CLASS - 10th

SCIENCE HANDRITTEN NOTES

K.V.S

Chapter - 4

CARBON AND ITS COMPOUNDS.

Compounds are two types:—

i) Organic Compounds
ii) Inorganic Compounds

✓ Covalent Bond:—

→ Carbon always forms Covalent Bond.

→ The bond formed by sharing of electron pair between two atoms are known as Covalents atoms.

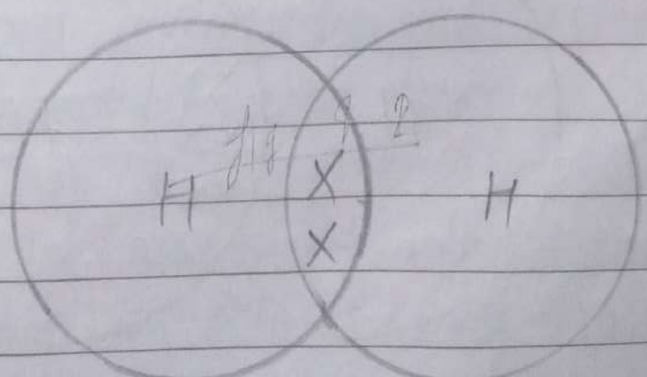
✓ Types of covalent Bond:—

i) Single covalent Bond:— when a Single Pair of electrons are shared between two atoms in a molecule.

Ex. F_2, Cl_2, H_2 etc.

ii) Double Covalen

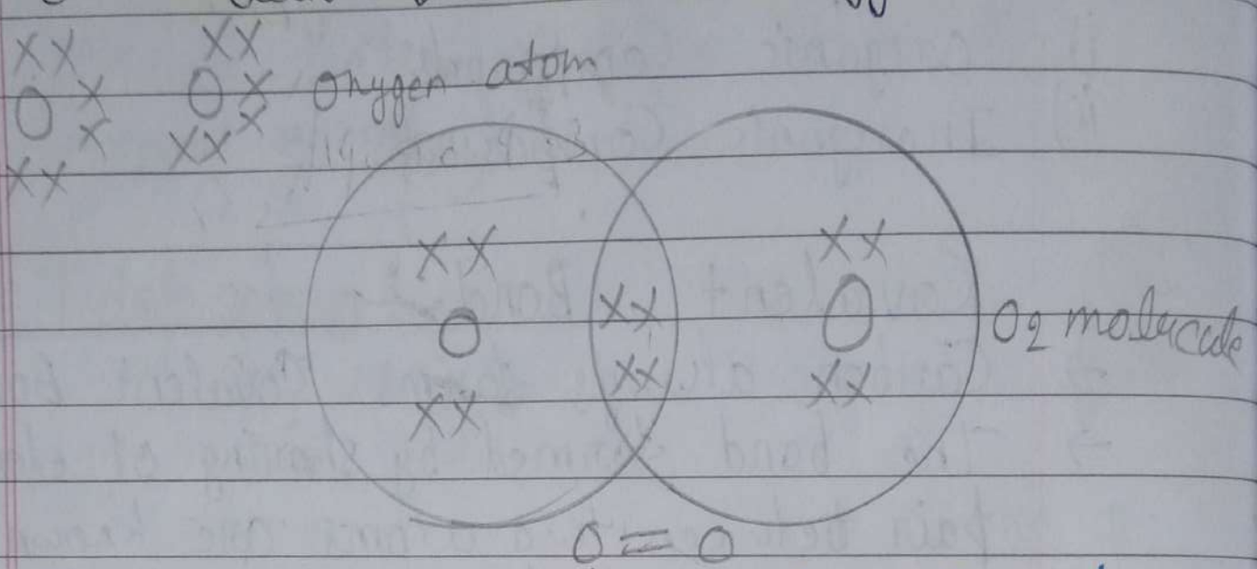
§ H – H Single Bond between hydrogen ato



ii) Double covalent Bond:— when two pairs of electrons are shared between two atoms in a molecule.

Ex. O_2, Co_2 etc.

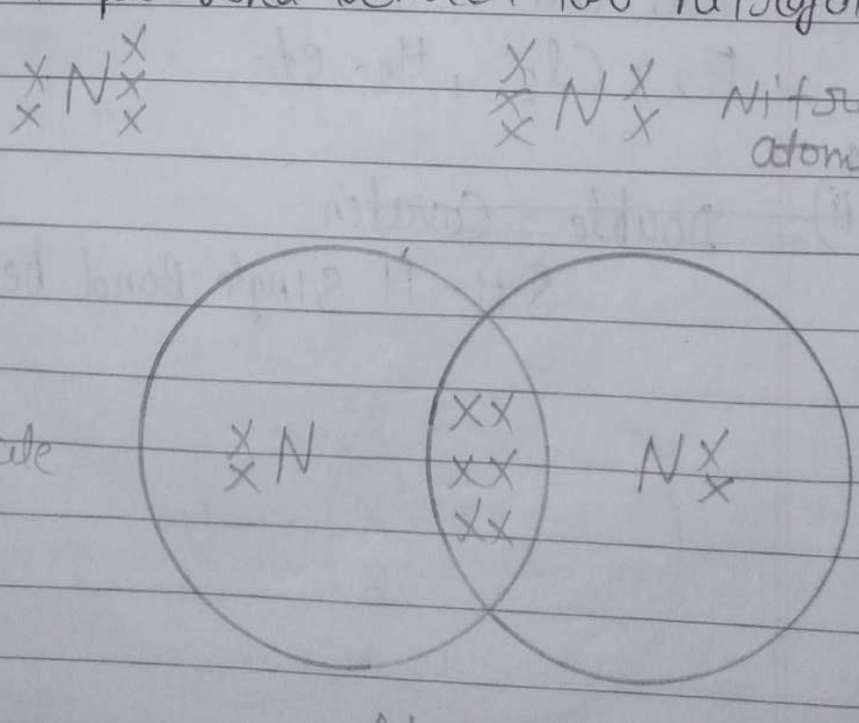
O = O double bond between oxygen atoms Co_2



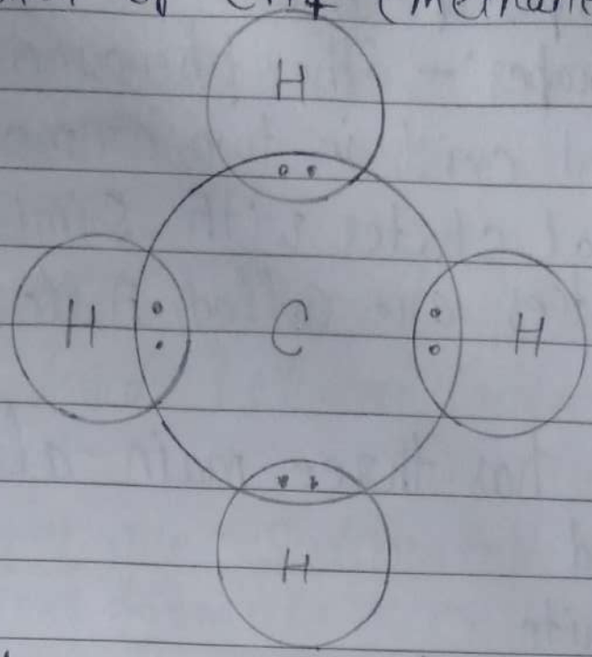
iii) Triple covalent Bond:— when three pairs of electrons are shared between two atoms in a molecule.

ex. N_2 etc.

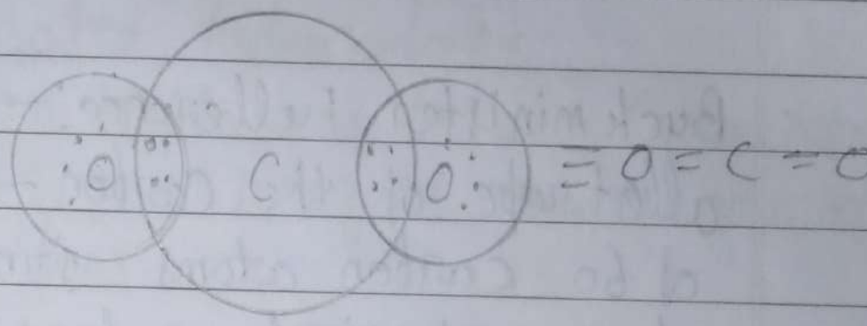
$N \equiv N$ Triple bond between two nitrogen atoms



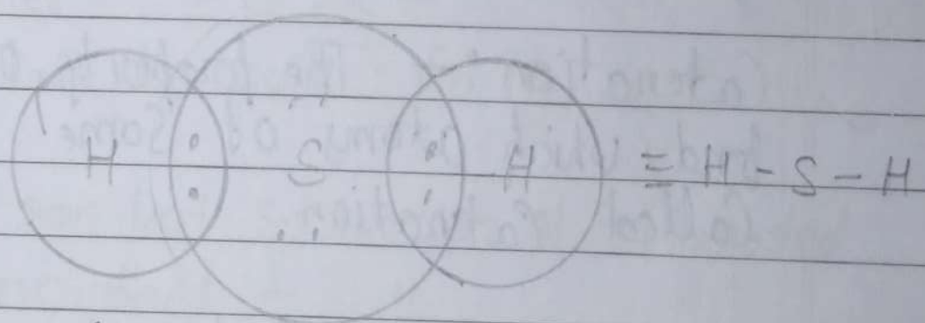
Formation of CH_4 (methane) Molecule:-



Formation of CO_2 molecule:-



Formation of H_2S molecule:-



- Physical properties of Covalent compounds:-

i) Covalent compounds have low melting and boiling points as they have week intermolecular force.

ii) They are generally poor conductor of electricity as electrons are shared between atoms and no charged particles are formed.

Allotropes of Carbon:-

Allotropes:- The phenomenon in which the element exist in two or more different Physical states with similar chemical Properties are called Allotropes.

Carbon has three main allotropes.

i) Diamond
ii) Graphite
iii) Buckminister fullerene 3

Buckminister Fullerence:- it is an allotrope of the carbon - Containing cluster of 60 carbon atoms joined together to form spherical molecules. it is dark solid at room temperature.

Catenation:- The property of forming bond which atoms of Some element is Called Catenation.

Tetravalency:- Carbon has 4 valence electrons. Carbon can bond with four carbon atoms, monovalent atoms, oxygen, nitrogen and Sulpur.

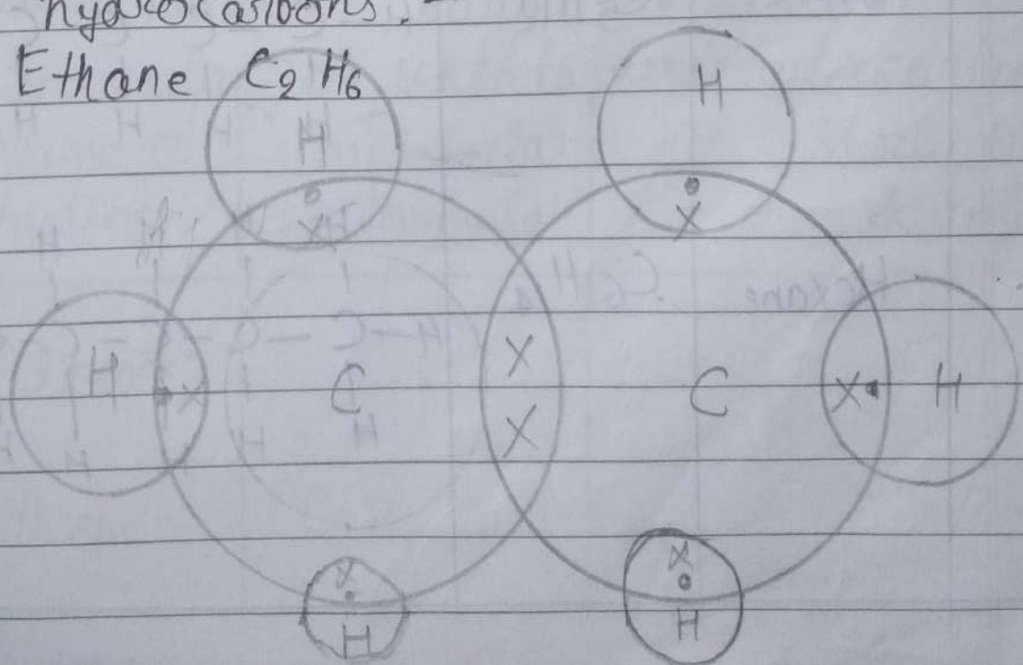
Hydro Carbons:- Compounds made up of hydrogen and Carbon are Called hydro Carbon.

There are two types of hydrocarbons
i) Saturated hydrocarbons
ii) unsaturated hydrocarbons

i) Saturated hydrocarbons :-
→ Single bond between Carbon atoms.
→ $-C-C$
→ Alkanes are saturated hydrocarbons
General formula : C_nH_{2n+2}

ii) Unsaturated hydrocarbons :-
→ Double or triple bond between Carbon atoms.
→ Alkenes and Alkynes are unsaturated hydrocarbons.
Alkenes: $-C=C-$
General formula : C_nH_{2n}
Alkynes :- $-C\equiv C-$
General formula : C_nH_{2n-2}

Electron Dot Structure of Saturated hydrocarbons :-
• Ethane C_2H_6



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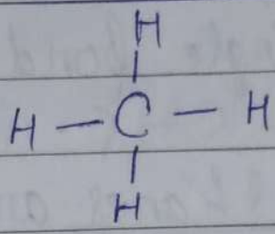
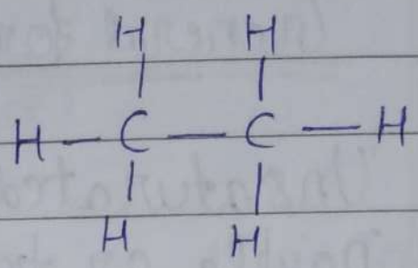
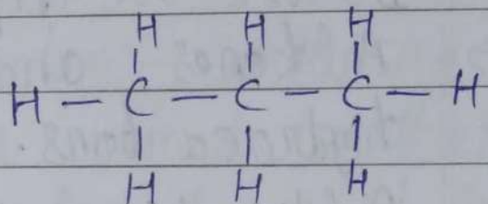
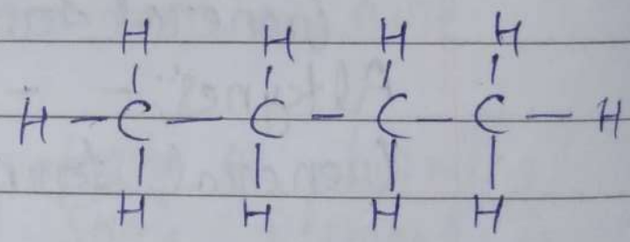
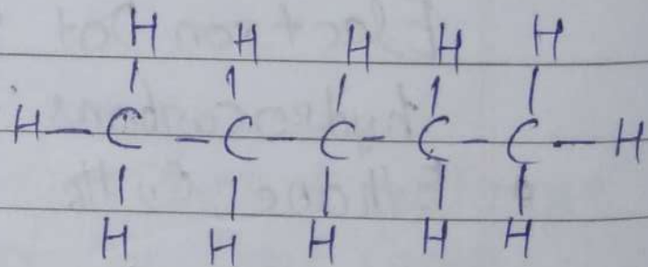
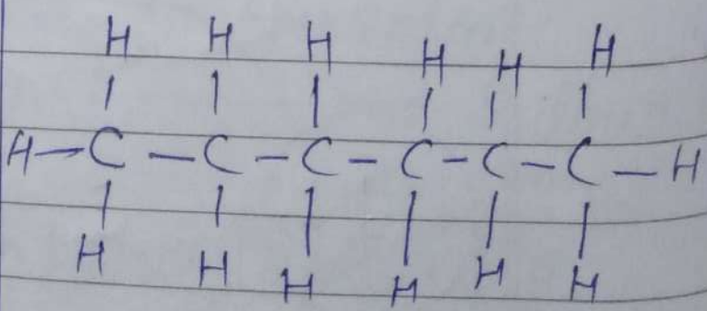
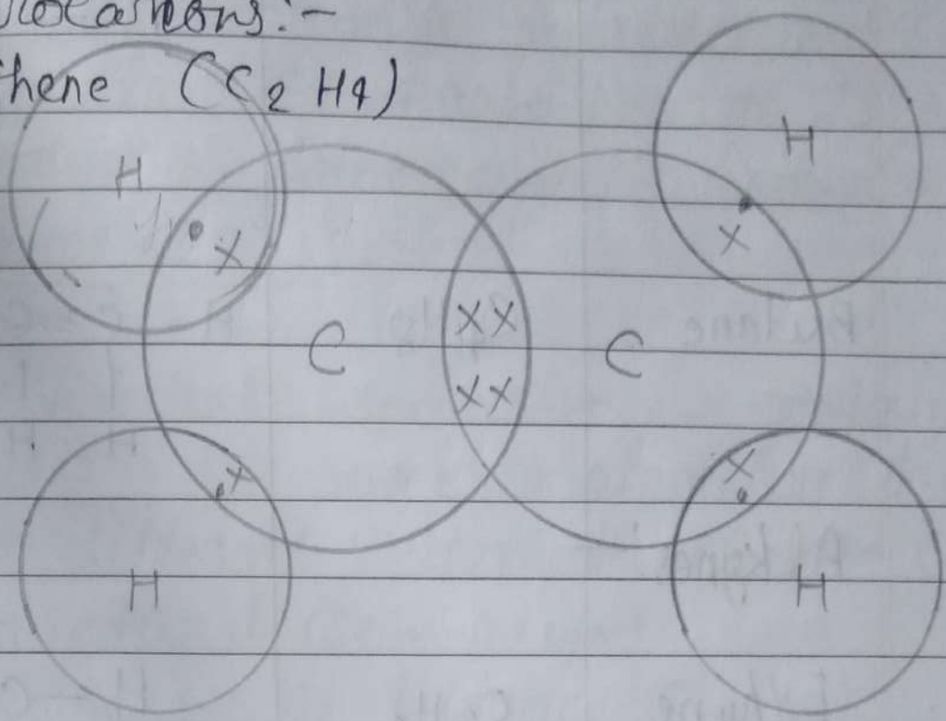
Names, molecular formulae and structure formulae of saturated hydrocarbons:-

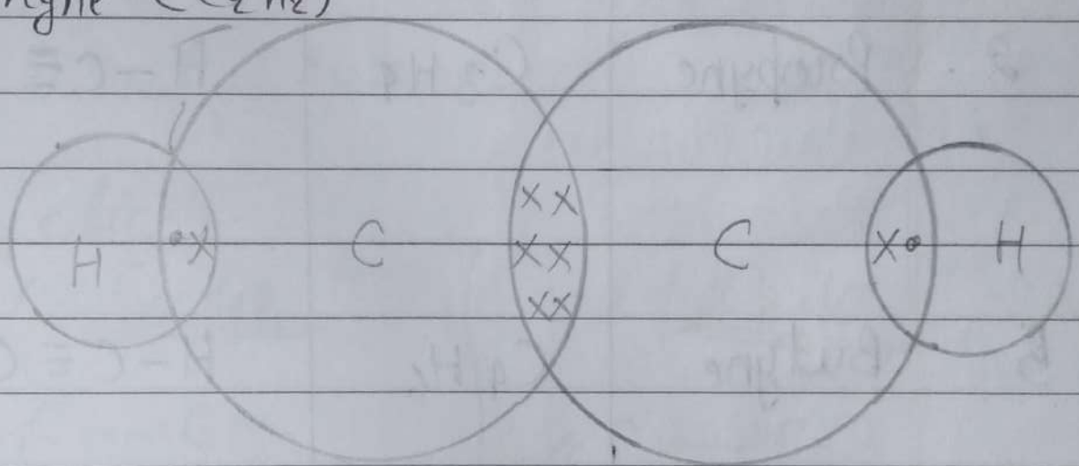
No. of C atoms	Name	formula	Structure
1.	Methane	CH_4	
2.	Ethane	C_2H_6	
3.	Propane	C_3H_8	
4.	Butane	C_4H_{10}	
5.	Pentane	C_5H_{12}	
6.	Hexane	C_6H_{14}	

Electrons dot structure of unsaturated Hydrocarbons:-

- Ethene (C_2H_4)

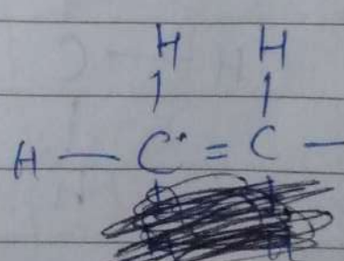


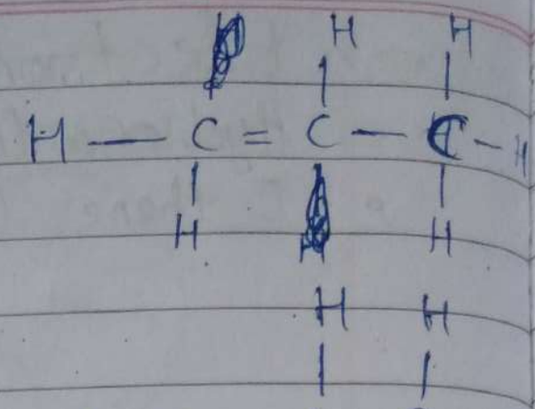
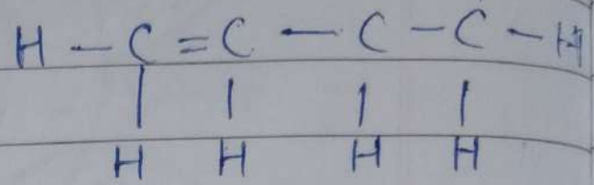
- Ethyne (C_2H_2)



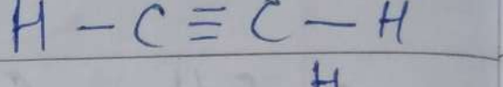
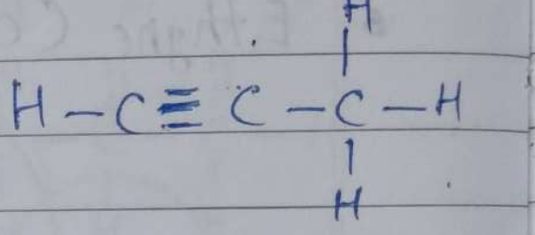
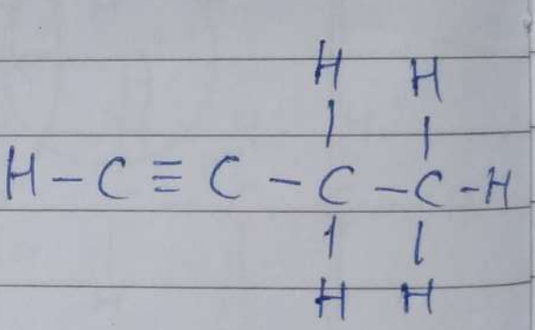
$H-C\equiv C-H$

Names, molecular formulae and structure formulae of unsaturated hydrocarbons.

Name of hydrogen	molecular formula	Structural formula
Alkenes:		
1. Ethene	C_2H_4	

2.	Propene	C_3H_6	
3.	Butane	C_4H_8	

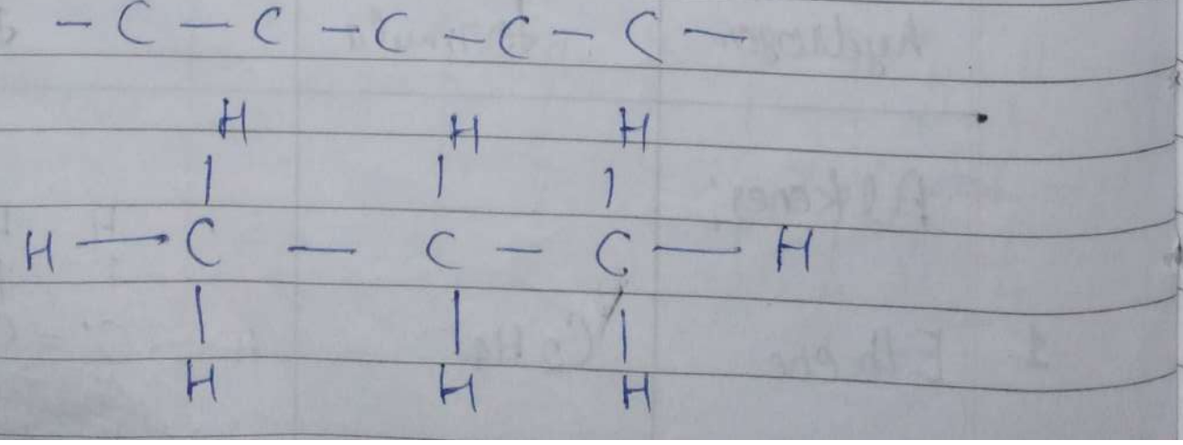
Alkynes:—

1.	Ethyne	C_2H_2	
2.	Propyne	C_3H_4	
3	Butyne	C_4H_6	

Carbon Compounds on the Bases of Structure:—

i) Straight (unbranched) chain:—

Ex:— C_3H_8



ii) Isomerism :- Compounds having the same molecular formula but different structural formula and properties as Isomers and this phenomenon is known as Isomerism.

Structural Isomerism :- Compounds having the same molecular formula but different structures are called structural isomerism.

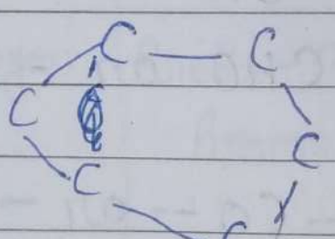
Ex :- Isomers of butane (C_4H_{10})

$CH_3 - CH_2 - CH_2 - CH_3$

n - Butane

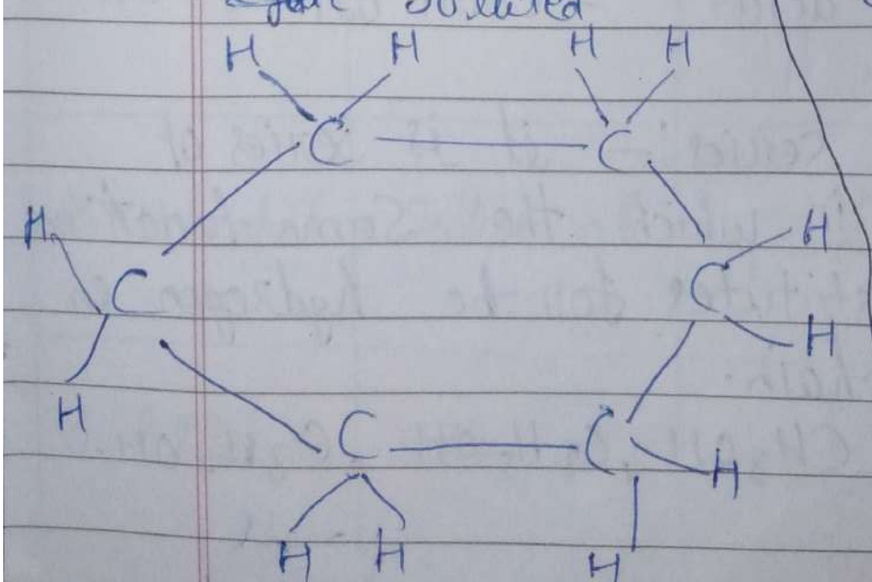
iii) Cyclic :-

Ex. C_6H_6

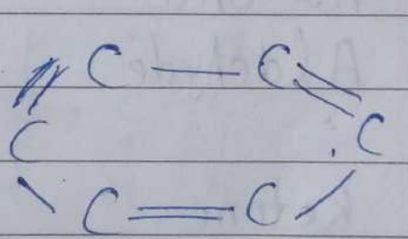


Cyclic Saturated

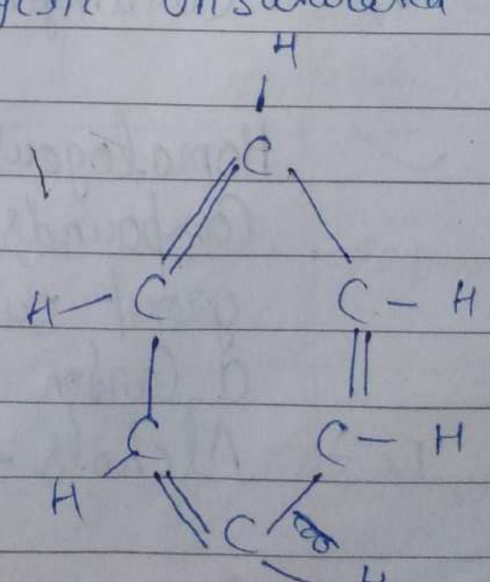
~~Cyclic~~ Saturated



C_6H_6



Cyclic Unsaturated



Functional group:- These hetero atom or groups of atoms which make Carbon Compound reactive and decided its properties are called functional groups.

OR

An atom or group of atoms present in a molecule which largely determines its chemical properties are called functional group.

	Functional group	Formula of functional group.
i)	Halo (Chloro / Halo bromo)	$-Cl$ / $-Br$
ii)	Alcohol	$-OH$
iii)	Aldehyde	$-CHO$ or $-\overset{O}{\overset{\|\|}{C}}-H$
iv)	Ketone	$-CO-$ or $-\overset{O}{\overset{\|\|}{C}}-$
v)	Carboxylic acid	$-COOH$ or $-\overset{O}{\overset{\|\|}{C}}-OH$

Homologous series:- it is series of Compounds in which the Some functional group substitutes for the hydrogen in a Carbon chain.

Ex:- Alchols - CH_3OH, C_2H_5OH, C_3H_7OH.

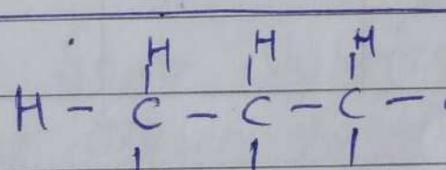
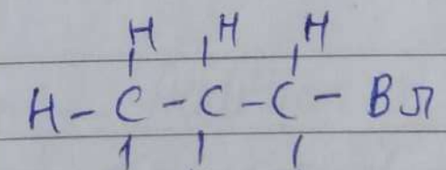
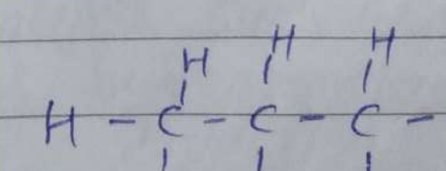
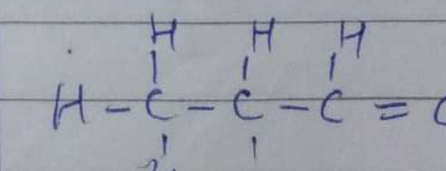
~~Alomen~~

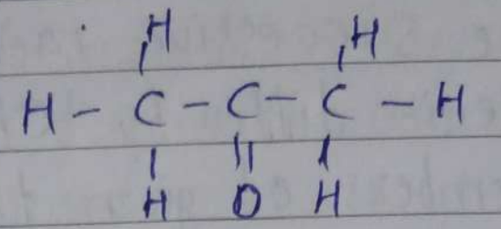
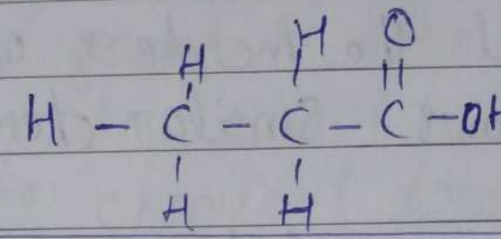
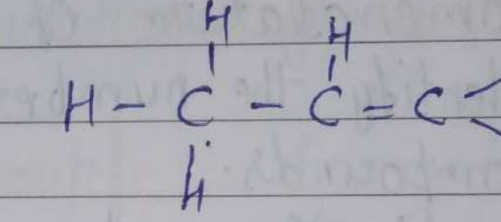
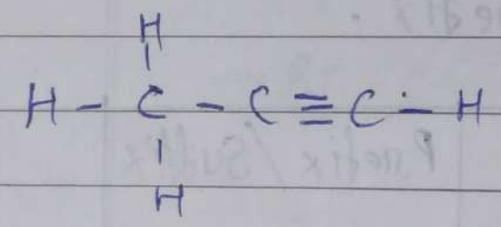
Characteristic of Homologous series:-

i) The successive members in homologous series differ by CH_2 unit or 14 mass unit.
ii) Members of given homologous series have the same functional group.
iii) All the members of homologous series shows similar chemical properties.

Nomenclature of Carbon Compounds:-

i) Identify the number of carbon atoms in Compounds.
ii) Functional group is indicated by suffix or Prefix.

Functional group	Prefix / Suffix	Examples
1. Halogen	Prefix - chloro Bromo etc.	 Chloro propane
		 ~~Chlo~~ Bromo propane
2. Alcohol	Suffix - ol	 Propanol
3. Aldehyde	Suffix - al	 Propanal

S.No.	functional group	Prefix / Suffix	Example
4.	Ketone	Suffix - one	 Propanone
5.	Carboxylic acid	Suffix - oicacid	 propanoic acid
6.	Double bond (Alkenes)	Suffix - ene	 Propene
7.	Triple bond (alkynes)	Suffix - yne	 propyne.

Chemical properties of carbon Compounds:-

i) Combustion:- The complete combustion of carbon compounds in the air gives carbon dioxide water, heat and light.

$$CH_3CH_2OH + O_2 \longrightarrow CO_2 + H_2O + \text{Heat and light}$$

* Saturated hydrocarbone generally burn in air with blue and non-sooty flame.
* Unsaturated hydrocarbon burns in air with yellow sooty flame.

ii) Oxidation:- oxidation of etanol in presence of oxidizing agents gives ethanoic acid.

$$CH_3-CH_2OH \xrightarrow[+\text{Heat}]{\text{Alkaline } KMnO_3} CH_3COOH$$

Oxidizing agent:- Some substances are capable of adding oxygen to others are called oxidizing Agent.

iii) Addition Reaction:- Addition of dihydrogen with unsaturated hydro carbon in the presence of catalysts such as nickel are known as hydrogenation reaction.

$$\underset{R}{\overset{R}{\diagdown}}C=C\underset{R}{\overset{R}{\diagup}} \xrightarrow[H_2]{\text{Addition, Nickel Catalyst}} R-\overset{H}{\underset{R}{\overset{|}{\underset{|}{C}}}}-\overset{H}{\underset{R}{\overset{|}{\underset{|}{C}}}}-R$$

Catalyst:- Substances that cause a reaction to occur or proceeds to different rated without consuming in it are called a catalyst.

ex. Ni, Pt, Pd etc.

(iv) Substitution Reaction:- Replacement of one or more hydrogen atom of an organic molecule by another atom or group of the atom is known as Substitution reaction.

$$CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} CH_3Cl + HCl.$$

Important Carbon compounds: ethanol and ethanoic acid:-

☆ Physical properties of ethanol:-

i) Colourless, pleasant smell and burning taste.
ii) Soluble in water.
iii) Volatile liquid with low boiling point of 351 K.
iv) Neutral Compound.

Chemical properties of ethanol:-

i) Reaction with Sodium

$$2Na + 2CH_3CH_2OH \longrightarrow 2CH_3CH_2ONa + H_2$$

(ethanol) (Sodium ethoxide)

This reaction is used as a test for ethanol by evolution of H_2 gas.

ii) Dehydration

$$CH_3CH_2OH \xrightarrow[H_2SO_4]{\text{Hot Conc.}} CH_2 = CH_2 + H_2O.$$

Physical properties of ethanoic acid:—

i) Colourless liquid having sour taste and have smell of vinegar.

ii) Boiling point is 391 k.

iii) When pure CH_3COOH is freezed, it forms colourless ice like solid. So it is called glacial acetic acid.

Chemical properties:—

i) Esterification :—

$$CH_3COOH + CH_3CH_2OH \xrightarrow{\text{Acid}} CH_3COOCH_2CH_3 + H_2O$$

(ethanoic acid) (ethanol) Ester

Sweet smelling ester is formed.

ii) Reaction with base:—

$$NaOH + CH_3COOH \rightarrow CH_3COONa + H_2O$$

iii) Reaction with Carbonates and hydrogen Carbonates:—

$$2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$$

$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$.

Soaps :- Sodium or potassium salts of long chain fatty acids is called Soap.
formula :- $-COO^-Na^+$

Detergent :- Ammonium or sulphonate Salts of long chain fatty acids are called Detergent.

Ex. $CH_3-(CH_2)_{11}-C_6H_4-SO_3Na$.

Hard and Soft water :- water that does not produce lather with soap readily is called hard water and which produces lather with soap is called Soft water.

Hardness of water is due to the presence of bicarbonates, chlorides and sulphate Salt of Calcium and magnesium.

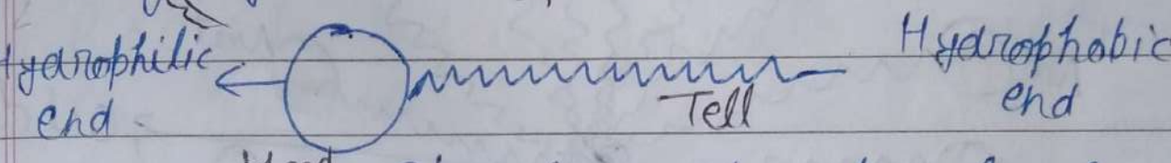
Difference between Soaps and detergents.

Soaps	Detergents
i) These are Sodium or Potassium Salts of long chain fatty acids	ii) These are ammonium and sulphonate Salts of long chain fatty acids
iii) Ionic part of the Soap is $-COO^-Na^+$	ii) Ionic part of detergent is $-OSO^{3-}Na^+$

iii) Their efficiency decreases in hard water.	iii) Their efficiency is unaffected in hard water.
iv) Soaps are biodegrad-able	iv) Detergent are ~~bio~~ non-biodegradable.

Soap molecule has:—

i) Ionic (hydrophillic) part
ii) Long hydrocarbon chain part.



Structure of soap molecule.

Cleansing action of Soap:—

→ most dirt is oily in nature and hydrophobic end attaches itself with dirt and the ionic end is surrounded with molecule in water. This result in formation of a radial structure called micelles.

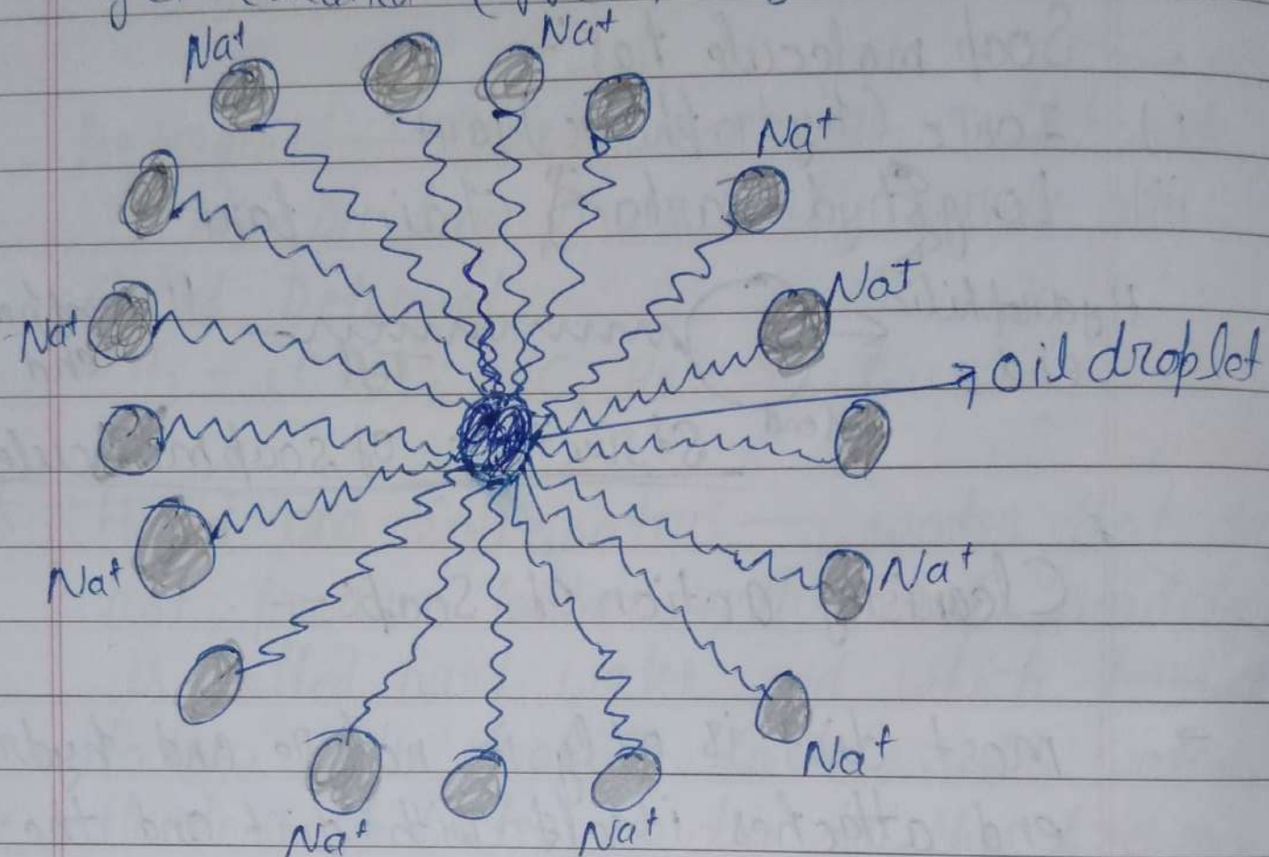
→ Soap micelles helps to dissolve dirt and grease in water.

→ Soap is mixture of miscelles

→ The magnesium and Calcium salt present in hard water react with Soap mole-cule to form insoluble product.

Called Scum. This Scum create difficulty in cleansing action.

→ By use of detergent, Insoluble Scum is not formed with hard water and cloths get cleaned effectively



formation of micelles.

Saponification Reaction :- Ester reacts in the presence of an acid or a base to give back the alcohol & carboxylic acid this reaction is called Saponification.

~~$CH_3COOC_2H_5 + NaOH$~~ $\rightarrow$ CH_3COONa + ~~C_2H_5OH~~

$CH_3COOCH_2CH_3 + NaOH$ $\rightarrow$ CH_3COONa + CH_2CH_3OH

Chapter-4

Carbon & Its Compounds

Intext Question home-work

Q.1 How many structural isomers can you draw for pentane?

Ans Three structural isomers are possible for pentane

i) $CH_3 - CH_2 - CH_2 - CH_2 - CH_3$

ii) $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$

iii) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - CH_3$

Q.2 What are the two properties of Carbon which lead to the huge number of Carbon Compounds we see around us?

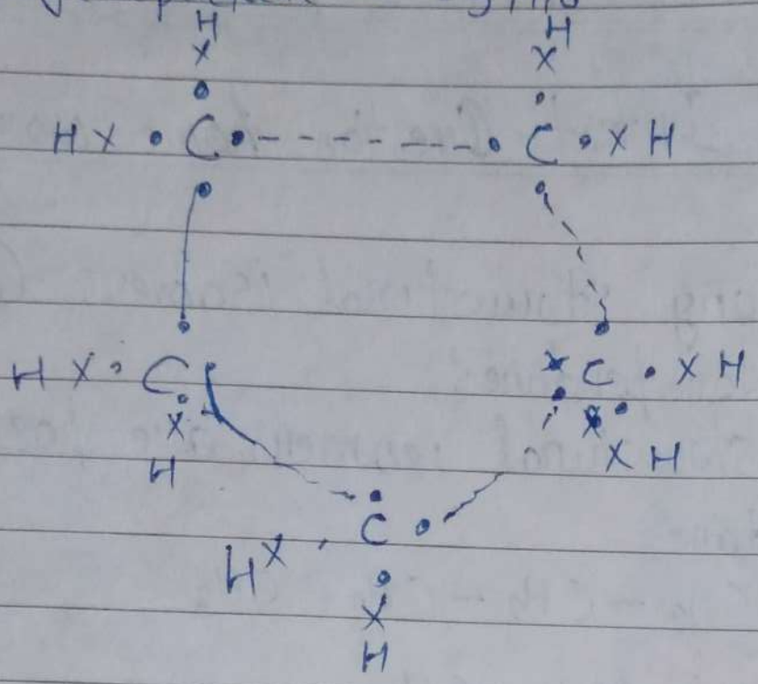
Ans The two features of Carbon that give rise to a large number of compounds are as follows

→ Catenation :- it is the ability to form bonds with other atoms of Carbon.

→ Tetravalency :- With the valency of four, Carbon is capable of bonding with four other atoms.

Q.3 What will be the formula and Electron dot structure of cyclopentane?

Ans Cyclopentane – C_5H_{10}



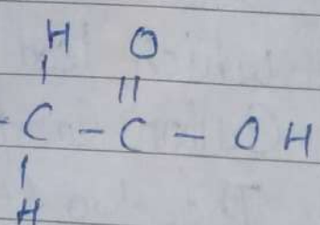
Q.4 Draw the structures for the following Compounds.

i) Ethanoic acid ii) Bromopentane

iii) Butanone iv) Hexanal

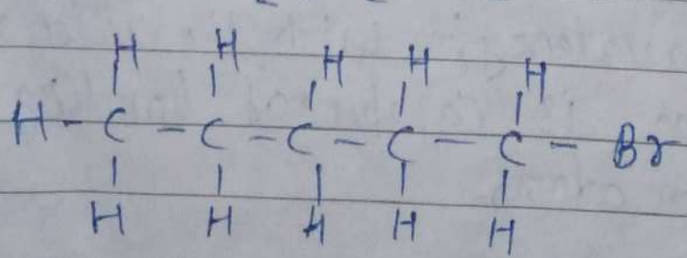
Ans i) Ethanoic acid

CH_3COOH,



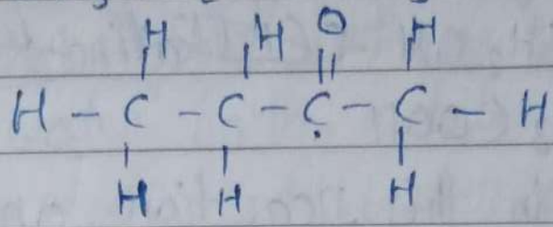
ii) Brom opentane

$CH_3CH_2CH_2CH_2CH_2Br$



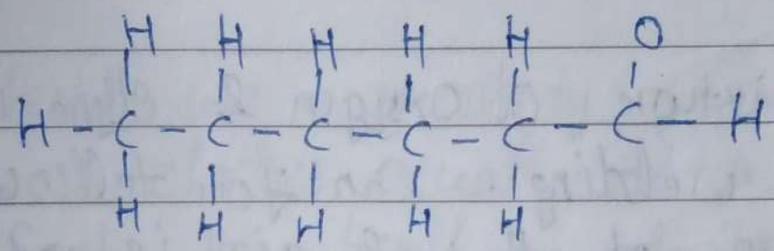
iii) Butanone

~~C_4H_8~~ $CH_3CH_2COCH_3$



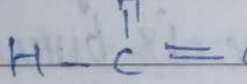
iv) Hexanal

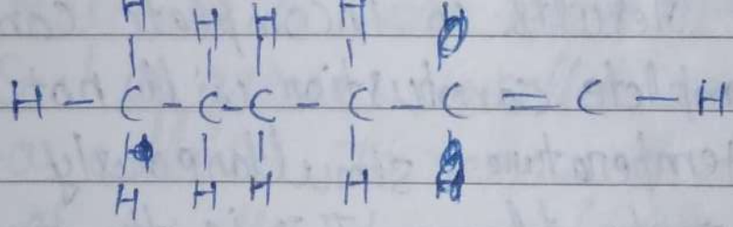
$CH_3CH_2CH_2CH_2CH_2CHO$



Q.5 How would you name the following Compounds:

i) $CH_3 - CH_2 - Br$

ii) 

iii) 

Ans i) Bromo ethane

because There is a bromo group with two carbon atoms.

ii) methanal

because There is an aldehyde group in this compound with one Carbon atom.

iii) Hexyne

because there is a triple bond with Six Carbon atoms.

Q.06 Why is the conversion of ethanol to ethanoic acid an oxidation reaction?

Ans CH_3CH_2OH ~~(Alkaline $KMnO_4$)~~ $\rightarrow$ CH_3COOH

Since in this reaction one oxygen is added to ethanol, hence it is an oxidation reaction.

Q.07 A mixture of oxygen & etyne is burnt for welding. Can you tell why a mixture of ethyne & air is not used?

Ans When mixture of oxygen and etyne is burnt, it gives high temperature because of complete combustion and gives clean flame. But when ethyne is burnt with air, it results in incomplete combustion. In complete combustion will not give a high temperature. simultaneously it will give sooty flame. This is the reason, oxygen is used, Instead of air, to burn ethyne.

Q.08 What are oxidising agents?

Ans Substances which give oxygen or replace hydrogen on reaction with other Compounds are called oxidising agents.

ex:- Potassium permanganate.

Q.9 Would you be able to check if water is hard by using a detergent?

Ans Detergent gives lather with hard and soft water both, while a soap gives lather with soft water only. Thus, it is not possible to check if water is hard by using a detergent.

Q.10 People use a variety of methods to wash clothes. usually after adding the soap, they 'beat' the clothes on a stone, or beat it with a paddle, scrub with a brush or the mixture is agitated in a washing machine. why is agitation necessary to get clean clothes?

Ans molecules of soap form micelles with dirt, such as grease. micelles remain suspended as colloid. To remove dirt in the form of micelles from clothes agitation is necessary to get clean clothes.

Exercise

Q.5 Draw the electron dot structures for

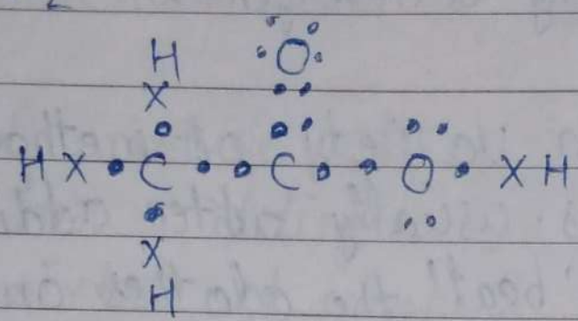
i) ethanoic acid

ii) H_2S

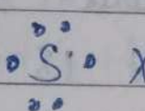
iii) Propanone

iv) F_2

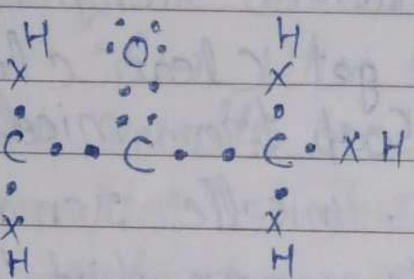
Ans i)



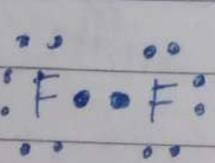
ii)



iii)



iv) F_2



Q.7 How can ethanol and ethanoic acid be differentiated on the basis of their physical and chemical properties?

Teacher's Sign.

Physical properties

Ethanol	Ethanoic acid
i) it has specific smell	i) it has vinegar like smell.
ii) it has burning taste.	ii) it is sour in taste.
iii) it does not freeze in winters.	iii) it freezes in winter.

Chemical properties.

Ethanol	Ethanoic acid
i) No change on litmus paper.	i) Blue litmus turns red.
ii) Burns with blue flame.	ii) Does not burns with blue flame.
iii) Does not react with Sodium bicarbonate	iii) Gives Carbon dioxide and Sodium bicarbonate.

Q8 Why does micelle formation take place when Soap is added to water? will a micelle be formed in other Solvent like, ethanol also?

Ans because the hydrocarbon chains of soap molecules are hydrophobic while the ionic ends are hydrophillic and hence Soluble in water. micelle will not form in all types of solvents. it will form in Such type of solvent where Soap is insoluble in that particular solvent.

P.T.O.

No, micelle formation does not take place in ethanol because the alkly chain of soap becomes soluble in alcohol. micelles can be formed only around suspended molecules of oil in a mixture. Ethanol is a very good solvent and it can even dissolve oil to form a clear solution.

Q.9 Why are carbon and its compounds used as fuels for most applications?

Ans Carbon and its compounds give large amount of heat on combustion due to high percentage of carbon and hydrogen carbon compounds used as fuel have optimum ignition temperature with high calorific values and are easy to handle. Their combustion can e controlled. Therefore, carbon & its compounds are used as fuels.

Q.10 Explain the formation of scum when hard water is treated with soap.

Ans Hard water often contains salts of calcium & magnesium. Soap molecules react with the salts of calcium and magnesium and form a precipitate. This precipitate begins floating as

an off-white layer over water. This layer is called scum. Soaps lose their cleansing property in hard water because of formation of scum.

Q.11 What change will you observe if you test soap with litmus paper (red and blue)?

Ans Since soap is basic in nature, it will turn red litmus blue. However, the colour of blue litmus will remain blue.

Q.12 What is hydrogenation? What is its industrial application.

Ans The process in which unsaturated compounds reacts with hydrogen in the presence of catalyst to form saturated compounds are called hydrogenation.

Industrial application:-

This reaction is commonly used in the hydrogenation of vegetable oils. Vegetable oil have long unsaturated carbon chains, which are converted into vegetable ghee i.e. saturated fatty acids.

Q.13 Which of the following hydrocarbons undergo addition reaction:

C_2H_6, C_3H_8, C_3H_6, C_2H_2 and CH_4

Ans Unsaturated hydrocarbons C_3H_6 and C_2H_2 undergo addition reactions.

Q.14 Give a test that can be used to differentiate chemically between butter and cooking oil.

Ans Butter contains saturated fats. therefore, it cannot be hydrogenated. on the hand
oil has unsaturated fats. That is why it can be hydrogenated to saturated fats (solid).