MONOSACCAHARIDES:

Can be further classified on the basis of number of C-atoms or functional groups present in them.

Nomenclature:

If compound contains Aldehyde group, then Aldose, If Ketone then Ketose, Accord to number of C-atoms →

di, tri, tetra, etc.

Ex: For 3 C-atom

General name → Triose

Ald. group → Aldotriose

Keto. group → Ketotriose

Glucose: Occurs freely in nature, as well as in combined state.

Ex: Ripe grapes, honey, in sweet fruits

Preparation a) From Sucrose.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{HCl} C_6H_{12}O_6 + C_6H_{12}O_6$$

Sucrose — Glucose (50%) + Fructose (50%)

(b) From starch.

$$(C_6H_{10}O_5)_n + nH_2O \xrightarrow[293\ K,\ 2\text{-}3\ atm.]{HCl} nC_6H_{12}O_6.$$

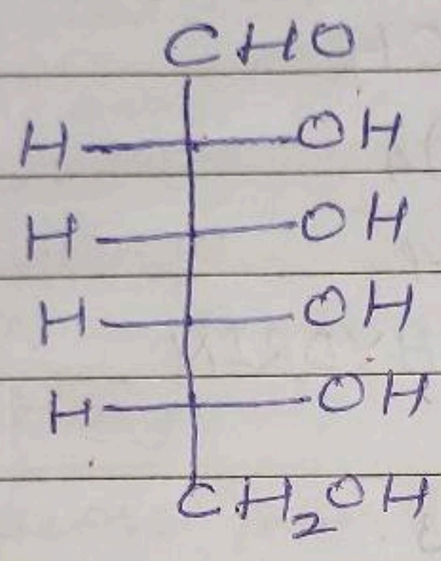
starch — Glucose.

- Known as Aldohexose
- Also known as Dextrose
- most abundant organic solvent on earth.

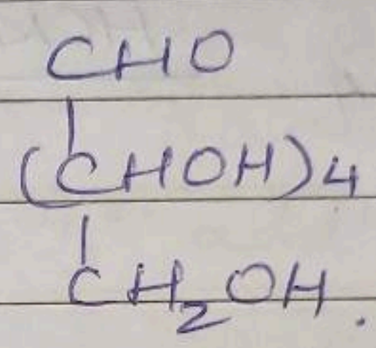
Physical properties

- white crystalline solid.. M.P = 419 K.
- readily soluble in water
- sparingly soluble in alcohol
- insoluble in ether.
- optically active nature, have different D- and L- structures

General structure of Glucose.

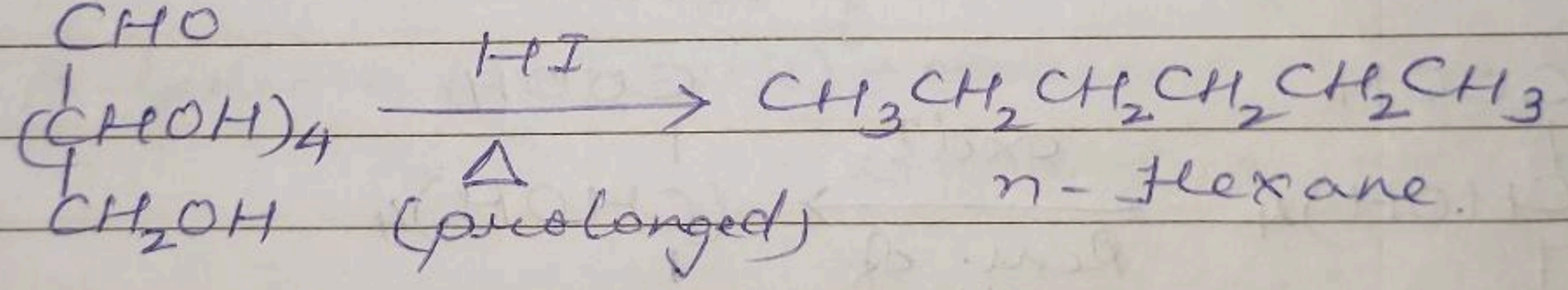


or

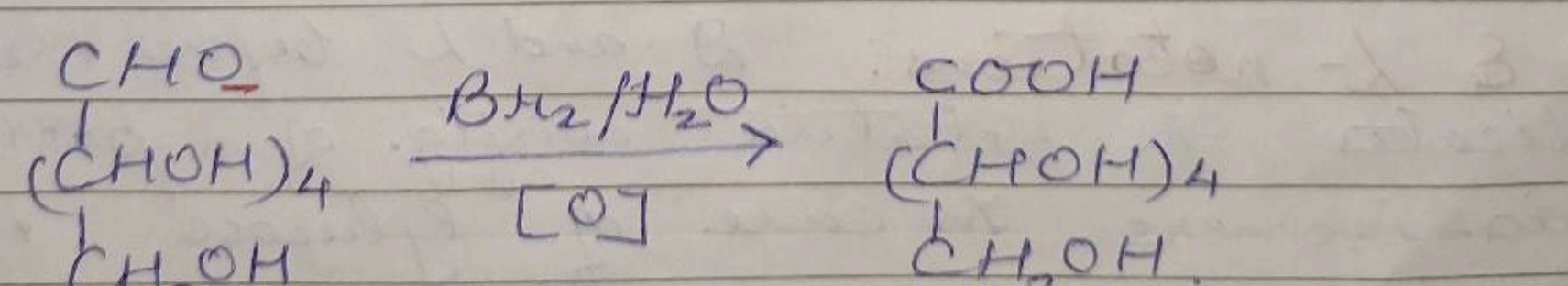


Chemical properties: Due to the presence of -CHO group shows some of the similar properties of aldehydes.

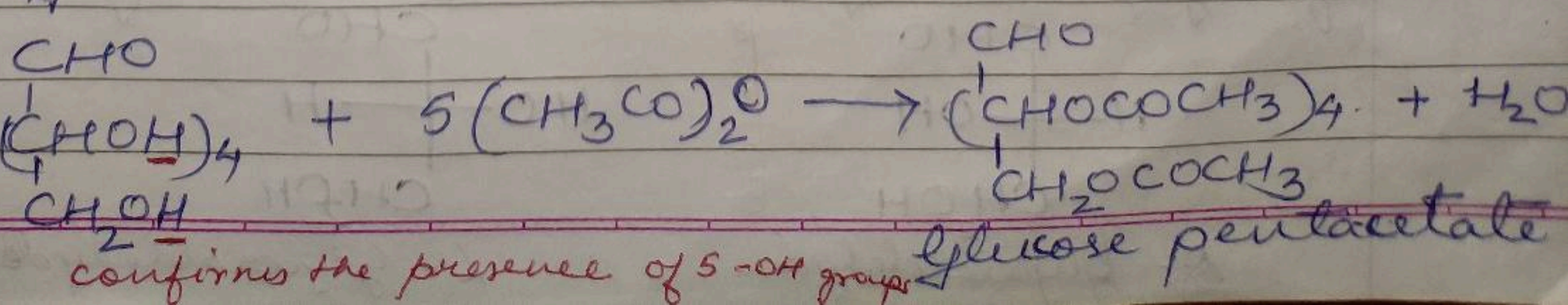
i) Reduction →



ii) Oxidation → mild oxidising agent like Br_2 is used

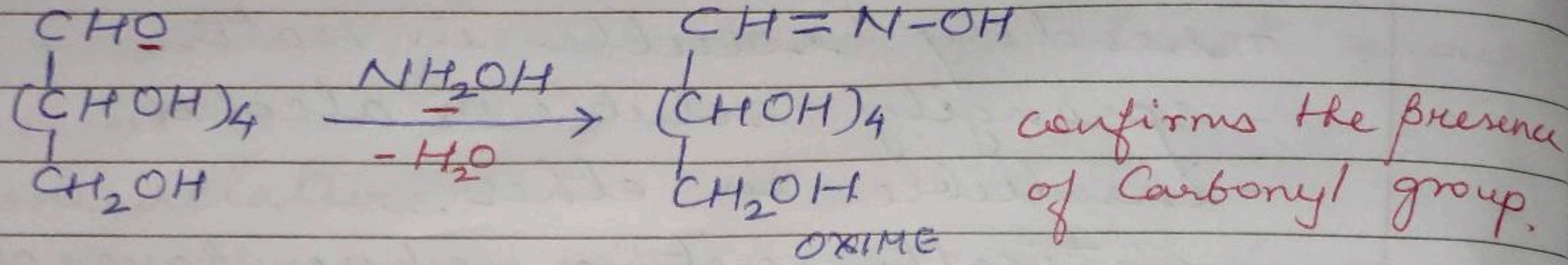


iii) Acetylation.

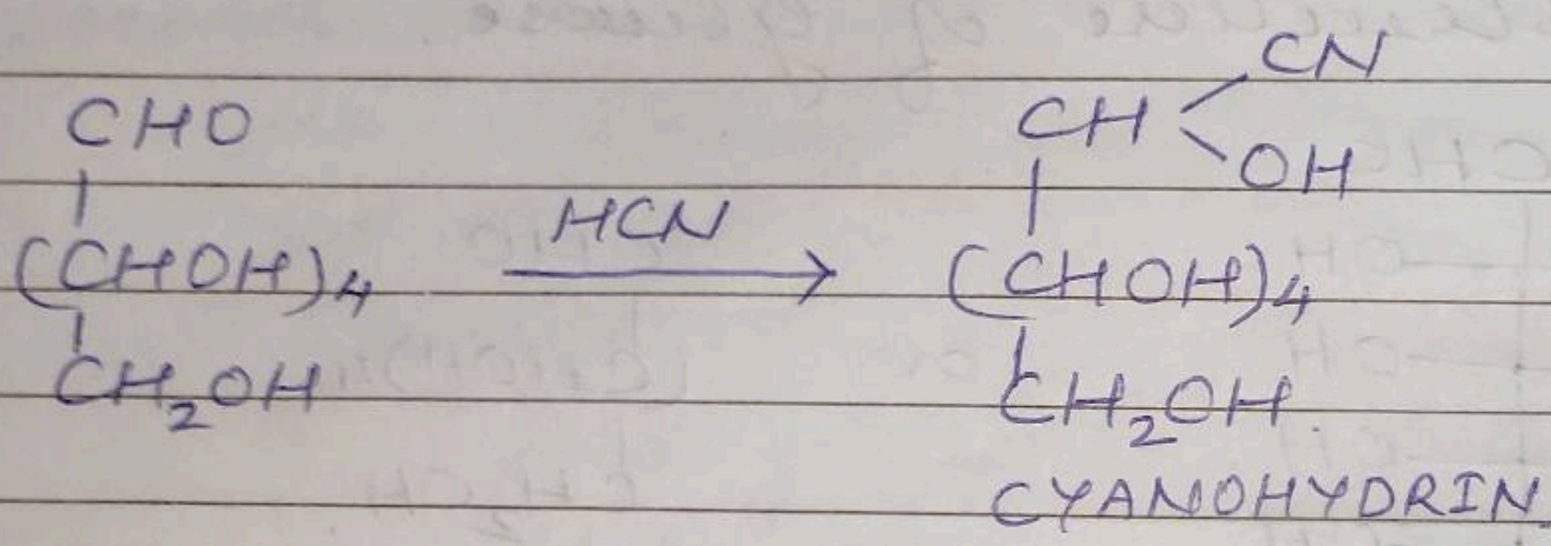


confirms the presence of 5 -OH groups

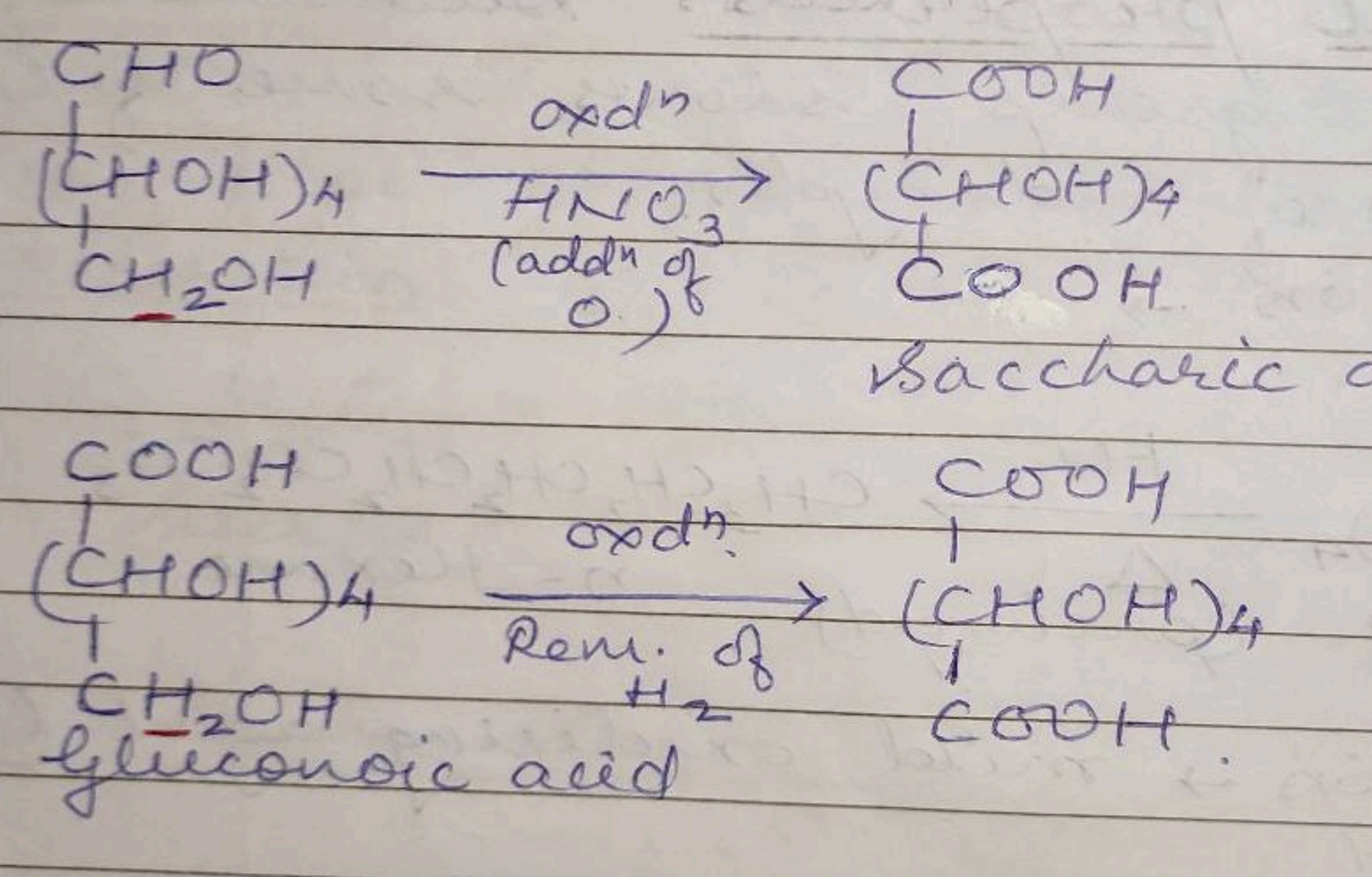
iv) R/c. with hydroxyl amine (NH_2OH).



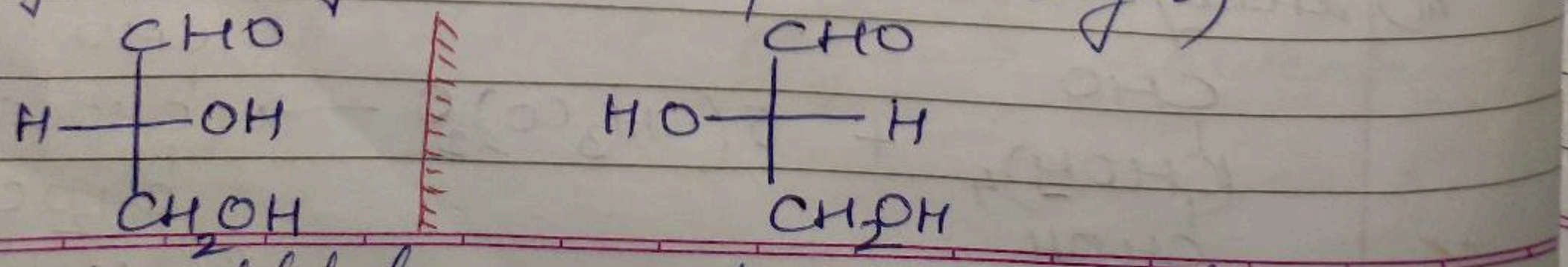
v) R/c. with HCN, KCN, etc.



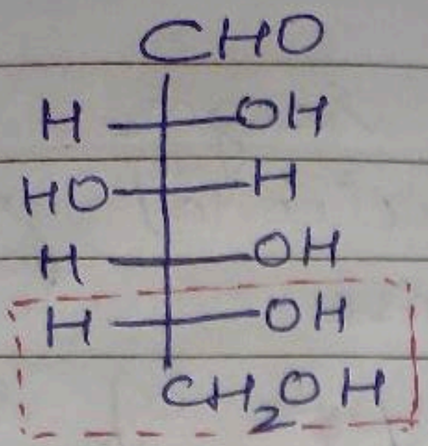
vi) Oxidation with HNO_3.



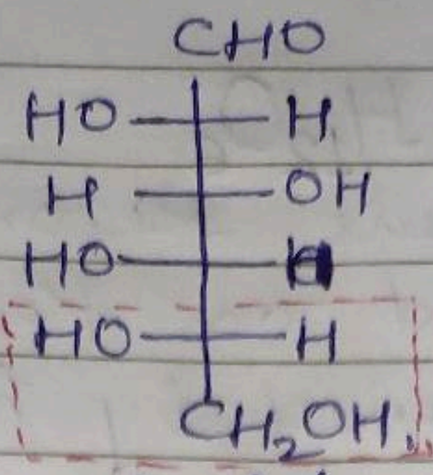
D & L- notations: D- and L- before the names indicates the relative config. of a particular steric-isomers. In case of glucose, this refers to their relation with a particular isomer of Glyceraldehyde (simplest sugar)



D- Glyceraldehyde. L- Glyceraldehyde.



D-Glucose



L-Glucose.

Cyclic structures of Glucose:

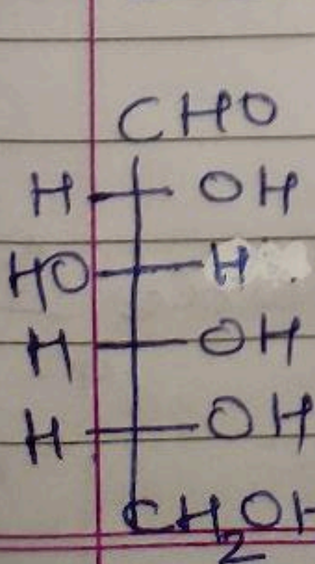
Following reactions and facts cannot be explained by this structure of Glucose.

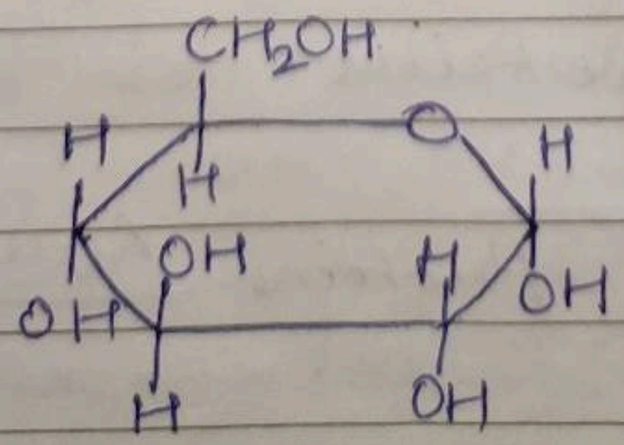
- Glucose do not restore the pink color of Schiff's reagent, despite having aldehyde group
- Also fails to form HSO_3^- add^n product with $NaHSO_3$.
- Glucose pentaacetate does not react with NH_2OH, which shows absence of free -CHO group.
- Glucose occurs in two forms;

α-Glucose (M.P = 419 K) → Crystalline. obtained from conc. sol^n of Glucose at 303°K

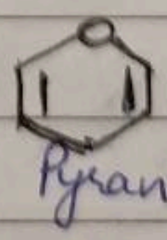
β-Glucose (M.P = 371 K) → obtained from hot and saturated. aq. sol^n by crystallisation.

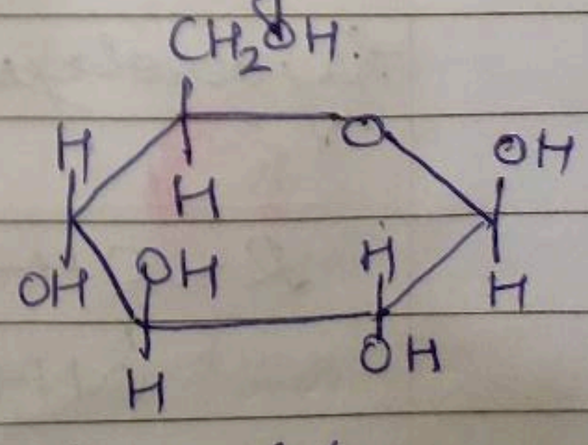
Pyranose structure: Six membered cyclic structure of glucose is known as pyranose structure. (α or β). It is analogous to Pyran. which is a cyclic organic compound with 1 O-atom and 5 C-atom in the ring.





α-D-Glucopyranose.





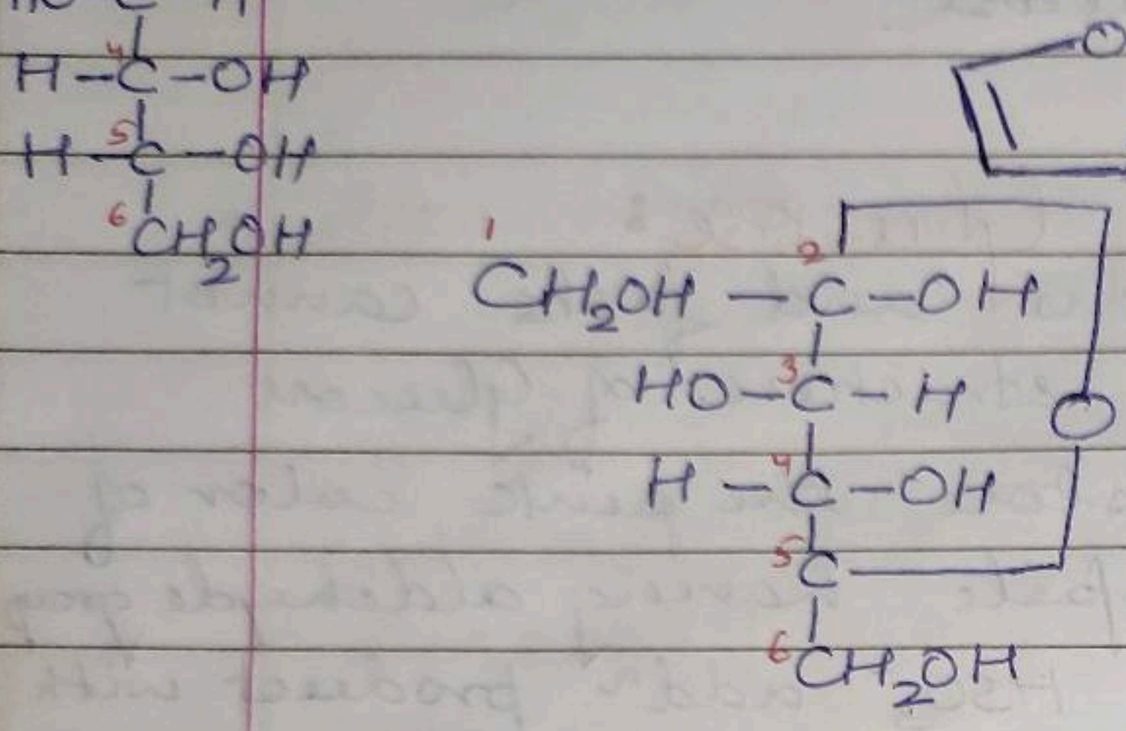
β-D-Glucopyranose

"Also called as Haworth structures".

Date:

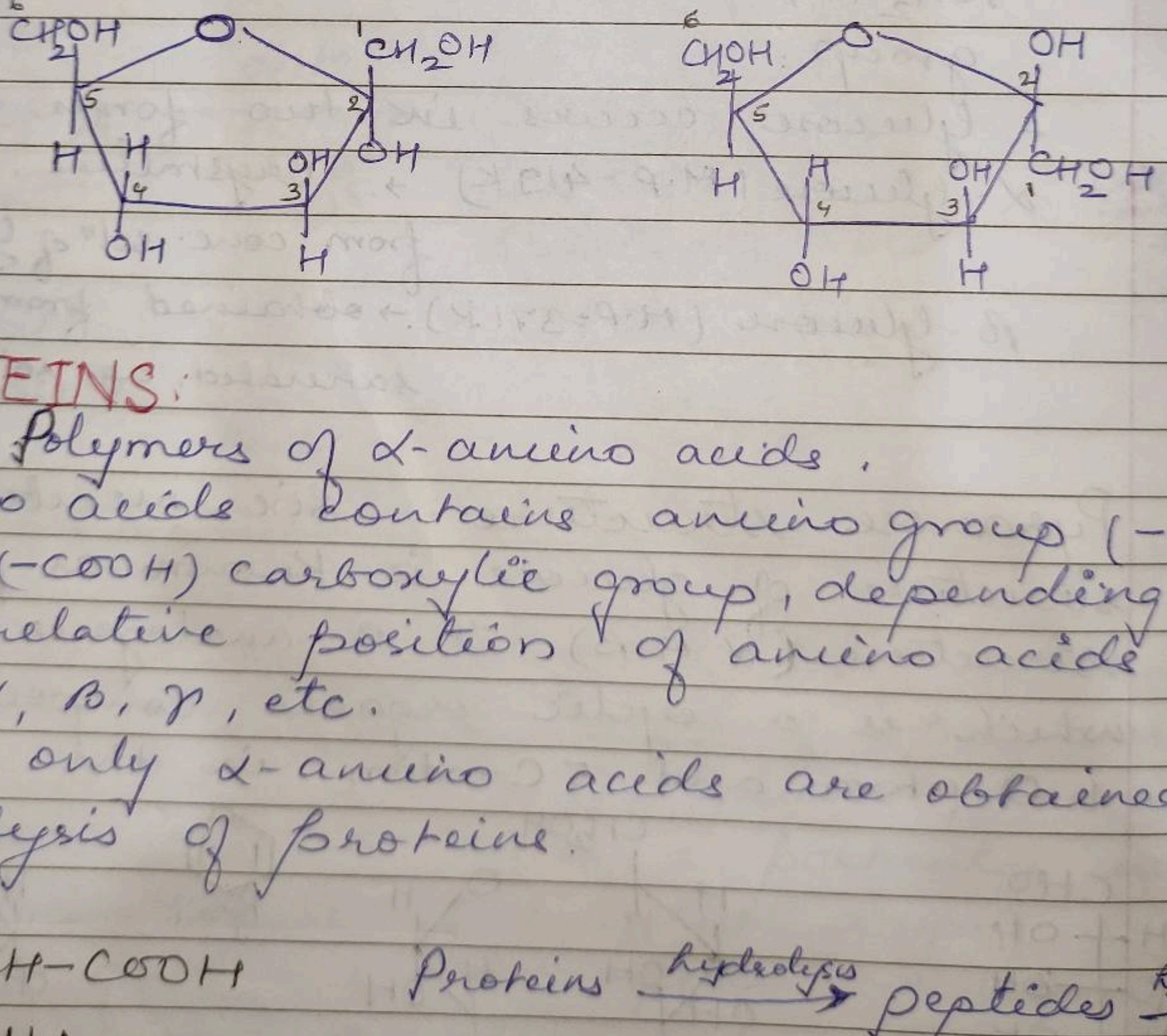
Fructose: $C_6H_{12}O_6$ Fruit sugar.

- Contains Ketone functional group
- called as Ketohexose
- obtained by hydrolysis of sucrose



α-D. fructofuranose β-D-fructofuranose.

Cyclic structure of two anomers of Fructose.



PROTEINS:

Polymers of α-amino acids.

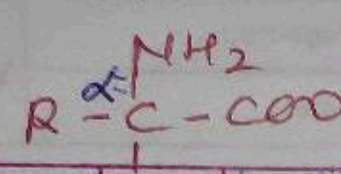
Amino acids contains amino group ($-NH_2$) and ($-COOH$) carboxylic group, depending upon the relative position of amino acids can be α, β, γ, etc.

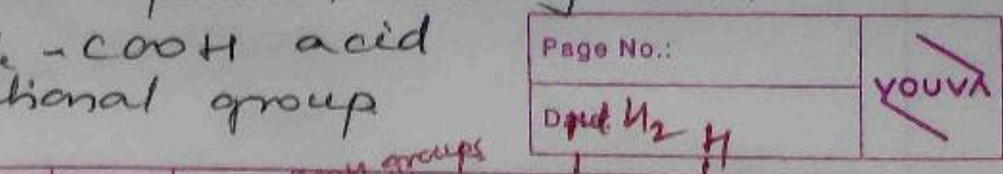
only α-amino acids are obtained on hydrolysis of proteins.

$R-\underset{\underset{NH_2}{|}}{CH}-COOH$ α-amino acids.

Proteins $\xrightarrow{\text{hydrolysis}}$ peptides $\xrightarrow{\text{hydrolysis}}$ α-amino acids.

Amino acid → organic compound having both amine & -COOH acid as functional group





α-amino acids so far 26. A.A commonly occuring proteins & present in species tissues

H_2N-CH_2-COOH Glycine (only α-amino acid, which is optically inactive due to absence of chiral-C.

Classification:

i) Acidic amino acid — more no. of -COOH groups — Ex: Aspartic acid

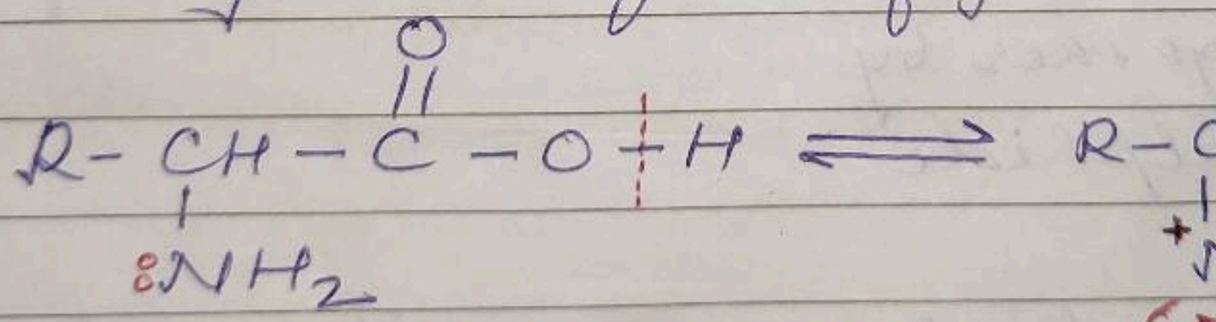
ii) Basic amino acid — more no of $-NH_2$ group — Ex: Lysine

iii) Neutral amino acid — (equal NH_2 & COOH group) — Ex: Alanine.

Essential A.A.	Non-Essential A.A.
A.A which is not synthesised by body, hence supplied in the form of diet	A.A which is synthesised by our body.
Ex: Villine, Lysine	Ex: Glycine, Alanine.

Properties:

- usually colourless, crystalline solids, soluble in water, High M.P.
- due to $-NH_2$ and -COOH, it behaves like salts rather than simple amines.
- In aq. soln, they neutralise each other by transfer of proton.



(Zwitter ion)

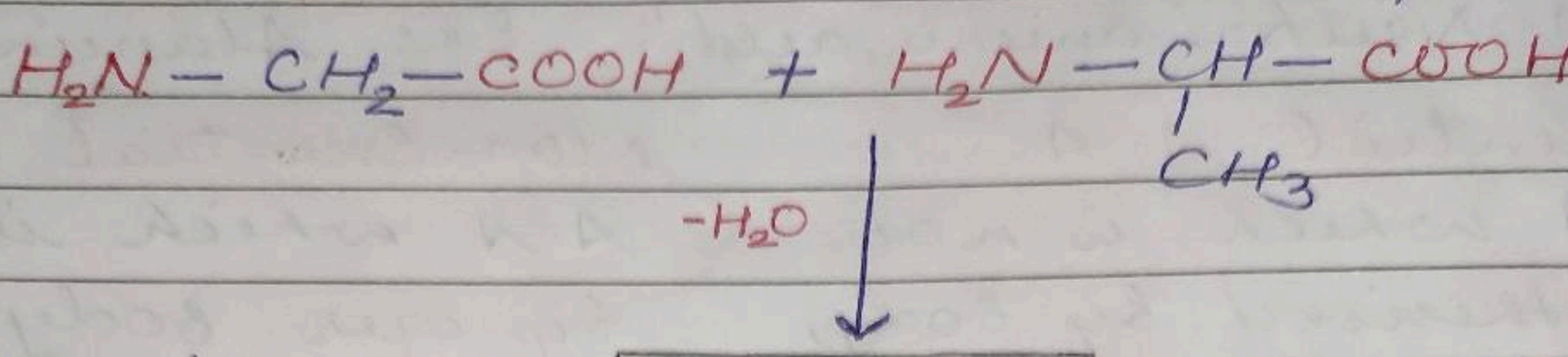
In aq. soln, the carboxyl group can lose a proton and amino group can accept a proton, giving rise to a dipolar ion known as "Zwitter ion"

This is neutral but contains both +ve and -ve charges.

In Zwitter ionic form, amino acids show amphoteric behaviour as they react both with acids and bases.

Peptide Linkage:

Proteins are connected to each other by $-CO-NH-$, bond called as peptide linkage



Glycylalanine (Gly-Ala).

"The poly peptide with molecular mass more than 10,000 ie is called Proteins"
(in noi more than 100).

Classification of Proteins:

	Fibrous protein	Globular protein
1)	Thread or fibre like structures in which polypeptide chains run parallel and are held together by H and disulphide bonds.	spherical structures in chains of polypeptides, coil around.
2)	Generally insoluble in water.	usually soluble in water
3)	Ex: Keratin, Myosin.	

Structure and shape of Proteins:

1) Primary structure → One or more polypeptide chains having large number of α-amino acids linked in a specific sequence.

sequence of amino acids in protein.

Date: YOUVA

2] Secondary structure → H-bonding between $-COOH$ and $-NH_2$ groups of peptide bond.

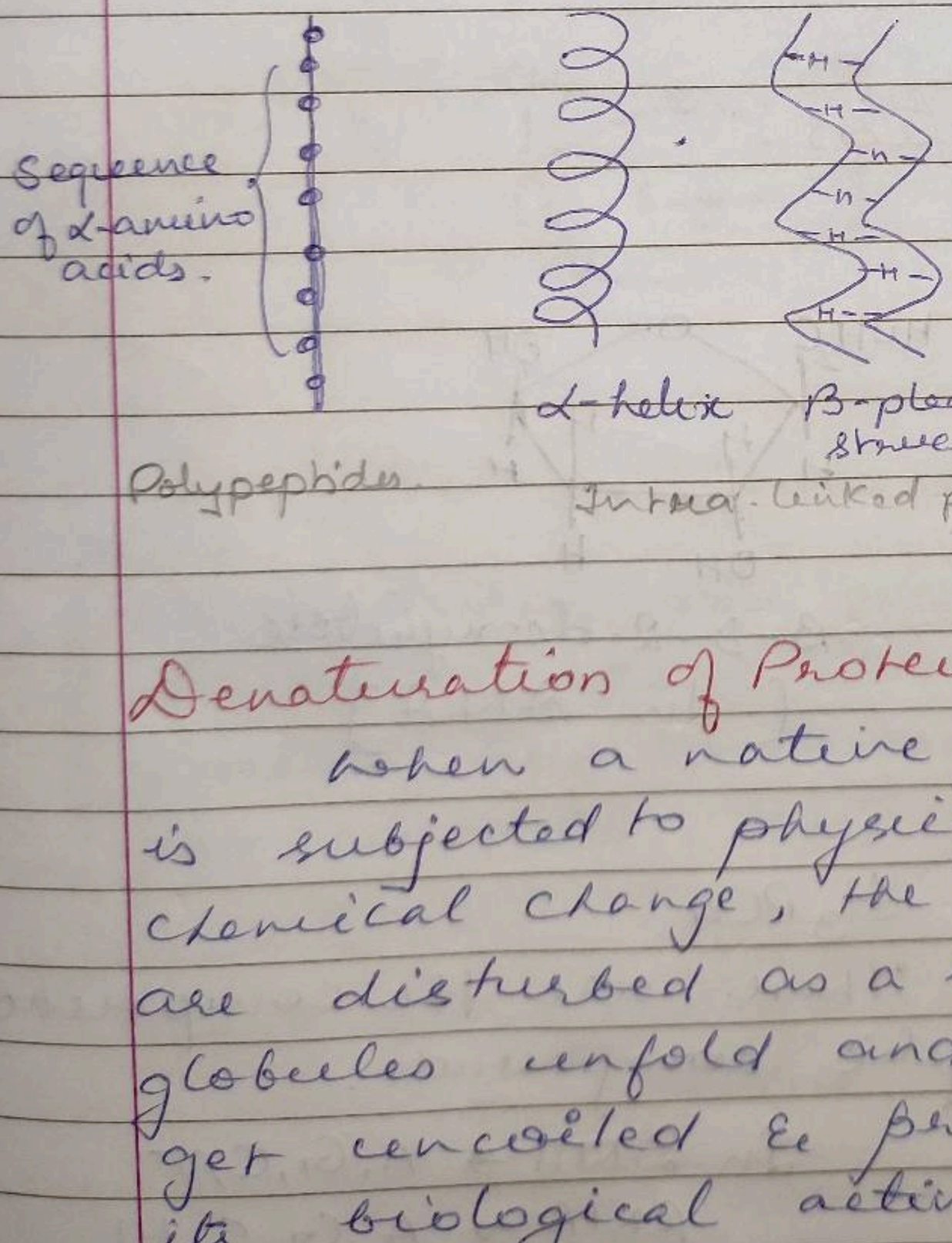
a) α-Helix - are possible H-bonds by twisting into a right handed helix.

b) β-pleated sheet structure - All peptide chains are stretched out to nearly maximum extension and are layed down side by side which are held together by H-bonds.

3] Tertiary structure → Further folding of 2° structure is known as Tertiary structure.. H-bond, V-Waal's force & electrostatic forces stablises 2° & 3° structure

4] Quaternary structure → The spatial arrangement of sub-units of proteins with respect to each other.

1° 2° 3°



Denaturation of Proteins

When a native protein is subjected to physical & chemical change, the H-bonds are disturbed as a result, globules unfold and helix get uncoiled & protein loses its biological activity.

Date: YOUVA

Nucleic acids:

Nucleic acids are the polymers of nucleotides

Chromosomes are composed of proteins and nucleic acids. There are of two types. (i) RNA } Also called as polynucleotides,
(ii) DNA } as they are made of long chain of polymers of nucleotides.

Nucleotide

↓

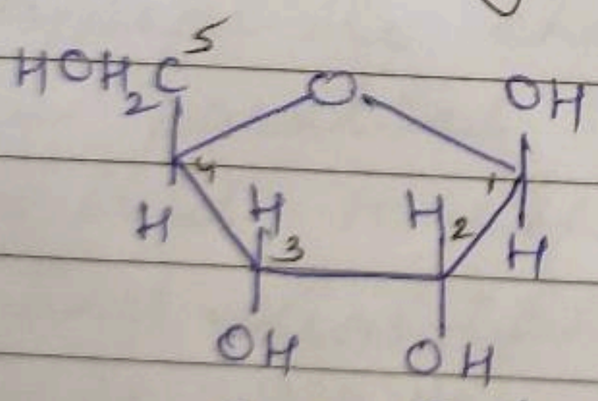
Nucleoside + Phosphoric acid

↓

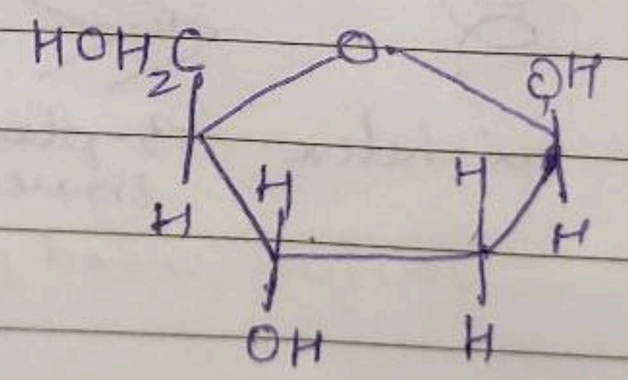
Nitrogen base. Pentose sugar

Chemical composition:

i) Pentose Sugar →



β-D-Ribose
(~~In~~ Ribose in RNA)



β-D-2-deoxyribose
(In DNA)

ii) Phosphoric acid. H_3PO_4.

iii) Nitrogenous base → These are the compounds containing heterocyclic compounds.

Two types

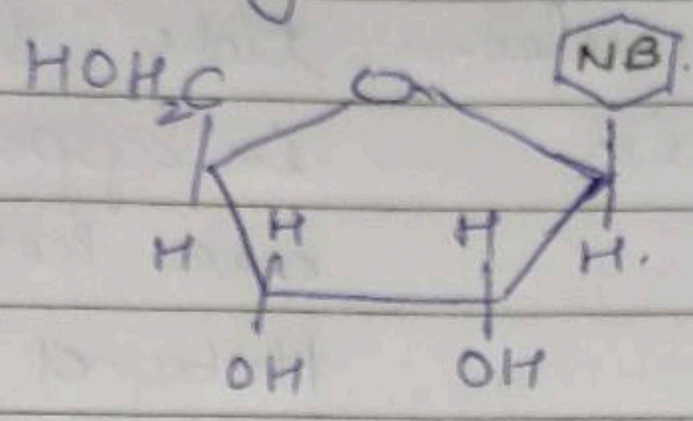
Purines — Adenine, Thymine

Pyrimidines — Uracil, Thymine, Cytosine

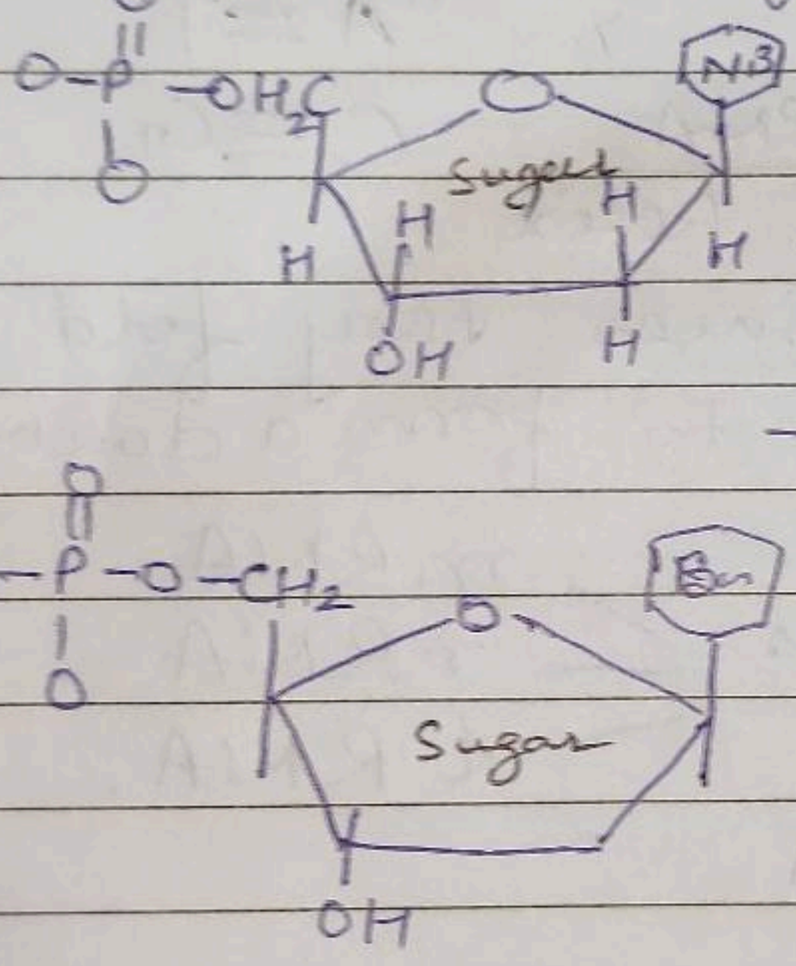
In DNA → A, G, C, T
RNA → A, G, C, U.

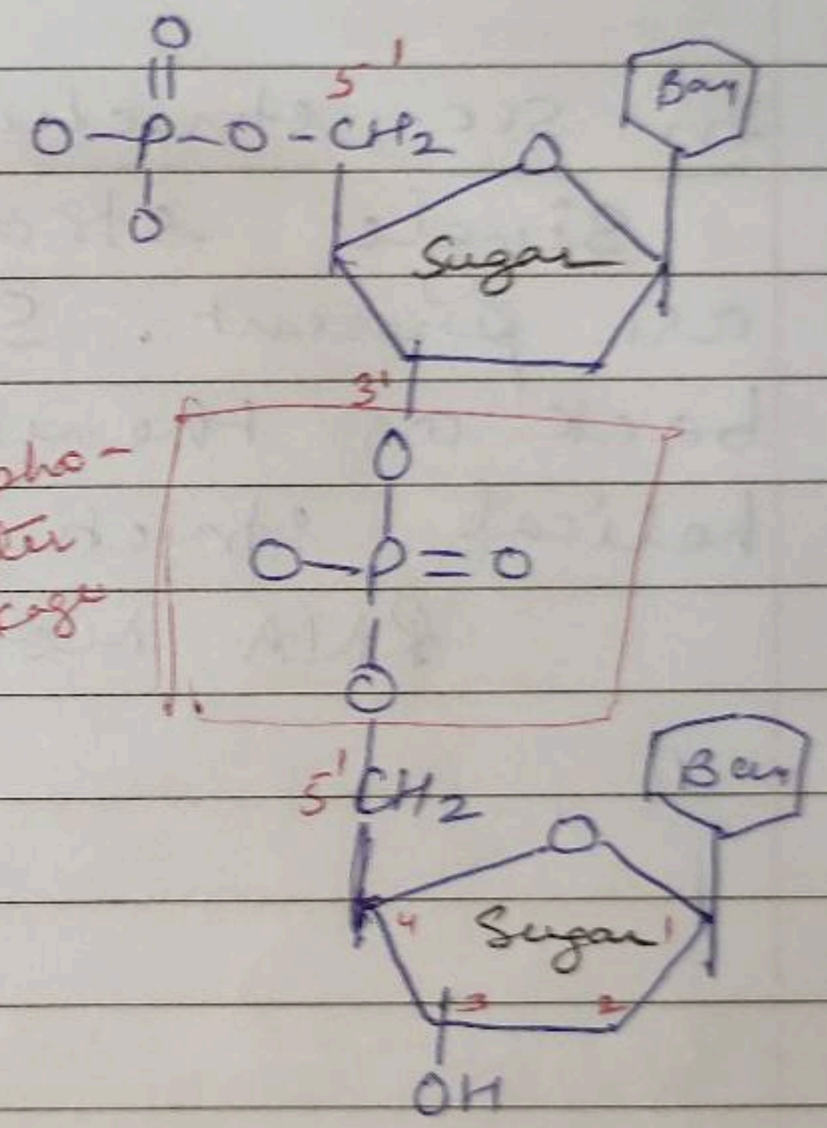
structure of nucleic acid

Nucleoside → consist 2- basic compounds pentose sugar and nitrogenous base.



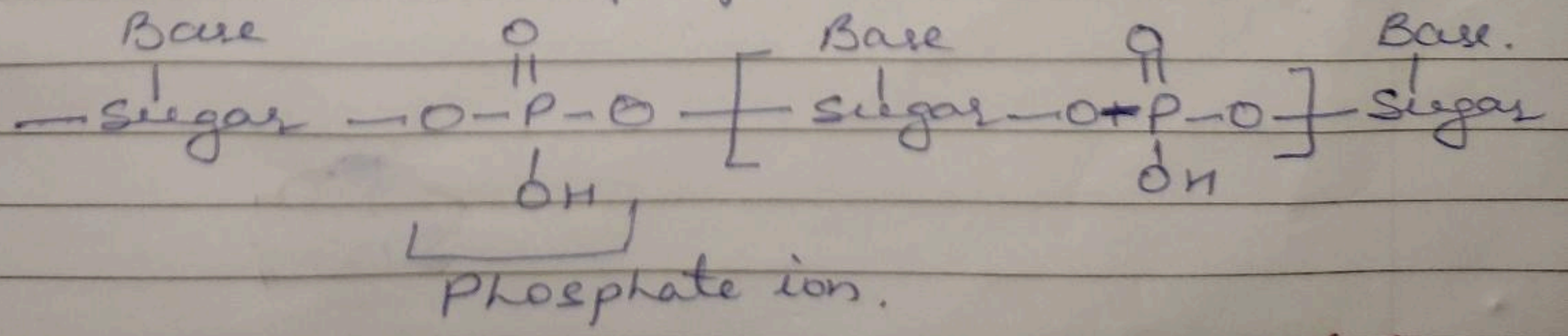
Nucleotide → Nucleoside is linked to H_3PO_4 at 5th position of sugar moiety (portion.)





phospho-diester linkage

Nucleotides are joined together by phospho-diester linkage between 5' and 3' atoms of pentose sugar. when large no. of nucleotides are connected, they form nucleic acids.



A simplified version of nucleic acid

Structure

1° structure.
Information regarding the sequence of nucleo-tides in the chain of nucleic acid.

2° structure.
2 separate polynucleo-tide strands leading in opposite direction are held together by H-bond betⁿ pairs of bases complementary to each other.

A = T 2 H-bonds
C ≡ G 3 H-bonds

Th sec. structure of RNA
Single stranded helix are present. Sometimes they fold back on themselves to form a double helical structure.

RNA molecules → mRNA
rRNA
tRNA.