

Introduction to Organic Chemistry

Introduction to Organic Chemistry – Study Notes

1. What Is Organic Chemistry?

Aspect	Description
Definition	The branch of chemistry that studies carbon-containing compounds (with the exception of a few simple inorganic molecules such as carbonates, oxides, and cyanides).
Scope	Structure, nomenclature, synthesis, reactions, mechanisms, and physical properties of organic molecules.
Why It Matters	Foundations for pharmaceuticals, polymers, fuels, agrochemicals, biochemistry, materials science, and many everyday products.

2. Core Concepts

Concept	Key Points
Carbon's Versatility	• Forms four covalent bonds (tetra-valent). • Can create single, double, triple bonds and rings. • Enables isomerism (structural, stereoisomers).
Hybridization	sp^3 : tetrahedral (4 bonds only). sp^2 : trigonal planar (one π + one σ). sp : linear (one π + two σ).
Functional Groups	Specific atom/group patterns that dictate reactivity (e.g., $-OH$, $-COOH$, $-NH_2$, $-C=O$, $-C\equiv C$).
Isomerism	Structural (chain, position, functional) vs. Stereoisomerism (geometric <i>cis/trans</i> , optical <i>R/S</i>).
Bonding & Stability	• σ bonds: strongest, directional. • π bonds: weaker, responsible for reactivity (addition, polymerization).
Resonance	Delocalization of electrons over adjacent atoms; stabilizes molecules (e.g., aromatic rings, carbonyl conjugation).

Introduction to Organic Chemistry

3. Nomenclature Basics (IUPAC)

1. **Identify the longest carbon chain** – gives the base name (meth-, eth-, prop-, but-, pent-, etc.).
2. **Number the chain** – give the lowest possible numbers to substituents and multiple bonds.
3. **Name substituents** – alkyl groups (methyl, ethyl) or functional groups (chloro, hydroxy).
4. **Use prefixes for multiple identical substituents** – di-, tri-, tetra-.
5. **Indicate multiple bonds** – “-ene” for C=C, “-yne” for C≡C; use locants (e.g., 2-butene, 3-butyne).
6. **Assign suffixes for principal functional groups** – -ol (alcohol), -al (aldehyde), -one (ketone), -oic acid (carboxylic acid), -amine, etc.
7. **Combine in the order:** substituents → multiple bonds → principal functional group.

Example: 3-ethyl-2-methyl-1-butanol

- Longest chain: 4-carbon (butane).
- OH gets highest priority → suffix “-ol”.
- Numbering gives OH at C-1, methyl at C-2, ethyl at C-3.

4. Major Classes of Organic Compounds

Class	General Formula	Representative Functional Group	Typical Reactions
Alkanes	C _n H _{2n+2}	– (only C–C and C–H bonds)	Combustion, free-radical halogenation
Alkenes	C _n H _{2n}	C=C (sp ²)	