Hydrocarbons:

Hydrocarbons: Molecules that contain only Carbon and Hydrogen
Pure Hydrocarbons - mainly used for fuel

Carbons:
- Make 4 bonds (covalent)
- "Organic Chemistry" - chemicals that contain carbon

Definitions:

Structural Formula:
- Shows the structure without showing each atom and bond.

Empirical Formulae:
- The simplest whole number ratio for atoms of different elements in a compound.
- (ionic compound always shown as empirical formulae)

Molecular Formulae:
- Shows the actual/total number of atoms of different elements in one molecule of a compound.

Displayed Formulae:
- Shows all the bonds between atoms in a molecule.

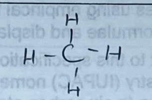
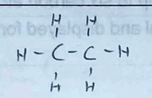
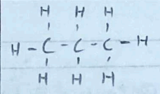
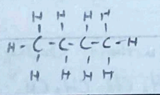
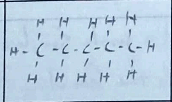
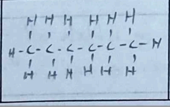
Homologous Group:
- A family of compounds with similar chemical properties and in which the formula differ by [redacted].

The same general formula

Alkanes

- Hydrocarbon molecules in which all the carbons are joined by single bonds.
- Saturated Molecules - only single bonds.

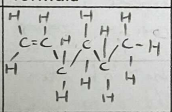
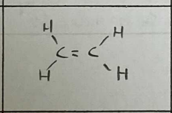
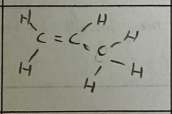
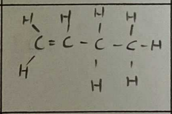
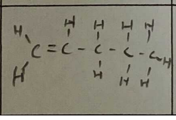
- General Formula: Cn H2n+2

Name	No. of C atoms	Displayed formula	Structural formulae	Molecular formulae	Empirical formulae
Methane	1		CH_4	CH_4	CH_4
Ethane	2		$CH_3\ CH_3$	C_2H_6	CH_3
Propane	3		$CH_3CH_2CH_3$	C_3H_8	C_3H_8
Butane	4		$CH_3CH_2CH_2CH_3$ $[CH_3(CH_2)_2CH_3]$	C_4H_{10}	C_2H_5
Pentane	5		$CH_3CH_2CH_2CH_2CH_3$ $[CH_3(CH_2)_3CH_3]$	C_5H_{12}	C_5H_{12}
Hexane	6		$CH_3CH_2CH_2CH_2CH_2CH_3$ $[CH_3(CH_2)_4CH_3]$	C_6H_{14}	C_3H_7

Alkenes

- Hydrocarbons with at least one double bond between pairs of carbon atoms.
- Unsaturated molecules - double bonds present.

- General Formula: Cn H2n

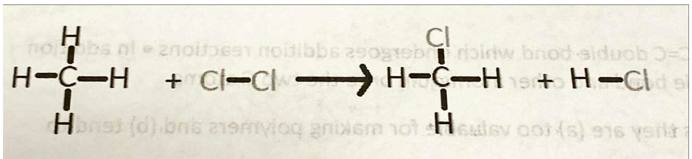
Name	No. of C atoms	Displayed formula	Structural formulae	Molecular formulae	Empirical formulae
Hexene	6		$CH_2=CH(CH_2)_3CH_3$	C_6H_{12}	CH_2
Ethene	2		$CH_2=CH_2$	C_2H_4	CH_2
Propene	3		$CH_2=CHCH_3$	C_3H_6	CH_2
Butene	4		$CH_2=CHCH_2CH_3$	C_4H_8	CH_2
Pentene	5		$CH_2=CH(CH_2)_2CH_3$	C_5H_{10}	CH_2

Alkane Reactions

Three types of reactions:
- Addition: Molecules are added to an organic compound.
- Substitution: Atom or functional group is replaced by a different atom or functional group.
- Elimination: A small molecule is removed from an organic compound.

- Alkanes react with Chlorine (Cl2) in UV light.

Ex.



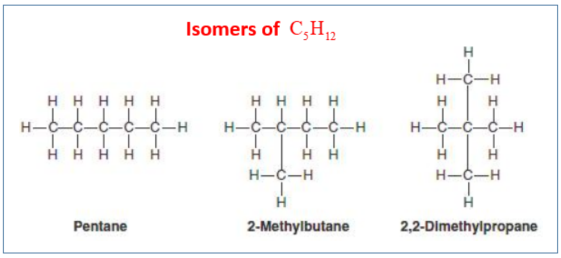
Alkene Reactions (addition reaction)

- Alkenes are very reactive due to the double Carbon bond - addition reactions occur easily.
  - The double Carbon bond becomes a single Carbon bond.
  - Only the double bonded Carbon atoms react.
- Alkenes are rarely burned, as they are too valuable to make polymers and often result in incomplete combustion.
- Alkenes react and decolourise Bromine water - used to test for double Carbon bonds.
- Reaction with Bromine —> Dibromoalkanes

Isomers

- Same compounds, but with different arrangements.

Ex.



Crude Oil

- A mixture of hydrocarbons.
- Useless by itself - it must be processed or refined/saturated (into groups called fractions)
- Fractions are mixtures - they have a range of boiling points.

- The fraction of Crude Oil (from top to bottom in fractionating column):
  - Fuel/Refinery Gases - cooking.
  - Gasoline - petrol for cars.
  - Kerosene - fuel for planes and jets.
  - Diesel (gas oil) - fuel for trucks, lorry, diesel engines.
  - Fuel Oil - Ship fuel.
  - Bitumen - for roads

Fractionating Columns

- Fractionating columns are hotter at the bottom and cooler at the top.

- There are several steps to separate fractions in a fractionating column (fractional distillation)

1. Heat the crude oil
2. Pass it through a fractionating column - entering from the bottom and rising up the column.
3. The column is hotter at the bottom and cooler at the top.
4. Fractions/compounds/molecules of hydrocarbons separate due to the different boiling points.
5. The compounds then condense and are collected in appropriate stages of the column/refinery.

Properties of Hydrocarbons

- The longer the chain of hydrocarbons (the larger the hydrocarbon molecule), the higher the boiling points.
- The molecules have covalent bonds that are still present after heated, and only the intermolecular forces are broken (not the molecules themselves)
  - The intermolecular forces are stronger in larger molecules, and therefore require more energy to break to forces between the molecules - meaning higher boiling points.

	Small Hydrocarbons	Large Hydrocarbons
Boiling Points	Low boiling point	High boiling point
Flammability	Easy to ignite	Difficult to ignite
Cleanliness (of flame)	Clean Flame	Smoky flame (soot)
Viscosity	Runny	Viscous

Catalytic Crackling

- Crude oil has more heavier fractions than light ones - there is a higher demand for lighter fraction as they are more useful.
- Catalytic Crackling - breaking down long chains of hydrocarbons to get lighter hydrocarbons for meeting demand of lighter hydrocarbons.
  - Breaking down large into smaller molecules using catalyst (thermal decomposition reaction)

- Hydrocarbons are heated to become gas:
  - Mixed with a catalyst.
  - Molecules break apart (into shorter chains).
  - Smaller alkanes and alkenes are formed.
- At least one unsaturated compound is formed.
- This process requires:
  - Catalysts - silica or alumina
  - A temperature of 600~700°c

- These smaller molecules are used to make plastics, and other chemicals.