

UNIT-1

SECTION-A

1. Define radioactivity?

Radioactivity is the spontaneous emission of **radiation** in the form of particles or high energy photons resulting from a nuclear reaction. Alpha, beta, and gamma decay are three common processes through which radioactive materials lose energy.

2. Give the use of sodium thio sulphate.

- *It acts as an antidote.
- * It is also used in conjunction with the treatment of certain cancers.
- *It acts as a neutralizing agent to protect the kidneys.

3. What is the definition of semiconductor?

A semiconductor is a substance used in electronics whose ability to conduct electricity increases with greater heat. A substance, such as germanium or silicon, that has an electrical conductivity that increases with temperature and is intermediate between that of a metal and an insulator.

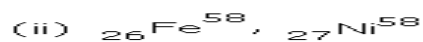
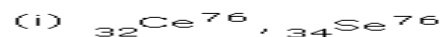
4. Define isotopes.

- These are elements which have the same atomic number but different atomic mass.
- Isotopes are chemically same but physically different. Examples



5. Define isobars.

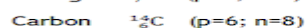
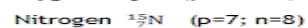
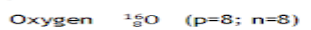
- These are elements which have same atomic mass but a different atomic number. examples:



6. Define isotones.

These are elements having the same number of neutrons.

Example:



are isotones because of having same no. of neutron (8).

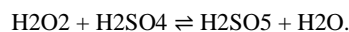
SECTION-B

1. Explain about the permonosulphuric acid.

The laboratory scale preparation of Caro's acid involves the combination of chlorosulfuric acid and hydrogen



usually as an intermediate for the production of potassium monopersulfate (PMPS), a bleaching and oxidizing agent. One patent for production of Caro's acid for this purpose gives the following reaction:



2. What is the Difference Between Nuclear Fission and Fusion?

Definition:

Nuclear Fission: Nuclear fission is the splitting of a nucleus into smaller particles, releasing a high amount of energy.

Nuclear Fusion: Nuclear fusion is the combination of two smaller atoms to create a large atom releasing energy.
Natural Occurrence:

Nuclear Fission: Nuclear fission reactions are not common in nature.

Nuclear Fusion: Nuclear fusion reactions are common in stars such as the sun.

Requirements:

Nuclear Fission: Nuclear fission reactions may require high-speed neutrons.

Nuclear Fusion: Nuclear fusion reactions require high temperature and high pressure conditions.

Energy Production:

Nuclear Fission: Nuclear fission reactions produce a high energy.

Nuclear Fusion: Nuclear fusion reactions of light nuclei produce a very high energy whereas nuclear fusion reactions of heavy nuclei may not release energy.

Examples:

Nuclear Fission: Neutron bombardment of Uranium-235 and radioactive decay in unstable isotopes are examples of nuclear fission.

Nuclear Fusion: Nuclear fusion reactions are most commonly found as the fusion between Deuterium and Tritium.

Conclusion:

The difference between nuclear fission and fusion is that nuclear fission is the division of an atom into smaller particles whereas nuclear fusion is the combination of smaller atoms to form a large atom.

3. Explain about the band theory.

The introduction of band theory happened during the quantum revolution in science. The electrons in an atom are present in different energy level. When we try to assemble a lattice of a solid with N atoms, then each level of an atom must split up into N levels in the solid. This splitting up of sharp and tightly packed energy levels forms Energy Bands. The gap between adjacent bands representing a range of energies that possess no electron is called a **Band Gap**.

Valence Band:

The energy band involving the energy levels of valence electrons is known as the valence band. It is the highest occupied energy band. When compared with insulators, the bandgap in semiconductors is smaller. It allows the electrons in the valence band to jump into the conduction band on receiving any external energy.

Conduction Band:

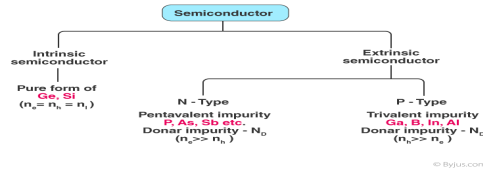
It is the lowest unoccupied band that includes the energy levels of positive (holes) or negative (free electrons) charge carriers. It has conducting electrons resulting in the flow of current. The conduction band possess high energy level and are generally empty. The conduction band in semiconductors accepts the electrons from the valence band.

SECTION-C

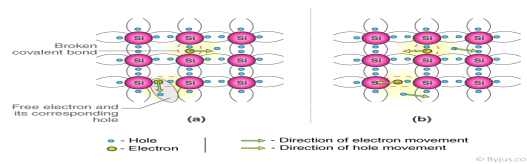
1. Explain about the types of semiconductors.

TYPES OF SEMICONDUCTORS:

- **Intrinsic Semiconductor**
- **Extrinsic Semiconductor**



An intrinsic type of semiconductor material is made to be very pure chemically. It is made up of only a single type of element.



Germanium (Ge) and Silicon (Si) are the most common type of intrinsic semiconductor elements. They have four valence electrons (tetravalent). They are bound to the atom by covalent bond at absolute zero temperature.

When the temperature rises, due to collisions, few electrons are unbounded and become free to move through the lattice, thus creating an absence in its original position (hole). These free electrons and holes contribute to the conduction of electricity in the semiconductor. The negative and positive charge carriers are equal in number.

The thermal energy is capable of ionizing a few atoms in the lattice, and hence their conductivity is less.

EXTRINSIC SEMICONDUCTOR

The conductivity of semiconductors can be greatly improved by introducing a small number of suitable replacement atoms called IMPURITIES. The process of adding impurity atoms to the pure semiconductor is called DOPING. Usually, only 1 atom in 10^7 is replaced by a dopant atom in the doped semiconductor. An extrinsic semiconductor can be further classified into:

- **N-type Semiconductor**
- **P-type Semiconductor**

N-TYPE SEMICONDUCTOR

- Mainly due to electrons
- Entirely neutral
- $I = I_h$ and $n_h \gg n_e$
- Majority – Electrons and Minority – Holes

When a pure semiconductor is doped by pentavalent impurity then, four electrons out of five valence electrons bonds with the four electrons of Ge or Si.

The fifth electron of the dopant is set free. Thus the impurity atom donates a free electron for conduction in the lattice and is called “Donor”.

Since the number of free electron increases by the addition of an impurity, the negative charge carriers increase. Hence it is called n-type semiconductor.

Crystal as a whole is neutral, but the donor atom becomes an immobile positive ion. As conduction is due to a large number of free electrons, the electrons in the n-type semiconductor are the MAJORITY CARRIERS and holes are the MINORITY CARRIERS.

P-TYPE SEMICONDUCTOR

- Mainly due to holes
- Entirely neutral
- $I = I_h$ and $n_h \gg n_e$

- Majority – Holes and Minority – Electrons

When a pure semiconductor is doped with a trivalent impurity (B, Al, In, Ga) then, the three valence electrons of the impurity bonds with three of the four valence electrons of the semiconductor.

This leaves an absence of electron (hole) in the impurity. These impurity atoms which are ready to accept bonded electrons are called “**Acceptors**”.

With the increase in the number of impurities, holes (the positive charge carriers) are increased. Hence, it is called p-type semiconductor.

2.Explain about the electron gas theory?

In electronic gas theory metal atoms lose their valence electrons and form a dense network of cations.

For example, in the case of sodium, whose electronic configuration is $2s^2 1s^2 2p^6 3s^1$;

The Na^+ cations, formed by atomic nuclei and electrons of the inner layers, are packaged and the valence electrons move freely. These electrons don't belong to individual atoms, but are common to all atoms that form the network. It is said that electrons are delocalized.

Depending on the number of valence electrons that the metal has, there will be as many electrons delocalized as atoms or even more. For example, in sodium, which loses an electron, there will be many electrons as sodium atoms, but magnesium, which has two valence electrons and loses both, there will be twice electron nuclei Mg^{2+} .

Thus, the cations are arranged forming a metallic compact or packaging crystal lattice and each cation surrounds the maximum number of neighbors cations. Valence electrons move freely through the interstices of the grid, forming the electron gas and also acting as a cushion which prevents repulsion between different cations.

Given the freedom of movement of valence electrons, this theory explains the metallic bond very well many of the metallic properties, such as high electrical and thermal conductivity properties. It also explains the ductility and malleability or resistance to deformation, because the layers of cations can slide over each other, keeping the type of structure and the bond strength.

UNIT-2

SECTION-A

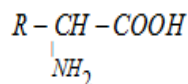
1.What are proteins?

Proteins are complex nitrogenous organic compounds.They contain carbon,nitrogen,hydrogen,oxygen,sulphur,halogens.

2.What are carbohydrates?

Any of a large group of organic compounds occurring in foods and living tissues and including sugars, starch, and cellulose. They contain hydrogen and oxygen in the same ratio as water (2:1) and typically can be broken down to release energy in the animal body.

3.What are amino acids?



A simple organic compound containing both a carboxyl ($-COOH$) and an amino ($-NH_2$) group.

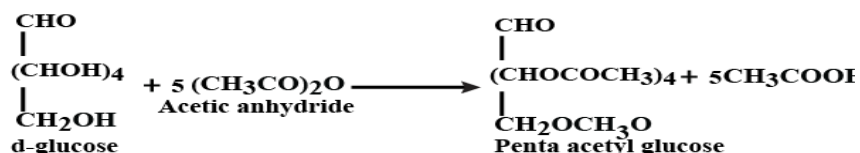
4.What is ninhydrin test?

The ninhydrin test is a test to detect proteins.It is based on the reaction between ninhydrin and amino acids containing a free amino group to give a coloured compound.

5. What is a peptide linkage?

The divalent group $CONH$ that unites the amino acid residues in a peptide : the bivalent group $CONH$ that unites the amino acid residues in a peptide.

6. Give the reaction of acetic anhydride on glucose.



8. What are the shapes of proteins?

Fibrous proteins

- a) When the polypeptide chains run parallel and are held together by hydrogen and disulphide bonds, then fibre-like structure is formed.
- b) These proteins are generally insoluble in water
- c) Examples: keratin (present in hair, wool, silk) and myosin (present in muscles), etc

Globular proteins

- a) This structure results when the chains of polypeptides coil around to give a spherical shape.
- b) These are usually soluble in water.
- c) Examples: Insulin and albumins

SECTION -B

1. Explain the classification of carbohydrates.

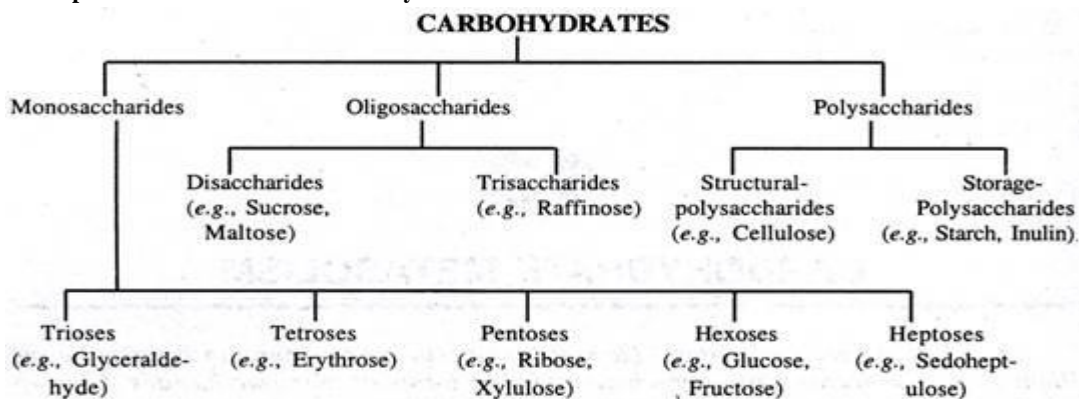


Fig. 13.1. Classification of the Carbohydrates

2. Explain the tests for protein.

- **Biuret test**

An alkaline solution of protein is treated with a drop of aqueous copper sulfate and a bluish violet color is obtained.

Note: Formation of violet coloration confirms the presence of Proteins.

- **Xanthoproteic test**

Proteins on treatment with nitric acid give a yellow or orange color. Concentrated nitric acid is used for nitration.

Note: The appearance of a yellow color solution confirms the presence of proteins.

- **Millions test**

Gelatin does not give this test. First, a white precipitate is formed when proteins are treated with millions reagent and then turns to brick red color on boiling, this confirms the presence of proteins.

Note: The appearance of brick red color solution confirms the presence of proteins.

- **Ninhydrin test**

Proteins react with pyridine solution of ninhydrin and change to a colored solution from a deep blue to violet-pink or sometimes even to a red color.

Note: The appearance of violet color solution confirms the presence of proteins.

3. What is the inversion of sugar?

* Common sugar is the disaccharide sucrose which is made up of one molecule of glucose and one molecule of fructose

* Sucrose is split into its component monosaccharides by heating in aqueous solution, by the action of the enzyme sucrase or by treatment with dilute acid.

* Most carbohydrates are optically active, that is they rotate the plane of polarization of plane polarized light.

* Sucrose is dextrorotatory, that is it rotates the plane to the right, while the mixture of glucose and fructose is laevorotatory, that is it rotates the plane to the left.

* These changes can be measured in a polarimeter. So, as sucrose is hydrolysed, the extent of rotation progressively decreases until converted solution the direction of rotation changes from right to left. This process is called inversion.

4. Explain about the starch.

It is a polymer of α -glucose and consists of two components — Amylose and Amylopectin.

- **Amylose:**

1. It is a water soluble component
2. It is a long unbranched chain polymer
3. It contains 200 – 1000 α -D-(+)- glucose units held by α - glycosidic linkages involving C1 – C4 glycosidic linkage
4. It constitutes about 15-20% of starch

- **Amylopectin**

1. It is a water insoluble component
2. It is branched chain polymer
3. It forms chain by C1 – C4 glycosidic linkage whereas branching occurs by C1 – C6 glycosidic linkage
4. It constitutes about 80-85% of starch

SECTION-C

1. Explain the physical properties of amino acid.

1. SOLUBILITY

Most of the amino acids are usually soluble in water and insoluble in organic solvents.

2. MELTING POINT

Amino acids are generally melted at a higher temperature of ten above 200°C.

3. TASTE

Amino acids may be sweet (Gly, Ala & Val), tasteless (Leu) or Bitter (Arg & Ile).

4. OPTICAL PROPERTIES

All amino acids possess optical isomers due to the presence of asymmetric α -carbon atoms.

5. ZWITTER ION AND ISOELECTRIC POINT

The name zwitter is derived from the German word which means “hybrid”. [Zwitter ion](#) (or) dipolar ion is a hybrid molecule containing positive & negatively ionic groups.

Basically the proton shifts from carboxyl group to the amino group of the self molecule at normal pH cellular levels.

6. TITRATION CURVE OF GLYCINE

Glycine is optically inactive, simplest amino acid because it has no asymmetric carbon atom. Acid-Base titration involves the gradual addition (or) removal of proton

It has three different stages when the Glycine undergoes acid-base titration.

2. Discuss about the structure of proteins.

- **Primary structure of proteins:** The sequence of amino acids is said to be the primary structure of a protein.
- **Secondary structure of proteins:** It refers to the shape in which long polypeptide chain can exist. Two different types of structures:

α - Helix

1. It exists when R- group is large.
2. Right handed screw with the NH group of each amino acid residue H – bonded to – C = O of adjacent turn of the helix.
3. Also known as 3.613 helix since each turn of the helix has approximately 3.6 amino acids and a 13 – membered ring is formed by H – bonding.
4. C = O and N – H group of the peptide bonds are trans to each other.

β -pleated sheet:

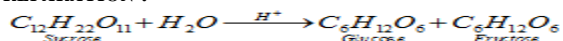
1. It exists when R group is small.
 2. In this conformation, all peptide chains are stretched out to nearly maximum extension and then laid side by side which are held together by hydrogen bonds.
- **Tertiary structure of proteins:** It represents the overall folding of the polypeptide chain i.e., further folding of the 2° structure.
 - **Types of bonding which stabilize the 3° structure:**
 1. Disulphide bridge (-S – S-)
 2. H – bonding – (C = O ... H – N)
 3. Salt bridge (COO– ... + NH_3)
 4. Hydrophobic interactions
 5. van der Waals forces

3 Quaternary structure of proteins:

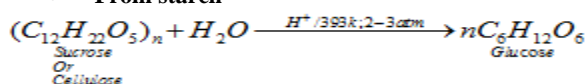
1. Some of the proteins are composed of two or more polypeptide chains referred to as sub-units.
2. The spatial arrangement of these subunits with respect to each other is known as quaternary structure of proteins.

3. Explain the preparation structural elucidation of glucose ,fructose.

PREPARATION :

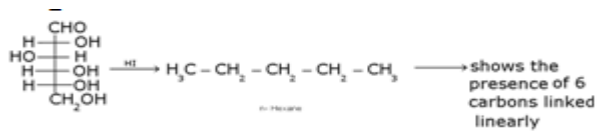


- **From starch**

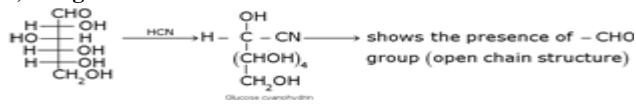


Structure elucidation of glucose:

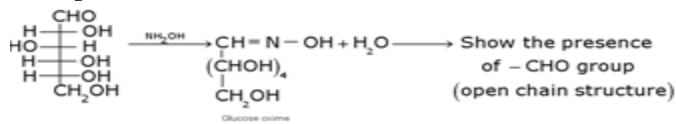
a) D – glucose with HI



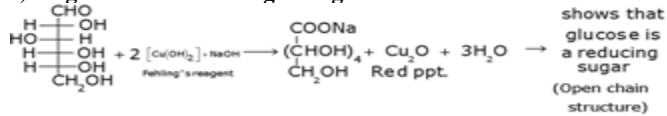
b) D – glucose with HCN



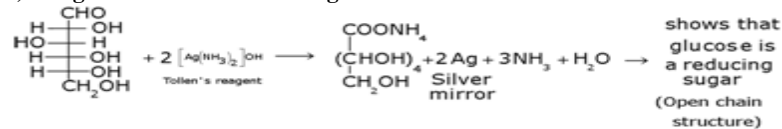
c) D – glucose with NH₂OH



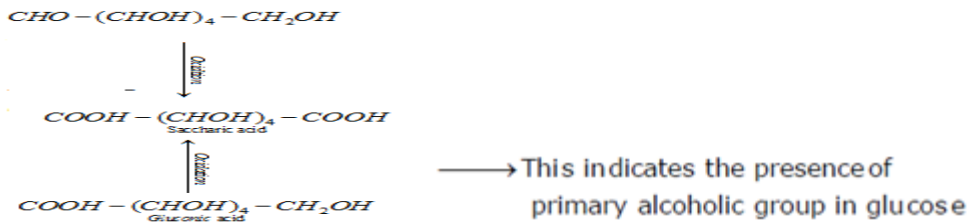
d) D- glucose with Fehling's reagent



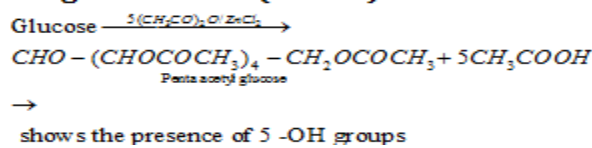
e) D – glucose with Tollen's reagent



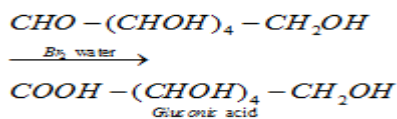
f) D – glucose with nitric acid



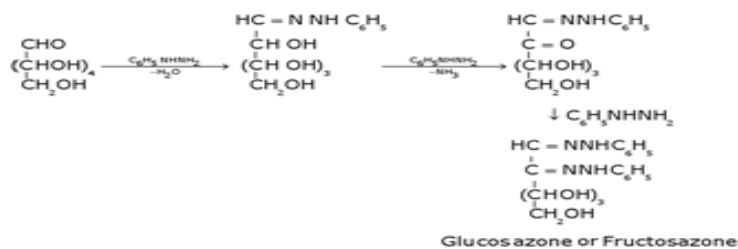
g) D – glucose with (CH₃CO)₂O and ZnCl₂



h) D – glucose with bromine water

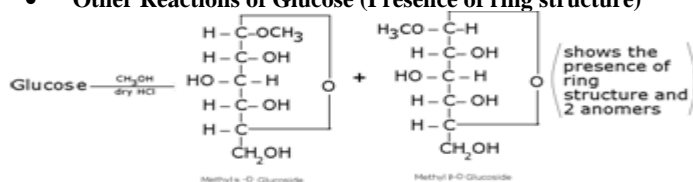


i) GLUCOSE WITH PHENYLHYDRAZINE TO FORM OSAZONE



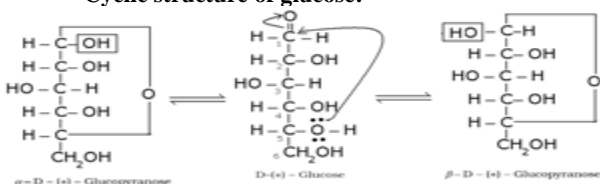
Glucose and fructose gives the same osazone because the reaction takes place at C1 and C2 only.

• **Other Reactions of Glucose (Presence of ring structure)**

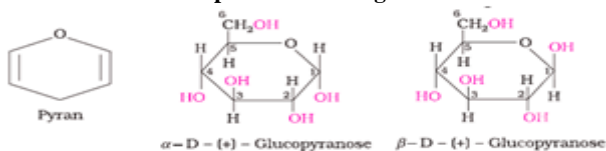


Glucose does not give Schiff's test and does not react with sodium bisulphite and NH_3 . Pentaacetyl glucose does not react with hydroxyl amine. This shows the absence of $-\text{CHO}$ group and hence the presence of ring structure.

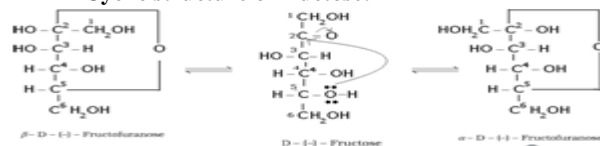
• **Cyclic structure of glucose:**



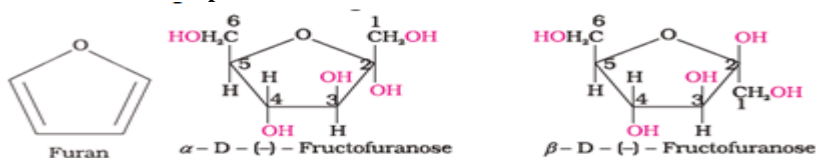
• **Haworth representation of glucose:**



• **Cyclic structure of fructose:**



• **Haworth representation of fructose**

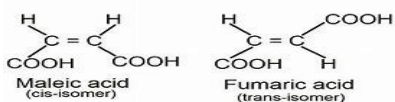


UNIT-3

SECTION-A

1. Give the structures of maleic acid and fumaric acid.

Structures of maleic and fumaric acid



2. Give the examples of addition and condensation polymers.

Condensation polymer:

Polyesters, polyamides, proteins and polysaccharides such as cellulose, are all examples of condensation polymers.

Addition polymer:

Ethylene \rightarrow polyethylene

Vinyl chloride \rightarrow polyvinylchloride (pvc)

3. How is Teflon produced?

Teflon is a plastic like substance which is produced by polymerizing tetrafluoroethylene ($\text{CF}_2 = \text{CF}_2$).

4. What is the Diels Alder Reaction?

The **Diels–Alder reaction** is the reaction between a conjugated diene and an alkene (dienophile) to form unsaturated six-membered rings. Since the reaction involves the formation of a cyclic product via a cyclic transition state, it is also referred to as a "cycloaddition".



5. What are polymers?

The large molecules formed by polymerisation are called polymers.

6. What is stereoisomerism?

Isomers which have same structural formula but have different relative arrangement of atoms or groups in space are called stereoisomers and the phenomenon is called stereoisomerism.

e.g maleic and fumaric acid.

7. What are diastereoisomers?

The compounds which have same molecular and structural formula but have different configurations, which are not mirror images

e.g maleic and fumaric acid

8. Mesotartaric acid is optically inactive-account for

Despite of containing two stereocenters (chiral centers) **meso**-tartaric acid is not chiral, because it is not stereospecific

9. What is the IUPAC name of Teflon?

Poly (1, 1, 2, 2-tetrafluoroethylene).

10. Why is pyridine basic?

Pyridine is more fundamental than pyrrole, since in pyridine and pyrrole lone pairs of electrons on N are different in nature. Hence, a H^+ ion or a Lewis acid can be conveniently transferred to the lone pair of electrons on the N atom in pyridine. The pyridine is also a better base than pyrrole.

11. What are the basic requirements for a compound to exhibit optical activity.

The basic requirements of optical activity is chirality. A molecule must be a chiral if it is to exhibit optical activity.

SECTION-B

1. what are chiral centre?

A **chiral centre** is an atom that has four different groups bonded to it in such a manner that it has a nonsuperimposable mirror image.

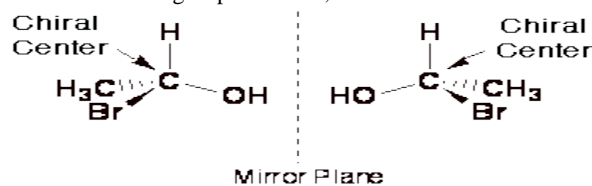
The term "chiral centre" has been replaced by the term **chirality centre**.

In the molecule below, the carbon atom is a chirality centre. But there are only three isomers.

The (S,R) and (R,S) isomers are a single **meso** compound because they are superimposable on each other. They are achiral because they have an internal plane of symmetry.

The most common chirality centres in organic molecules are sp^3 hybridized carbon atoms, because they can form four bonds.

It has four different groups attached, and the two structures are nonsuperimposable mirror images of each other.



Molecules with a single chirality centre are chiral.

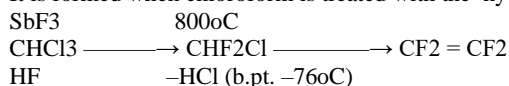
1. Explain the preparation properties of Teflon.

TEFLON:

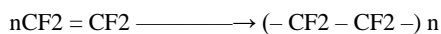
Teflon is a plastic like substance which is produced by polymerizing tetrafluoroethylene ($\text{CF}_2 = \text{CF}_2$). Polytetrafluoroethylene is also known as Teflon. It is a synthetic fluoropolymer of tetrafluoroethylene.

FORMATION:

It is formed when chloroform is treated with the hydrofluoric acid and antimony trifluoride.



when polymerised tetrafluoroethylene forms a material which plastic like on appearance and is called *Teflon*.



(Tetrafluoroethylene) (Teflon)

PROPERTIES :

- Teflon is one of the chemically inert substance.
- And It is not affected by strong acids which are chemically harmful and even after boiling aqua-regia.
- It has a melting point of 600 K (327 °C; 620 °F).
- It bears mechanical properties such as the degrade gradually at temperatures above 194 K.
- PTFE mainly consist of carbon-fluorine bonds and it also gains the properties from the bonds created only.
- It has a coefficient of friction that is 0.05 to 0.10 which is the third-lowest of any known solid material.

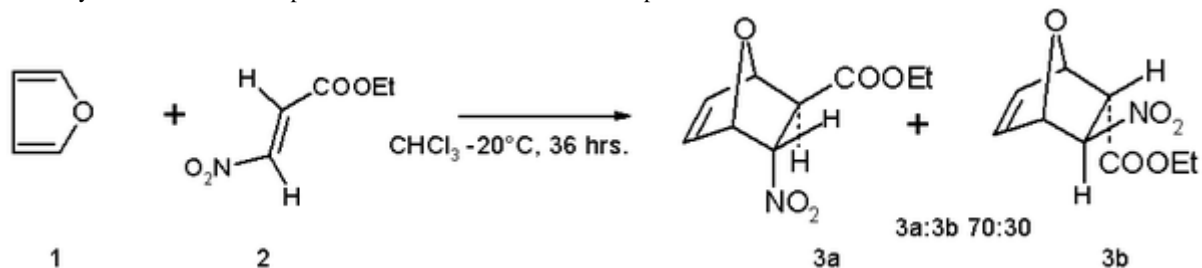
APPLICATIONS:

- PTFE is usually used to coat in the non-stick frying pans as it has the ability to resist high temperatures.
- IT is mostly used as a film interface patch for sports and medical applications, having a pressure-sensitive adhesive backing.
- It is widely used in medical synthesis, test and many more medicines.

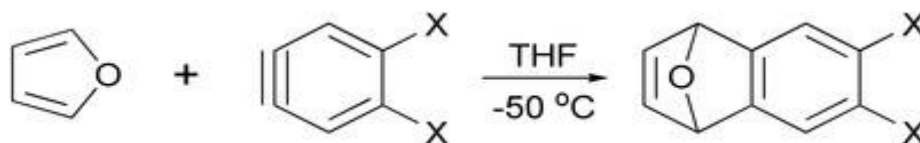
2. Explain about the furan.

Furan is aromatic because one of the lone pairs of electrons on the oxygen atom is delocalized into the ring, creating a $4n + 2$ aromatic system (see Hückel's rule) similar to benzene. Because of the aromaticity, the molecule is flat and lacks discrete double bonds. The other lone pair of electrons of the oxygen atom extends in the plane of the flat ring system.

- Furan serves as a diene in Diels-Alder reactions with electron-deficient dienophiles such as ethyl (*E*)-3-nitroacrylate.^[12] The reaction product is a mixture of isomers with preference for the *endo* isomer:



Diels-Alder reaction of furan with arynes provides corresponding derivatives of dihydronaphthalenes, which are useful intermediates in synthesis of other polycyclic aromatic compounds.^[13]



- Hydrogenation of furans sequentially affords dihydrofurans and tetrahydrofurans.
- In the Achmatowicz reaction furans are converted to dihydropyran compounds.
- Pyrrole can be prepared industrially by reacting furan and ammonia in the presence of solid acid catalysts, such as SiO₂ and Al₂O₃.^[14]

3. Write the properties, uses of Pyridine?

Pyridine is a heterocyclic compound which is colourless to yellow liquid with a chemical formula C₅H₅N. It is a basic heterocyclic organic compound. It is also known as *Azine or Pyridine*. The structure is like benzene, with one methine group replaced by a nitrogen atom. It has a sour, putrid, and fish-like odour.

It is *weakly basic* and is miscible with water. It is highly flammable and when inhaled or ingested it becomes toxic. Some of the symptoms, when exposed to pyridine, are nausea, asthmatic breathing, vomiting, headache, laryngitis, and coughing. It is widely used in the precursor to agrochemicals and pharmaceuticals. Also, it is used as an important reagent and organic solvent.

Properties

Pyridine and its simple derivatives are stable and relatively unreactive liquids, with strong penetrating odours that are unpleasant. Pyridine is the hydrogen derivative of this ring, it is benzene in which one CH- or methine group is replaced by a nitrogen atom. The structure of pyridine is completely analogous to that of benzene, being related by replacement of CH by N.

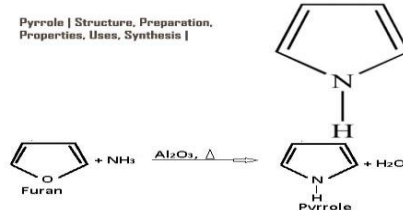
Uses :

- It is used in the chemical industries as a very important raw material
- It is used as an antiseptic in dental care products
- It is used as a solvent which is suitable for dehalogenation
- It is used in pharmaceuticals
- It is used for antifreeze mixtures as a denaturant
- It is used as a sulfonating agent
- It is used as a reducing agent
- It is used in dyes and paints
- It is used as a disinfectant
- It is used in coordination chemistry as a ligand.

4. Explain the preparation, properties of pyrrole.

Pyrrole, C₄H₅N:

- **Pyrrole** is an important five-membered heterocyclic compound because many naturally occurring substances contain the **pyrrole ring** e.g., chlorophyll, hemoglobin, and some of the alkaloids.



Properties:

- It is a colourless liquid.
- It is a weak base. It dissolves in cold dil. acids.
- When it is reduced with Ni and H₂ we get pyrrolidine or tetrahydropyrrole.
- When it is heated with methylene iodide in the presence of sodium methoxide, pyrrole ring expands giving pyridine.
- Pyrrole is aromatic.

SECTION-A

1. what are the two phases in the chromatographic techniques?

The two phases in the chromatographic techniques are mobile phase and stationary phase.

2. what are gels? give examples.

A gel is a jelly-like colloidal system in which a liquid is dispersed in a solid medium. When a hot solution of gelatin is cooled it sets to a semi-solid mass. Examples: jellies, gelatin, agar-agar, aluminium hydroxide etc.

3. What are emulsions? give examples.

An emulsion is a colloidal system in which both the dispersed phase and dispersion medium are liquids. An emulsion may be defined as a dispersion of finely divided liquid droplets in another liquid. Examples: milk, butter etc.

4. What is fluorescence and phosphorescence.

Both fluorescence and phosphorescence are chemical processes in which light absorption and emission occurs. The difference between fluorescence and phosphorescence is that fluorescence stops as soon as we take away the light source whereas phosphorescence tends to stay little longer even after the irradiating light source is removed.

5. Define chromatography.

Chromatography is a method by which a mixture is separated by distributing its components between two phases. The stationary phase remains fixed in place while the mobile phase carries the components of the mixture through the medium being used.

6. Define photosynthesis.

Photosynthesis is a process in which carbon dioxide, water and light energy are utilized to synthesize an energy-rich carbohydrate like glucose and to produce oxygen as a by-product.

7. What does TLC Rf value mean?

It is the ratio of distance travelled by a substance to distance travelled by a solvent front. Higher the Rf value lesser the polarity of the substance. Lower the Rf value higher is the polarity of the substance.

8. What is the major application of thin layer chromatography?

Separating multi-component pharmaceutical formulations is one of the major uses of TLC.

9. What is the major difference between Thin layer chromatography and paper chromatography?

The stationary phase used in paper chromatography is Cellulose filter paper containing water in its pore whereas in TLC the stationary phase used is Glass plate coated with silica gel.

SECTION-B

1. Discuss how a photochemical reactions differ from a thermal reaction.

- A photo chemical reaction is caused by exposure to light of suitable wavelength only.
- A photo chemical reaction does not depend upon temperature.
- The temperature co-efficient of a thermal reaction is generally very large as compared with that of a photochemical reaction.
- A thermal reaction is always accompanied by a decrease in free energy whereas a large number of photochemical reactions are accompanied by increase of free energy. (e.g) photosynthesis.

2. What is Column Chromatography?

Column chromatography is a technique which is used to separate a single chemical compound from a mixture dissolved in a fluid. It separates substances based on differential adsorption of compounds to the adsorbent as the compounds move through the column at different rates which allow them to get separated in fractions.

Principle:

Principle of involved in this technique is the separation of components by adsorption.

Applications:

- Column Chromatography is used to isolate active ingredients.
- It is very helpful in Separating compound mixtures.
- It is used to determine drug estimation from drug formulations
- It is used to remove impurities.
- Used to isolation metabolites from biological fluids

3..What is paper chromatography?.

Paper Chromatography consists of two phases: one mobile phase and one contiguous stationary phase. The stationary phase a paper and the mobile gas is solvent.

- Paper chromatography is a chromatography technique used to separate mixture of chemical substances into its individual compounds. Paper used in paper chromatography is made of cellulose.
- A suitable solvent (mobile phase) is moved along with a compound mixture through the paper according to the polarity and the degree of adhesion of each component on the stationary phase.
- The ratio of the distance that the compound travelled and the distance that the solvent travelled is denoted as R_f.

4.What are the advantages of paper chromatography?**Advantages:**

- Paper Chromatography requires very less quantitative material.
- Paper Chromatography is Cheaper compared to other chromatography methods.
- Both unknown inorganic as well as organic compounds can be identified by paper chromatography method.
- Paper Chromatography do not occupy much space.compared to other analytical methods or equipments.

SECTION-C**1.Explain the laws of photochemistryand its applications.****a).Lambert's law:**

When a beam of monochromatic radiation passes through a homogeneous absorbing medium,the rate of decrease of intensity of the radiation with thickness of absorbing medium is proportional to the intensity of the incident radiation.

b).Lambert-beer's law:

When a beam of monochromatic radiation is passed through a solution ,the rate of decrease of intensity of the radiation with the thickness of the solution is proportional to the intensity of incident radiation and the concentration of solution.

c).Grothus-Drapper law:

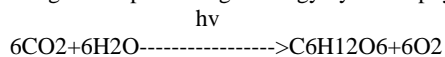
When light falls on matter ,it may be transmitted,reflected,refracted,scattered,or absorbed.There cannot be a photochemical reaction unless the radiation is absorbed.

d)Einstein's law :

Each molecule taking part in a photochemical reaction absorbs one quantum of radiation.

APPLICATIONS:**1.Photosynthesis:**

It occurs in visible light for which both the reactant carbon dioxide and water are transparent and takes place through absorption of light energy by chlorophyll.

**2.Photoelectric effect:**

When some metals absorb light,electrons are ejected from the metals.This is known as photo electric effect.

3.Photography:

When silver bromide is exposed to sun light,silver ion is reduced to silver which forms the negative of photography.

2.Write a short notes on emulsion.

An emulsion is a colloidal system in which both the dispersed phase and dispersion medium are liquids.An emulsion may be defined as a dispersion of finely divided liquid droplets in another.

Properties:

- Emulsions contain both a continuous and the dispersed with the boundary coming between the phases that are called "interface".
- Emulsions have a cloudy appearance due to many phase interfaces scattering light passing through the emulsions.
- Emulsions appear in white colour when the light is dispersed in equal proportions.
- If the emulsion is dilute, then higher-frequency and the low-wavelength type of light will be scattered in more fractions, and this kind of emulsion will appear in blue in colour. This is also referred to as the Tyndall effect.

Types:

1) Oil in water (O/W):

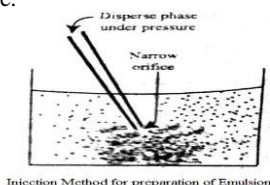
- In this type of emulsion, the oil will be the dispersed phase and water will be the dispersion medium. The best example for o/w emulsion is milk. In milk, the fat globules (which act as the dispersed phase) are suspended in water (which acts as the dispersion medium).

- **2) Water in oil (w/o):**

- In this type, water will be the dispersed phase and oil will be the dispersion medium. Margarine (a spread used for flavouring, baking and working) is an example of water in oil emulsion.

Preparation:

An emulsion is a dispersion of one liquid into another liquid in the form of small globules. Emulsions are generally prepared by dispersion methods. Most emulsions are prepared by mixing the two liquids along with a suitable emulsifier and then passing the mixture through a colloid mill or a similar appliance. One of the liquids, mainly decided by the emulsifier, is broken down by the shearing forces into small globules and an emulsion results. The continental method is used to prepare the initial or primary emulsion from oil, water, and a hydrocolloid or "gum" type emulsifier (usual acacia). It can either be oil-in-water (O/W) or water-in-oil (W/O), depending on whether the continuous phase is the water or the oil, respectively. In other methods, the liquid to be dispersed is forced through a narrow capillary and injected directly into the dispersion medium containing the emulsifier as shown in Figure.



Under the pressure in the nozzle, the dispersed phase is broken down into small globules giving rise to an emulsion. The emulsifier could also be dissolved in the dispersed phase. The most common example of the emulsion is milk where small fat globules are dispersed in water, protein brings the principle stabilizer.

Applications:

- Usually used in cosmetics, pharmaceuticals, personal hygiene.
- Microemulsions are used to deliver vaccines to kill various microbes.
- It is used in chemical synthesis mainly in the manufacture of polymer dispersions.
- It is used in firefighting.
- Nanoemulsions such as soybean oil are used to kill microbes.

3..Write a note on gels.

A gel is a jelly-like colloidal system in which a liquid is dispersed in a solid medium. When a hot solution of gelatin is cooled it sets to a semi- solid mass.

Examples: jellies, gelatine, agar-agar, aluminium hydroxide etc.

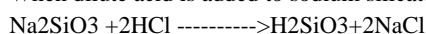
Preparation:

1) by cooling: Gels are prepared by dissolving them in hot water and allowing the solution to cool.

2) by coagulation: Adding a coagulating agent to the colloidal solution gives a gel. Gels of $\text{Al}(\text{OH})_3$ and $\text{Fe}(\text{NO})_3$ may be prepared by adding salts as coagulating agents to their solutions.

3) by double decomposition:

When dilute acid is added to sodium silicate, silicic acid is obtained.



4) by exchange of solvent: Gels may be formed by changing suddenly the solvent in which the substance is insoluble.

Classification: Dry gels are called xerogels. (examples) gelatin sheets and cellophane. Gels are classified in to two types: elastic gels, non-elastic gels.

Properties: Hydrations, swelling, syneresis, thixotropy.

Applications:

- It can be used as a dehydrating agent.

- It is used in laboratories for making liquid junctions in electrochemistry.
- Curds and eatable jellies are forms of gels.
- Protected gels are used in food preparations.
- Boot polishes and animal tissues have gel structures.

4. What Is Thin Layer Chromatography?

Thin Layer Chromatography is a technique used to isolate non-volatile mixtures. The experiment is conducted on a sheet of aluminium foil, plastic, or glass which is coated with a thin layer of adsorbent material. The material usually used is aluminium oxide, cellulose, or silica gel.

On completion of the separation, each component appears as spots separated vertically. Each spot has a retention factor (R_f) expressed as:

$R_f = \frac{\text{dist. travelled by sample}}{\text{dist. travelled by solvent}}$

The factors affecting retardation factor are the solvent system, amount of material spotted, adsorbent and temperature. TLC is one of the fastest, least expensive, simplest and easiest chromatography technique

Principle

Thin layer chromatography (TLC) depends on the separation principle. The separation relies on the relative affinity of compounds towards both the phases. The compounds in the mobile phase move over the surface of the stationary phase. The movement occurs in such a way that the compounds which have a higher affinity to the stationary phase move slowly while the other compounds travel fast. Therefore, the separation of the mixture is attained. On completion of the separation process, the individual components from the mixture appear as spots at respective levels on the plates.

Procedure: components required

1. Thin Layer Chromatography Plates – ready-made plates are used which are chemically inert and stable. The stationary phase is applied on its surface in the form of a thin layer. The stationary phase on the plate has a fine particle size and also has a uniform thickness.
2. Thin Layer Chromatography Chamber – Chamber is used to develop
3. develop plates. It is responsible to keep a steady environment inside which will help in developing spots. Also, it prevents the solvent evaporation and keeps the entire process dust-free.
4. Thin Layer Chromatography Mobile phase – Mobile phase is the one that moves and consists of a solvent mixture or a solvent. This phase should be particulate-free. The higher the quality of purity the development of spots is better.
5. Thin Layer Chromatography Filter Paper – It has to be placed inside the chamber. It is moistened in the mobile phase.

APPLICATIONS:

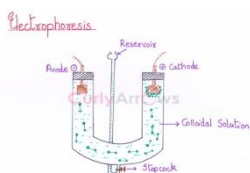
- The qualitative testing of Various medicines such as sedatives, local anaesthetics, anticonvulsant tranquilisers, analgesics, antihistamines, steroids, hypnotics is done by TLC.
- TLC is extremely useful in Biochemical analysis such as separation or isolation of biochemical metabolites from its blood plasma, urine, body fluids, serum, etc.
- Thin layer chromatography can be used to identify natural products like essential oils or volatile oil, fixed oil, glycosides, waxes, alkaloids, etc
- It is widely used in separating multicomponent pharmaceutical formulations.
- It is used to purify of any sample and direct comparison is done between the sample and the authentic sample
- It is used in the food industry, to separate and identify colours, sweetening agent, and preservatives
- It is used in the cosmetic industry.
- It is used to study if a reaction is complete.

5. Explain about the electrophoresis.

The colloidal particles carry specific charge. When current is passed through colloidal solution the colloidal particles migrate and when the dispersion medium does not migrate the phenomenon is known as electrophoresis.

Burton tube experiment:

The colloidal solution is taken in a U tube such that level in the two limbs are same. Two platinum electrodes are dipped in electrolytic solution. When current is passed, the colloidal particles move towards the electrodes. The charge of the particles can be ascertained from the direction of the movement of the boundary.



Applications:

Electrophoresis is an important industrial process. It is useful.

- To classify colloids as positive or negative colloids.
- For the removal of smoke from chimney gases.
- For the removal of suspended impurities.
- Electro-deposition of rubber on metal surfaces from latex

UNIT-5 SECTION-A

1. Define pH

pH is a measure of hydrogen ion concentration, a measure of the acidity or alkalinity of a solution. The pH scale usually ranges from 0 to 14. Aqueous solutions at 25°C with a pH less than 7 are acidic, while those with a pH greater than 7 are basic or alkaline

2. State Kohlrausch's law.

Kohlrausch's law states that the equivalent conductivity of an electrolyte at infinite dilution is equal to the sum of the conductances of the anions and cations.

3. State Ostwald's dilution law

It relates the dissociation constant of the weak electrolyte with the degree of dissociation and the concentration of the weak electrolyte. $K_a = \text{dissociation constant of weak acid}$, $\alpha = \text{degree of dissociation}$. **Ostwald's dilution law** states that the weak electrolyte undergoes complete ionisation at infinite dilution only.

4. Define specific conductivity.

Specific conductivity (better known as conductivity) is the **measure of the ability of that material to conduct electricity**. It is represented by the symbol " κ ".

5. Define equivalent conductivity.

It is defined as the **conducting power of all the ions produced by dissolving one gram equivalent of an electrolyte in solution**. where C is the concentration in gram equivalent per litre (or Normality). This term has earlier been quite frequently used.

6. What is cell constant?

cell constant. [$sel, k\ddot{a}n\cdot st\ddot{a}nt$] (physical chemistry) **The ratio of distance between conductance-titration electrodes to the area of the electrodes**, measured from the determined resistance of a solution of known specific conductance.

SECTION-B

1. Explain about the Kohlrausch's law.

Kohlrausch's law of independent migration of ions:

At infinite dilution, each ion migrates independently of its co-ion and makes its own contribution to the total molar conductivity of an electrolyte irrespective of the nature of other ion with which it is associated.

Thus, $\Lambda_0 = \lambda_+ + \lambda_-$

Here,

Λ_0 = the molar conductivity of the electrolyte at zero concentration

λ_+ = the molar conductivity of cation at zero concentration

λ_- = the molar conductivity of anion at zero concentration

For example, $\Lambda_0(HCl) = \lambda_0(H^+) + \lambda_0(Cl^-)$

Here,

$\Lambda_0(HCl)$ = the molar conductivity of HCl at zero concentration

$\lambda_0(H^+)$ = the molar conductivity of protons at zero concentration
 $\lambda_0(Cl^-)$ = the molar conductivity of chloride ions at zero concentration

2. Explain about the Ostwald dilution law.

Ostwald's dilution law relates the dissociation constant of the weak electrolyte with the degree of dissociation and the concentration of the weak electrolyte.

$$Ka = \frac{c\alpha^2}{1-\alpha}$$

Ka = dissociation constant of weak acid

α = degree of dissociation.

Ostwald's dilution law states that the weak electrolyte undergoes complete ionisation at infinite dilution only.

3. Explain the application of Kohlrausch's law.

(i) **Determination of conductance for weak electrolytes** : The molar conductivity of a weak electrolyte at infinite dilution cannot be determined by extrapolation method.

(ii) **Determination of the degree of ionisation of a weak electrolyte**:

Kohlrausch's equation the degree of ionisation at any concentration can be determined.

(iii) **Determination of the ionisation constant of a weak electrolyte** : Weak electrolytes in aqueous solutions ionise to a very small extent. Such an equilibrium can be described by a constant called **ionisation constant**.

(iv) **Determination of the solubility of a sparingly soluble salt** : The solubility of a sparingly soluble salt in a solvent is quite low.

The molar concentration of the sparingly soluble salt in its saturated solution The solubility of the salt in gram per litre units can be obtained by multiplying with the molar mass of the salt.

4. Explain the limitations of Ostwald dilution law.

The law holds good only for weak electrolytes and fails completely in the case of strong electrolytes. The value of ' α ' is determined by conductivity measurements by applying the formula Λ/Λ^∞ . The value of ' α ' determined at various dilutions of an electrolyte when substituted in gives a constant value of K only in the case of weak electrolytes like CH_3COOH , NH_4OH , etc. the cause of failure of Ostwald's dilution law in the case of strong electrolytes is due to the following factors"

(i) The law is based on the fact that only a portion of the electrolyte is dissociated into ions at ordinary dilution and completely at infinite dilution. Strong electrolytes are almost completely ionized at all dilutions and Λ/Λ^∞ does not give accurate value of ' α '.

(ii) When concentration of the ions is very high, the presence of charges on the ions appreciably effects the equilibrium. Hence, law of mass action its simple form cannot be strictly applied in the case of strong electrolytes.

5. Explain the importance of P^H

- 1. Soils of specific pH are required for optimum crop growth and better yields of crops.
- Specific pH values are to be maintained for the biological process and industrial process to occur.
- Specific pH is also to be maintained by the blood.
- PH plays an important role in chemical analysis.

6. Write the importance of buffer solution.

- Blood as a Buffer Solution. Blood itself tends to be a buffer solution by keeping its pH value.
- Role of Buffers in Human Body. Reactions inside the human body take place in the blood plasma.
- The importance of Buffer Solutions to Human Body.
- The action of Buffers in Blood Plasma.

SECTION-C

1. What are advantages and disadvantages of the conductometric titration?

Advantages:

- This process is very useful in the titrations of very dilute solutions and weak acids.

- The end-point of this method of titration is very sharp and accurate when compared to a few other titration processes.
- This type of titration is applicable for solutions that are coloured or turbid, and for which the endpoint of the titration with normal indicators cannot be observed easily by the human eye.
- Conductometric titration has numerous applications in acid-base titrations, redox titrations, precipitation titrations, and complex titrations.

Disadvantages :

1. Only a few specific redox titrations can be done with the help of this process. This is because the conductivity of the solution is masked by relatively high hydronium ion concentration.
2. The accuracy of conductometric titration is low when the concentrations of the electrolyte are high, making the titration process unsatisfactory.

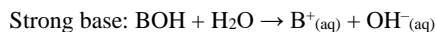
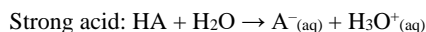
2.Explain about the Conductometric Titration :

strong acid and strong base:

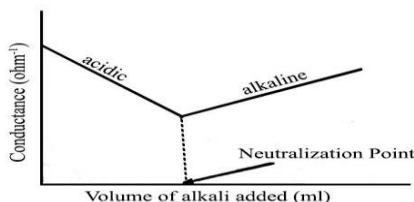
Strong Acid is an acid that is totally ionized in aqueous solution. This means when the strong acid is positioned in a solution such as water, all of the strong acids will detach into its ions, as contrasting to a weak acid.

Strong Base is a base that is totally ionized in aqueous solution. This means when the strong base is positioned in a solution such as water, all of the strong bases will detach into its ions.

In water, one mole of a strong acid HA dissolves yielding one mole of H⁺ (as hydronium ion H₃O⁺) and one mole of the conjugate base, A⁻. Fundamentally, none of the non-ionized acid HA remains.

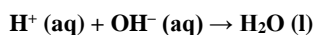
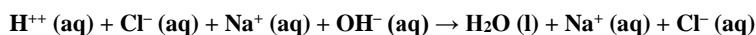


An example of this would be the titration of hydrochloric acid (strong acid) and sodium hydroxide (strong base) to



form sodium chloride and water.

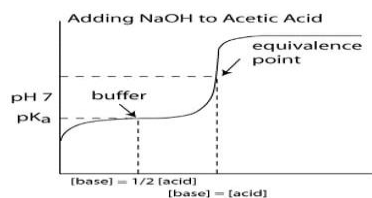
Let us consider the titration of a solution of HCl by NaOH solution. Before NaOH is added, the conductance is high due to the existence of highly mobile hydrogen ions. The net reaction in this neutralization reaction is the production of water from H⁺ and OH⁻. The neutralization reaction is



However, H⁺ ion of the acid is gradually replaced by Na⁺ as NaOH is added to the acid solution. Since the ionic conductance of H⁺ is much higher than that of Na⁺ there will be a decrease in the conductance as the addition of NaOH continues. This will go on until all the acid is neutralized.

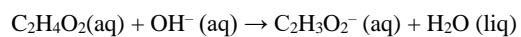
weak acid and strong base:

. For conductometric titration experiments, a known volume of the solution to be titrated is placed in a beaker and a conductivity cell dipped into it. The conductivity cell is now connected to one end of the Wheatstone's bridge.



Let us consider that ethanoic acid is titrated against NaOH. The initial conductance of the acid solution is very low because of the low ionization of the weak acid. However, as NaOH is gradually added to the acid solution a salt, CH_3COONa , will be formed which ionizes readily to form Na^+ and CH_3COO^- ions.

The titration of a weak acid with a strong base involves the direct transfer of protons from the weak acid to the hydroxide ion. The reaction of the weak acid, acetic acid, with a strong base, NaOH, can be seen below. In the reaction the acid and base react in a one to one ratio.



In a titration of a Weak Acid with a Strong Base the titrant is a strong base and the analyte is a weak acid.