# UNIT-II CARBOHYDRATES

## (Saccharides / Sacharose)

→ Biomolecules which are made up of carbon, Hydrogen & Oxygen.

→ most abundant organic molecules in nature.

→ Hydrate of carbon.

→ Polyhydroxy, aldehyde or ketone compounds

↓ multiple -OH group ↓ -CHO ↓ -C=O

→ On the basis of no. of sugar unit

- Monosaccharides (made up of one sugar unit.) eg - Glucose, fructose
- Oligosaccharides (made up of 2-10 sugar units) ↓ disaccharide eg - Sucrose
- Polysaccharides (made up of more than 10 units)

# GLUCOSE [D & L isomers).

| | |
|---|---|
| H-C=O<br>H-C-OH<br>HO-C-H<br>H-C-OH<br>H-C-OH<br>CH₂OH<br>(D-Glucose)<br>[OH on right side] | H-C=O<br>OH-C-H<br>H-C-OH<br>HO-C-H<br>HO-C-H<br>CH₂OH<br>(L-Glucose) |

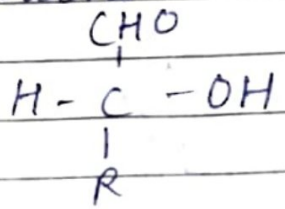
## * Stereoisomerism :-

→ Same structural formula but different spatial configuration.

→ Due to the presence of asymmetric or chiral carbon. chiral carbon.

Example : D & L Glucose.

→ Chiral carbon → carbon which is attached with 4 carbons

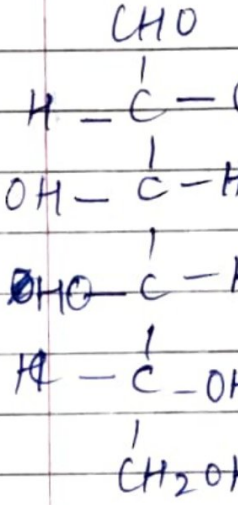


## * Epimers :-

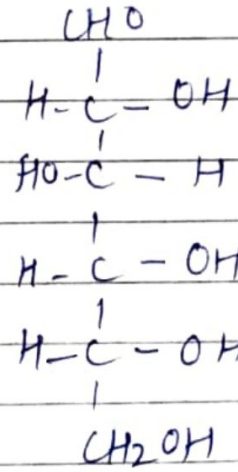
→ carbohydrates which are different at a single specific carbon other than $C_1$ atom.

eg D- Glucose & D- Galactose ( $C_4$ epimers)
D- Glucose & D- Mannose ( $C_2$ epimers)

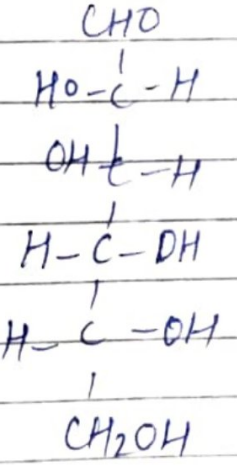
D-Galactose



D-Glucose



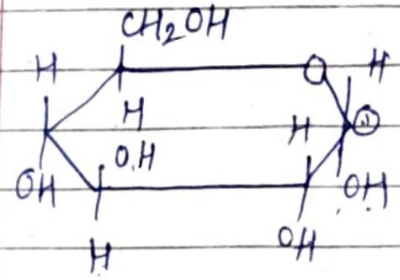
D-Mannose



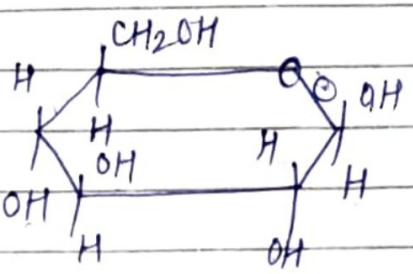
Epimers :-

→ If two monosaccharides diff from each other in their configuration around a single specific carbon other than $C_1$ carbon.
ex glucose & glactose ($C_4$)
Glucose & Mannose ($C_2$)

→ Anomers :- If two monosaccharides differ from each other around also Anomeric carbon. ex. α-β Cyclic forms of D-Glucose.




α-D Glucose




β-D Glucose.

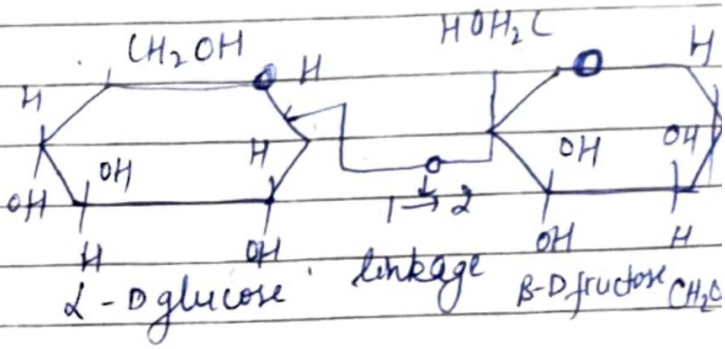
## Carbohydrates

**Reducing sugar**
↓
free aldehyde (-CHO) or ketone gp (-C=O) is present eg- lactose, mannose, maltose.

**Non-Reducing sugar**
↓
No free aldehyde or ketone gp
eg- Sucrose.

→ Oligosaccharides
↓
Disaccharides
↓
Made up of 2 sugar units
↓
two units linked togather by glycosidic benes
eg. Sucrose made up of.

α-D glucose & β-D fructose




* Function of Carbohydrates :-

(i) Carbohydrates are the most abundant source of energy.
(ii) Carbohydrates are the structural components of many organisms. eg cellulose forms the cell wall of the plants.
(iii) Carbohydrates are pre-cures for many organisms components. eg. lipids & Amino acids.
(iv) Carbohydrates participate in the structure of cell Membrane.
(v) Carbohydrates also serve as the storage form of energy to meet the immediate energy demands of the body.

## * LIPIDS :-

→ organic compounds which contain carbon, hydrogen & oxygen.

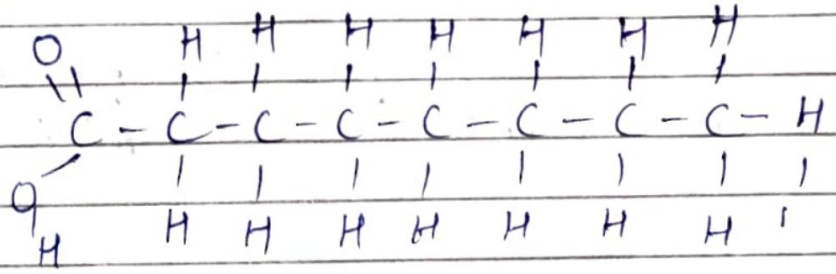
→ made up of hydrocarbons soluble in organic solvent (alcohol, ether) soluble in water.

→ lipids are found in oil, butter, whole milk cheese & fried foods.

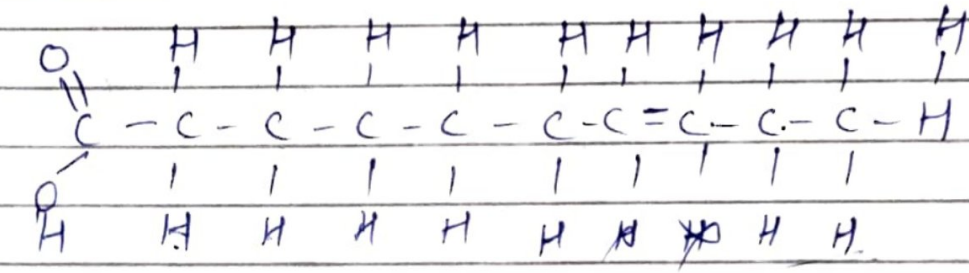
## * LIPID STRUCTURE :-

Polymers of fatty acid that contain along non polar hydrocarbon chain with small polar region containing oxygen.

### Saturated :-



### Unsaturated :-



* Classifications of lipids :-

(i) Non Saponifiable → cannot break down into smaller molecules through hydrolysis. eg cholesterol.

(ii) Saponifiable :-> break down into ester gps through hydrolysis. eg. wax.

Polar lipids

Non-polar lipids.

→ Polar lipids :- form barrier with an external in water environment.

→ Non-polar lipids :- are utilized as fuel and to store energy.

* On the basis of molecules attached

Simple lipids

↓

It is a fatty acid ester of different alcohols & carries no other substance.
eg phospholipids.

Compound lipids/ Complex lipids

↓

It consist of a fatty acid, an alcohol, & one or more other gps such as phosphorus & Nitrogen
eg. steroids

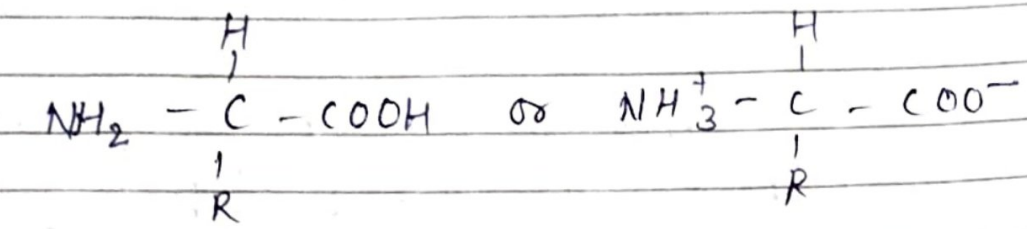
Derived lipids

↓

These are the hydrolyzed compounds of simple & complex lipids.
eg fatty acids.

## * AMINO ACIDS :→

→ Organic compounds containing amino ($-NH_2$) gp & carboxyl gp ($-COOH$)

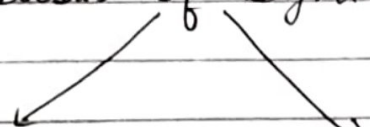


Basic Structure of Amino acids.

* Glycine is the simplest amino acids.

* Classification of Amino Acids :-

On the basis of Synthesis by body




Essential :- Those amino acids which are not synthesised by body. These amino acids include in our diet. for ex. 9 amino acids are essential amino acids. Lysine, Valine, Threonine, Histidine.

Non-Essential :- Those amino acids are synthesised by body. for ex. Glycine, Serine. Total 11 amino acids in Non-essential.

* On the basis of charge:

- Positive net charge (Basic) eg. Lysine
- Neutral (No net charge) eg. Valine, glycine
- Negative net charge (Acidic) eg. glutamic acid

* On the basis of aromaticity:-

- Aliphatic (linear chain) eg. valine, glycine.
- Aromatic (ring like structure) eg. Tryptophan

* Functions of Amino Acid:-

→ Amino acids are monomers of protein that form building blocks of the body
→ Amino acids acts as fuel in glycolysis & fatty acids synthesis.
→ Deficiency of amino acids causes various diseases.

## * NUCLEIC ACID *

→ Nucleic acids are polymers of Nucleotides. two type of Nucleic acid presents
→ DNA (Deoxyribonucleic acid) & RNA (Ribonucleic acid)

(Deoxyribonucleic acid) (Ribonucleic acid)

* DNA :- Adeline
Valine & Cytocine
thymine + sugar
Nucleosible
It phospho gp Nucleotides

RNA :- Guanine, Cytocine
Adenine, Uracil.

* Adenine & Guanine } Purine (double ring)

* Cytocine thymine Uracil } Pyrimidine (single ring structure)

* PROTEINS :-

→ 6 polypeptides linear chain of aa linked together by peptide bond.

→ complex structure larger than carbohydrates of lipids e.g Insulin, Collagen

Denaturation :-

→ means breaking of bonds within protein molecule.

→ property of protein to chang its focus due to change in temperature or ph in K | as denaturation.

eg. Egg → albumin protein → liquid state in intial

heating → comes in solid state

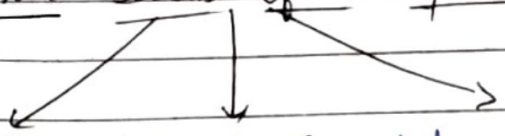
* Classification of proteins :-

On the basis of structure :-

Globular protein
Round & spherical
eg albumin

Fibrous protein
long, fibrous, linear in shape
eg keratin, collagen (muscles)

On the basis of composition :-

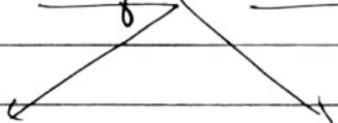


Simple protein (only contains aa eg keratin)

Conjugated protein (contain aa + non protein part)
eg phosphoprotein
glycoprotein
lipoprotein

Derived protein (hydroproducts of proteins eg peptides)

On the basis of source of protein :-



Plant source
eg pulses soyabean etc. tofu.

Animal source
eg. fish, egg etc

## On the basis of structural configuration of proteins

### Primary structure (1°)
linear chain of aa linked together by peptide bond

### Secondary structure (2°)
- α-Helix
  - → intera hydrogen bond present
  - → helical structure
  - → covalent bond is present
  - → eg. keratin
- β-pleated sheet
  - → inter H bond present
  - → sheet like structure
  - eg fibroin silk.

### Tertiary Structure
- → 3 bonds present
- → covalent bond
- → H bonds
- → Disulphide bounded hydrophilic bond.
- → proper folding of protein eg Insulin.

### Quanternary Structure
- → 4 bonds present
- → H-bond
- → covalent bond
- → Disulphide bond
- → Vandenwaal force
- eg Haemoglobin

## On the basis of function:

- Structural
- Enzymatic
- Hormones
- Respiratory pigments
- Transport proteins
- Storage proteins

→ Structural
forms the structure of body
eg keratin (Hair) collagen (muscle)

Enzymatic
→ Biological catalyst
eg lipase, Amylase, protease.

Hormones
→ Maintain balance in body
eg Insulin

→ Respiratory
coloured protein eg. Haemoglobin

Transport
→ material from one part to another part
eg. Haemoglobin

→ Shortage
store metal ions of amino acids in cells.

# TISSUES :→

→ Tissues are cells with similar functions are called Tissues.

They may be classified as :→

1.) Animal Tissue  2.) Plant Tissue

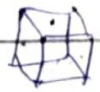
Animal Tissue are of four types :→

(i) Epithelial
(ii) Connective
(iii) Muscular
(iv) Nervous

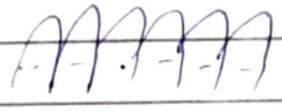
(1.) **Epithelial** :→ They are the outermost layer of the body.

- Squamous → single layer of cells

- Cubodial → Multiple layer of cells



- Columnar → column like (multiple layer)



Example :
Skin, stomach
function → To protect stomach (protection)
= Absorbation.

(2) Connective Tissue :→ They are present inside the body and they generally connect or separate a body part.

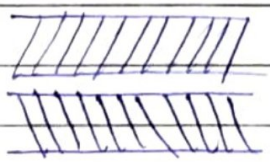
Types of cells :→ Blood Cells (Rbc's, Wbc's)

example = Bone, Blood
function = Distribute blood nutrients in the whole body.
Bones = Skelton System

(3) Muscular Tissue :→ It is present in each and every organ of the body and body parts.

Types of cells => Satisfied / Unsatisfied

Satisfied: layers in a pattern
Unsatisfied: layers in Random



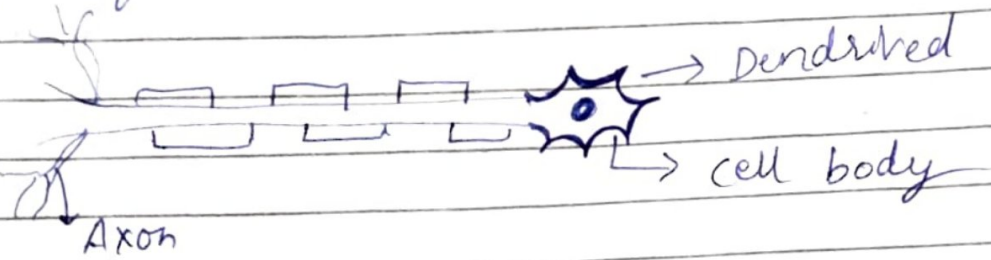
Example = Cardian muscle, Hand muscles

function = Muscles → Movement of body

Muscles → Voluntary / Involuntary

(4) Nervous Tissue :→ It is present in brain from Spinal cord to the whole body.

Types of cells : Neurons




Example : Brain, Spinal cord, sense organs. functions : Send and recieve signals.

## Plant Tissue

- Meristematic Tissue
- Permanent Tissue

(1) Meristematic Tissue :→

☆ It is present in tips of stem & roots.
☆ They are generally square & cubical.

function

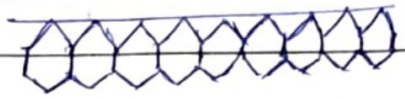
→ growth of plants.

(2) Permanent Tissue :→

- Epidermis
- Parenchyma
- Sclerenchyma
- Xylem
- Phloem

(1.) Epidermis :→

* It is present in outermost layer of the plant. It is present on stem, leaves and roots.
* Hexagonal type of cell is present in it.

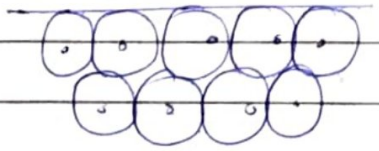


function :→

* It acts as a barrier b/w plants and the surrounding.

(2) Parenchyma :→

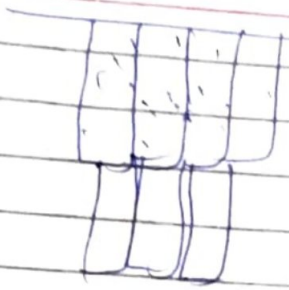
* It is a basal soft tissue that forms majority of stem, root, leaves and fruits.
* They are generally oval or round.



* functions :→ Storage of Nutrients

(3.) Sclerenchyma :→

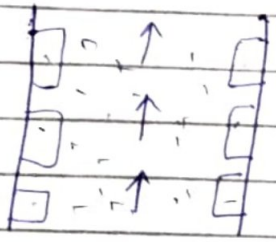
* It is hard, stiff tissue. present in branches, bark and seeds.
* They are generally long, column type cells.



* It gives stiffness and support to the plant.

(4.) **Xylem :→**

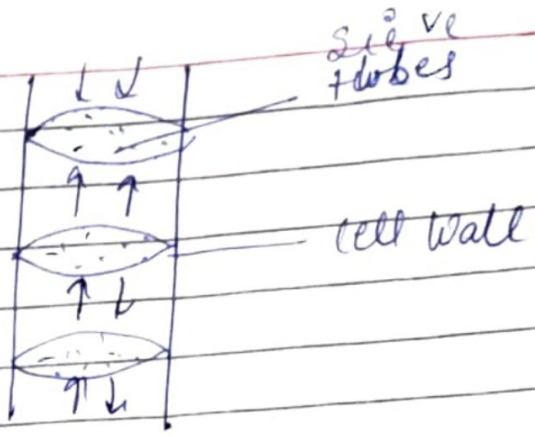
* It is present inner to parenchyma.
* It forms cambium.
* They are generally dead cells that regulates one way flow of water from water to higher



* Transportation of water and Minerals.

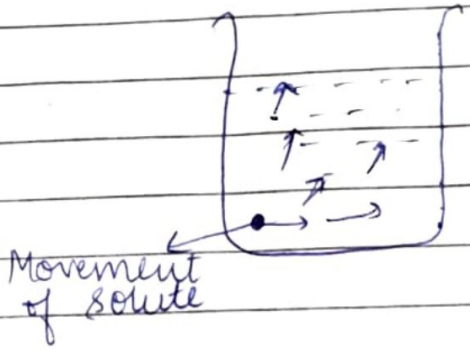
(5.) **Phloem :→**

* It is present in the innermost part of the plant.
* They are live cells, multidirectional cells, long columner cells that are joint with cell wall.




* Transportation of food and Nutrients.

# Diffusion :→ Movement of solute particles from higher concentration to lower concentration.
ex→ Mixture of salts & sugar with water.




# faciliated diffusion:→ To speed up the process of diffusion when an aid is used. ex→ mixing salt & water with spoon.

# Osmosis :→ Movement of solvent molecules through a semi permeable membrane.
ex→ raisins kept in water.

# Absorbtion:→ It is a condition at which molecules of solvent enter

into bulk phase.
ex. Sponge kept in water.

# Adsorbtion :→ Absorbtion at surface is called adsorption.
ex → Adsorbtion of water by plant root.

# Osmoregulation :→ It is process in which organism regulates the ionic balance and water to maintain its osmotic pressure.

There are two types :→

1) Osmoconformos :→ They try to maintain water and ionic balance of their body with surroundings. for ex → Starfish, jelly fish.

2.) Osmoregulators :→ They do not have any concern with surrounding and they can maintain their own water & ionic balance.
for ex. Human, frogs, Tortoise.