St.JOHN'S

RESIDENTIAL PUBLIC SCHOOL

SONAGOPALPUR,SAMPATCHAK,PATNA-7

AFFILIATED TO C.B.S.E

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CHEMISTRY NOTES

CARBON AND ITS COMPOUNDS

Chemical substances containing carbon are called carbon compounds. Except hydrogen, there are more carbon compounds than any other chemical element.

Compounds of carbon with double bonds(C=C) and triple bonds(C≡ C)are called as *unsaturated compounds* while those with carbon-carbon single bonds are called *saturated compounds.*

Covalent Bonding

Difficulty of Carbon to Form a Stable Ion

To achieve the electronic configuration of the nearest noble gas, **Helium**.

If the carbon atom loses four of its valence electrons, a huge amount of energy is involved.

C^{4+} ion hence formed will be highly unstable due to the presence of six protons and two electrons.

If the carbon atom gains four electrons to achieve the nearest electronic configuration of the noble gas, Ne, C^{4-} ion will be formed.

But again, a huge amount of energy is required.

Moreover, in C^{4+} ion it is difficult for 6 protons to hold 10 electrons.

Hence, to satisfy its *Tetravalency*, carbon shares all four of its valence electrons and forms covalent bonds.

Ionic Bond

Ionic bonding involves the transfer of valence electrons, between a metal and a nonmetal.

The electrostatic attractions between the oppositely charged ions hold the compound together.

Ionic compounds:

1. Are usually crystalline solids (made of ions?)

2. Have high melting and boiling points

3. Conduct electricity when melted

4. Are mostly soluble in water and polar solvents

Covalent Bond

A covalent bond is formed when pairs of electrons are shared between two atoms.

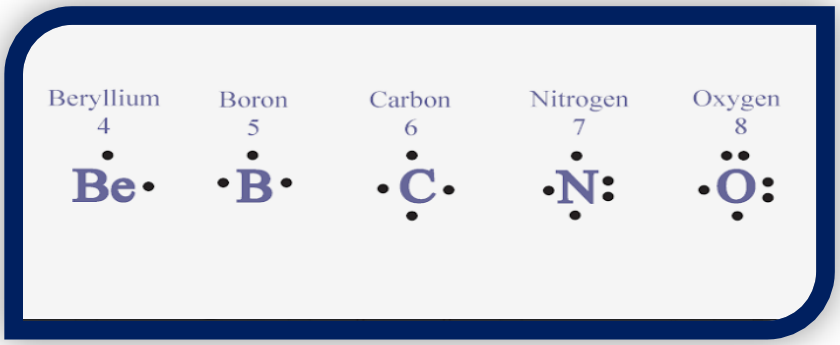
It is formed between two same nonmetallic atoms or between nonmetallic atoms with similar electro negativity.

Lewis Dot Structure or Electron dot structure

Lewis structures are also known as *Lewis dot structures or electron dot structures.*

These are basically diagrams with the element's symbol in the centre.

The dots around it represent the *valence electrons* or the electron present in the *outer most orbit* of the element.



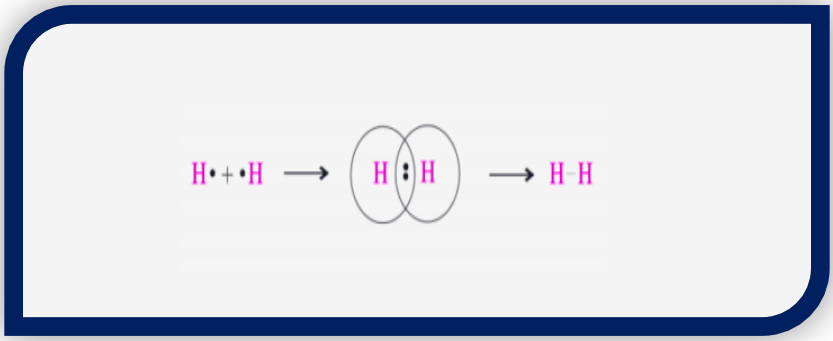
Lewis structures of elements with atomic number 5-8

Covalent Bonding in H_2, N_2 and O_2

Formation of a single bond in a hydrogen molecule:

Each hydrogen atom has a single electron in the valence shell. It requires one more to acquire the nearest noble gas configuration (He).

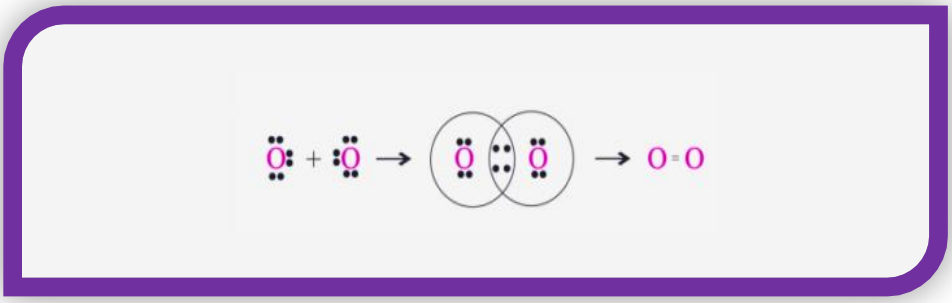
Therefore, both the atoms share one electron each and form a single bond.



Formation of a double bond in an oxygen molecule (O_2):

Each oxygen atom has six electrons in the valence shell (2, 6). It requires two electrons to acquire the nearest noble gas configuration (Ne).

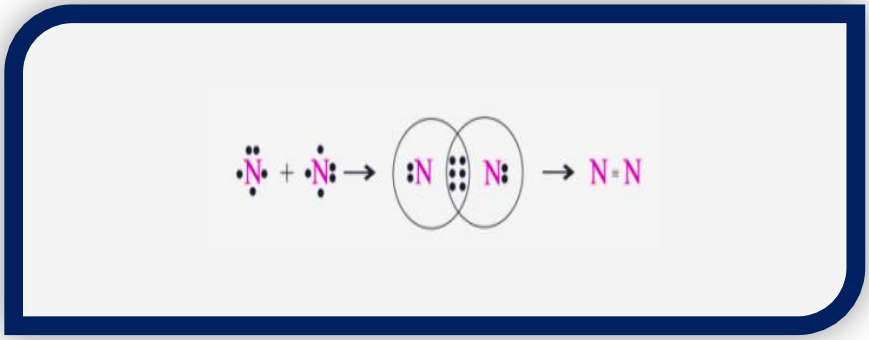
Therefore, both the atoms share two electrons each and form a double bond.



Formation of a triple bond in a nitrogen molecule (N_2):

Each nitrogen atom has five electrons in the valence shell (2, 5). It requires three electrons to acquire the nearest noble gas configuration (Ne).

Therefore, both atoms share three electrons each and form a triple bond.



Single, Double and Triple Bonds and Their Strengths

A single bond is formed between two atoms when two electrons are shared between them, (*one electron from each*) participating atom.

It is denoted by a single line between the two atoms.

A double bond is formed between two atoms when four electrons are shared between them,(*one pair of electrons from each*) participating atom.

It is denoted by double lines between the two atoms.

A triple bond is formed between two atoms when six electrons are shared between them,(*two pairs of electrons from each*) participating atom.

It is denoted by triple lines between the two atoms.

Bond strength:

The bond strength of a bond is determined by the amount of energy required to break a bond.

The order of bond strengths when it comes to multiple bonds is:

Triple bond>double bond>single bond

This is to signify that the energy required to break three bonds is higher than that for two bonds or a single bond.

Bond length:

Bond length is determined by the distance between nuclei of the two atoms in a bond.

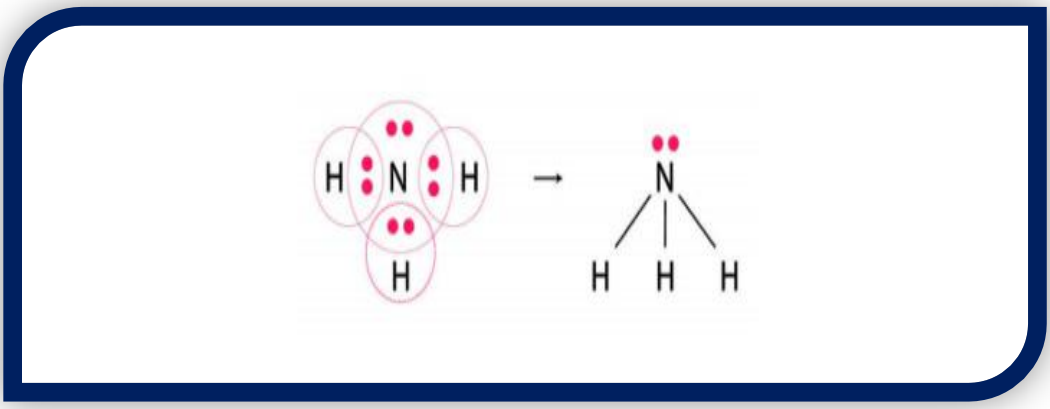
The order of bond length for multiple bonds is:

Triple bond<double bond<single bond

The distance between the nuclei of two atoms is least when they are triple bonded?

Covalent Bonding of N, O with H and Polarity

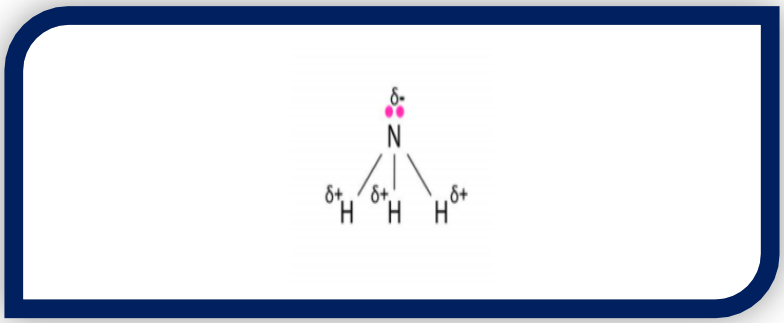
In ammonia (NH_3), the three hydrogen atoms share one electron each with the nitrogen atom and form three covalent bonds.



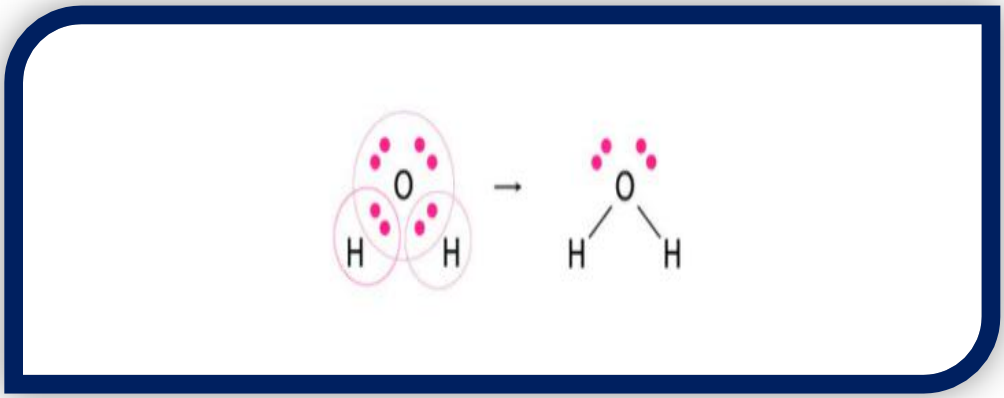
- Ammonia has one lone pair. (*A lone pair of electrons that are not shared with another atom in a covalent bond).*
- All three N-H covalent bonds are polar in nature*.(polar means sharing of electrons between two different atom).*

- N atom is more electronegative than the H atom. Thus, the shared pair of electrons lies more towards N atom.

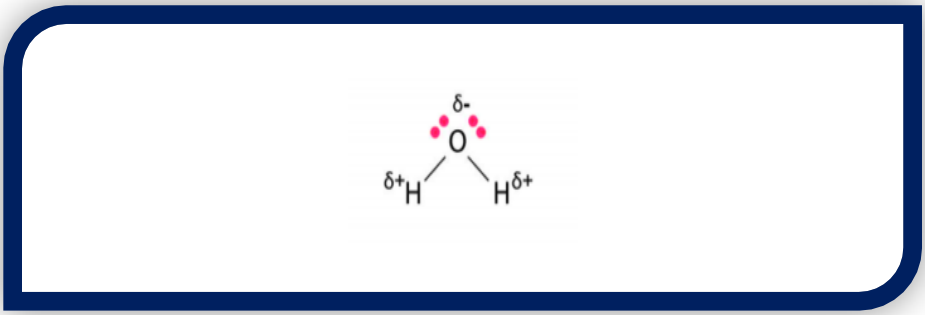
- This causes the N atom to acquire a slight negative charge and H atom a slight positive charge.



In water (H_2O), the two hydrogen atoms share one electron each with the oxygen atom and form two covalent bonds.

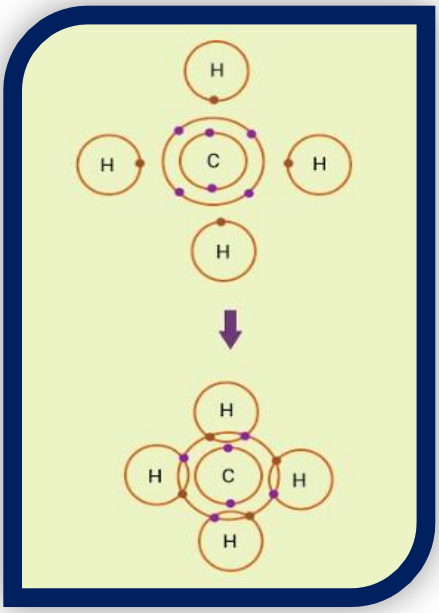


- Water has two lone pairs.
- The two O-H covalent bonds are polar in nature.
- O atom is more electronegative than the H atom. Thus, the shared pair of electrons lies more towards O atom.
- This causes the O atom to acquire a slight negative charge and H atom a slight positive charge.



Covalent Bonding in Carbon

A methane molecule (CH_4) is formed when four electrons of carbon are shared with four hydrogen atoms as shown below.



Importance of Carbon

Why Carbon Can Form so Many Compounds

Catenation occurs most readily with carbon due to its small size, electronic configuration and unique strength of carbon-carbon bonds.

Tetravalency, catenation and tendency to form multiple bonds with other atoms account for the formation of innumerable carbon compounds.

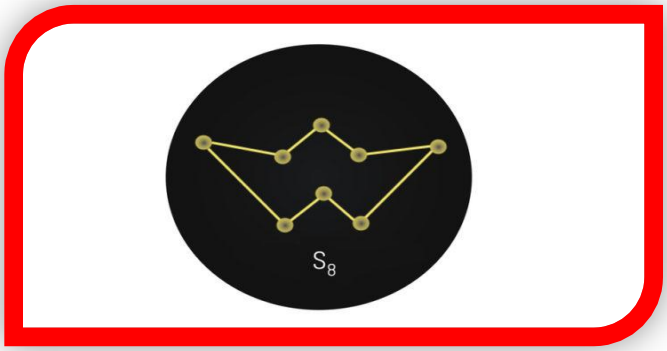
Catenation

Catenation is the self-linking property of an element by which an atom forms covalent bonds with the other atoms of the same element to form straight or branched chains and rings of different sizes.

It is shown by carbon, sulphur and silicon.

SULPHUR (S_8)

In its native state, sulphur show catenation up to 8 atoms in the form of S_8 molecule. It has a puckered ring structure.



Versatile Nature of Carbon

Tetravalency, and Catenation The carbon forms single, double, and triple bond shows its versatility.

It can also form chains, branching chains, and rings when joined to other carbon atoms.

Hydrogen, oxygen, carbon, and a few additional elements make up organic molecules.

Organic compounds, on the other hand, are significantly more numerous than inorganic compounds that do not form bonds.

Carbon is a chemical element with the atomic number 6 and the symbol C.

It's a versatile element that can be found in a wide variety of chemical combinations.

Carbon's versatility is best appreciated through properties like tetravalency and catenation.

- *Tetravalency:* Carbon has a valency of four so it is capable of bonding with four other atoms of carbon or atoms of some other mono-valent element.

- *Catenation*: A unique property of self- linking of carbon atoms through covalent bonds to form long stable straight or branched or cyclic chain is called *catenation.*

MP, BP and Electrical Conductivity

Covalent compounds:

1. Are molecular compounds

2. Are gases, liquids or solids

3. Have weak intermolecular forces

4. Have low melting and boiling points

5. Are poor electrical conductors, but carry electric current in aqueous solutions as well as in molten state.

6. Are insoluble in water but soluble in non-polar or organic liquids like *benzene,ether,chloroform,petrol* etc.

Allotropes of Carbon

The phenomenon of the existence of the same element in different physical forms with similar chemical properties is known as allotropy.

Some elements like *carbon, sulphur, phosphorus,* etc., exhibit this phenomenon.

Crystalline allotropes of carbon include diamond, graphite and, fullerene.

Amorphous allotropes of carbon include coal, coke, charcoal, lamp black and gas carbon.

Diamond

Diamond has a *regular tetrahedral* geometry.

This is because *each carbon is connected to four neighbouring carbon atoms* via single covalent bonds, resulting in a single unit of a crystal.

These crystal units lie in different planes and are connected to each other, resulting in a rigid three-dimensional cubic pattern of the diamond.

Diamond:

Has a high density of 3.5g/cc.

Has a very high refractive index of 2.5.

Is a good conductor of heat.

Is a poor conductor of electricity, hardest known substance.

Graphite

In graphite, *each carbon atom is bonded covalently to three other carbon* atoms, leaving each carbon atom with one free valency.

This arrangement results in *hexagonal rings* in a single plane and such rings are stacked over each other through weak Van der Waals forces.

Graphite:

Has a density of 2.25 g/cc.

Has a soft and slippery feel.

Is a good conductor of electricity.

C_{60}

C_{60}, also known as *Buckminsterfullerene*, designed by (*Buckminster Fuller) is* the very popular and stable form of the known ***fullerenes.***

It is the most common naturally occurring fullerene and can be found in small quantities in soot.

It consists of 60 carbon atoms arranged in 12 pentagons and 20 hexagons, like in a soccer ball.

***HYDROCARBONS** are the chemical compound that is a mixture of hydrogen and carbon.*

***ORGANIC COMPOUNDS** are the compounds of carbon containing usually hydrogen and one or more other elements such as Oxygen,Nitrogen, Sulphur,Halogens,Phosphorus etc.*

***ORGANIC CHEMISTRY** is the branch of chemistry which deals with the study of carbon and its organic compounds.*

Chains, Branches and Rings of Hydrocarbons

Saturated and Unsaturated Hydrocarbons

Saturated hydrocarbons:

These hydrocarbons have all carbon-carbon single bonds. These are known as *alkanes.* General formula *= C_nH_{2n+2} where n = 1, 2, 3, 4……*

Unsaturated hydrocarbons:

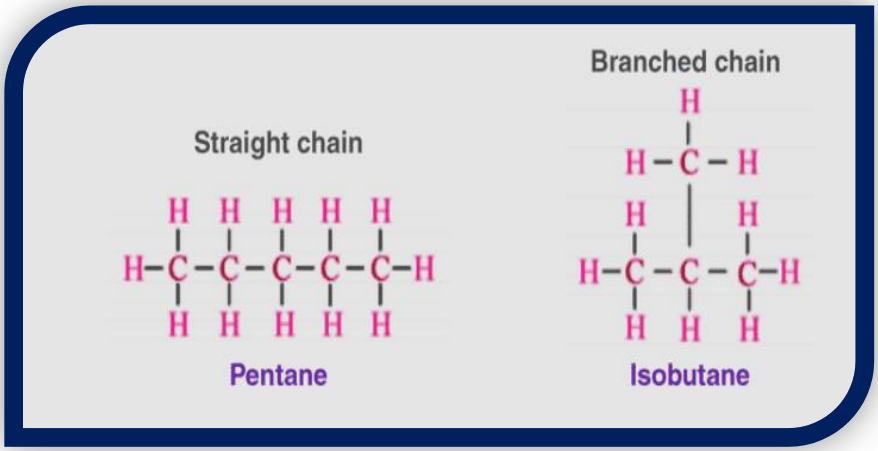
These hydrocarbons have at least one carbon-carbon double or triple bond.

Hydrocarbons with at least one carbon-carbon double bond are called *alkenes.* General formula = *C_nH_2n where n = 2, 3, 4…..*

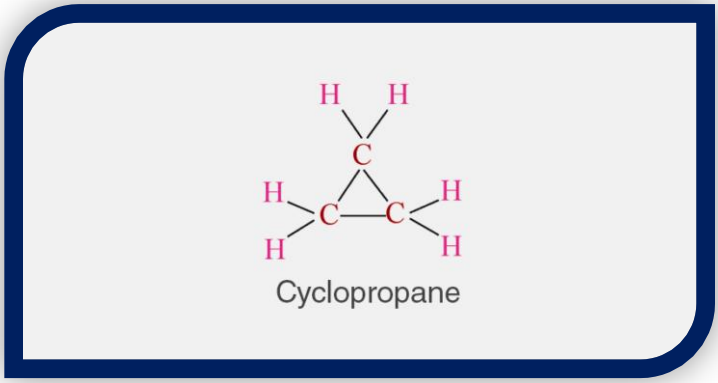
Hydrocarbons with at least one carbon-carbon triple bond are called *alkynes*. General formula = C_nH_{2n-2} *where n = 2, 3, 4…..*

Chains, Rings and Branches

Carbon chains may be in the form of straight chains, branched chains or rings.



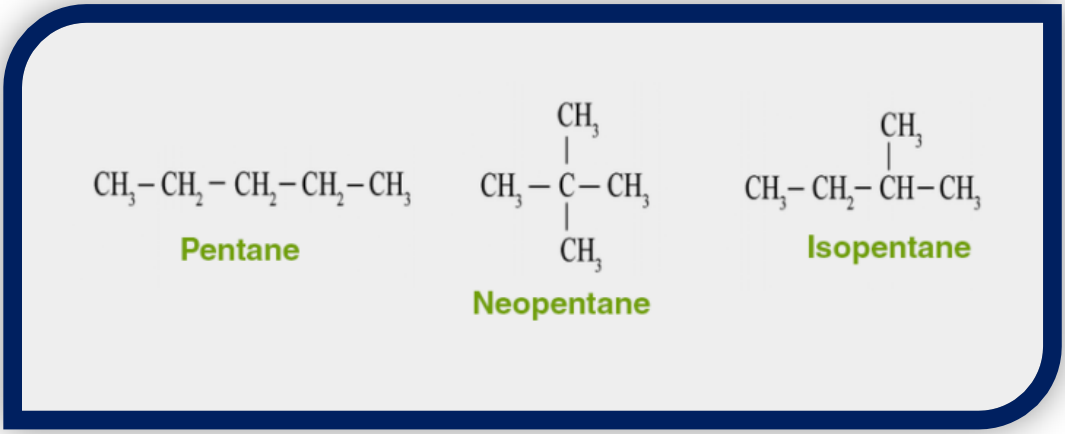
In cyclic compounds, atoms are connected to form a ring.



Structural Isomers

The compounds with the same molecular formula and different physical or chemical properties are known as *isomers* and the phenomenon is known as *isomerism.*

The isomers that differ in the structural arrangement of atoms in their molecules are called structural isomers and the phenomenon is known as structural isomerism.



ISOMERS of BUTANE

Butane forms 2 Isomers

1.CH_3 –CH_2-CH_2-CH_3

n- Butane or Butane

2.CH_3-CH(-CH_3)-CH_3

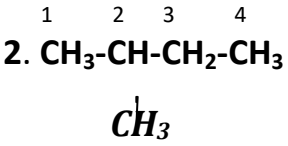
Isobutane or 2-Methylpropane

ISOMERS of PENTANE

Pentane forms 3 Isomers

1.CH_3-CH_2-CH_2-CH_2-CH_3

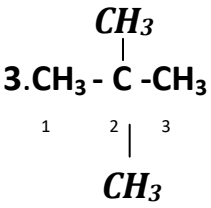
n-Pentane or Pentane



2. CH_3-CH-CH_2-CH_3

CH_3

Isopropane or 2-Methylbutane



3.CH_3 - C -CH_3

CH_3

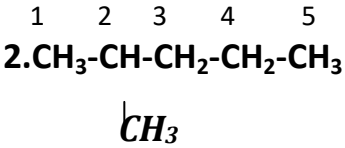
Neopentane or 2,2-Dimethylpropane

ISOMERS of HEXANE

Hexane forms 5 Isomers

1.CH_3-CH_2-CH_2-CH_2-CH_2-CH_3

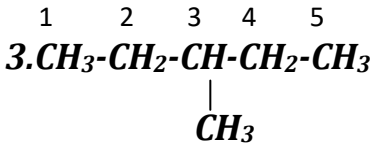
Hexane



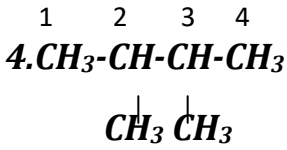
2.CH_3-CH-CH_2-CH_2-CH_3

CH_3

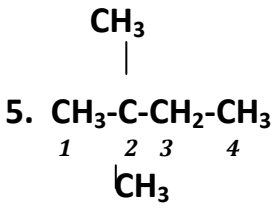
2-Methylpentane



3-Methylpentane



2,3-Dimethylbutane



2,2-Dimethylbutane

Benzene

Benzene is the simplest organic, aromatic hydrocarbon.

Physical properties:

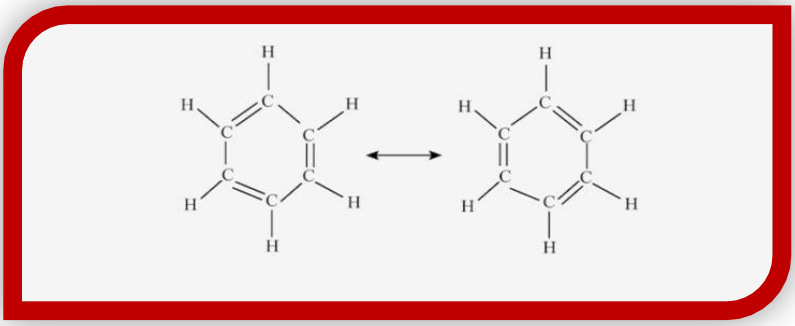
colourless liquid, pungent odour, flammable, volatile.

Structure:

Cyclic in nature with chemical formula, C_6H_6, i.e., each carbon atom in benzene is arranged in a six-member ring and is bonded to only one hydrogen atom.

It includes 3-double bonds which are separated by a single bond.

Hence, this arrangement is recognized to have conjugated double bonds and two stable resonance structures exist for the ring.



Functional Groups and Nomenclature

Functional Groups

An atom or a group of atoms which when present in a compound gives specific physical and chemical properties to it regardless of the length and nature of the carbon chain is called a *functional group.*

Classification of Functional Groups

Main Functional Groups:

1.Hydroxyl group (-OH) or Alcohol group

All organic compounds containing -OH group are known as alcohols.

For IUPAC system of nomenclature, we remove "E" from ALKANE and add "OL".

For example, ***Methanol (CH_3-OH), Ethanol (CH_3–CH_2–OH), etc.***

2.Aldehyde group (-CHO):

All organic compounds containing -CHO group are known as aldehydes.

For IUPAC system of nomenclature, we remove "E" from ALKANE and add "AL".

For example, ***Methanal (H-CHO), Ethanal (CH_3-CHO), etc.***

3. Ketone group (-C=O):

All organic compounds containing (-C=O) group flanked by two alkyl groups are known as ketones.

For IUPAC system of nomenclature, we remove "E" from ALKANE and add "ONE".

For example, ***Propanone (CH_3-CO-CH_3), Butanone (CH_3-CO-CH_2-CH_3)***, etc.

4. Carboxyl group (-COOH) or Carboxylic Acid group:

All organic acids contain a carboxyl group (-COOH). Hence, they are also called carboxylic acids.

For IUPAC system of nomenclature, we remove "E" from ALKANE and add "OIC ACID".

For example, ***Ethanoic acid (CH_3-COOH), Propanoic acid (CH_3-CH_2-COOH), etc.***

5.Halogen group or Haloalkane (F, CI, Br, I) or (PREFIX GROUP)

The alkanes in which one or more than one hydrogen atom is substituted by-X (F, CI, Br or I) are known as haloalkanes.

For example, ***Chloromethane (CH_3-Cl), Bromomethane (CH_3-Br), etc.***

Homologous Series

Homologous series constitutes organic compounds with the same general formula, similar chemical characteristics but different physical properties.

The adjacent members differ in their *molecular formula by $-CH_2$.*

Examples of homologous series

Methane, ethane, propane, butane, etc. are all part of the alkane homologous series.

The general formula of this series is C_nH_{2n+2}.

Methane (CH_4), Ethane (CH_3CH_3), Propane ($CH_3CH_2CH_3$), Butane ($CH_3CH_2CH_2CH_3$).

There is a *difference of $-CH_2$ unit* between each successive compound.

Nomenclature of Carbon Compounds

International Union of Pure and Applied Chemistry (IUPAC)

Decided some rules to name the carbon compounds. This was done to maintain the uniformity throughout the world.

Names which are given on this basis are popularly known as IUPAC name.

Some important IUPAC rules of NOMENCLATURE

1. Identify the number of Carbon atoms in the compound.

2. Count only the Carbon atoms.

3. Start counting from functional group side or nearest branch side.

4. Give priority to the Functional group & indicated it either by a prefix or by a Suffix.

5. Give number 1, 2, 3, 4…..below the Carbon atom to show their position.

6. Write in Alphabetical order.

7. Give (-) between digit and word & (,) between two digit.

8. Choose the longest Carbon chain.

9. Write parental title at last.

10. Genarally prefix is use for Halogens or Haloalkanes group (F,Cl,Br,I) & suffix for other groups.

11. Use **PREFIX** ***Fluoro for Flourine, Chloro for Chlorine,Bromo for Bromine & Iodo for Iodine.***

12. Use **SUFFIX** ***"Ol" for Alcohol, "A" for Aldehyde, "One" for Ketone, "Oic Acid" for Carboxylic Acid, "Ene" for Alkenes & "Yne" for Alkynes.***

13. If functional group is absent in carbon compound then ALKYL group is works as functional group.

1 carbon atom will be named ***----Meth***

2……Eth

3……Prop

4……But

5……Pent

6……Hex

7……Sept/Hept

8……Oct

9……Non

10……Dec

ALKYL GROUP

The removal of one hydrogen atom from the molecule of an ALKANE gives an ALKYL GROUP.

-CH_3 ……Methyl

-C_2H_5……Ethyl

-C_3H_7……Propyl

-C_4H_9……Butyl

-C_5H_{11}……Pentyl

…….& so on…..

Heteroatom:

In a Hydrocarbon chain, one or more hydrogen can be replaced by the elements such as halogens (F,Cl,Br & I),Oxygen,Nitrogen,Sulphur is called Heteroatom.

Physical Properties

The members of any particular family have almost identical chemical properties due to the same functional group.

Their physical properties such as *melting point, boiling point, density*, etc., show a regular gradation with the increase in the molecular mass.

Chemical Properties

A chemical property is a property that describes a substance's ability to undergo a specific chemical change.

A chemical change always results in the formation of one or more types of matter that are distinct from the matter that existed before to the change.

Combustion Reactions

Combustion means burning of carbon or carbon-containing compounds in the presence of air or oxygen to produce carbon dioxide, heat and light.

For example,

Methanol burns in air to give CO_2

$$\mathbf{2CH_3OH + 3O_2 \rightarrow 4H_2O + 2CO_2 + heat\ and\ light}$$

Naphthalene also undergoes combustion in the presence of oxygen to afford carbon dioxide gas and water.

The chemical equation for this reaction is given by:

$$12O_2 + C_{10}H_8 \rightarrow 4H_2O + 10CO_2 + \text{Heat and light}$$

OR

$$CH4 + O2 \rightarrow H_2O + CO_2 + \text{Heat and light}$$

Flame Characteristics

Saturated hydrocarbons give clean flame while *unsaturated hydrocarbons* give smoky flame.

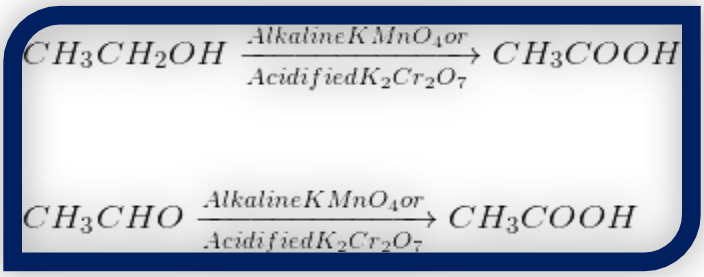
In the presence of limited oxygen, even saturated hydrocarbons give smoky flame.

A black substance formed by combustion or separated from fuel during combustion, rising in fine particles, and adhering to the sides of the chimney or pipe conveying the smoke especially:

The fine powder consisting chiefly of carbon that colors smoke called soot.

Oxidation Reaction

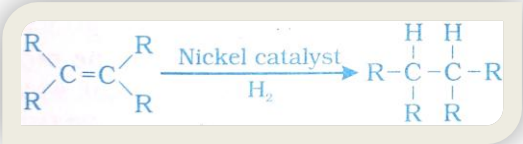
Oxidation is a chemical reaction that occurs in an atom or compound and results in the loss of one or more electrons.



Alkaline potassium permanganate or acidified *potassium dichromate oxidizes Alcohols to acids.*

Addition Reaction

The reactions in which two molecules react to form a single product having all the atoms of the combining molecules are called addition reactions.



The *hydrogenation reaction* is an example of the addition reaction.

In this reaction, hydrogen is added to a double bond or a triple bond in the presence of a *catalyst* like *nickel, palladium or platinum*.

CATALYSTS ***are*** those chemical substances which increase or decrease the rate of chemical reactions without taking part itself.

HYDROGENATION Reaction is commonly used for making *vegetable oil.*

Vegetable oil having long carbon chain *unsaturated fatty Acids*, which is good for health.

Animal fat like *GHEE and BUTTER* containing *saturated fatty acids.*

It is said to be bad for health, because it increase the level of bad Cholesterol in blood and causes Coronary Attack.

$$C_2H_2 + H_2 \xrightarrow{Ni\,or\,Pt\,or\,Pd} C_2H_4$$

Substitution Reaction

The reaction in which an atom or group of atoms in a molecule is replaced or substituted by different atoms or group of atoms is called substitution reaction.

In alkenes, hydrogen atoms are replaced by other elements.

$CH_4 + Cl_2 + Sunlight \rightarrow CH_3Cl + HCl$

$CH_3Cl + Cl_2 + Sunlight \rightarrow CH_2Cl_2 + HCl$

$CH_2Cl_2 + Cl_2 + Sunlight \rightarrow CHCl_3 + HCl$

$CHCl_3 + Cl_2 + Sunlight \rightarrow CCl_4 + HCl$

Ethanol

1. Ethanol, C_2H_5OH is a colourless liquid having a pleasant smell.

2. It boils at 351 K.

3. It is miscible with water in all proportions.

4. It is a nonconductor of electricity (it does not contain ions)

5. It is neutral to litmus.

Uses:

1. as antifreeze in radiators of vehicles in cold countries.

2. as a solvent in the manufacturing of paints, dyes, medicines, soaps and synthetic rubber.

3. as a solvent to prepare the tincture of iodine.

How Do Alcohols Affect Human Beings?

1. Ethanol is an important industrial solvent.

To prevent its misuse, it make unfit for drinking by adding poisonous substances like *methanol*.

Methanol is oxidized to *METHANAL* in the liver. It *coagulates the protoplasm*, in much the same way an *EGG* is *coagulated* by cooking.

Mixture of *methanol and ethanol* is called *DENATURED ALCOHOL*.

It causes serious poisoning and loss of eyesight.

2. It causes addiction (person is called *Alcoholic*), damages the liver if taken in excess.

3. High consumption of ethanol may even cause death.

Reactions of Ethanol with Sodium

Ethanol reacts with sodium to produce hydrogen gas and *sodium ethoxide.*

This reaction supports the acidic character of ethanol.

$$2C_2H_5OH+2Na \rightarrow 2C_2H_5ONa+H_2(\uparrow)$$

Elimination Reaction

An elimination reaction is a type of reaction in which two substituents are removed from a molecule.

These reactions play an important role in the preparation of *alkenes.*

Dehydration Reaction

Ethanol reacts with concentrated sulphuric acid at 443 K to produce *ethylene or Ethene.*

This reaction is known as dehydration of ethanol because, in this reaction, a water molecule is removed from the ethanol molecule.

$$CH_3CH_2OH \rightarrow CH_2=CH_2+H_2O$$

(reaction taking place in presence of Conc.H_2SO_4)

Ethanoic Acid or Acetic Acid

1. Molecular formula: CH_3COOH

2. It dissolves in water, alcohol and ether.

3. It often freezes during winter in cold climate and therefore it is named as *glacial acetic acid.*

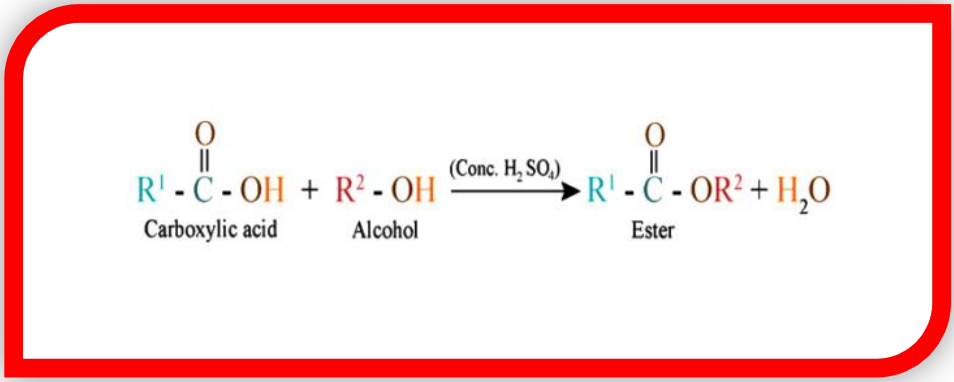
4.*5 to 8 %* solution of *Acetic Acid* in *water* is called *VINEGAR.*

Esterification

When a carboxylic acid is reacts with alcohol in the presence of a small quantity of conc.H_2SO_4, a sweet-smelling substance is formed called *ESTER.*

This reaction of ester formation is called *esterification.*

Esters are use in making perfumes and Flavouring agents



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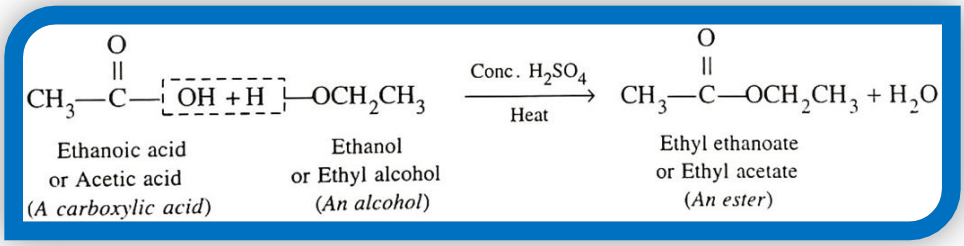


When *ethanol* reacts with *ethanoic acid* in presence of *conc.H_2SO_4*, *ethyl ethanoate* and *water* are formed.

$$CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$$

(reaction taking place in presence of Conc.H_2SO_4)

Saponification

A soap is a sodium or potassium salt of long-chain carboxylic acids (fatty acid).

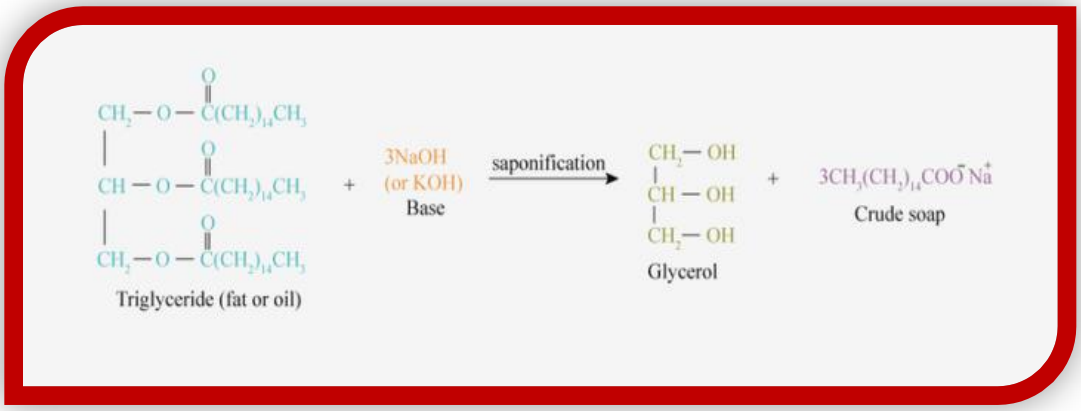
The soap molecule is generally represented as RCOONa, where R = non-ionic hydrocarbon group and $-COO^-Na^+$ ionic group.

When oil or fat of vegetable or animal origin is treated with a concentrated sodium or potassium hydroxide solution.

Hydrolysis of fat takes place; soap and glycerol are formed.

Fat or Vegetable oil + NaOH → (heat) Soap + Glycerol

This alkaline hydrolysis of oils and fats is commonly known as saponification.



Reaction of Ethanoic Acid with Metals and Bases

Ethanoic acid (Acetic acid) reacts with metals like sodium, zinc and magnesium to liberate hydrogen gas.

$$2CH_3COOH+2Na \rightarrow 2CH_3COONa+H_2(\uparrow)$$

It reacts with a solution of *sodium hydroxide* to form *sodium ethanoate* and *water.*

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

Reaction of Ethanoic Acid with Carbonates and Bicarbonates

Carboxylic acids react with *carbonates and bicarbonates* with the evolution of *CO_2 gas.*

For example, when ethanoic acid (acetic acid) reacts with *sodium carbonate and sodium bicarbonate, CO_2 gas* is evolved along with respective salt.

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

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

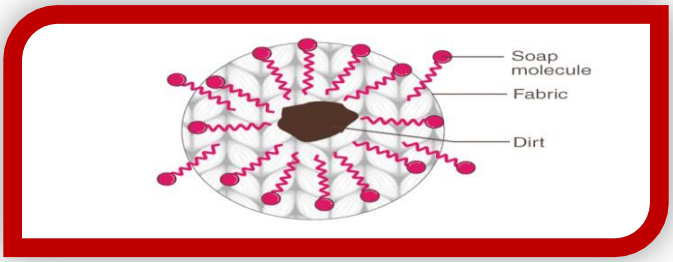
Soaps and Detergents

Sodium and Potassium salts of higher fatty acids such as palmitic acid,stearic acid,oleic acid etc.are called soaps while Detergents are sodium salts of sulphonic acids or sodium sulphates or Ammonium salts of long chain hydrocarbons* *containg 12-18 carbon atoms.

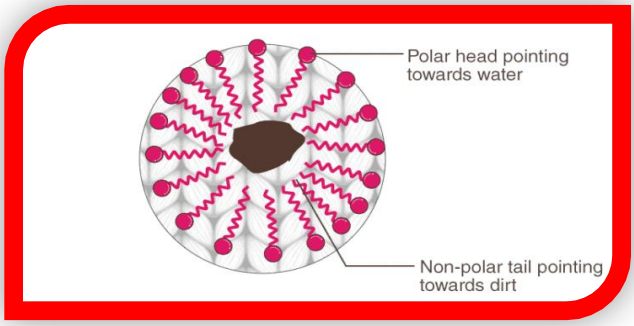
Synthetic detergents* *are also called* *soap less soaps* *because they have cleansing action like that of soaps but chemically they are not soaps.

Cleansing Action of Soap

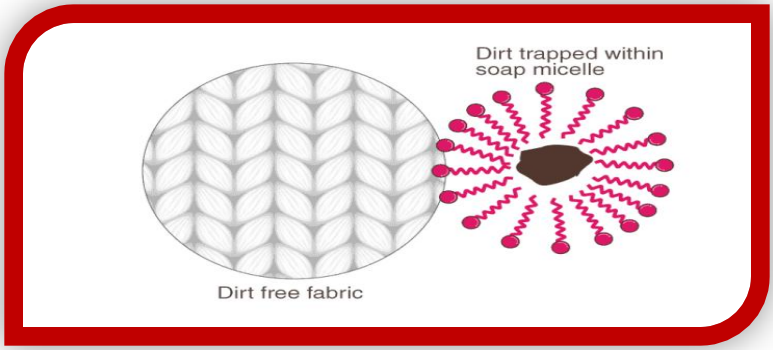
When soap is added to water, the soap molecules uniquely orient themselves to form *spherical shape micelles.*



The *non-polar hydrophobic (water –repelling) part or tail* of the soap molecules attracts the dirt or oil part of the fabric, while the *polar hydrophilic (water-attracting)part or head,(–COO⁻Na⁺)* remains attracted to water molecules.



The agitation or scrubbing of the fabric helps the micelles to carry the oil or dirt particles and detach them from the fibres of the fabric.



Hard Water

Hard water contains salts of calcium and magnesium, principally as bicarbonates, chlorides, and sulphates.

Water that does not produce foam or lather with soap readily is called hard water and the water that produce foam or lather with soap readily is called Soft water.

When soap is added to hard water, calcium and magnesium ions of hard water react with soap forming insoluble curdy white precipitates of calcium and magnesium salts of fatty acids.

$$2C_{17}H_{35}COONa + MgCl_2 \rightarrow (C_{17}H_{35}COO)_2Mg + 2NaCl$$

$$2C_{17}H_{35}COONa + CaCl_2 \rightarrow (C_{17}H_{35}COO)_2Ca + 2NaCl$$

These precipitates stick to the fabric being washed and hence, interfere with the cleaning ability of the soap.

Therefore, a lot of soap is wasted if the water is hard.

(The Hardness of water is due to the presence of bicarbonates, chlorides and sulphates of CALCIUM and MAGNESIUM).

What is a micelle?

Micelle is an aggregate of molecules in a colloidal solution (those formed in detergents).

What are the types of covalent bonds?

1. Single covalent bond

2. Double covalent bond

3. Triple covalent bond

What are 'Allotropes'?

Elements are present in more than one physical form but chemically they are similar is called Allotropes.

For example carbon,Sulphur.

SOAPS are 100% biodegradable but DETERGENTS are not.

It causes water pollution.

Now-a-days the branching of detergents is kept to a minimum so that detergents become biodegradable to prevent water pollution.

SOAP or DETERGENTS solution appears cloudy because the soap or detergents micelles are quite large and hence they scatter light.

*MANUFACTURING OF SOAP. (**Saponification)***

Fat or Vegetable Oil + NaOH $\xrightarrow{\text{heat } + H_2SO_4}$ ***Soap + Glycerol***

(Vegetable oil means……Caster oil,Cotton seed oil,Soyabean oil,Linseed oil,Palm oil,Coconut oil,Olive oil etc.).

Raw materials used…….vegetable oil, 20% NaOH, NaCl