

Introduction to Organic Chemistry

Organic Compounds

Elements that most organic compounds contain:

- All organic compounds contain **carbon**.
- Most also contain hydrogen
- Others may contain elements such as oxygen, nitrogen or a halogen.

Homologous Series

- A homologous series is a family of compounds with the **same general formula and similar chemical properties**.
- Each homologous series has a general formula.
 - Subsequent members of organic compounds in the same homologous series differ by a chemical formula of $\text{C}_n\text{H}_{2n+2}$

Functional Group

- A functional group is a group of atoms that are bonded together in a way that is unique to that particular homologous series. The functional group is responsible for a compound's characteristic **chemical properties**.
- As they possess the same functional group, members of the same homologous series will **react in a similar way to one another**.

Alkanes and Alkenes

Properties

| | Alkane | Alkene |
|---------------------------|---|---|
| Saturated or Unsaturated? | Saturated hydrocarbon. An alkane contains only single covalent bonds between carbon atoms, C-C . | Unsaturated hydrocarbon. An alkene contains a double covalent bond between carbon atoms, C=C . |
| General Formula | $\text{C}_n\text{H}_{2n+2}$ | C_nH_{2n} |

Using Prefixes to Name Organic Compounds

| Prefix | Number of Carbon | Name of Alkane | Name of Alkene |
|--------|------------------|----------------|----------------|
| meth- | 1 | methane | - |
| eth- | 2 | ethane | ethene |

| Prefix | Number of Carbon | Name of Alkane | Name of Alkene |
|--------|------------------|----------------|----------------|
| prop- | 3 | propane | propene |
| but- | 4 | butane | butene |
| pent- | 5 | pentane | pentene |

Properties

- E.g: Boiling point, Melting point, Electrical conductivity (physical properties).
- For Organic Chemistry: **Viscosity (physical)** and **Flammability (Chemical)**

Viscosity

- Measure of "thickness" and stickiness of a liquid
- Ability of fluid to flow

Flammability

- **Chemical property:** The ability of a chemical to burn or ignite, causing fire or combustion.
- Can compare flashpoints: GENERALLY - **higher flashpoint, lower flammability.**

Trends: MP and BP (physical)

Trend and Explanation

The melting points and boiling points of the alkanes generally increases as *relative molecular mass* increases.

- Larger molecules have stronger intermolecular forces of attraction.
- More energy is required to overcome the stronger intermolecular forces of attraction.
- higher MP and BP.

Trends: Flammability (chemical)

Trend and Explanation

The flashpoints of the alkanes and alkenes generally increases as *relative molecular mass* increases → *flammability* decreases.

- larger molecules have stronger intermolecular forces of attraction, thus less volatile (likelihood of existing as a gas)
- larger molecules also have higher percentage of carbon → requires more oxygen to burn → less flammable.

Trends: Viscosity (Physical)

Trend and Explanation

As relative molecular mass increases, the liquid alkanes and alkenes have *higher viscosity*.

- larger molecules have stronger intermolecular forces of attraction.
- harder for liquid containing larger molecules to flow.

Summary

The gradual change in properties can be observed in **all** homologous series as a result of the *increase in molecular mass of molecules down the homologous series*.

Isomerism

Definition

Isomerism is the phenomenon where **compounds (isomers) have the same molecular formula but different structural formulae**.

- Do not have to be of the same homologous series.
- Different homologous series can have the **same molecular formula**.