

Hydrocarbons

Introduction

Hydrocarbons are part of a group of substances known as **organic compound**- these compounds all contain **carbon** atoms, combined with other elements such as hydrogen, oxygen, nitrogen, chlorine etc. Carbon atoms have a special ability to link up with other carbon atoms to form long chains, which may be branched or form rings. This gives rise to an enormous number of different compounds which are found in every part of our daily life.

Hydrocarbons are compounds which contain **carbon and hydrogen only**. The most important group of these are the **alkanes** paraffins which make up the bulk of petroleum and natural gas. From these we get most important products such as, petrol, kerosene, oils, of all grades, natural gas (C.N.G.) and **liquefied** petroleum gas (L.P.G.)

Alkanes

Formula	Name	B.P. °C	M.P. °C	State	M.W.	Use
CH ₄	methane	-161.5	-184	gas	16	natural gas, c.n.g.
C ₂ H ₆	ethane	-88.3	-172	gas	30	fuel gas
C ₃ H ₈	propane	-42	-188	gas	44	} rock gas, l.p.g., lighter fluid
C ₄ H ₁₀	butane	-0.6	-135	gas	58	
C ₅ H ₁₂	pentane	36	-130	liquid	72	} petroleum ether
C ₆ H ₁₄	hexane	69	-94	liquid	86	
C ₇ H ₁₆	heptane	98	-90	liquid		} petrol
C ₈ H ₁₈	octane	126	-57	liquid		
C ₉ H ₂₀	nonane	151	-51	liquid		
C ₁₀ H ₂₂	decane	174	-30	liquid		
C ₁₀ H ₂₂ — C ₁₆ H ₃₄						kerosene
C ₁₅ H ₃₂ — C ₁₉ H ₄₀						light fuel oil
C ₂₀ H ₄₂ +						lubricating oil
Higher molecular weights						tar, petroleum jelly and paraffin wax.

Important Properties of Hydrocarbons

1. State

From the table we can see that as the number of carbon atoms increases so does the melting point, boiling point and molecular weight. Also the state changes from gas, to liquid to solid.

The flash point also increases with the number of carbon atoms. (The flash point determines the flammability of a liquid, more than any other factor).

Gases (such as methane) or gases which can be **liquefied** under pressure (propane and butane) make explosive mixtures with air.

Liquids of low molecular weight (and low flash point) are **very** volatile and easily evaporate to make- explosive mixtures. e.g. octane - flash point about 13 'C.

Liquids of higher molecular weight are less volatile, for example. fuel oil - flash point about 200'C-

2. Density

Gases: The density of methane- (C.N.G.) is less than that of air (M.W. (molecular weight) of methane = 16, compared to M.W. air = 30) C.N.G. will rise when released in air.

The density of propane and butane (L.P.G.1 is) greater than that of air (M.W. propane = 44, M.W. butane = 58) L.P.G. will sink when released in air.

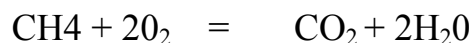
Liquids. 'Me densities of liquid hydrocarbons are all less than that of water. Liquid hydrocarbons will all float on water.

3. Miscibility with water

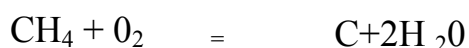
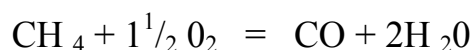
The liquid hydrocarbons are all immiscible with water. This means that they will always float on water (because they are less dense.)

4. Combustion products

All hydrocarbons will burn, if there is sufficient oxygen present to form carbon dioxide and water



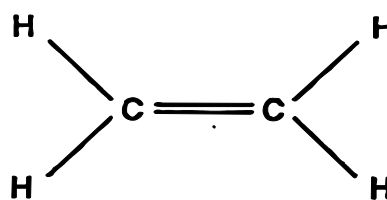
When there is less oxygen available the fuel burns less efficiently and carbon monoxide or carbon (soot) is produced.



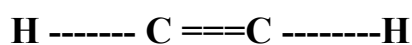
5. Unsaturated hydrocarbons

Other hydrocarbons of importance are the unsaturated hydrocarbons. These contain double and triple covalent bonds between the carbon atoms.

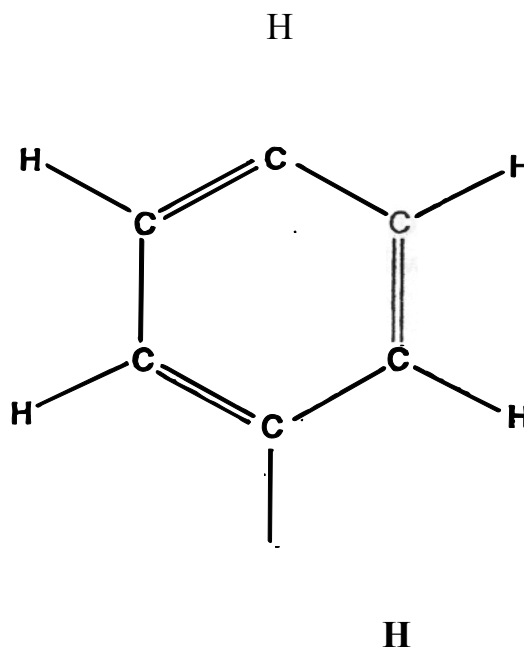
Ethene (alkene)



Acetylene (alkyne)



Benzene (aromatic)



Summary

- Hydrocarbons are made up of hydrogen and carbon atoms only.
- The melting points, boiling points and flash points increase with the number of carbon atoms in a molecule.
- Hydrocarbons with a higher number of carbon atoms are less flammable.
- Liquid hydrocarbons are less dense than water and are immiscible with it.
- * The combustion products from burning hydrocarbons are H_2O and CO_2 (also possibly CO and C)

