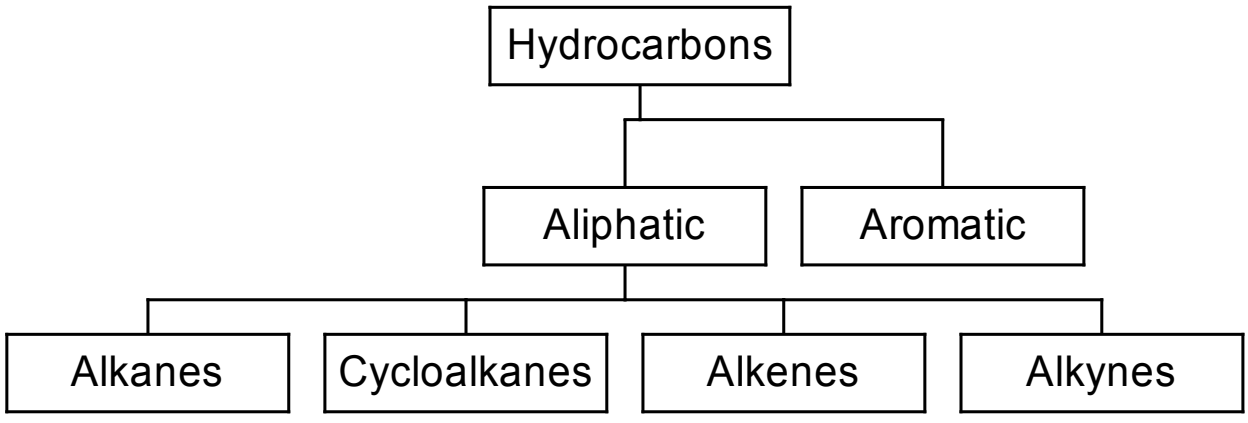
Alkanes, Alkenes and Alkynes

Hydrocarbons

Hydrocarbons generally fall into 2 general groupings, a**liphatic** hydrocarbons and **aromatic** hydrocarbons.
Aliphatic hydrocarbons contain chains and rings of hydrocarbons, such as octane or 2-methylcyclopentane.

Aromatic hydrocarbons contain at least one benzene ring. We will discuss aromatics later in the unit.

The first organic families that we will discuss in detail are the Alkanes, Alkenes and Alkynes.



Remember Prefix + Root + Suffix (family name).

Shapes in Organic Chemistry

Tetrahedral – Carbon with 4 single bonds

Trigonalplanar – Carbon with one double bond and 2 single bonds

Linear – Carbon with one single bond and a triple bond

Bent – molecules with two lone pairs of electrons and two single bonds

Naming Alkanes.

1. Find the longest chain or ring and write the root.
2. Attach the appropriate suffix (-ane, -ene or –yne) for the hydrocarbon.
3. Number the main chain of carbons to give the lowest possible number to a side group or the double bond. Use di, tri etc prior to the suffix when there are more than one double or triple bond present.
4. Write the prefix where applicable.
5. Put the name together.

** If there are 2 or more different branches on your hydrocarbon, the numbering priority begins with the –OH, then $–NH_2$, Halogens (Cl, Br etc), Alkyl groups (large – small).
Eg.

Common Alkyl Groups:

methyl	ethyl	propyl	isopropyl
butyl	sec-butyl	iso-butyl	tert-butyl

Practice:

Draw a full structural diagram of each molecule.

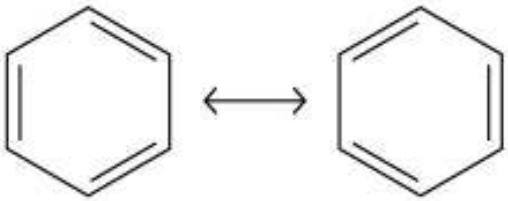
3-ethylheptane

3,3-dimethyl-2- octane

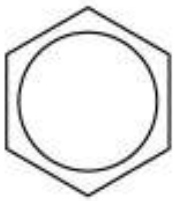
3 – bromo-1-pentyne

Aromatic Compounds

Aromatic compounds are compounds that contain a benzene ring.



Kekulé structures



Simplified molecular orbital representation

Number the benzene ring from wherever there is a functional group attached. If there are multiple attachments, use the highest priority. Name the branches as a prefix and add that name to the word 'benzene'

Eg. Methylbenzene. (Toluene)

Benzene has alternate naming system for the side chains that does not include numbering.

Ortho Meta Para

Other Functional Groups

Functional groups are the parts of organic molecules that distinguish each family from one another. We will be looking at

Family Name	Functional Group	Example
Alcohols	Hydroxyl (-OH)	Ethanol
Ethers	R – O - R	Methoxypropane
Amines	Amine ($-NH_2$)	2-pentanamine
Aldehydes	Carboxyl (R-COH)	Methanal
Ketone	Carboxyl (R-CO - R	Propanone
Carboxylic Acid	R-COOH	Ethanoic Acid
Esters	R-COO-R	Ethyl ethanoate
Amides	R-CONH-R	Ethanamide

Each Functional Group will have unique characteristics based on structure. These characteristics will affect the behavior and reactivity of each molecule. Each family of organic molecules will follow certain trends in terms of solubility in water, boiling point, melting point, state at room temperature, and reactivity. These properties are governed by the functional groups and the size of the molecule.

Properties that affect organic molecules and their behaviour.

Intermolecular Forces: The way two molecules interact determines many of their properties. There are three main types of intermolecular forces that are at play in organic chemistry.

1. London Dispersion Forces – Weak forces based on size

2. Dipole-Dipole Bonds – Medium strength forces based on polar ends of molecules

** Bond dipoles

** Molecular dipoles

Dipole interactions

3. Hydrogen Bonding - Strongest interaction between OH and NH groups of molecules

** The effectiveness of dipole attractions and hydrogen bonding diminishes with the increase in length of a molecule.

Properties of Alkanes, Alkenes and Alkynes

- Alkanes, Alkenes and Alkynes are simple molecules that tend to be insoluble in water especially as they increase in length.
- They tend to have very low melting and boiling points.
- Intermolecular forces are dispersion forces.

Name