NCERT Solutions for Class-XII Chemistry

CHAPTER -10

NCERT Chemistry Class 12

1. What are monosaccharides?

1. Monosaccharides are carbohydrates that cannot be hydrolysed further to give simpler units of polyhydroxy aldehyde or ketone.
Monosaccharides are classified on the bases of number of carbon atoms and the functional group present in them. Monosaccharides containing an aldehyde group are known as aldoses and those containing a keto group are known as ketoses. Monosaccharides are further classified as trioses, tetroses, pentoses, hexoses and heptoses according to the number of carbon atoms they contain. For example, a ketose containing 3 carbon atoms is called ketotriose and an aldose containing 3 carbon atoms is called aldotriose.

2. What are reducing sugars?

2. Those type of carbohydrates which reduces the Fehling's solution and Tollen's reagent are termed as reducing sugars.

3. Write two main functions of carbohydrates in plants.

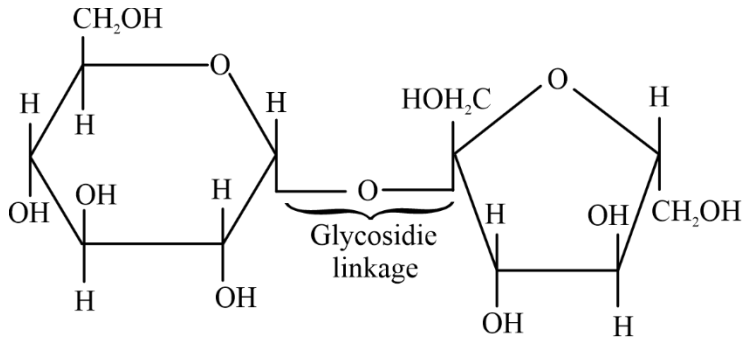
3. Two main functions of carbohydrates in plants are:
(i) Polysaccharides such as starch serve as storage molecules.
(ii) Cellulose, a polysaccharide, is used to build the cell wall.

4. Classify the following into monosaccharides and disaccharides.
Ribose, 2-deoxyribose, maltose, galactose, fructose and lactose.

4. Monosaccharides: 2-deoxyribose, galactose, Ribose, fructose
Disaccharides: lactose, Maltose

5. What do you understand by the term glycosidic linkage?

5. Glycosidic linkage refers to the linkage formed between two monosaccharide units through an oxygen atom by the loss of a water molecule.
For example, in a sucrose molecule, two monosaccharide units, α-glucose and β-fructose, are joined together by a glycosidic linkage.



– D – glucose – D – fructose

Sucrose

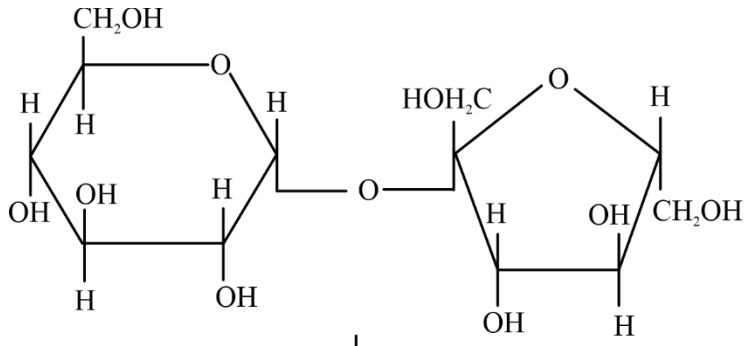
6. What is glycogen? How is it different from starch?

6. Glycogen, also termed as animal starch, is found only in animals. It is a polysaccharide. Both Glycogen and starch are the main source of glucose that provides energy to humans that are later converted into carbohydrates.

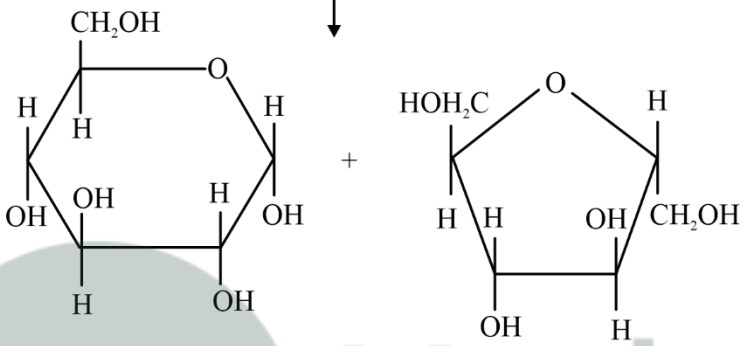
They differ in structure. Starch comprises a chain and a branched compound whereas glycogen is composed of a single molecule and it is branched.

7. What are the hydrolysis products of (i) sucrose and (ii) lactose?

7. (i) On hydrolysis, sucrose gives one molecule of α-D glucose and one molecule of β-Dfructose.

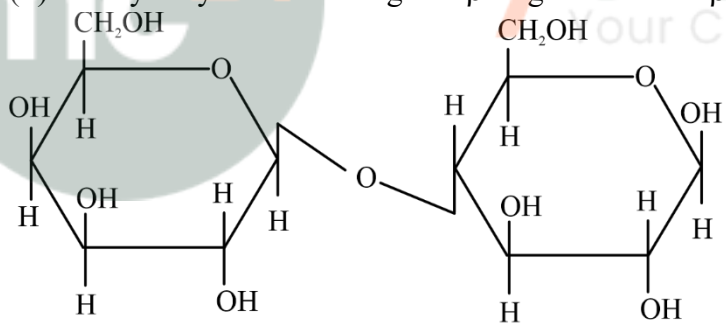


Hydrolysis

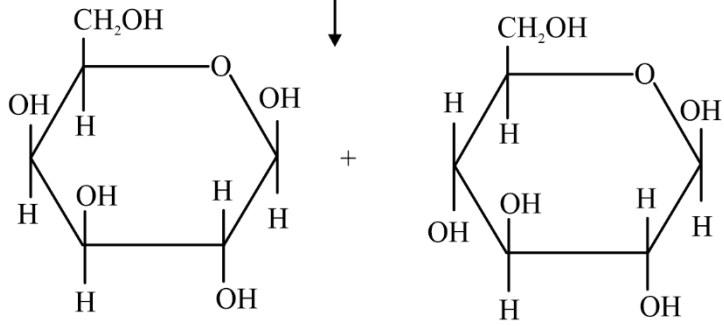


α – D – glucose β – D – fructose

(ii) The hydrolysis of lactose given β-D-galactose and β-D glucose.



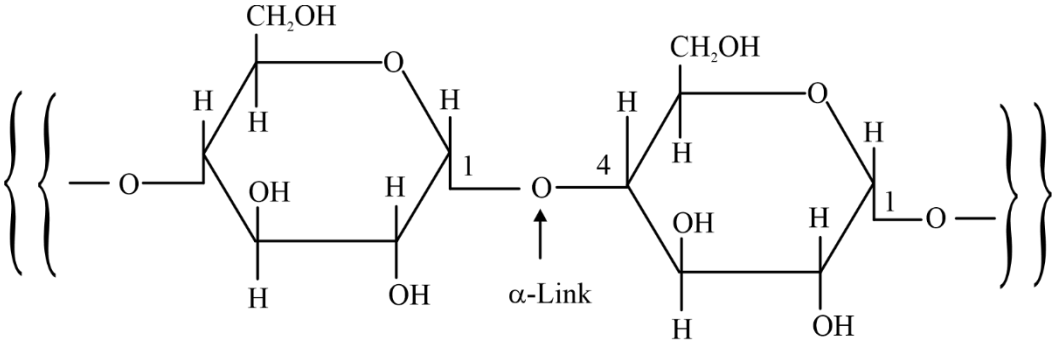
Hydrolysis



β – D – galactose β – D – glucose

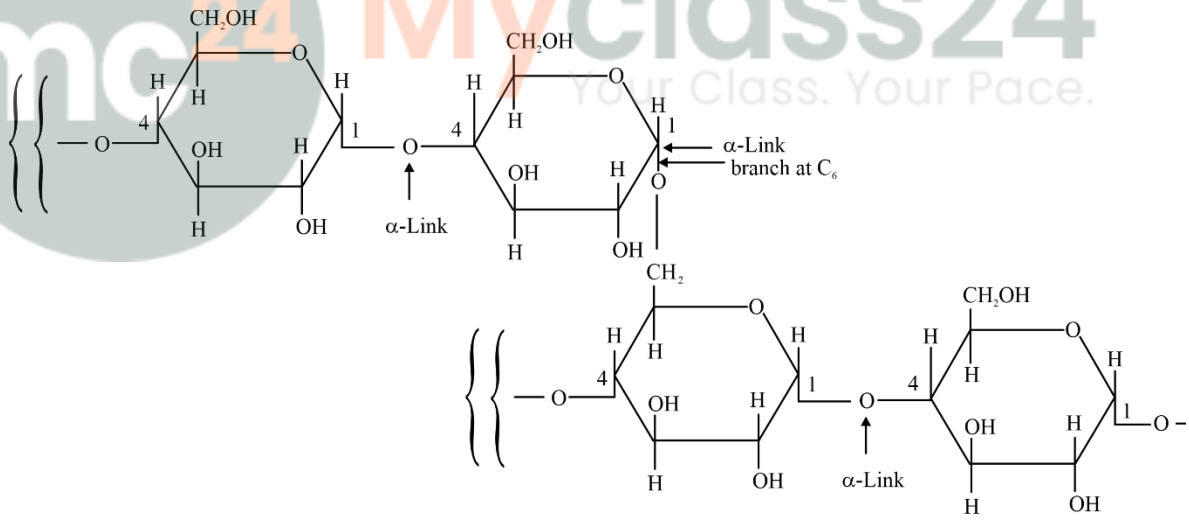
8. What is the basic structural difference between starch and cellulose?

8. Starch consists of two components – amylopectin and amylose. Amylose have a longer linear chain of α - D- (+) -glucose units joined by $C_1 – C_4$ glycosidic linkage (α -link).



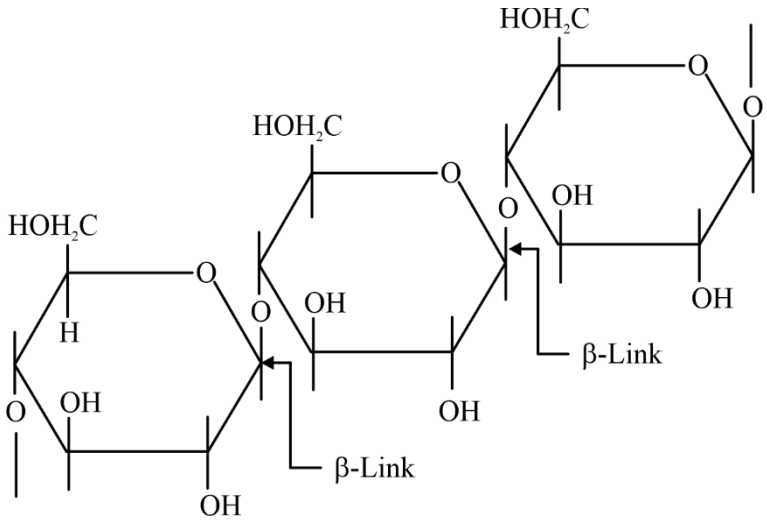
Amylose

While amylopectin is branched-chain polymer of α -D glucose units, in which the chain is formed by C_1-C_4 glycosidic linkage and the branching occurs by C_1-C_6 glycosidic linkage.



Amylopectin

While, cellulose is a straight-chain polysaccharide of β-D glucose units joined by C_1-C_4 glycosidic linkage (β-link).



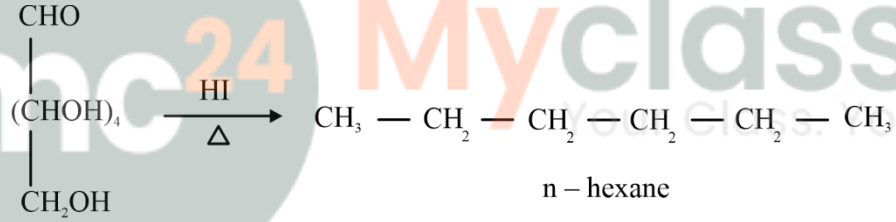
9. What happens when D-glucose is treated with the following reagents?

(i) HI

(ii) Bromine water

(iii) HNO_3

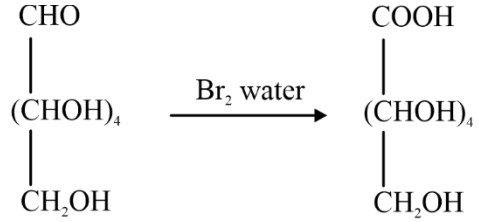
9. (i) When D-glucose is heated with HI for a long time, n-hexane is formed.



D – glucose

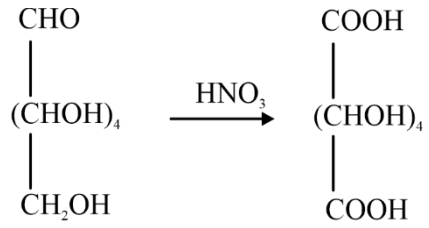
n – hexane

(ii) When D-glucose is treated with Br_2 water, D-gluconic acid is produced.



D – glucose D – gluconic acid

(iii) On being treated with HNO_3, D-glucose get oxidized to give saccharic acid.



D – glucose Saccharic acid

10. Enumerate the reactions of D-glucose which cannot be explained by its open chain structure.

10. (i) The pentaacetate of glucose does not react with hydroxylamine. This shows that a free –CHO group is not present in glucose.

(ii) Aldehydes from the hydrogen sulphite additional product by giving 2,4 – DNP test, Schiff's test and react with $NaHSO_4$.

(iii) Glucose is available in two crystalline forms α - and β. The α - form (m.p. = 417 K) crystallizes from a concentrated solution of glucose at 303 K and the β-form (m.p. = 423 K) crystallizes from a hot and saturated aqueous solution at 371 K. This behaviour can't be explained by the open chain structure of glucose.

11. What are essential and non-essential amino acids? Give two examples of each type.

11. Essential amino acids are required by the human body, but they cannot be synthesized in the body. They must be taken through food. For example: valine and leucine Non-essential amino acids are also required by the human body, but they can be synthesized in the body. For example: glycine, and alanine.

12. Define the following as related to proteins.

(i) Peptide linkage

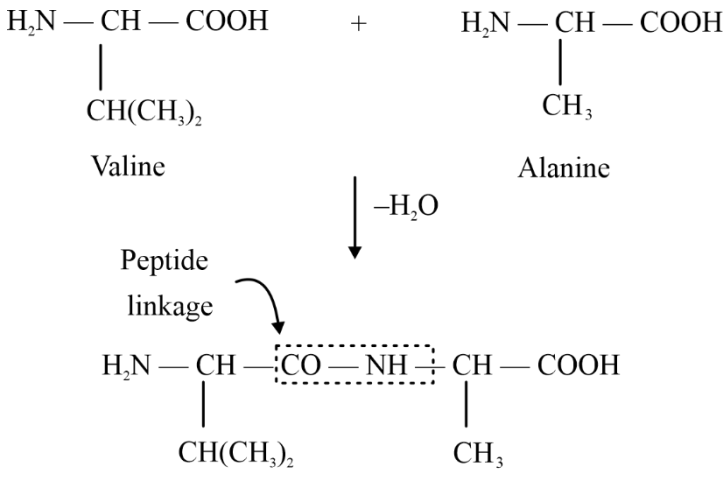
(ii) Primary structure

(iii) Denaturation

12. **(i) Primary Structure**

We can refer to the specific sequence. In which various amino acids are present if we talk about the primary structure of the protein. Like the sequence of linkage between amino acid in a polypeptide chain.

The amino acids are arranged in a different sequence in each of the proteins. A little difference in the sequence of the arrangements will create a completely different protein.



Valylalanine(Val - Ala)

(ii) Peptide Linkage

A peptide linkage is an amide which is formed by the elimination of a water molecule between the – COOH group of one molecule of amino acid and -NH_2 group of another molecule of the amino acid.

(iii) Denaturation

A protein has a unique 3 – dimensional structure and a unique biological activity inside a biological system. In these type of circumstances, proteins are called a native protein. Whenever we put a native protein into a physical change like change in temperature or any chemical changes like change in pH, then there its H – bonds are disturbed or changes.

This result in the unfolding of the globules and uncoils the helix. And the consequences of this change are that the protein results in the loss of its biological activity. This loss of biological activity by the protein is called denaturation. During this process, no changes are encountered in primary structure whereas tertiary and secondary structures will be destroyed.

Example for denaturation, proteins is the coagulation of egg white when an egg is boiled.

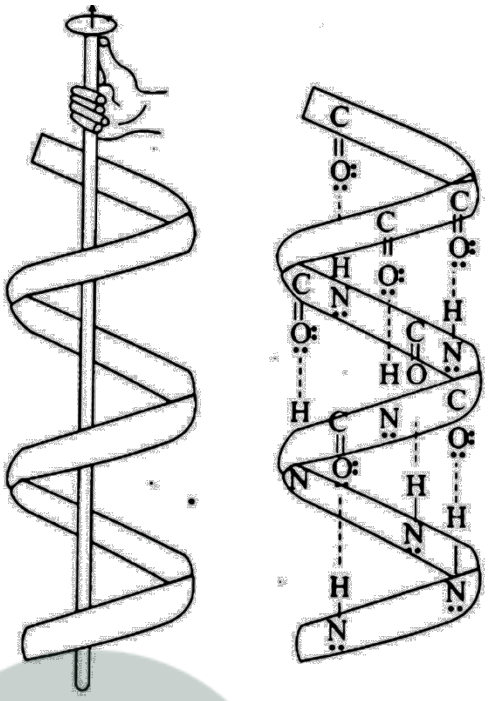
13. What are the common types of secondary structure of proteins?

13. There are two common types of secondary structure of proteins:

(i) α-helix structure

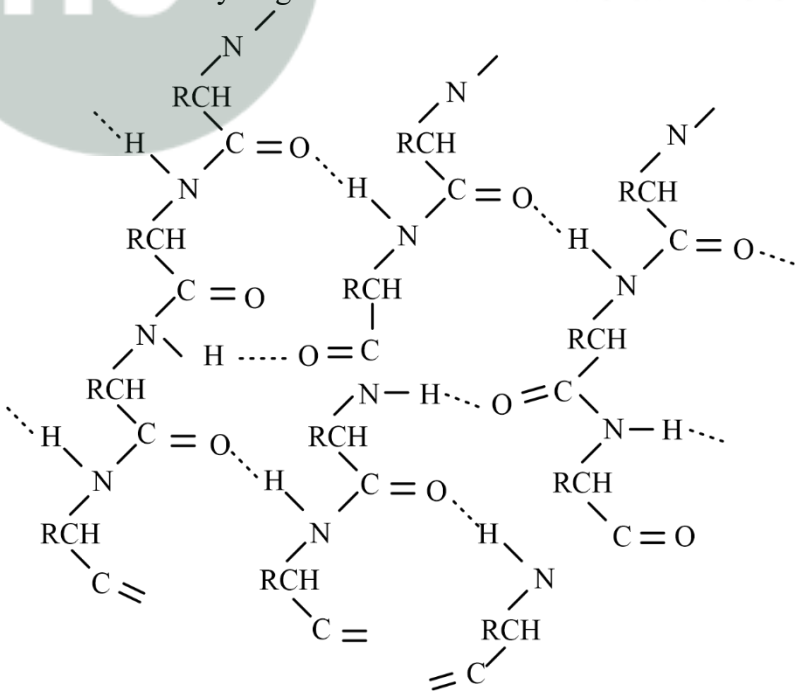
(ii) β-pleated sheet structure

α-Helix structure: In this structure, the – NH group of an amino acid residue forms H-bond with the group of the adjacent turn of the right-handed screw (α-helix).



The α-Helix structure of proteins

β-pleated sheet structure: This structure is called so because it looks like the pleated folds of drapery. In this structure, all the peptide chains are stretched out to nearly the maximum entension and then laid side by side. These peptide chains are held together by intermolecular hydrogen bonds.



14. What type of bonding helps in stabilizing the α-helix structure of proteins?

14. The H-bonds formed between the –NH group of each amino acid residue and the Group of the adjacent turns of the α-helix help in stabilizing the helix.

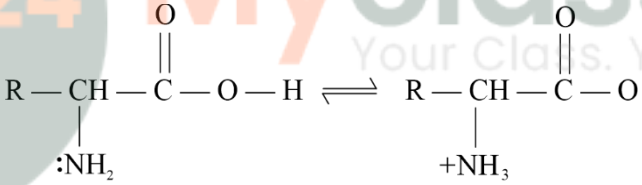
15. Differentiate between globular and fibrous proteins.

15.

	Fibrous protein		Globular protein
1.	It is a fibre-like structure formed by the polypeptide chain. These proteins are held together by strong hydrogen and disulphide bonds.	1.	The polypeptide chain in this protein is folded around itself, giving rise to spherical structure.
2.	It is usually insoluble in water.	2.	It is usually soluble in water.
3.	Fibrous proteins are usually used for structural purposes. For example, keratin is present in nails and hair; collagen in	3.	All enzymes are globular proteins. Some hormones such as insulin are also globular
	tendons; and myosin in muscles.		proteins.

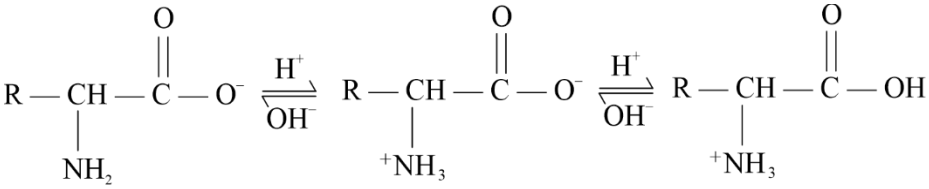
16. How do you explain the amphoteric behaviour of amino acids?

16. In the presence of water or aqueous solution, the carboxyl group of an amino acid can lose a proton and the amino group can accept a proton to give a dipolar ion known as zwitter ion.



Zwitter ion

Therefore, the amino acid can act both as an acid and as a base, in the presence of zwitter ionic form.



So, The amino acid show amphoteric behaviour.

17. What are enzymes?

17. Enzymes are proteins that catalyse biological reactions. They are very specific in nature and catalyse only a particular reaction for a particular substrate. Enzymes are usually named after the particular substrate or class of substrate and some times after the particular reaction.

For example, the enzyme used to catalyse the hydrolysis of maltose into glucose is named as maltase.

$$\underset{\text{Maltose}}{C_{12}H_{22}O_{11}} \xrightarrow{\text{Maltase}} \underset{\text{Glucose}}{2C_6H_{12}O_6}$$

Again, the enzymes used to catalyse the oxidation of one substrate with the simultaneous reduction of another substrate are named as oxidoreductase enzymes.
The name of an enzyme ends with '– ase'.

18. What is the effect of denaturation on the structure of proteins?

18. The outcome of denaturation, helixes get uncoiled and globules get unfolded. There would be no change in the primary structure of the protein while the secondary and the tertiary structure gets destroyed. We can say that the secondary and the tertiary – structured proteins are changed into primary – structured proteins. Also, because of the loss of secondary and the tertiary structure the enzymes loses its activity.

19. How are vitamins classified? Name the vitamin responsible for the coagulation of blood.

19. On the basis of their solubility in water or fat, vitamins are classified into two groups.
(i) Fat-soluble vitamins: Vitamins that are soluble in fat and oils, but not in water, belong to this group. For example: Vitamins A, D, E and K.
(ii) Water-soluble vitamins: Vitamins that are soluble in water belong to this group. For example: B group vitamins (B_1, B_2, B_6, B_{12}, etc.) and vitamin C However, biotin or vitamin H is neither soluble in water nor in fat.
Vitamin K is responsible for the coagulation of blood.

20. Why are vitamin A and vitamin C essential to us? Give their important sources.

20. These two vitamins are essential to us because the deficiency of these two vitamins causes us harmful disease like the deficiency of vitamin causes us xerophthalmia (hardens the cornea of the eye) night blindness. While the deficiency of vitamin C causes scurvy (bleeding gums).
The sources of these two vitamins are:
Vitamin A: Carrots, fish liver oil, milk and butter.
Vitamin C: amla, citrus fruits and green leafy vegetables.

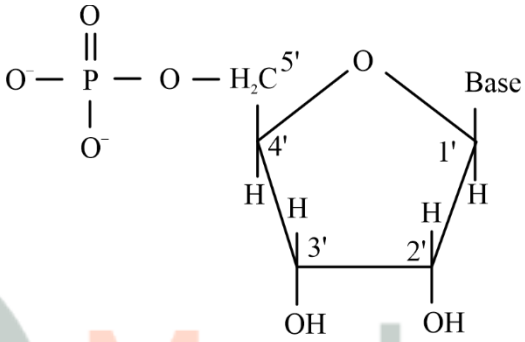
21. What are nucleic acids? Mention their two important functions.

21. Nucleic acids are biomolecules found in the nuclei of all living cells, as one of the constituents of chromosomes. There are mainly two types of nucleic acids – deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Nucleic acids are also known as polynucleotides as they are long-chain polymers of nucleotides.

(i) DNA is responsible for the transmission of inherent characters from one generation to the next. This process of transmission is called heredity.
(ii) Nucleic acids (both DNA and RNA) are responsible for protein synthesis in a cell. Even though the proteins are actually synthesized by the various RNA molecules in a cell, the message for the synthesis of a particular protein is present in DNA.

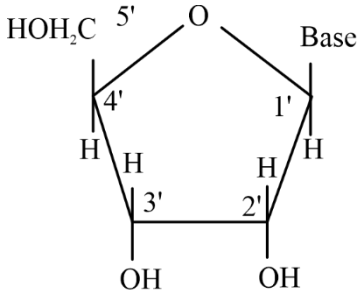
22. What is the difference between a nucleoside and a nucleotide?

22. A Nucleotide is formed by the combination of all the three basis components of nucleic acids (i.e., base, a pentose sugar and phosphoric acid).
Therefore, Nucleotide = Base + Sugar + Phosphoric acid



Structure of nucleotide

On the other hand, A nucleoside is formed by the attachment of a base to 1' position of the sugar.
Nucleoside = Sugar + Base



Structure of nucleoside

23. The two strands in DNA are not identical but are complementary. Explain.

23. In the helical structure of DNA, the two strands are held together by hydrogen bonds between specific pairs of bases. Cytosine forms hydrogen bond with guanine, while adenine forms hydrogen bond with thymine. As a result, the two strands are complementary to each other.

24. Write the important structural and functional differences between DNA and RNA.

24. The difference on the basis of their functions is:

DNA		RNA	
1.	DNA is the chemical basis of heredity.	1.	RNA is not responsible for heredity.

The differences on the basis of their structures are as follows:

DNA		RNA	
1.	The sugar moiety in DNA molecules is β-D-2-deoxynbose.	1.	The sugar moiety in RNA molecules is β-D-ribose.
2.	Bases are Adenine(A), Guanine(G), Cytosine(C), Thymine(T).	2.	The bases are Adenine(A), Guanine(G), Cytosine(C), Uracil(U).
3.	The helical structure of DNA is double-stranded.	3.	The helical structure of DNA is single-stranded.

25. What are the different types of RNA found in the cell?

25. (i) Messenger RNA (m-RNA)
(ii) Ribosomal RNA (r-RNA)
(iii) Transfer RNA (t-RNA)