9. Carbon Compounds
Extra Questions

1. Generally the melting and boiling points of carbon compounds are high

Ans – False

2. Till now the number of known carbon compounds is about 10 million

Ans – True

3. Unsaturated hydrocarbons are less reactive than saturated hydrocarbons

Ans – False

4. Benzene is an aromatic compound

Ans – True

5. The general formula of alkynes is C_nH_2n

Ans – False

6. Naphthalene burns with a yellow flame

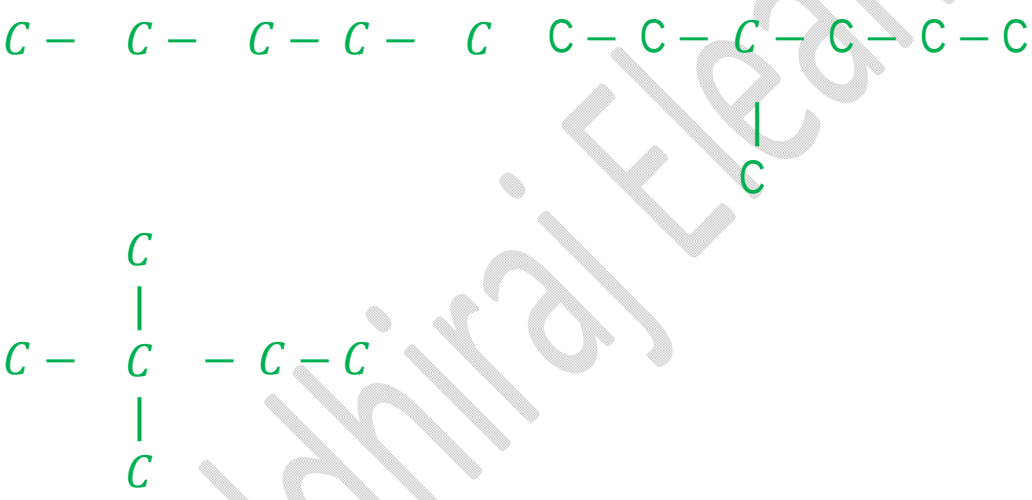
Ans – True

7.Write a short note on catenation power.

Ans – (1) Carbon has a unique ability to form strong covalent bonds with other carbon atoms : this results in formation of big molecules . this property is called as catenation power.

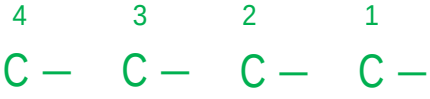
(2) Carbon shows Catenation . two or more carbon atoms can share their valance electrons and bond with each other. Thus , carbon chains can be straight or branched or closed chain ring structure forming large molecules. The covalent bond between two carbon atoms is strong and therefore stable. Carbon is bestowed with catenation power due to the strong and stable covalent bonds.

(3) Hence, carbon atoms can form an unlimited number of compounds.



8. write the structural formula of Butanoic acid

Ans – 1) But stand for 4 carbon atoms in a chain number the carbon atoms in a chain as 1,2,3……..

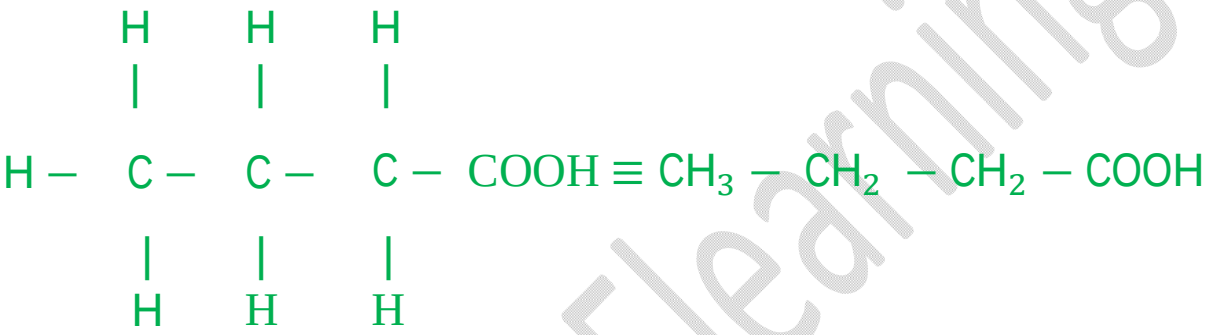


‘- oic acid’ stands for functional group – COOH Assign the number 1 to carbon in the functional group – COOH

4 3 2 1

C – C – C – COOH

Now satisfy the valencies of each carbon atom



$CH_3 - CH_2 - CH_2 - COOH$

9. Ethane, Propane, Ethane, Butane

Ans – Ethane

10. Methane, butane, benzene, sodium chloride

Ans – sodium chloride

11.$C_2H_4,\ C_3H_6,\ C_3H_3,\ C_5H_{12}$

Ans – C_5H_{12}

12. Methane. Propane, Pentane, Benzene

Ans – Benzene

13. Polyethylene, Teflon, Polyvinylchloride, PET

Ans – PET

14. Complete the second pair (co – relation)

C_3H_8 : Alkenes : : C_3H_4

Ans – alkynes

15. Alcohol : - OH : : carboxylic acid :

Ans - $-COOH$

16. Acetylene : $CH \equiv CH$ :: $Ethylene$:

Ans - $CH_2 = CH_2$

17. Write names of first four homologous series of alcohols.

Ans: First four homologous series of alcohols are

(1) Methanol CH_3-OH
(2) Ethanol C_2H_5-OH
(3) Propanol C_3H_7-OH
(4) Butanol C_4H_9-OH

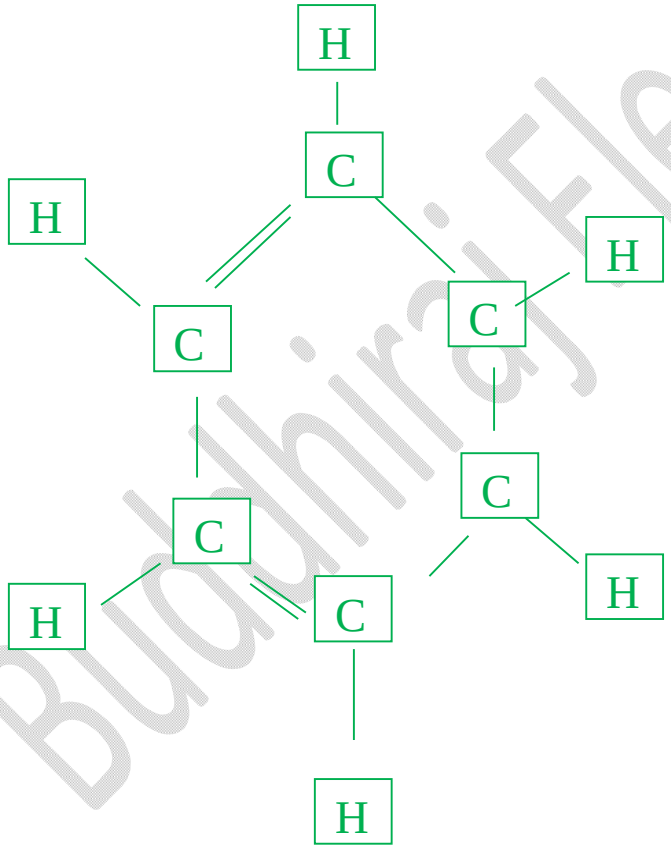
18. How is hydrogen molecule formed?

Ans:- The atomic number of hydrogen is 1, its atom contains 1 electron in K shell . It requires one more electron to complete

the k shell and attain the configuration of helium (He). To meet this requirement two hydrogen atoms, share their electrons with each other to form H_2 molecule . one covalent bond i.e. a single bond is formed between two hydrogen atoms by sharing of two electrons.

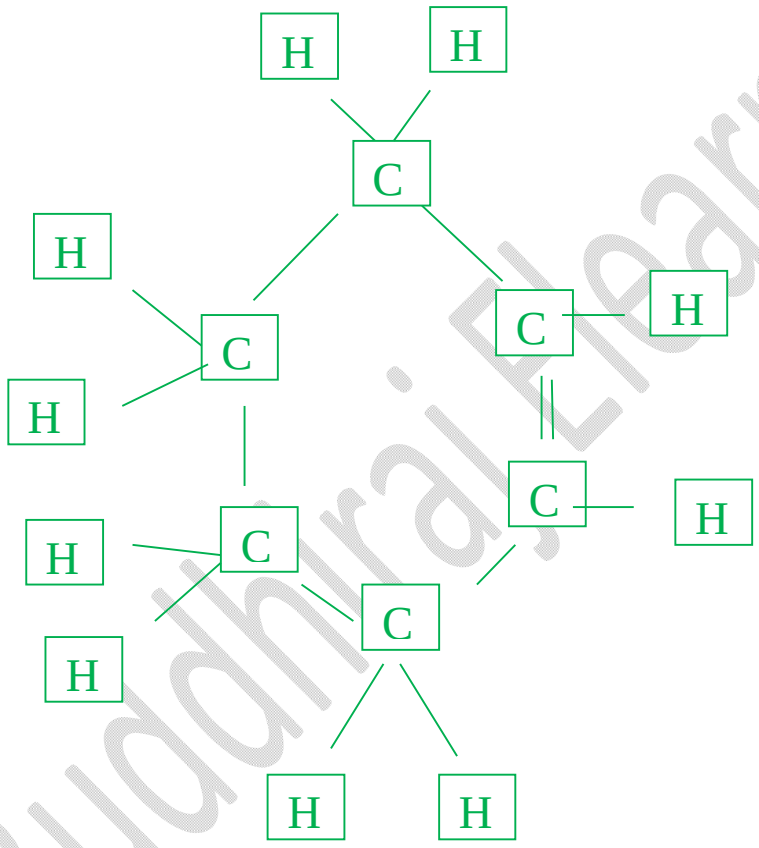
19. State the structure and molecular formula of benzene

Ans – The molecular formula of benzene is C_6H_6 structural formula



20. Write the structural and molecular formula of cyclohexane

Ans – The molecular formula - C_6H_{10}



21. Alkane

Ans – the saturated hydrocarbons containing only a single bond between two carbon atoms are called alkanes.

22. Alkenes

Ans – The unsaturated hydrocarbons containing a carbon double bond are called ‘Alkenes’

23. Alkynes

Ans – The unsaturated hydrocarbons containing a carbon triple bond are called alkynes.

24. Match the following

Column I	Column II	Answer
1) Ethyne	C_2H_6	Ethane - C_2H_2
2) Ethene	C_2H_2	Ethane - C_2H_4
3) Ethane	C_3H_6	Ethane - C_2H_6
4) Propyne	C_2H_4	Propyne - C_3H_4
	C_3H_4	

25.

Column I	Column II	Answer
1) cyclohexane	CH_3COOH	CH_6H_{12}
2) Methanol	CH_3Cl	CH_3OH
3) Acetaldehyde	CH_2Cl_2	CH_3COH
4) Ethnic acid	CH_3OH	CH_3COOH
	C_6H_{12}	
	CH_3CHO	

26. Define Esterification

Ans – A carboxylic acids reacts with an alcohol in presence of an acid catalyst an ester is formed. The reaction is known as esterification

$$\underset{\text{Acid}}{CH_3} - COOH + \underset{\text{alcohol}}{CH_3} - CH_2 - OH \xrightarrow[\text{Catalyst}]{\text{Acid}} \underset{\text{Ester}}{CH_3COOC_2H_5} + H_2O$$

27. Addition reaction

Ans – when a carbon compound combines with another compound to form a product that contains all the atoms in both the reactants; it is called an addition reaction

$$\text{vegetable oil} + H_{2(g)} \xrightarrow[catalyst]{ni} vanaspati\ ghee$$

28. Polymerization

Ans – The reaction by which monomer molecules are converted into a polymer is called polymerization

29. $CH_3 - CH_2 - CH_2\,OH + (O) \rightarrow CH_3 - CH_2 - COOH$

Ans - $CH_3 - CH_2 - CH_2\,OH \xrightarrow[\text{alk. kmno}_4]{(o)} CH_3 - CH_2 - COOH$

30. $CH_3 - CH = CH - CH + Br_2 \rightarrow CH_3 - CHBr - CHBr - CH_3$

Ans – Addition reaction

31. Explain the following term

Ans – The chemical bond formed by sharing of two valence electron between the two atoms is called covalent bond

i) A covalent bond is represented clearly by drawing an electron dot structure.

ii) In this method a circle is drawn around the atomic symbol and each of the valence electrons is indicated by a dot or a cross the covalent bond formed between the atoms is indicated by showing the circles around the atomic symbols crossing each other.

iii) The shared electrons are shown in the overlapping regions of the two circles by dot or cross. The electrons – dot structure is also drawn without showing the circle one pair of shared electrons constitutes one covalent bond

iv) A covalent bond is also represented by a small line joining the symbol of the two atoms. The line structure is also called structural formula

O (2,6) O (2,6) shared pair of electron 2 covalent bonds

32. Hetero atom in a carbon compound

Ans – Many more types of carbon compound are formed by formation of bonds of carbon with other elements such as halogens, oxygen, nitrogen, sulphur. The atoms of these elements substitute one or more hydrogen atoms in the hydrocarbon chain and thereby the tetravalency of carbon is satisfied. The atom of the elements which is substitute for hydrogen is referred to as a hetro atoms. Sometimes hetro atoms are not alone but exist in the form of certain groups of atoms.

The compound acquires specific chemical properties due to these hetro atoms or the groups of atoms that contain hetroatoms, irrespective of the length and nature of the carbon chain in that compound. Therefore, these hetro atoms or the groups of atoms containing hetro atoms are called functional group

i) for example

$$CH_4 + Cl_2 \xrightarrow{sunlight} CH_3 - Cl + HCl$$

33. Explain the term Homologous Series.

(i) You have seen that chains of different length are formed by joining the carbon atoms to each other moreover you have also seen that a functional group can take place of a hydrogen atom on these chains as a result of this, large number of compound are formed having the same functional groups but different length of carbon chain for example , there are many compounds such as

CH_3-OH , CH_3-CH_2-OH, CH_3-CH_2-CH_2-OH, which contain alcohol as the functional group.

(ii) The length of the carbon chains in them is different , their chemical properties are very much similar due to the presence of the same functional group in them. The series of compounds formed by joining the same functional group in the place of a particular hydrogen atom on the chains having sequentially increasing length is called homologus series.

(iii) there are different homologus series in accordance with the functional group e.g. homologus series of alcohols, homologus series of carboxylic acid

34. Explain the term oxidation

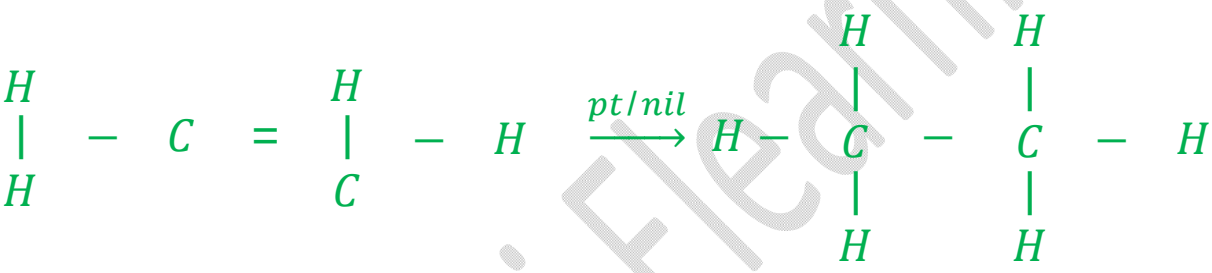
Ans- In this process of combination all the chemical bonds in the molecule of the carbon compounds break and CO_2 and H_2O Are formed as the products . In other words the carbon compound is completely oxidized during combustion . chemical compounds can also be used as source of oxygen substances that can give oxygen to other substance are called oxidants or oxidizing agents. Potassium permangate or potassium dichromate are commonly used as oxidizing agents an oxidizing agents affects on certain functional group in present carbon compounds

35. Explain the term of Reduction?

Ans – The chemical reaction in which hydrogen is received called reduction reaction.

for example

In hydrogenation of vegetable oil in presence of nickel catalyst converts unsaturated hydrocarbon compound into saturated hydrocarbon

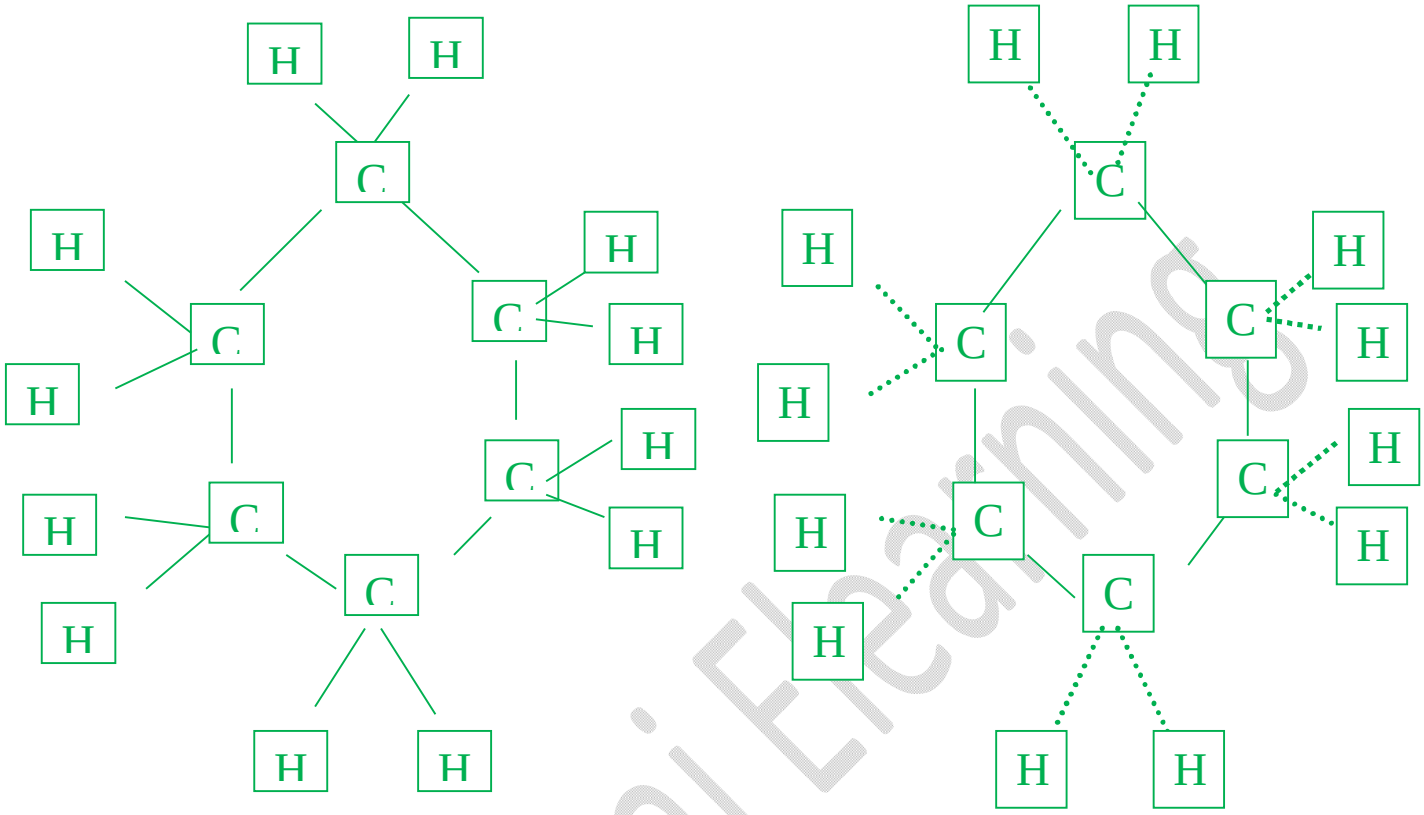


Ethelene [understand compound]

In this reaction hydrogen get attached to every carbon atom by breaking double bond so it reduction reaction.

36. Draw the electron – dot structure of cyclohexane

Ans – cyclohexane : Molecular formula : C_6H_{12}

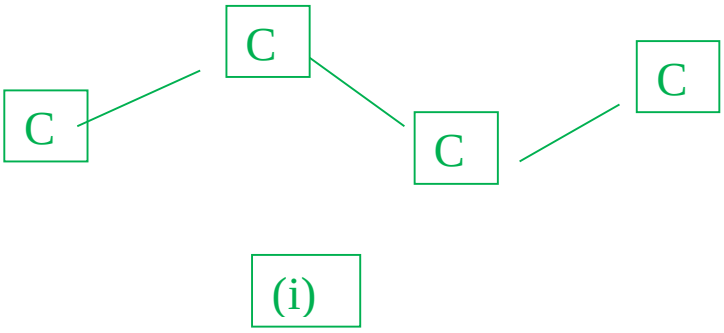


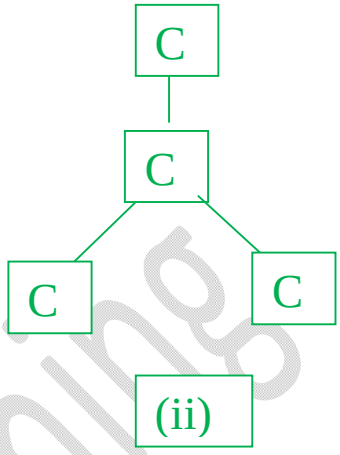
37. Explain the item of structural isomerism

Ans – i) Two different structural formulae are obtained on joining hydrogen atoms to these two chains so as to satisfy the tetravalency of the carbon atom the molecular formula of both these structural formulae is the same which is C_uH_{10}

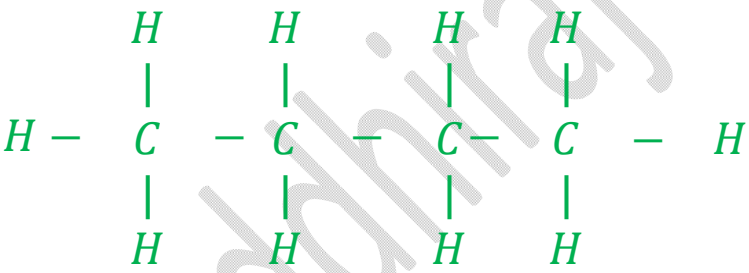
ii) These are two different compounds as their structural formulae have the same molecular formula is called ‘structural isomerism’ The number of carbon compounds increases further due to the isomerism observed in carbon compounds.

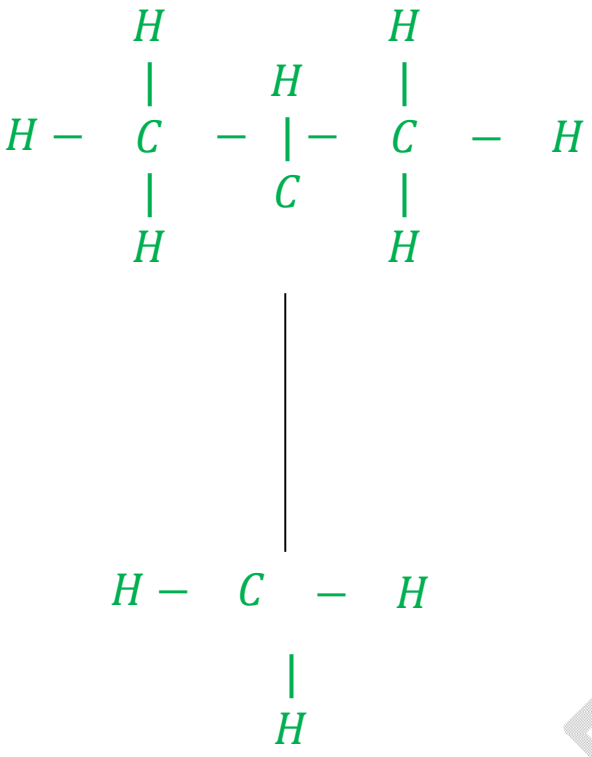
A) Two possible carbon chains





B) Two structural formulae for the molecular formula C_uH_{10}

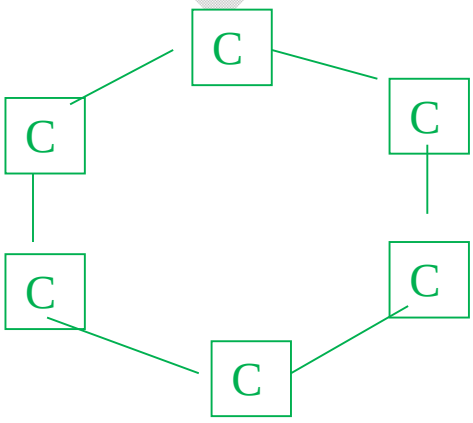




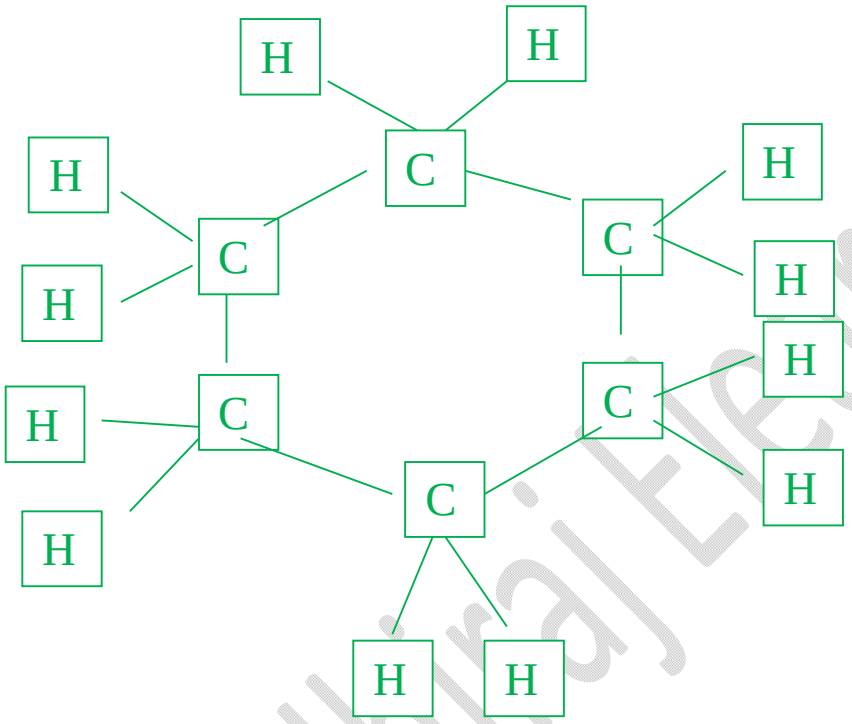
Apart from the straight chains and branched chains, closed chains of carbon atom are present in some carbon compounds, where in rings of carbon atoms form, for example, the molecular formula of cyclohexane is C_6H_{12} and its structural formula contains a ring of six carbon atoms

A) The carbon ring in

cyclohexane



B) Structural formula of cyclohexane



38. Explain the term of substitution Reaction?

Ans – As the single bands C – H and C – C are very strong, the saturated hydrocarbons are not reactive, and therefore they remain insert in presence of mast reagents. However, saturated hydrocarbons, in presence of sunlight react rapidly with chlorine. In this reaction chlorine atoms replace, one by one, all the hydrogen atoms in the saturated hydrocarbons the reaction in

which the place of one type of atom/group in a reactant is taken by another atom/group of atoms, is called substitution reaction. Chlorination of methane is a substitution reaction which gives four products.

$$CH_4 + Cl_2 \xrightarrow{sunlight} CH_3 - Cl + HCl$$

$$CH_3Cl + Cl_2 \xrightarrow{sunlight} CH_2Cl_2 + HCl$$

$$CH_2Cl_2 + Cl_2 \xrightarrow{sunlight} CHCl_3 + HCl$$

$$CHCl_3 + Cl_3 \xrightarrow{sunlight} CCl_u + HCl$$

39. Explain the term of combustion?

Ans – Let us first look at combustion as a chemical property of carbon compounds we have seen in the previous standards that, carbon in the form of various allotropes on ignition in presence of oxygen undergoes combustion to emit heat and light, and forms carbon dioxide. Hydrocarbon as well as most of the carbon compounds under water as the common products. Some of the combustion reactions are as follows.

i) $C + O_2 \rightarrow CO_2 + heat + light$

(carbon)

ii) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + heat + light

(methane)

iii) $CH_4 - CH_2 - OH + 3O_2 \rightarrow 2O_2 + 3H_2O$ + heat + light

40. State the properties of ethanoic acid

Ans – i) Ethanoic acid contain carboxylic acid as its functional group. The chemical reaction of ethanoic acid are mainly due to this functional group.

ii) Its aqueous solutions is acidic and turns blue litmus red.

iii) A 5 – 8% aqueous solution of acetic acid is used as vinegar

iv) It is a weak acid

41. State the characteristics of carbon

Ans – A) Carbon has a unique ability to form strong covalent bonds with other carbon atoms, this result in formation of big molecules. This property of carbon is called catenation power.

i) The carbon compounds contain open chains or closed chains of carbon atoms. An open chain can be a straight chain or a branched chain. A closed chain is a ring structure. The covalent bond between two carbon atoms is strong and stable covalent bonds carbon is bestowed with catenation power.

B) Two carbon atoms can be bonded together by one, two or three covalent bonds, double bond, and triple bond respectively. Due to the ability of carbon atoms to from multiple bonds as well as single bonds, the number of carbon compounds increases. For example three are three compounds namely,

ethane ($CH_3 - CH_3$) ethane ($CH_2 = CH_2$) and ethane (CH = CH) which contain two carbon atoms.

C) Being tetravalent one carbon atom can form bonds with four other atoms (carbon or any other) . This results in formation of many compounds. These compound possess different properties as per the atoms to which carbon is bonded. For example, five different compounds are formed using one carbon and two monovalent elements hydrogen and chlorine : CH_4, $CH_3Cl, CH_2Cl_2, CHCl_3$, CCl_4

42. Answer the following question

Describe the IUPAC rules of naming organic compound

Ans – i) International union for pure and applied chemistry (IUPAC) put forth a nomenclature system based on the structure of the compounds, and it was accepted all over the world. There is a provision in this system for giving a unique name to all the carbon compounds.

ii) There are three units in the IUPAC name of any carbon compound : parents, suffix and prefix. These are arranged in the name as follows

prefix – parent – suffix

an IUPAC name is given to a compound on the basis of the name of its parent alkenes. The name of the compound in constructed by attaching appropriate suffix and prefix to the

name of the parent alkenes. The steps in the IUPAC nomenclature of straight chain compounds are as follows.

Step 1: Draw the structural formula of the straight chain compound and count the number of carbon atoms in it. The alkenes with the same number of carbon atoms is the parent alkenes of the concerned compound. Write the name of this alkenes. In case the carbon chain of the concerned compound contains a double bond, change the ending of the parent name from ‘ane’ to ‘ene’. If the carbon chain in the concerned compound contains a triple bond, change the ending of the parent name from ‘ane’ to ‘yne’

Step 2 : If the structural formula contains a functional group replace the last letter ‘e’ from the parent name by the condensed name of the functional group as the suffix.

Step 3 : Number the carbon atoms in the carbon chain from one end to the other. Assign the number ‘1’ to carbon in the functional group – CHO or – COOH, if present, otherwise, the chain can be numbered in two directions. Accept that numbering which gives smaller number to the carbon carrying the functional group. In the final name a digit and a character should be separated by a small horizontal line.

43. write the IUPAC names of the following structural formulae.

Ans – a) $CH_3 - CH_2 - CH_2 - CH_3$

⇒ The number of carbon atoms in the longest chain : 4 parent alkane : Butane IUPAC name : n – Butane

b) $CH_3 - CHOH - CH_3$

⇒ The number of carbon atoms in the longest chain : 3

c) $CH_3 - CH_2 - COOH$

⇒ The number of carbon atoms in the longest chain : 3

parent alkenes : propane

Functional group : COOH (- oic acid)

If the carbon chain of the compound contain a – COOH group then change the ending of the parent name i.e. ‘e’ of propane is replaced by ‘oic acid’ parent suffix : propane acid

IUPAC name : propane acid

d) $CH_3 - CH_2 - NH_2$

⇒ number of carbon atoms : 2

parent alkenes : Ethane

Functional group : NH_2 (amine)

If the carbon chain of the compound contains a $-NH_2$ group, then change the ending of the parent name, i.e. ‘e’ of ethane is replaced by ‘amine’

parent suffix : Ethanamine

IUPAC name : Ethanamine

e) $CH_3 - CHO$

⇒ Number of carbon atoms :2

parent alkenes : Ethane

functional group – CHO (a1)

If the carbon chain of the compound contains a – CHO group then change the ending of the parent name, i.e. ‘e’ of ethane is replaced by ‘a’

f) $CH_3 - C \equiv C - H$

⇒ Number of carbon atoms in the longest chain : 3 paretn alkane : propyne

functional group : triple bond

parent suffix : propane

IUPAC none : propane

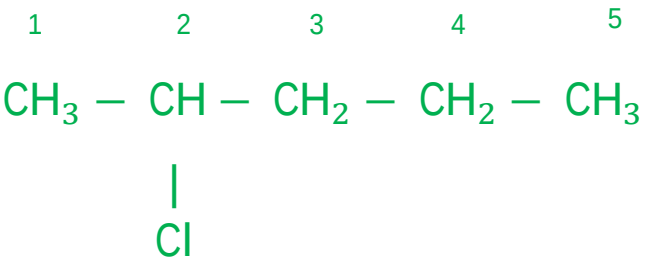
i) $CH_3 - \underset{\underset{Cl}{|}}{CH} - CH_2 - CH_2 - CH_3$

⇒ The number of carbon atoms in the longest chain : 5

parent alkenes : pentane

prefix functional group : chloro

assign the number : 2



The carbon atom to which the – Cl atom is attached is numbered as (2 and the other (atoms are numbered accordingly.

prefix parent : 2 chloropentane

IUPAC name : 2 chloropentane

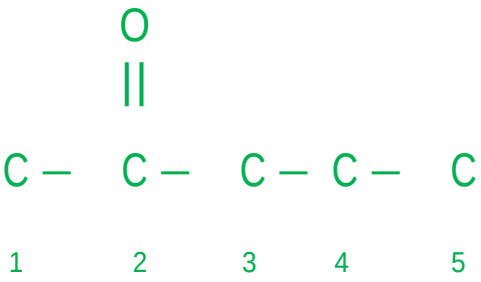
44. write the structural formulae for the following IUPAC names

Ans – A) pent 2 – one

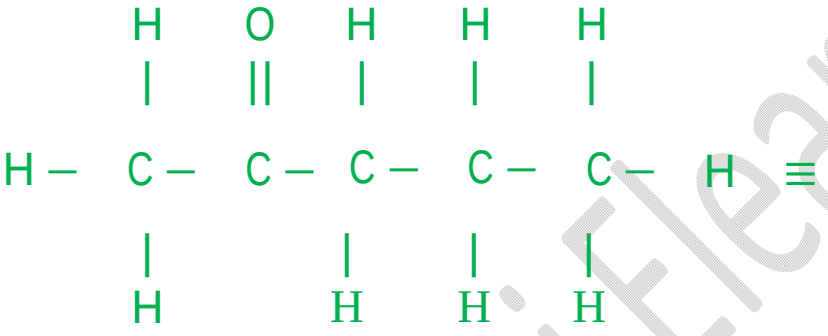
1) pent stand for 5 carbon atoms in a chain number the carbon atoms in a chain as 1,2,3……

2) 'one' stand for functional group $\left(\begin{matrix} O \\ || \\ -C- \end{matrix}\right)$

ketone. The number assigned for the ketone group is 2 show the ketone group at C_2



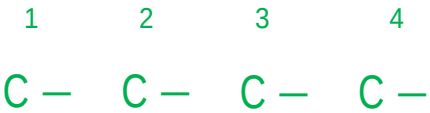
Now satisfy the valencies of each carbon atom.



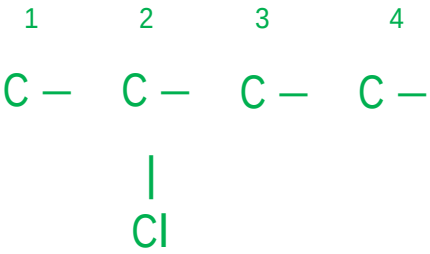
$CH_3 - C - CH_2 - CH_2 - CH_3$

B) 2 – chlorobutane

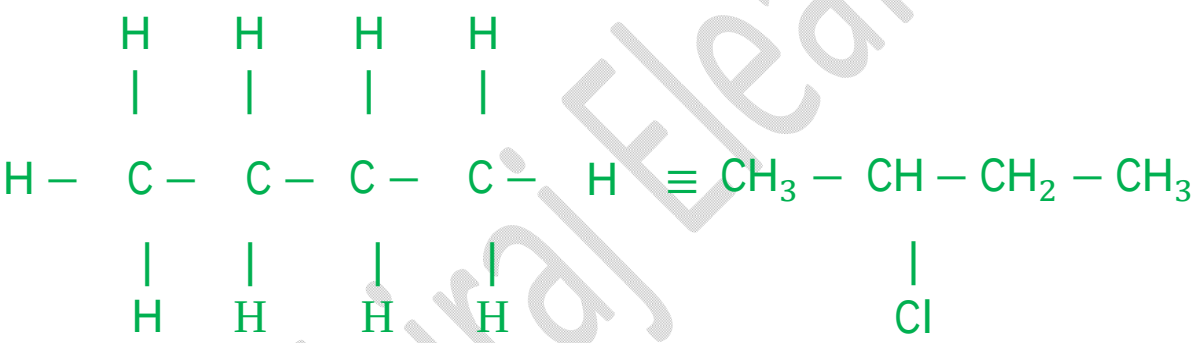
1) In 2 – chlorobutane, butane is parent alkenes stands for 4 carbon atoms and number the carbon atoms in a chain as 1,2,3



2) chloro o; $(Halo)$ is the prefix and the number assigned for prefix (chloro) is 2. Show the chloro atom at C_2



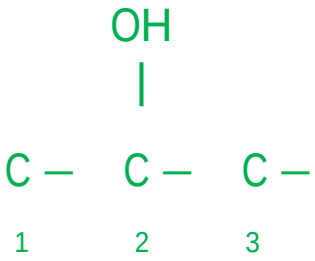
3) Now satisfy the valencies of each carbon atom



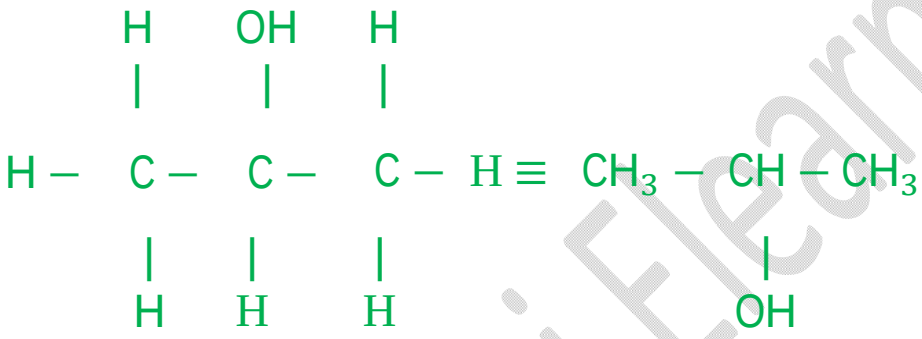
c) propane -2 – ol

1) propane stands for 3 carbon atoms in a chain number the carbon atom in a chain as 1,2,3……

2) ‘ol’ stands for (-OH) hydroxyl group. The number assigned for the hydroxyl group is 2. show the – OH group at C_2



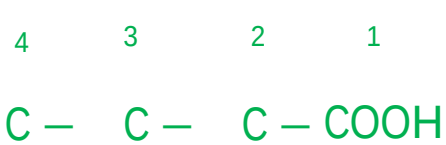
3) Now satisfy the valencies of each carbon atom



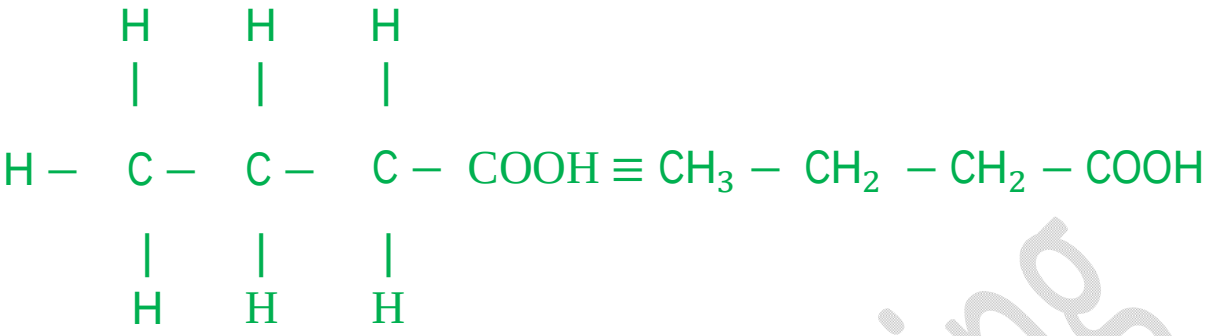
d) Butanoic acid

1) But stand for 4 carbon atoms in a chain number the carbon atoms in a chain as 1,2,3……..

‘- oic acid’ stands for functional group – COOH Assign the number 1 to carbon in the functional group – COOH

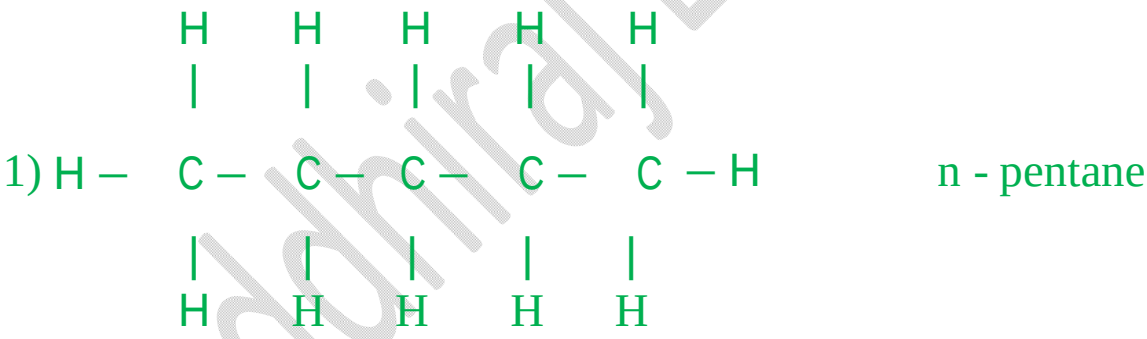


Now satisfy the valencies of each carbon atom

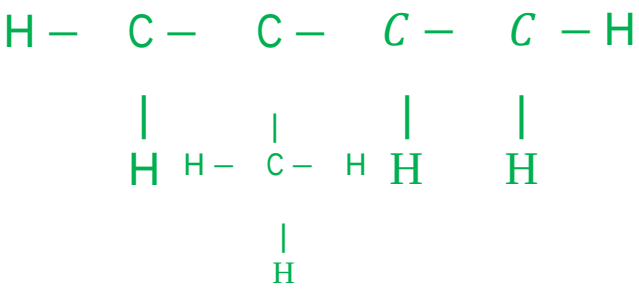


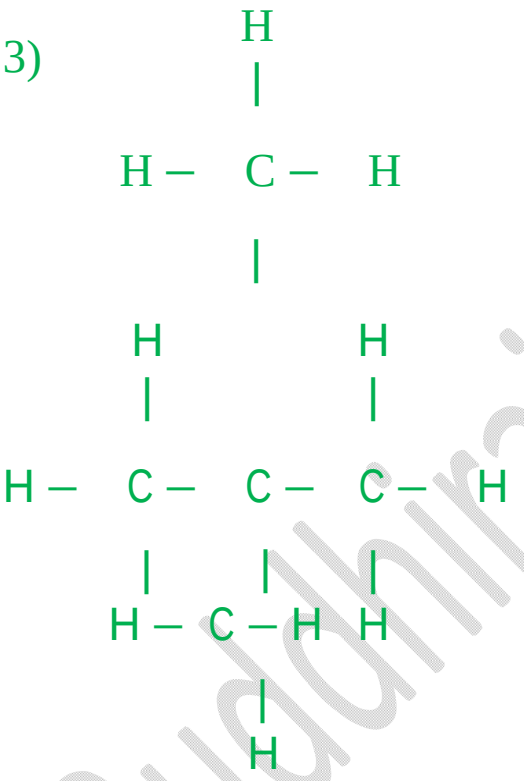
$CH_3 - CH_2 - CH_2 - COOH$

45) Draw three structural formulae having molecular formula C_5H_{12} Given the names n – pentane i- pentane and neo – pentane to the above structural formulae



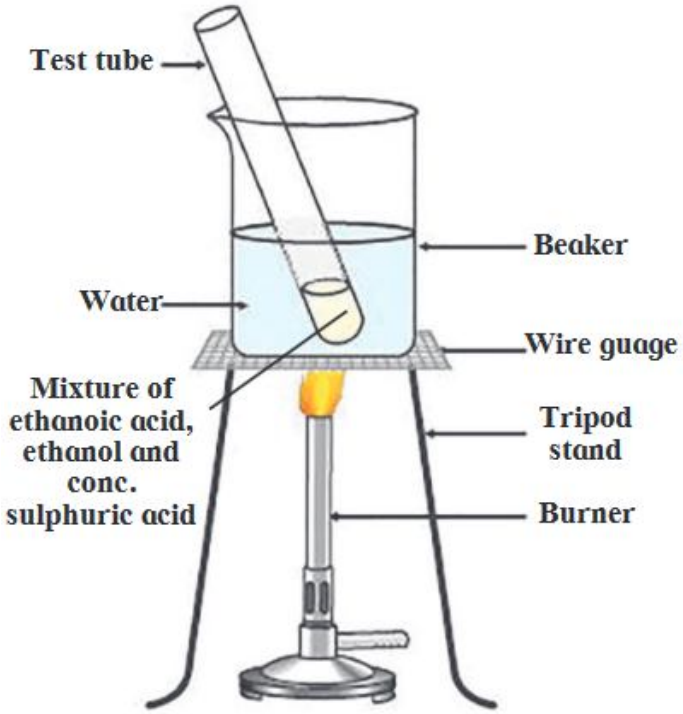
1) n - pentane

2)  i - pentane

3)  neo - pentane

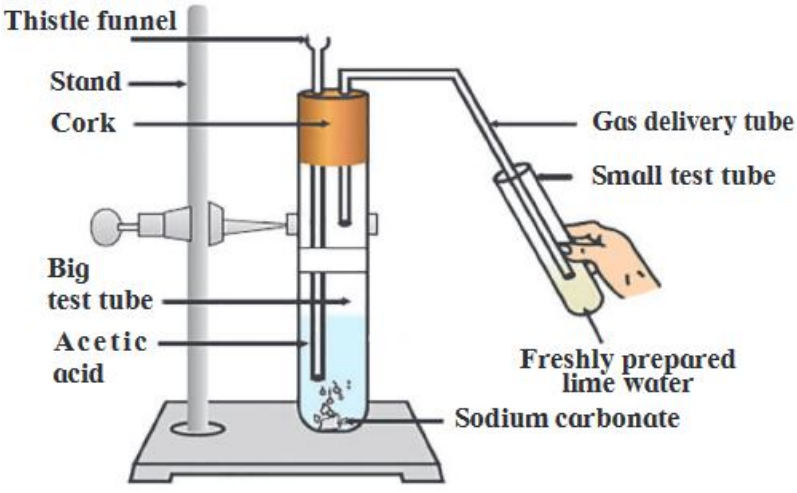
46. Draw a neat diagram

1) Esterfication reaction



9.25 Esterification Reaction

2) Reaction of acetic and sodium carbonate



9.24 Reaction of acetic acid and sodium carbonate

47. Saturated hydrocarbons and unsaturated hydrocarbons

Saturated hydrocarbons	Unsaturated hydrocarbons
1) In Saturated hydrocarbons the carbons atoms are linked to each other only by single covalent bonds.	1) In Unsaturated hydrocarbons valencies of carbon atom are not fully satisfied by single covalent bonds.
2) They contain only a single bonds.	2) They contain carbon to carbon double or triple bonds.
3) They are chemically less reactive.	3) They are chemically more reactive.
4) Substitution reaction is a characteristics property of these hydrocarbons.	4) Addition reaction is a characteristics property of these hydrocarbons.
5) Their general formula is C_nH_{2n} + 2	5) Their general formula is C_nH_{2n} or C_nH_{2n-2}

48. Short notes

Catenation power

1) carbon has a unique ability to form strong covalent bonds with other carbon atoms. This results in formation of big molecules. This property of carbon is called catenation power.

2) The atoms chains are longest open chains or closed chains.

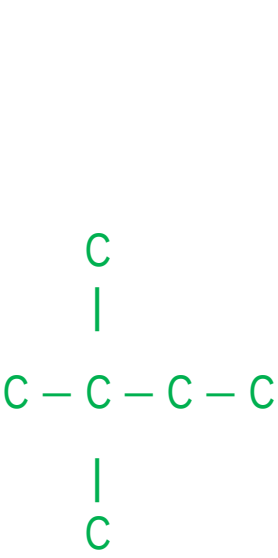
3) The open chains can be a straight chain for a branched chain.

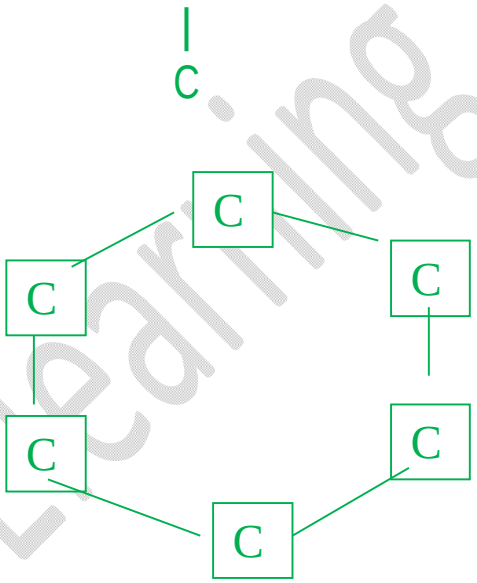
4) Two carbon atom can be bonded together by one two or three covalent bonds. These are called single bond double bond and triple bond respectively.

5) Due to the ability of carbon atom to form multiple bonds as well as single bonds, the number of carbon compounds increases.

6) C – C – C – C – C – C

C – C – C – C – C – C





49. Explain by writing a reaction, what will happen when pieces of sodium metal are put in h-propyl alcohol

Ans – n – propyl alcohol reacts with pieces of sodium metal, sodium propoxide and hydrogen gas are obtained.

$2CH_3 – CH_2 – CH_2 – OH + 2Na \rightarrow 2CH_3 – CH_2 – CH_2 – ONa + H_2 \uparrow$

n – propyl alcohol

sodium propoxide

50. Explain why does the lime water turns milky in the reaction of acetic acid with sodium carbonate?

Ans – In the reaction of acetic acid with sodium carbonate carbon dioxide gas is evolved which turns lime water milky resulting in the formation of insoluble calcium carbonate

$$2CH_3 - COOH + Na_2CO_3 \rightarrow 2CH_3COONa$$

Acetic acid Sodium carbonate Sodium acetate

$$Ca(OH)_2 + CO_{2(9)} \rightarrow CaCO_3 \downarrow + H_2O$$

lime water carbon dioxide calcium carbonate (milky)