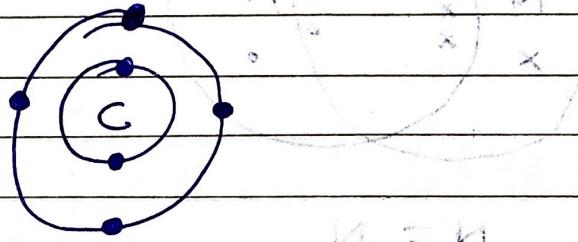


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[CHAPTER - 4] [Carbon and its Compound]

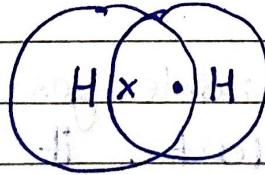
※ Carbon →

- ① Carbon is a non-metal. Its symbol is [C]
- ② All the living things like plant and animal are made up of carbon.
- ③ Carbon always forms covalent bond.
- ④ The atomic number of carbon is [6]
- ⑤ Electronic Configuration → 2, 4



Covalent bond → When pair of electrons are shared between two atom it is called Covalent bond.

① Single bond → H₂

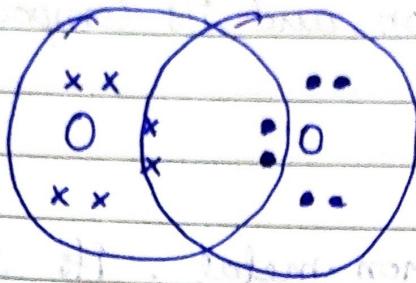


Teacher's Sign

Spiral

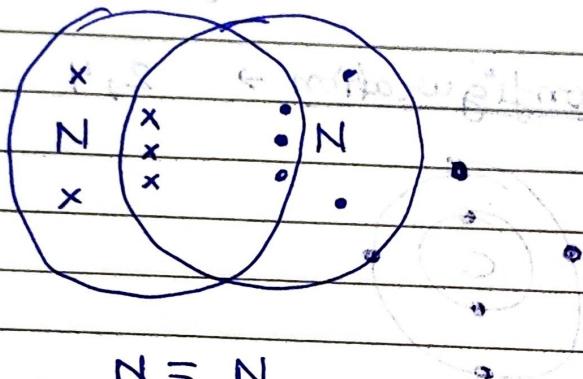
Date.....

② Double bond \rightarrow O_2 $O(8) \rightarrow 2,6$



$$O=O$$

③ Triple bond \rightarrow N_2 $N(7) \rightarrow 2,5$



$$N=N$$

* Physical properties of covalent compound \rightarrow

① They have low melting point and boiling point.

② They are generally poor conductor of Electricity.

Q \rightarrow How carbon attains noble gas configuration?

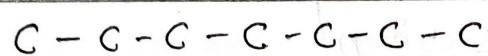
A \rightarrow Carbon is tetravalent. It does not form ionic bond by losing or gaining electrons. Carbon can form covalent bond by sharing of its electrons with other element therefore Carbon attains noble gas configurations.

Date.....

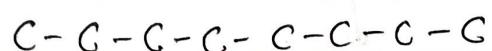
Versatile Nature of Carbon →

① Catenation → Property of carbon atom to form bonds with the other atom of carbon is called catenation.

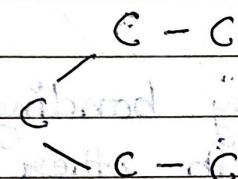
It creates straight chains, Branched chains, and rings.



[Straight chain]



[Branched chain]



[Ring]

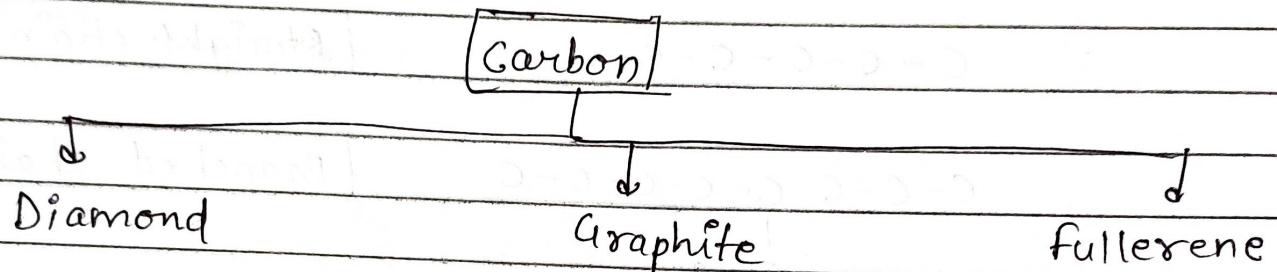
② Tetravalency → Carbon have four valence electrons. Carbon can bond with four other carbon atoms, oxygen, nitrogen, hydrogen and sulphur.

Date.....

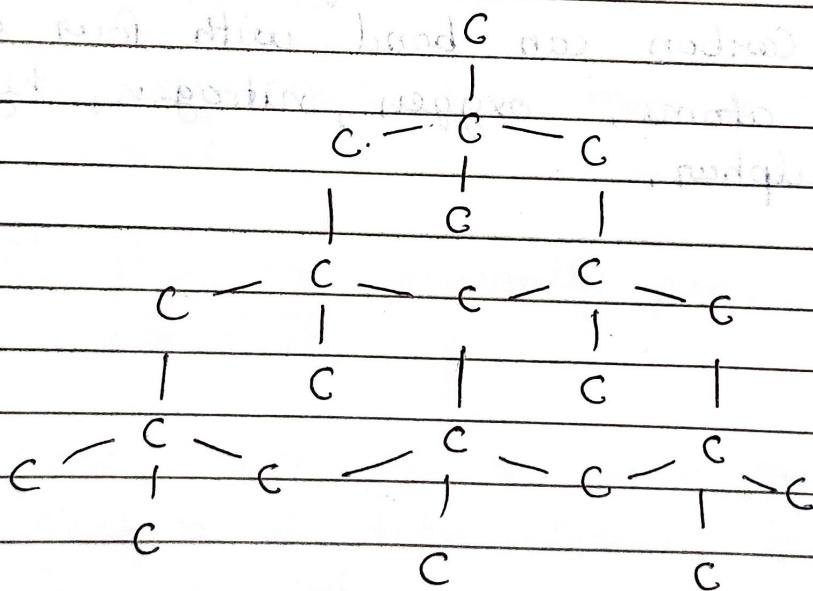
※ Allotropes of Carbon →

→ Allotropy → It is a property by which an element can exist in more than one form.

→ Each form have different property and similar chemical properties.



① Diamond → It is formed by bonding of each Carbon atom with other four carbon atoms.

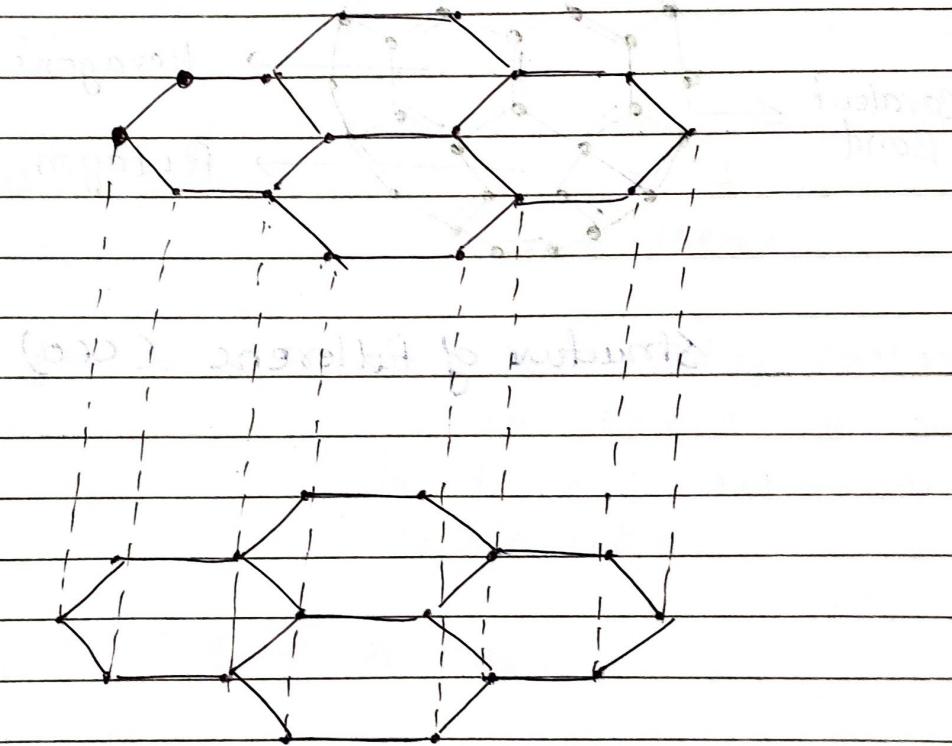


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Properties of diamond →

- (1) It is the hardest thing on earth
- (2) It is a bad conductor of Electricity.
- (3) It have very high melting point
- (4) It is used for making jewellery and cutting glasses.

(ii) Graphite → It is formed by bonding of each carbon atom with other carbon atom hexagonally in plane.



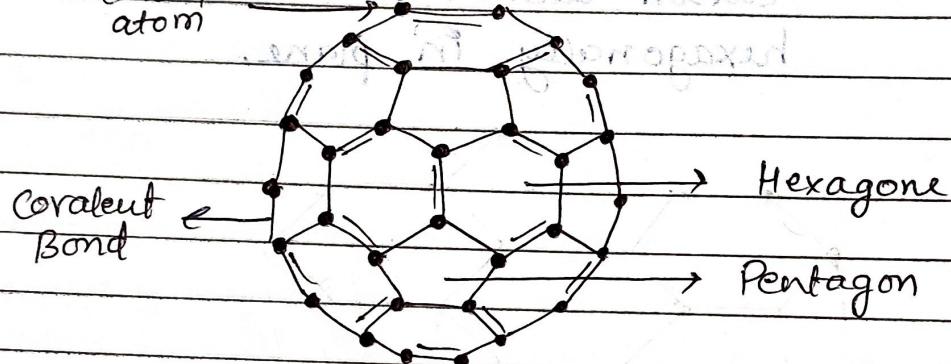
Properties of Graphite →

- (1) It is very soft and slippery because layers can slide over one another.
- (2) It is good conductor of electricity.
- (3) It is used for making pencil lead, engine oil, Battery and cells.

Date.....

iii) Fullerene →

- Smallest fullerene have 60 carbon atoms → Carbon atom are arranged in the shape of football. → It was twelve pentagon and twenty hexagons.

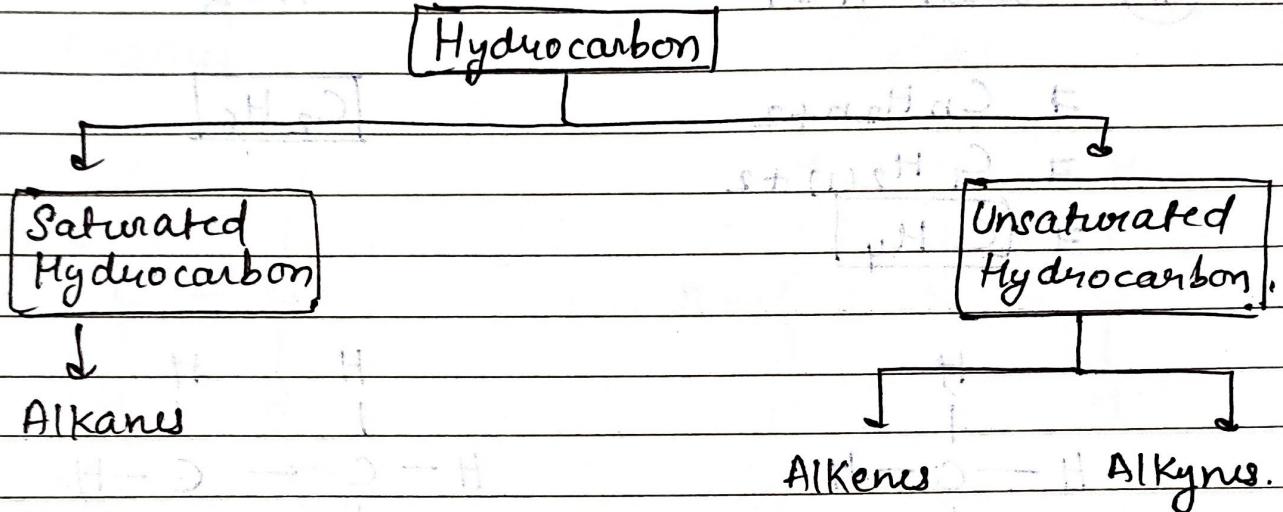


Structure of fullerene (C_{60})

Date.....

* Hydrocarbon → Compounds which are made up of Carbon and Hydrogen are called hydrocarbon.

Ex → CH_4 , C_2H_6



* Saturated Hydrocarbon → Compound of carbon which are linked by single bond are called saturated hydrocarbon.

Ex → Alkanes,

* Unsaturated hydrocarbon → Compound of carbon which are linked by double or triple bond are called unsaturated hydrocarbon.

Ex → Alkenes

→ Alkynes.

Date.....

① Alkanes → The hydrocarbon in which carbon atoms are linked by only single bond are called Alkanes.

Formula → $C_n H_{2n+2}$

Ex → When $n=1$

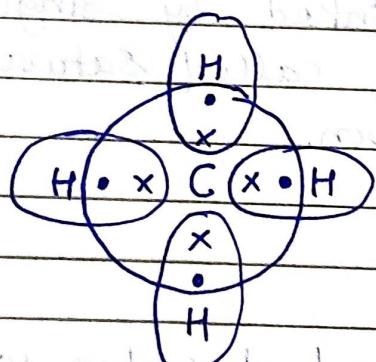
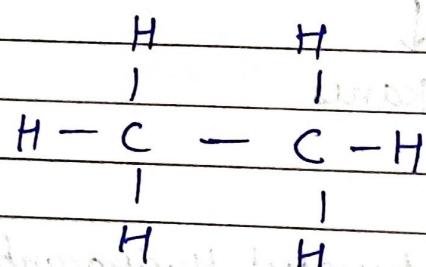
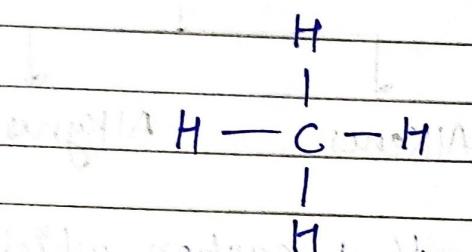
$n=2$

$$\Rightarrow C_n H_{2n+2}$$

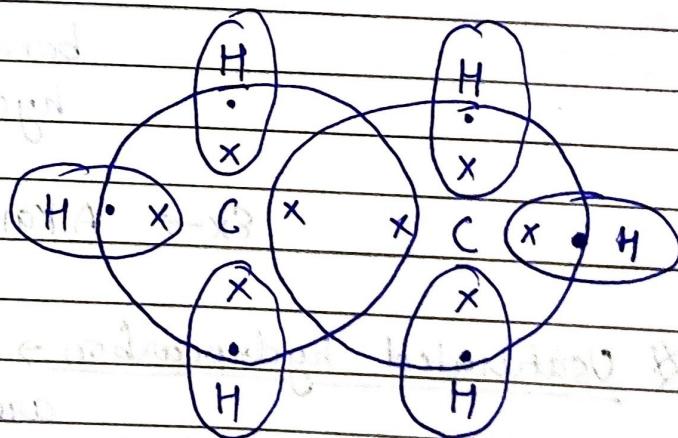
$$\Rightarrow C_1 H_{2(1)+2}$$

$$\Rightarrow [C \text{ H}_4]$$

$$[C_2 H_6]$$



Methane



Ethane

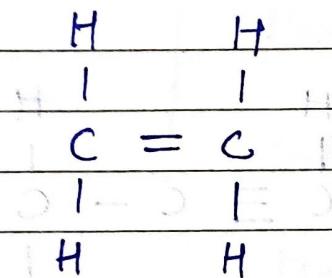
Date.....

② Alkenes → Hydrocarbons which atleast have one double bond are called Alkenes.

formula $\rightarrow C_nH_{2n}$

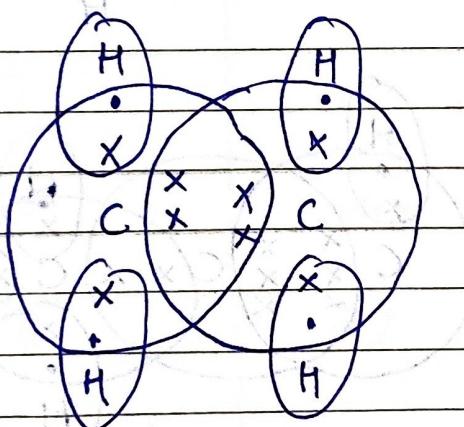
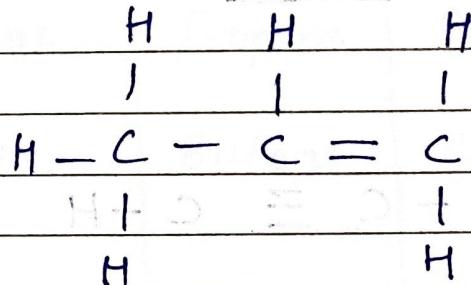
when $n=2$

$[C_2H_4]$

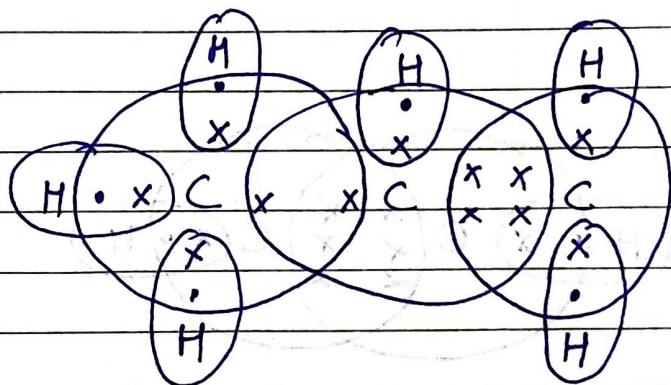


$n=3$

$[C_3H_6]$



Ethene



propane

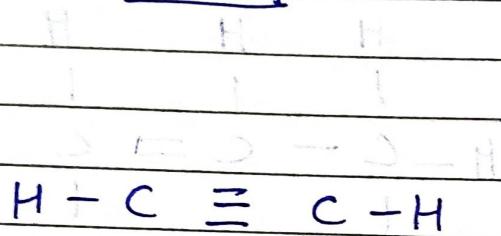
Date.....

③ Alkynes \rightarrow Hydrocarbon which atleast have one triple bond between carbon atom are called Alkynes.

formula \rightarrow $C_n H_{2n-2}$

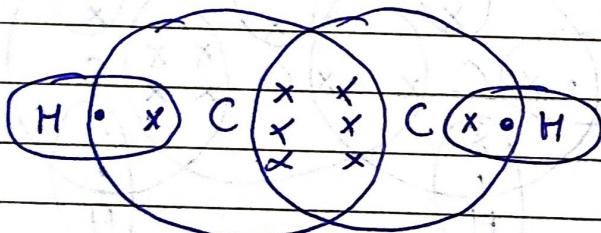
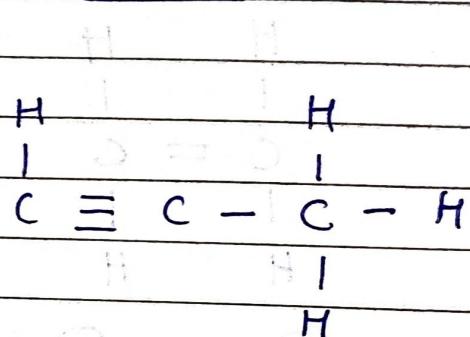
when $n=2$

$[C_2 H_2]$

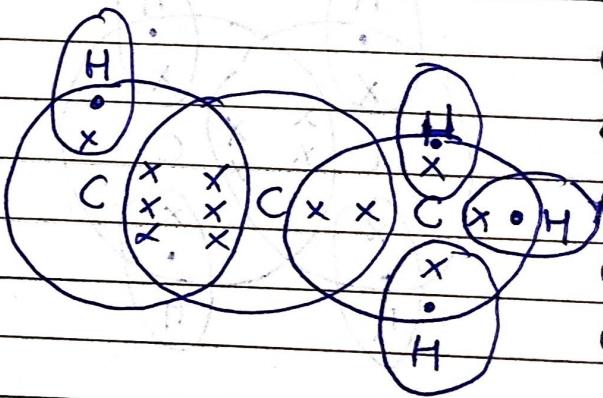


$n=3$

$[C_3 H_4]$



Ethyne



Propyne

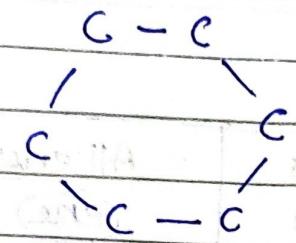
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* IUPAC Nomenclature of Carbon Compounds →

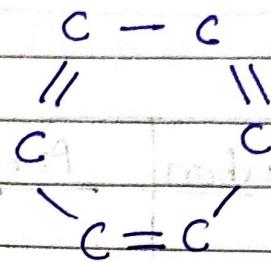
No of Carbon	Prefix	Alkanes ane	Alkenes ene	Alkynes yne
C ₁	Meth	Methane		
C ₂	Eth	Ethane	Ethene	Ethyne
C ₃	Prop	Propane	Propene	Propyne
C ₄	But	Butane	Butene	Butyne
C ₅	Pent			
C ₆	Hex			
C ₇	Hept			
C ₈	Oct			
C ₉	Non			
C ₁₀	Dec			

Date.....

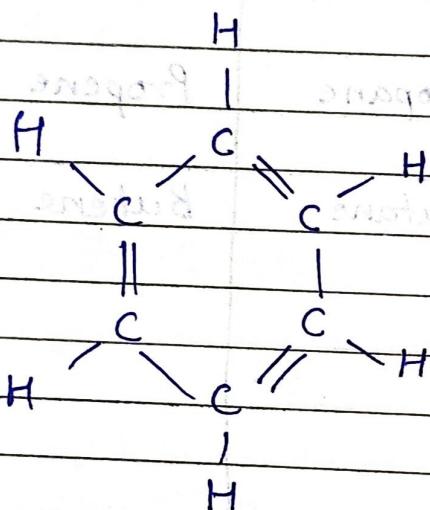
Cyclic structure →



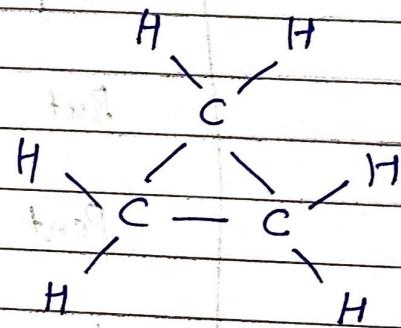
cyclic saturated



cyclic unsaturated

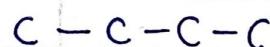


Benzene



Cyclo-Propane.

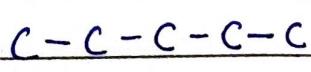
XX Structural isomer → Compounds having identical molecular formula but different structures.



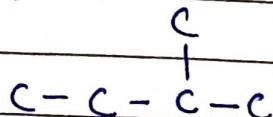
(n-butane)



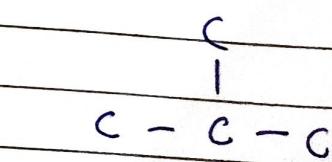
(iso-butane)



(n-pentane)



(iso-pentane)



(neo-pentane)

Spiral

Teacher's Sign

Date.....

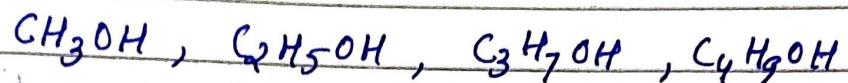
※ Hetero atoms → In hydrocarbon chain, hydrogen atom can be replaced by other atoms. The element that other replaces hydrogen is called a heteroatom.

※ functional group → heteroatoms and the group containing them give chemical properties to the compound and called functional group.

Hetero atom	functional group	formula	P
Cl/Br	Halogen (Chloro/Bromo)	-Cl -Br	-chloro- Bromo-
Oxygen	①. Alcohol	-OH	-ol
	② Aldehyde	$\begin{array}{c} H \\ \\ -C=O \end{array}$	-yde
	③ Ketone	$\begin{array}{c} \\ -C-O- \\ \end{array}$	-one
	④ Carboxylic acid	$\begin{array}{c} \\ -C-OH \\ \\ O \end{array}$	-oic acid

Date.....

* Homologous series → A series of carbon compound in which same functional group are differ by CH_2 are known as Homologous series.



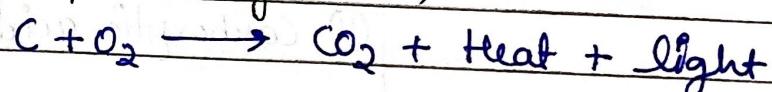
→ Properties of Homologous Series →

- i. All members have similar chemical properties but different physical properties.
- ii. Melting point and boiling point increases with increasing molecular mass.

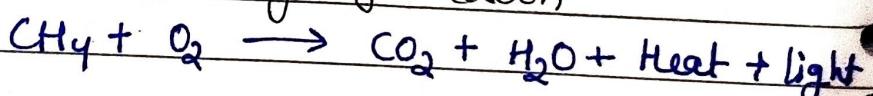
* CHEMICAL PROPERTIES OF CARBON COMPOUNDS →

i. Combustion → a chemical reaction in which heat and light are given out is called combustion.

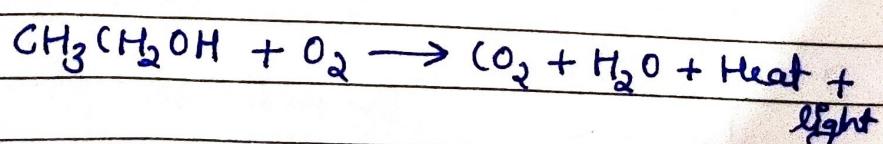
(Ex) i. Combustion of carbon



ii. Combustion of hydrocarbon



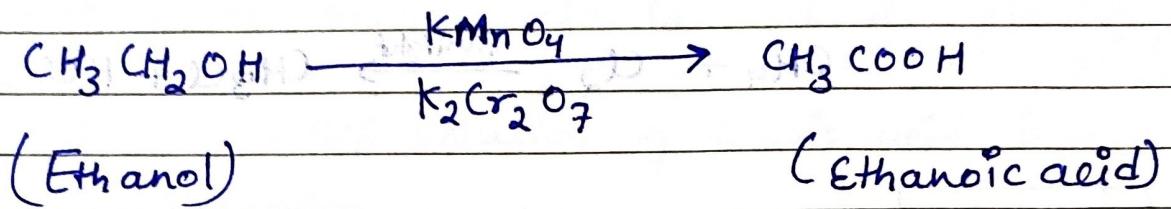
iii. Combustion of Alcohol



Date.....

② Oxidation →

when alcohols are converted to carboxylic acid by oxidising them in the presence of oxidizing agents ($KMnO_4$) or ($K_2Cr_2O_7$) Potassium dichromate.



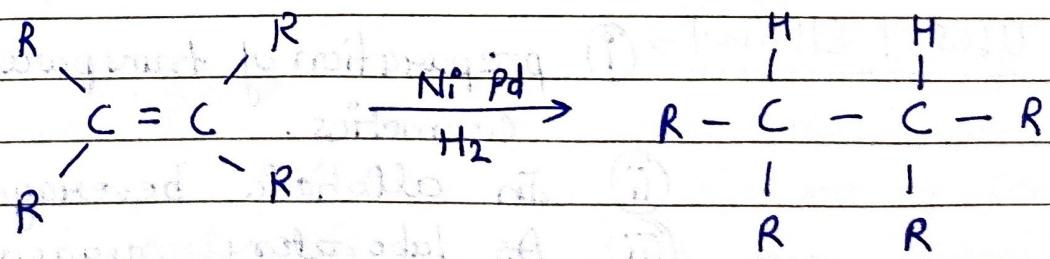
Note: Catalyst → A substance that make a chemical reaction happen faster without being used up in the reaction.

Ex) Nickel (Ni),
Palladium (Pd)
Potassium dichromate ($K_2Cr_2O_7$)

③ Addition Reaction →

When hydrogen is added to unsaturated hydrocarbon in the presence of nickel, platinum, or palladium.

→ This process is also called hydrogenation.

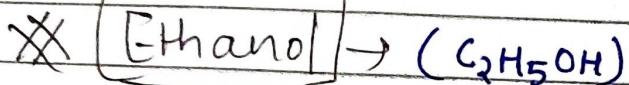
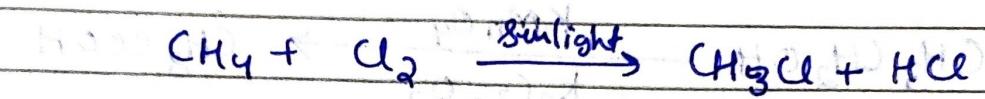
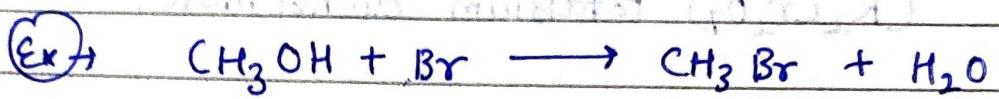


→ Vegetable oils are converted to vegetable ghee using this process.

Date

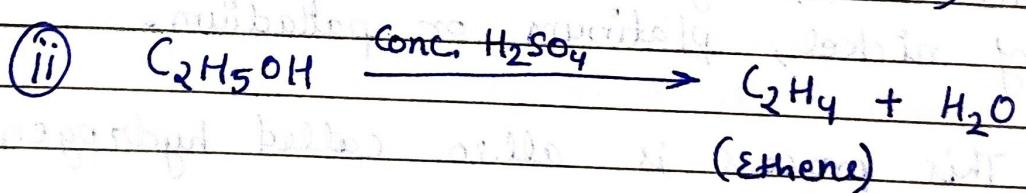
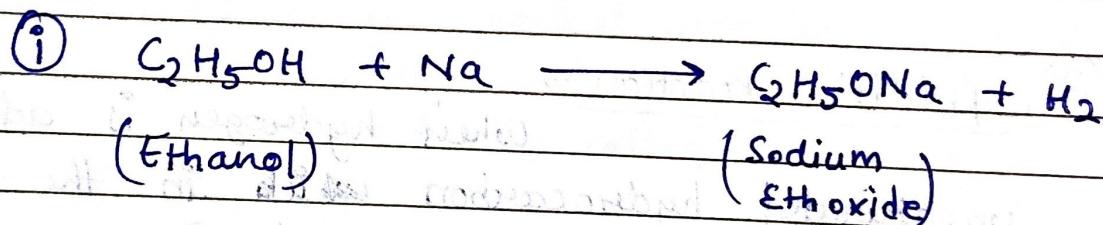
(4) Substitution Reaction →

In this type of reaction one functional group is replaced by another functional group.



- Melting Point of Ethanol is 156 K.
- Boiling point of Ethanol is 351 K.
- They are soluble in water.
- It has Burning taste.

Chemical properties →



Uses of Ethanol → i) preparation of transparent soaps, cosmetics.

- ii) In alcoholic beverages
- iii) As laboratory reagent.
- iv) In Medicines and Tonics.

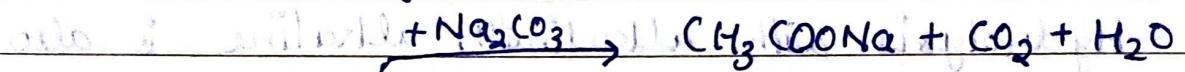
Date.....

* Ethanoic Acid \rightarrow [CH₃COOH] Acetic Acid

- It has Melting point in 290 K.
- Boiling point is 391 K.
- It has sour taste
- It is soluble in water.
- pure acetic acid is called glacial acetic acid.
- 3% - 4% solution of acetic acid is called vinegar.

Chemical properties \rightarrow

(Sodium Carbonate)



CH₃COOH

+ Na

$\text{CH}_3\text{COONa} + \text{H}_2$

(Sodium Ethanate)

(Sodium Bicarbonate)

+ NaHCO₃

$\text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$

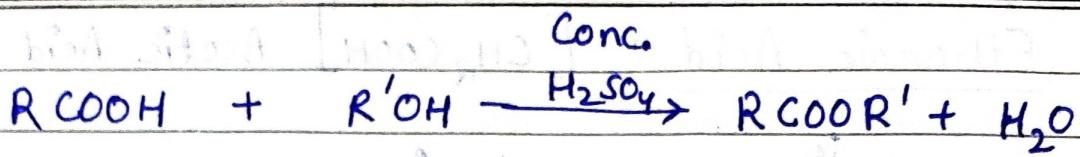
(Ethanol)
+ CH₃-CH₂OH

$\text{CH}_3\text{COOCH}_2\text{CH}_3 + \text{HOH}$

(Ester)

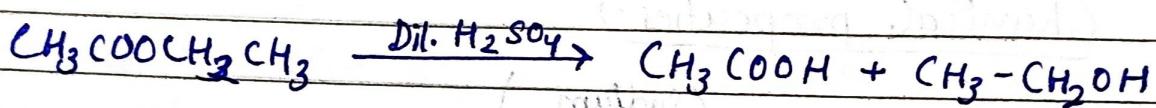
* Esterification \rightarrow Carboxylic acids react with alcohols in the presence of conc. sulphuric acid and form sweet smelling compound called ester.

Date.....



★ Hydrolysis →

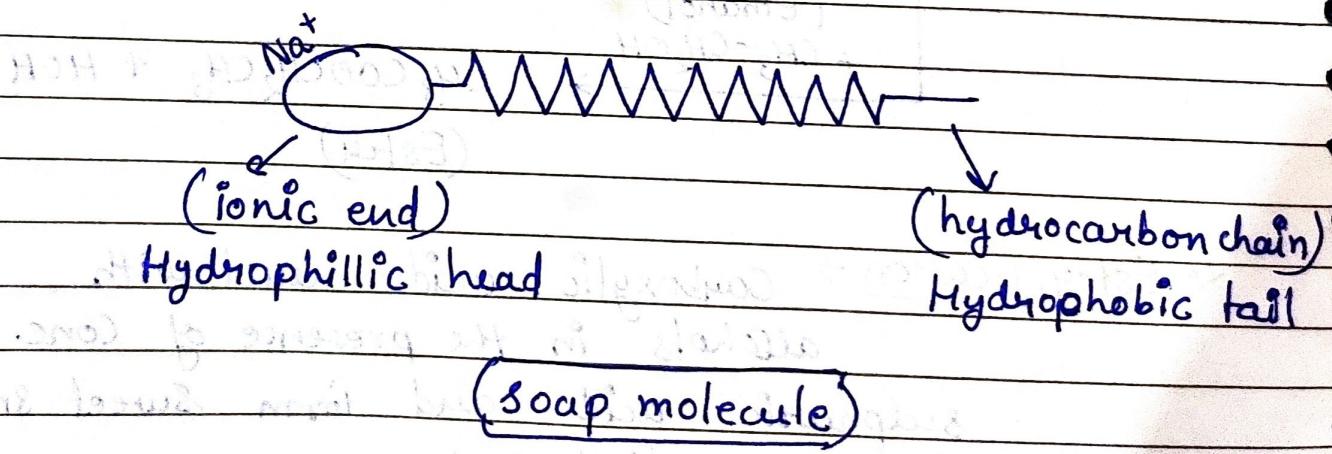
When ester is heated with acid or base it forms back the original alcohol and carboxylic acid. It is called Hydrolysis.



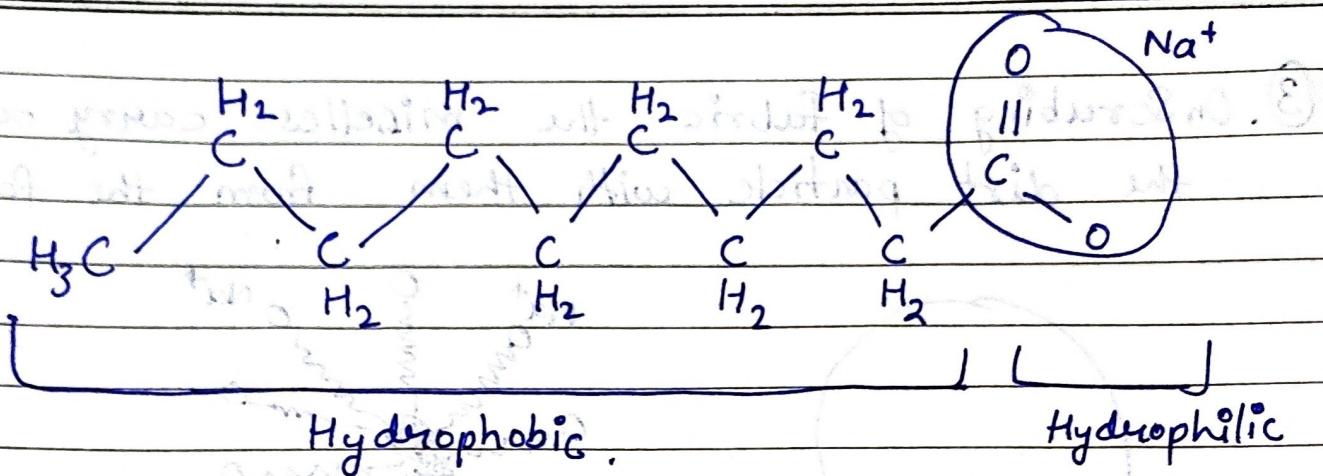
→ Hydrolysis of ester with alkaline is also called saponification.

★ Soap → Soap is sodium and potassium salt of carboxylic acids with long chain.

→ Soap is effective with soft water only and ineffective with hard water.

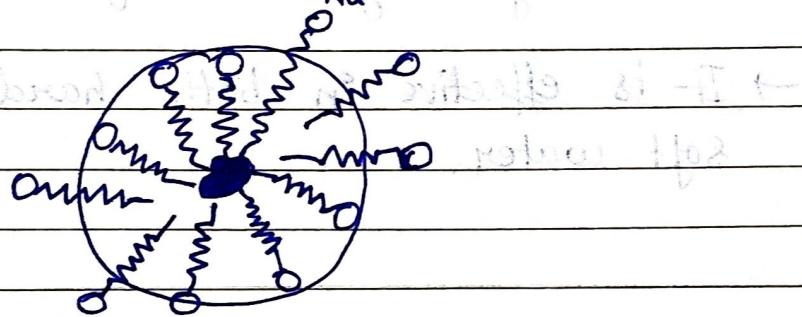


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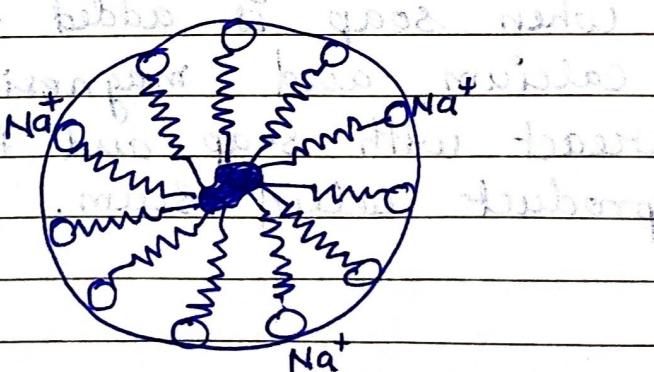


→ Cleansing action of soap →

- ① When soap is added to water the soap molecules uniquely orient themselves to form spherical shape micelles.

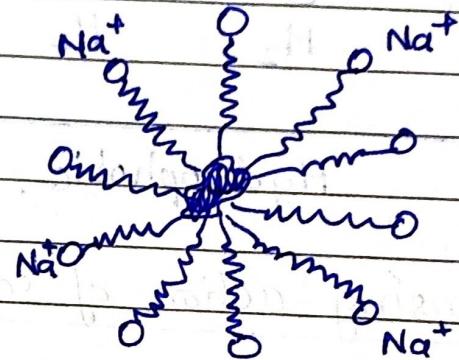
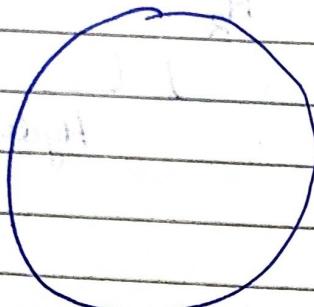


- ② The hydrophobic part of tail of the soap molecule attract the dirt part of the fabric while the hydrophilic part remains attracted to water molecule.



Date.....

- ③ On Scrubbing of fabric the micelles carry out the dirt particle with them from the fabric.



Clean fabric

* Detergent → Detergents are ammonium or sulphonate salt of long chain of carboxylic acid.

→ It is effective in both hard water and soft water.

Hard water → Water having high amount of Calcium and magnesium ions are called Hard water.

Scum → When soap is added to hard water, calcium and magnesium of hard water react with soap and forms insoluble product called scum.