INTRODUCTION TO ORGANIC CHEMISTRY

Formulae

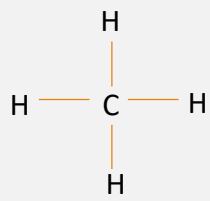
- **Structural formula** gives the minimum detail on the arrangement of atoms in a molecule, without drawing any bonds
- e.g. CH3CH2CH3 (Propane)

- **Molecular formula** shows the number and types of atoms of each element in a compound. However, it does not give any information on how the molecule is bonded together.
- e.g. C2H5OH (ethanol)

- **Skeletal formula** is a simplified formula used to represent organic molecules. Lines represent bonds between atoms, junctions are carbon atoms. Other labels are omitted.
- e.g. (Propane)

- **Displayed formula** shows the relative positioning of atoms and the bonds between them. All atoms and bonds are shown

e.g.

- 

(methane)

- **Empirical formula** the simplest whole–number ratio of each element present in a compound.
  e.g. CH_2O. (empirical formula for glucose)

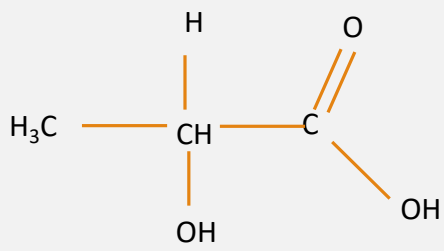
Name a compound

- **To name a compound:**
  - The stem is the main part of the name derived from the longest carbon chain.
  - The suffix after the stem, comes from the highest priority functional group
  - The prefix before the stem comes from functional groups attached to the main carbon chain (2nd or 3rd priority)
  - Numbers and hyphens indicating the position of functional groups on the carbon chain
  - Order of priority highest first: Carboxylic acids **>aldehydes>ketones>alcohols>alkenes>halogenoalkanes**

Compound	Prefix	Suffix
Alkanes	–	–ane
Alkenes	–	–ene
Alcohols	Hydroxy–	–ol
Carboxylic Acids	–	–oic acid
Haloalkanes	Fluoro– Chloro– Bromo– Iodo–	–
Aldehydes	–	–al
Ketones	–	–one

Carbon Atoms in alkyl group	Prefix
1	Methyl
2	Ethyl
3	Propyl
4	Butyl
5	Pentyl
6	Hexyl

e.g. 2-Hyrdoxypropanoic acid

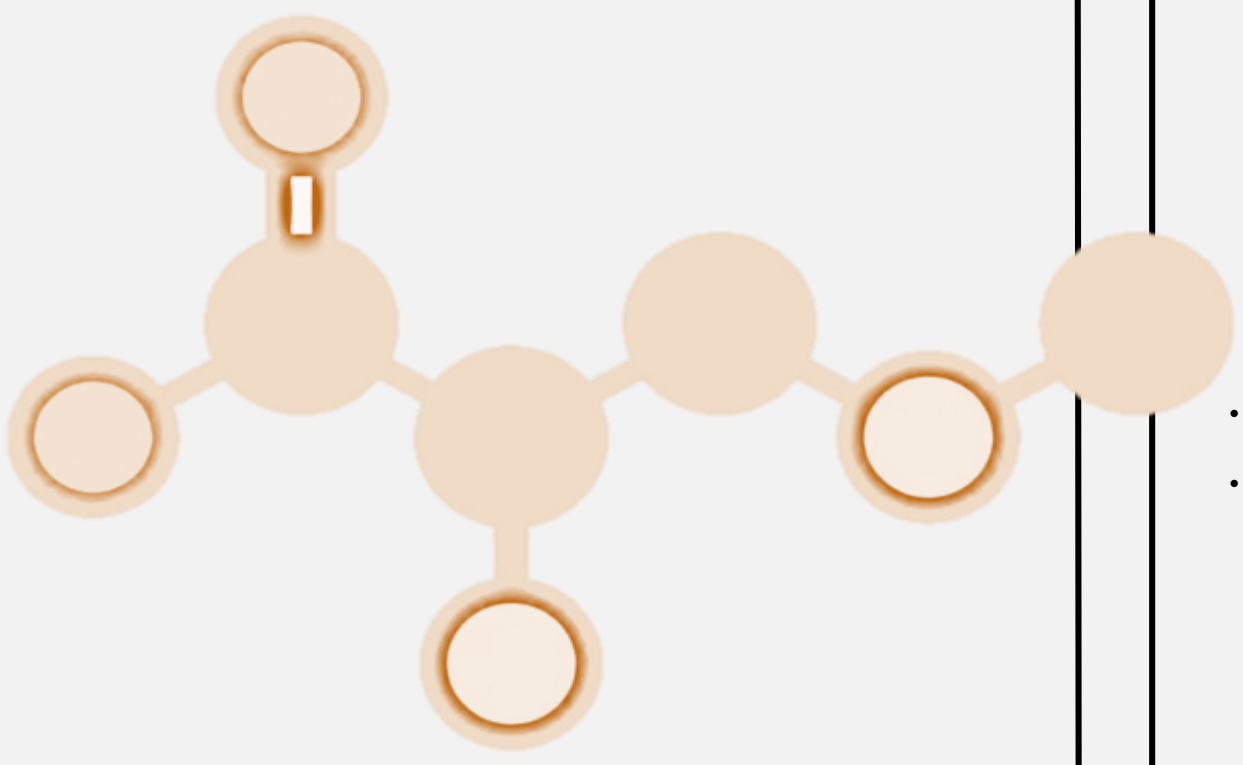


Nomenclature

- **Hydrocarbons can be:**
  - ***Aliphatic*** — carbon atoms form straight or branched chains
  - ***Alicyclic*** — carbon atoms form a ring
  - ***Aromatic*** — carbon atoms form a ring and have a delocalised electron system

- **Homologous series** are compounds with the same functional group and similar chemical and physical properties. They differ by the number of repeating units they contain

- **A functional group** is the group of atoms responsible for the characteristic reactions of a compound.

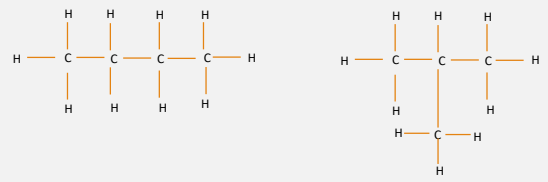


Isomerism

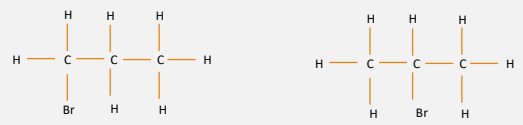
- **Isomers** are compounds with the same molecular formula but a different arrangement of atoms

- **Structural isomers** are compounds with the same molecular formula but a different structural formula

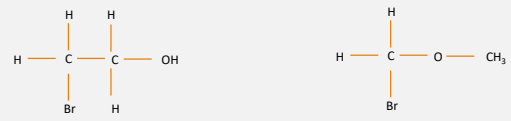
- **Chain isomers** —Same molecular formula but a different arrangement of the carbon chain. Chains can be straight or branched.



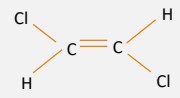
- **Position isomers —** These are molecules with the same functional group attached to a different position on the carbon chain



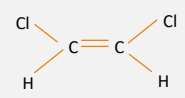
- **Functional group isomers —** These **are molecules with the same molecular formula but differen**t functional groups.



- **Stereoisomers** are organic compounds with the same molecular and structural formulae but a different arrangement of atoms in space
- **E/Z isomerism** is a type of stereoisomerism that can arise in alkenes due to the restricted rotation around the C=C bond.
  - •If a carbon atom has two of the same substituent attached, it will not show E/Z isomerism
  - •Substituents can be assigned priorities based on atomic mass (Cahn– Ingold–Prelog rules to name E/Z isomers). Greater the atomic mass, the higher the priority
  - •Highest priority groups are on **different sides** of double bond, the isomer is an **E–isomer**.
  - •Highest priority groups are on **the same side** of double bond, the isomer is a **Z–isomer**



E-1,2-dichloroethane



Z-1,2-dichloroethane