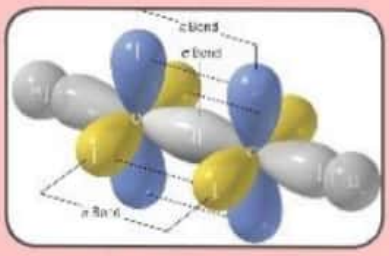
8 FACTS ABOUT ALKANES

Physical State	
Carbon Count	State
1 – 4	Gases
5 – 15	Liquid
15 – more	Solid

C – in sp3 Hybridisation



General Formula :- C_nH_{2n+2}

Preparation of Alkanes

1. From unsaturated Hydrocarbons in the presence of catalyst 'Ni' or 'Pt'

$$CH_2{=}CH_2 + H_2 \xrightarrow[\Delta]{Ni} CH_3 - CH_3$$

2. By Wurtz Reaction:

$$CH_3 - Br + Na + Br - CH_3 \xrightarrow[Ether]{Dry} CH_3 - CH_3 + 2NaBr$$

3. By the Reduction of Aldehydes and Ketones

$$R{-}\overset{\overset{O}{\|}}{C}{-}H + 4[H] \xrightarrow[\Delta]{Zn.Hg/conc.HCL} R{-}CH_3 + H_2O$$

4. Grignard's Reagent

$$R\text{-}Mg\text{-}X + H_2O \longrightarrow R\text{-}H + HO\text{-}Mg\text{-}X$$

Uses

Lighter alkanes are used in natural gas.

Propane and Butane are used in LPG cylinders

Density of alkanes is less than water therefore they float over it.

Boiling

Boiling point depends on Vander waal forces.

More Carbon atoms

↓

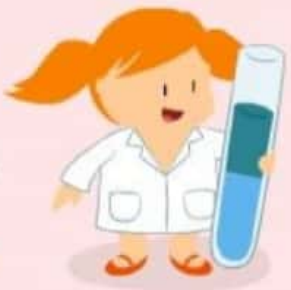
High Vander waal forces

↓

High boiling point

Solubility

Alkanes do not dissolve in water. They form a layer on top of water. However alkanes dissolve in non-polar organic solvents like Toulene, Benzene



Melting

Melting point depends on packing of compound.

More branching

↓

Close packing

↓

High melting point

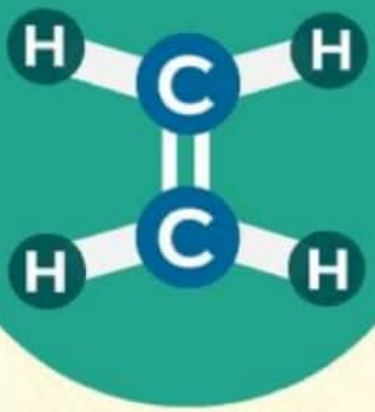
Example of Alkanes

Methane

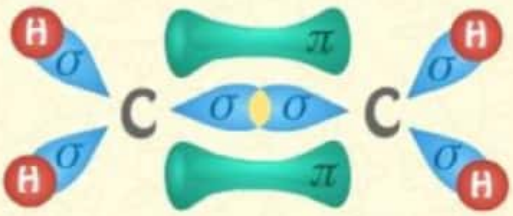
Ethane

Propane

ALKENES



SP² hybridisation



Acts as a Nucleophile

In organic chemistry, π– bond is considered as a nucleophile. Therefore alkenes participate in addition reactions

Polymerisation

Ethene undergoes polymerisation and forms products like polyethene

Preparation

1. Dehydration of alcohols

A molecule of water is eliminated from an alcohol molecule by heating the alcohol in the presence of a strong mineral acid.

$$CH_3CH_2CH_2\ddot{O}H + H_2SO_4 \xrightarrow{heat} CH_3CH = CH_2 + H_2O$$

2. Dehydrohalogenation of alkyl halides

The **dehydrohalogenation** of alkyl halides, another β elimination reaction, involves the loss of a hydrogen and a halide from an alkyl halide (RX).

ethyl chloride — sodium ethoxide

$$H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-Cl + NaOCH_2CH_3 \xrightarrow{heat} H-\underset{H}{\overset{H}{C}}=\underset{H}{\overset{H}{C}}-H + CH_3CH_2OH + NaCl$$

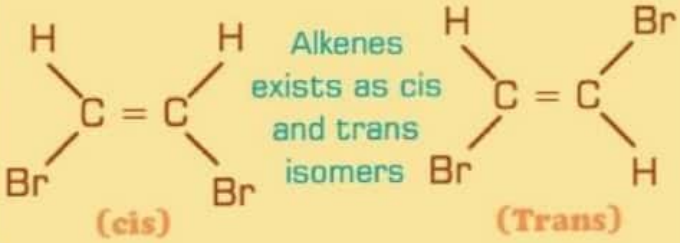
ethene — ethanol — sodium chloride

Test for Alkenes

$$CH_2=CH_2 + Br_2 \rightarrow \overset{Br}{\underset{|}{CH_2}}-\overset{Br}{\underset{|}{CH_2}}$$

If you add bromine water to alkene, it decolourises the liquid because bromine reacts with alkene, where as with alkanes it cannot react.

Isomerism

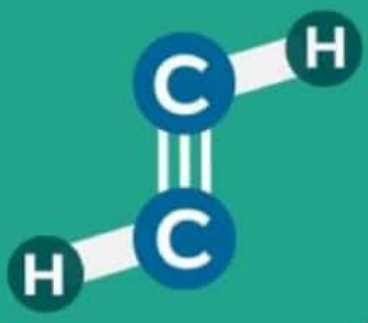


Dipole Moments	cis > 0, trans = 0
Melting Point	trans > cis
Boiling Point	cis > trans

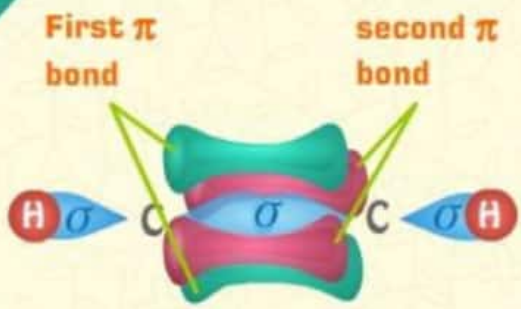
More dipole moment → More polarity → More solubility in polar solvents

More polarity → More interaction between compounds → Higher boiling point

ALKYNES



SP hybridisation



Physical Properties

Alkynes are gases at room temperature.

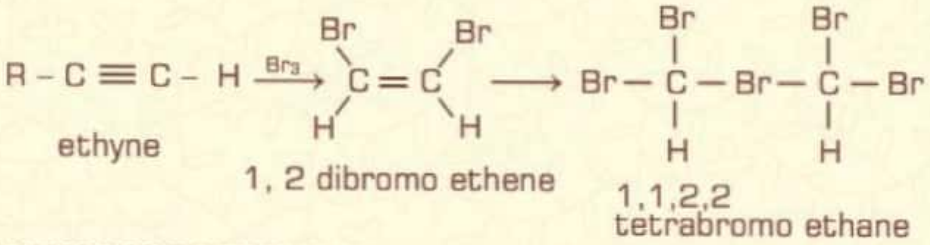
192 kcal/mol energy is required to break the triple bond.

Shortest bond length is 120 Å.

Test for Alkynes

Reaction with Bromine

The alkynes react slowly with bromine water to decolourise it, and this reaction can be used to distinguish between alkenes and alkynes.
Alkenes decolourise bromine water very rapidly, but alkynes take several minues.



Acidic Hydrogen

R – C ≡ C – H

Order of electronegativity is

$sp > sp^2 > sp^3$

Due to large electronegativity of sp carbon, terminal hydrogen becomes acidic and reacts with bases and undergoes neutralization.

For Terminal Alkynes

Terminal alkynes have acidic hydrogen, therefore by reacting with CuCl in NH_4OH, acidic hydrogen is replaced with Cu giving red colour.

R – C ≡ C–H + CuCl → R – C ≡ C⁻ –⁺Cu
(Red)

Uses

Alkynes don't have any commercial use. Acetylene is used in oxy – acetylene flame.

Nucleophile: Like alkenes, they also act as nucleophiles, due to presence of 2π bonds

Preparation: Alkynes are prepared by **hydrolysing carbides.**

CaC_2 H_2O C_2H_2 $Ca(OH)_2$