ORGANIC CHEMISTRY
AN INTRODUCTION

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Organic Chemistry

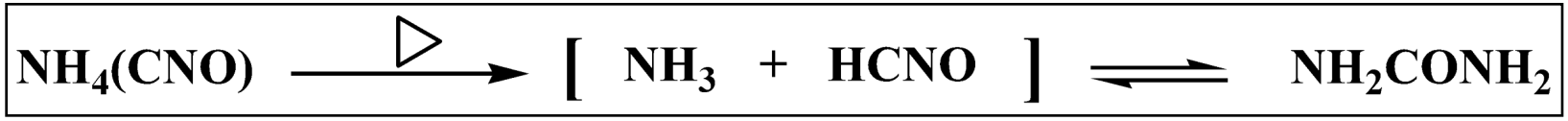
- **> 95% of All Known Compounds Composed of Carbon**
- **Organic Chemistry Crucial to Our Way of Life: Clothing, Materials (Polymers), Petroleum, Medicine, OUR BODIES , ...**
- **> 50% of Chemists Are Organic**

Chemistry is the study of matter, and all matters are made up of atoms.

Organic chemistry is the study of the structure, properties, composition, mechanisms, and reactions of organic compounds

Organic Chemistry: What is it?

- 1780: Organic compounds very complex and only obtained from living sources (vitalism) Vitalism: Belief that a "magic" vital force, present in plants and animals, is necessary for the synthesis of organic compounds.
- 1789: Antoine Laurent Lavoisier observed that organic compounds are composed primarily of carbon and hydrogen.
- 1828: Friedrich Wohler synthesized an organic compound (urea) from inorganic compounds. (lead cyanate and ammonium hydroxide).



Modern organic chemistry is the chemistry of carbon compounds.

Organic chemistry is a growing subset of **chemistry**.

- The application of **organic chemistry** today can be seen everywhere you look, from the **plastic** making up components of your computer, to **nylon** which make up your clothes, to **macromolecules** and cells that make up your very body! **Organic chemistry** has expanded our world of knowledge and it is an essential part of the fields of **biochemistry**, **biology**, **industry**, **nanotechnology**, **rocket science**, and many more!

Organic Chemistry

- **STRUCTURE;**

  Determining the Way in Which Atoms Are Put Together in Space to Form Complex Molecules

- **MECHANISM;**

  Understanding the Reactivity of Molecules: How and Why Chemical Reactions Take Place

- **SYNTHESIS;**

  Building Complex Molecules From Simple Molecules Using Chemical Reactions

Why Carbon?

- **Carbon forms a variety of strong covalent bonds to itself and other atoms.**
- **This allows organic compounds to be structurally diverse.**

  Carbohydrates /Amino Acids /DNA Bases /Hormones , etc.
- **Over 10 million compounds have been identified**
  - **about 1000 new ones are identified each day!**
- **Why Does Carbon Bond in This Way?**

Why Carbon?

 # C is a small atom, it forms single, double, and triple bonds,

 # C is intermediate in electronegativity (2.5) it forms strong bonds with C, H, O, N,

 # C has a special property; CATENATION: Catenation is the linkage of atoms of the same element into longer chains.

This is the reason for the presence of the vast number of organic compounds in nature.

Why Does Carbon Bond in This Way?
----- Chemical bonding -----

- **Lewis Bonding Theory ;**Atoms **transfer or share electrons to gain a filled valence shell of electrons.**
- **A. IONIC BONDING :** Between atoms of widely different electronegativity ($\Delta EN > 2$); usually a metal and a non-metal; atoms held together by electrostatic attraction, **not electron sharing**
- **B. COVALENT BONDING (Electron Sharing)**

  Very important in organic molecules! • Between atoms of similar electronegativity; usually non-metallic . [**LONE PAIR: unshared electron pair; non-bonding pair of electrons]**

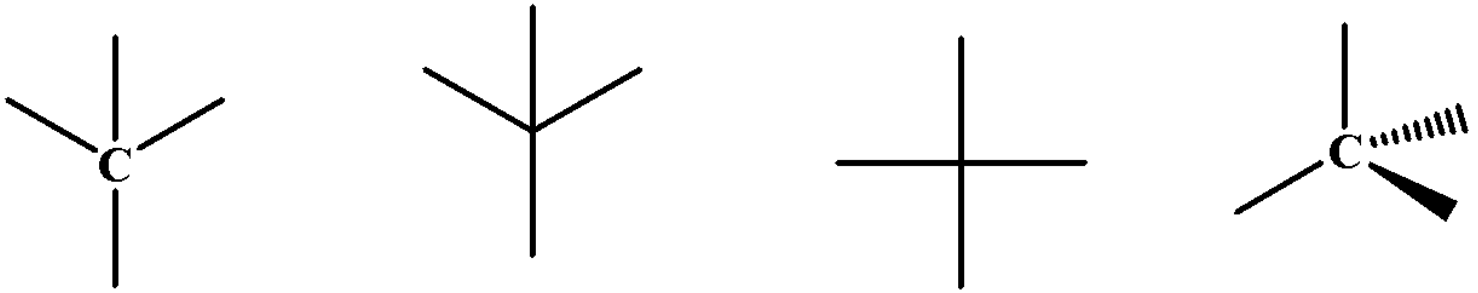
Rules for Drawing

- Bonds are represented by lines
  (one line = two shared electrons)
- Do not draw carbon or hydrogen atoms, except at termini (for aesthetics)
- Assume carbon atoms are at ends of lines and where they meet
- Assume enough C–H bonds to give each carbon atom four bonds (an octet)
- Draw hetero-atoms and attached hydrogen atoms (N,O,S,P,F,Cl,Br,I, etc.)

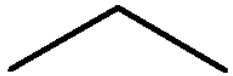
Molecules Are Not Flat!

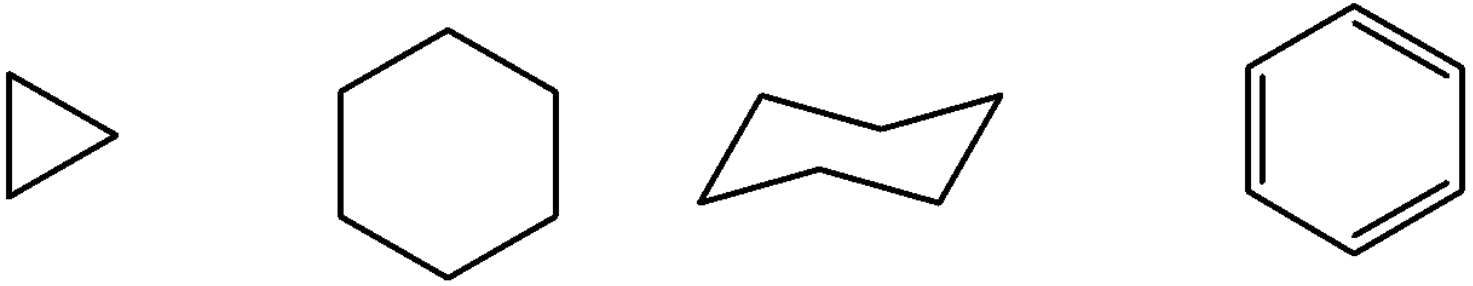
- **Methane, Ethane, Propane**
- **Cyclopropane, Cyclohexane, Benzene**

CH_4



$CH_3CH_2CH_3$





BOOKS FOR ORG-CHEMISTRY I[H]

- **TEXT BOOKS FOR B.Sc. Hons COURSES**:
- A Guidebook to Mechanism in Organic Chemistry by Sykes, Prentice Hall.
- Organic Chemistry --- [Vol-I & II] I. L. Finar.
- Organic Chemistry ----- By Morrison & Boyd
- Organic Chemistry ----- Pathak & Saha [1-3]
- Organic Chemistry-A Modern Approach-N.Tewari [1-3]
- Basic Stereochemistry of Organic Molecules --- by S. Sengupta.

- Nasipuri, D. *Stereochemistry of Organic Compounds,Wiley Eastern Limited .*
- *Stereochemistry, Oxford Chemistry Primer, Oxford University Press, 2005*
- Organic ChemistryOrganic Chemistry by Clayden, Greeves and Warren, Oxford University Press, 2012 (ISBN 978-0199270293)
- Fleming, I. *Molecular Orbitals and Organic Chemical Reactions, Reference/Student Edition, Wiley, 2009.*

Learning Resources

- **Online Resources**
- Organic Chemistry (Free wikibook)
- Organic Chemistry (Free Michigan State University resource)
- Organic Chemistry (Free Daley & Daley resource)
- Organic Chemistry I MIT OpenCourseWare (Spring 2005)
- Organic Chemistry II MIT OpenCourseWare (Fall 2006)
- **Software**
- Molecule editing software
  - ChemOffice (Paid chemical software suite)
  - ChemSketch (Free chemical drawing software)

- THANK YOU