

Introduction to Organic Chemistry

Introduction to Organic Chemistry – Study Notes

1. What Is Organic Chemistry?

- **Definition:** The branch of chemistry that studies carbon-containing compounds (with the exception of a few simple carbon oxides and carbonates).
 - **Scope:** Includes hydrocarbons, functionalized molecules, biomolecules, polymers, and many industrial chemicals.
 - **Why It Matters:**
 - Basis of life science disciplines (biochemistry, pharmacology, genetics).
 - Foundations for materials science, petrochemistry, and green chemistry.
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2. Core Concepts

Concept	Key Points	Typical Examples
Carbon's Bonding	• 4 valence electrons → 4 covalent bonds (tetrahedral geometry). • Ability to form single, double, triple bonds and catenation (C-C chains).	Methane (CH ₄), ethene (C ₂ H ₄), acetylene (C ₂ H ₂)
Hybridization	• sp³ → tetrahedral (4 bonds). • sp² → trigonal planar (3 + 1). • sp → linear (2 + 2).	CH ₄ (sp ³), ethene (sp ²), acetylene (sp)
Functional Groups	Specific atom/group patterns that dictate reactivity.	Alcohol –OH, Carbonyl –C=O, Carboxyl –COOH, Amino –NH ₂ , Halide –X
Isomerism	• Structural (constitutional) isomers: different connectivity. • Stereoisomers: same connectivity, different spatial arrangement (cis/trans, enantiomers).	Butanol (4 structural isomers), 2-butene (cis/trans), lactic acid (R/S)

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Concept	Key Points	Typical Examples
Nomenclature (IUPAC)	- Identify longest carbon chain & base name. - Number chain to give substituents lowest possible locants. - Prefixes for substituents, suffixes for functional groups. Addition – to multiple bonds (e.g., hydrogenation). Elimination – removal of small molecules (e.g., dehydration).	3-methylpentanol, 1-chlorobutene
	Substitution – replacement of a group (e.g., SN1/SN2). Oxidation/Reduction – change in oxidation state (e.g., oxidation of alcohols).	Alkene + H ₂ → Alkane; 2-bromopropane → propene + HBr
	Stepwise electron-flow descriptions using curved-arrow notation.	Nucleophilic attack, carbocation rearrangement, radical chain propagation

3. Classification of Organic Compounds

Class	General Formula	Characteristic Functional Group(s)	Typical Uses
Alkanes	C _n H _{2n+2}	Only C–C and C–H bonds	Fuels, lubricants
Alkenes	C _n H _{2n}	C=C double bond	Polymer precursors (e.g., ethylene)
Alkynes	C _n H _{2n-2}	C≡C triple bond	Specialty chemicals, pharmaceuticals
Aromatics	C _n H _n (ring)		