

# Organic Compounds

## A. Introduction

**Hydrocarbons:** compounds that contain only hydrogen & carbon  
eg. petroleum, coal & natural gas

**Organic Compounds:** any compound containing covalently bonded carbon atoms

**Inorganic Compounds:** everything else, only simple carbon containing molecules  
eg. CO, CO<sub>2</sub>

## B. Sources of Organic Compounds - *most come from living compounds*

- **Fossil Fuels** are products of decomposition of once living organisms, formed beneath the Earth's surface by the action of great pressure and high temperature over millions of years.
- **Petrochemicals** are organic compounds from oil & natural gas.

## C. Properties of the Carbon Atom

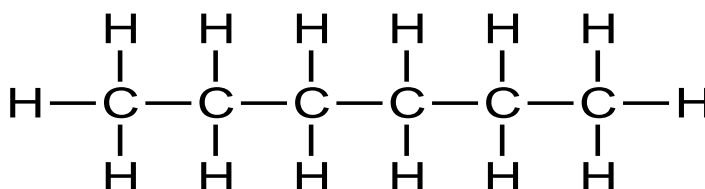
- Carbon can make up to 4 bonds with other atoms of itself or different elements.
- Carbon readily bonds with other carbons to form chains, rings, spheres, sheets and tubes of various sizes.
- C-C bonds are very strong.

## D. Hydrocarbons : *Compounds containing carbon & hydrogen*

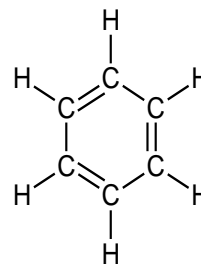
### a. **Aliphatic:** open or cyclic chains

**Open Chains**(Not Alice in... hahaha)

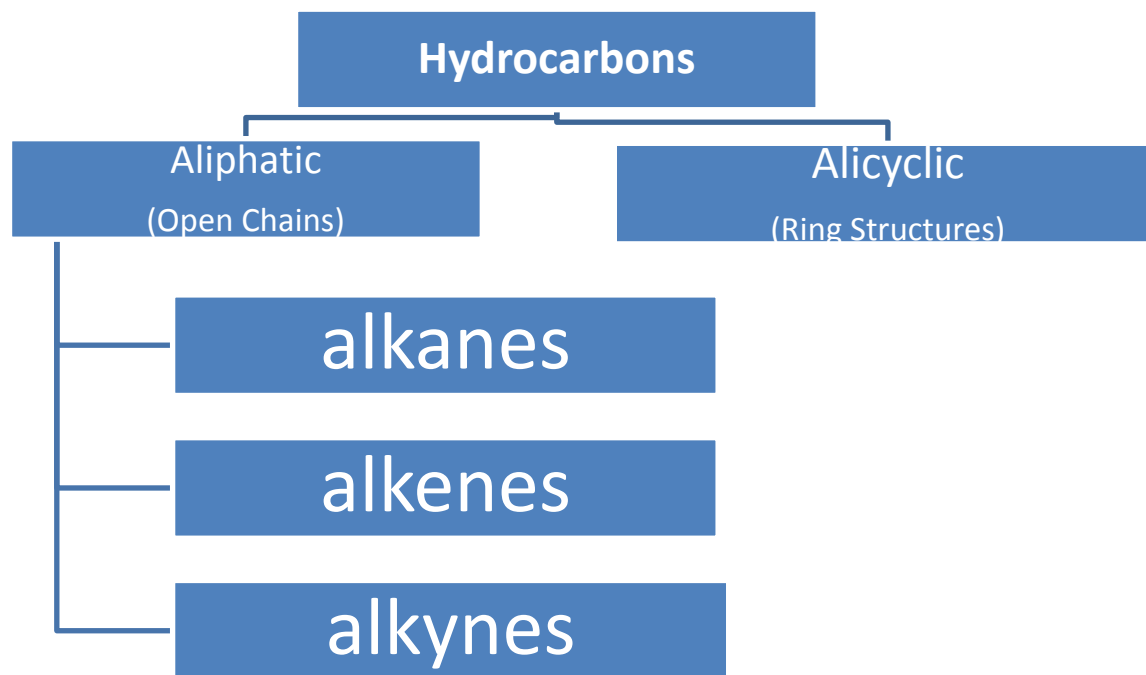
- Alkanes** : single bonds
- Alkenes** : at least one double bond
- Alkynes** : at least one triple bond



### b. **Cyclic:** ring structures



E. Summary



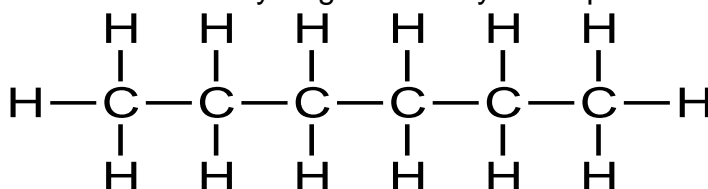
# Alkanes

## A. Introduction

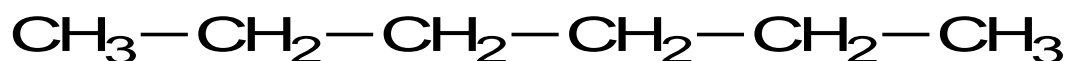
- Hydrocarbons that contain only single bonds.
- Carbons are either bonded to other carbons or hydrocarbons
- Number of carbons dictates the shape of the chain
- General formula:  $C_nH_{2n+2}$ ,  $n$  = # of carbons

## B. Hydrocarbon Formulae

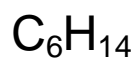
- The **Structural Formula** had the carbon backbone with the bonds sticking out with or without the hydrogen atom symbols present



- The **Condensed Formula** shows the carbon backbone with the bonds sticking out



- The **Molecular Formula** shows how many carbon and hydrogen are present without indicating the bonds.



- The **Line Structural Formula** shows the carbon backbone only



### C. Types of Chains

- **Straight Chain** : all carbons are aligned in a single long chain
- **Branched Chain** : this is a main carbon “backbone” with other chains branching off of it
- **Cyclic Chain**: carbons are attached to each other in a ring-like structure  $C_nH_{2n}$

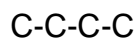
### D. Naming Hydrocarbons

- The prefix indicates the number of carbon atoms in the longest chain
- The suffix is “ane”
- For a branched chain: number the backbone, use a prefix + “yl” to indicate the type of branch, then name the backbone
- For a cyclic chain: use a prefix “cyclo” in front of the alkane name.

Prefix	IUPAC Name	Formula
Meth	Methane	$CH_4(g)$
Eth	Ethane	$C_2H_6(g)$
Prop	Propane	$C_3H_8(g)$
But	Butane	$C_4H_{10}(g)$
Pent	Pentane	$C_5H_{12}(l)$
Hex	Hexane	$C_6H_{14}(l)$
Hept	Heptanes	$C_7H_{16}(l)$
Oct	Octane	$C_8H_{18}(l)$
Non	Nonane	$C_9H_{20}(l)$
Dec	Decane	$C_{10}H_{22}(l)$

### E. Structural Isomers

- These occur when two different hydrocarbons have the same molecular formula (same number of C and H) but different structural formula.



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# ALKANE STRUCTURES AND FORMULAE

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# Alkenes & Alkynes

## A. Alkenes

- Have at least one double bond
- There must be a minimum of 2 carbons
- General formula:  $C_nH_{2n}$
- Use the same prefixes as for alkanes
- Change the ending to “**ene**”
- Indicate the location of the bond by assigning the carbon backbone numbers
- The numbering begins closest to the double bond
- If there is more than one double bond-number as before and change the suffix to “**diene**” if there are 2, and “**triene**” if there are three

## B. Alkynes

- Have at least one triple bond
- There must be a minimum of 2 carbons
- General Formula:  $C_nH_{2n-2}$
- Use the same prefixes and numbering as for alkanes and alkenes
- Change the ending to “**yne**”

## C. Saturated vs. Unsaturated

- **Saturated**: contains the maximum number of single bonds (ALKANES)
- **Unsaturated**: contains at least one double or triple bond (ALKENES or ALKYNES)

## D. Positional & Geometric Isomers

**Positional**: when two hydrocarbons have the same carbon backbone but different position of the double or triple bonds

**Geometric Isomers**: AKA **Stereoisomerism** – when two or more hydrocarbons have their atoms arranged in the same order but different 3-D shape

- **Cis and Trans Isomers** : at each side of a double bond, the different groups can either be on the **same side of the bond (cis)** or **opposite sides of the bond (trans)**

#### **E. Homologous Series**

- Sequential arrangement of members of the same family (ie: methane, ethane, propane etc.)
- Exhibit similar properties, showing a gradual change as the arrangement changes size.
- All have the same general formula.

## ALKENE STRUCTURES AND FORMULAE

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## ALKYNE STRUCTURES AND FORMULAE

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