



Biomolecules are the organic compounds which form the basis of life.

Carbohydrates

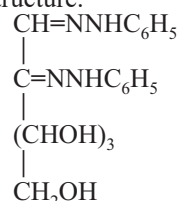
Optically active polyhydroxy aldehydes (aldoses) or ketones (ketoses) or the compounds which produce these units on hydrolysis are known as carbohydrates.

- ❖ All monosaccharides and disaccharides (except sucrose) are reducing carbohydrates. Polysaccharides are non-reducing carbohydrates.
- ❖ The monosaccharides and oligosaccharides having sweet taste are collectively known as sugars. Polysaccharides which are insoluble in water and not sweet in taste, are known as non-sugars.
- ❖ All naturally occurring monosaccharides belong to D-series.
- ❖ Kiliani synthesis is used to convert an aldose into next higher aldose.
- ❖ **Glucose:** It is also known as Dextrose. It is present in grape sugar, corn sugar and blood sugar ($C_6H_{12}O_6$).
- ❖ **Anomers:** Anomers are cyclic monosaccharides differing from each other in the configuration at C-1 if they are aldoses or in the configuration at C-2 if they are ketoses.
- ❖ **Mutarotation:** The change in optical rotation on standing is called mutarotation.

α -D-(+) Glucose \rightleftharpoons Open chair form \rightleftharpoons β -D-(+) Glucose

+111.5° +52.5° +19.5°

- ❖ **Epimers:** Monosaccharides differing in configuration at a carbon other than anomeric carbon are called epimers, e.g. glucose and galactose differ in configuration at C_4 , hence called epimers.
- ❖ **Osazones:** Monosaccharides and reducing disaccharides react with excess of phenyl hydrazine to form crystalline substances of the structure.



It is known as osazone. Glucose, fructose and mannose give same osazone.

- ❖ **Sucrose ($C_{12}H_{22}O_{11}$):** Sucrose is most abundant in plants and known as cane sugar or table sugar or invert sugar.
- ❖ **Lactose or milk sugar:** It is present in milk of mammals and made up of one glucose and one galactose units. It is a reducing sugar.

- ❖ **Maltose or Malt sugar:** It is named because of its occurrence in malted grain of Barley. It is a reducing sugar.
- ❖ **Starch ($C_6H_{10}O_5$)_n:** It is a polymer of α -glucose and a major reserve food in plants. It turns blue with iodine. It is a mixture of two components:
 - (i) Amylose (20%), an unbranched water soluble polymer.
 - (ii) Amylopectin (80%), a branched water insoluble polymer. Sources of starch are potatoes, wheat, rice, maize, etc.
- ❖ **Cellulose ($C_6H_{10}O_5$)_n:** It is the most abundant and structural polysaccharide of plants. It is important food source of some animals. It is a polymer of β -D-(+) -glucose.
- ❖ **Glycogen:** It is found in animal body (mainly in liver and muscles) as reserve food and is called animals starch. Like starch, it is a polymer of α -D-glucose.

Test for Carbohydrates

- ❖ Molisch's test, it is positive for all carbohydrates.
- ❖ Iodine test, it is specific for starch and glycogen.
- ❖ Benedict's test, it is positive for reducing sugars.
- ❖ Barfoed's test, it differentiates between monosaccharides and disaccharides.
- ❖ Seliwanoff's test, it is positive for monosaccharides with ketonic group.
- ❖ Osazone test, it is the confirmatory test in which shape of crystals tell the type of sugar present in the solution.

Amino Acids

The compounds containing amino group ($-NH_2$) and carboxylic group ($-COOH$) are called amino acids.

- (a) **Neutral amino acids:** Having one $-NH_2$ and one $-COOH$ group. E.g. glycine.
 - (b) **Acidic amino acids:** Having one $-NH_2$ and two $-COOH$ groups. E.g. aspartic acid.
 - (c) **Basic amino acids:** Having two or more $-NH_2$ and one $-COOH$ group. E.g. lysine.
- ❖ **Essential and Non-essential amino acids:** Amino acids synthesised by body are called non-essential amino acids and that are not synthesised by body are called essential amino acids.
 - ❖ **Nomenclature:** They are known by their common names and abbreviated by first three letters of their common names e.g. glycine as 'gly' and alanine as 'ala'. Naturally occurring α -amino acids are L-amino acids.

Peptides

Peptides are condensation products of two or more amino acids, $\text{—}\overset{\text{O}}{\parallel}\text{C—NH—}$ is known as peptide linkage. A polypeptide made up of n -amino acids has $(n - 1)$ peptide bonds.

- ❖ **Fibrous proteins:** Polypeptide chains are held together by hydrogen and disulphide bonds. Such proteins are insoluble in water. E.g. Keratin (present in hair, wool) etc.
- ❖ **Globular proteins:** These are usually soluble in water. E.g. Insulin, albumins.
- ❖ **Simple proteins:** These yield only α -amino acids upon hydrolysis. E.g. Albumin.
- ❖ **Conjugated proteins:** These yield α -amino acids and non-protein part, called prosthetic group.
- ❖ **Derived proteins:** These are obtained by partial hydrolysis of simple or conjugated proteins.

Denaturation of Proteins: The process that changes the three dimensional structure of native proteins is called denaturation of proteins.

Tests of Proteins

- (i) **Biuret Test:** Protein solution + NaOH + dil. $\text{CuSO}_4 \rightarrow$ pink or violet colour.
- (ii) **Millon's Test:** Protein solution + Millon's reagent \rightarrow red colour.
Millon's reagent is a solution of mercuric nitrate and traces of sodium nitrate solution.
- (iii) **Iodine reaction:** Protein solution + iodine in potassium iodide solution \rightarrow yellow colour.

(iv) **Xanthoproteic test:** Protein solution + conc. $\text{HNO}_3 \rightarrow$ yellow colour $\xrightarrow{\text{NaOH}}$ orange colour.

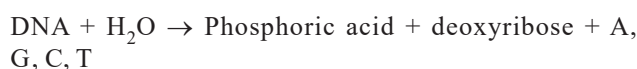
Enzymes: Serve as biological catalyst e.g., pepsin, trypsin etc.

Vitamins: Vitamins are required by body to maintain normal health, growth and nutrition.

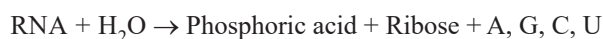
- ❖ Vitamins A, D, E and K are fat soluble whereas vitamins B and C are water soluble.
- ❖ Vitamin H is neither fat soluble nor water soluble.

Nucleic Acid: DNA and RNA

(i) **DNA** (Deoxyribonucleic acid).



(ii) **RNA** (Ribonucleic acid).



- ❖ In both DNA and RNA, heterocyclic base and phosphate ester linkages are at C_1 and C_5 respectively of the sugar molecule.

Hormones

These are the chemical substances which are produced by endocrine (ductless) glands in the body. Hormones acts as chemical messengers.

Insulin is a protein hormone. Its deficiency leads to diabetes mellitus.