A Review on General Organic Chemistry

Samruddhi Thombare[1], Payal Shitole[2], Najiya Shikilkar[3], Pratiksha Ovhal[4], Prof. Priya B. Kulal[5]
[1, 2, 3, 4, 5] Dept of Chemistry
[1, 2, 3, 4, 5] Eknath Sitaram Divekar College Of Pharmacy, Varvand

Abstract- *General Organic Chemistry (GOC) introduces students to the fundamental ideas of organic chemistry. A solid comprehension of the principles covered by General Organic Chemistry is essential for studying more advanced topics (such as the mechanisms of named reactions). Berzelius (1808) introduced the vital force theory and defined organic chemistry as the chemistry of chemicals contained in living matter. Wohler's synthesis of urea, the first organic chemical synthesized in a laboratory, delivered a fatal blow to the vital force idea.*

Organic compounds are hydrocarbons and their derivatives. Organic chemistry is the branch of chemistry that deals with these substances. Carbon typically catenates with four valence electrons, suggesting that it binds to itself, resulting in the formation of different compounds. Long chains of carbon atoms and hydrogens, such as dodecane, can be found, as can bands of carbon, such as anthracene, or complex structures of carbon and other atoms, such as the steroid estradiol. Organic biochemistry is the scholarly study of particles that have carbon atoms. Carbon frequently catenates with four valence electrons, indicating it binds to itself, developing various compounds. You can find lengthy chains of carbon atoms and hydrogens, such as dodecane, bands of carbon such as anthracene, or complex structures and other atoms like the steroid estradiol. Many reactions can be brand new contacts and there can be new types of comprehending them. These are the result of hundreds of years of hard work to separate chemicals, figuring out what they're doing, and coming across accidents, which have resulted in innovative ideas.

Keywords- Catenates , Dodecane, Estradiol, Anthracene, Comprehension, Berzelius.

I. INTRODUCTION

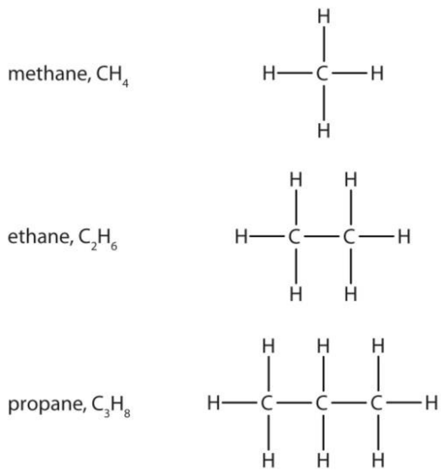
Organic Chemistry- is the study of the chemistry of carbon compounds. Carbon is singled out because it has a chemical diversity unrivaled by any other chemical element. Its diversity is based on the following:

- Carbon atoms bond reasonably strongly with other carbon atoms.
- Carbon atoms bond reasonably strongly with atoms of other elements.
- Carbon atoms make a large number of covalent bonds (four).

Curiously, elemental carbon is not particularly abundant. It does not even appear in the list of the most common elements in Earth's crust. Nevertheless, all living things consist of organic compounds.

Most organic chemicals are covalent compounds, which is why we introduce organic chemistry here. By convention, compounds containing carbonate ions and bicarbonate ions, as well as carbon dioxide and carbon monoxide, are not considered part of organic chemistry, even though they contain carbon.

The simplest organic compounds are the hydrocarbons, compounds composed of carbon and hydrogen atoms only. Some hydrocarbons have only single bonds and appear as a chain (which can be a straight chain or can have branches) of carbon atoms also bonded to hydrogen atoms. These hydrocarbons are called alkanes (saturated hydrocarbons). Each alkane has a characteristic, systematic name depending on the number of carbon atoms in the molecule. These names consist of a stem that indicates the number of carbon atoms in the chain plus the ending *–ane*. The stem *meth–* means one carbon atom, so methane is an alkane with one carbon atom. Similarly, the stem *eth–* means two carbon atoms; ethane is an alkane with two carbon atoms. Continuing, the stem *prop–* means three carbon atoms, so propane is an alkane with three carbon atoms."Formulas and Molecular Models of the Three Simplest Alkanes" gives the formulas and the molecular models of the three simplest alkanes.



The three smallest alkanes are methane, ethane, and propane.

Some hydrocarbons have one or more carbon–carbon double bonds (denoted C=C). These hydrocarbons are called alkenes. Note that the names of alkenes have the same stem as the alkane with the same number of carbon atoms in its chain but have the ending *–ene*. Thus, ethene is an alkene with two carbon atoms per molecule, and propene is a compound with three carbon atoms and one double bond.

Birth of Organic Chemistry-

Flowers like willow, ephemera, and poppies were understood by old civilisations having medicine. In the early 1800s, there was a breakthrough in understanding their properties being medical, and people started to extract therapeutic chemicals from their websites. These plants in today's time contain organic compounds, and this is certainly medical, like salicylic acid, ephedrine, and morphine. Organic implies 'derived from residing things'. The Swedish chemist Jöns Jacob Berzeliuso discovered a few elements that developed the current substance symbols being made use of today.

Basics of General Organic Chemistry-

Language is difficult, and it is especially complicated in scientific biochemistry studies. The International Union of Pure and Applied Chemistry, otherwise known as IUPAC, was established in 1919 to unite the medical community. This group wanted to make sure chemists all over the global world could communicate effectively. Now there are some standard guidelines for naming organic chemistry.

There are three basic steps to IUPAC in systematic naming:

- Get a hold of the longest carbon sequence and its root name.
- Identify the highest priority functional group and add its suffix to the root title.
- Identify the types of substitution and their particular roles from the carbon string, adding a prefix that is numbered to the basis title.

The simplest form of organic molecules are hydrocarbons, which only have hydrogen and carbon atoms. There are four hydrocarbons: alkanes, alkenes, alkynes, and aromatics- reaction.

- **Reaction Mechanism of General Organic Chemistry-**

Effect mechanisms maps that can easily be detailed show us the paths we can need and notable pits along the way. An effect mechanism is a step by step sequence that helps us keep tabs on electron movements, bonds that type and break, and any molecules that appear on top of a chemical reaction in simple terms.

Reactants Catalyst or Energy → Intermediate (Transition State) → Product

The reactants of an effect that is organic are classified as:

Reagent: The reactant that supplies C towards the new bond to other reactants is named reagent.

Substrate: After that, the option is arbitrary and for a reason; in that case, the molecule on which the attention is focused is called the substrate if both reactants provide C to the new bond.

Important GOC Topics -

Electrophiles and Nucleophiles-

Electrophile: A reagent that takes away an e-pair (E+); in simple words, these regions love electrons.

Nucleophiles: A region that adds an e-pair (N) nuclear; in simple words, these regions are the lover of the molecule's positive regions.

Inductive effect (+I and – I Effects)

Based on the ability of substitutions to withdraw or donate electrons, it can be classified as : electron-withdrawing or electron-donating electron groups relative to hydrogen.

Electromeric Effect (+E and –E Effects)

The consequence is electrometric. It is seen only in that organic element with numerous bonds (double relationship or triple bond). When the electron pair moves towards the attacking reagent, it is a +E impact that is electrometric. It is a- E impact electrometric whenever the electron pair moves away from the attacking reagent.

Hyperconjugation

Hyperconjugation is a permanent effect, and it's a gene interaction that stabilises. It involves delocalisation of the C-H bond associated with the alkyl team directly attached with an atom with a p-orbital that is unshared.

Resonance and Resonance Effect

It is defined because of the polarity produced in the molecule by the interaction of two bonds and a loving pair of electron's present on an adjacent atom.

- Positive Resonance Effect (+R) – In this effect, the transfer of e-s is away from the subsequent atom group attached to the conjugated system. This e-s displacement makes certain positions in the molecule or high e- densities.
- Negative Resonance Effect (-R) – Transfer of e- towards the substituent.

Isomeric – Structural Isomeric and Stereoisomerism

Isomers are compounds that are identical molecular formulas, but they differ in structures. Isomers can be subdivided into two categories:

- **Structural isomeric:** Compounds with the same molecular formula but different connectivity of atoms.
- **Stereoisomerism:** Compounds that have identical formulas and connectivity but differ in arrangements of atoms in space.

General Properties of Organic Compound-

1. These are carbon compounds containing H, O, N, S, P, F, CI, Br, and I.
2. These are common in living beings. Carbohydrates, proteins, and so on.
3. These can be either gases, liquids, or solids.
4. Because they are covalent, they have a low boiling and melting point and are soluble in organic solvents.
5. These are often flammable and volatile.
6. Because there are no free ions, they do not conduct electricity.
7. They have a distinct color and aroma.

Terms involved in organic chemistry-

Nomenclature

The International Union of Pure and Applied Chemistry, or IUPAC, was founded in 1919 to bring the medical community together. This organization intended to ensure that chemists from all around the world could communicate successfully. There are now some general criteria for naming organic compounds. The most significant aspect of this method is that each molecular structure has only one IUPAC designation that corresponds to only one molecular structure.

The key features of the IUPAC system

- Only one name can be assigned to a given compound.
- The writing of a single chemical structure can be directed by a specified name.
- The approach is useful for naming complex organic substances.
- The approach is useful for naming multifunctional organic molecules.
- This is a straightforward, systematic, and scientific approach to organic compound nomenclature.

Any organic compounds IUPAC name is composed of two or three elements.

- word root
- suffix
- prefix

The fundamental unit is a set of word roots that represent linear or continuous chains of atoms of carbon. The carbon chain with the greatest number of carbon is chosen as the root word.

Primary suffixes are added to root words to indicate saturation or unsaturation in a carbon chain.

Secondary suffixes are suffixes that are added after the primary suffix to indicate the existence of a certain functional group in the carbon chain.

Hybridization

S and p orbitals are involved in hybridization in organic or carbon molecules. This results in three types of hybridization: sp^3(in alkanes), sp^2(in alkenes), and sp (in alkayes). Generally, alkanes are tetrahedral in shape, alkenes are linear molecules, and alkynes are linear in shape.

Functional groups

The functional groups are the reactive groups present in compounds that determine the chemical properties of these compounds. Eg: -OH, -F, -CHO, -COOH.

Homologous series

A homologous series is a family of organic compounds with the same functional group, identical chemical characteristics, and successive members that differ in molecular formula by —CH2 units.

Members of a homologous series can be represented by the same general molecular formula.

Reaction mechanism of general organic chemistry-

Effect mechanism maps that are easily detailed show us the paths we may require as well as noticeable problems along the way. In simple terms, an effect mechanism is a step-by-step sequence that lets us keep track of electron movements, bonds that form and break, and any molecules that arise on top of a chemical reaction. Generally, the reaction mechanism involves:

Reactants + Catalyst or Energy → Intermediate (Transition State) → Product

Appropriate reaction conditions assist in the production of a transition from the synthetic response between the reactants.

These intermediates are often unstable, yet they react rapidly and provide a final product.

The reactants in a natural response are organized as follows:

Reagents are responsive compound species that initiate a response by attacking another species.

The substrate is the species that is attacked by the reagent in a natural response.

Depending on whether the reagent is electrophilic or nucleophilic, the area of reagent attack changes:- Electrophiles are electron-deficient entities that attack the substrate in an electron-rich region.

Nucleophiles are elements that have a lot of electrons and enjoy giving them away. Nucleophiles often attack the reagent at a low electron density region.

Bond Cleavage in organic chemistry-

In most substance processes, existing compound bonds break down and new synthetic bonds are formed. There are two ways to break a covalent bond:

1. Homolytic Fission

It occurs when a covalent bond breaks off, leaving each molecule with one unpaired electron. Free radicals are complex compounds formed by homolytic fission. They are extremely sensitive (due to their unpredictable electron arrangements).

2. **Heterolytic Fission**

It occurs when a covalent bond breaks down to the point where one molecule retains two electrons while the other particle retains none. A component of heterolytic fission is the formation of a particle pair consisting of an effectively charged cation and an adversely charged anion.

Reaction intermediate involved in general organic chemistry-

Heterolytic and homolytic bond fission produce short-lived fragments known as reaction intermediates. Carbonium ions, carbanions, carbon-free radicals, nitrenes, and carbenes are among the main chemical intermediates.

Free radicals

These are homolysis byproducts with an odd electron. With Sp2 hybridization, these are extremely reactive planar species.

Carbocations

Carbonium ions or carbocations are organic ions that contain a positively charged carbon atom. They are produced as a result of heterolytic bond fission. These are also planar chemical species, particularly sp2 hybridized with an empty p-orbital.

Carbanion

An organic ion with a negatively charged carbon atom is known as a carbanion. They are also produced as a result of heterolytic bond fission. These are pyramidal and made of Sp3 hybridized carbon (one lone pair).

Carbene

These are divalent carbon species with two bond pairs and two non-bonding electrons. These are produced via photolysis or pyrolysis.

The C-atom in singlet carbene is Sp2 hybridized. In these species, a hybridized orbital has no electrons, whereas a hybridized orbital has two electrons. Singlet carbene has a bent structure and is less stable than triplet carbene. The central C-atom in triplet carbene is sp-hybridized. Each sp – sp-hybridized orbital has one electron. The geometry of a triplet carbene is linear.

Nitrene

These are neutral monovalent nitrogen species having two unshared pairs of electrons on the N atom and a monovalent atom or group attached.

Isomerism-

Isomerism occurs when two or more compounds have the same molecular formula but different structural formulas and differing physical and chemical characteristics. These chemicals are known as isomers.

There are two different types of isomerism:

Structural isomerism

Compounds with the same molecular formula but different structural formulae differ in the arrangement of atoms exhibit structural isomerism. Structural isomerism is further divided into various types. They are:

Chain isomerism: Chain isomers are isomeric compounds that differ solely in the arrangement of carbon atoms in the base chain, and chain isomerism refers to their isomeric connection.

Positional isomerism: Isomers have similar functional groups but are positioned at different places on the same carbon chain in position isomerism. This isomerism is often induced by functional groups attaching to different carbon atoms in the carbon chain.

Functional isomerism: Isomers with the same chemical formula but different functional groups are known as functional group isomers, and the process is known as functional group isomerism.

Metamerism: The relative position of alkyl groups surrounding polyvalent functional groups (such as S, N, O, and CO) in a molecule at different places causes this sort of isomerism. The existence of separate alkyl chains on each side of the functional group causes metamerism.

Stereoisomerism

Stereoisomerism occurs when isomers are generated by differing atomic or group configurations in space. The stereoisomers have the same structural formula but differ in how the atoms are arranged in space. It is further divided into different types:

Conformational isomerism

Stereoisomers can be interconverted in conformational isomerism by rotating around one or more single bonds, the bonds. These rotations provide non-superimposable atomic configurations in space.

Configurational isomerism

Stereoisomerism happens when different atomic or group configurations in space produce isomers. The stereoisomers have the same structural formula but differ in the arrangement of the atoms in space.

Geometrical isomerism

Geometrical isomerism, also known as cis-trans isomerism, occurs when atoms are unable to freely rotate due to a rigid structure, such as that found in compounds with carbon-carbon, carbon-nitrogen, or nitrogen-nitrogen double bonds, where the rigidity is due to the double bond, and cyclic compounds, where the rigidity is due to the ring structure.

The geometric isomerism is thus caused by the double bond between the two carbon atoms. Geometrical isomers are chemical isomers that differ in the spatial arrangement of groups or atoms but do not display optical activity.

Cis isomer indicates the orientation when the two largest substituents are on the same side of the double bond. When the two substituents with the highest priority are on the same side of the double bond, the orientation is defined as a trans isomer.

What do organic chemists do?

Organic chemistry is a highly creative science that allows chemists to create and explore molecules and compounds. Organic chemists spend much of their time developing new compounds and finding better ways of synthesizing existing ones.

Where is organic chemistry used?

Organic compounds are all around us. Many modern materials are at least partially composed of organic compounds. They're central to economic growth, and are foundational to the fields of biochemistry, biotechnology, and medicine. Examples of where you can find organic compounds include agrichemicals, coatings, cosmetics, detergent, dyestuff, food, fuel, petrochemicals, pharmaceuticals, plastics, and rubber.

Which industries hire organic chemists?

Biotechnology

Virtually all biotechnology ("biotech") products are the result of organic chemistry. Biotech involves using living organisms and bioprocesses to create or modify products for a specific use. For example, a biotech company might produce seeds for crops that are disease-resistant, or plants that are drought-resistant.

Common employment areas in biotechnology include:

- Health care
- Crop production and agriculture
- Nonfood uses of crops
- Consumer products (e.g., biodegradable plastics, vegetable oil)
- Environmental sector
- Biofuels

Consumer Products

Most consumer products we use involve organic chemistry. Take the cosmetics industry as an example. Organic chemistry examines how the skin responds to metabolic and environmental factors, and chemists formulate products accordingly.

Other examples of everyday products that involve organic chemistry include soaps, plastic goods, perfume, coal, and food additives.

Organic Industrial Chemistry

Crucial to modern world economies, organic industrial chemistry focuses on converting raw materials (e.g., oil, natural gas, air, water, metals, and minerals) into consumer and industrial products.

Today, organic industrial chemistry is based mainly on petroleum and natural gas. Because these are finite raw materials, a lot of industry focus is on learning how to convert renewable resources (e.g., plants) into industrial organic chemicals.

Major organic industrial chemistry sectors include:

- Rubber and plastic products
- Textiles and apparel
- Petroleum refining
- Pulp and paper
- Primary metals

Petroleum

The largest-volume petroleum products are fuel oil and gasoline. Petroleum is also the raw material for many chemical products (e.g., pharmaceuticals, solvents, fertilizers, pesticides, and plastics).

The petroleum industry is usually divided into three major components:

- Upstream – Exploration and production
- Midstream – Transportation
- Downstream – Refining crude oil, processing and purifying natural gas, creating petrochemicals

Pharmaceutical-

The pharmaceutical industry develops, produces, and markets drugs used as medications for humans or animals. Some pharmaceutical companies deal in brand-name (i.e., has a trade name and can be produced and sold only by the company holding the patent) and/or generic (i.e., chemically equivalent, lower-cost version of a brand-name drug) medications and medical devices (agents that act on diseases without chemical interaction with the body).

Pharmaceuticals (brand name and generic) and medical devices are subject to many country-specific laws and regulations regarding patenting, testing, safety assurance, efficacy, monitoring, and marketing.

Types of Organic Reactions

There are five main types of organic reactions that can take place. They are as follows:

- Substitution reactions
- Elimination reactions
- Addition reactions
- Radical reactions
- Oxidation-Reduction Reactions

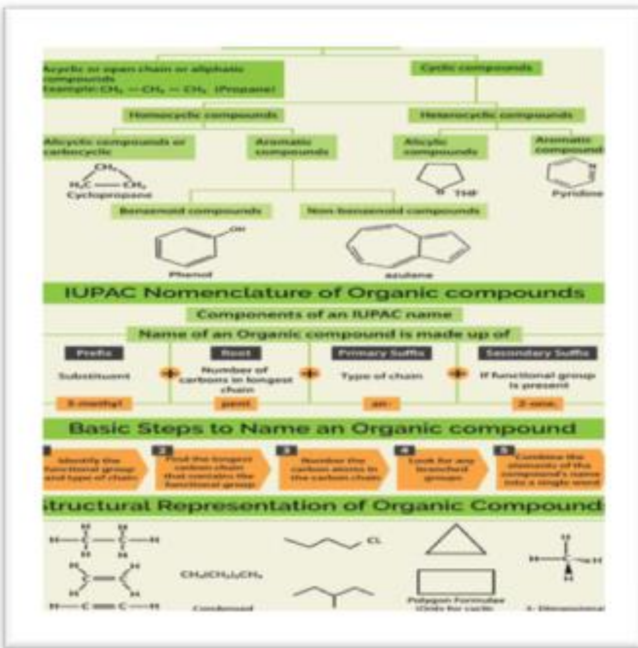


Fig- structure and nomenclature

Result and Discussion

Organic chemistry is the chemistry of compounds of carbon. Carbon is unique among the other elements in that its atoms can form stable covalent bonds with each other and with atoms of other elements in a multitude of variations. The resulting molecules can contain from one to millions of carbon atoms.

II. CONCLUSION

Organic chemistry takes everything we all know and love, from general organic chemistry to the amount this is certainly next from electrons to acid-base reactions. Except, that implies that they are natural, but we're specifically working with the chemistry of carbon. Through interesting frameworks, it will make into the reactions that carbon-containing compounds do.

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