

Acyclic/Open chain/Aliphatic

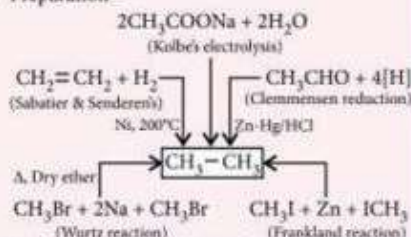
Cyclic/Closed chain

[Source: Petroleum]

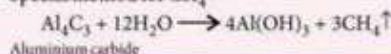
Saturated

Alkanes/paraffins $[C_nH_{2n+2}]$:

- Isomerism - Chain, Conformational.
- Hybridisation - sp^3
- Preparation -



- Special method for CH_4



Properties

Alkanes

Physical

- Boiling point**: For straight chain alkanes, b.pt \propto molecular size.
In isomeric alkanes, b.pt $\propto 1/\text{branching}$.
- Melting point**: Even no. of C-atoms \rightarrow Higher m.pt.; Odd no. of C-atoms \rightarrow Lower m.pt.
- Density \propto molecular mass.

Chemical

- Least reactive because of strong C—C and C—H σ bonds.
- Undergo only substitution reactions.
- Sulphonation and halogenation occur by free radical mechanism.

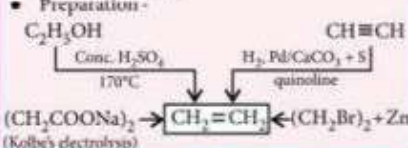
Aromaticity-Hückel's Rule

- An aromatic molecule** -
- Planar, cyclic and completely conjugated.
- Contains $(4n + 2)\pi$ -electrons, (where n = an integer).
- If, on ring closure, the π -electron energy of an open chain polyene decreases.
e.g., [6] annulene (Benzene)
- An anti-aromatic molecule** -
- Planar, cyclic and completely conjugated.
- Contains $4n\pi$ -electrons, (where n = an integer).
- If, on ring closure, the π -electron energy increases.
e.g., [4] annulene (Cyclobutadiene)
- A non-aromatic molecule** -
- Non-planar, non-cyclic and not completely conjugated.
- If, on ring closure, the π -electron energy remains the same.
e.g., Alkanes, alkenes and 1, 3, 5-cycloheptatriene.

Unsaturated

Alkenes/olefins $[C_nH_{2n}]$:

- Isomerism - Chain, Position, Geometrical, Ring-chain.
- Hybridisation - sp^2
- Preparation -



Properties

Alkenes

Physical

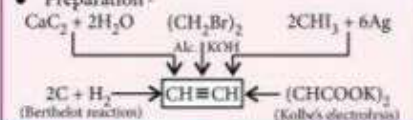
- B. pt, m. pt. and specific gravity \propto molecular mass.
- Less volatile than alkanes i.e. b. pt. and m. pt. are higher than alkanes.

Chemical

- Undergo electrophilic addition reactions.
- Test for unsaturation-Gives bromine water and Baeyer's tests.
- Addition of unsymmetrical reagents (HX, H_2O , HOX , etc.) \rightarrow Markovnikov's rule.
- In presence of peroxides, addition is anti-Markovnikov's or Peroxide or Kharasch effect.

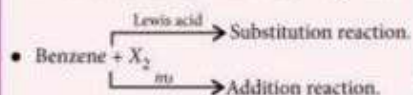
Alkynes $[C_nH_{2n-2}]$:

- Isomerism - Chain, Position, Functional, Ring-chain.
- Hybridisation - sp
- Preparation -

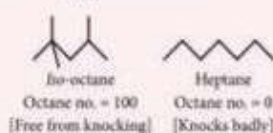


Have A Look!

- The first three members of alkanes do not exhibit isomerism.
- Alkanes containing odd no. of C atoms cannot be prepared by Kolbe's electrolysis.
- Methane cannot be prepared by Sabatier and Senderen's reaction.
- Method -
- to ascend the C-chain - Wurtz reaction.
- to descend the C-chain - Decarboxylation.



- Octane no.-Knocking quality of an automobile fuel



- Gasolines
Octane no. = 74 \rightarrow Regular gasoline
Octane no. < 74 \rightarrow Third grade gasoline
Octane no. > 74 \rightarrow Premium gasoline

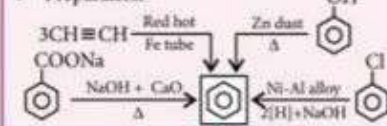
Aromatic

[Source: Coal]

Benzenoids/arenes $[C_nH_{2n-6m}]$:

(where, n = no. of C-atoms, m = no. of rings.)

- Isomerism - Position.
- Preparation -



Properties

Benzenoids

Physical

- Melting and Boiling points \propto molecular size.
- Solubility**: Insoluble in water but soluble in organic solvents.

Chemical

- Reactivity**: Alkenes > alkynes > arenes > alkanes.
- Undergo electrophilic substitution reactions.
- Do not give Baeyer's test.

Non-benzenoids:

- Do not contain benzene ring.
e.g., Azulene, tropolone, pyrrole, etc.

Alicyclic

- Contain a ring of three or more C-atoms.
e.g., Cyclopropane, cyclobutene, etc.

Properties

Alkynes

Physical

- Melting and boiling points**: Alkynes > alkanes and alkenes.
- Solubility**: Insoluble in water but soluble in organic solvents.

Chemical

- Acidity**: Alkynes > alkenes > alkanes (as s -character \propto acidity).
- Test for unsaturation-Gives bromine water and Baeyer's test.
- Undergo electrophilic and nucleophilic addition reactions.
- Degree of unsaturation or index of hydrogen deficiency = $(2n_1 + 2 - n_2)/2$, where n_1 = number of carbon atoms, n_2 = number of hydrogen atoms.

- Tetraethyl lead (an antiknock compound) is used as a mixture of TEL (63%), ethylene bromide (26%), ethylene chloride (9%) and methylene blue (2%).

- Cetane no. - Scale to decide quality of diesel fuel.

