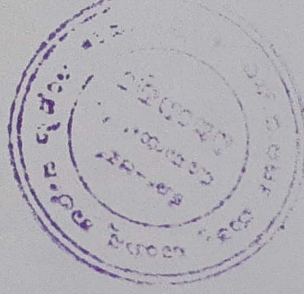


B.L.D.E. Association's

**S. B. Arts & K.C.P. Science College,
VIJAYAPUR- 586 103.**



ASSIGNMENT

For B.A./ B.Sc.^{II} Semester
2021 - 2022

Name of the Student Radhika . M. Halli

Roll No. 446 R.C.U. Seat No. U15KMJISQJH

Subject Chemistry [OEC]

Assignment No.	Date	Marks Assigned	Marks Obtained	Name and Signature of Teacher	Remarks
1	25-08-22	08	08		
2					
3					
4					

ASSIGNMENT -01

- 1 Explain mechanism and factors affecting Enzymes action.

Mechanism of Enzyme action

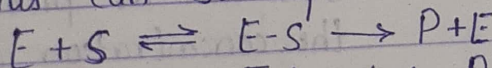
The scheme for Enzyme action is suggested by Arrhenius. According to this, the substrate combines with an Enzyme making intermediate complex having lower Energy reaction pathway and is more reactive. From this complex, products and free Enzyme is formed.

Mechanism

Step 1: A molecule of Enzyme, say E combines with substrate say S forming an intermediate complex E-S, having lower activation Energy (ΔE) and E-S complex is more reactive.

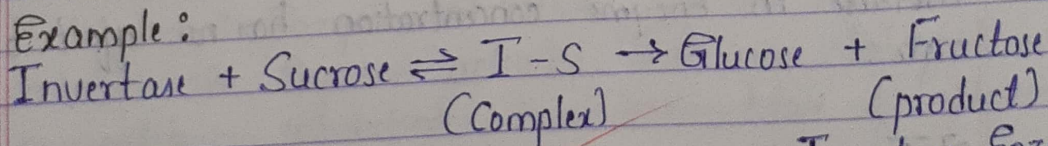
Step 2: The E-S complex involves the information of product, which release from the surface of the Enzyme having behind the free Enzyme.

This can be represented as follows -



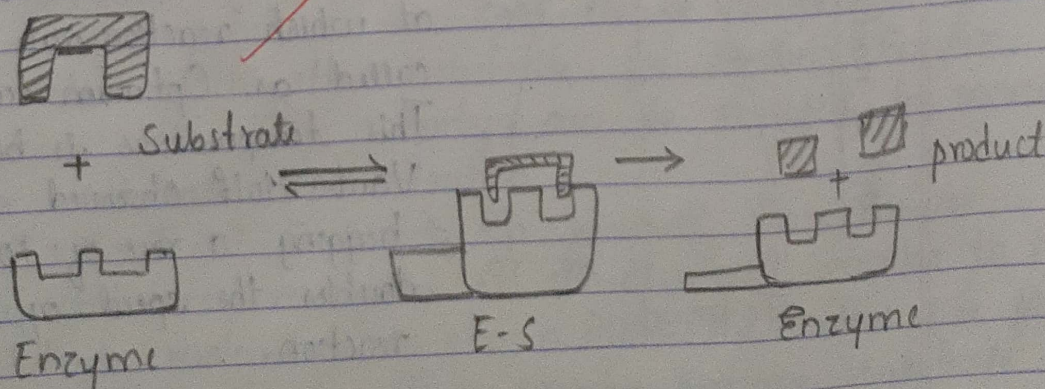
Enzyme substrate Intermediate Product Enzyme
Complex

Example:



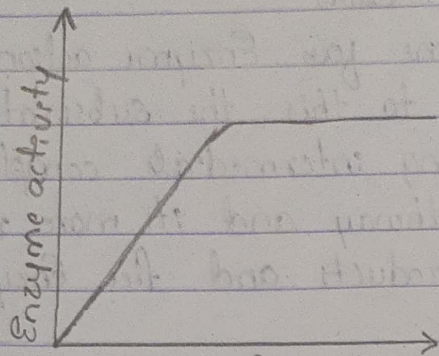
Invertase Enzyme

This can be dramatically presented as follows -



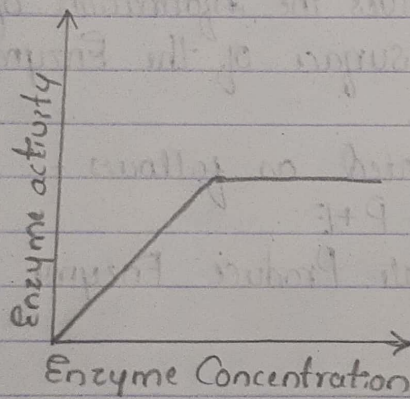
Factors affecting Enzyme action:

1. Substrate Concentration:



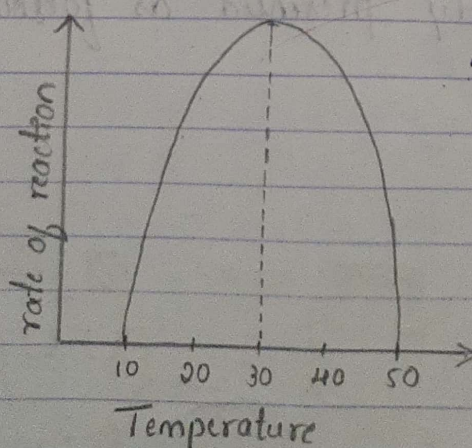
The concentration of substrate has influence on the rate of reaction. The rate of reaction increases as substrate concentration increases upto a certain level once the Enzyme is saturated with substrate the concentration of substrate has no effect on reaction rate.

2] Enzyme Concentration:

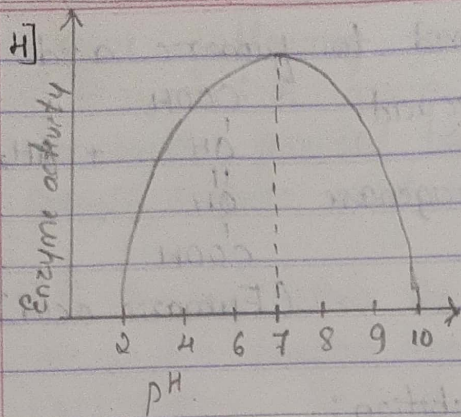


Enzyme concentration has Effect on reaction rate. If an Excess substrate is present by doubling the concentration of Enzyme reaction rate doubles only in the initial stage one the substrate is saturated with Enzyme molecules. Further increase in Enzyme concentration has no effect on reaction rate.

3] Temperature



As temperature increase rate of reaction increases. The temperature at which reaction rate is maximum called as Optimum temperature. This temperature is between 20-40°C. Vant Holf observed that in the begging a rise of 10°C - temperature doubles the speed of an Enzyme reaction.



Due to protein nature of Enzymes, pH (i.e. H^+ ion concentration) has influence on enzyme activity. At certain pH range enzyme show max activity i.e. pH is called as optimum pH . For most of Enzymes it's 7 to 9. In the figure it is shown that Enzyme

activity is dropped rapidly by increasing or lowering pH by 2 units.

5] Activators :- The activity of Enzymes is influenced by presence of metal ions as cofactors.

Ex:- Activity of leucyl peptidase is activated by Mg or Mn. Aramase requires Co or Mn or Fe.

6] Inhibitors :- Certain reagents inhibit Enzyme activity are called inhibitors. Presence of inhibitors decrease the Enzyme activity.

Q] What is inhibition? Explain the types with suitable Example?

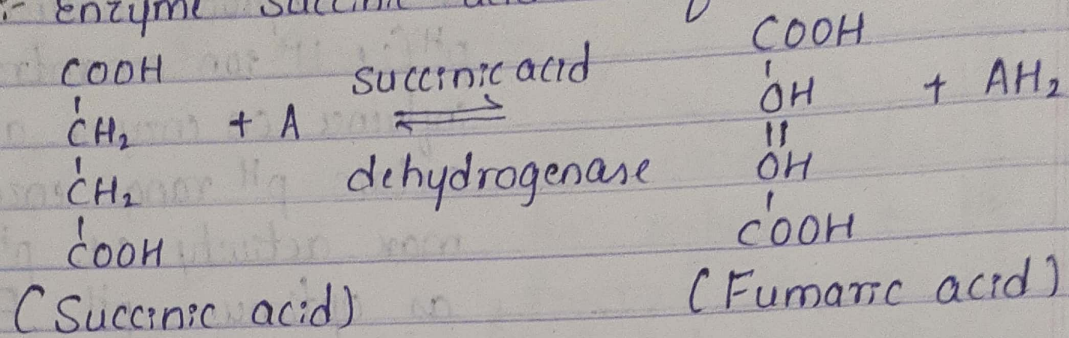
Inhibition :- Enzyme inhibitors are the molecules that inhibit the Enzyme activity. They are classified as competitive inhibition, non-competitive & allosteric inhibitors.

1] Competitive Inhibitors:

An inhibitors is said to be competitive. If it competes with the substrate for binding Enzyme, active site. Its activity can be reversed by increasing the substrate concentration.

$\text{E} + \text{S} + \text{I} \rightleftharpoons \text{E} + \text{I} \rightarrow \text{No product}$ through Enzyme
The inhibitors molecules is structurally similar to the substrate molecule, so it occupies the active site for substrate molecule. Thus no Enzyme substrate formed to no reaction, product.

Ex:- Enzyme succinic acid to fumaric acid:

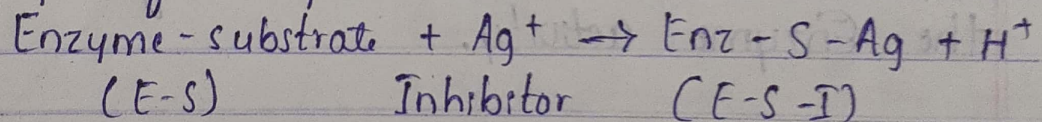


2) Non - Competitive inhibition:

In this type inhibitor occupies the site of Enzyme other than active site so, substrate can bind at active site. Hence chance of producing E-S and E-SI complex is there.

* The inhibitor occupying other site of Enzyme reduces the efficiency of Enzymes to produce product. So whether active site occupied substrate or not turn over no. of Enzyme is decreased.

Ex:- Heavy metal ions like Ag^+ , Hg^{+2} , Pb^{+2} inhibit the activity of Enzymes.



2) CN^- , H_2S inhibit action of Enzyme containing iron like catalase and peroxidase.

3) Allosteric inhibition:

* Here the inhibitor molecule binds at the allosteric site of Enzyme other than active site.

* It is similar to non-competitive inhibitors but not same.

* Here attaching of inhibitors at allosteric site causes conformation changes and decreases activity of Enzymes.

* This is also called as "Feed back inhibition".

3] Define following terms:

a] Enzymes :- A group of complex proteinoid organic compounds, provided by living organisms which catalyze specific organic reactions are called Enzyme.

b] Co-Enzyme :- When the co-factor of an Enzyme is a non-protein organic molecule the cofactor is known as Co-Enzyme. Ex :- B Group of Vitamin.

c] Co-factor :- The non-protein part of an Enzyme is called a Cofactor. Ex :- Metal ions as Mg^{2+} , Zn^{2+} , etc.

d] Activators :- In case the cofactor of an Enzyme molecule is a metal ion such as Fe^{2+} , Mg^{2+} , Cu^{2+} , K^+ , Na^+ , Zn^{2+} . The Cofactor is known as an activator.

e] Active site :- The part of an Enzyme where are the Events of the catalytic process occur is called as its active site.

f] Apo Enzyme :- The protein part of an Enzyme molecule is known as apoEnzyme.

g] HoloEnzyme :- The combination of an apoEnzyme and the cofactor is known as Holoenzyme.

h] Inhibitors :- Certain reagents inhibits Enzyme activity are called Inhibitors.

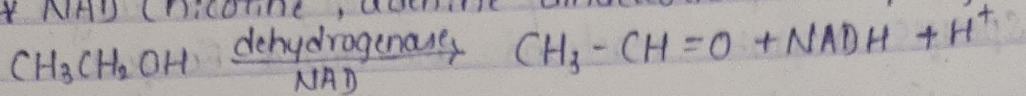
4] What is difference between Co-Enzymes and Co-factors?

CoEnzyme	Cofactor
* When the cofactor of an Enzyme is non protein organic molecule is known as CoEnzyme.	* The non protein part of an Enzyme is called Co-factor.
* Can be removed from the Enzyme Easily.	* Can only be removed by denaturing the Enzyme.
* Serves as carries to the Enzyme.	* Increase the rate of the reaction that is catalysed by the Enzyme.

5] Explain the importance of

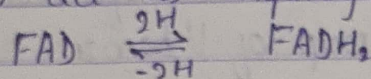
a. Co-Enzymes & Co-factors

* NAD (nicotine, adenine dinucleotide) as hydrogen acceptor.



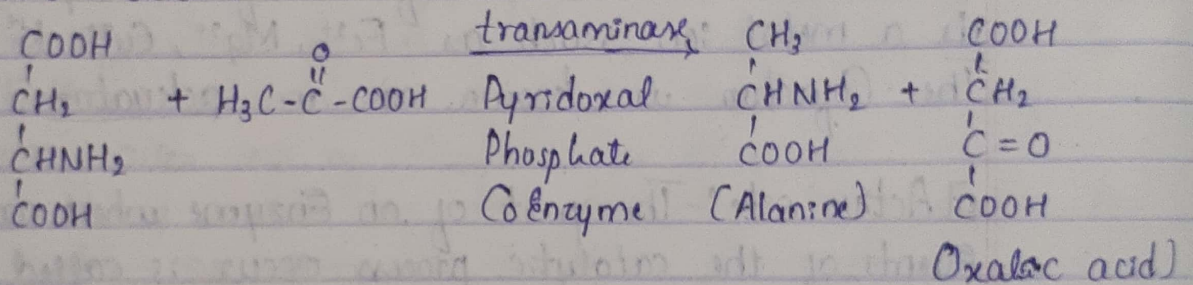
* Flavin adenine dinucleotide (FAD):

FAD act as hydrogen acceptor



* As decarboxylate and transaminase:

The transaminase catalyse the transfer of an amino group from amino acid to corresponding keto acid form of other amino acids.



b. Enzyme Inhibition

* Understanding regulations of Enzyme activity in living cells.

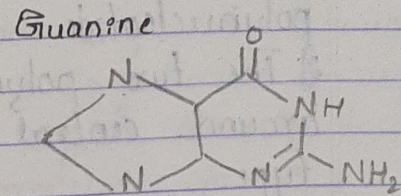
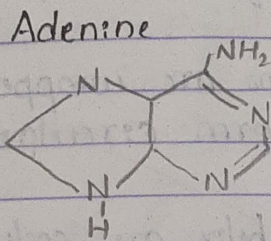
* In identifications of catalytic or functional group present at the active site.

* In studying mechanism of Enzymes catalytic activity.

* They find applications in the Therapeutic use like to treat patients who injected methanol inhibition technique is used.

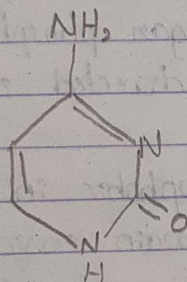
* Methanol reacts with Enzyme alcohol dehydrogenase producing formaldehyde, which is lethal. So to avoid formaldehyde formation from methanol, Ethanol is inserted into or nervously and methanol is Exacted harmlessly through urine.

6] Write the structure of purines and pyrimidines:
Structures of Purines

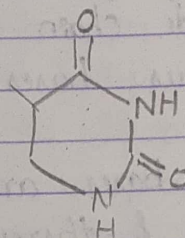


Structures of Pyrimidines

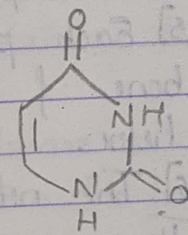
Cytosine



Thymine



Uracil



7] Write Nucleosides and Nucleotides of RNA & DNA:

Nucleic acid	Base (Nucleobase)	Nucleoside	Nucleotide (Given for a nucleoside - 5' - monophosphate)
<u>RNA</u>	Adenine (A)	Adenosine	Adenosine - 5' - monophosphate or adenylylate (AMP)
	Cytosine (C)	Cytidine	Cytidine - 5' - monophosphate or Cytidylylate (CMP)
	Guanine (G)	Guanosine	Guanosine - 5' - monophosphate or guanylylate (GMP)
	Uracil (U)	Uridine	Uridine - 5' - monophosphate or Uridylylate (UMP)
<u>DNA</u>	Adenine (A)	Deoxyadenosine	Deoxyadenosine - 5' - monophosphate or deoxyadenylylate (dAMP)
	Cytosine (C)	Deoxycytidine	Deoxycytidine - 5' - monophosphate or deoxycytidylylate (dCMP)
	Guanine (G)	Deoxyguanosine	Deoxyguanosine - 5' - monophosphate or deoxyguanylylate (dGMP)
	Thymine (T)	Deoxythymidine	Deoxythymidine - 5' - monophosphate or deoxythymidylylate (dTMP)

8] Describe Watson and Crick model of DNA?

1] The double helix comprises of two complementary polynucleotide chains.

2] The two polynucleotide chains are wrapped clockwise around central axis to form circular staircase type.

3] The two strands of double helix are coiled. They run in opposite direction one strand is aligned in $5' \rightarrow 3'$ direction and other chain is aligned in $3' \rightarrow 5'$ direction.

4] Each phosphate group give the molecule negative charge.

5] Each polynucleotide chain has sugar phosphate backbone & nitrogenous bases are directed inside the helix.

6] The nitrogenous bases are hydrophobic in nature. They avoid water & therefore remain inside helix.

7] The nitrogenous base lie almost perpendicular to the axis of molecule. Therefore these are stacked one on top of another.

8] The diameter of double helix is 2nm .

9] The nitrogenous bases of two antiparallel polynucleotide strands are linked through hydrogen bonds. There are two hydrogen bonds between adenine & thymine & three hydrogen bonds between guanine & cytosine.

10] There are ten base pairs in one turn helix. Therefore Each turn of helix is 3.4nm .

11] The double helix has two helical group is a major groove which is deep & wide & major minor groove which is shallow & narrow.

9] Give the classification of amino acids as Essential and non-Essential with Examples?

Classification of Amino Acids:-

1] Essential amino acids :- As the name suggests Essential amino acids cannot be synthesised by the body and it has to be acquired through food.

Deficiency : illness and hormonal imbalance.

* There are 9 amino acids all of 20 are thought to be Essential.

* Source :- Essential amino acids acquired through food. Such as soya, Chicken, Egg, meat or vegetable.

* Function :- Serves to build & repair muscle tissue also it forms precursor molecules for the formation of neurotransmitters in the brain.

* Ex :- Histidine, leucine, lysine, methionine, Valine, tryptophan.

9] Non-Essential Amino Acids :- Non-Essential Amino Acids need not to be taken in through diet as they can be produced by the body.

* There are 11 of the 20 amino acids are non-Essential.

* Sources :- Sources are produced within the body from other amino acids and other components.

* Function :- Removal of toxins, integral in the synthesis of RBC & WBC. Promotes brain function & many more.

Deficiency : Probability of deficiency is rare but can still occur due to starvation.

Ex :- Alanine, Arginine, Asparagine, Aspartic acid, Cysteine, Glutamic acid & Glutamine, Glycine.

10] Write the structure of proteins with Examples?

Proteins have a complex 3-dimensional structure.

It is studied step by step as follows:

1] Primary Structure :- The primary structure of a protein refers to the number and the sequence of amino acids in a polypeptide chain. The amino acid sequence in many proteins have been determined & following observations have been made.

a] A protein may contain more than one amino acid chain.

b] Sequence of amino acids in the proteins is essentially random.

c] Small variations in the sequence of amino

acid have pronounced effects on the properties of protein.

a) Infrared spectra exhibit absorption characteristic of amides. The X-Ray diffraction studies have revealed that the amide portion of the peptide chain is planar.

2] Secondary Structure :- The Secondary Structure of a protein refers to the shape in which long amino chains exist. X-Ray crystallographic study showed that the peptide backbone could fold itself in two conformations (i) α -helix (ii) β -Structure

In the α -helix structure of coil or helix is formed by twisting the backbone of a polypeptide chain in such a way that each amide group is hydrogen-bonded to the amide group which is the third one from it in either direction along the chain as shown below.

In the β -Structure, the polypeptide chains aligned in a sheet-like arrangement and the chains are held together by intermolecular hydrogen bonds having rippled or pleated edge as shown below.

3] Tertiary Structure :- Tertiary Structure refers to the intramolecular folding of polypeptide chain into a compact, three-dimensional structure with a specific shape. The tertiary structure is far more complex than primary and secondary because the polypeptide chains of proteins are not arranged along one axis but involves irregular and compact folding to give a three dimensional structure. The tertiary structure is maintained by electrovalent linkages, hydrogen bonds, disulphide bridges, Vanderwaals forces and hydrophobic interactions, Hydrophobic

interactions are major forces in maintaining the unique tertiary structure of a protein.

The tertiary structures of proteins have been elucidated by X-ray analysis, viscosity measurement, diffusion, light scattering, ultracentrifuge and neuromicroscopy.

4] Quaternary Structure:- The Quaternary structure is usually determined by X-Ray crystallography. Association of several protein chains or composed of combining many polypeptide chains and there Each sub units are closely packed arrangement. Any alteration in the structure of subunits causes marked changes in biological activity and if forms and structure with the compact combination.

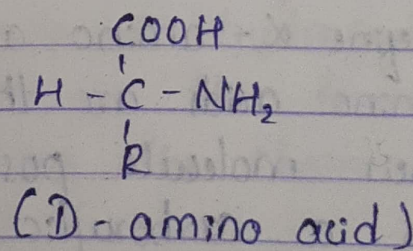
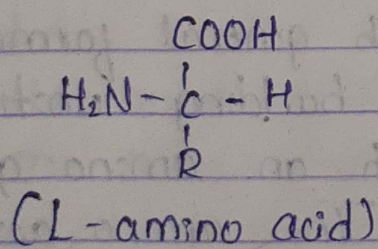
11] Define α -amino acids with general formula.
Amino acids are the basic building units of proteins. Their molecule possess both an amino group as well as a carboxylic group. The amino acids having amino & carboxyl group attached to the same carbon i.e. alpha carbon atom is called as alpha-amino acids.

Ex of α -amino acids are Glycine, Alanine etc.
General formula is $R-H(NH_2) - COOH$.

12] Explain configuration of optically active α -amino acids found in proteins!
Proteins are made of twenty types of amino acids. Both one and three letter abbreviation for Each amino acid can be used to represent the amino acids in peptides.

* Except glycine, all amino acids have asymmetric carbon so they are optically active.

- * Some amino acids are dextrorotatory & some are leorotatory depending upon the rotation of plane polarized light towards right or direction respectively.
- * D-amino acids found in some proteins produced by Exotic sea dwelling organisms.
- * L-amino acids represent the vast majority of amino acids found in proteins.
- * Most naturally occurring amino acids have a L- Configuration.
- * L-amino acids are represented by writing the $-NH_2$ group on the left hand side.



Assignment - 02

I Answer the following questions.

1. What are reducing and non reducing sugars?

Reducing Sugars :- These are carbohydrates that can act as reducing agent due to the presence of free aldehyde groups or free ketone groups.

Ex:- Monosaccharides & disaccharides.

Non-Reducing Sugars:- These are carbohydrates that cannot act as reducing agent due to the absence of free aldehyde group (or) free ketone groups.

Ex:- Polysaccharides.

2. Write the general formula of triglycerides?

3. What is Genetic Code?

The genetic code is the set of rules by which information encoded in genetic material is translated into proteins by living cells.

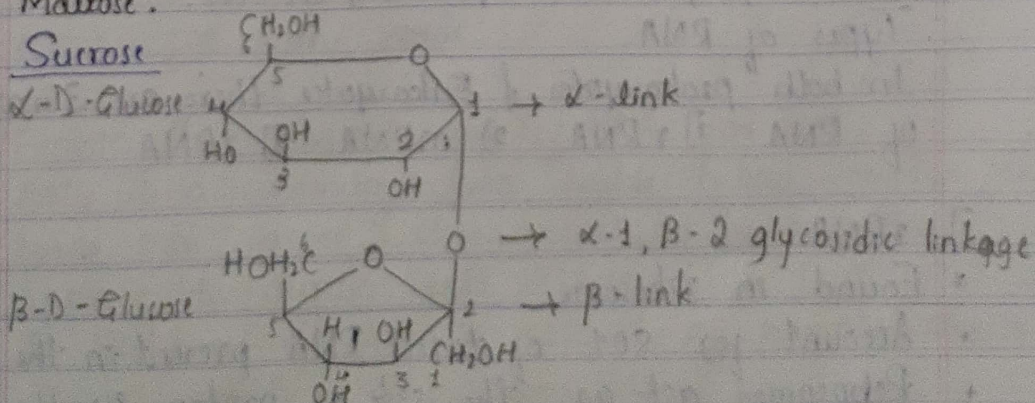
4. Give the methods to prevent rancidity of oils and fats.

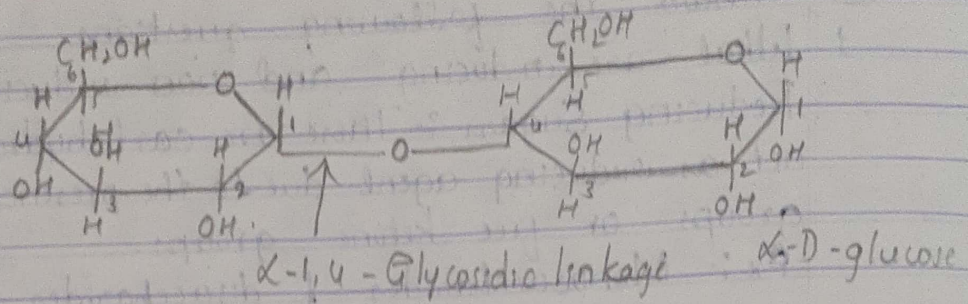
- * Avoiding the Exposure to air, light and moisture.
- * Partial hydrogenation also reduces oxidative rancidity.
- * Hydrolytic rancidity is very common in butter, can be prevented by refrigeration and pasteurization.

II Answer the following questions.

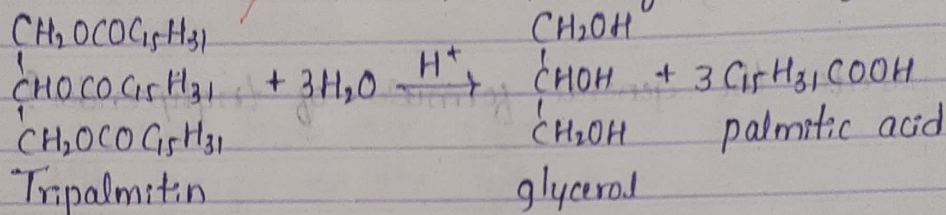
5. Explain glycosidic linkage with structure in Sucrose and Maltose.

Sucrose

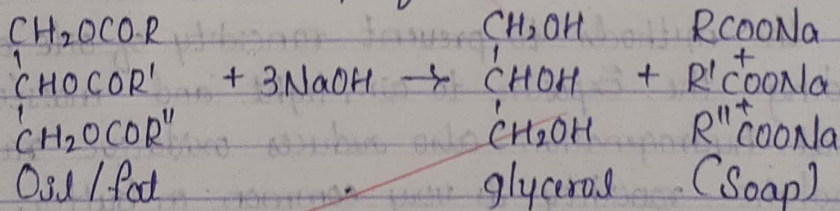




- 6] Explain Saponification and Acid hydrolysis of oils & fats.
Acid Hydrolysis: Oils and fats can be hydrolysed to glycerol and mixture of fatty acids by action of acids is called Acid hydrolysis of oils and fats.



Saponification: The hydrolysis of oils and fats can be carried out by action of alkalis, then glycerol & mixture of alkali salts of fatty acid is formed. This process is called as Saponification.



7. Write a note on RNA and it's types.

RNA or Ribonucleic acid is a polymer of nucleotides which is made up of a ribose sugar, a phosphate, & bases Adenine, Guanine, cytosine, Uracil.

Types of RNA.

In both prokaryotes & Eukaryotes, there are 3 main types of RNA 1) rRNA 2) mRNA 3) tRNA

- 1) rRNA

- * Found in ribosome.
- * Account for 80% of total RNA present in the cell.
- * Ribosomes act as the site of protein synthesis.

2] mRNA

- * Accounts for about 5% of the total RNA present in cell.
- * It carries genetic code copying for the DNA during transcription in the form of triplet nucleotide called Codons.

3] tRNA

- * It is the smallest of all 3 types of RNA.
- * tRNA are an essential component of translation which main function is transfer of amino acids during protein synthesis.

III Answer the following questions.

8] Explain

1] Epimers:- The change of configurations of one of the asymmetric carbon atoms in compounds is known as Epimers.

2] Mutarotation:- The change in specific rotation of an optically active compound in solution with time to an Equilibrium value is called as Mutarotation.

3] Anomers:- The sugar that differs in configuration only at the anomeric carbon.

9] Explain Refining of oils and Drying of oils.

Drying of oils:- Certain oils, containing glycerides of unsaturated acids with two or three double bonds such as linolenic acid, linoleic acid, linic acids, absorb oxygen slowly from air and form a hard transparent coating. This process is known as drying of oils.

Refining of oils:- The crude oil produced, contains impurities like suspended matter, unpleasant odour, colour, free fatty acids.

10] Explain the biological roles of RNA and DNA.

- * DNA is a continuous long double helical structure that turns into genes & chromosomes by breaking itself appropriately during cell division.
- * To Exchange the genetic material of parental chromosome during meiotic cell division.

RNA:- A primary function of RNA is to provide a copy of DNA sequence, and to move out of nucleus.
1) as mRNA 2) as rRNA 3) as tRNA.

11) What are Lipids? Give the biological importance of phospholipids & cholesterol.

Lipids are the biomolecules which are water insoluble, oily or greasy organic compounds soluble only in organic solvents. Lipids are the Esters of alcohols & fatty acids.

Biological importance of Phospholipids are Lecithin is component of plasma membrane, it transports fats & oils through plasma membrane.

Biological importance of Cholesterol are Cholesterol found in skin produces vitamin D on Exposure to sunlight, it is useful in building & maintaining plasma membrane.

12) Describe transcription and translation.

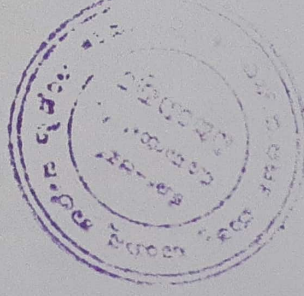
Transcription:- It is one of the first process in gene Expression. The genetic information flows from DNA to proteins and this flow of information takes place in a sequential process of transcription and translation. Only one strand of DNA is copied during the process of transcription known as the template strand & the RNA synthesised is called the mRNA.

Translation:- In translation the cell uses an mRNA strand that it has just transcribed from its genetic code as a template to assemble proteins. The cell has just transcribed this mRNA strand from its DNA, and it now translates the mRNA's nucleotide sequence into a chain of amino acids. This chain, called a polypeptide, forms the basic structure of a protein.

A cellular component called a ribosome coordinates the translation process. A ribosome is a molecular machine that synthesises proteins in the cell. It consists of two main parts, a large and small subunits.

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ASSIGNMENT

For B.A./ B.Sc.^{II} Semester
2021 - 2022

Name of the Student Radhika . M. Halli

Roll No. 446 R.C.U. Seat No. U15KMJISQJH

Subject Chemistry [OEC]

Assignment No.	Date	Marks Assigned	Marks Obtained	Name and Signature of Teacher	Remarks
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ASSIGNMENT -01

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Mechanism of Enzyme action

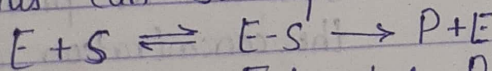
The scheme for Enzyme action is suggested by Arrhenius. According to this, the substrate combines with an Enzyme making intermediate complex having lower Energy reaction pathway and is more reactive. From this complex, products and free Enzyme is formed.

Mechanism

Step 1: A molecule of Enzyme, say E combines with substrate say S forming an intermediate complex E-S, having lower activation Energy (ΔE) and E-S complex is more reactive.

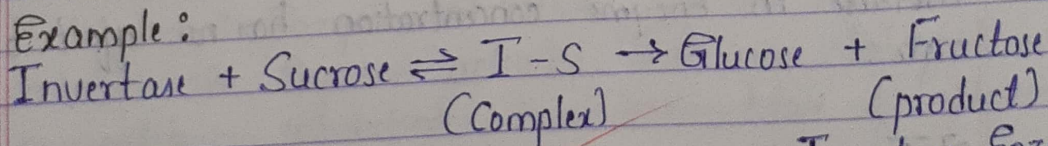
Step 2: The E-S complex involves the information of product, which release from the surface of the Enzyme having behind the free Enzyme.

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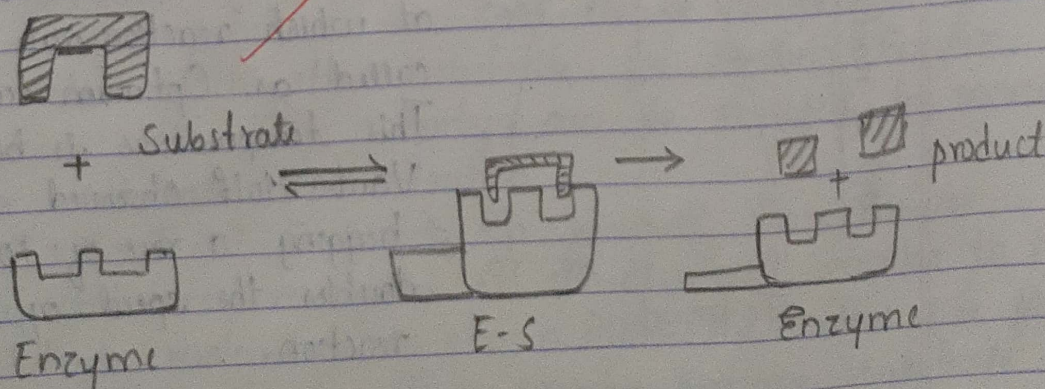
Enzyme substrate Intermediate Product Enzyme
Complex

Example:



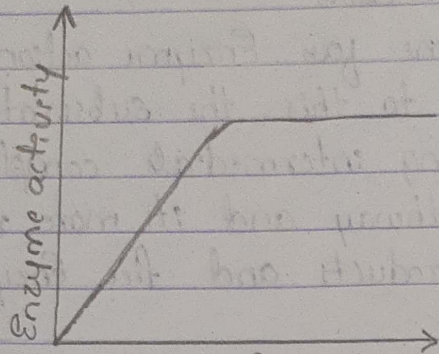
Invertase Enzyme

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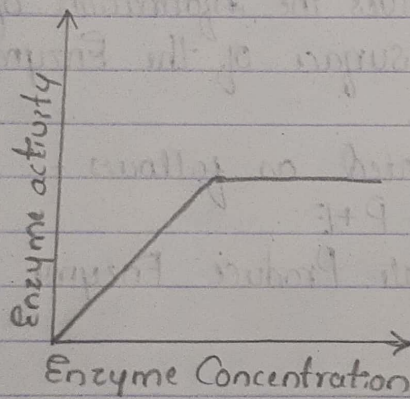
Factors affecting Enzyme action:

1. Substrate Concentration:



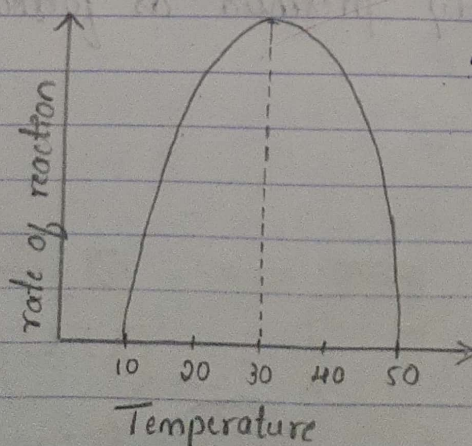
The concentration of substrate has influence on the rate of reaction. The rate of reaction increases as substrate concentration increases upto a certain level once the Enzyme is saturated with substrate the concentration of substrate has no effect on reaction rate.

2] Enzyme Concentration:

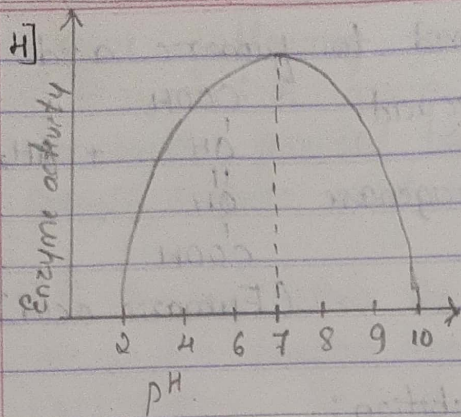


Enzyme concentration has Effect on reaction rate. If an Excess substrate is present by doubling the concentration of Enzyme reaction rate doubles only in the initial stage one the substrate is saturated with Enzyme molecules. Further increase in Enzyme concentration has no effect on reaction rate.

3] Temperature



As temperature increase rate of reaction increases. The temperature at which reaction rate is maximum called as Optimum temperature. This temperature is between 20-40°C. Vant Holf observed that in the begging a rise of 10°C - temperature doubles the speed of an Enzyme reaction.



Due to protein nature of Enzymes, pH (i.e. H^+ ion concentration) has influence on enzyme activity. At certain pH range enzyme show max activity i.e. pH is called as optimum pH . For most of Enzymes it's 7 to 9. In the figure it is shown that Enzyme

activity is dropped rapidly by increasing or lowering pH by 2 units.

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Ex:- Activity of leucyl peptidase is activated by Mg or Mn. Aramase requires Co or Mn or Fe.

6] Inhibitors :- Certain reagents inhibit Enzyme activity are called inhibitors. Presence of inhibitors decrease the Enzyme activity.

Q] What is inhibition? Explain the types with suitable Example?

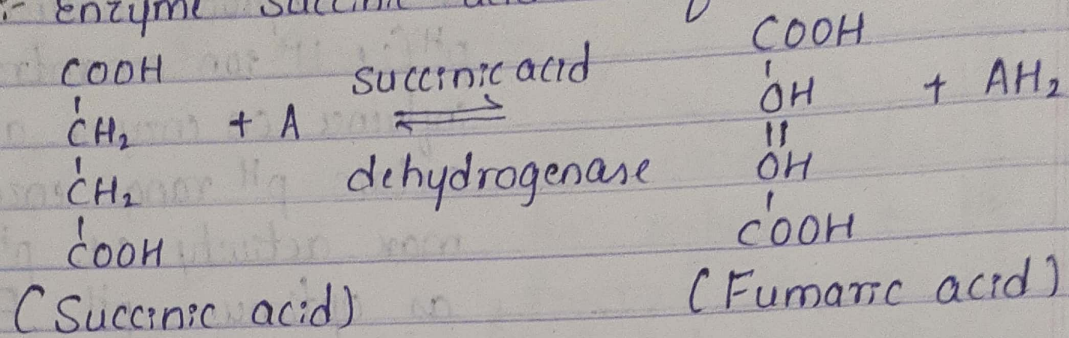
Inhibition :- Enzyme inhibitors are the molecules that inhibit the Enzyme activity. They are classified as competitive inhibition, non-competitive & allosteric inhibitors.

1] Competitive Inhibitors:

An inhibitors is said to be competitive. If it competes with the substrate for binding Enzyme, active site. Its activity can be reversed by increasing the substrate concentration.

$\text{E} + \text{S} + \text{I} \rightleftharpoons \text{E} + \text{I} \rightarrow \text{No product}$ through Enzyme
The inhibitors molecules is structurally similar to the substrate molecule, so it occupies the active site for substrate molecule. Thus no Enzyme substrate formed to no reaction, product.

Ex:- Enzyme succinic acid to fumaric acid:

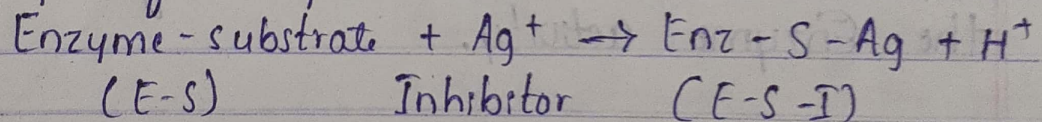


2) Non - Competitive inhibition:

In this type inhibitor occupies the site of Enzyme other than active site so, substrate can bind at active site. Hence chance of producing E-S and E-SI complex is there.

* The inhibitor occupying other site of Enzyme reduces the efficiency of Enzymes to produce product. So whether active site occupied substrate or not turn over no. of Enzyme is decreased.

Ex:- Heavy metal ions like Ag^+ , Hg^{+2} , Pb^{+2} inhibit the activity of Enzymes.



2) CN^- , H_2S inhibit action of Enzyme containing iron like catalase and peroxidase.

3) Allosteric inhibition:

* Here the inhibitor molecule binds at the allosteric site of Enzyme other than active site.

* It is similar to non-competitive inhibitors but not same.

* Here attaching of inhibitors at allosteric site causes conformation changes and decreases activity of Enzymes.

* This is also called as "Feed back inhibition".

3] Define following terms:

a] Enzymes :- A group of complex proteinoid organic compounds, provided by living organisms which catalyze specific organic reactions are called Enzyme.

b] Co-Enzyme :- When the co-factor of an Enzyme is a non-protein organic molecule, the cofactor is known as Co-Enzyme. Ex :- B Group of Vitamin.

c] Co-factor :- The non-protein part of an Enzyme is called a Cofactor. Ex :- Metal ions as Mg^{2+} , Zn^{2+} , etc.

d] Activators :- In case the cofactor of an Enzyme molecule is a metal ion such as Fe^{2+} , Mg^{2+} , Cu^{2+} , K^+ , Na^+ , Zn^{2+} . The Cofactor is known as an activator.

e] Active site :- The part of an Enzyme where the events of the catalytic process occur is called as its active site.

f] Apo Enzyme :- The protein part of an Enzyme molecule is known as apoEnzyme.

g] HoloEnzyme :- The combination of an apoEnzyme and the cofactor is known as Holoenzyme.

h] Inhibitors :- Certain reagents inhibit Enzyme activity are called Inhibitors.

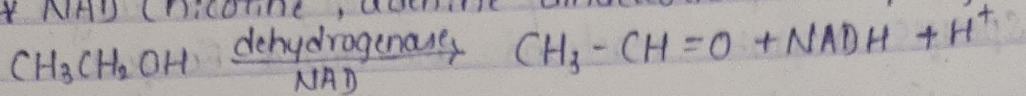
4] What is difference between Co-Enzymes and Co-factors?

CoEnzyme	Cofactor
* When the cofactor of an Enzyme is non protein organic molecule is known as CoEnzyme.	* The non protein part of an Enzyme is called Co-factor.
* Can be removed from the Enzyme Easily.	* Can only be removed by denaturing the Enzyme.
* Serves as carries to the Enzyme.	* Increase the rate of the reaction that is catalysed by the Enzyme.

5] Explain the importance of

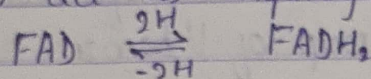
a. Co-Enzymes & Co-factors

* NAD (nicotine, adenine dinucleotide) as hydrogen acceptor.



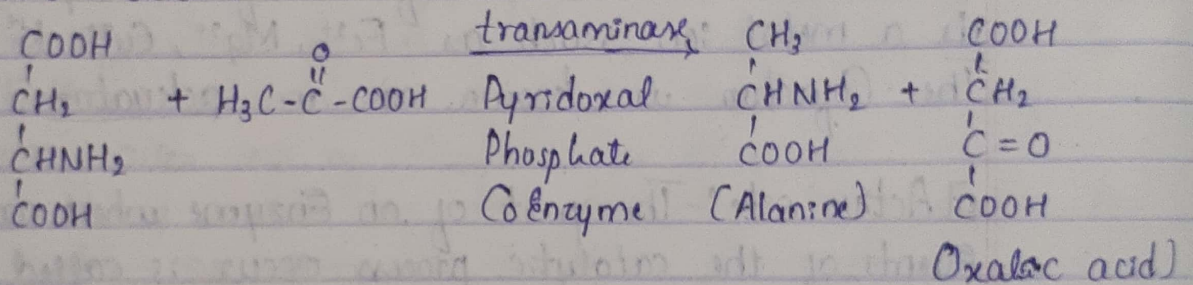
* Flavin adenine dinucleotide (FAD):

FAD act as hydrogen acceptor



* As decarboxylate and transaminase:

The transaminase catalyse the transfer of an amino group from amino acid to corresponding keto acid form of other amino acids.



b. Enzyme Inhibition

* Understanding regulations of Enzyme activity in living cells.

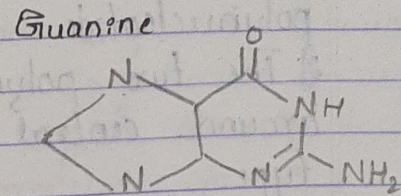
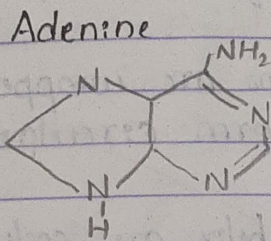
* In identifications of catalytic or functional group present at the active site.

* In studying mechanism of Enzymes catalytic activity.

* They find applications in the Therapeutic use like to treat patients who injected methanol inhibition technique is used.

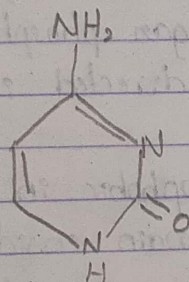
* Methanol reacts with Enzyme alcohol dehydrogenase producing formaldehyde, which is lethal. So to avoid formaldehyde formation from methanol. Ethanol is inserted into or nervously and methanol is excreted harmlessly through urine.

6] Write the structure of purines and pyrimidines:
Structures of Purines

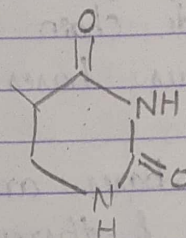


Structures of Pyrimidines

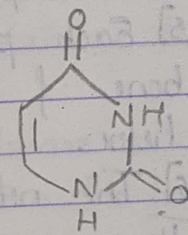
Cytosine



Thymine



Uracil



7] Write Nucleosides and Nucleotides of RNA & DNA:

Nucleic acid	Base (Nucleobase)	Nucleoside	Nucleotide (Given for a nucleoside - 5' - monophosphate)
<u>RNA</u>	Adenine (A)	Adenosine	Adenosine - 5' - monophosphate or adenylylate (AMP)
	Cytosine (C)	Cytidine	Cytidine - 5' - monophosphate or Cytidylylate (CMP)
	Guanine (G)	Guanosine	Guanosine - 5' - monophosphate or guanylylate (GMP)
	Uracil (U)	Uridine	Uridine - 5' - monophosphate or Uridylylate (UMP)
<u>DNA</u>	Adenine (A)	Deoxyadenosine	Deoxyadenosine - 5' - monophosphate or deoxyadenylylate (dAMP)
	Cytosine (C)	Deoxycytidine	Deoxycytidine - 5' - monophosphate or deoxycytidylylate (dCMP)
	Guanine (G)	Deoxyguanosine	Deoxyguanosine - 5' - monophosphate or deoxyguanylylate (dGMP)
	Thymine (T)	Deoxythymidine	Deoxythymidine - 5' - monophosphate or deoxythymidylylate (dTMP)

8] Describe Watson and Crick model of DNA?

1] The double helix comprises of two complementary polynucleotide chains.

2] The two polynucleotide chains are wrapped clockwise around central axis to form circular staircase type.

3] The two strands of double helix are coiled. They run in opposite direction one strand ^{chain} is aligned in $5' \rightarrow 3'$ direction and other chain is aligned in $3' \rightarrow 5'$ direction.

4] Each phosphate group give the molecule negative charge.

5] Each polynucleotide chain has sugar phosphate backbone & nitrogenous bases are directed inside the helix.

6] The nitrogenous bases are hydrophobic in nature. They avoid water & therefore remain inside helix.

7] The nitrogenous base lie almost perpendicular to the axis of molecule. Therefore these are stacked one on top of another.

8] The diameter of double helix is 2nm .

9] The nitrogenous bases of two antiparallel polynucleotide strands are linked through hydrogen bonds. There are two hydrogen bonds between adenine & thymine & three hydrogen bonds between guanine & cytosine.

10] There are ten base pairs in one turn helix. Therefore Each turn of helix is 3.4nm .

11] The double helix has two helical group is a major groove which is deep & wide & major minor groove which is shallow & narrow.

9] Give the classification of amino acids as Essential and non-Essential with Examples?

Classification of Amino Acids:-

1] Essential amino acids :- As the name suggests Essential amino acids cannot be synthesised by the body and it has to be acquired through food.

Deficiency : illness and hormonal imbalance.

* There are 9 amino acids all of 20 are thought to be Essential.

* Source :- Essential amino acids acquired through food. Such as soya, Chicken, Egg, meat or vegetable.

* Function :- Serves to build & repair muscle tissue also it forms precursor molecules for the formation of neurotransmitters in the brain.

* Ex :- Histidine, leucine, lysine, methionine, Valine, tryptophan.

9] Non-Essential Amino Acids :- Non-Essential Amino Acids need not to be taken in through diet as they can be produced by the body.

* There are 11 of the 20 amino acids are non-Essential.

* Sources :- Sources are produced within the body from other amino acids and other components.

* Function :- Removal of toxins, integral in the synthesis of RBC & WBC. Promotes brain function & many more.

Deficiency : Probability of deficiency is rare but can still occur due to starvation.

Ex :- Alanine, Arginine, Asparagine, Aspartic acid, Cysteine, Glutamic acid & Glutamine, Glycine.

10] Write the structure of proteins with Examples?

Proteins have a complex 3-dimensional structure.

It is studied step by step as follows:

1] Primary Structure :- The primary structure of a protein refers to the number and the sequence of amino acids in a polypeptide chain. The amino acid sequence in many proteins have been determined & following observations have been made.

a] A protein may contain more than one amino acid chain.

b] Sequence of amino acids in the proteins is essentially random.

c] Small variations in the sequence of amino

acid have pronounced effects on the properties of protein.

a) Infrared spectra exhibit absorption characteristic of amides. The X-Ray diffraction studies have revealed that the amide portion of the peptide chain is planar.

2] Secondary Structure :- The Secondary Structure of a protein refers to the shape in which long amino chains exist. X-Ray crystallographic study showed that the peptide backbone could fold itself in two conformations (i) α -helix (ii) β -Structure

In the α -helix structure of coil or helix is formed by twisting the backbone of a polypeptide chain in such a way that each amide group is hydrogen-bonded to the amide group which is the third one from it in either direction along the chain as shown below.

In the β -Structure, the polypeptide chains aligned in a sheet-like arrangement and the chains are held together by intermolecular hydrogen bonds having rippled or pleated edge as shown below.

3] Tertiary Structure :- Tertiary Structure refers to the intramolecular folding of polypeptide chain into a compact, three-dimensional structure with a specific shape. The tertiary structure is far more complex than primary and secondary because the polypeptide chains of proteins are not arranged along one axis but involves irregular and compact folding to give a three dimensional structure. The tertiary structure is maintained by electrovalent linkages, hydrogen bonds, disulphide bridges, Vanderwaals forces and hydrophobic interactions, Hydrophobic

interactions are major forces in maintaining the unique tertiary structure of a protein.

The tertiary structures of proteins have been elucidated by X-ray analysis, viscosity measurement, diffusion, light scattering, ultracentrifuge and neuromicroscopy.

4] Quaternary Structure:- The Quaternary structure is usually determined by X-Ray crystallography. Association of several protein chains or composed of combining many polypeptide chains and there Each sub units are closely packed arrangement. Any alteration in the structure of subunits causes marked changes in biological activity and if forms and structure with the compact combination.

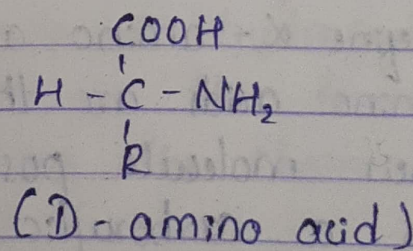
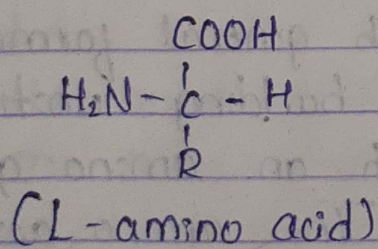
11] Define α -amino acids with general formula.
Amino acids are the basic building units of proteins. Their molecule possess both an amino group as well as a carboxylic group. The amino acids having amino & carboxyl group attached to the same carbon i.e. alpha carbon atom is called as alpha-amino acids.

Ex of α -amino acids are Glycine, Alanine etc.
General formula is $R-H(NH_2) - COOH$.

12] Explain configuration of optically active α -amino acids found in proteins!
Proteins are made of twenty types of amino acids. Both one and three letter abbreviation for Each amino acid can be used to represent the amino acids in peptides.

* Except glycine, all amino acids have asymmetric carbon so they are optically active.

- * Some amino acids are dextrorotatory & some are leorotatory depending upon the rotation of plane polarized light towards right or direction respectively.
- * D-amino acids found in some proteins produced by Exotic sea dwelling organisms.
- * L-amino acids represent the vast majority of amino acids found in proteins.
- * Most naturally occurring amino acids have a L- Configuration.
- * L-amino acids are represented by writing the $-NH_2$ group on the left hand side.



Assignment - 02

I Answer the following questions.

1. What are reducing and non reducing sugars?

Reducing Sugars :- These are carbohydrates that can act as reducing agent due to the presence of free aldehyde groups or free ketone groups.

Ex:- Monosaccharides & disaccharides.

Non-Reducing Sugars:- These are carbohydrates that cannot act as reducing agent due to the absence of free aldehyde group (or) free ketone groups.

Ex:- Polysaccharides.

2. Write the general formula of triglycerides?

3. What is Genetic Code?

The genetic code is the set of rules by which information encoded in genetic material is translated into proteins by living cells.

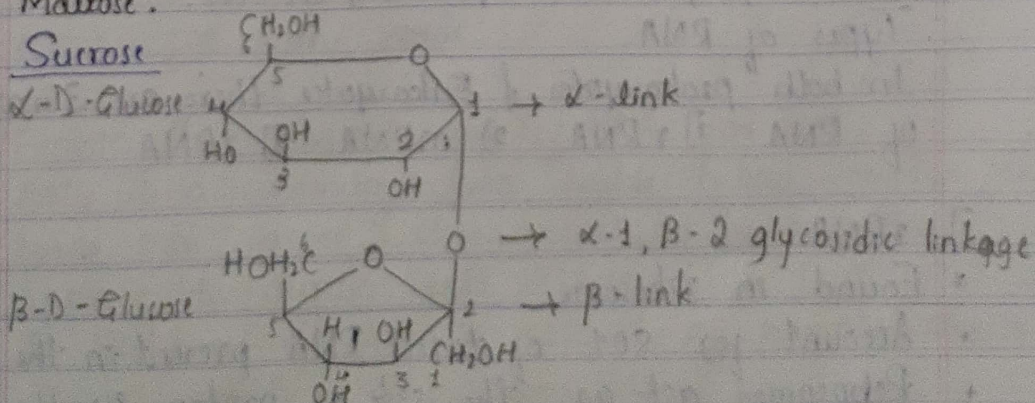
4. Give the methods to prevent rancidity of oils and fats.

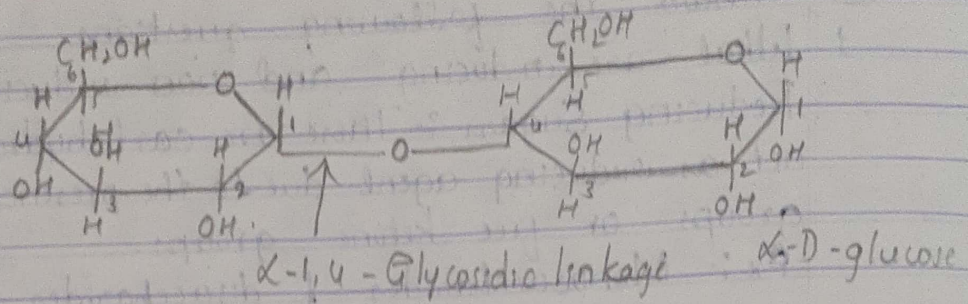
- * Avoiding the Exposure to air, light and moisture.
- * Partial hydrogenation also reduces oxidative rancidity.
- * Hydrolytic rancidity is very common in butter, can be prevented by refrigeration and pasteurization.

II Answer the following questions.

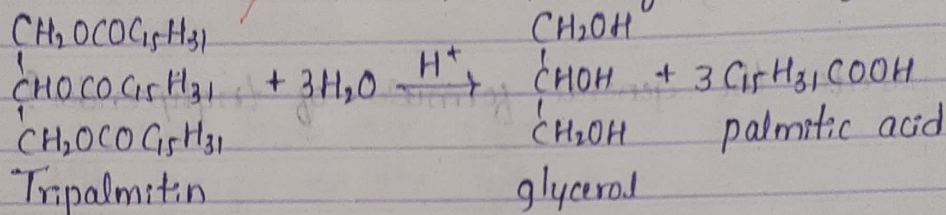
5. Explain glycosidic linkage with structure in Sucrose and Maltose.

Sucrose

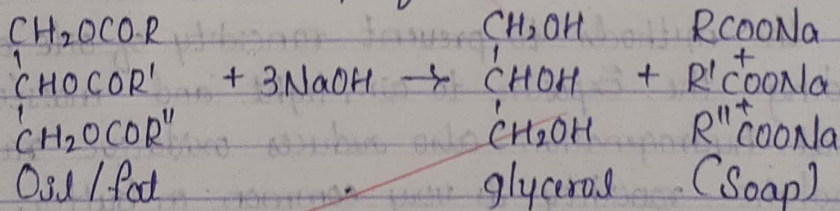




- 6] Explain Saponification and Acid hydrolysis of oils & fats.
Acid Hydrolysis: Oils and fats can be hydrolysed to glycerol and mixture of fatty acids by action of acids is called Acid hydrolysis of oils and fats.



Saponification: The hydrolysis of oils and fats can be carried out by action of alkalis, then glycerol & mixture of alkali salts of fatty acid is formed. This process is called as Saponification.



7. Write a note on RNA and it's types.

RNA or Ribonucleic acid is a polymer of nucleotides which is made up of a ribose sugar, a phosphate, & bases Adenine, Guanine, cytosine, Uracil.

Types of RNA.

In both prokaryotes & Eukaryotes, there are 3 main types of RNA 1) rRNA 2) mRNA 3) tRNA

- 1) rRNA

- * Found in ribosome.
- * Account for 80% of total RNA present in the cell.
- * Ribosomes act as the site of protein synthesis.

2] mRNA

- * Accounts for about 5% of the total RNA present in cell.
- * It carries genetic code copying for the DNA during transcription in the form of triplet nucleotide called Codons.

3] tRNA

- * It is the smallest of all 3 types of RNA.
- * tRNA are an essential component of translation which main function is transfer of amino acids during protein synthesis.

III Answer the following questions.

8] Explain

1] Epimers:- The change of configurations of one of the asymmetric carbon atoms in compounds is known as Epimers.

2] Mutarotation:- The change in specific rotation of an optically active compound in solution with time to an Equilibrium value is called as Mutarotation.

3] Anomers:- The sugar that differs in configuration only at the anomeric carbon.

9] Explain Refining of oils and Drying of oils.

Drying of oils:- Certain oils, containing glycerides of unsaturated acids with two or three double bonds such as linolenic acid, linoleic acid, linic acids, absorb oxygen slowly from air and form a hard transparent coating. This process is known as drying of oils.

Refining of oils:- The crude oil produced, contains impurities like suspended matter, unpleasant odour, colour, free fatty acids.

10] Explain the biological roles of RNA and DNA.

- * DNA is a continuous long double helical structure that turns into genes & chromosomes by breaking itself appropriately during cell division.
- * To Exchange the genetic material of parental chromosome during meiotic cell division.

RNA:- A primary function of RNA is to provide a copy of DNA sequence, and to move out of nucleus.
1) as mRNA 2) as rRNA 3) as tRNA.

11) What are Lipids? Give the biological importance of phospholipid & cholesterol.

Lipids are the biomolecules which are water insoluble, oily or greasy organic compounds soluble only in organic solvents. Lipids are the Esters of alcohols & fatty acids.

Biological importance of Phospholipids are Lecithin is component of plasma membrane, it transports fats & oils through plasma membrane.

Biological importance of Cholesterol are Cholesterol found in skin produces vitamin D on Exposure to sunlight, it is useful in building & maintaining plasma membrane.

12) Describe transcription and translation.

Transcription:- It is one of the first process in gene Expression. The genetic information flows from DNA to proteins and this flow of information takes place in a sequential process of transcription and translation. Only one strand of DNA is copied during the process of transcription known as the template strand & the RNA synthesised is called the mRNA.

Translation:- In translation the cell uses an mRNA strand that it has just transcribed from its genetic code as a template to assemble proteins. The cell has just transcribed this mRNA strand from its DNA, and it now translates the mRNA's nucleotide sequence into a chain of amino acids. This chain, called a polypeptide, forms the basic structure of a protein.

A cellular component called a ribosome coordinates the translation process. A ribosome is a molecular machine that synthesises proteins in the cell. It consists of two main parts, a large and small subunits.

B. L. D. E. Association's

S. B. Arts & K.C. P. Science College,
VIJAYAPUR-586 103



ASSIGNMENT

For B.A. / B.Sc. IVth (P.C.M) Semester
2021 -2022

Name of the Student : Shambhavi R. Mench
Roll No. : 391(B) R.C.U. Seat No. : S2028997
Subject : Chemistry

Assignment No.	Date	Marks Assigned	Marks Obtained	Name and Signature of Teacher	Remarks
1	22/7/22	03	03		
2					
3					
4					

① Give the statement of Boyle temperature?

⇒ The temperature at which a real gas obeys Boyle's law is known as the Boyle temperature. T_B is given by the expression

$$T_B = \frac{a}{bR}$$

where a and b are the van der Waals constant

② Why transition elements will show variable oxidation state?

∴ $(n-1)d$ and ns orbitals in the atoms of d-block elements have almost the same energies and hence electron can be removed from $(n-1)d$ orbitals as easily as they can be removed from ns orbitals as easily as they can be removed from ns orbital.

∴ After removing ns electron(s) the remainder is called core or kernel (penultimate shell)

3) Define unit cell and space lattice

unit cell

It is smallest part of the space lattice

space lattice

The constituent particles such as atoms or ions arranged in 3-dimensional

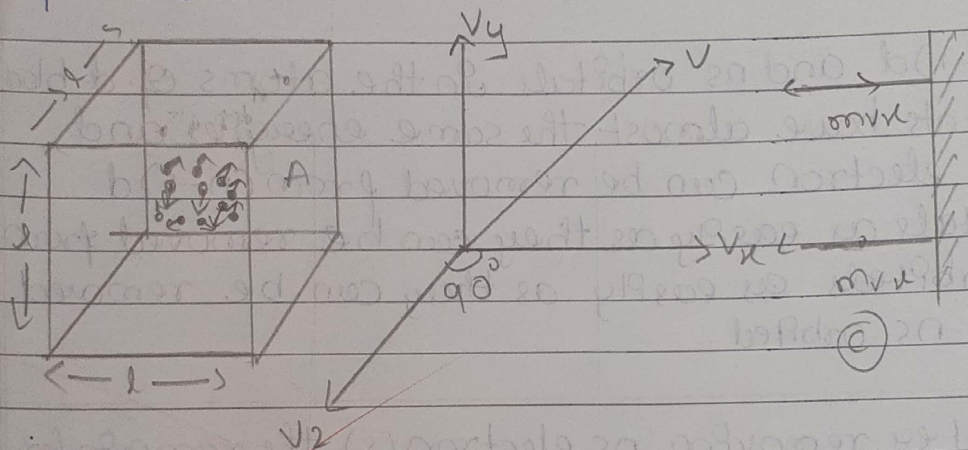
u) Define most probable velocity?

As already stated the most probable velocity is possessed by the largest number of molecules in a gas according to the calculations made by Maxwell the most probable velocity.

v_{rms} is given by the expression $v_{rms} = \sqrt{\frac{3RT}{M}}$

⑤ Derive the kinetic gas equation?

Let us consider one single molecule of the gas having velocity (v). This velocity can be resolved into three components along the 3-axes (x, y, z) mutually at the right angles to one another and parallel to the 3-sides of the cube as shown below.



Let these components be v_x, v_y & v_z along x -axis, y -axis and z -axis respectively. These components will be related to the velocity (v) by the following relation.

$$v^2 = v_x^2 + v_y^2 + v_z^2 \quad \text{--- (1)}$$

Consider the motion of 1 gas molecule along the x -axis striking the face (A). Its momentum mv_x . On striking the wall it will re-bounce in opp-direction with the same velocity because the collision is completely elastic there is no loss of energy.

The pressure of the gas molecule is the force exerted by the gas molecule per unit area of the wall of the container and is given by the equation.

$$P = \frac{F}{A}$$

Let us consider a gas molecule moving in the x direction towards "force A". The molecule hits the wall with a velocity v_x and rebounds back with the same velocity v_x and will experience a change of momentum which is equal to

$$\Delta p = -2mv_x$$

For a total No. of gas molecules in the container all such change in momentum is given by

$$\Delta p = -2Nmv_x$$

The force is given by the equation $F = \Delta p / t$

$$F = \frac{-2Nmv_x}{t}$$

Gas molecule will hit the wall A and will travel back across the box collide with opposite face and hit force A again after a time 't' which is given by the equation.

$$t = \frac{2l}{v_x}$$

Substituting the value of 't' in the force equation we get the force on the molecule as

$$F = \frac{-2Nmv_x}{\frac{2l}{v_x}}$$

$$F_{\text{molecule}} = \frac{-2Nmv_x}{2l}$$

Therefore the force exerted on the wall is
 $F_{\text{wall}} = \frac{Nmv_x^2}{l}$

Now, the pressure 'P' is given by the equation

$$P = \frac{\text{Force on the wall}}{\text{Area}}$$

$$= \frac{Nmv_x^2}{l^2}$$

$$= \frac{Nmv_x^2}{l^3}$$

$$\text{Hence } PV = Nmv_x^2 \quad \text{--- (1)}$$

Since v_x , v_y & v_z are independent speed in three directions and we consider the gas molecule in bulk the

$$v_x^2 = v_y^2 = v_z^2$$

Hence

$$v^2 = 3v_x^2$$

Substituting the above equation in (1)
 we get-

$$PV = \frac{Nm v^2}{3}$$

Therefore

$$PV = \frac{1}{3} m N v^2$$

6) What is d-d transition? Explain with an example.

Ions with d orbital electrons, appears coloured because energy from visible light is absorbed and used to promote a d-orbital electron to a higher energy of d-sublevel which is referred to as d-d transition

=> Colour of transition metal ion is due to

① presence of incomplete d-orbitals
[containing 1-9 elements]

② d-d transition

③ Nature of ligand. attach to CMT increase of complex compound

Sc^{3+} - Colourless

Fe^{+} - Green

Ti^{3+} - Purple

Co^{2+} - Pink

V^{3+} = Green

Ni^{2+} - Green

Cr^{3+} = Violet

Cu^{2+} - Blue

Mn^{3+} = Violet

Ti^{2+} - Colourless

Fe^{3+} = Yellow

* A substance will appear coloured if it absorbs light from some portion of the visible spectrum (3800 - 7600 Å)

* Ions with no d-orbital electrons are colourless (eg: Sc^{3+} , Ti^{2+}). Ions with d^{10} electron configuration (eg: Zn^{2+}) are also colourless since the d-orbitals are filled d-d transition is not possible

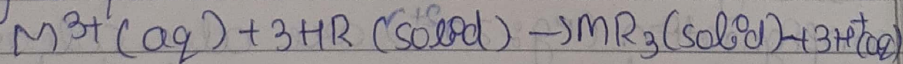
2) Write the difference between crystalline solids and amorphous solid.

Crystalline	Amorphous
* Crystalline solids are regular in shape	* Amorphous solids are irregular in shape
* Crystalline solids are definite geometrical shape	* Amorphous solids are do not having geometrical shape
* Crystalline solids are anisotropic in the nature	* Amorphous solids isotropic in the nature
* Eg: NaCl, CaCO_3	* Eg: glass

3) Explain the separation of lanthanides by ion exchange method

This is the most rapid & most effective method

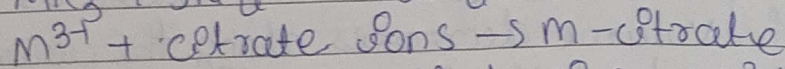
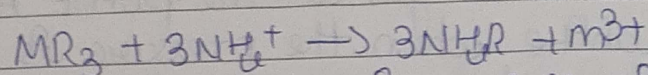
When an aqueous solution containing the mixture of usual trivalent lanthanide ions, $\text{M}^{3+}(\text{aq})$ is passed through a column having synthetic cation exchange resin coated as $\text{HR}(\text{solid})$ the $\text{M}^{3+}(\text{aq})$ ions get fixed on it.



Since $\text{Lu}^{3+}(\text{aq})$ is largest in size and $\text{La}^{3+}(\text{aq})$ is smallest $\text{La}^{3+}(\text{aq})$ is attached to the column with maximum & $\text{Lu}^{3+}(\text{aq})$ with minimum firmness

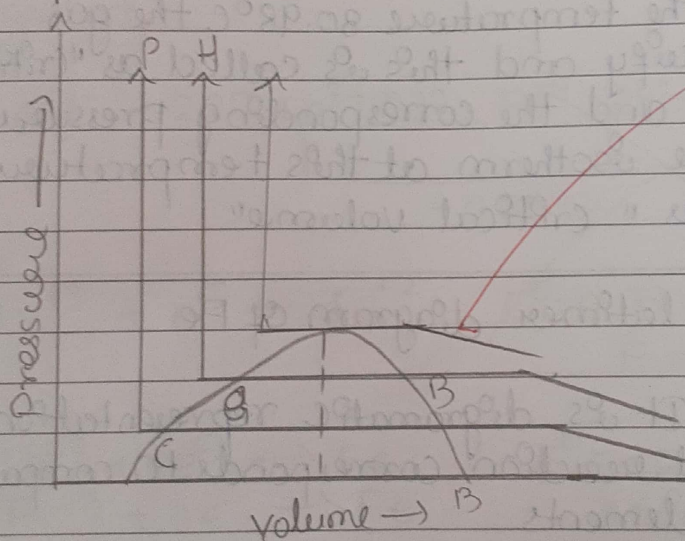
In order to recover the M^{3+} ions fixed on the resin the column is eluted

Co. e leached with a carboxylic acid. ammonium citrate elution process NH_4^+ ions replace M^{3+} ions and M-citrate complex are formed.



complex we have seen that since $\text{La}^{3+}(\text{aq})$ is $\text{La}^{3+}(\text{aq})$ with minimum firmness La-citrate complex comes out of the column first & La citrate complex comes out last in actual practice the process has to be repeated several times by careful control of concentration of citric acid ammonium citrate solution.

9) Explain the Andrew's Isotherm of CO_2



Andrew's Isotherm of gas CO_2

- # Andrew's Isotherm is the plot of pressure versus volume (Pv Plot) at different temperature for CO_2 . Each of the plots are in isotherm however it is known as "Andrew's Isotherm" because of critical phenomenon and Isotherm is noted on CO_2 gas molecules by "Andrews in 1861".

In this studies over CO_2 gas the explains that when temperature is 13.1°C at low pressure the CO_2 exists as a gas at the point A in graph while when the pressure the CO_2 exists as a gas at the point A in graph while when the pressure is increase the volume decreases along the curve shown AB. and at the B is the liquefaction

At the point 'C' liquefaction is completed & now the increase in pressure has very little effect on volume hence the straight 'CD' curve is obtained which becomes more and more smaller at horizontal portion when the temperature is increased and at 30.98°C the curve is reduced at the point

So about the temperature 30.98°C the gas can not liquefy and this is called as "critical temperature" and the corresponding pressure (PC) and the isotherm at this temperature is called as "critical volume"

10) Explain the Latimer diagram of Fe

It is diagrammatic representation of half cell reaction corresponds to compounds of an element

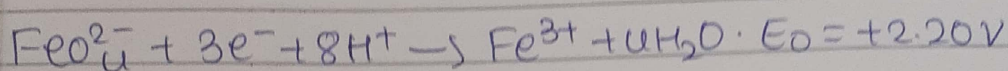
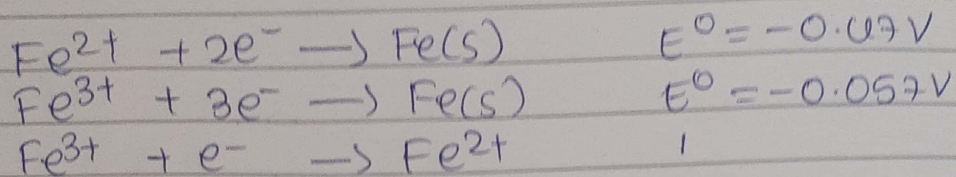
i) The highest oxidation state is written on left & lowest oxidation state is written at right & species such as electrons H^+ H_2O

ii) The value of the standard potential (in volts) is written over a horizontal line connecting species with the element in

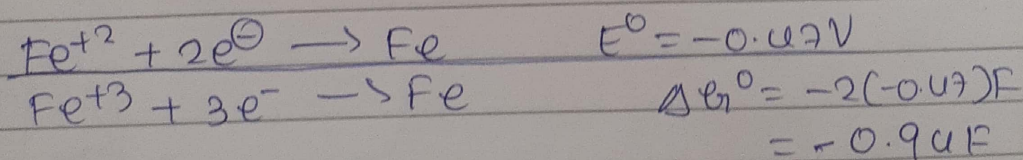
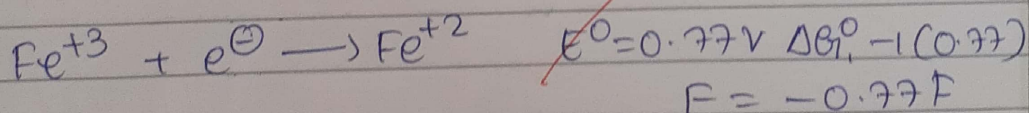
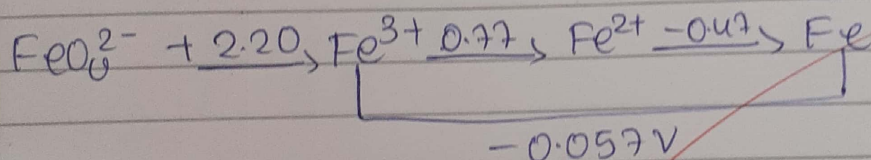
different oxidation state

Iron exist in different oxidation states like Fe(VI) in FeO_4^{2-} , Fe(III) in Fe^{3+} , Fe(II) in Fe^{2+} & Fe(0) in Fe

The half cell reactions involving these changes are



The ladder diagram for iron giving all the above information can be represented

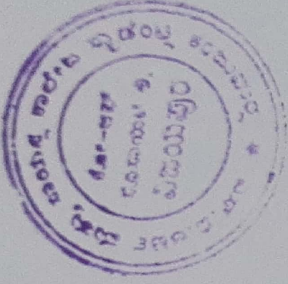


Now, E° for the above reaction $\text{Fe}^{3+} + 3e^- \rightarrow \text{Fe}$ may be calculated by continuing free energy change - in to potential

$$E^\circ = \frac{\Delta G^\circ}{-nF} = \frac{0.88F}{-3F} = \boxed{-0.29\text{V}}$$

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ASSIGNMENT

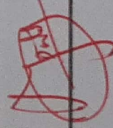
For B.A. / B.Sc. VI Semester

2021 -2022

Name of the Student : Vijayakumar.

Roll No. : 50 R.C.U. Seat No. : 51925350

Subject : Chemistry - 1

Assignment No.	Date	Marks Assigned	Marks Obtained	Name and Signature of Teacher	Remarks
1	27/07	03	03	 PAB	
2					
3					
4					

IR - Spectroscopy :-

principle of IR - Spectroscopy .

IR Spectroscopy detects the absorption of light by a compound in the IR region of the Electromagnetic Spectrum. To absorb light a molecule must have a bond within its structure that can exhibit what is referred to as a dipole moment which means electrons within a bond are not shared equally.

The Types of Vibrations

The infrared portion of the Electromagnetic Spectrum is usually divided into the three regions.

- * near
- * mid
- * far - infrared.

Named for their relation to the visible spectrum the higher energy near IR approximately $14000 - 4000 \text{ cm}^{-1}$ [$0.8 - 2.5 \mu\text{m}$ wavelength]. Can excite overtone or harmonic vibration.

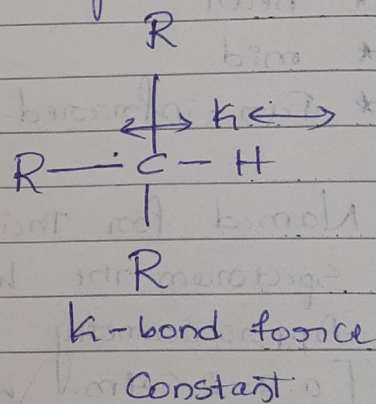
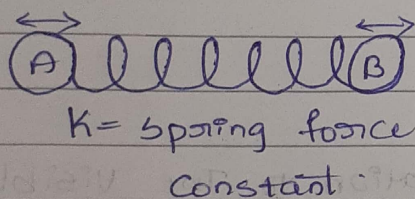
Five Examples of identification of organic compounds by stretching frequencies

It is as the mentioned above stretching modes are those in which internuclear distance change. For such a distance change to occur

IR - Spectroscopy - 91

⇒ The bond between the nuclei must be stretched or compressed one way or the other about this is to consider a chemical bond as a spring connecting two masses [Figure 11.34]

⇒ Each spring has a particular force constant which corresponds to the force required to compress or stretch that spring. Further more the frequency of the vibration is dependent on the masses that the spring connects. For a given spring heavy mass lead to a low frequency vibrations while light masses lead to higher frequency vibration.

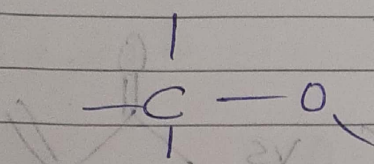


⇒ This analogy is actually very close to correct in describing stretching vibrations of bonds because the potential curve for springs and bonds have the same general shape & behaviour at lower energies.

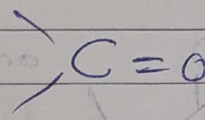
⇒ The major difference is that the vibrational energies of a spring are not

As a result there are discrete vibrational energy levels that are allowed for a bond in a molecule. At room temperature the vast majority of molecules are in the lowest vibrational energy levels.

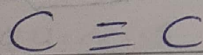
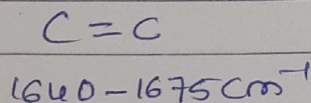
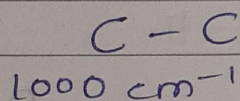
- 1) Multiple bonds are stronger than single bonds and they have larger force constants and absorb at higher frequencies than single bonds. For example



1000 - 1200 cm^{-1}

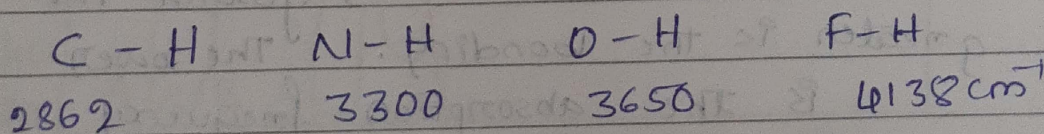


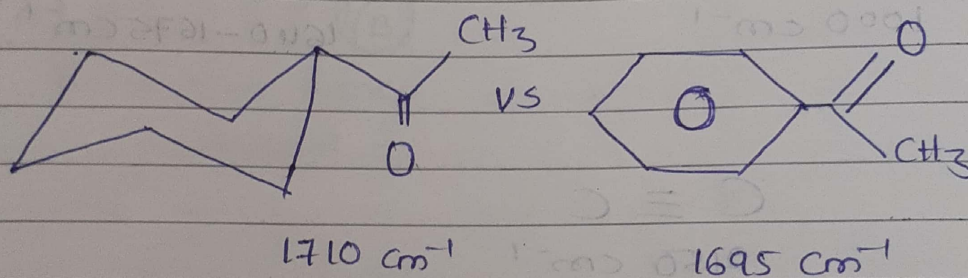
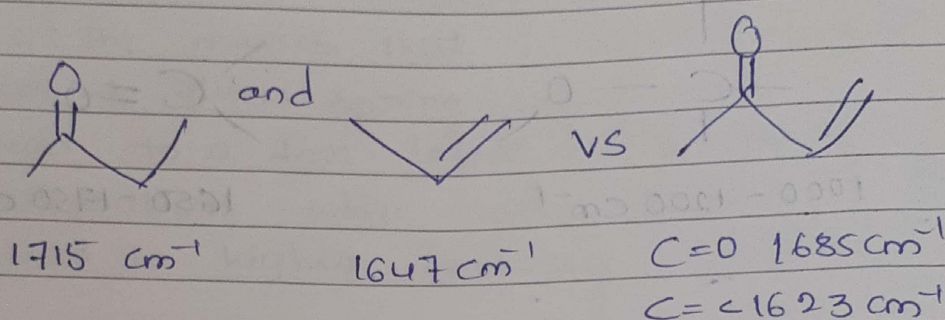
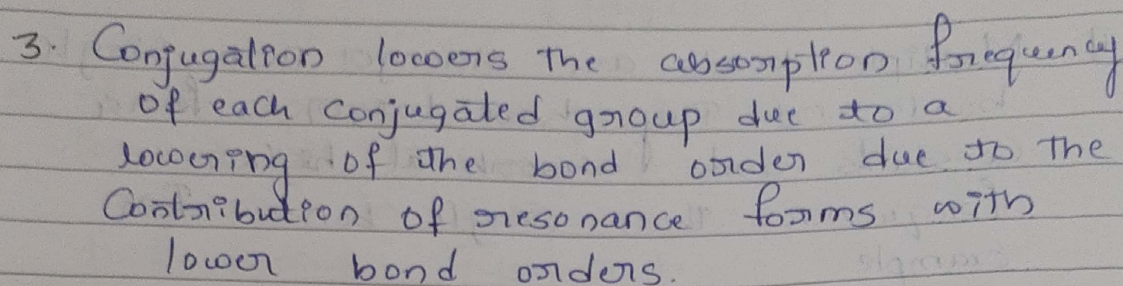
1650 - 1750 cm^{-1}



2150 cm^{-1}

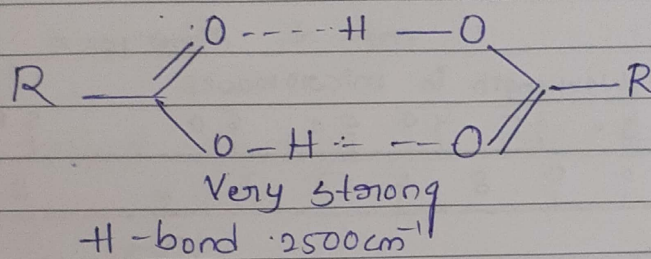
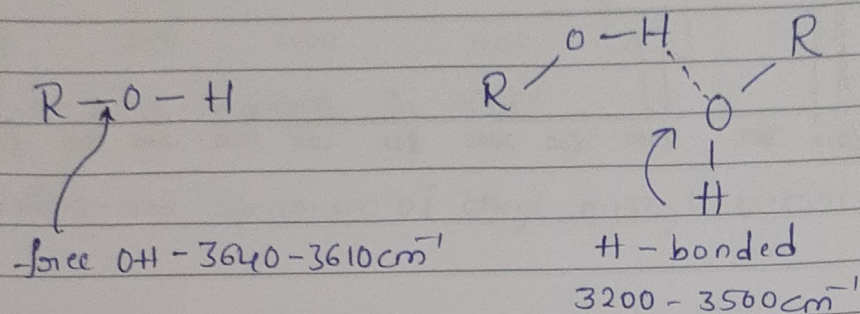
- 2) More polar bonds are generally stronger than less polar bonds and consequently absorb at higher frequencies.





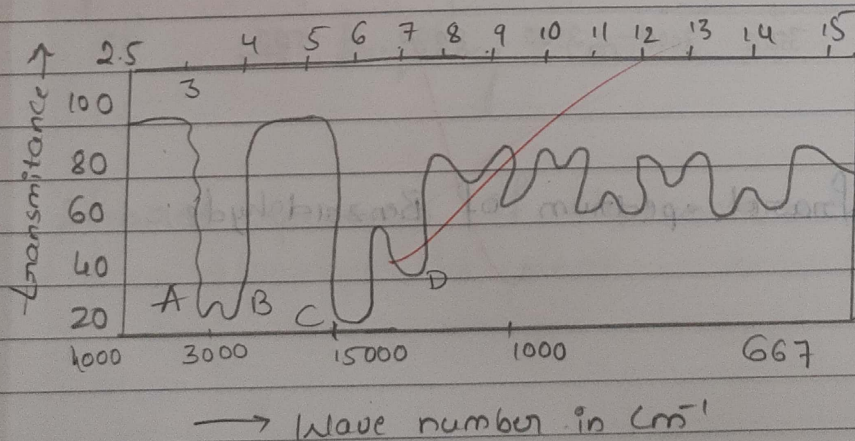
4. Hydrogen bonding causes the absorption frequency of acidic protons to be very widely depending on the solution environment. In general the greater is the bonding, the lower is the absorption frequency.

For Example normal alcohol OH group is dilute As the concentration is increased and H-bonding increases the OH absorption becomes broad and moves to lower frequencies.

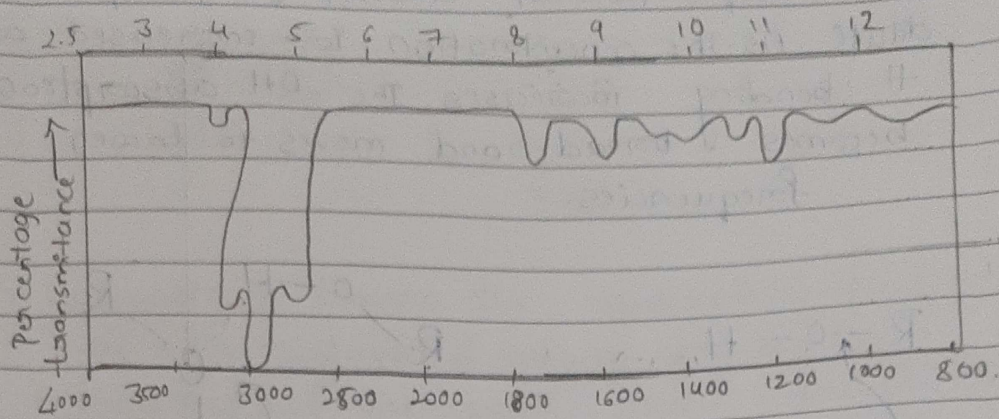


Identification of organic Compounds by stretching Frequencies

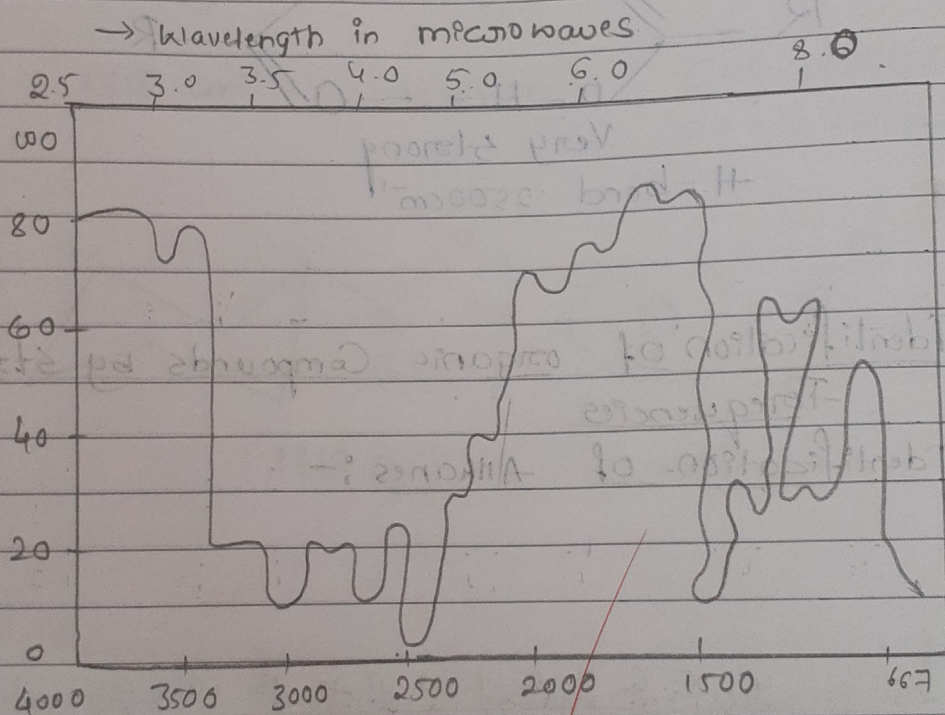
1. Identification of Alkanes:-



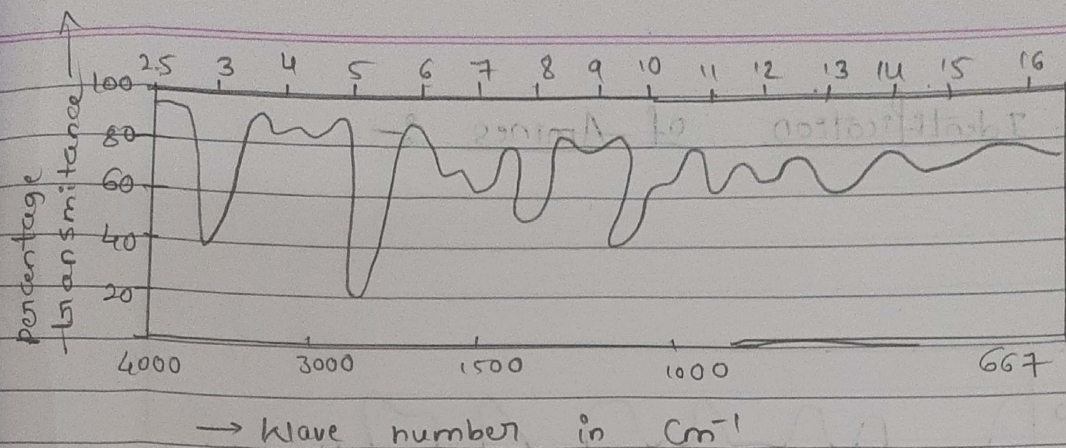
Infrared Spectrum of 3-methyl pentane



2) Identification of Aldehydes and Ketones



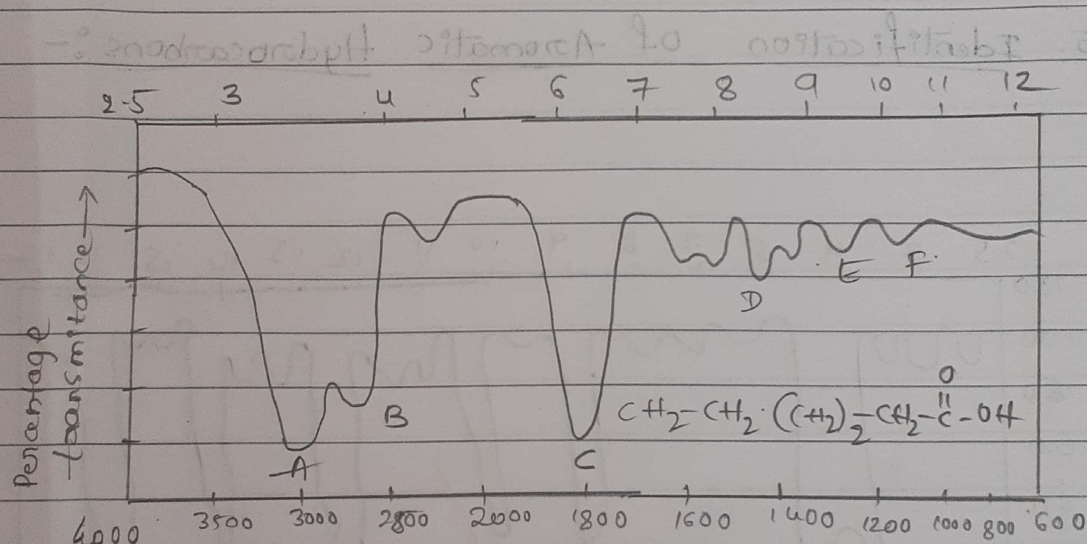
Infrared spectrum of Benzaldehyde



Infrared Spectrum of Ethyl methyl ketone

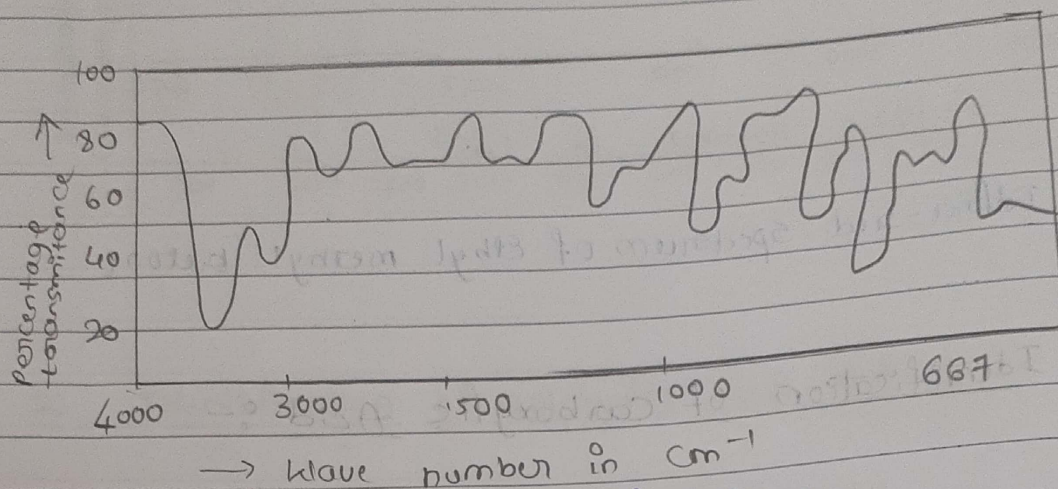
3. Identification of Carboxylic Acid :-

Wavelength in μm



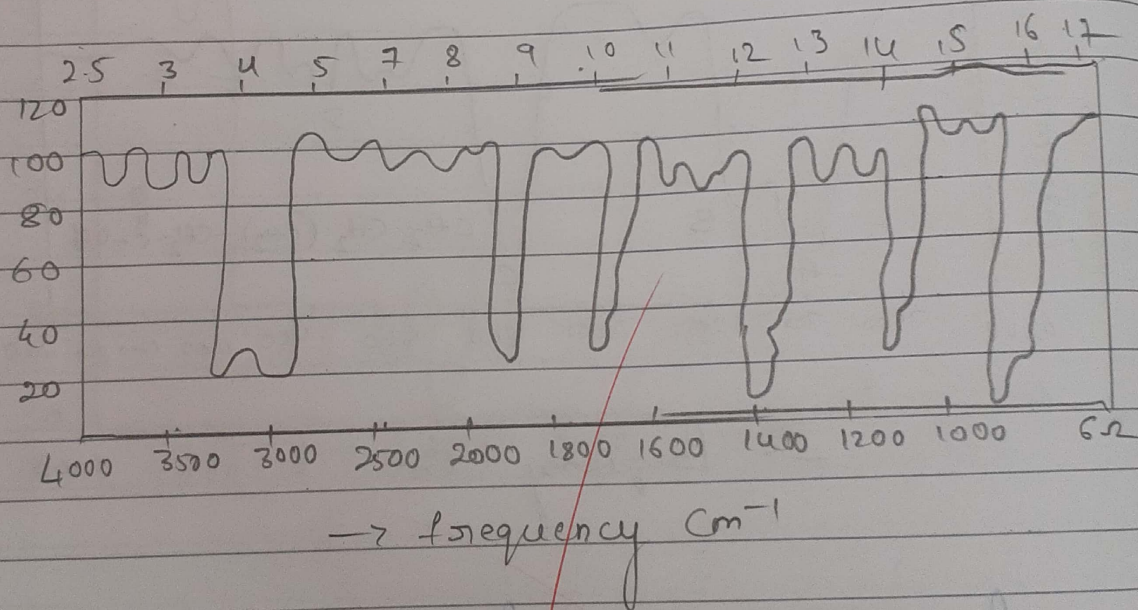
Infrared spectrum of Heptanoic acid

4. Identification of Amines :-



Infrared spectrum of Aniline

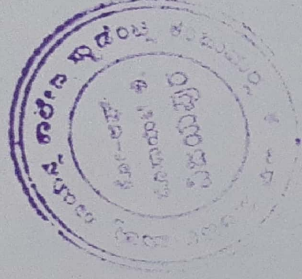
5. Identification of Aromatic Hydrocarbons :-



Infrared spectrum of Heptanoic acid.

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VIJAYAPUR-586 103**



ASSIGNMENT

For B.A. / B.Sc. VIth Semester

2021 -2022

Name of the Student : SHAHEERABANU . B. GOGI

Roll No. : 273 R.C.U. Seat No. : S1925211

Subject : Chemistry (Paper-II)

Assignment No.	Date	Marks Assigned	Marks Obtained	Name and Signature of Teacher	Remarks
1	27/7	03	03		
2					
3					
4					

Raman Spectroscopy [vibrational]

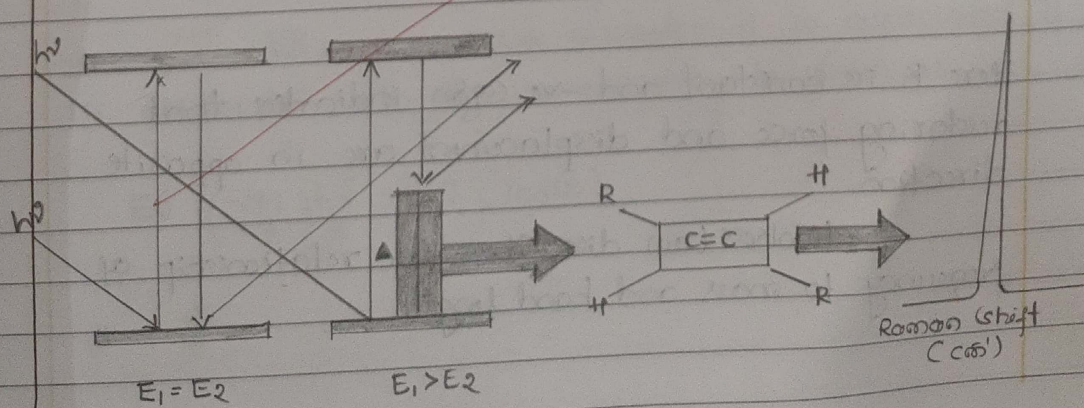
Definition:

Raman Spectroscopy is a molecular spectroscopic technique that utilizes the interaction of light with matter to gain insight into a material's make up or characteristics like FTIR.

- ⇒ The information provided by Raman spectroscopy results from a light scattering process.
- ⇒ Raman spectroscopy yields information about intra and inter molecular vibrations and can provide additional understanding about a reaction.
- ⇒ Raman spectroscopy can give information about the lower frequency modes and vibrations that give insight into crystal lattice and molecular backbone structure.

Principle of Raman Spectroscopy:

When light interacts with molecules in a gas, liquid or solid, the vast majority of the photons are dispersed or scattered at the same energy as the incident photons. This is described as elastic scattering or Rayleigh scattering. A small number of these photons, approximately 1 photon in 10 million will scatter at a different frequency than the incident photon. This process is called 'inelastic scattering or the Raman effect'.



Simple Harmonic Oscillator

In classical mechanics, a harmonic oscillator is a system that, when displaced from its equilibrium position, experiences a restoring force ' F ' proportional to the displacement x ;

$$\vec{F} = -k\vec{x}$$

where k is a positive constant.

If F is the only force acting on the system the system is called 'simple harmonic oscillator' and it undergoes simple harmonic motion.

Sinusoidal oscillations about the equilibrium point with a constant amplitude and a constant frequency (which does not depend on the amplitude)

If a frictional force (damping) proportional to the velocity is also present, the harmonic oscillator is described as a damped oscillator depending on the friction co-efficient.

Hooke's Law:

Statement: Hooke's Law states that the restoring force of a spring is directly proportional to the displacement (x).

$$F \propto -x$$

$$F = -kx$$

Here k is constant and -ve sign indicates that restoring force and displacement are in opposite direction.

Hooke's Law describes the relationship of frequency to mass and bond length.

⇒ The frequency of bond vibration can be derived from Hooke's law, which describes the motion of vibrating spring:

Hooke's law: $\bar{\nu} = \frac{1}{2\pi} \sqrt{\frac{k}{\mu}}$

strong bond - higher frequency
smaller mass - higher frequency.

k : force constant

μ : mass

k : Constant.

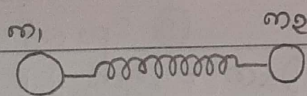
Energy levels of Simple Harmonic Oscillator.

In simple harmonic oscillator consider a diatomic molecular in which the bond behave as a spring and it has stretching frequency.

$$\bar{\nu} = \frac{1}{2\pi} \sqrt{\frac{k}{\mu}}$$

where, k - force constant

$$\mu - \text{reduced mass} = \frac{m_1 m_2}{m_1 + m_2}$$



According to Hooke's law.

$$F \propto -x$$

$$F = -kx$$

Restoring force is directly proportional to displacement, restoring our molecules are ~~also~~ ^{are} here potential energy and kinetic energy are inter-connected and follow Hooke's law.

When a molecule vibrates it is associated with the same energy it given as.

$$E_v = \left(\nu + \frac{1}{2}\right) h\nu \quad T (\text{Joules})$$

where,

v - vibrations quantum number

$v = 0, 1, 2, \dots$

h - Planck's constant

ν - frequency

Put $v=0$ in eqⁿ (A)

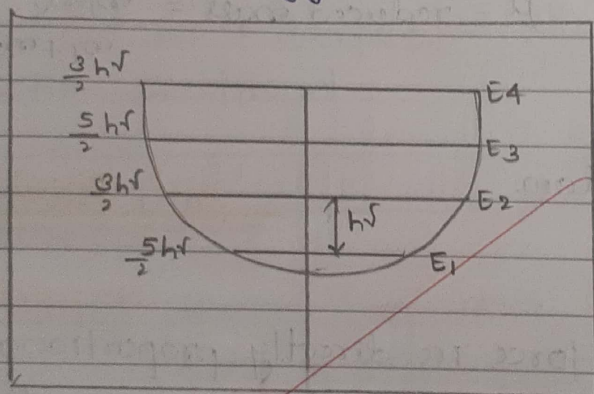
$E_v = \frac{1}{2} h\nu$ this energy is known as zero point energy

Similarly, $E_1 = \frac{3}{2} h\nu$

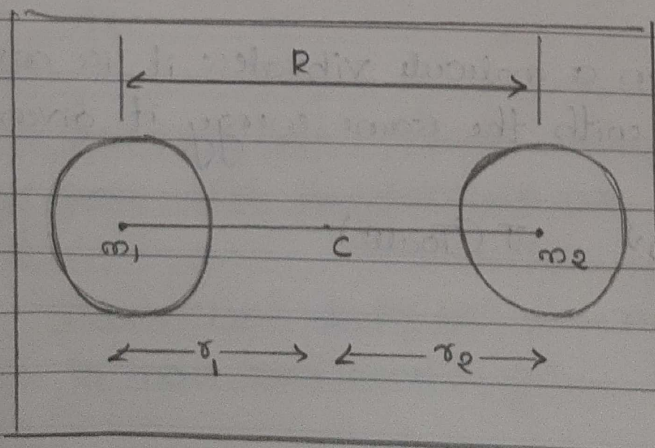
$$E_2 = \frac{5}{2} h\nu$$

$$E_3 = \frac{7}{2} h\nu$$

Plotting graph of potential energy and displacement energy is constant $h\nu$.



Molecule as a rigid rotator;



Consider, a diatomic molecule consist of two atoms of masses m_1 and m_2 are separated by a bond distance R which is given by.

$$R = r_1 + r_2$$

The molecule rotate end over end about the centre of mass C which is defined by

$$I = m_1 r_1^2 + m_2 r_2^2 \longrightarrow (1)$$

where, r_1 and r_2 distance of m_1 and m_2 from the axis of rotation through C as the system is balanced about its centre of mass C we have,

$$m_1 r_1 = m_2 r_2 \longrightarrow (2)$$

$$I = m_1 r_1 (r_2) + m_2 r_2 (r_1)$$

$$I = r_1 r_2 (m_1 + m_2) \longrightarrow (3)$$

from eqⁿ (2). $R = r_1 + r_2$

$$r_1 = R - r_2$$

$$r_2 = R - r_1$$

put in eqⁿ (2)

$$m_1 r_1 = m_2 (R - r_1)$$

$$m_1 r_1 = m_2 R - m_2 r_1$$

$$m_1 r_1 + m_2 r_1 = m_2 R$$

$$r_1 (m_1 + m_2) = m_2 R$$

$$r_1 = \frac{m_2 R}{m_1 + m_2}, \text{ similarly } r_2 = \frac{m_1 R}{m_1 + m_2}$$

substitute r_1 and r_2 value in eqⁿ (1)

$$I = m_1 \frac{m_2^2 R^2}{(m_1 + m_2)^2} + m_2 \frac{m_1^2 R^2}{(m_1 + m_2)^2}$$

$$I = m_1 m_2 R^2 \frac{(m_1 + m_2)}{(m_1 + m_2)^2}$$

$$I = \frac{m_1 m_2 R^2}{(m_1 + m_2)}$$

$\therefore$ Reduced mass of system

$$\mu = \frac{m_1 m_2}{m_1 + m_2}$$

$$I = \mu R^2 \longrightarrow (4)$$

Eqⁿ (4) defines moment of Inertia in terms of atomic mass and Bond length.

Instead of dealing the rotations of diatomic molecule, we have to deal with the rotation of single point mass μ at fixed distance R from the axis of rotation.

Kinetic energy due to the rotation is given by,

$$K.E = \frac{1}{2} m v^2$$

$$K.E = \frac{1}{2} I \omega^2 \rightarrow (5) \quad \omega: \text{angular velocity}$$

The angular momentum ' L ' of a molecule is given by;

$$L = I \omega \rightarrow (6)$$

from eqⁿ (5) and (6)

$$E = \frac{L^2}{2I}$$

The angular momentum of a rotating diatomic molecule is quantized according to

$$L = \sqrt{J(J+1)} \frac{h}{2\pi} \quad \text{where, } J = 0, 1, 2, 3, \dots$$

J = rotational quantum number.

substituting the value of L in eqⁿ (7)

$$E = \frac{J(J+1) h^2}{8\pi^2 I}$$

$$E_J = \frac{J(J+1) h^2}{8\pi^2 I} \text{ in Joules.}$$

$\Rightarrow$ If we divide the Expression for energy $\frac{E}{hc}$, we get

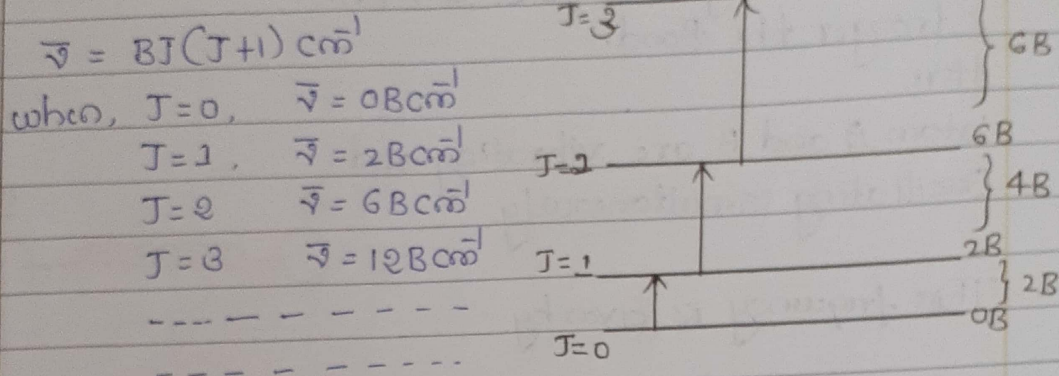
term value i.e. Energy is converted from Joules to wave number.

$$\frac{E}{hc} = \frac{h}{8\pi^2 I C} J(J+1) \rightarrow \text{cm}^{-1}$$

$$\bar{\nu} = \frac{h}{8\pi^2 I C} J(J+1) \text{ cm}^{-1}$$

$$\bar{\nu} = BJ(J+1) \text{ cm}^{-1}$$

Energy Level Diagram.



⇒ Selection Rule:

$\Delta J = \pm 1$ where, $+1 \Rightarrow$ absorption
 $-1 \Rightarrow$ Emission

From the above rule, it is evident that only those transition are permitted in which there is increase or decrease by unity in the rotational quantum number.

Zero point Energy, Determination of force constant;

Zero point Energy, vibrational Energy that molecules retain even at the absolute zero of temperature. In physics has been found to be a measure of the intensity of random molecule motion. and it might be expected that as temperature is reduced to absolute zero.

$E_v = \frac{1}{2} h\nu$ this Energy is known as zero point Energy

Expression for force Constant (K)

Let us assume a diatomic molecule to be a simple harmonic motion. Oscillator.

According to Hooke's Law.

$$F \propto -x$$

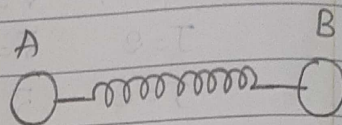
$$F = -Kx \rightarrow \textcircled{1}$$

This force constant is the measure of HCl strength of HCl bond higher the force constant.

stronger the Bond.

Here,

atom A and B are vibrating and Oscillating simultaneously.



This frequency is given by.

$$\nu = \frac{1}{2\pi} \sqrt{\frac{K}{\mu}} \rightarrow \textcircled{2}$$

In terms of mass number it is, $\bar{\nu} = \frac{\nu}{c} = \frac{1}{2\pi c} \sqrt{\frac{K}{\mu}} \rightarrow \textcircled{3}$

On rearranging Equation

$$K = 4\pi^2 c^2 \bar{\nu}^2 \mu \rightarrow \textcircled{4}$$

where;

K = Force Constant

c = velocity of light = 3×10^8 m/s

μ = reduced mass = $\frac{m_1 m_2}{m_1 + m_2}$

Significance of force constant - greater the 'K' values greater HCl bond length