Carbon and its Compounds

What are Organic Compounds?

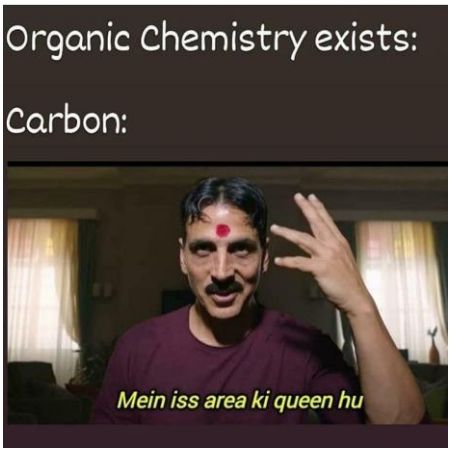
Organic compounds are made up of carbon and form the basis of all living organism.

Vital Force Theory

This theory assumed that organic compounds could only be formed within a living system, that is some special, vital force was necessary for the synthesis but Friedrich Wohler disproved this theory in 1828 by preparing urea from Ammonium Cyanate.

$$NH_4CNO \xrightarrow{\Delta} NH_2 - \overset{\overset{O}{||}}{C} - NH_2$$

Ammonium Cyanate — Urea



Carbon - The Element of Life

- Atomic no. of Carbon is 6
- Electronic Configuration k(2), L(4)
- Outer most shell of Carbon Contain 4 electrons
- Earth's Crust has only 0.02% Carbon in the form of minerals
- Atmosphere has 0.03% of Carbon-dioxide
- Cloths, Books, Food, medicines all Contain Carbon

Bonding in Carbon – Covalent Bond

- The Bond formed by sharing of electron pair between two atoms are known as Covalent Bond.

"Sharing is Caring"

- Carbon always form Covalent Bond, as we know outer most shell of carbon has $e^{\ominus}$s, it does not form ionic bond by either losing four electrons (C^{4+}) or by gaining four electrons (C^{4-}) **[Delhi 2014]**
- It is very tough to hold four extra electrons, and it require vary large amount of energy to remove $4e^{\ominus}$s therefore carbon believes in "Sharing is Caring"
- Shared electrons belong to the outmost shell of Both the Atoms.
- Most Carbon Compounds are poor conductor of electricity, as these compounds does not give rise any ions. **[Delhi 2014]**
- Elements like Oxygen, Chlorine, Hydrogen, Nitrogen also Form Bond by Sharing of electrons.

Previous Years Questions

Q. What are covalent compounds? Why are they different from ionic compounds? List their three characteristic properties? **[Delhi 2016]**

Ans. Covalent compounds are those compounds which are formed by sharing of valence electrons between the atoms e.g. H_2 molecule is formed by sharing of valence electrons between the atoms.

Ionic compounds are formed by complete transfer of electrons from one atom to another eg HCl

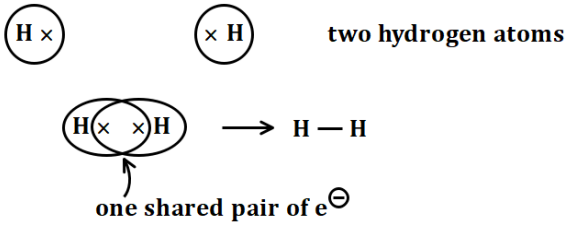
i. They are generally insoluble or less soluble in water but soluble in organic solvent.
ii. They have law melting and Boiling point.
iii. They do not conduct electricity as they do not contain ions.

Lewis Dot Structure

Lewis Structure is simplified representation of Valence shell/outermost shell electron in a molecule.

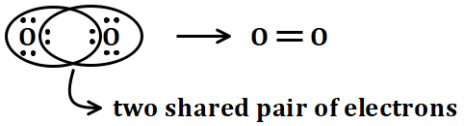
→ It is based on octet rule

1. Single Bond between H – H [H_2]



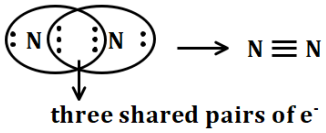
[NCERT]

2. Double Bond b/w O_2



[NCERT]

3. Triple Bond b/w N_2

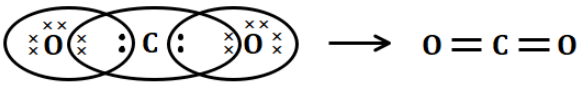
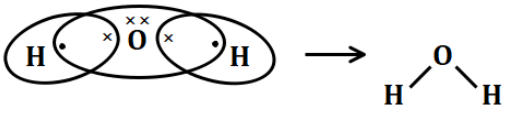
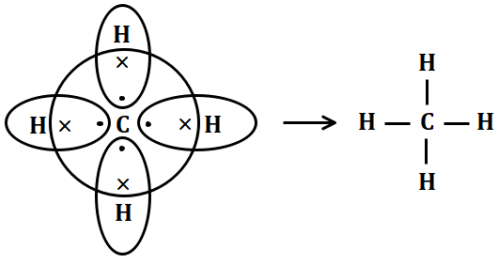


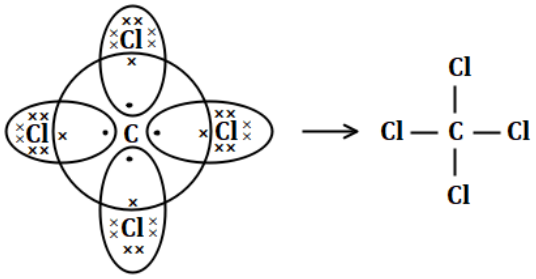
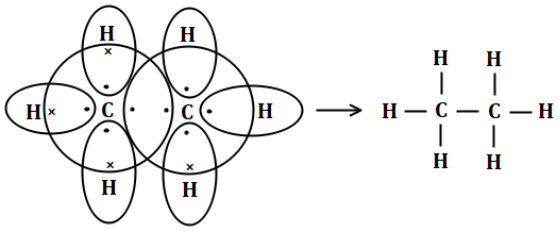
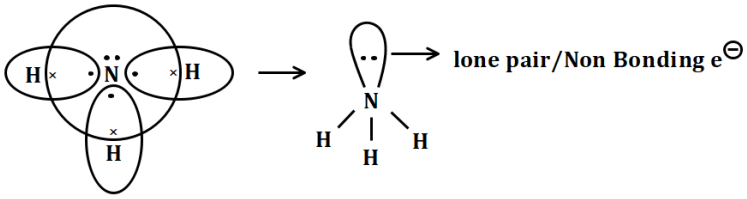
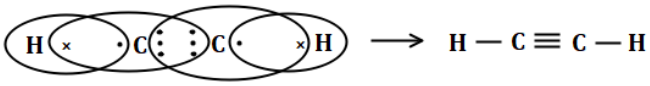
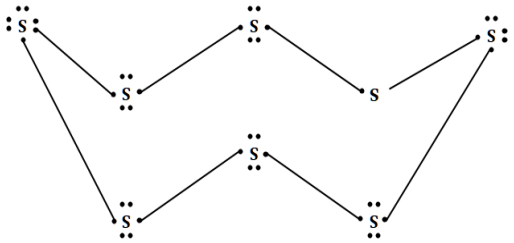
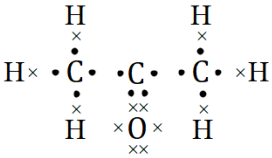
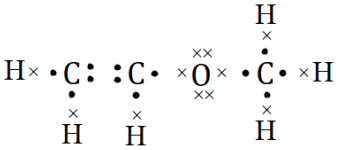
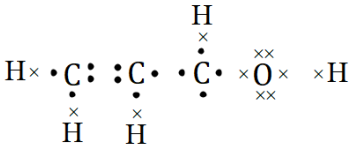
[NCERT]

Conclusion:

- One shared pair of e^- → Single Bond
- Two shared pairs of e^- → double Bond
- Three shared pairs of e^- → triple Bond

Some More Examples

CO_2		**[NCERT]**
H_2O		**[NCERT Exemplar]**
Cl_2		**[NCERT Exemplar]**
CH_4		**[NCERT Exemplar, Delhi 2019]**

CCl_4	 Total covalent bonds = 4	**[Exemplar]**
C_2H_6	 Total covalent bonds = 6 **(AI – 2015, Delhi 2014)**	**[NCERT]**
NH_3	 Total covalent bonds = 3	**[Exemplar]**
C_2H_2	 Total covalent bonds = 5	**[AI 2015]**
S_8 (Crown Shaped)		**[NCERT]**
$CH_3 - \underset{\underset{O}{\|}}{C} - CH_3$		**[Exemplar]**
$CH_2 = CH - OCH_3$		**[Exemplar]**
$CH_2 = CH - CH_2OH$		**[Exemplar]**

Previous Years Questions

Q. Why do ionic compounds not conduct electricity in solid state but conduct electricity in molten and aqueous state? **[CBSE 2016]**

Ans. Ionic Compounds do not conduct electricity in solid state but conduct electricity in molten and aqueous state because in solid state, there is no free ion to move and pass electricity. Where as in the molten and aqueous state, there is free ions to move and pass electricity.

Q. Why covalent compounds are volatile in nature with low boiling and low melting point? **[CBSE 2020, AI 2019]**

Ans. Covalent compounds are volatile in nature due to small intermolecular force of attraction between the atoms.

Q. Carbon exist in the atmosphere in the form of **[Exemplar]**

a) Carbon monoxide b) Coal

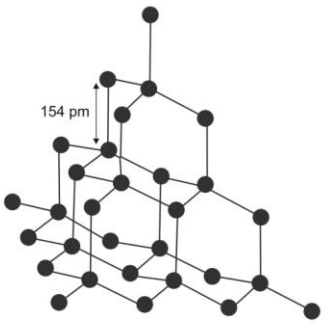
c) only carbon dioxide d) Carbon monoxide in traces and Carbon dioxide

Ans. (c) Only Carbon dioxide

Allotropes of Carbon

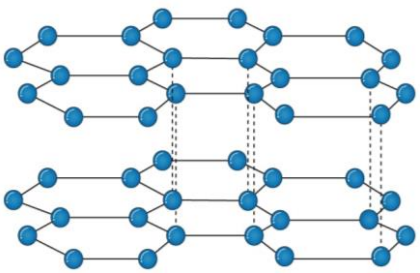
"The element Carbon occur in diff. form in Nature with widely Varying physical properties".

- **Allotropy:** It is the property of some chemical elements to exist in two or more diff. forms, in the same chemical properties and diff. physical properties called allotropy and these element are called allotropes, Diamond and graphite are allotropes of Carbon.
- **Diamond:**
  → In diamond, each carbon atom is Covalently bonded to four other forming Rigid 3-D Structure.
  → diamond is a very hard material and has very high melting point



The structure of diamond

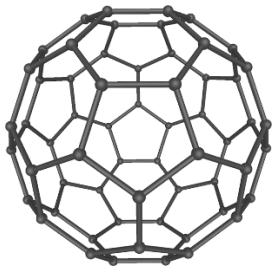
- **Graphite:**
  → In graphite, each carbon atom is bonded to other carbon atoms in the same plane giving hexagonal array
  → Atoms are arranged in layers, within each layer atoms are arranged in six-member rings
  → Graphite is soft and slippery substance, attributed to the fact that the layers are not chemically bonded and can slide over one another.
  → Graphite is less dense than diamond.
  → It can be used for lubricating those machine parts which operates at high temp.

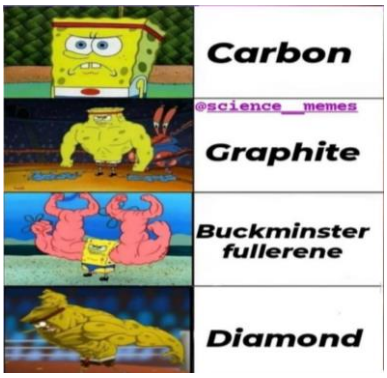


Difference between Diamond and Graphite

	Diamond		Graphite
1.	It occurs naturally in Free state	1.	It occurs naturally and is manufactured artificially
2.	It is the hardest natural substance known	2.	It is soft and greasy to touch
3.	It is Transparent and has high refractive index	3.	It is Black in colour and opaque.
4.	Diamond is more denser than graphite	4.	Graphite is less denser.

- **Fullerenes:**
  → Fullerenes form another class of carbon allotropes.
  → Fist one to be identified was C – 60, which has carbon atom arranged in the shape of football.
  → It contain both five – member as well as six – membered rings





Previous Years Questions

Q. Give reasons for the following: **[CBSE 2016]**

i) Diamond has high melting point

ii) Graphite is a good conductor of electricity

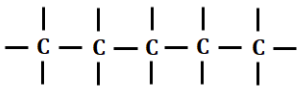
Ans.

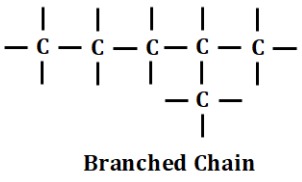
i) In Diamond, each carbon atom is bonded to four other carbon atoms forming a hardest known substance. Thus, it has high melting point

ii) In graphite, each carbon atom is bonded to three other carbon atoms by covalent bond in the same plane giving a hexagonal array. Hence, 3 valence e^- are used for bond formation, hence 4^{th} valence e^- is free to move.

Versatile Nature of Carbon **[AI 2011, 2020 & 2017]**

1. **Catenation:** "The self-linking property of an element due to which a large number of its atoms can be linked with each other by covalent bonds.
   Due to catenation, long chains in Nature





- No other element exhibits the property of catenation to the extent seen in carbon compounds.
- Silicon forms compounds with hydrogen and can show catenation up to seven or eight atoms,

but these compounds are very reactive.

- Carbon – carbon bond is very strong and hence very stable.

2. **Tetravalency:** It order to attain the Noble gas configuration, Carbon share its four valence electrons with other atoms of carbon, or with atoms of other element Hence, due to small size, and presence of four valence electrons, carbon can form strong bonds with other carbon atoms like, hydrogen, oxygen, nitrogen or sulphur.

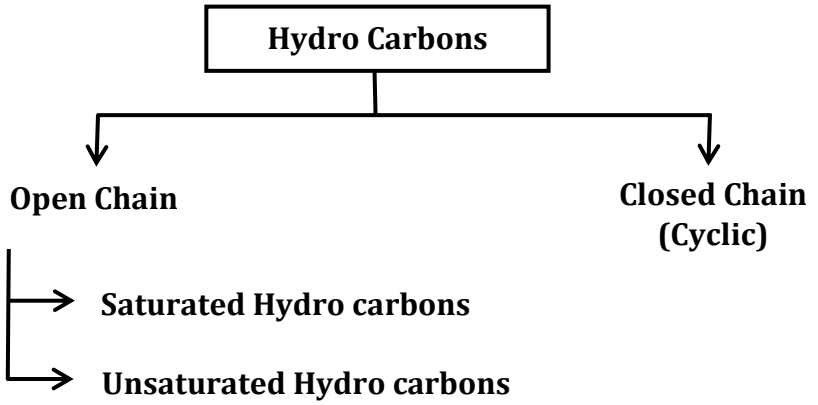
Super Powers of Carbon!

a. **Catenation**
b. **Tetravalency**

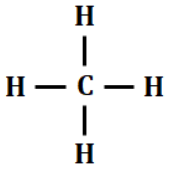
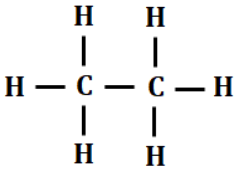
Hydrocarbons:

"Hydro carbons are organic compounds consisting entirely of Hydrogen and Carbon"

[Exemplar, Foreign 2014]

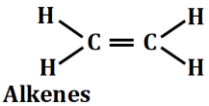


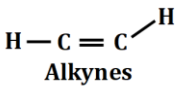
- **Saturated Hydrocarbons:** **[AI - 2017]**
  Compounds of carbon, which are linked by only single bond between carbon atoms are called saturated compounds/Hydrocarbons, also called as Alkanes.
  General formula of saturated Hydrocarbon is C_nH_{2n+2} they are commonly called paraffin.

{3 *Valencies of each carbon atom are satisfied with Hydrogen*}

- **Unsaturated Hydrocarbons:** **[AI - 2017]**
  If in a Carbon Skeleton, there are one or more multiple bonds present between carbon atoms, they are called unsaturated based on the type of multiple bond they are further classified as Alkenes and Alkynes


Alkenes


Alkynes

- **Alkenes:** "An alkenes are unsaturated hydrocarbons at least one carbon – carbon double bond with the gen formula C_nH_{2n}
  Simplest Alkene, ethylene (C_2H_4)

- **Alkynes:** An alkyne is an unsaturated hydrocarbon, at least one carbon – carbon triple bond between carbon atom with gen. Formula C_nH_{n-2}, Alkynes are traditionally known as acetylenes

Naming of Hydrocarbons:

Name of a hydrocarbon contains two parts 1.Word root and 2. Suffix

a. **Word Root:** It indicates no. of carbon atoms in the chain
b. **Suffix:** Shows saturation and unsaturation of hydrocarbons.

No. of Carbons Present in longest chain	Word Root
1	Meth
2	Eth
3	Prop
4	But
5	Pent
6	Hex
7	Hept
8	Oct
9	Non
10	Dec

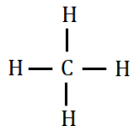
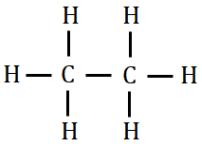
Suffix:

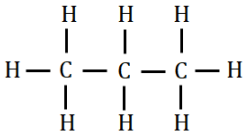
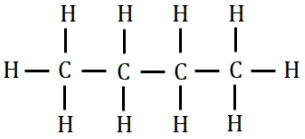
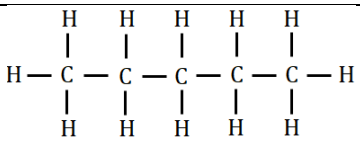
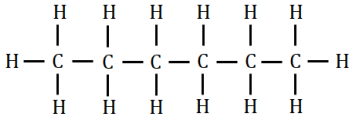
i. Saturated Hydrocarbon → ane
(single bond)
ii. Double Bond → ene
iii. Triple Bond → yne

$H_3C - CH_2 - CH_3$	Propane
$H_3C - CH_2 = CH_2$	Propene
$H_3C - C \equiv CH$	Propyne

Open Chain Compounds:

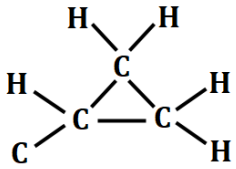
In open chain compounds, the carbon atoms are linked to each other by covalent bond

No. of Carbon Atoms	Name of Alkane	Formula	Structure
1	Methane	CH_4	
2	Ethane	C_2H_6	

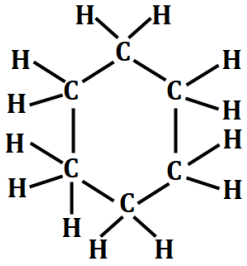
3	Propane	C_3H_8	
4	Butane	C_4H_{10}	
5	Pentane	C_5H_{12}	
6	Hexane	C_6H_{14}	

Closed Chain Compounds:

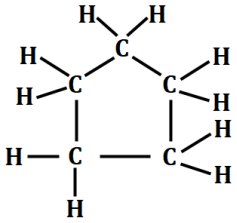
The organic compounds can have Cyclic or Ring structure.



Cyclopropane

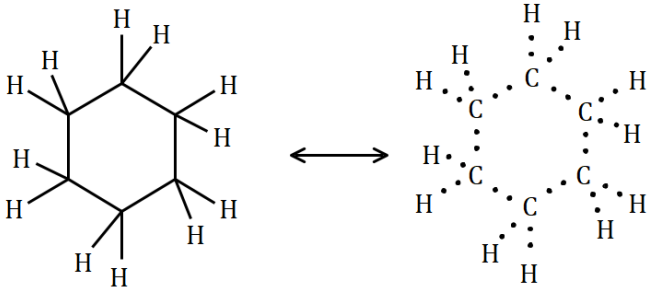


Cyclohexane



Cyclopentane

Electron dot Structure of Cyclohexane:

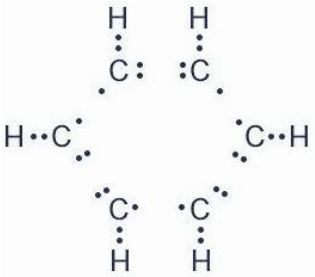


Unsaturated Cyclic Compound:

[CBSE – 2020, AI - 2019]

Benzene

C_6H_6



Isomerism: [AI – 2015, 2011 , 2019]

Isomers are different compounds having same molecular mass as well as molecular Formula but diff. arrangement of the atoms present.

$CH_3 - CH_2 - CH_2 - CH_3$ Butane		$CH_3 - \underset{\displaystyle CH_3}{\underset{\vert}{CH}} - CH_3$ Isobutane
$CH_3 - CH_2 - CH_2 - CH_2 - CH_3$ Pentane OR n - pentane	$CH_3 - \underset{\displaystyle CH_3}{\underset{\vert}{CH}} - CH_2 - CH_3$ Isopentane	$CH_3 - \underset{\displaystyle CH_3}{\underset{\vert}{\overset{\displaystyle CH_3}{\overset{\vert}{C}}}} - CH_3$

Functional Groups: [Delhi - 2014]

"It may be defined as an atom which largely determines the properties of a particular organic compounds.

Functional Group	Family	Suffix used in Nomenclature
$-OH$	Alcohol	$-Ol$
$-\underset{\displaystyle O}{\underset{\Vert}{C}} - H$	Aldehyde	$-al$
$-\underset{\displaystyle O}{\underset{\Vert}{C}} -$	Ketones	$-one$
$-\underset{\displaystyle O}{\underset{\Vert}{C}} - OH$	Carboxylic Acid	$-oic\ acid$
$-Cl/-Br$	Halo (Chloro/bromo)	$-Chloro, -bromo$ (as a prefix)

These groups confer specific properties to the compound, regardless of the length and Nature of Carbon chain, and hence called functional groups.

Homologous Series: [AI - 2014]

"A series of similar constituted compounds in which the members present have the same functional groups, same chemical properties and any two successive members in a particular series differ by CH_2 unit"

[CBSE - 2020]

For Example:- The general formula for the members of the Alkanes C_nH_{2n+2} (n = 1,2,3,4,. . . . .)

$CH_4,\ C_2H_6,\ C_3H_8,\ C_4H_{10},\ C_5H_{12},\ C_6H_{14}$

CH_2 CH_2 CH_2

Previous Years Questions

Q. Write the name and formula of the 2nd member of homologous series having general formula C_nH_{2n} **[Delhi 2015]**

Ans. Homologous series of Alkenes have general formula C_nH_{2n}, whose first member is ethene.

2^{nd} member of homologous series of alkene is C_3H_6 i.e., propene

Q. Write the name and formula of the 2^{nd} member of homologous series having general formula C_nH_{2n+2} **[Delhi 2015]**

Ans. Alkanes have general formula, C_nH_{2n+2} 2^{nd} member of homologous series of alkanes is C_2H_6 i.e., ethane

Q. Write the name and formula of the 2^{nd} member of homologous series having general formula C_nH_{2n-2} **[Delhi 2015]**

Ans. General formula, C_nH_{2n-2} belong to Alkyne series. The second member of the series is propyne i.e., (C_3H_4) or $CH_3 - C \equiv CH$

Q. Which of the following does not belong to the same homologous series? **[Exemplar]**

a) CH_4 b) C_2H_6 c) C_3H_8 d) C_4H_8

Ans. In a Homologous series, successive members of a Homologous series differ by CH_2 unit

$\mathbf{C_4H_8 - CH_2 = C_3H_6}$

and, we know C_3H_6 do not belong to same Homologous series

★ Nomenclature of Carbon Compounds

Common Names System:

According to this system of Nomenclature, Names are given according to their origin

e.g. → Acetic Acid is derived from Greek work Acetum (Meaning Vinegar)

IUPAC System:

IUPAC stands for International union of pure and applied chemistry is an international organization which decides the name of compounds on the Basis of some set Rules.

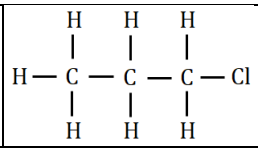
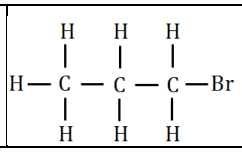
IUPAC Nomenclature :

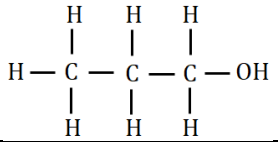
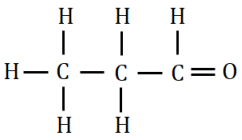
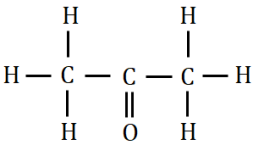
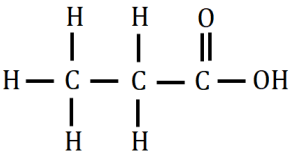
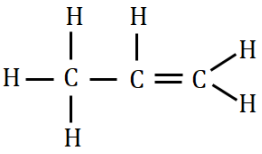
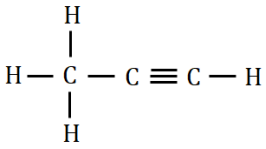
Prefix	+	Word Root	+	Suffix
−Cl → Chloro −Br → Bromo		(No. of Carbon Atoms)		(Functional Groups) or (ane/ene/yne)

Rules For IUPAC Nomenclature

1. Longest continuous carbon chain which include the F.G is selected; then the carbon chain is numbered from the end near to the F.G, F.G get the least number.
2. If the name of the Functional group is to be given as suffix, the name of carbon chain is modified by deleting final 'e' and adding the Appropriate suffix
   Propane – e = propan + one = propanone
3. If the carbon chain is unsaturated, then the Final 'ane' in the name of the carbon chain is substituted by ene or yne

Examples:

i.		**Chloropropane**	ii.		**Bromopropane**

iii.	 **Propanol**	iv.	 **Propanal**
v.	 **Propanone**	vi.	 **Propanoic acid**
vii.	 **Propene**	viii.	 **Propyne**
ix.	$CH_3 - CH_2 - CH_2 - COOH$ **Butanoic Acid**	x.	$CH_3 - CH_2 - CH_2 - CH_2 - OH$ **Butanol**
xi.	$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_2 - \overset{\overset{O}{\|}}{C} - H$ **Heptanal**		
xii.	$H_3C - CH_2 - CH_2 - C \equiv C - H$ **Pentyne**		

★ Chemical Properties of Carbon Compounds

- **Combustion:** A chemical reaction in which heat and light are given out is called combustion.
  OR
  "Combustion is rapid oxidation/burning of any substance in which heat and light are produced".

  Combustion of Carbon

  $C(s) + O_2(g) \longrightarrow CO_2(g) + \text{Heat} + \text{Light}$

  Combustion of Hydrocarbon

  $CH_4(g) + O_2(g) \longrightarrow CO_2(g) + H_2O(g) + \text{Heat} + \text{Light}$

  Combustion of Alcohol

  $CH_3CH_2OH(g) + O_2(g) \longrightarrow CO_2(g) + H_2O(g) + \text{Heat} + \text{Light}$

The Nature of Flame

- Saturated hydrocarbon such as, methane, ethane burn with clear b/w flame in the presence of sufficient oxygen.
- Saturated hydrocarbon in the presence of Limited amount of oxygen give sooty Flame
- Unsaturated hydrocarbon such as ethene, ethyne etc. burn with yellow flame with lots of black smoke
- Kerosene when burnt in the presence of sufficient oxygen gives clear between flame.
- Some hydrocarbons like benzene, naphthalene etc. burn with sooty flame.
- Coal and Petroleum on burning produce mainly CO_2, CO, Oxides of Nitrogen and sulphur. The oxides of Nitrogen and sulphur cause air pollution.

Q. **Why Coal or Charcoal burns with just a glow red and gives out heat without flame while LPG burns with flame?**

Ans. Coal or Charcoal burns with just a glow and gives out heat without flame, however LPG burns with flame, this is because flame is produced only when gaseous substance burns.

When wood or charcoal is ignited, the volatile substance present in it vaporises and burns with a flame in the beginning. A luminous flame is seen when the atom of gaseous substance are heated and start to glow.

Q. When we light a Bunsen burner it burns with blue flame but sometimes we get Yellow sooty flame why?

Ans. When the air holes of Bunsen burner are open, sufficient amount of oxygen rich air is available and it burn with blue flame. Sometimes when these holes get blocked due to the lack of oxygen rich air we get yellow sooty flame.

Q. Explain the formation of Coal and Petroleum ?

Ans. Coal and Petroleum have been formed from biomass, which has been subjected to various biological and geological process. Coal is the remains of trees, tern and other plants, these were crushed into earth perhaps by earthquakes or Volcanic eruptions.

Q4. Explain the formation of oils and gas?

Ans. Oil and gas are the remains of millions of tiny plants and animals that lived in the sea. When they died, their bodies sank to the sea bed and were covered by silt. Bacteria attacked the dead remains turning them into oil and gas under high pressure.

Oxidation Reactions

During combustion, the compounds get oxidized completely

$$2C(s) + O_2(g) \longrightarrow 2CO(g)$$

(limited; Carbon monoxide)

$$C(s) + O_2(g) \longrightarrow CO_2(g)$$

(excess)

} Diff. products depending upon oxygen available

Oxidation of Alcohol **[CBSE - 2020]**

$$CH_3 - CH_2 - OH \xrightarrow[\text{Acidified } K_2Cr_2O_7]{\text{Alkaline } KMnO_4} CH_3COOH$$

(ethanol)

Both Alkaline $KMnO_4$ and acidified $K_2Cr_2O_7$ act as oxidising Agents (substance that supply oxygen for oxidation) **[Delhi - 2016]**

Previous Years Questions

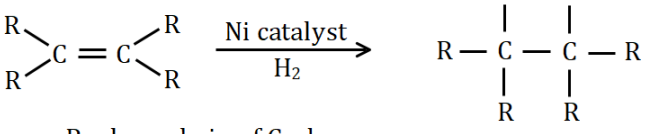
Q. What happens when an oxidising agent is added to propanol? **[Delhi 2016, AI - 2019]**

Ans. $CH_3 - CH_2 - CH_2 - OH \xrightarrow{\text{Alkaline } KMnO_4} CH_3 - CH_2 - COOH$

Addition Reaction **[Delhi 2015, 2013, Foreign - 2012]**

Unsaturated hydrocarbon add hydrogen in the presence of catalyst such as palladium or Nickel to give saturated hydrocarbons

"Catalyst are the substance that cause a reaction to occur at a different rate, without being used up in the reaction."



R = long chain of Carbon

Above reaction is also known as "Hydrogenation" reaction,

- This reaction is used in the hydrogenation of Vegetable oil Vegetable oil generally have long unsaturated carbon chains while animal fats have saturated carbon chain
- Animal fats generally contain saturated fatly acid which are harmful for health **[Delhi - 2015]**

Substitution Reactions

It is a single replacement chemical reaction during which one functional group in chemical compounds is replaced by another functional groups.

$$CH_3OH + HBr \longrightarrow CH_3Br + H_2O$$

$$CH_4 + Cl_2 \xrightarrow{hv} CH_3Cl + HCl$$

★ Some Important Carbon Compounds – Ethanol and Ethanoic Acid

Properties of Ethanol

1. Ethanol is liquid at room temperature
2. Ethanol is commonly called alcohol and is the active ingredient of Alcoholic drinks
3. Ethanol is a good solvent, so it is used in medicines such as tincture iodine, cough syrups and many tonics.

Reactions of Ethanol

i. Reaction with sodium **[Delhi - 2019]**

$$2Na + 2CH_3CH_2OH \longrightarrow 2CH_3CH_2O^-Na^+ + H_2$$

(sodium ethoxide)

ii. Reaction to give unsaturated hydrocarbons **[Delhi - 2019]**

$$CH_3 - CH_2 - OH \xrightarrow[H_2SO_4]{\text{Hot conc.}} CH_2 = CH_2 + H_2O$$

Hot conc. H_2SO_4 act as dehydrating Agent

↓

Removes Water

Q. How do Alcohol affect Living beings?

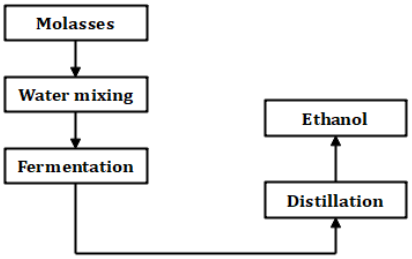
Ans. When large quantities of ethanol are consumed, it tends to slow metabolic processes and to depress the central Nervous system, which results in lack of coordination mental confusion, drowsiness etc.

Q2. What is denatured Alcohol?

Ans. Ethanol is an important industrial solvent, to prevent the misuse of ethanol produced for industrial use, it is made unfit for drinking by adding poisonous substance like methanol to it, Dyes are also added to colour the Alcohol blue so that it can be identified easily; Intake of Methanol in very small quantities can cause death because Methanol is oxidised to Methanol in the liver; Methanol reacts rapidly and causes Protoplasm to get coagulated.

★ Alcohol as a Fuel

Sugarcane Juice can be used to prepare molasses which is fermented to give ethanol we can use alcohol as an additive in petrol since it is a cleaner fuel, which give rise to only CO_2 + H_2O on burning in sufficient O_2.



★ Properties of Ethanoic Acid

1. Ethanoic acid is commonly called as Acetic Acid.
2. Solution of Acetic Acid in water is called Vinegar and is used as preservative in pickles
3. Melting point of pure ethanoic Acid is 290 K.
4. Ethanoic Acid is also known as glacial Acetic Acid because it often freezes during winter in cold climate.

Reactions of Ethanoic Acids

i. Esterification Reaction: Reaction of Acid and Alcohol gives Ester.

[Delhi – 2011, 2016, AI – 2017, 2020, 2016]

$$CH_3 - COOH + HO - CH_2 - CH_3 \xrightarrow{\text{Acid}} CH_3 - \underset{\underset{O}{||}}{C} - O - CH_2 - CH_3$$

(Ethanoic Acid) (Ethanol) (Ester)

- Esters are sweet smelling substances
- Used in Making Perfumes and as Flavouring Agents.

ii. Saponification Reaction: [Delhi – 2011, AI – 2017, Foreign - 2014]

Ester + Base ⟶ Alcohol + Carboxylic Acid

this reaction is used in the preparation of soap

$$CH_3COOC_2H_5 \xrightarrow{NaOH} C_2H_5OH + CH_3COONa$$

(Alcohol) (sodium acetate)

$$NaOH + CH_3COOH \longrightarrow CH_3COONa + H_2O$$

iii. Reactions with Carbonates and Hydrogen carbonates

$$2CH_3COOH - Na_2CO_3 \longrightarrow 2CH_3COONa + H_2O + CO_2$$

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

We can distinguish experimentally between alcohol and Carboxylic acid by reacting them with sodium Carbonate, turning lime water milky. Alcohols do not react to give lime water milky.
When Carboxylic acid React with sodium bicarbonate solution, Carbon dioxide is evolved with a brisk effervescence along with sodium acetate is formed **[AI – 2015]**

Previous Years Questions

Q. Esters are sweet smelling substances and are used in making perfumes. Suggest some activity and the reaction involved for the preparation of an ester **[AI - 2019]**

Ans.

Step – I: Take 1 ml of ethanol and 1 mL of glacial acetic along with a few drops of concentrated sulphuric acid in a test tube

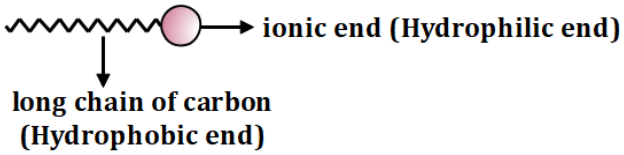
Step – II: Warm the content in a water bath for at least five minute

Step – III: Pour the content into a beaker containing 20-50 mL of water and small the resulting mixture.

★ Soaps and Detergents

What are Soaps? **[Delhi – 2011]**

Soaps are sodium or potassium salts of long – chain carboxylic acids. The ionic – end of soap dissolve in water the carbon chain dissolves in oil.

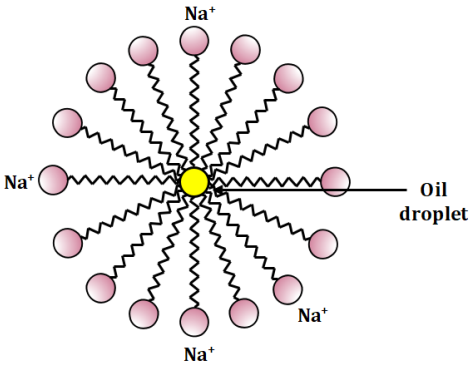


What are Detergents? **[AI – 2012, Florigen2012, 2011]**

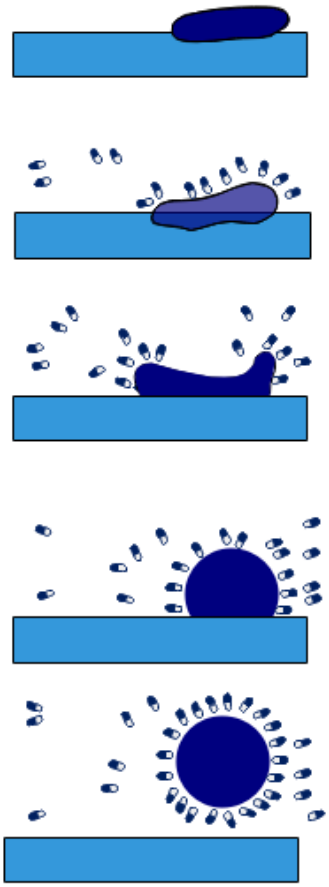
Detergents are generally ammonium or sulphonates salts of long chain carboxylic acid.

★ Cleaning Action of Soap: [Delhi – 2011, 2017]

- Most of the dirt is oily in nature and oil does not dissolve in water
- The soap molecule form the structure called Micelles
- In Micelles one end is towards the oils droplet and other end which is ionic faces outside.
- Soap in the form of a micelle in the centre of the micelles
- The micelles stay in the solution as a colloid and will not come together to precipitate due to ion - ion Repulsion.
- Soap micelles are large enough to scatter light; Hence soap solution appears cloudy



Formation of micelles



★ Hardness of Water [Delhi – 2011]

Hard water means, water having a very high mineral content like calcium and Magnesium salts soup molecule react with the salts of calcium and magnesium and for precipitate also known as sum.

Soft water (which do not contain calcium and Magnesium salts are) do not form sum with soap.

→ Detergents are generally ammonium or sulphonates salts of long chain carboxylic acid. The charged ends of these compounds do not form insoluble precipitates with Hardwater, thus they remain effective in Hard water.

Q. **Why detergents are better cleansing agents than soaps?** **[Exemplar]**

Ans. The charged ends of detergents do not form insoluble precipitates with calcium and magnesium ion in Hard water, while when soaps are used for washing clothes with hardwater, it react with the calcium and magnesium ions of hardwater to form an insoluble precipitate called scum; therefore detergents are better cleansing agents than soaps, because they can be used even with hard water.