleavage produces free radical.

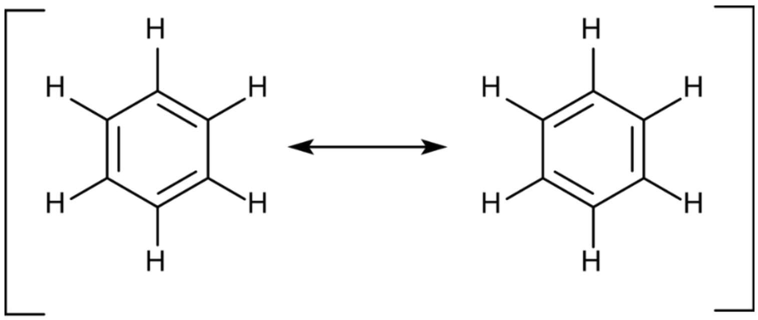
Heterolytic fission

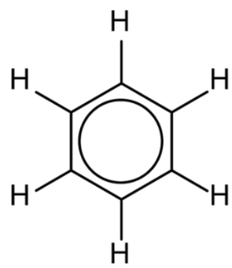
In this type of fission of covalent bond , the shared pair of electrons remain with one of the fragments.Hetrolytic fission produces carbocation and carboanion.

Electromeric effect

1. Within the molecule when electron pair are displaced internally within same atomic octet by some group or atom in presence of some attacking reagent , then the effect is called as electromeric effect.
2.This kind of effect is shown by molecule which contain multiple bonds.
3.This effect is shown due to attacking reagent.
4.Electromeric effect is positive(+E) and negative(-E).

Resonance





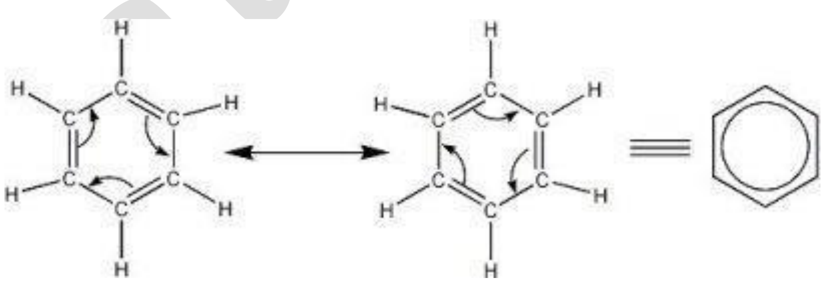
1. Resonance is the ability of system to move its pi electrons in the system.
2. The delocalized electron when show movement contributing structures are prepared , this structures are called as resonating structures.

Example : Benzene shows resonance.

Resonance effect

The mesomeric effect is a permanent effect. Re**sonance** or **mesomerism** is delocalised electrons within certain molecules havingh conjugated double bonds, and the position of double bond cannot be expressed by one single Lewis structure. A molecule or ion with such delocalized electrons is represented by several **contributing structures**(also called **resonance structures** or **canonical structures**).It is represented by M .

Resonance structure

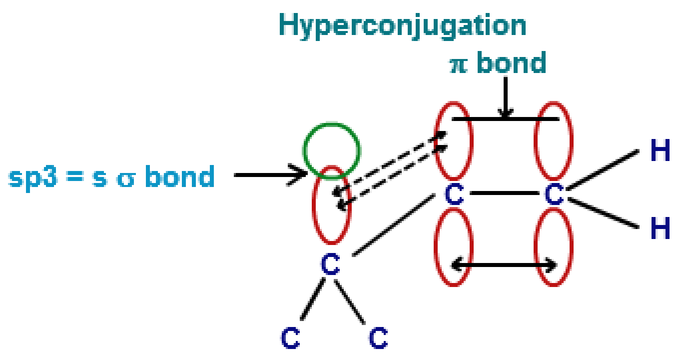


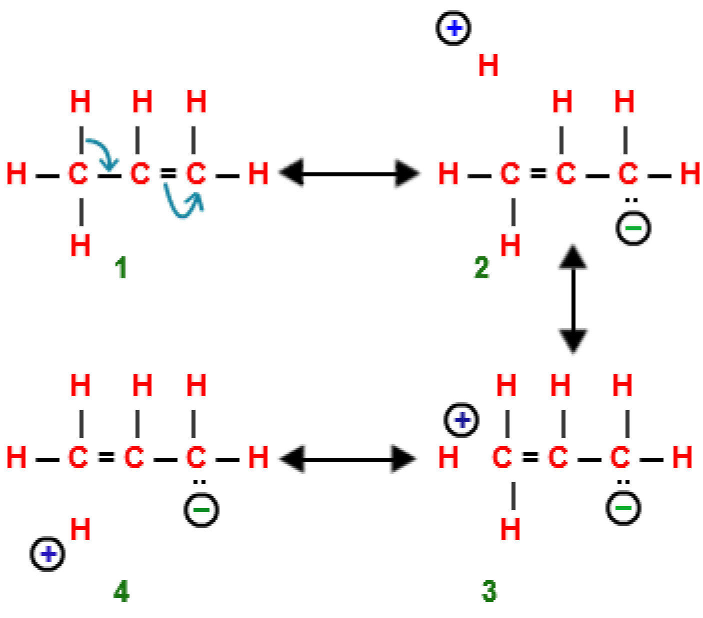
Resonance of benzene

Hyperconjugation

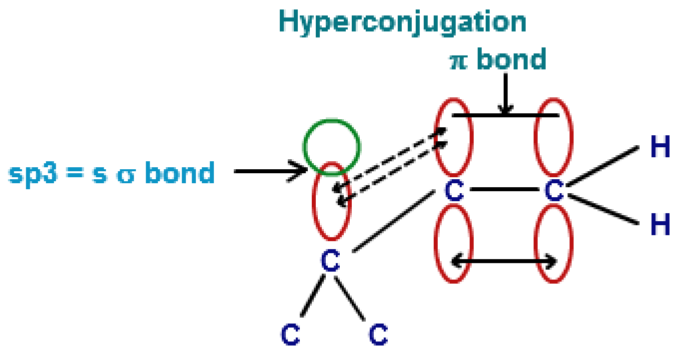
It is a general stabilising interation in which delocatisation of sigma electrons of C-H bond of an alkyl group directly attached to an atom of unsaturated system takes place.It provides stability to molecule.

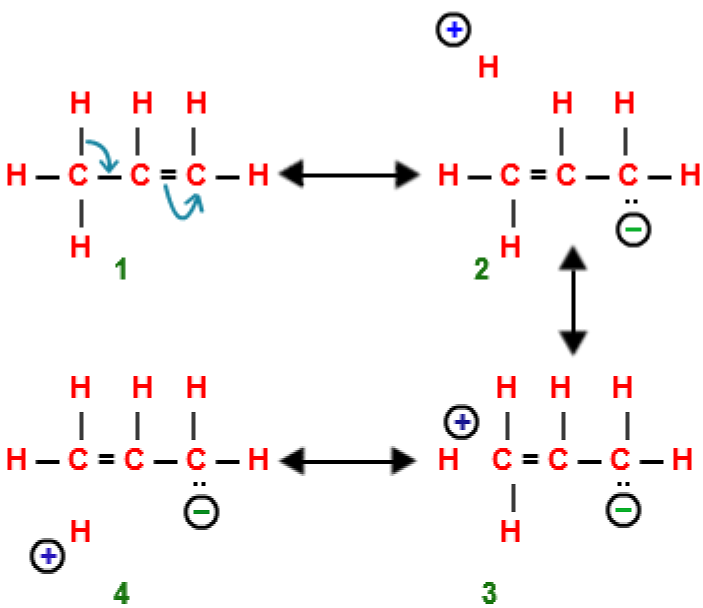
Hyperconjugative strutures





Reactive intermediates



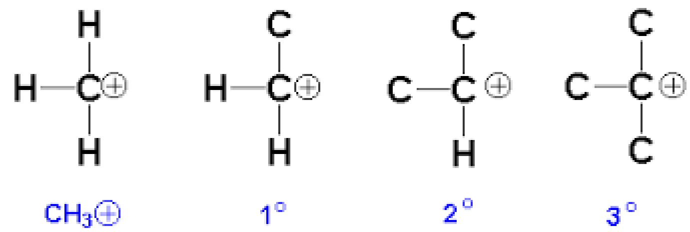


A reactive intermediate is a short-lived, high-energy, highly reactive molecule. When generated in a chemical reaction, it will quickly convert into a more stable molecule.
Example : carbocation, carboanion, free radicals etc.

Carbocation

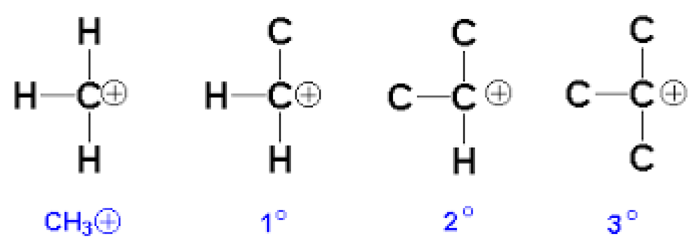
The reactive intermediates which is formed by heterolytic fission is called as carbocations.They carry positive charge on central carbon atom. Among simplest examples are methenium CH^{+3} carbocation.

Classification of carbocation



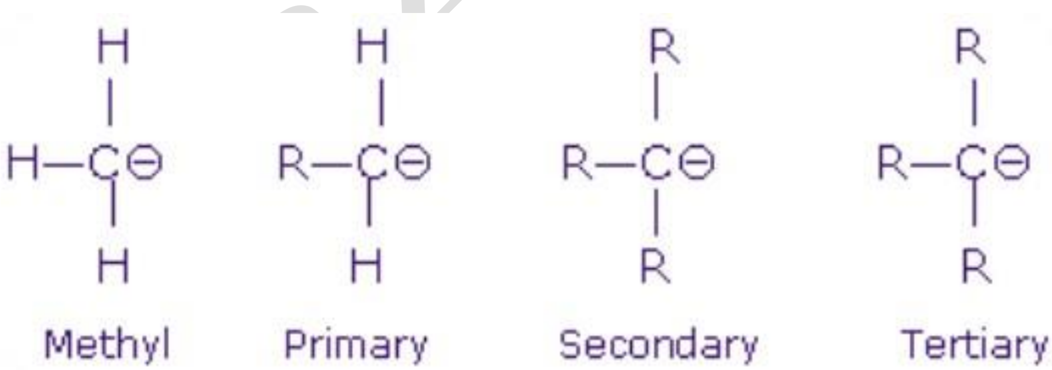
Carbocations are classified as Primary, Secondary, Tertiary carbocation.
The stability of carocation depends on resonance and decreasing electron density.
Carbocation reactivity depends on electron density.
Orbital structures :

Carboanions



The reaction intermediate which is formed by hetrolytic fission in which central carbon atom carry negative charge.
Example : Nucleophiles

Classification of carboanion



Carboanion are classified as Primary, Secondary, Tertiary .
Stability of carbocation depends upon Inductive effect, hyperconjugation, resonance.
Reactivity of carbocation increase if more electrondonating group is attched to it.

Benzyne and state its properties

Arynes or benzynes are highly reactive species derived from an aromatic ring by removal of two ortho substituents.
Arynes are usually best described as having a strained triple bond; however, they possess some biradical character as well. The term aryne is most closely associated with *ortho*-aryne (1,2-didehydrobenzene), however 1,3- and 1,4-didehydrobenzene intermediates have been described.

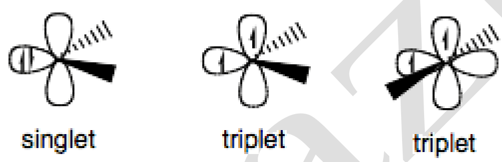
nitrenes and its properties

Nitrenes are uncharged, electron-deficient molecular fragments containing a nitrogen atom with only six electrons in its valence shell (5,6). Singlet state, with two pairs of electrons and a low energy empty orbital, and a triplet state, with one electron pair and two electrons with parallel spins, are possible.

Carbenes

A carbene is a molecule containing a neutral carbon atom with a valence of two and two unshared valence electrons. The general formula is R-(C**:**)-R' or R=C**:**.

Carbenes , its stability,reactivity,and orbital structure



The two classes of carbenes are singlet and triplet carbenes. Singlet carbenes are spin-paired. In the language of valency bond theory , the molecule adopts an *sp*2 hybrid structure.Triplet carbenes have two unpaired electrons. Most carbenes have a nonlinear triplet ground state, except for those with nitrogen, oxygen, or sulfur atoms, and halides directly bonded to the divalent carbon.

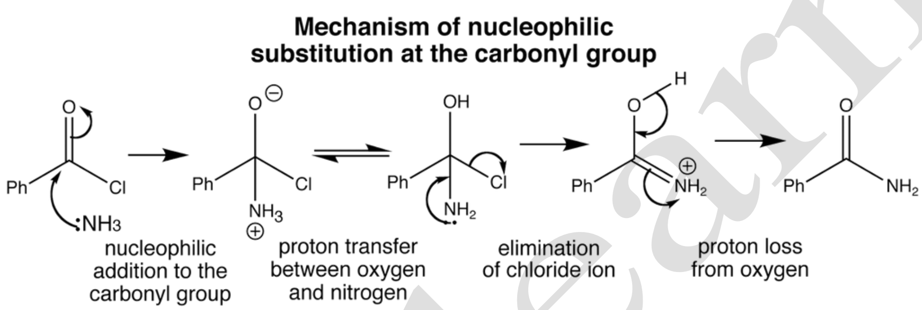
Classification of free radical

1. Free radical are classified as Primary, Secondary, Tertiary free radicals.
2. Its stability is depend upon attachment of electron donating group, and resonance.
3.Stability of free radicals are in the order:Tertiary>Secondary>Primary>CH_3CH3

Substitution reaction

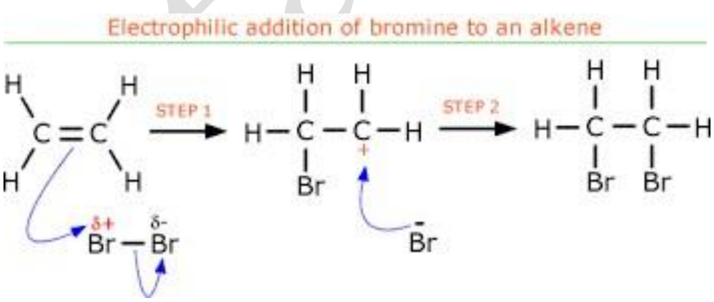
Substitution reaction (also known as single displacement reaction or single replacement reaction) is a chemical reaction during which one functional group in a chemical compound is replaced by another functional group.They are classified as electrophilic substitution reaction and nucleophilic substitution reaction depends upon attack of electro or nucleophile.

Mechanism of nucleophilic substitution reaction



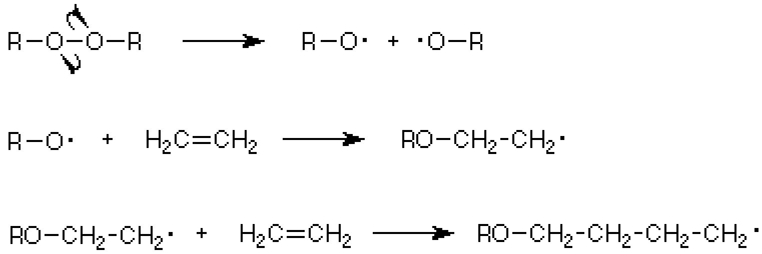
In this type of reaction, a nucleophile reacts with haloalkane having a partial positive charge on the carbon atom bonded halogen. A substitution reaction takes place and halogen atom, called leaving group departs as halide ion. Since the substitution reaction is initiated by a nucleophile, it is called nucleophile substitution.

Electrophilic addition reaction mechanism

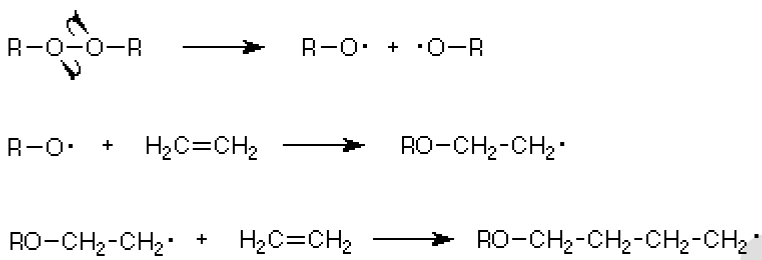


In this mechanism electrophile attacks on double bonded alkene as shown in figure.

Mechanism of free radical addition reaction

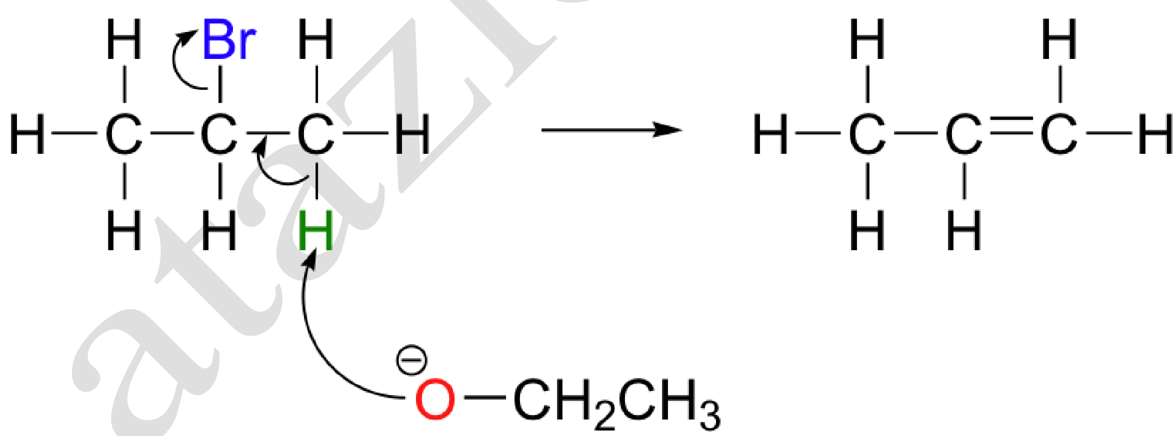


Elimination reaction



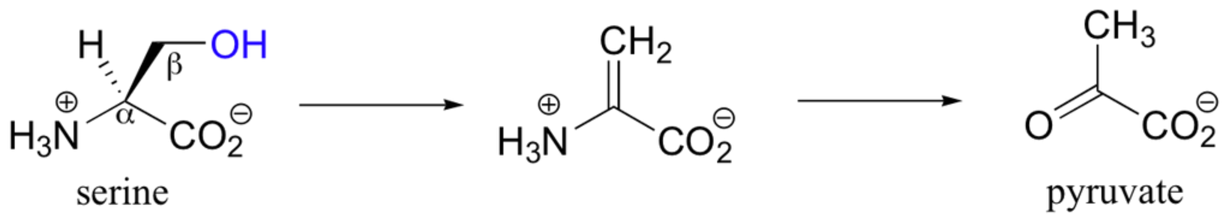
An elimination reaction is a type of organic reaction in which two substituents are removed from a molecule in either a one or two-step mechanism. The one-step mechanism is known as the E2 reaction, and the two-step mechanism is known as the E1 reaction.

Mechanism of alpha –elimination



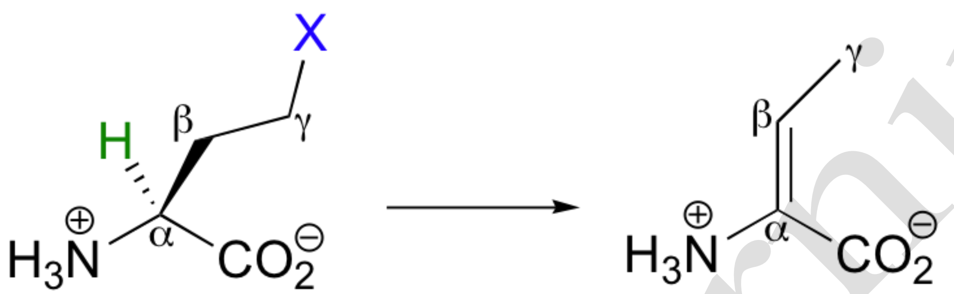
Alpha elimination reaction takes place in presence of base which attacks the alpha hydrogen atom and double bond structure is formed.

Mechanism of beta-elimination



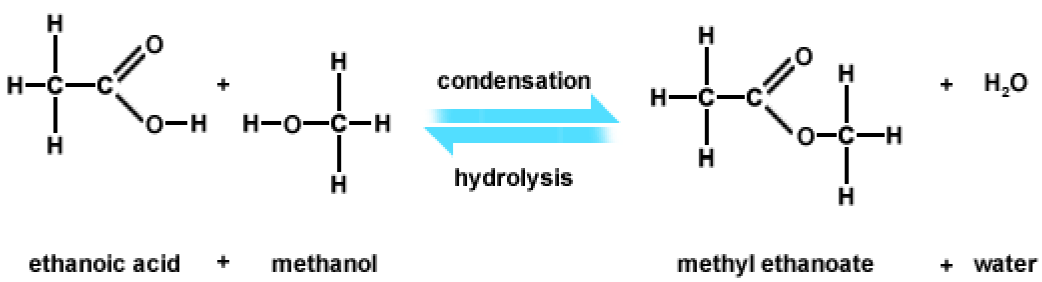
In this mechanism the H atom is replaced from beta position.

Gamma elimination reaction



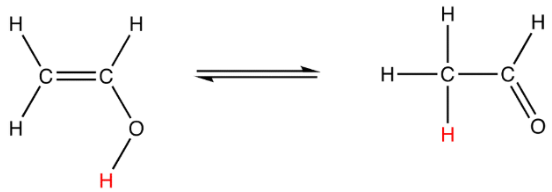
The mechanism of elimination reaction in which a atom , group is eliminated from gamma position is gamma elimination reaction.

Define condensation reaction



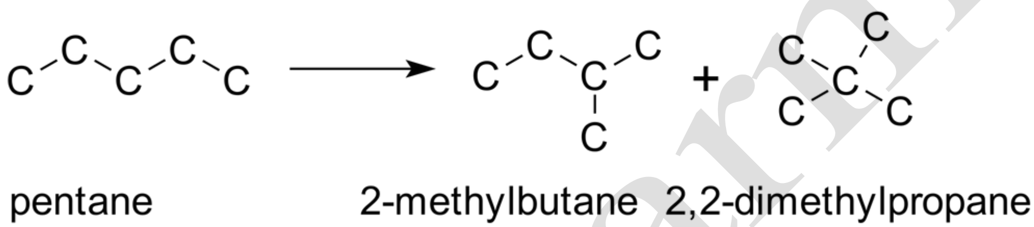
A condensation reaction is a chemical reaction in which two molecules combine to form a larger molecule, together with the loss of a small molecule.

Rearrangement reaction



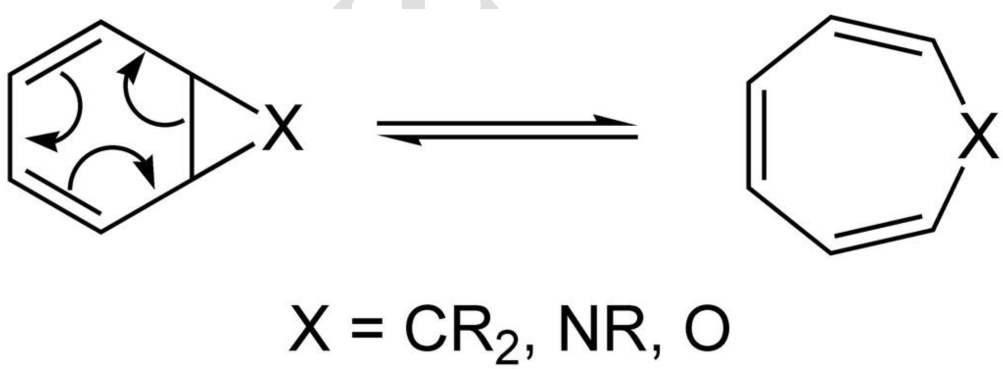
A rearrangement reaction is a broad class of organic reactions where the carbon intermediate of a molecule is rearranged to increase stability and give structural isomer of the original molecule. Often a substituent moves from one atom to another atom in the same molecule.

Isomerisation reactions



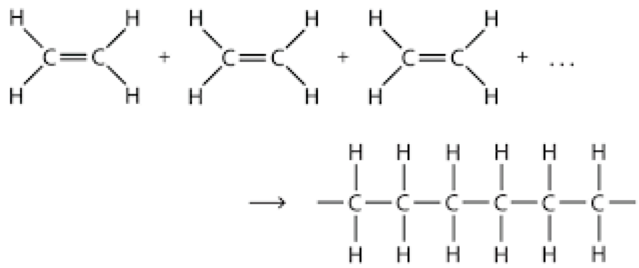
In chemistry,isomerization (also isomerisation) is the process by which one molecule is transformed into another molecule which has exactly the same atoms, but the atoms have a different arrangement e.g. A-B-C B-A-C

Pericyclic reaction



In organic chemistry, a pericyclic reaction is a type of organic reaction wherein the transition state of the molecule has a cyclic geometry, and the reaction progresses in a concerted fashion. Pericyclic reactions are usually rearrangement reactions.

Polymerization reaction



Polymerization is a process of reacting monomer molecules together in a chemical reaction to form polymer chains or three-dimensional networks.

Different methods of purification of organic compound

The common techniques used for purification are as follows :
1. Sublimation
2. Crystallisation
3. Distillation
4. Differential extraction
5. Chromatography

Crystallisation

In this process the impure compound is dissolved in a solvent in which it is highly soluble at high temperature and sparingly soluble at room temperature.The solution is concentrated to get saturated solution.On cooling the solution , pure compound crystallises out and is removed by filtration.

Process of fractional crystallization

In fractional crystallization the compound is mixed with a solvent, heated, and then gradually cooled so that, as each of its constituent components crystallizes, it can be removed in its pure form from the solution.In this method fractionating column are used to different components . Example : Different types of rock salts.

Distilation under reduced pressure

Vacuum distillation is a method of distillation whereby the pressure above the liquid mixture to be distilled is reduced to less than its vapor pressure (usually less than atmospheric pressure) causing evaporation of the most volatile liquid(s) (those with the lowest boiling point). This distillation method works on the principle that boiling occurs when the vapor pressure of a liquid exceeds the ambient pressure. Vacuum distillation is used with or without heating the mixture.
Example : Petroleum products

Steam distillation

Steam distillation is a special type of distillation for temperature sensitive materials like aromatic compounds.Many organic compounds tend to decompose at high sustained temperatures. Separation by distillation at the normal (1 atmosphere) boiling points is not an option, so water or steam is introduced into the distillation apparatus. The water vapor carries small amounts of the vaporized compounds to the condensation flask, where the condensed liquid phase separate, allowing for easy collection.
Example : Aromatic compounds

Differential extraction

The process of extraction of organic compound from it's aqueous solution by shaking it with an organic solvent in which it is insoluble is called as differential extraction.
Example : Separation of oil water mixture .

Chromatography and its example

Chromatography is defined as a technique for separation of mixture by passing it in solution through a medium in which the components moves with different rates. Based on the principle involved , chromatography is classified into different categories.
1. Adsorption chromatography
2. Partition chromatography
3. Thin layer chromatography
4. Paper chromatography

Define analytical chemistry

Analytical chemistry studies and uses instruments and methods used to separate, identify, and quantify matter.

Quantitative analysis

Analytical chemistry is the study of the separation, identification, and quantification of the chemical components of natural and artificial materials. In analytical chemistry, quantitative analysis gives an indication of the identity of the chemical species in the sample, and quantitative analysis determines the amount of certain components in the substance. The separation of components is often performed prior to analysis.

Detection of oxygen

There is no such test to directly indicate presence of oxygen. They are indicated by presence of functional groups which contain O, like alcohols, phenols, aldehyde etc.

Quantitative analysis

The percentage composition of elements present in an organic compound is determined by various methods .This analysis is called as quantitative analysis.

Principle and calculation of methods in estimation of carbon and hydrogen

Both C and H is estimated in one experiment . A known mass of an organic compound is burnt in the presence of excess of oxygen and copper(2) oxide.Carbon and hydrogen in the compound are oxidised to carbon dioxide and water respectively.The mass of water produced is determined by passing the mixture through a weighed U -tube containing concentrated solution of potassium hydroxide.

Calculation of amount of nitrogen

The method consists of combusting a sample of known mass in a high temperature (about 900C) chamber in the presence of oxygen. This leads to the release of carbon dioxide, water and nitrogen.
The gases are then passed over special columns(such as potassium hydroxide aqueous solution)

that absorb the carbon dioxide and water. A column containing a thermal conductivity detector at the end is then used to separate the nitrogen from any residual carbon dioxide and water and the remaining nitrogen content is measured.

Estimation of amount of halogen

A known mass of an organic compound is heated with fuming nitric acid in the presence of silver nitrate contained in a hard glass tube, known as Carius tube, in a furnace.Carbon and hydrogen present in the compound are oxidised to carbon dioxide and water. The halogen present forms the corresponding silver halide (AgX). It is filtered, washed, dried and weighed.
Let the mass of organic compound taken = m g
Mass of AgX formed = m1 g
1 mol of AgX contains 1 mol of X
Mass of halogen in m1 g of AgX = (atomic mass of X x m1)/(molecular mass of AgX)

Estimation of phosphorous

A known mass of an organic compound is heated with fuming nitric acid where upon phosphorous present in the compound is oxidized to phosphoric acid .The mass of phosphoric acid provides the percentage of phosphorous.

Understand the molecular mass by silver salt and chloroplatinate method

A known mass of organic base is treated with chloroplatinic acid to form chloroplatinate salt. These salt on heating decompose to give metallic platinum.
A known mass of a carboxylic acid is dissolved in ammonium hydroxide. The ammonium salt of the acid is treated with silver nitrate to obtain the silver salt of the acid. The silver salt of the acid is ignited and metallic silver is obtained as residue.

The percentage of oxygen in an organic compound is usually found by difference between the total percentage composition and the sum of the percentage of all other elements.

Living chemistry

The chemistry of substances produced by living organisms but now extended to substances synthesized artificially is called as living chemistry.

Modern definition of organic chemistry

Organic chemistry can be defined as the study of carbon compounds. The branch of chemistry that studies the formation and properties of organic compounds is known as organic chemistry.

Organic compounds

Earlier people thought that compounds which are obtained from plants and animals are organic compounds and compounds which are obtained from minerals, non-living sources are termed as inorganic compounds. According to the modern definition, an organic compound is any compounds whose molecules contain carbon.

Inorganic compounds

An inorganic compound is a compound that does not contain a carbon to hydrogen bond, also called a C-H bond. Moreover, inorganic compounds tend to be minerals or geologically-based compounds that do not contain carbon to hydrogen bonds.

Organic and Inorganic compounds

Organic compounds contain carbon atom(s) and often hydrogen atoms. e.g. methane, ethanol, etc.
Inorganic compounds don't contain Carbon to hydrogen bond(s). e.g. sodium chloride

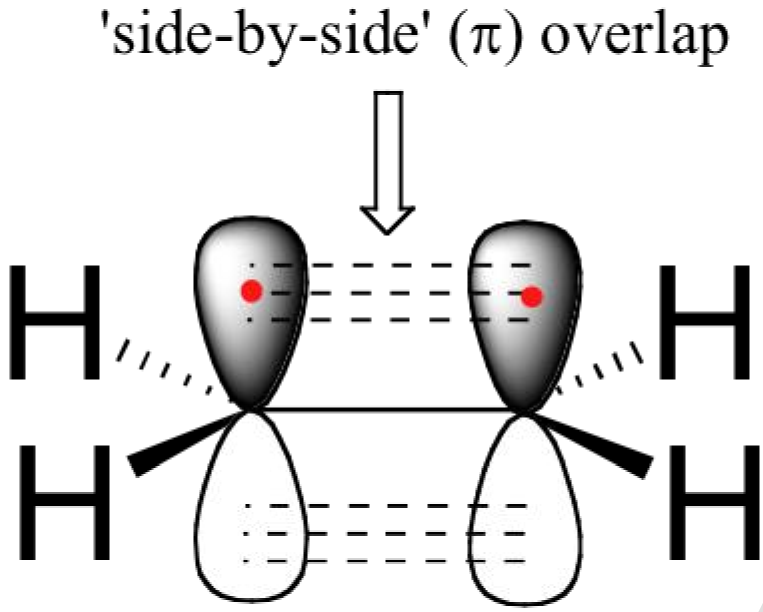
Vital force theory

The vital force theory was a philosophical, scientific and spiritual belief that organic material contained a "vital force" that enabled them to live.

Shapes of simple organic molecule

1. Shapes of simple organic molecule depends upon its hybridization state .
2. Like carbon shows $sp^3$3 hybridization in methane hence the shape is tetrahedral while in case ethene it shows $sp^2$2 hybridization hence the shape is trigonal planar.
3. Alkyne molecule shows sp hybridization hence shape is linear.

Characteristics of pi bonds



1. Pi (π) bond formation takes place by parallel orientation of the two p orbitals in adjacent atoms by proper sideways overlap.
2. Thus in any molecule in which pi bond formation takes place all the atoms must be in the same plane.
3. Thus in pi bond carbon carbon double bond rotation is restricted due to maximum overlap of p orbitals.
4.Example : Ethene molecule

Effect of hybridazation on bond lengths and bond strengths

The length and strength of a CH bond depend on the hybridization of the carbon atom to which the hydrogen is attached. The more s character in the orbital used by carbon to form the bond, the shorter and stronger is the bond because an s orbital is closer to the nucleus than is a p orbital.

Complete and condensed formulae of organic compounds

The structural formula in which a covalent bond is represented by dash,
(single bond is by 1 dash, double bond by 2 dash and triple bond by 3 dash)provides the exact information about the compound is called as complete structure.The structural formula represented by omitting some dashes indicating the covalent bond is called as condensed formula.

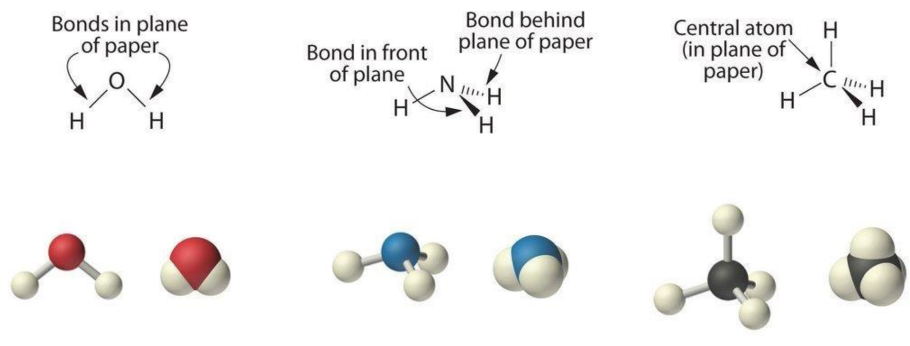
Bond line structural formule

The structural formulas in which C and C are shown only by lines which represent carbon-carbon bonds and assuming that the remaining valencies are satisfied by hydrogens, are called as bond-line structural formula.

Polygon formulae of organic compound

The formulae in which different types of structures like triangle, square , pentagon, hexagon etc are used for representation is called as polygon formulae .

3-D Representation of organic molecules



(a) Water, H_2O **(b) Ammonia, NH_3** **(c) Methane, CH_4**

1.The three - dimensional structure of organic molecules can be represented on paper by using certain conventions.
For example: by using solid and dashed wedge formula a three dimensional picture is represented.

Natural sources of organic compounds

Plants, animals, coal and petroleum are the natural sources of organic compounds.

Importance of organic compounds

Organic compounds are important because all living organisms contain carbon. While carbohydrates, proteins and fats are the basic structures of life, organic compounds are also the basic components of many of the cycles that drive the earth, primarily the carbon cycle including the exchange of carbon between plants and animals in photosynthesis and cellular respiration.

Properties of organic compounds containing covalent bonds

Organic compounds have relatively low melting points and boiling points in comparison to the inorganic compounds of a similar molecular mass. Organic acids and bases are less stronger and they have a limited dissociation in aqueous medium. Organic compounds with metal combinations are called organometallic compounds which are industrially a very important compounds used as catalysts, promoters, analysers and stabilizers.

Heteroatom

A heteroatom is any atom other than carbon or hydrogen in an organic molecule.

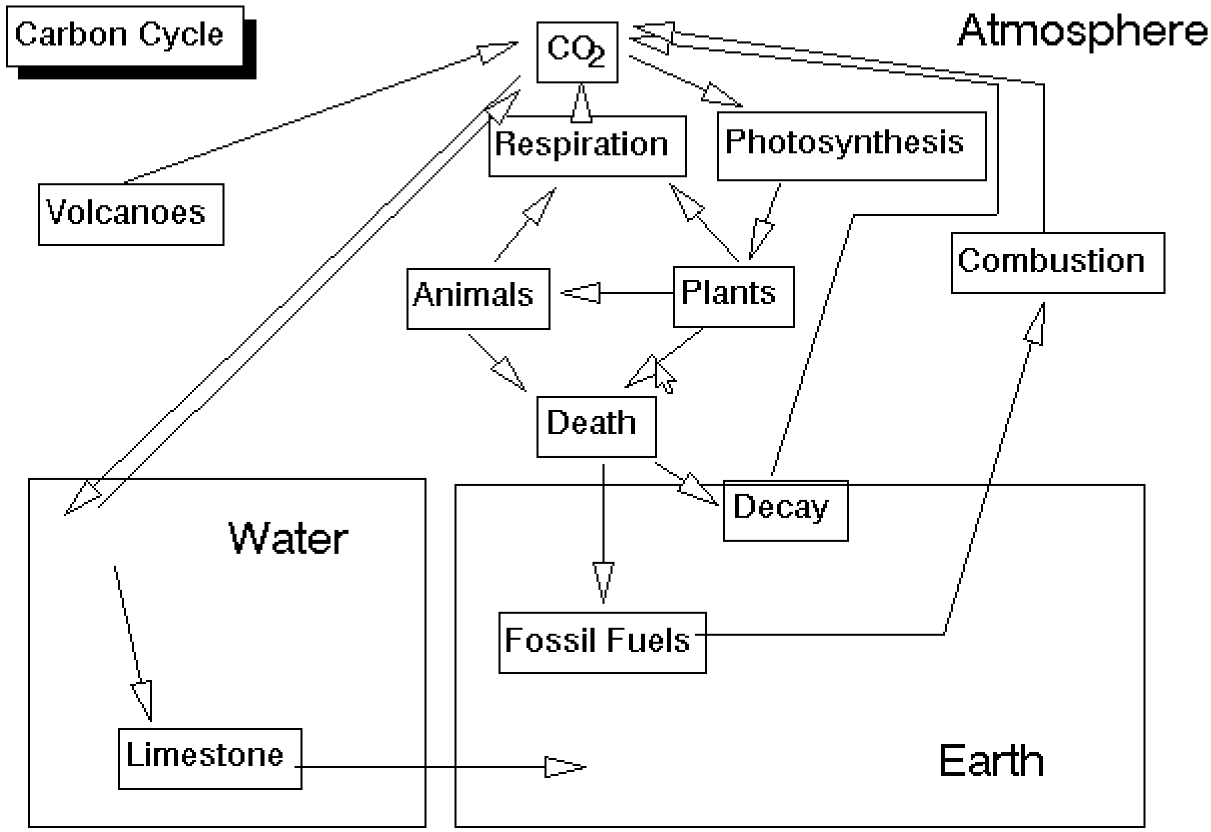
Describe carbon

1. Carbon is an element with atomic number 6 with symbol C.
2. Carbon shows sp^3sp3 hybridization hence its valence is 4 and it is called as tetravalent.
3. Carbon is most commonly obtained from coal deposits, although it usually must be processed into a form suitable for commercial use.
4. Three naturally occurring allotropes of carbon are known to exist: amorphous, graphite and diamond.
5. Carbon present in saturated form eg. Alkane where it contain single bond.
6. Carbon in unsaturation shows double and triple bond eg. Alkene and Alkyne.

Catenation

Catenation is the linkage of atoms of the same element into longer chains. It occurs most readily in carbon, which forms covalent bonds with other carbon atoms to form longer chains and structures. e.g. pentane, butane, etc.

Carbon cycle



1. The carbon cycle is the circulation and transformation of carbon with biosphere,hydrosphere and atmosphere of the earth.
2. The carbon cycle comprises a sequence of events that are key to making the Earth capable of sustaining life. It describes the movement of carbon as it is recycled and reused throughout the biosphere, including carbon sinks.

Allotropes

Allotropy is the property of an element to exist in more than one physical forms having similar chemical properties but different physical properties. Carbon exists both in crystalline and amorphous allotropic forms.

Tetravalency of 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. It is tetravalent in nature.

Allotropes of carbon

Allotropy is the property of an element to exist in more than one physical forms having similar chemical properties but different physical properties. Carbon exists both in crystalline and amorphous allotropic forms. Crystalline allotropes of carbon: diamond, graphite and fullerene. Amorphous allotropes of carbon: coal, coke, charcoal, lampblack, gas and coke.

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.

Versatile nature of carbon

The unique nature of carbon atom and the arrangement of the bond carbon forms with other atoms enable the existence of a large number of organic compounds. It can form so many compounds due its tetravalent nature and catenation property.

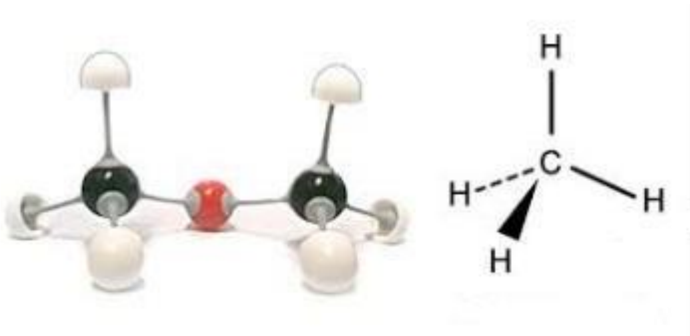
Saturated carbon compounds

Saturated hydrocarbons are molecules that only contain single bonds and a maximum amount of hydrogen atoms bonded to the carbon atom present. eg C_2H_6.

Chain, branch and ring structure of carbon compound

The compounds of carbon in which all the carbon atoms are connected in a straight chain are called straight chain molecules. Branched chain compounds consist of one or more carbon atoms of a straight chain compound forming bonds with more than two carbon atoms. Ring chain compounds consist of a ring of carbon atoms.

3-d representation of organic molecule



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