

# Source of organic Compound :-

- i Animal & plants
- ii Natural gas & petroleum
- iii coal
- iv Fermentation
- v Synthesis

## iii) Fermentation:-

→ Fermentation is defined as the reproduction of chemical & by the action of microorganism.

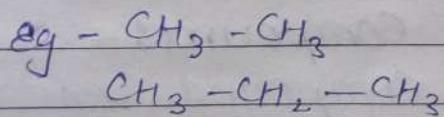
eg- Alcohol, vitamins, Antibiotics

## \* Classification of organic Compound:-

→ It is classified on 5 category

### i) Aliphatic Compound

→ It is those compound which can exist of open chain of carbon atom are called aliphatic compound



### ii) Saturated & unsaturated compounds:-

→ Compounds which contain only C, H, are called hydrocarbon.

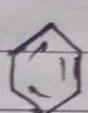
→ A hydrogen carbon is said to be saturated if it contain only C-C single bond.

→ A hydrocarbon is said to be unsaturated

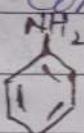
If it contain  $C=C$  &  $C\equiv C$  multiple bonds are called unsaturated.

### iii) Aromatic Compounds:-

→ Benzene and all compound that have structural & chemicals properties resembling benzene are called aromatic Compound.



Benzene



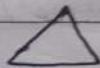
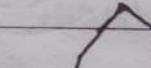
Anilin



Naphthalene

### iv) Alicyclic Compound:-

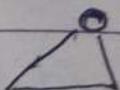
→ Which consist only of C-atoms are called Alicyclic Compound.

cyclo  
propanecyclo  
butanecyclo  
pentanecyclo  
hexane

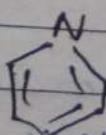
### v) Heterocyclic Compound:-

→ It is a compound in which the ring atom of carbon & some other element are called heterocyclic compound.

Eg- Carbon, Oxygen, Nitrogen



Ethylidene oxide

Nitrobenzene  
Crypline

# Structure of atom

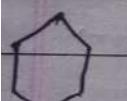
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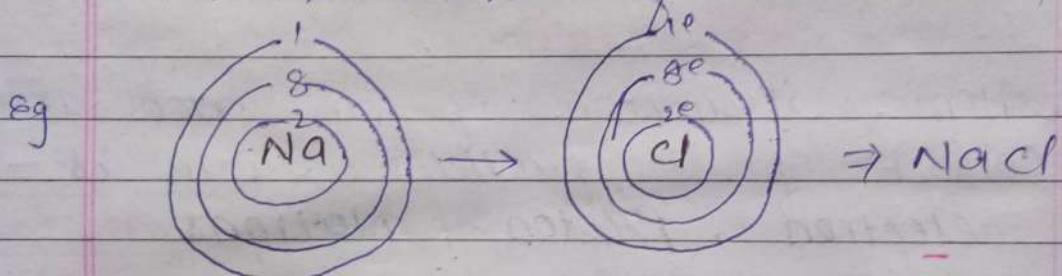
- The atomic structure was 1<sup>st</sup> described by "John Joseph, thomson" & "Ernest" 1900"
- This model of atom is still used as basis of modern atomic theory.
- Atoms are nothing but building blocks of matter atomic theory: which has mass & takes up space
- Atoms are nothing but building
- All the matter is made up of atom
- The word 'Atom' is obtained from Greek and each individual.
- Atomic structure of an atom mainly consists of 3 particles such as - electron, proton, neutrons
- Atoms are particle of elements or, substance these. Cannot be broken further without changing the chemical nature of the substance
- Proton have +ve electric charged and it should be much larger and heavier than electron.
- Neutron have no electric charged and it has much behaviour and larger like proton
- Electron are very small tiny & lighter particles and it has -ve electric charged

## Types of Bond:-

- i) Ionic or electrovalent bond
- ii) Co-valent bond
- iii) Co-ordinate bond

### i) Ionic or, Electrovalent bond:-

- Ionic bond are formed by transfer of valence  $e^-$  from one atom to another. Excess electron than the other.
- This type of bond unites two atoms one of which has excess electron than the stable no (2 or, 8) and the other is short of electrons.



### ii) Co-valent Bond:-

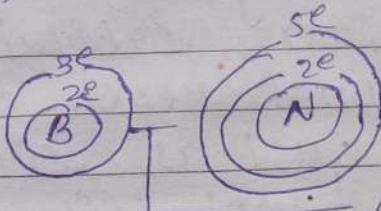
- Co-valent bond are formed by mutual sharing of electron this type of bond unites two atom both of which are short of  $e^-$  the two atoms contributed one electron each and then share the resulting pair of electron.

Eg - Hydrogen H H

### iii) Co-ordinate bond

- Co-ordinate bond is also formed by mutual sharing of electron but in this case the two electron ~~but~~ that

are shared come from the same atom



co-ordinate bond.

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### \* Atomic orbital :-

The three dimensional region or shape that is volume around the nucleus of an atom where probability of finding electron having a certain energy is maximum (90 - 95%) is called atomic orbitals.

### \* Orbit :-

As postulated by Bohr's an orbit is a definite circular path at a diff't distance from the nucleus in which the electron revolves around the nucleus to which the orbit are numbered as 1, 2, 3, 4 - from the nucleus and are designated by the Capital letter K, L, M, N ... etc

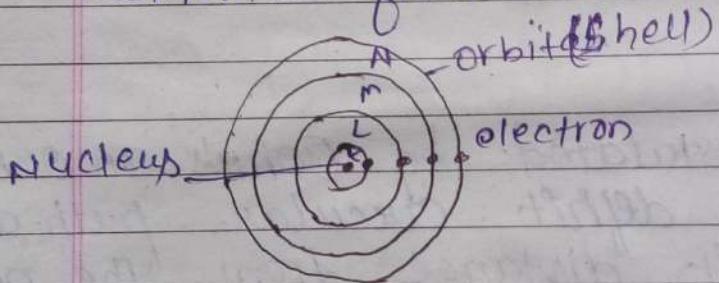
→ An orbit indicates and exact position / location of an electron in an atom

e.g - According to Bohr's theory an electron of hydrogen is found at the distance of  $0.53\text{\AA}$  from the nucleus.

## Orbital:-

As postulated by wave nature of an electron an orbital is defined as 3-dimensional region or space around the nucleus within which the possibility / probability of finding an electron with a certain energy is maximum

- An orbital does not specify the definite exact position of an electron in an atom because the electron due to its wave nature can not be found at a fixed distance from the nucleus



## St. of Bohr's atomic model

~~18/11/21~~

### Molecular Orbital

- The goal of molecular orbital to describe molecules in a similar way to how we describe atoms that is in terms of orbital
- Orbital diagram and electronic configuration

→ Molecules can share 1, 2 or 3 pairs of electrons

→ Sing bond -1  
Double bond -2

Triple bond -3

iii) Other type of bonds are formed by charge atoms that is ionic and metal (metallic atom)

### Orbital mixing :-

- when atoms share electrons to form a bond their atomic ~~that~~ <sup>orbital</sup>s mixed to form molecular bond in order for these orbital to mix they must
  - i) Have similar energy level
  - ii) overlap well
  - iii) well closed together

### Molecular orbital Theory (MOT)

- Atomic orbital mixed together and make
  - i) Bonding orbitals
    - electrons in this orbitals hold help hold atom near each other.

#### (II) Antibonding orbitals

- electrons in this orbital push atom apart from each other.

#### Non bonding orbital (like lone pair)

- electron in this orbitals have no effect on bonding
- Molecular orbital can
  - be sigma( $\sigma$ )  $\text{O}_2$ ,  $\text{P}_i(\pi)$
  - be spread over multiple atoms

### Principle of molecular orbital theory

- In molecules atomic orbital combine to form molecular orbitals which surround the molecules

- (a) Bonding  $\text{O}_2 \rightarrow \text{O} \cdot \text{O}$  Bonding  
 (b) Antibonding  $\text{O}_2 \rightarrow \text{O} \parallel \text{O}$

→ Molecular bonds have lower potential energy than in separate atomic orbitals.

→ Thus electrons prefer to stay in a molecular bond.

- Equal no. of orbitals
- Order of energy
- Atomic orbitals, a like energy
- Following both the Pauli exclusion principle and Hund's rules
- \*  $\sigma$  Bond (Sigma)

→ They are symmetrical about the axis.

- \*  $\pi$  Bond (Pi)

→ The  $\pi(\pi)$  bonding bonds as a side to side overlap which then causes their density above the and below the axis.

### 25/11/12) 1. Hybrid orbitals

The strength of equivalent bond stems from the exchange of electrons b/w two atoms.

- The magnitude of this exchange energy is proportional to the amount of the overlap of atomic orbital structure constituting the bond.
- <sup>max overlap of</sup> <sup>orbital structure</sup> Atomic bond result will result in the strongest bond consequently the bond formed by a given orbital

will tend to lie in the direction in which the orbital has the maximum value called hybrid orbitals.

### ii) Intermolecular force:-

We must remember that the particular method of mentally building molecules that we are learning to use is artificial. It is a purely intellectual process involving imaginary overlap of imaginary orbitals.

— There are other equally artificial ways that use different mental or physical models. Our method is the one that so far has seemed to work out best for the chemist.

But however we arrive at be see the actual structure of a molecule to be the net result of a combination of repulsive & attractive force. We are related to charge & electron spin.

### \* Repulsive force:- Electrons tend to

'Stay as far apart as possible' because they have the same charge and also if they are unpaired because they have the same spin.

(Pauli exclusion principle)

— The live charge atomic nuclei to repel each other

\* Attractive force :- Electrons are attracted by atomic nuclei as are the nuclei by the electrons because of their opposite charge and hence tend to occupy the reason b/w two nuclei opposite. Spine permits to electrons to occupy the same regions

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### Q) Bond dissociation energy

$O_2$

#### Bond Energy

→ The bond energy is defined as the strength of the bond as if exist in a molecule or the contribution of the bond between a particular pair of atom A-B in a molecule to the total bond energy present in that molecule

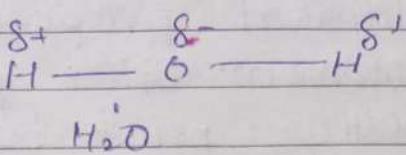
#### 1 Polarity of bonds :-

→ Besides the properties already describe certain co-valent bonds have another properties polarity two atoms joint by a co-valent bond share electrons their nuclei are held by the same electrons but in most cases the two nuclei do not share the electrons equally.

→ The electron is denser about one atom than the other. One end of the bond is relatively negative and other end is relatively positive that is there is a negative pole & a positive pole

positive pole. Such a bond is said to be a polar po bond.

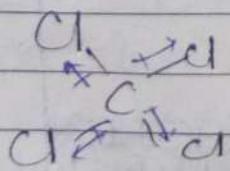
Example



### \* Polarity of molecules:-

A molecules is a polar if the centre of negative charge does not coincide with the centre of positive charge. Such a molecule constitute a dipole to equal and opposite charge separate in a space.

- A dipole is obtain symbolized by " $\vec{+} \rightarrow$ " where the arrow point from Positive to negative. →
- The molecule possess a dipole moment which is equal to the magnitude of charge electron multiplied by distance "D" between the centre of charge
- Methane and Carbon tetra Chloride ( $\text{CCl}_4$ ) and zero(0) dipole moment we generally would expect the individual bonds of Carbon tetra Chloride atleast to be polar because of the very symmetrical tetrahedral arrangement



$$\mu = 0D$$

where, Dipole moment =  $\mu$

Distance =  $d$

Magnitude of Charge =  $e$

$$e = exd$$

dipole esu cm

→ unit  $D$

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\* Structure and physical properties  
we have just discussed discussed on  
physical properties of compound dipole  
movement Other physical properties like  
melting point boiling point or solubility  
in a particular solvent are also of  
concern to us

→ The physical properties of a new  
Compound give valuable structure.  
In attempting to synthesize a new  
Compound

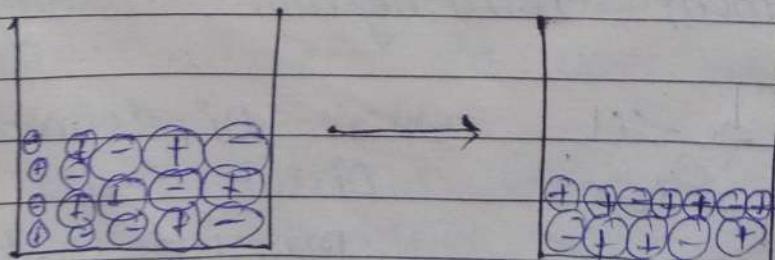
Example - A new

We must plan a series of  
reaction to convert a compound that  
we have into the compound that we  
want

Q) melting point

In a crystalline the particles acting as  
has structural unit ion or molecule  
are arranged in some very regular  
symmetrical way. There is a geometrical  
pattern repeated over and over within  
a crystal.

→ melting is the change from highly ordered  
arrangement of particles in the crystalline



melting of an ionic crystal - the units are ion

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### Boiling point:-

- The particles in a liquid are arranged less regularly and are free to move about than in a crystal each particle is attract by a number of other particles. Boiling involves the breaking away from the liquid of individual molecules or pairs of oppositely charged ions this occurs when a temperature is reached at which the thermal energy of the particles is great enough to over come the cohesive force that hold them in the liquid.

### Solubility:-

- When solid or liquid dissolved the structural unit ions or molecules become separate from each other. And the species of liquid in b/w become separate occupied by solvent molecules in dissolution as in melting & boiling energy must be supplied to over come the inter-ionic or inter-molecular force.
- The energy required to break the bonds b/w solute particles is supplied by the formation of bond. b/w the <sup>solute</sup> solid particles & the solvent molecules the attractive force are replaced by new molecules.

### \* Inter molecular force :-

what kinds of forces neutals molecule to each other like interionic force these forces seems to be electrostatic in nature involving attraction of the

Charge & negative charge. There are two kinds of intermolecular force

- (i) Dipole - dipole interaction
- (ii) Non-van-derwaals forces -

### i) Dipole - Dipole Interaction -

The attraction of the positive end of one polar molecule for the negative end of another polar molecule ~~in~~ in hydrogen chloride.

Example - The relatively positive hydrogen of one molecule is attracted to the relatively negative chlorine of another.

- As a result of dipole - dipole interaction polar molecules are generally held to each other more strongly than are non polar molecules of comparable molecular weight this differences in strength of intermolecular force is reflected in the physical properties in the compound.

### ii) Van-derwaals forces -

There must be forces b/w the molecules of a non polar compound. Even such compounds can solidify. Such attraction are caused van der waal forces.

## Stereochemistry

These compounds have the same molecular formula but differ from each other in physical or chemical properties, and are called isomers and the Phenomenon is called isomerism.

There are two main types of isomerism.

(1) Structural isomerism.

(2) Stereoisomerism.

### Structural isomerism.

Structural isomers are compounds that have the same molecular formula but different structural formula is called structural isomerism.

They are five types of structural isomerism.

(1) Chain isomerism

(2) Position isomerism.

(3) functional isomerism.

(4) Metamerism.

(5) Tautomerism.

### Stereoisomerism

The stereoisomers have the same structural formulas but differ in arrangement of atoms in space. is called stereoisomerism.

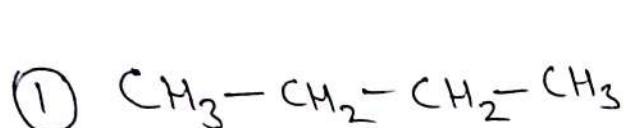
(2)

These are two types.

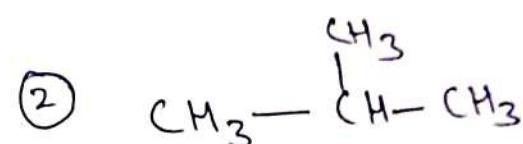
- (1) geometrical or cis-Trans isomerism
- (2) Optical isomerism.

### (1) Chain isomerism.

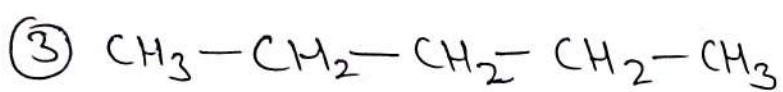
Chain isomers have the same molecular formula but differ in the order in which the carbon atoms are bonded to each other.



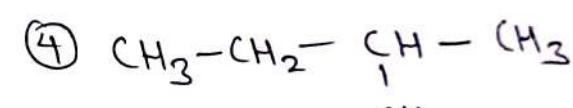
n-Butane



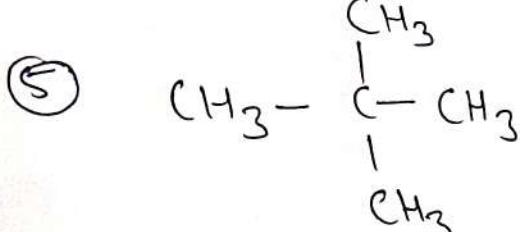
isobutane



n-Pentane



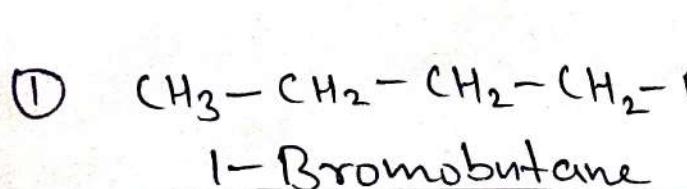
2-methylbutane



2,2-Dimethylpropane.

### (2) Position isomerism

Position isomers have the same molecular formula but differ in the position of a functional group on the carbon chain.



1-Bromobutane

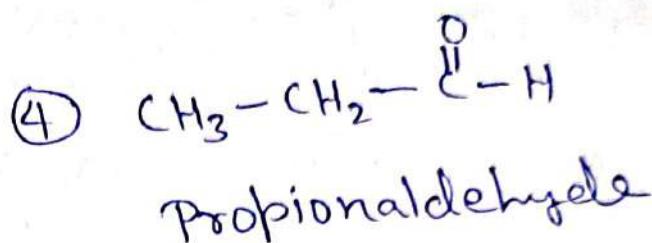
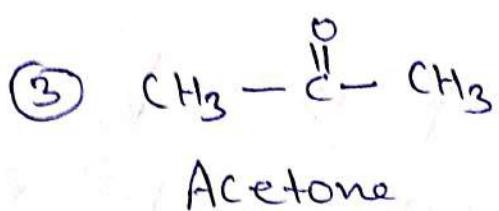
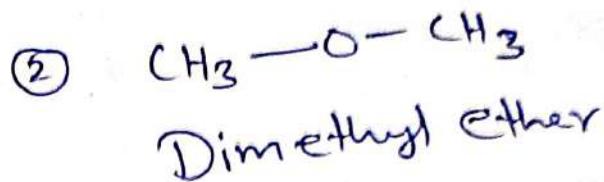
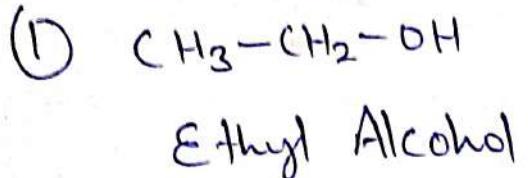


2-Bromobutane

### (3) Functional Isomerism.

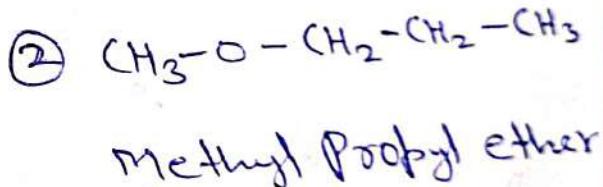
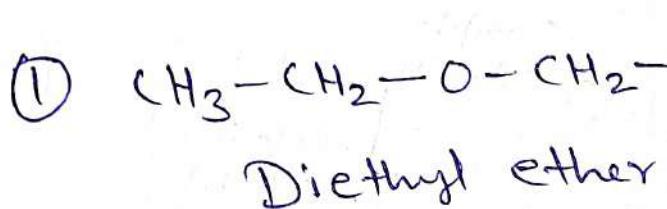
(3)

-functional isomers have the same molecular formula but different functional groups.



### (4) Metamerism

This type of isomerism is due to the unequal distribution of carbon atoms on either side of the functional group. Members belong to the same homologous series.

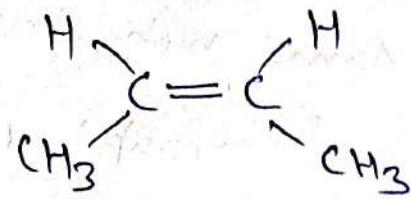


→ Geometrical isomerism (cis-Trans isomerism)

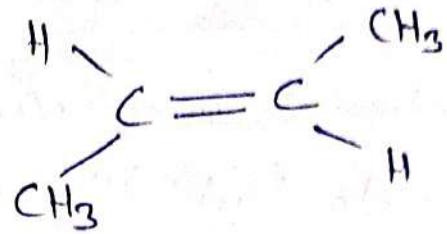
- Geometric isomerism (also called cis-trans isomerism) results from a restriction in rotation about double bonds, or about single bonds in cyclic compounds.
- The cis isomer is one in which two similar groups are on the same side of the double bond. The trans isomer is that in which two similar groups are on the

(4)

Opposite sides of the double bond.



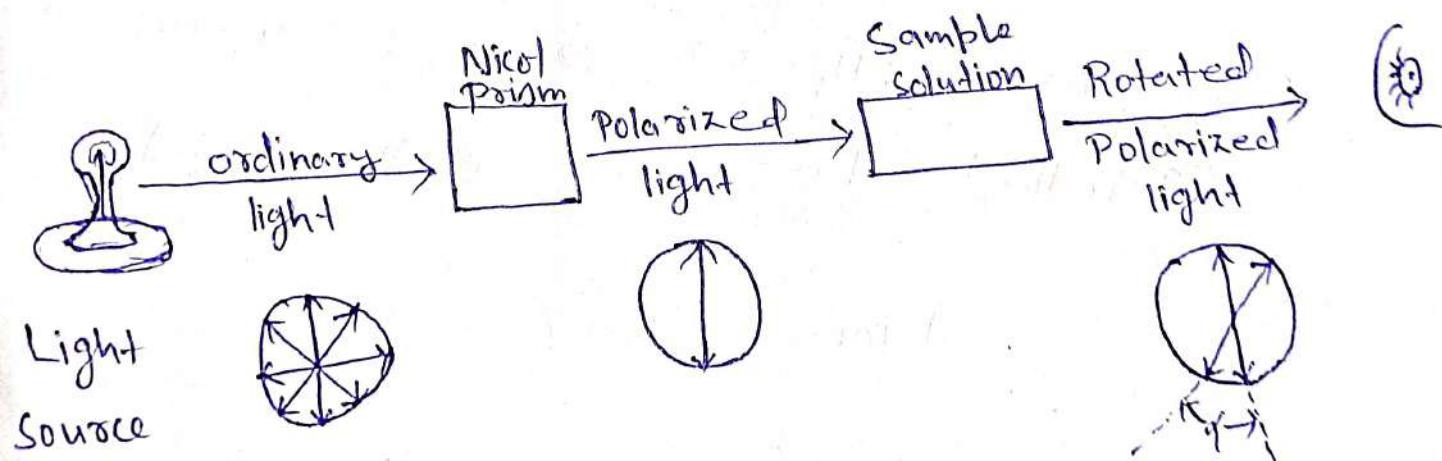
cis



trans

## ⇒ OPTICAL ACTIVITY

- Light from ordinary electric lamp is composed of waves vibrating in many different planes.
- Solutions of some organic compounds have the ability to rotate the plane of polarized light. These compounds are said to be optically active. This property of a compound is called optical activity.



Simple polarimeter in operation.

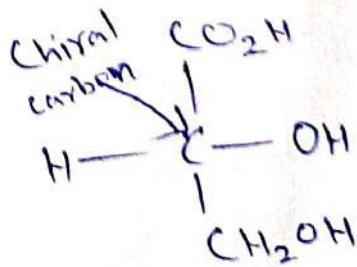
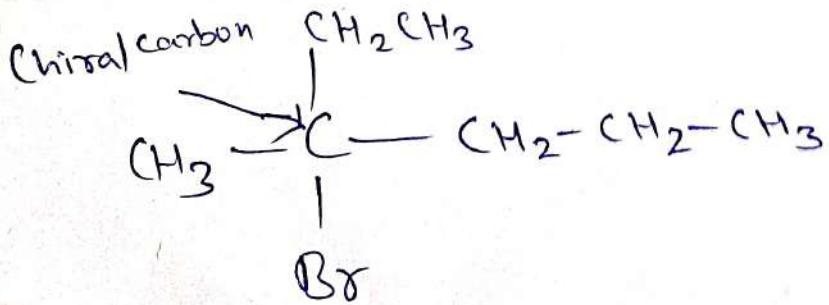
- Optical Activity in a compound is detected and measured by means of a Polarimeter. When a solution of a known concentration of an optically

Active material is placed in the polarimeter<sup>(S)</sup>  
 the beam of Polarized light is rotated through a certain number of degree, either to the right (clockwise) or to the left (anticlockwise). The compound which rotates the plane of Polarized light to the right (clockwise) is said to be Dextrorotatory, it is indicated by the sign (+). The compound which rotates the plane of Polarized light to the left (anticlockwise) is said to Levorotatory.

- ⇒ Chirality → A molecule is chiral if its two mirror-image forms are not superimposable in three dimension  
 Chiral meaning "hand".
- Plane of Symmetry.  
 • A Plane which divides an object into two symmetrical halves (BILATERAL) is said to be plane of symmetry.

### Chiral Carbon Atom.

- A carbon atom which is bonded to four different groups is called a chiral (or Asymmetric) carbon atom. for example.



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The term chiral (Greek handedness, Pronoun-ed kairal) carbon atom means that a carbon atom is bonded to four different groups and that a molecule of this type lacks a Plane of Symmetry. Such a molecule is also called Dissymmetric or Asymmetric.

- Chirality most often occurs in molecules that contain a carbon that is attached to four different groups.

## Q. Structural & nomenclature

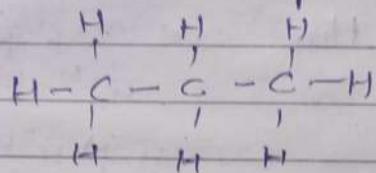
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### Alkane:-

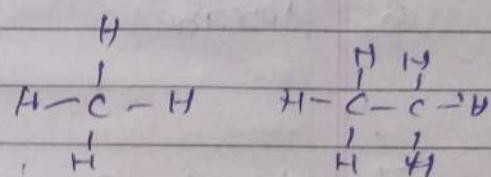
- Alkane are the simplest organic compound made up carbon & hydrogen only.
- They have the general formula  $C_nH_{2n+2}$

where  $n = 1, 2, 3, 4$

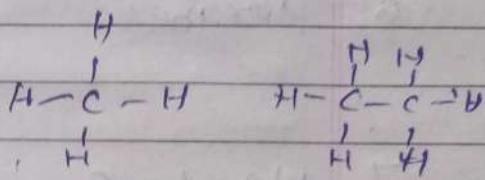
The first three member of this class can be represented as



Propane



Methane



Ethane

Alkane contain strong C-C and C-H co bond co-valent bond therefore this class of hydrocarbon are relatively chemically inert.

### Nomenclature:-

#### (i) Common name-

The first four member of this series are called by their common name methan, ethane, propane & Butane.

SNO	Name	molecular form	Structure
1	Methane	$CH_4$	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C}-\text{H} \\   \\ \text{H} \end{array}$
2	Ethane	$C_2H_6$	$\begin{array}{c} \text{H} & \text{H} \\   &   \\ \text{H}-\text{C} & -\text{C}-\text{H} \\   &   \\ \text{H} & \text{H} \end{array}$

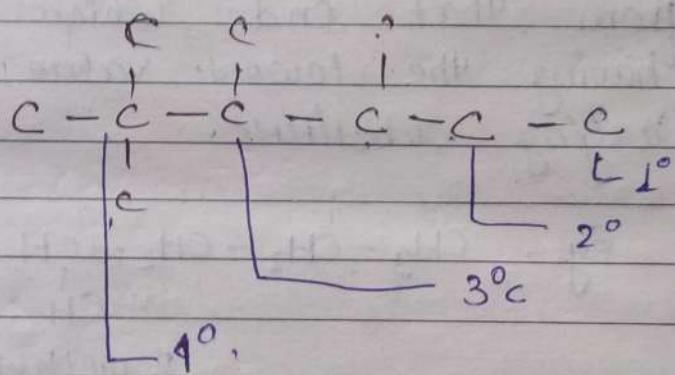
		(Jan 19)
3	Propane $C_3H_8$	$\begin{array}{c} H & H & H \\   &   &   \\ H-C-C-C-H \\   &   &   \\ H & H & H \end{array}$
4	Butane $C_4H_{10}$	$\begin{array}{ccccc} H & H & H & H \\   &   &   &   \\ H-C-C-C-C-H \\   &   &   &   \\ H & H & H & H \end{array}$
5	Pentane $C_5H_{12}$	$\begin{array}{ccccc} H & H & H & H & H \\   &   &   &   &   \\ H-C-C-C-C-C-H \\   &   &   &   &   \\ H & H & H & H & H \end{array}$
6	Hexane $C_6H_{14}$	$\begin{array}{ccccccc} H & H & H & H & H & H & H \\   &   &   &   &   &   &   \\ H-C-C-C-C-C-C-H \\   &   &   &   &   &   &   \\ H & H & H & H & H & H & H \end{array}$
7	Heptane $C_7H_{16}$	$\begin{array}{ccccccc} H & H & H & H & H & H & H \\   &   &   &   &   &   &   \\ H-C-C-C-C-C-C-C-H \\   &   &   &   &   &   &   \\ H & H & H & H & H & H & H \end{array}$
8	Octane $C_8H_{18}$	$\begin{array}{ccccccc} H & H & H & H & H & H & H \\   &   &   &   &   &   &   \\ H-C-C-C-C-C-C-C-C-H \\   &   &   &   &   &   &   \\ H & H & H & H & H & H & H \end{array}$
9	Nonane $C_9H_{20}$	$\begin{array}{ccccccc} H & H & H & H & H & H & H \\   &   &   &   &   &   &   \\ H-C-C-C-C-C-C-C-C-C-H \\   &   &   &   &   &   &   \\ H & H & H & H & H & H & H \end{array}$
10	Decane $C_{10}H_{22}$	$\begin{array}{ccccccc} H & H & H & H & H & H & H \\   &   &   &   &   &   &   \\ H-C-C-C-C-C-C-C-C-C-C-H \\   &   &   &   &   &   &   \\ H & H & H & H & H & H & H \end{array}$

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\* Primary: carbon - secondary & tertiary  
 → The structural formula of alkanes contain 4 types of carbon atoms

i) A carbon atom attached to one another carbon is called primary carbon. (P. carbon)

- ii) A carbon atom attached to two another carbon atom is called secondary carbon ( $2^{\circ}$  carbon)
- iii) A carbon atom attached to three another carbon is called tertiary carbon ( $3^{\circ}$  carbon)
- iv) A carbon atom attached to four carbon atom is called quaternary carbon ( $4^{\circ}$  carbon)



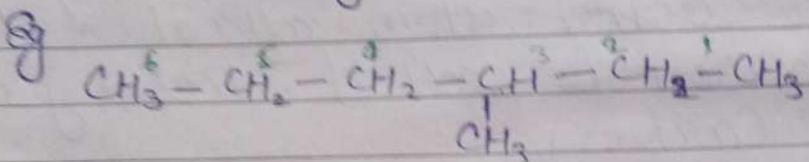
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IUPAC System :— (International Union of Pure & Applied Chemistry)

- The common system has some limitation
- pentane has three isomeric
- heptane has five isomeric.
- the more completed the alkane the greater the number of special prefix needed to name the isomer.
- In order to device a system of nomenclature that could be used for even the most completed compounds committee of chemist have meet periodically.

→ The IUPAC system is much the same for all families of organic compound

Step I Name the longest chain

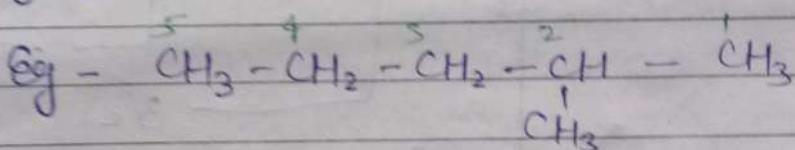


Step II

3-methyl heane

Step II Number of the longest chain

- The carbon atoms in the longest chain are numbered. The numbering is started from that end which will give numbers having the lowest value to carbons carrying substituent.

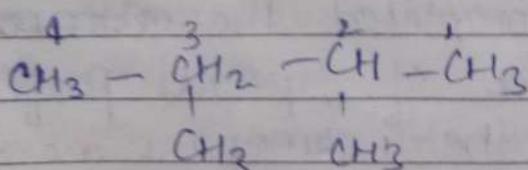


Eg

2-methyl pentane

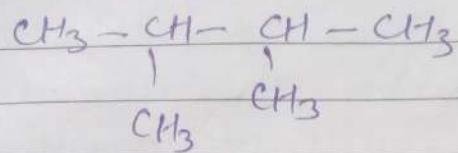
Step III locate and name the substituent

Each substituent is named and the position of each substituent is indicated by the number of carbon atom to which it is attached



Step IV Combine the longest chain and substituent into the name

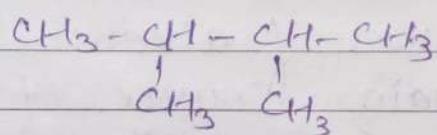
- The position and the name of substituent are added to the name of the longest chain



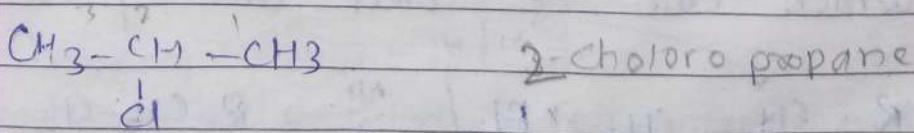
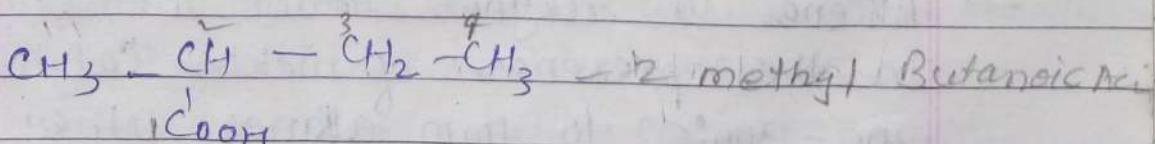
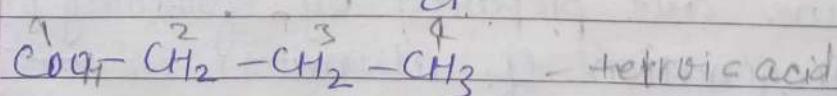
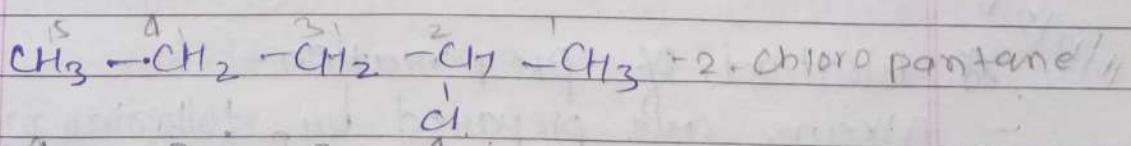
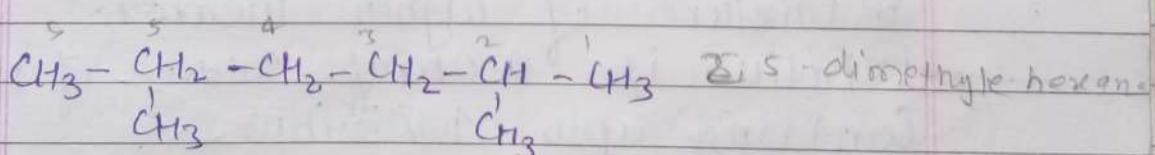
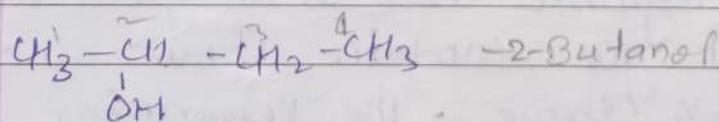
2,3-dimethyl Butane

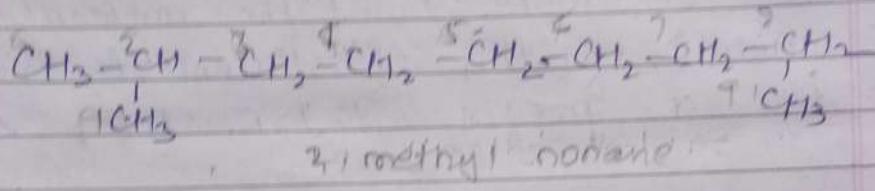
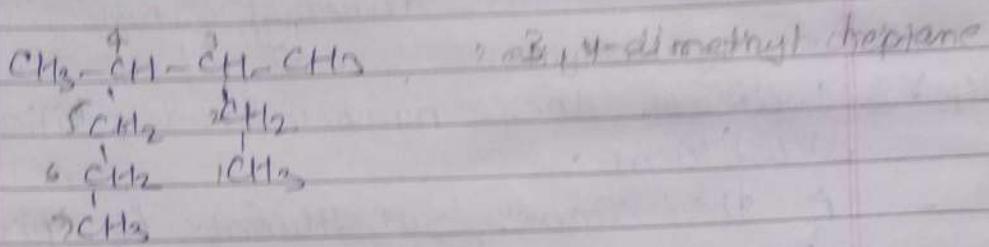
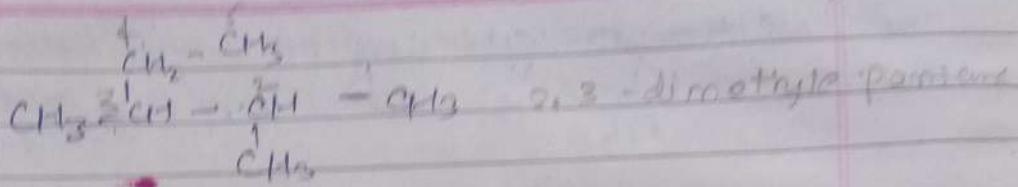
**Step 2** Indicate the number and position of substituent.

- If the same substituent is present two or more time in the molecule the number of this substituent is indicated by a prefix di, tri, tetra etc



e.g.  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$  — Butane





(II) Red  
→ Alkyl  
hydro-

(III) Hydro  
→ Al  
gen  
ha

→ the

### ~~\*\*~~ Natural source of alkane

- The two main source of alkane  
natural gas & petroleum

both of these substance are principally  
found together in underground deposit.  
natural gas contain about 80% methane  
and 10% ethane. The remaining 10%  
is mixture of higher member.

- Petroleum is chief source of alkane  
containing upto 10% carbons

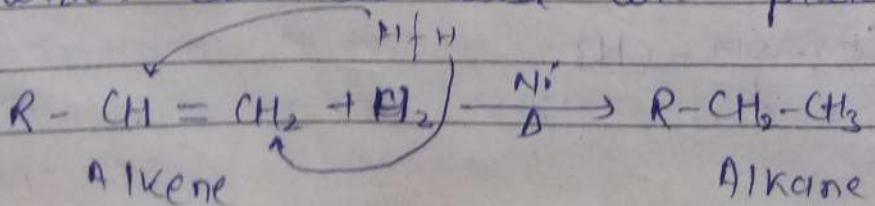
### ~~Method of preparation -~~

- Alkane are prepared by following method

(i) → hydrogenation of alkene (=) or alkyne (=).

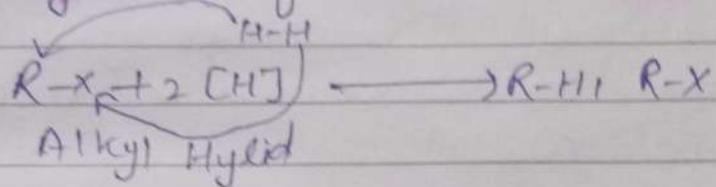
→ Alkenes or alkynes react with hydrogen

in the presence of nickles catalyst at  
200-300°C to form alkanes. Other catalyst  
which can be used are platinum (Pt)



### ii) Reduction of alkyl Halide-

→ Alkyl halides undergo reduction with recent hydrogen to form alkenes

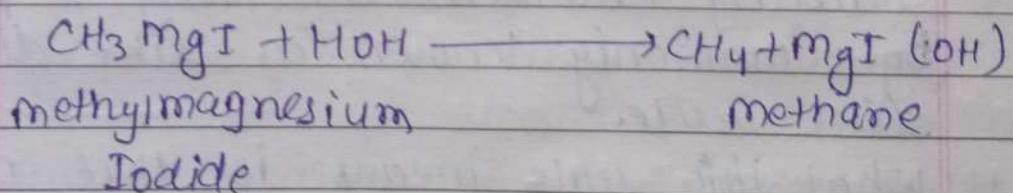
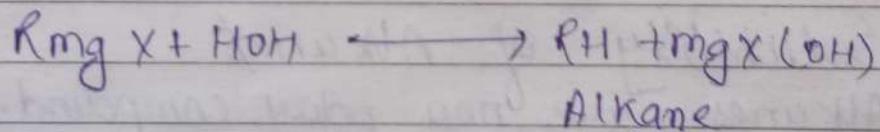
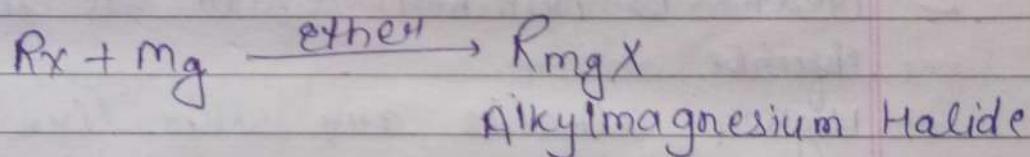


Allegle

where  $x = I, B^x, C$

### (iii) Hydrolysis of a Grignard Reagent.

- Alkyne magnacum halide (Wittigand Reagenz) are obtain by treating alkyle halide with magnesium in hydroum ether.
- these treatment with water give alkane



## Wolff-Kishner Reaction (Synthesis)

→ Higher alkanes are produced by heating a alkyle halide ( $R-X$ ) with Sodium metal in dry ether solution. Two molecules of the alkyle halide loss their Halogen atom. The net result in the joining two alkyle group to yield a symmetrical

alkane having an given even number  
of carbon atom

### Physical Properties :-

First four alkane - methane, ethane,  
propane, Butane are gaseous

- Next 15 number C<sub>5</sub> to C<sub>19</sub> are colourless liquid.
- Higher alkanes are wax like solid.

### Solubility of Alkanes

→ Alkanes are non polar compound. Their solubility characteristic may be predicted by Commonly known as like dissolve like rule.

— what this rule means is that non polar compound are soluble in the other non polar solvent and that polar compound are generally soluble in other polar solvent

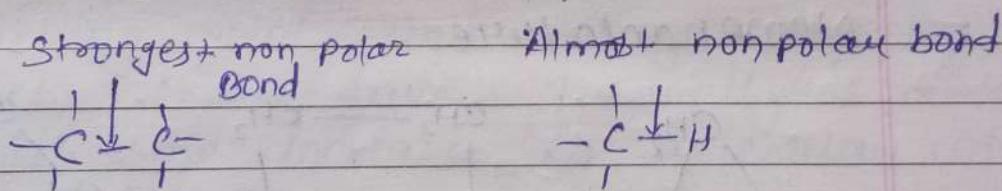
— Thus alkanes are soluble in the non polar solvent like carbon tetrachloride and benzene but they are

In soluble in polar solvent such as water.

Chemical properties of Alkane -

→ As already absorbed alkane are relatively stable to common reagent such as - Acid, Alkeli, oxidizing agent, at room temperature.

This is due to the fact that the electro negativity of carbon ( $2.060$ ) any hydrogen ( $2.1$ ) do not differ. Thus, the bond electron in carbon - Hydrogen ( $\text{CH}$ ) are practically equal shared shared between them and the bond is almost non-polar.



### \* Methane - ( $\text{CH}_4$ )

Methane is the first member of alkane series. It is also called "marsh gas" because it is found bubbling from marshy place where it is produced as a result of bacterial decomposition of dead vegetable.

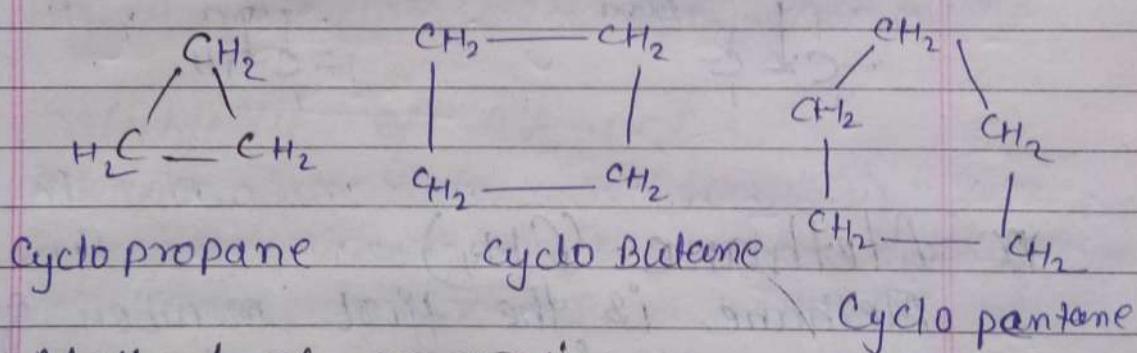
- It also occurs under presence in many coal. The coal mines are called it fire damp.

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## \* Cyclo alkane:-

Cyclo alkane or, Cyclo paraffin are saturated hydrocarbons in which the carbon atoms are joined by single co-valent bond to form a ring.

- They are also called ali-cyclic compound.
- The prefix - ali is added because of their similar to aliphatic compounds.
- The unsubstituted cyclo alkane form a homologous series with general formula  $(C_nH_{2n})$ .
- The first member of these series is Cyclo propane  $C_3H_6$ .
- Nomenclature

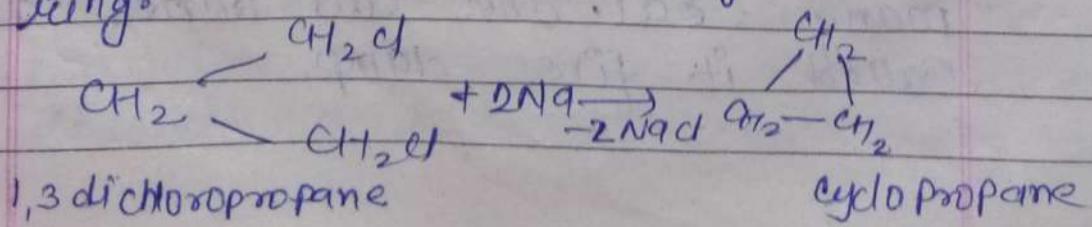


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## Method of preparation —

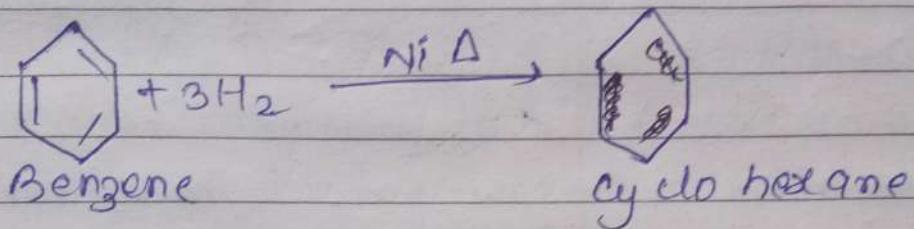
### (i) From dihalid:-

Terminal dihalid when treated with Sodium ( $Na$ ) or, Zinc ( $Zn$ ) from cyclo alkane. This reaction is an extension of Wurtz's heat and it is useful for the preparation of 3-6 membered ring.



(ii) From aromatic hydrocarbon —

6 membered cyclo alkane can be prepared by catalytic reduction of benzene and its derivative.



Physical properties -

i) Cyclo pro alkane

(i) Cyclo propane & cyclo Butane are gaseous at room temperature the remaining cyclo alkanes are liquid.

(ii) Melting point and boiling point of Cyclo alkane are gradually increase with the increase in molecular wt.

(iii) Cyclo alkane are insoluble in water but dissolve in ethanol & ether.

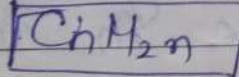
\*) Alkene Chemical properties.

D

### \* Alkene :-

→ Alkenes are hydrocarbon that contain a C=C double bond in their molecules.

→ They have the general formula -



→ In comparison to  $C_nH_{2n+2}$  of alkane.

→ Alkenes contain two hydrogen atom less than alkane.

### Structural :-

- Let us consider  $CH_2 = CH_2$  (C=C) of illustrating the orbital makeup of alkene

- In ethylene the carbon atom are  $sp^2$  hybridized.

→ They are attached to each other by sigma ( $\sigma$ ) bond and pi ( $\pi$ ) bond.

→ The sigma bond results from the