Dept. of Physiotherapy

CARBOHYDRATE

C : H : O
1 : 2 : 1

Formula - $C_n(H_2O)_n$
$n \geq 3$

* Hydrates of Carbon :-

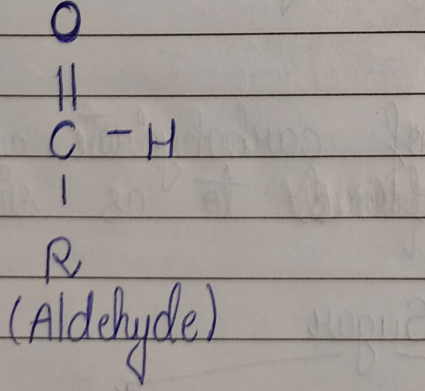
Deoxyribose sugar has general formula is not accumulation with that of the GF given about but it is an important carbohydr

Deoxyribose - $C_5H_{10}O_5$

Acetic acid is not a CHO its general formu is similar to that of the CHO.

Chemically CHO are defined as :-

(i) Polyhydroxy Alcohol of Ketone or Aldehyde Grou



(Aldehyde) (Ketone)

Max^m no. of C for a carbohydrate should be 3.

CARBOHYDRATE

* Non - Carbohydrate Compound :-

(a) Acetic Acid ($C_2H_4O_2$)

(b) Lactic Acid ($C_3H_6O_3$)

Classification :-

It is classified into three major groups based on the number of sugar units

① Monosaccharide
→ single glucose molecule

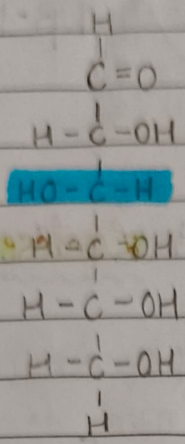
② Disaccharide / Oligosaccharide
→ 2 - 20 glucose molecule

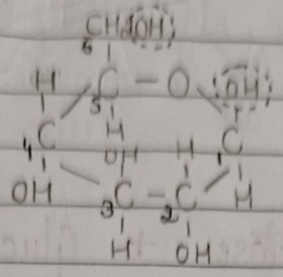
③ Polysaccharide
→ More than 20 glucose molecule

① Monosaccharide
- Simple sugar of carbohydrate and are obtained referred to as simple sugar.

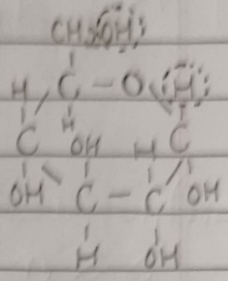
Sugar
- Aldose (Aldehyde)
- Ketose (Ketone)

(a) GLUCOSE



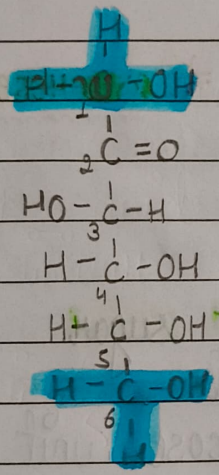


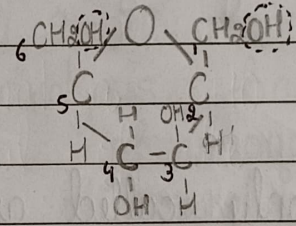
β - Glucose



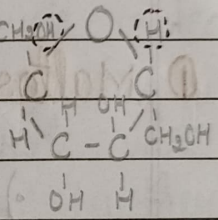
α - Glucose

(b) FRUCTOSE





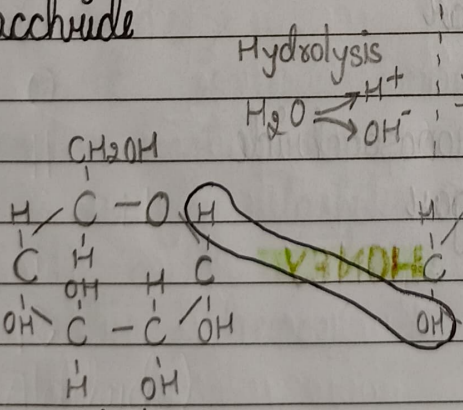
β - Fructose



α - Fructose

(II) Disaccharide

(I)



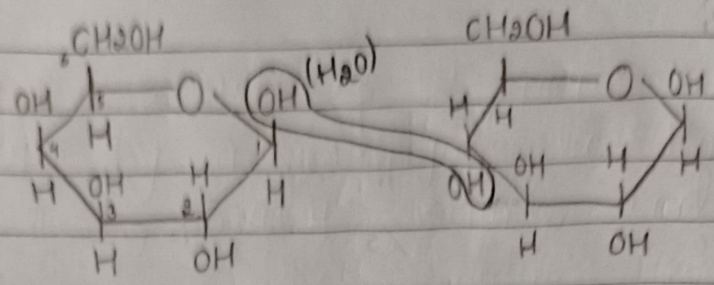
(α) (α)

Glucose + Glucose ⇒ Maltose

[α, 1-4 Glycosidic Linkage]

(C_1-O-C_4) yeah bond bnna chaye !!

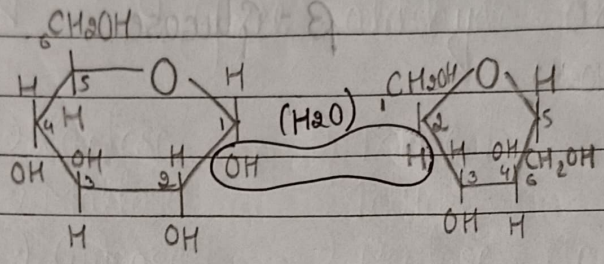
(ii)



[β-1,4-Glycosidic Bond]

Galactose + Glucose → Lactose

(iii)



[α-1,2 Glycosidic Bond]

Glucose + Fructose → Sucrose

① Maltose

- commonly called as Malt sugar
- α-1, 4 Glycosidic Bond
- compound of 2α-D Glucose unit

Glucose: Blood sugar
Grape sugar

Sucrose: Sweetest monosaccharide
Fruit sugar
Found in HONEY

(ii) Lactose

- commonly called as Milk sugar
- β, 1-4 Glycosidic Bond
- Least sweetest

(iii) Sucrose

- commonly called as Cane sugar
- two Monosaccharides are joined togther by Glycosidic Linkage.
- α, 1-2 Glycosidic Bond
- Sucrose is a Non-Reducing sugar.

(iii) Oligosaccharide

→ It contains 2-20 monosaccharide molecules which on hydrolysis are liberated based on the number of monosaccharide unit present in the oligosaccharide are further sub-divided to disaccharide, trisaccharide etc.

(iv) Polysaccharide

→ It is a monosaccharide unit with high molecular wt. more than 20 molecules. They are usually tasteless, non-sugar and form collides with water hence it is insoluble in water, hence they are not sweet.

* Disacchride

→ It consist of 2 monosacchride units hold together by a Glycoscidic Bond. They are crystalline, water soluble and sweet to taste.

They are of two types:-

① Reducing Sugar (free aldehyde or keto-group)

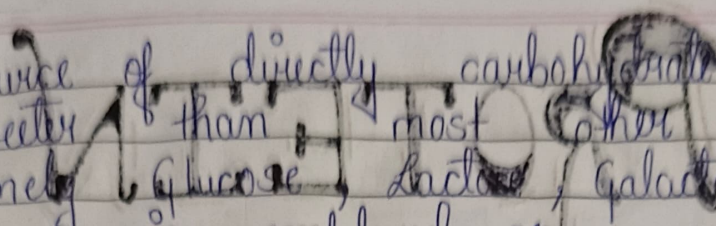
Ex:- •) Lactose •) Triose
•) Maltose •) Tetrose
•) Glucose •) Pentose, etc

② Non-Reducing Sugar (disacchride with no-free aldehyde or keto)

Ex:- •) Trehalose
•) Sucrose

SUCROSE

* It is the sugar of mostly produced by sugar-cane and sugarbeet. Sucrose is made up of α-D Glucose and β-D fructose. The two monosacchride are hold together by a Glycosidic Bond α & β between C_1 of α-Glucose and C_2 of β-fructose. Sucrose is the major carbohydrate produced in photosynthesis. It is transport into the storage organ of plants such as roots, tube and seeds. Sucrose is an important



source of directly carbohydrate. It is sweeter than most other common sugar namely Glucose, Lactose, Galactose and Maltose. Sucrose is employed as a sweetning agent in food industry.

Glucose + Fructose ⇒ Sucrose

POLYSACCHRIDE

Homopolysaccharide
→ contain only a single type of monosaccharides

- cellulose
- starch
- insulin
- Glycogen
- Chitin

Heteropolysaccharide
→ contains more than one different type of monosaccharide

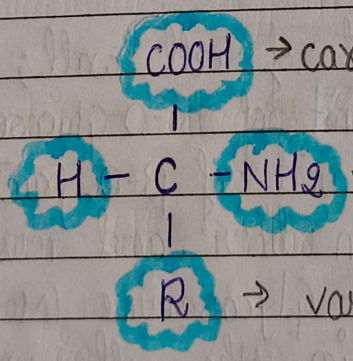
- Hemicellulose
- Pectin
- Hebarin
- Hyaluronidase

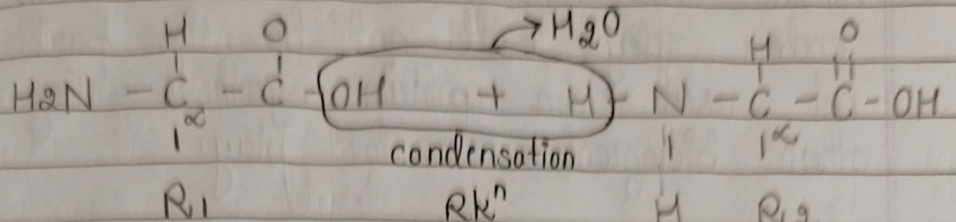
- Cellulose → component of cell wall; linear polymer of β-DG
- Starch → repititive unit of α-D Glucose; helical in structu
- Insulin → repititive unit of β-D fructose
- Glycogen → stored in liver and muscles too, α-D Gluc
- Chitin → N-acetyl Glycosamine (Modified sugars)
  - present in the cell wall of fungi and exoskeleton of arthropods.

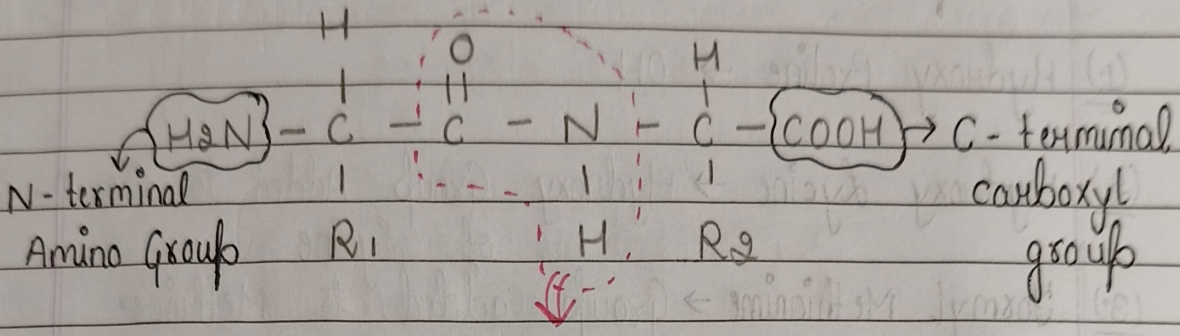
PROTEIN

* It is one of the diversified biomolecule made up of polymer of α-L- amino acid are linked together via Peptide Bond.
* Protein is next more abundant molecule than water.
* Proteins are heteropolymers of amino acids
* Collagen is most abundant in animal world.
* RuBisCo is most abundant in plant.
* There are approximately 300 AA but only 200AA are required for the formation of protein.

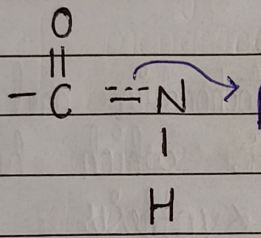
Amino Acids – substituted Methanes







PEPTIDE BOND



* Protein should have 51 AA residue below 51 AA in oligopeptid chain. (nhi bnyega)

* Nature of peptide bond rigid planar where oxy and hydrogen are in trans position. There is occurence of partial double bond b/w C and N atom due to partial resonance phenomenon

* There are 20 + 1 primary or standard amino acids those which has genetic code which ar used up in protein synthesis. In nature, more tha 300 AA are present but all are not utilized in protein synthesis. Only 200 AA are required.

* Amino acid non-standard do not have genetic code. They will not be the part of protein not used in protein synthesis. They have some other biological role to play.

Modified Amino Acid:-

(1.) Hydroxy Proline → OH

(2.) Hydroxy Lycine → Hydroxy Group Added to the R-chain of Lycine

(3.) Formyl Methionine → Group added to Methione.

Ex ⇒ Bacteria Prokaryote
- found in mitochondria and chloroplast in eukaryotic which helps in protein synthesis

Function :-

1.) Enzymes - Biocatalyst, Trypsin

2.) Structure Protein - Collagen, Elastin and Keratin

3.) Carrier Protein - Hb, Motor Protein

4.) Hormone - Insulin

5.) Glucose Transport - Glut-4

6.) Fight against Infectious Agent - Antibody (Immunoglobin)

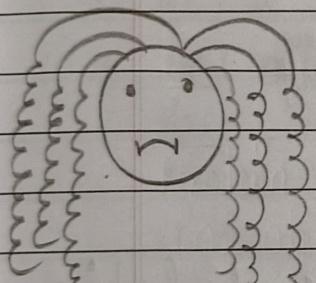
Structure of Protein :-

① Primary Protein

→ unfolded non-functional
→ most unstable
→ straight chain of protein
→ new formed protein from ribozome are primary in structure.

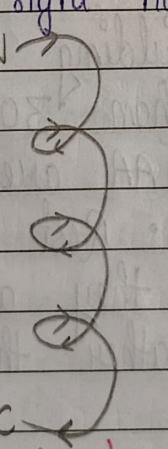
— A·A — A·A — A·A
Left side → 1st AA
Right side → Last A·A

② Secondary Protein

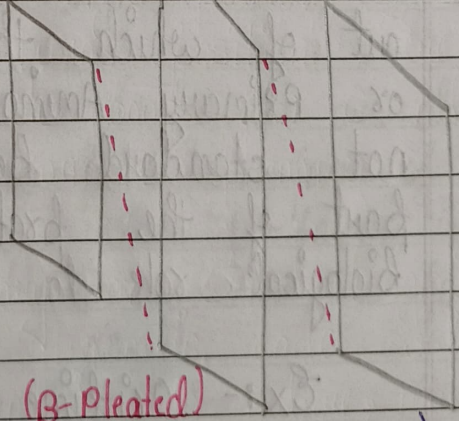


→ folding α-helix and β-pleated is achieve due to form of H-bond
→ spirally coiled structure
→ dipeptide bond, H-bond
→ right-handed

{ Parallel - (N-N)
{ Antiparallel - (N-C)

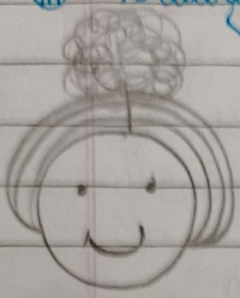


eg: Keratin (α-helix)
(due to H-bond b/w AA)



(β-Pleated)
(zig-zag pattern)
eg: Fibrin

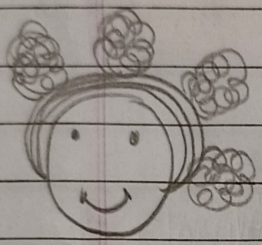
(iii) Tertiary Protein



→ biologically more active form
→ all protein and enzymes are present in protoplasm
→ highly folded
→ hollow woollen-ball like structure

eg:- Myoglobin (Muscles)

(iv) Quaternary Structure



→ most stable structure of protein
→ two or more polypeptide chain fold upon each other or by the folding of their sub units.
→ sub-units: spherical, cubical & plate-like structure.

eg: Haemoglobin (Hb)

* AMINO ACID

Amino acid are building blocks of proteins but in nature more than 300 AA are present out of which the 20 AA are called as standard or Primary Amino Acid. Rest of the AA are not standard Because they are utilise as the part of the protein rather than have other biological role to play.

Ex:- Ornithine (Urea Cycle)

•) Modified Amino Acid are formed by Hydroxypolin, Methyl Lycine, Methionine, Hydroxy Lycine.

•) After changing of specific initial RNA with Methionine, the modification of formly Methionine occur Before translation.

•) The AA has central carbon for variant fulfilled by for different amounts of atoms except for Glycine in which 1 of the variant is fulfilled by Amino Group ($-NH_2$) except in Polin where it is Imino Group ($-NH$), another variant is fullfiled by Carboxyl Group and third by Hydrogen atom and fourth by Amine Group.

•) It is the nature of (R) Group which is different in different Amino Acids and it is one of the Base of the chemical nature of (R). The Amino acid are classified into Hydrophilic and Hydrophobic

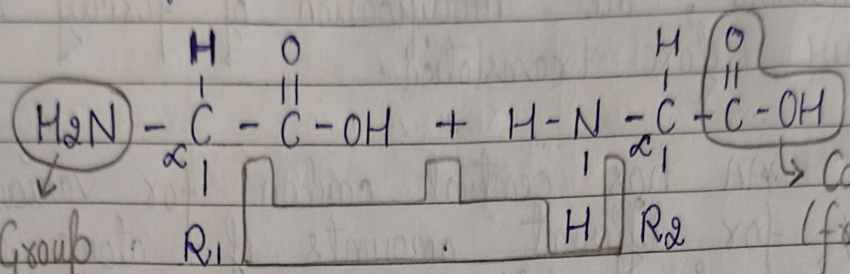
Property of Amino Acid :-

1.) Optical Isomerism : In nature (L_1-α AA) are abundant found with few exceptions D-form of AA are also present along with L_1-form in bacterial cell wall D-form of AA are found in

a.) Bacterial Cell Wall
b.) Certain Peptidoglycine
c.) Peptide Antibiotic

- Hexokinase, cannot bind to L_1-G
Synthesis of all the proteins.

* Peptide Tranquilise Enzyme :-
React with the Carboxyl Group of first Amino acid with the ($-NH_2$) Group and another group of amino acid.



No. of optical Isomers = 2^n
$= 2^1 = 2$
(D/L)

Classification of Amino Acid :-

1) On the basis AA are utilized by Protein or not.

(a) Standard 'or' Primary AA
- which have Genetic code and they are used as a part of protein
20 AA are standard AA.

(b) Non-Standard AA

(c) Modified AA

✱ CARBOHYDRATE

$C_n(H_2O)_n$
n = number

Carbohydrate

Monosaccharide (1)	Disaccharide (2)	Oligo/Trisaccharide (3-10)	Polysaccharide (<10)
• Glucose	• Sucrose	• Raffinase (Galactose + Glucose + Fructose)	• Starch
• Fructose	• Lactose		• Cellulose
• Galactose	• Maltose		• Glycogen
			• Heparin, &
			• Peptidoglycan

Homopolysaccharide
Heteropolysaccharide

- Sucrose - Glucose + Fructose
- Lactose - Galactose + Glucose
- Maltose - Glucose + Glucose

Catabolism + Anabolism ⇒ Metabolism ✱
↓ ↓
splitting of molecules add^n of molecules

✱ Glucagon → Increases @ Level

✱ Insulin → Decreases @ Level

Food
↓
Polysaccharide
↓
Saliva
↓
Salivary Amylase
(only 5% in mouth digestion)
↓
Stomach (Oligosaccharide)
↓
HCl (splits SA and Food)

Pancreas → Intestine (95%)
↓ ↓
Pancreatic Amylase
Lactase & Sucrase
(Monosaccharide)

* Mechanism Of Glucose :-

- Glucose —occupy→ Cell —Glycolysis→ Pyruvate (cytoplasm) → Acetyl CoA
- Acetyl CoA → TCA Cycle (Mitochondria)
  - By-Product:
    - CO2
    - H2O
  - NADH
  - FADH
  - GTP

★ RBC & Platelets Lacks 'Mitochondria'

- Fructose → (Through Glucagon) → Glucose
- Galactose → (Liver (store house)) → Glucose

Glucose → (store / Glycogenesis) → Glycogen → stored in Liver in this form

Glycogen → (Glucagon / Glycogenolysis) → Glucose

directly cell does not allow to pass only it allows in the form of (G)

★ PROTEIN

Protein

Amino Acid	Dipeptide	Oligo/Tri peptide	Polypeptide
(1)	(2)	(3-10)	(<10)

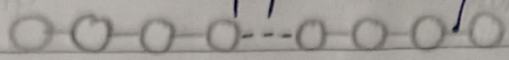
⇒ Food → Protein → Polypeptide → Stomach

Stomach → HCl & Pepsinogen (Tripeptide) → Intestine

Pancreas → Trysinogen, Chymotrypsinogen, Procarboxypeptide → Intestine

Intestine → Enterokinase → Amino Acid (1 protein)

Pepsinogen (Inactive) $\xrightarrow{HCl}$ Pepsin (Active) (Endopeptide) → Peptide Bond



Trypsinogen (Inactive) $\xrightarrow{Enterokinase}$ Trypsin (Active) $\xrightarrow{Activate}$ Chymotrypsinogen → Chymotrypsin

→ Procarboxypeptide → Carboxypeptide (Dipeptide) (Ex

↓

Amino Acid (Peptide)

- Pregnant woman → 1.1 g/kg/day
- Lacting woman → 1.13/kg/day
- Infant (0-6 month) → 1.3/kg/day
- Infant (6-12 month) → 1.69/kg/day
- Adult → 0.8 g/kg/day

Nitrogen

Positive Nitrogen	Negative Nitrogen	Balance / Neutral Nitrogen
• Hypothyroidism	• Hyperthyroidism	
• Growth	• During Accident	
• After accident	• Burn	

Protein

Fibrous (Insoluble)	Globular (Soluble)
• Keratin → Eg: Hair, nails & feather	

* Best Protein Source → Egg white
↓
Becoz it is directly a simple protein

* Protein ka jyada jyurat Growth mai hota hai!!

xopeptide)

C H O (N)
↳ only protein mai lagta hai!!

Inhale
- N = 78%
- O_2 = 21%
- CO_2 = 0.03%

Exhale
- N = 78%
- O_2 = 17%
- CO_2 = 4%

20 AA needed to our body

Essential AA
(9)
(Body nhi bna pa rha hai AA)

Semi-Essential
(Body bna pa rha hai AA but its insufficient for Body)

Non-Essential
(11)
(Body bna pa raha hai AA)

PROTEIN

Animal Source
'OR'
Biologically Complete protein

9 essential
bcoz, this animal cell also makes protein so, enough protein is essential.

Plant Source
'OR'
Biologically Incomplete Protein

7-8 essential