Unit -14 Biomolecules

Carbohydrates:-Chemically, the carbohydrates may be defined as optically active poly hydroxy aldehydes or ketones or the compounds which produce such units on hydrolysis.

Classification of Carbohydrates:- A. Based on hydrolysis :-

i) Monosaccharides:-. glucose, fructose, etc.

ii) Oligosaccharides:- having 2 to 10 monosaccharides units. Sucrose, maltose (disaccharides)

iii**) polysaccharides** starch, cellulose, glycogen, gums, etc.

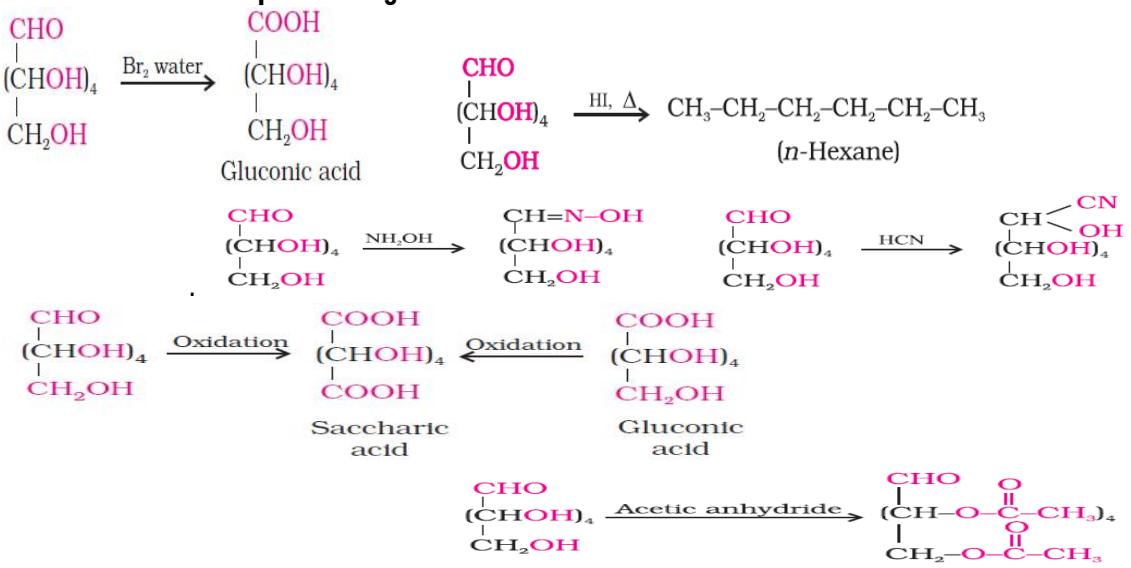
B. Based on Reducing property:-

i) Reducing sugars:- glucose. maltose

ii) Non-reducing sugars:- sucrose

C Based on Functional Group:- If a monosaccharide contains an aldehyde group, it is known as an aldose and if it contains a keto group, it is known as a ketose.

Chemical Properties of glucose:-



A linkage between two monosaccharide units through oxygen is called **glycosidic linkage**.

Disaccharides:-i) Sucrose: The two monosaccharides are α-glucose and β-fructose.

ii) Maltose:- Maltose is composed of **two α-D-glucose** units .

iii) Lactose: It is composed of **β-D-galactose** and **β-D-glucose**.

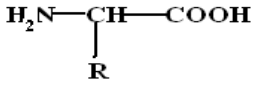
Polysaccharides:-<u>Starch</u>:-polymer of α-glucose .hving two parts**Amylose** and **Amylopectin**.

Amylose	Amylopectin
Amylose is water soluble component which constitutes about 15-20% of starch. Chemically amylose is a long unbranched chain with 200-1000 α-D-(+)-glucose units held by C_1– C_4 glycosidic linkage.	Amylopectin is insoluble in water and constitutes about 80- 85% of starch. It is a branched chain polymer of α-D-glucoseunits, branching occurs by C_1–C_6 glycosidic linkage.

(ii) <u>Cellulose</u>:- It is a straight chain polysaccharide composed only of **β-D-glucose** units.

(iii) <u>Glycogen:-</u> Animal starch, structurally similar to amylopectin, but more branched.

<u>Proteins:-</u> All proteins are polymers of α-amino acids. Amino acids contain amino (–NH_2) and carboxyl (–COOH) functional groups



Classification of Amino Acids:-

Essential amino acids	Nonessential amino acids

Those which cannot be synthesised in the body and must be obtained through diet, are known as **essential amino acids.** Eg. Valine, Lucine	The amino acids, which can be synthesised in the body, are known as **nonessential amino acids.** Eg. Glycine ,Alanine

Amino acids are connected to each other by **peptide bond** or **peptide linkage.** Chemically, peptide linkage is an amide formed between –COOH group and $–NH_2$ group.

Polypeptides	Proteins
When the number of amino acids is more than ten, then the products are called **polypeptides**.	A polypeptide with more than hundred amino acid residues, having molecular mass higher than 10,000u is called a **protein.**

Structure of proteins:

(i) Primary structure of proteins: ie. Sequence of amino acids in the chain.

(ii) Secondary structure of proteins: deals with folding of polypeptide chains of two types α-helix and β-pleated sheet structure.

α-helix structure	β-pleated sheet structure
In α-Helix, a polypeptide chain forms all possible hydrogen bonds by twisting into a right handed screw (helix) with the –NH group of each amino acid residue hydrogen bonded to the > C = O of an adjacent turn of the helix.	In β-structure all peptide chains are stretched out to nearly maximum extension and then laid side by side which are held together by intermolecular **hydrogen bonds**.

(iii) **Tertiary structure of proteins: deals with further folding and refolding of secondary structures**. The main forces which stabilise the 2° and 3° structures of proteins are hydrogen bonds, disulphide linkages, van der Waals and electrostatic forces of attraction.

Fibrous proteins	Globular proteins
When the polypeptide chains run parallel to form fibre– like structure Such proteins are generally insoluble in water. examples are keratin and myosin	This structure results when the chains of polypeptides coil around to give a spherical shape. These are usually soluble in water. Examples Insulin and albumins

Denaturation of Proteins:-Due to change of pH or Temperature, globules unfold and helix gets uncoiled and protein loses its biological activity. This is called **denaturation** of protein.

Vitamins:- The micronutrients required to keep the body healthy. Deficiency causes diseases

Classification of Vitamins:-

(i) Fat soluble vitamins:. These are vitamins A, D, E and K.

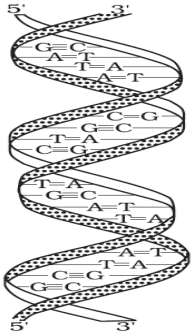
(ii) Water soluble vitamins: B group vitamins and vitamin C.

Nucleic Acids: Polymer of nucleotides**,** two types, the **deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).**

Deoxyribonucleic acid (DNA)	Ribonucleic acid (RNA)
The sugar moiety is β-D-2-deoxyribose	In RNA molecule, it is β-D-ribose.
DNA contains four bases viz. A, G, C and **T**.	RNA contains four bases viz. A, G, C and **U**.
It has double strand helix structure.	It has single stranded structure.
Can undergo self duplication.	Is of three types and perform different functions.

Structure of nucleic Acids:-

Nucleoside	Nucleotide
A unit formed by the attachment of a base to 1′ position of sugar is known as **nucleoside.**	When nucleoside bonded to phosphoric acid at 5′-position of sugar, we get a **nucleotide**.



Nucleotides are joined together by **phosphor-di-ester linkage** between 5′ and 3′ carbon atoms of the pentose sugar.

Two strands are complementary to each other because sequence of bases on one strand of DNA automatically fixes the sequence on other strand of DNA.

Biological Functions of Nucleic Acids

- Transmission of genetic information.
- Protein synthesis

Enzymes:- The biological catalysts made up of protein are known as enzymes.

Hormones:- The chemicals secreted by endocrine glands in our body.