GRAVITY CLASSES

"Come Gravity Feel Success"

11th & 12th BOARD (NEET & JEE)

5th - 10th (All Subject)

NOTES
CHEMISTRY

Directors
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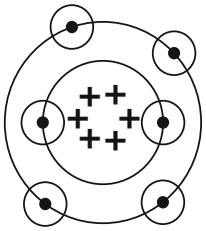
Blue star campus,
patther ki masjid, patna - 6

CARBON AND IT'S COMPOUND

→ Atomic Number is 6 i.e. 6p and 6e.



→ Also it has 6 NEUTRONS, so the MASS NUMBER becomes 12 (6p+6n).
→ Electronic Configuration is (2,4) → 4.....Valence electron count.
→ Hence valence is 4 so its is 'TETRAVALENT'. Element.

Q. Why is carbon so Important?

→ It is the main element present in all Living Plant, Animal Organism.
→ Almost all fuel that we use are made of carbon.
→ Other organic substances like carbohydrate, protein, fats, alcohol, vinegar, glucose etc contain Carbon.
→ Plastic have carbon.

Q. What is the uniquencess in CARBON?

→ It can from Huge Number of compounds.
→ Number of all carbon compounds is greater than all non carbon compounds.
→ So, organic chemistry is studied as a separate branch of chemistry.

Q. Reasons behind this uniquencess?

→ Tetra covalency. [Uniqueness only present in carbon] (4 valency only sharing of e^-.)
→ Catenation.
→ Polymerisation.
→ Isomerism.

1. Tetra Covalency:-

It's valency is 4 and it can form compound only by sharing electrons. Those compounds which make by sharing (4) is Covalent Compound.

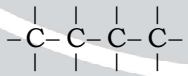
→ **Covalent Compound:-** The atomic number of carbon is 6. Its electronic configuration is 2, 4. It requires 4 electrons to achieve the inert gas electronic configuration. But carbon can't form an ionic bond. ex.- Na^+Cl^-
→ It could gain four electrons forming C^{4-} ion. But it would be difficult for nucleus with six protons to hold on to ten electrons.
→ It could lose four electrons fomring C^{4+} cations. But it requires a large amount of energy to remove four electrons.

2. Catenation:-

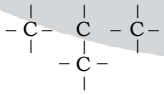
The property of direct bonding between atoms of same element (carbon) to form long chain, branches and ring structures.

→ Carbon posses this property.

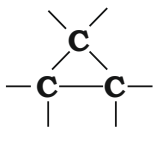
Straight Chain

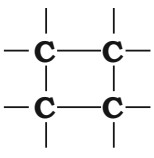


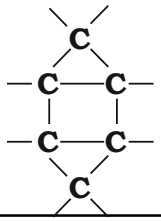
Branched Chain



Closed Chain





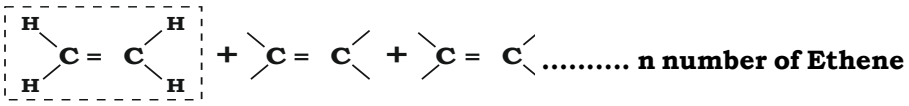


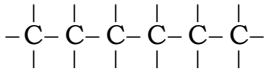
3. Polymerisation:-

→ Monomer → A small similar molecules.

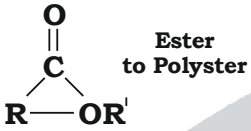
→ The chemical process that combines several monomers to form a polymer or polymeric compound.

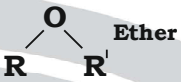
Ehtene



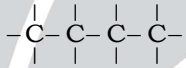
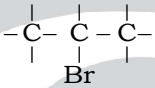
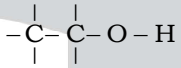
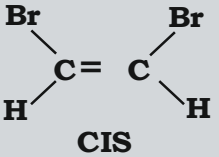
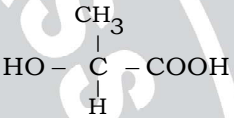
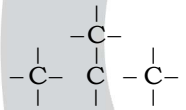
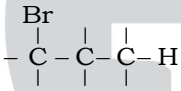
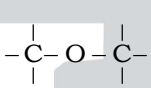
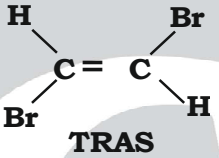
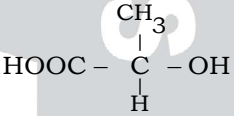


→ Ethene to Polythene





4. Isomerism:- Compounds having same molecular formula but different structures are called isomers and this property is called Isomerism.

Isomerism				
Structural Isomerism			Stereo Isomerism	
Branched Chain	Position	Functional Group	Geometric	Optical
			 CIS	
			 TRAS	

➢ **Allotropes of Carbon:-** Different physical forms of an element that has same chemical properties but different physical properties are known as Allotropes. There are three allotropes of carbon-diamond, Charcoal graphite and Fullerene.

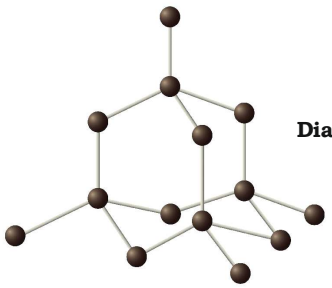
- **Graphite:-** This is soft substance. (ii) Due to free e^- it conduct electricity.

  Uses: (i) As a lubricant Gap ($1A^o = 10^{-10}m$) Angstron (A^o), (ii) Block electrode in battery, (iii) Pencil.

- **Diamond:-** Diamond exists as three dimensional network with strong carbon-carbon covalent bonds. Diamond is hard in nature with high melting point. It shines in presence of light and it is a bad conductor of electricity but good in heat. The most common use of diamond is in making jewellery. It is also used in cutting and drilling tools. So its Melting point is high.

→ Hardest and least compressible substance.

→ Age of Diamond 1 to 3.5 Billion and formed 150-250 km earth's mantle.



Diamond Carbon Bonding

- **Fullerence (Buckminster):-** Crystalline forms of carbon having 30 to 960 atoms in their molecules are called Fullerence.

→ It is a hollow cage or Foot ball which exists in form of sphere. Its structure is similar to fullerence. But along with hexagonal rings sometimes pentagonal or heptagonal rings are also present.

→ Made up of C60 (shape of fullerence)

→ Pentagon (12), Hexagonal (20)

→ Dark solid mud at room temperature.

→ Bad conductor of electricity and same members of Fullerence family superconductor.

➢ **Types of Compound:** Inorganic, Organic (only carbon) → Hydrogon.

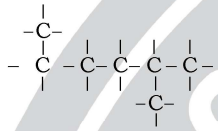
→ **Carbon Compound:-** Compounds contain carbon. Ex.- CS_2, CO_2, $C_6H_{12}O_6$, CH_4 etc.
Carbon Compound → (i) Inorganic, (ii) Organic

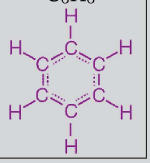
→ **Organic Compound:-** Compounds containing carbon and Hydrogen, O, N, S etc. (Living organism → Food → Carbohydrate, Protein etc.)
Ex.- C_2H_5OH (Alcohol), CH_3COOH (Acetic Acid/Vinegar), $C_6H_{12}O_6$ (Glucose).

→ **Hydrocarbon:-** Compounds containing carbon and Hydrogen ONLY. Ex.- CH_4, C_2H_6, C_2H_2 etc.

➢ **Classification of Hydrocarbon:-**

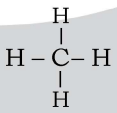
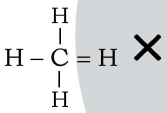
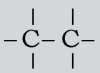
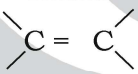
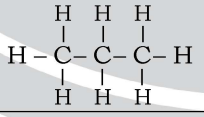
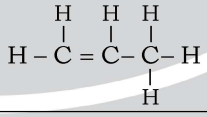
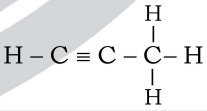
Hydrocarbon

Acyclic or Aliphatic (Open Chain): 3 Types	Closed Chain or Carbocyclic or Cyclic	
		

Alkanes (Singal Bond) C – C – C – C	Alkynes (Triple Bond) C ≡ C – C – C	Alicyclic			Aromatic (Benzene) C_6H_6
Alkenes (Double Bond) C – C – C = C		Cycloalkanes	Cycloalkenes ×	Cycloalkynes ×	

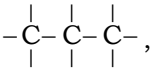
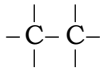
Name of Prefixes	Number of Carbon
Meth	1
Eth	2
Prop	3
But	4
Pent	5
Hex	6
Hept	7
Oct	8
Non	9
Dec	10
Undec	11
Dodec	12

➢ **Aliphatic Hydrocarbons (Open Chain):**

Number of Carbon (n) Atoms (Prefix)	Suffix	Suffix	Suffix
	ALKANE (–) [C_nH_{2n+2}]	**ALKENE (=) [C_nH_{2n}]**	**ALKYNE (≡)[C_nH_{2n-2}]**
1 (METH–)	Methane 	Methene  × Monovalent	Methyne
2 (ETH–)	Ethane 	Ethene 	Ethyne –C ≡ C –
3 (PROP–)	Propane 	Propene 	Propyne 
4 (BUT–)	Butane	Butene	Butyne
5 (PENT–)			

- Saturated → Completely filled (no more Hydrogen can be added).

→ **Alkane** are saturated Hydrocarbon.

Ex.-  , 

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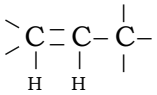
Opp. Kulhariya Complex, Pillar Number-09

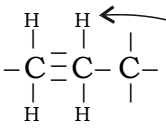
- We can't attach any hydrocarbon atom.

→ **Alkene and Alkyne** are unsaturated Hydrocarbon.

Ex.-



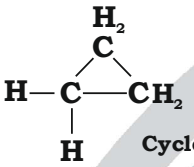
By breaking 1 Bond add 2 H



By breaking 2 Bond 4 H added

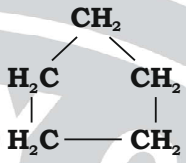
- CH_4 → Methane C_2H_6 → Ethane Propane → Propyle
- CH_3 → Methyl C_2H_5 → Ethyle

➢ **Cycloalkane:-** (Cyclo → Ring, Alkane → Single Bond)

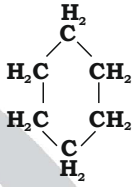


Cyclopropane

Cyclobutane



Cyclopentane



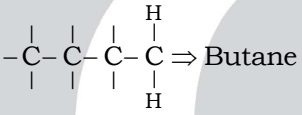
Cyclohexane

Note:- Cyclohexane is different from Benzene (Double Bond)structure.

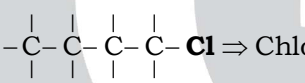
- **Functional Group:**

Hetroatom → Other than Hydrogen (Ex.- Cl, OH)

→ Functional groups are defined as specific atoms, group of atoms or ions which are parts of a larger hydrocarbon chain and imparts characteristic properties to the compound.



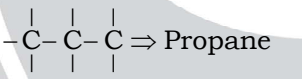
Butane



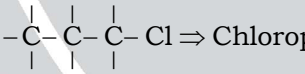
Chlorobutane (Cl → This is called Functional Group.)

➢ **IUPAC Nomenclature (International Union of Pure and Applied Chemistry):**

1. Halogen (Cl, Br, I, F) Prefix - Chloro, Bromo, Iodo, Floro

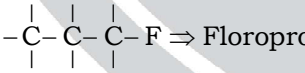


Propane

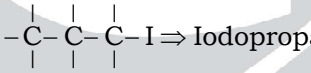


Chloropropane [Chloro → Halo (prefix), Propane → Single Bond]

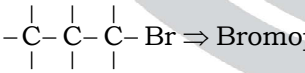
Halogen Group (Cl, Br, I, F)



Floropropane



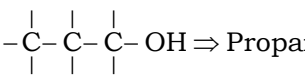
Iodopropane



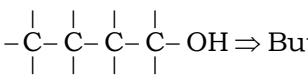
Bromopropane

2. Alcohol (–OH) **Suffix - *'Ol'***

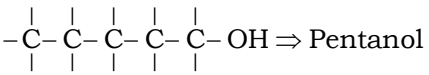
→ Alkanol



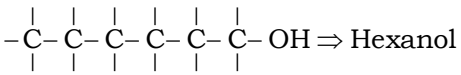
Propanol



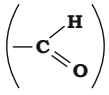
Butanol



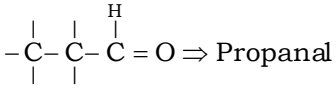
Pentanol

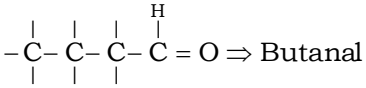


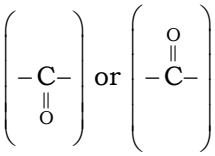
Hexanol

3. Aldehyde (-OH)  → At Terminal **Suffix - 'al'**

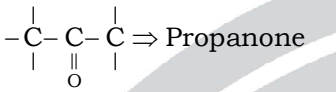
→ Alkanal (–CHO)

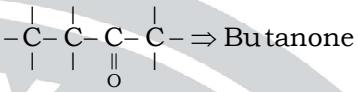


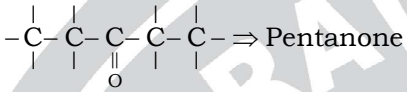


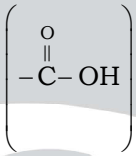
4. Ketone  **Suffix - 'one'**

→ Alkanone [Non-Termal carbon (In b/w)]

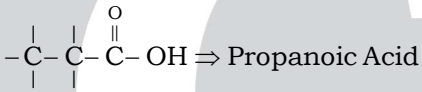




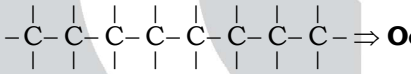


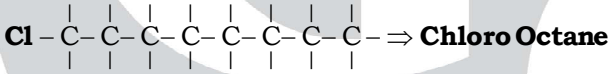
5. Carboxylic Acid (–COOH)  **Suffix - 'oic acid'**

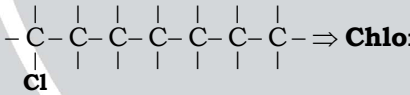
→ Alkanoic Acid

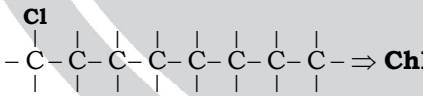


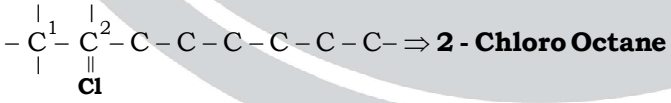
➢ **Nomenclature:**

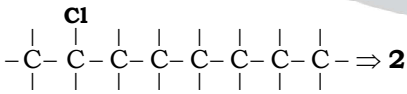
→  **Octane**

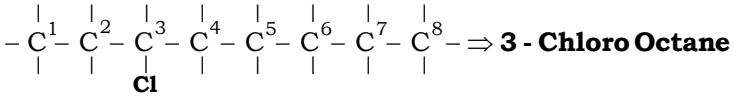
→  **Chloro Octane**

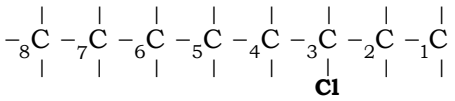
→  **Chloro Octane**

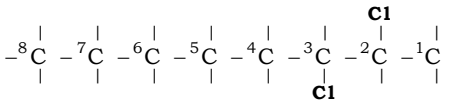
→  **Chloro Octane**

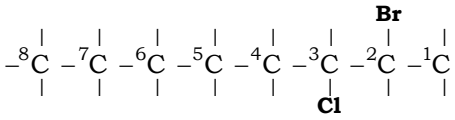
→  **2 - Chloro Octane**

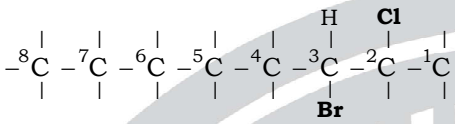
→  **2 - Chloro Octane**

→  **3 - Chloro Octane**

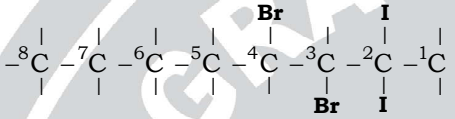
→  ⇒ **3 - Chloro Octane**

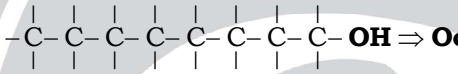
→  ⇒ **2,3 - Dichloro Octane**

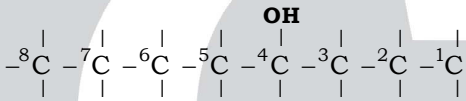
→  ⇒ **2 - Bromo - 3 - Chloro Octane**

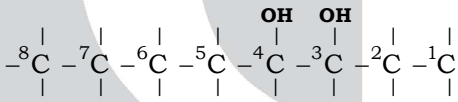
→  ⇒ **3 - Bromo - 2 - Chloro Octane**

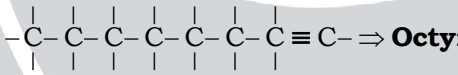
Note:- Alphabetically first take '**Br**' and then '**Cl**'.

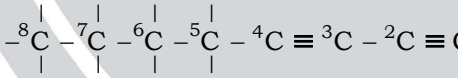
→  ⇒ **3,4 - Dibromo - 2,2 - DiIodo Octane**

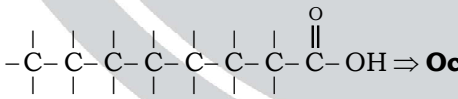
→  ⇒ **Octanol**

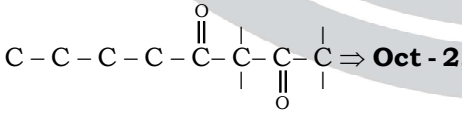
→  ⇒ **4 - Octanol / Octane - 4 - ol**

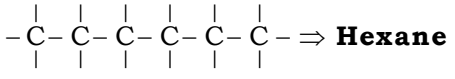
→  ⇒ **3,4 - Dioctanol / Octane - 3,4 - Diol**

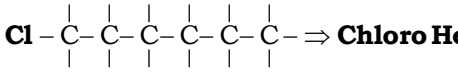
→  ⇒ **Octyne**

→  ⇒ **Oct - 1,3 - Diyne**

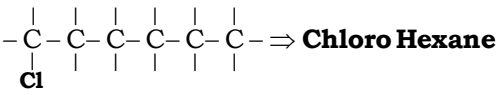
→  ⇒ **Octanoic Acid**

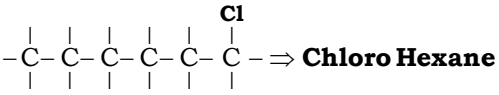
→  ⇒ **Oct - 2,4 - dione**

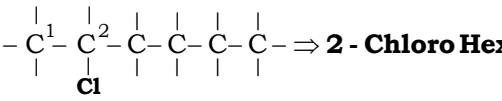
→  ⇒ **Hexane**

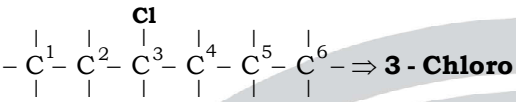
→  ⇒ **Chloro Hexane**

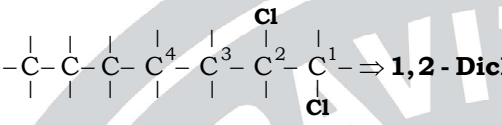
Bluestar, Patther Ki Masjid, Patna-800006, Mob - 7004166363, 7717752909
Opp. Kulhariya Complex, Pillar Number-09

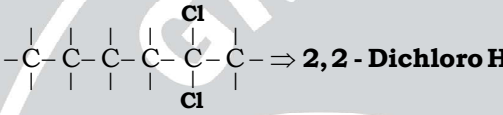
→  **Chloro Hexane**

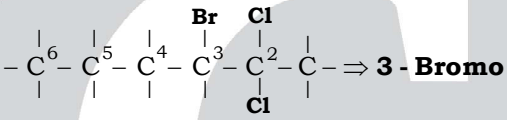
→  **Chloro Hexane**

→  **2 - Chloro Hexane**

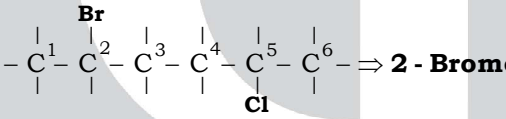
→  **3 - Chloro Hexane**

→  **1, 2 - Dichloro Hexane**

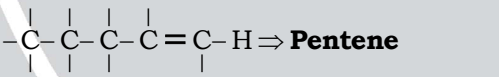
→  **2, 2 - Dichloro Hexane**

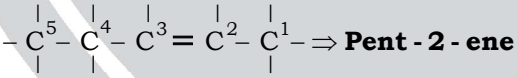
→  **3 - Bromo - 2, 2 - Dichloro Hexane**

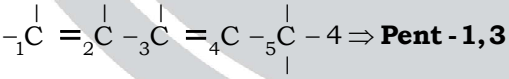
- Alphabetical order naming shoud be.

→  **2 - Bromo - 5 - Chloro Hexane**

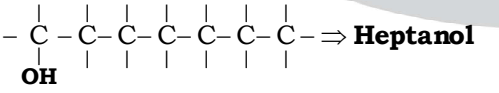
- Numberic will be A/c to **Alphabetical order**.

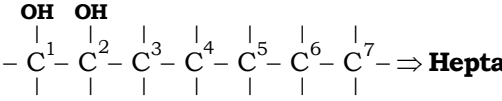
→  **Pentene**

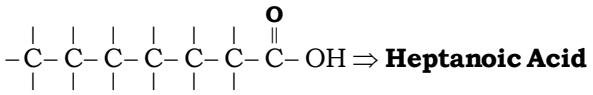
→  **Pent - 2 - ene**

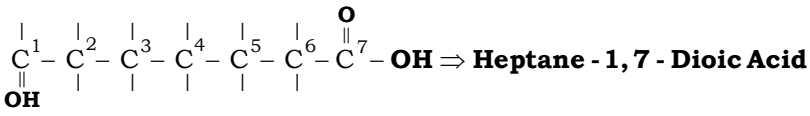
→  **Pent - 1, 3 - diene**

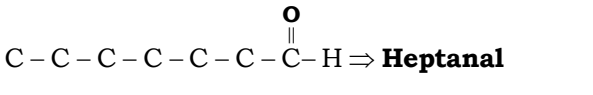
→  **Heptane**

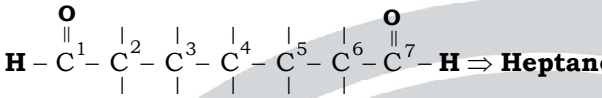
→  **Heptanol**

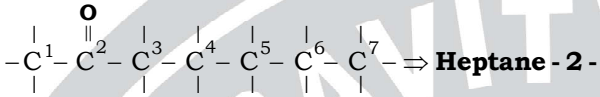
→  **Heptan - 1, 2 - diol**

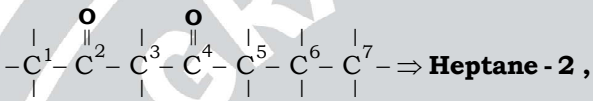
→  ⇒ **Heptanoic Acid**

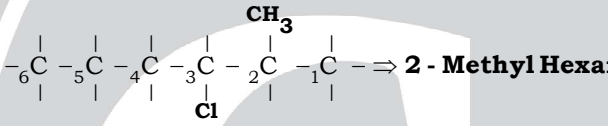
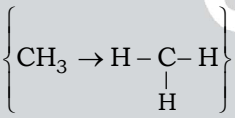
→  ⇒ **Heptane - 1, 7 - Dioic Acid**

→  ⇒ **Heptanal**

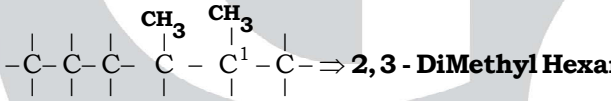
→  ⇒ **Heptane - 1, 7 - dial**

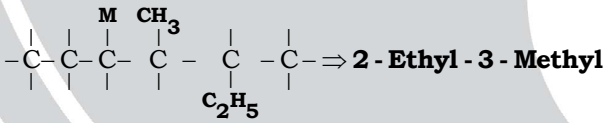
→  ⇒ **Heptane - 2 - one**

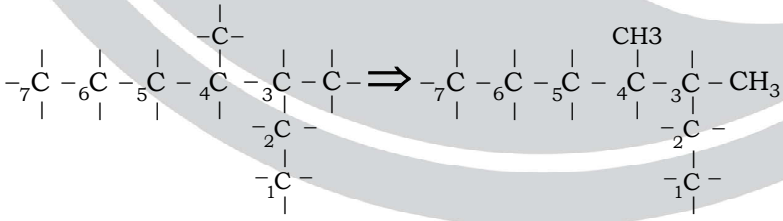
→  ⇒ **Heptane - 2 , 4 - Dione**

→  ⇒ **2 - Methyl Hexane** 

Methane Group	Alkyl (Prefix)
CH_3	Methyl
C_2H_5	Ethyl
C_3H_7	Propyl

→  ⇒ **2, 3 - DiMethyl Hexane**

→  ⇒ **2 - Ethyl - 3 - Methyl Hexane ×** $(C_2H_5 \rightarrow \text{Ethyl})$

→ 

3,4-Dimethyl Heptane

➢ **Homologous Series:-** A series of compounds with similar chemical properties, in which members differ from one another by additional CH_2 group is called a Homologous Series.

Ex.- CH_4(Methane), C_2H_6, C_3H_8, C_4H_{10}, C_5H_{12}

Difference: CH_2 | Δ: CH_2 | CH_2

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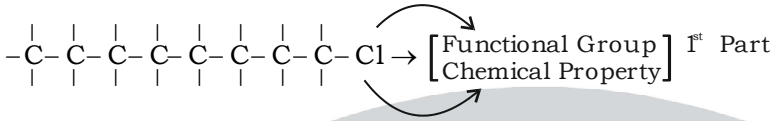
→ Alkane family is called homologous series → $[C_nH_{2n+2}]$
→ Alkene family will be same → $[C_nH_{2n}]$
→ Alkyne family will be same → $[C_nH_{2n-2}]$
→ Alcohol family will be same.

CH_3OH (Alcohol)
C_2H_5OH (Ethanol)
C_3H_7OH (Proponal)
C_4H_9OH (Butanol)

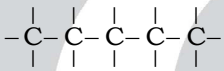
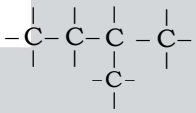
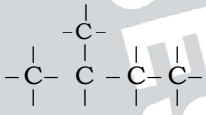
- **Two Parts of Carbon Compound:-**



→ This determine **Physical Property**

Melting Point
Boiling Point
Solid or Liquid or Gas
Soluble
Smell etc.

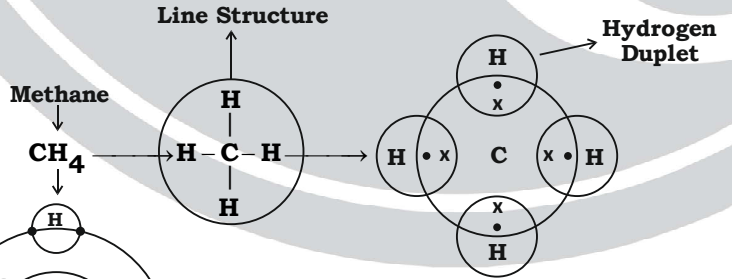
- **Isomers of Pentane:-**

		
C_5H_{12}	C_5H_{12}	C_5H_{12}

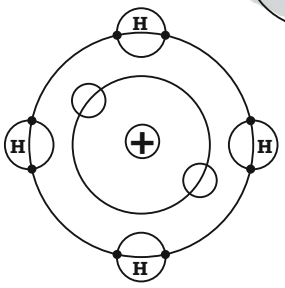
➢ **Lewis-Dot Structure (Electron-Dot Structure):-**

1. Methane (CH_4)

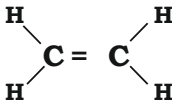
C (2, 4) H (1)

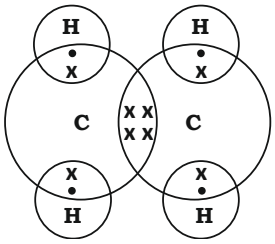


Ex.-



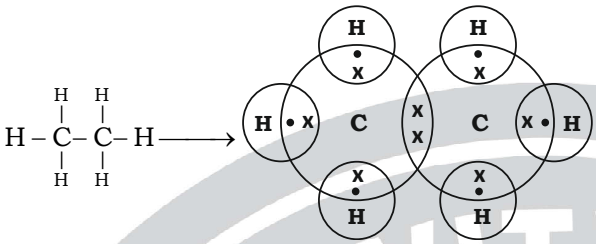
Ethene (C_2H_4):





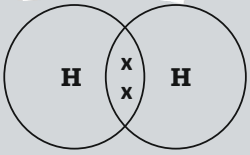
2. C_2H_6 → Ethane:

→ First of all draw **line structure**.



3. A Molecules of Hydrogen:

$H^x \rightleftharpoons {}_xH \Rightarrow$ (Sharing Electron)



(Shared e^- H_2 Molecule) $\Rightarrow H-H(H_2)$ ↓ (Single Bond)

→ Single bond between two hydrogen atoms.

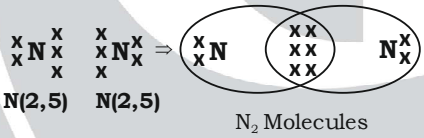
4. Oxygen (O_2) Atoms:

(O_2 Molecules) ⇒ $0 = 0$ (D.Bond)

O (2,6) O (2,6)

→ Doubled bond between two oxygen atoms.

5. Nitrogen (N_2) Atom:



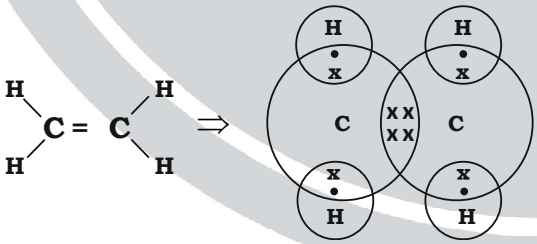
$\Rightarrow N \equiv N$ (T.Bond)

N(2,5) N(2,5)

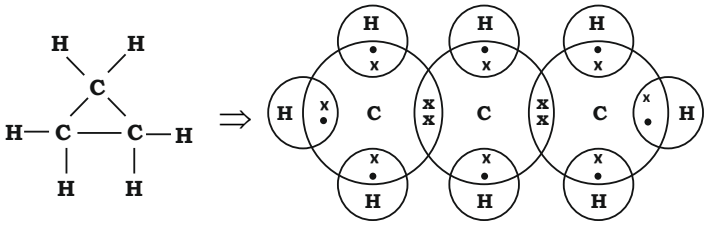
N_2 Molecules

Triple bond between two Nitrogen atoms.

6. C_2H_4 (Ethene)



7. Cyclo Propane (C_3H_6)



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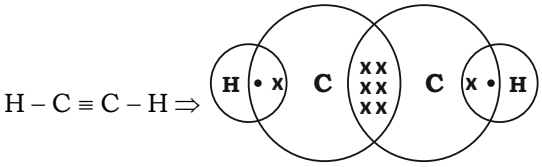
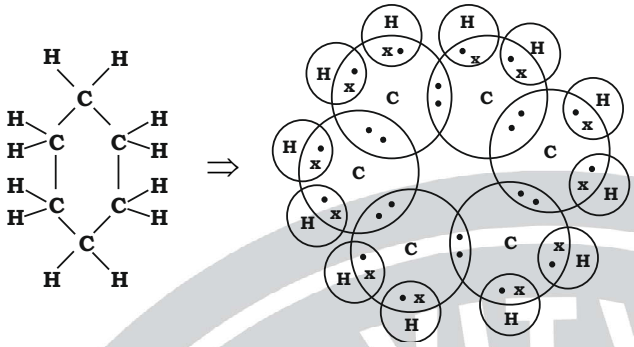
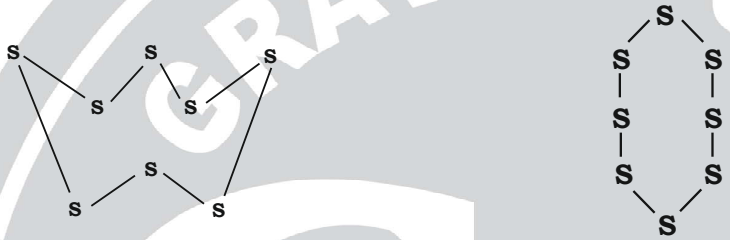
8. Ethyne (C_2H_2)



9. Cyclohexane



10. S_8 (Crown Shape)



➢ Chemical Properties of Carbon Compounds

1. Combustion Reaction:- All fuels are organic compound → Burning means addition of O_2.

i. $C + O_2 \rightarrow CO_2 + \text{heat \& light}$

ii. $CH_4(\text{Methane}) + O_2 \rightarrow CO_2 + H_2O + \text{heat \& light}$

iii. $CH_3CH_2OH(\text{Ethanol}) + O_2 \rightarrow CO_2 + H_2O + \text{heat \& light}$ [(Yellow) ← **Flame** → Blue(Good)]

→ SOOT due to Carbon Atom present in flame.

Saturated Hydro Carbon	Unsaturated
Alkane (C_2H_6)	Alkene C_2H_4
Total 8 Atom and 2 Carbon	Total 6 Atom and 2 Carbon
Pollution ↓	Alkyne C_2H_2
	Total 4 Atom and 2 Carbon only 50%
	Pollution ↑

Q. Why alkane is a good fuel ?

A. Because it is containing lesser carbon proportion as compare to Alkene & Alkyne or It produce less carbon particles or SOOT.

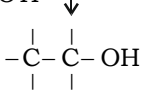
2. Oxidation Reaction:- Adding O_2 or Removing H_2.

$$CH_3 - CH_2OH(\text{Ethanol}) + 2O \xrightarrow[\text{Acidified } K_2Cr_2O_7 + \text{Heat}(\Delta)]{\text{Alkaline}(KMnO_4) + \text{Heat}(\Delta)} CH_3COOH(\text{Ethanoic Acid}) + H_2O$$

Oxidising Agent

or

C_2H_5OH

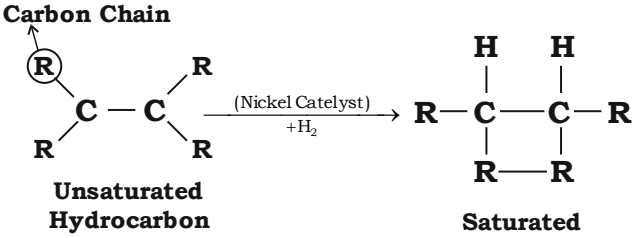


→ $KM_nO_4 \Rightarrow$ Potassium per Magnate

→ $K_2Cr_2O_7 \Rightarrow$ Potassium Dichromate

3. Addition Reaction:- Addition of H_2.

More Carbon Chain



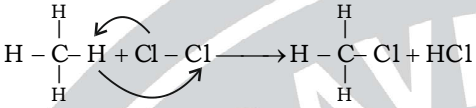
Unsaturated Hydrocarbon **Saturated**

$$\text{Oil} \xrightarrow[\text{Adding of H}]{\text{Hydrogenation}} \text{Dalda (Fat)}$$

$$\text{Unsaturated (Alkene or Alkyne)} \bullet \text{HC} \xrightarrow[+H_2]{} \text{Saturated H / Carbon}$$

4. Substitution Reaction:-

$$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl \quad \text{(in the presence of sunlight)}$$



➢ Ethanol and Ethanoic Acid

- **Ethanol:-** C_2H_5OH (Ethyl Alcohol)

→ Group - Alcohol Family (-OH) (Methanol, Ethanol, Propanol)
→ Molecular Formula - C_2H_5OH.
→ Nature - Neutral

$$2Na + 2CH_3CH_2OH\,(\text{Ethanol}) \longrightarrow 2CH_3CH_2O^-Na^+\,(\text{Sodium Ethoxide}) + H_2\uparrow$$

$$CH_3\,(\text{Ethanol}) - CH_2OH \xrightarrow[H_2So_4]{\text{Hot conc.}} CH_2\,(\text{Ethene}) = CH_2 + H_2O$$

Q. How to convert Ethonal into Ethene ?

→ Pleasant smell, colourless.
→ Low burning point 78°C.
→ All alcohals are poisonous accept Ethanol is less poisonous.
→ Ethanol is used in all alcoholic beverages.
→ In pure form Ethanol is 'Lethal' (Very Very Dangerous). It is also called 'Absolute Alcohol'.
→ Power Alcohol is said when a ethanol is mixed in petrol. So the ethanol mixed petrol can be used as a fuel. It is a clean fuel and increase the life quantity of petrol.
→ To avoid misuse of ethanol (colourless), some amount of poison (methenol/pyride) is mixed and colour (Blue) also mixed, that shows that the property is changed.
→ Ethanol is also a good Solvent (Medicine dissolved in this), so cough cyrup, tonic etc.

➢ **Ethanoic Acid (Acetic Acid):-** (Glacial Acetic Acid) Because freezing point 17°C (in winter looks glacier).

→ Group Carboxylic Acid Family $-\overset{\overset{O}{\|}}{C}-OH$ [Methanoic Acid, Ethanoic Acid, Propanoic Acid].

→ Mole, Formular : CH_3COOH
→ Nature : Acidic.

Note:- When in a **water** 5–8% of ethanoic acid is added then the solution become Vinegar (Acetic Acid) Chinese food.

$$CH_3COOH\,(\text{Ethanoic Acid}) + CH_3 - CH_2OH\,(\text{Ethanol}) \xrightarrow[(H_2SO_4)\,\text{Catalyst}]{\text{Acid}} CH_3 - \overset{\overset{O}{\|}}{C} - O - CH_2 - CH_3\,(\text{Easter}) + H_2O$$

or

$$CH_3 - \overset{\overset{O}{\|}}{C} - OH$$

or

$$C_2H_5OH$$

↓
Sweet Smelling Compound
Perfumes
Flavouring Agents

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$$CH_3COOC_2H_5 + \xrightarrow{NaOH+Heat} CH_3COONa\,(Soap) + C_2H_5OH\,(Ethanol)$$

Ester (Ethyl Ethanoate) — Heat Sodium Ethanoate — Ethyl Alcohol

$$CH_3-\overset{O}{\overset{\|}{C}}-O-C_2H_5$$ (Saponification)

$$Acid + Base \longrightarrow Salt + Water$$

$$CH_3COOH + NaOH \longrightarrow CH_3COONa\,(Soap) + H_2O$$

CH_3COON_a (Sodium Salt of Acidic Acid) or (Sodium Acetate/Ethanoate). But this is not a saponification.

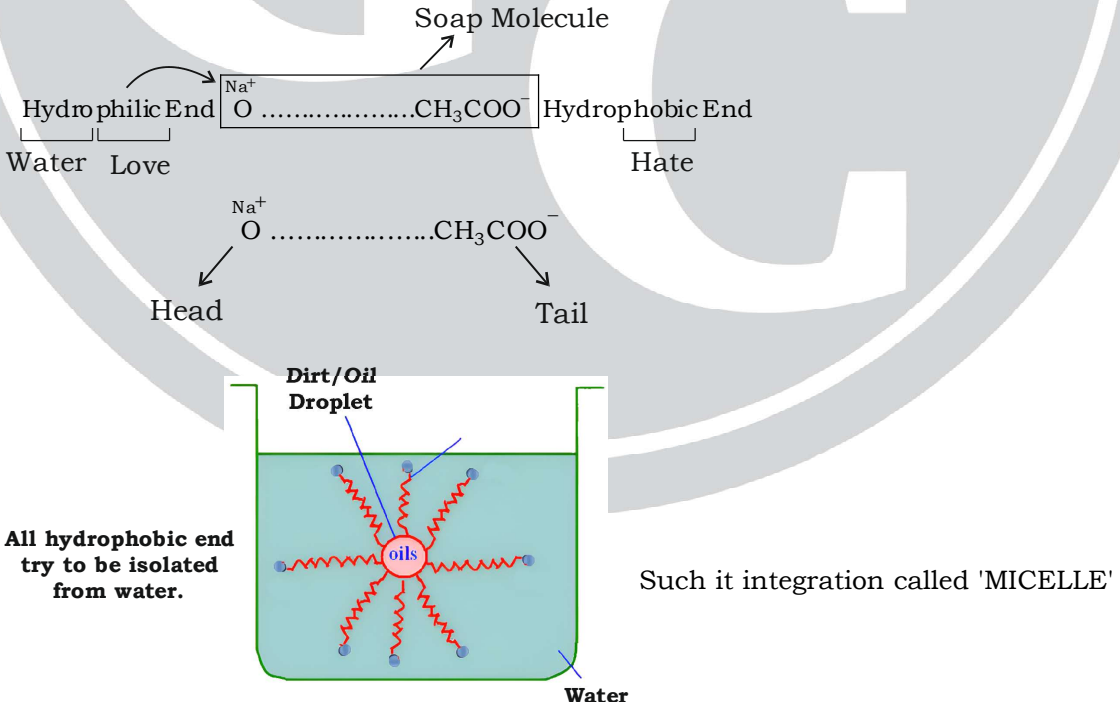
Q. What is the distinguish between Ethanoic Acid and Ethanol by any chemical reaction or test?

When, Acid + Metal Carbonate/Metal Hydrogen Carbonate → Salt + H_2O + CO_2

$CH_3COOH + Na_2CO_3/NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$

Distinguish between Soap and Detergent	
Soap	**Detergent**
Soaps work well in soft water	Detergent work well in soft and hard water
Biodegradable	Non-biodegradable
They have relatively weak cleansing action	They have strong cleansing action

- **Cleansing Action of SOAPS:-**



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