CLASS NOTES

| CLASS:XII | TOPIC:BOIMOLECULES |
|---|---|
| SUBJECT:CHEMISTRY | |

**Carbohydrates:**

Carbohydrates may be defined as optically active polyhydroxy aldehydes or ketones or the compounds which produce such units on hydrolysis.

The most common sugar, used in our homes is named as sucrose whereas the sugar present in milk is known as lactose.

Depending upon their behaviour on hydrolysis carbohydrates are classified into three groups.

**Classification of Carbohydrates**

1. **Classification of carbohydrates**

1. Monosaccharides

   1. Simplest carbohydrates
   2. Cannot be hydrolysed into simpler compounds
   3. Examples: Glucose, mannose

      Oligosaccharides

   • Carbohydrates which give 2–10 monosaccharide units on hydrolysis

   • Examples: Sucrose, Lactose, Maltose

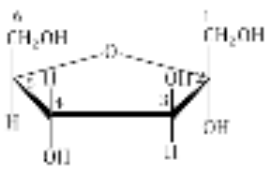
      Polysaccharides

- Carbohydrates which give a large number of monosaccharide units on hydrolysis
- Examples: Cellulose, starch

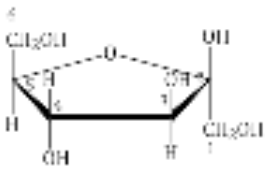
**Glucose (Aldohexose)**

Glucose is the monomer for many other carbohydrates. Alone or in combination, glucose is probably the most abundant organic compound on the earth. Glucose occurs freely in nature as well as in the combined form. It is present in sweet fruits and honey.

**Cyclic Structure of Glucose**



α-D-(-)-Fructofuranose



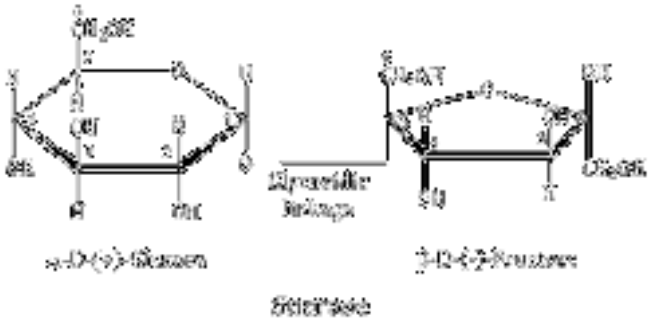
β-D-(-)-Fructofuranose

**Structure of Fructose**

The cyclic structures of two anomers of fructose are represented by Haworth structures:

1. **Disaccharides**
   Disaccharides on hydrolysis with dilute acids or enzymes yield two molecules of either the same or different monosaccharides. The two monosaccharides are joined together by an oxide linkage formed by the loss of a water molecule. Such a linkage through oxygen atom is called glycosidic linkage.
   **Sucrose**

   1. These two monosaccharides are held together by a glycosidic linkage between C1 of α-glucose and C2 of β-fructose. Reducing groups of glucose and fructose are involved in glycosidic bond formation due to this sucrose is a non reducing sugar.



   2. Sucrose is dextrorotatory but after hydrolysis gives dextrorotatory glucose and laevorotatory fructose. Thus, hydrolysis of sucrose brings about a change in the sign of rotation, from dextro (+) to laevo (–) and the product is named as invert sugar.

**Proteins:**

Proteins are classified on the basis of their chemical composition, shape and solubility into two major categories as discussed below.

- **Simple Proteins**
  Simple proteins are those which on hydrolysis give only amino acids. According to their solubility, the simple proteins are further divided into two major groups—fibrous and globular proteins.
  **Fibrous Proteins:** These are water-insoluble animal proteins, e.g. collagen (major protein of connective tissues), elastins (protein of arteries and elastic tissues) and keratins (proteins of hair, wool and nails) are good examples of fibrous proteins. Molecules of fibrous proteins are generally long and thread like.
  **Globular Proteins:** These proteins are generally soluble in water, acids, bases or alcohol. Some examples of globular proteins are albumin of eggs, globulin (present in serum) and haemoglobin. Molecules of globular proteins are folded into compact units which are spherical.

- The actual structure of a protein can be discussed at four levels:
- **Primary structure:** Information regarding the sequence of amino acids in a protein chain is called its primary structure. The primary structure of a protein determines its functions and is critical to its biological activity.
- **Secondary structure**: The secondary structure arises because of regular folding of the polypeptide chain due to hydrogen bonding between carbonyl and – NH– groups. Two types of secondary structures have been reported. These are α-helix when the chain coils up and a β-pleated sheet when hydrogen bonds are formed between the chains.
- **Tertiary structure:** It is the three-dimensional structure of proteins. It arises due to folding and superimposition of various α-helical chains or β-pleated sheets.
- **Quaternary structure:** The quaternary structure refers to the way in which simple protein chains associate with each other resulting in the formation of a complex protein.

α-Helix structure of proteins

**β-Pleated sheet structure of proteins**

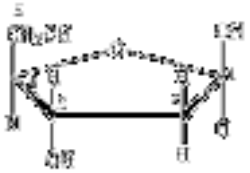
**Nucleic acids:**

1. Nucleic acids are mainly of two types:

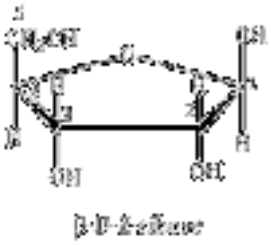
1. Deoxyribonucleic acid (DNA)
2. Ribonucleic acid (RNA)

1. **Chemical Composition of Nucleic Acids**

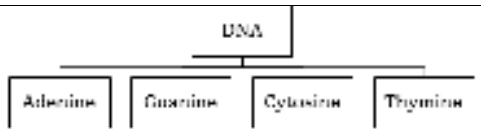
1. DNA or RNA on complete hydrolysis yields a pentose sugar, phosphoric acid and nitrogen containing heterocyclic compounds.
2. In DNA molecules, the sugar moiety is β-D-2-deoxyribose.



1. In RNA molecule, the sugar moiety is β-D-2-ribose.



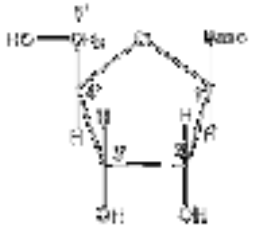
2. DNA contains four bases:




3. RNA contains four bases:

4. **Structure of Nucleic Acids**
**Nucleoside**

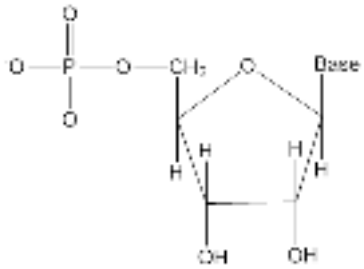
1. Nucleotide is a unit formed by linking a base to 1′ position of sugar.



2. The sugar carbons are numbered as 1′, 2′, 3′ etc. in order to distinguish from the bases.

**Nucleotide**

1. It is obtained when nucleoside is linked to phosphoric acid at 5′-position of sugar moiety.




2. Nucleotides are linked by phosphodiester linkage between 5′ and 3′ carbon atoms of the pentose sugar.
3. James Watson and Francis Crick gave a double strand helix structure for DNA.
4. In this two nucleic acids chains are wound about each other and held together by hydrogen bonds between pairs of bases.
5. The two strands are complimentary to each other because the hydrogen bonds are formed between specific pairs of bases.
6. Adenine forms hydrogen bonds with thymine whereas cytosine forms hydrogen bondsith guanine.

**RNA**

1. In secondary structure of RNA, helices are present which are only single stranded.
2. They sometimes fold back on themselves to form a double helix structure.
3. RNA molecules are of three types and they perform different functions.
4. They are named as:

1. Messenger RNA (m-RNA)

2. Ribosomal RNA(r-RNA)
3. Transfer RNA (t-RNA)

Content absolutely prepared at home.