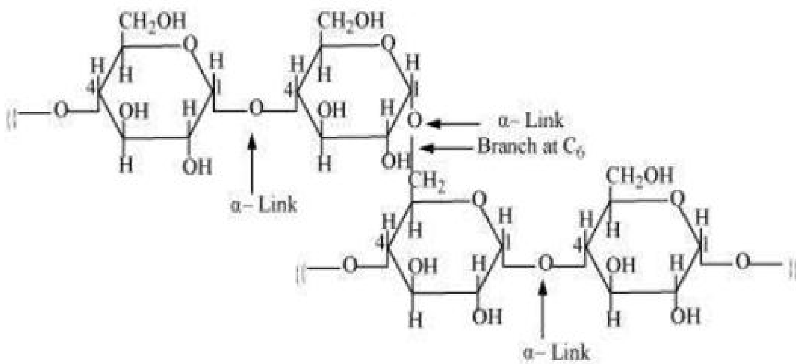
Question Bank

Questions carrying 3 Marks :

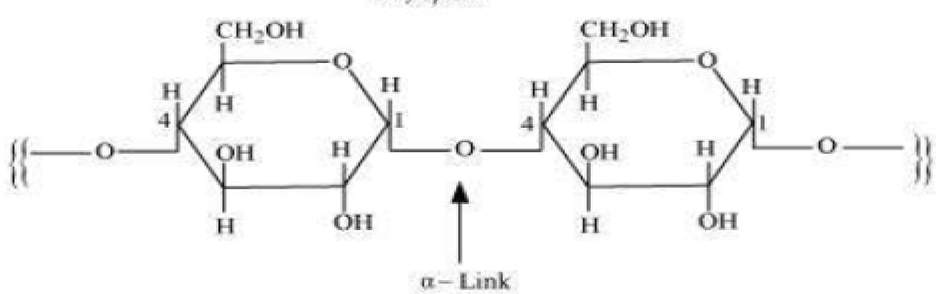
1. What is the basic structural difference between starch and cellulose?

Starch consists of two components – amylose and amylopectin. Amylose is a long linear chain of ∝–D–(+)–glucose units joined by C1–C4 glycosidic linkage (∝-link).

Amylopectin is a branched-chain polymer of ∝-D-glucose units, in which the chain is formed by C1–C4 glycosidic linkage and the branching occurs by C1–C6 glycosidic linkage.

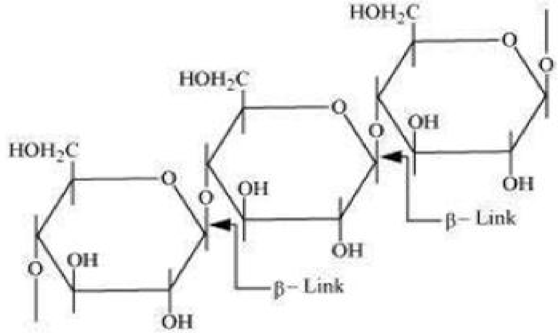


Amylopectin



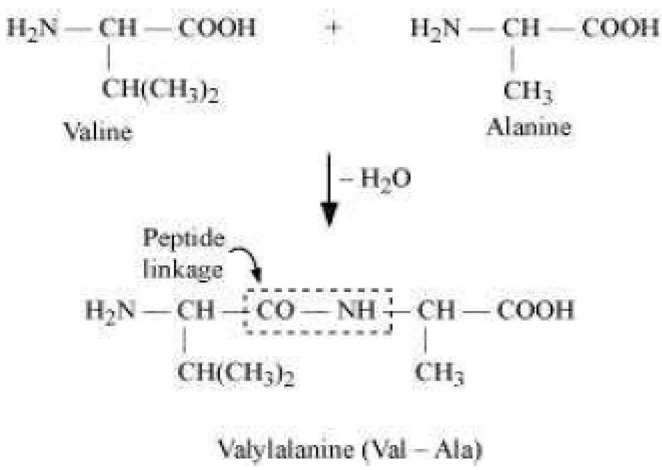
Amylose

On the other hand, cellulose is a straight-chain polysaccharide of β-D-glucose units joined by C1–C4 glycosidic linkage (β-link).



2. Define the following as related to proteins
   (i) Peptide linkage (ii) Primary structure (iii) Denaturation.

   (i) Peptide linkage:
   The amide formed between –COOH group of one molecule of an amino acid and $-NH_2$ group of another molecule of the amino acid by the elimination of a water molecule is called a peptide linkage.



(ii) Primary structure:
The primary structure of protein refers to the specific sequence in which various amino acids are present in it, i.e., the sequence of linkages between amino acids in a polypeptide chain. The sequence in which amino acids are arranged is different in each protein. A change in the sequence creates a different protein.
(iii) Denaturation:
In a biological system, a protein is found to have a unique 3-dimensional structure and a unique biological activity. In such a situation, the protein is called native protein.
However, when the native protein is subjected to physical changes such as change in temperature or chemical changes such as change in pH, its H-bonds are disturbed. This disturbance unfolds the globules and uncoils the helix. As a result, the protein loses its biological activity. This loss

of biological activity by the protein is called denaturation.
During denaturation, the secondary and the tertiary structures of the protein get destroyed, but the primary structure remains unaltered. One of the examples of denaturation of proteins is the coagulation of egg white when an egg is boiled.

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

There are two common types of secondary structure of proteins:

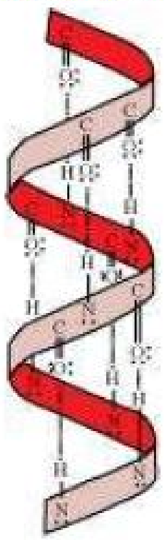
There are two common types of secondary structure of proteins:

(i) ∝-helix structure

(ii) β-pleated sheet structure

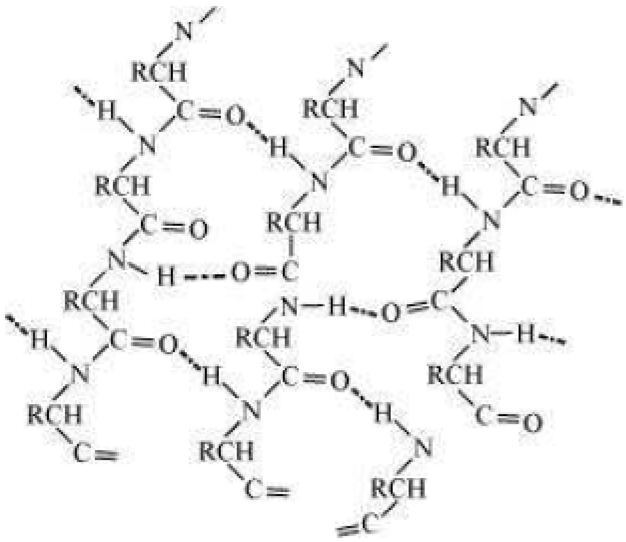
∝- Helix structure:

In this structure, the −NH group of an amino acid residue forms H-bond with the $>C=O$ group of the adjacent turn of the right-handed screw (∝-helix).



β-pleated sheet structure:

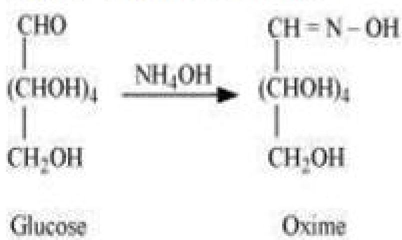
This structure is called so because it looks like the pleated folds of drapery. In this structure, all the peptide chains are stretched out to nearly the maximum extension and then laid side by side. These peptide chains are held together by intermolecular hydrogen bonds.



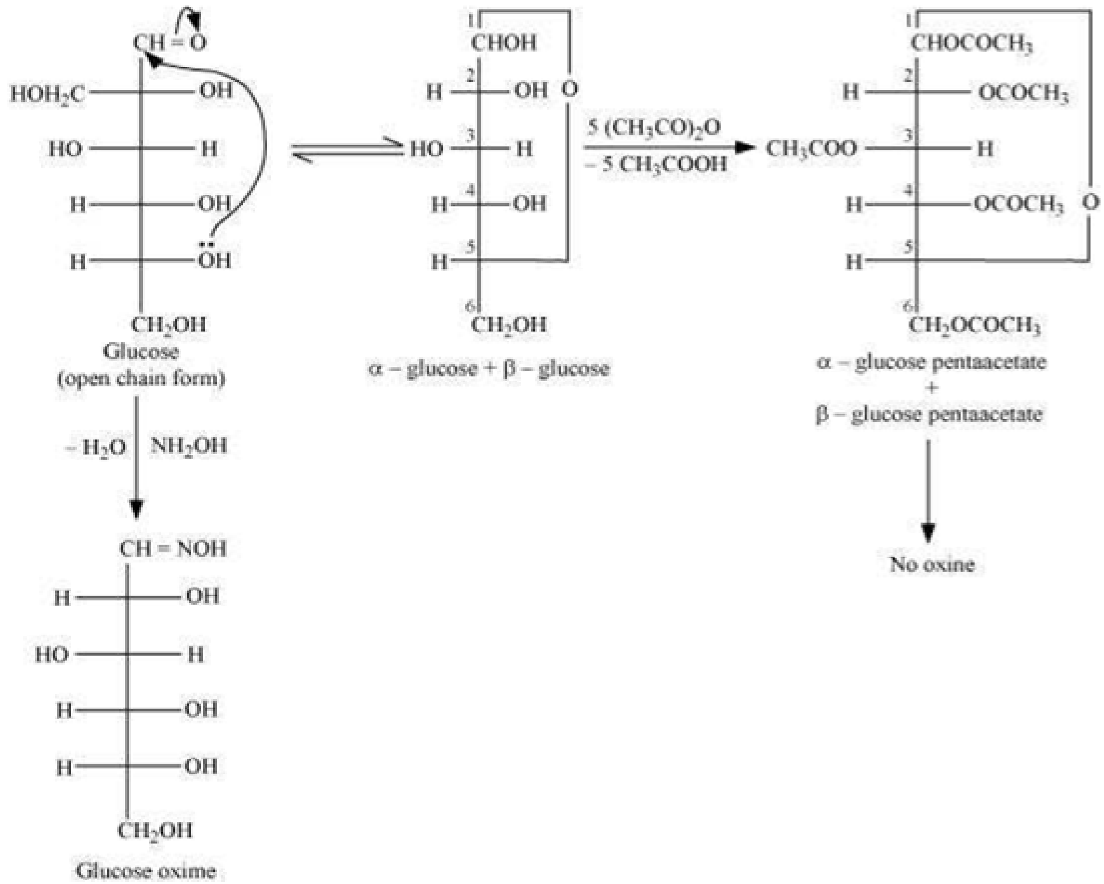
4.

How do you explain the absence of aldehyde group in the pentaacetate of D-glucose?

D-glucose reacts with hydroxylamine (NH_2OH) to form an oxime because of the presence of aldehydic (−CHO) group or carbonyl carbon. This happens as the cyclic structure of glucose forms an open chain structure in an aqueous medium, which then reacts with NH_2OH to give an oxime.



But pentaacetate of D-glucose does not react with NH_2OH. This is because pentaacetate does not form an open chain structure.

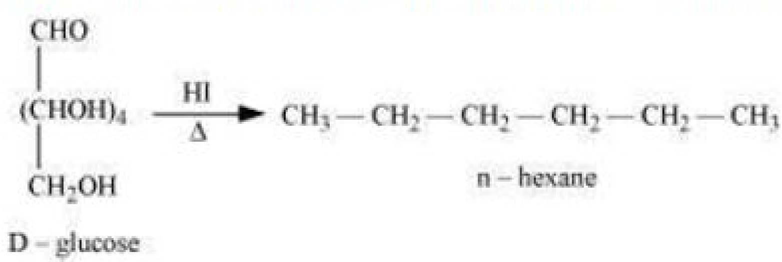


5.

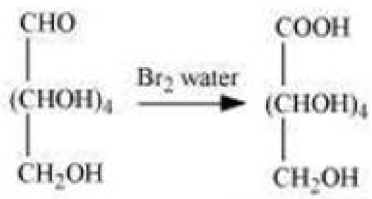
What happens when D-glucose is treated with the following reagents?

(i) HI **(ii)** Bromine water **(iii)** HNO_3

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

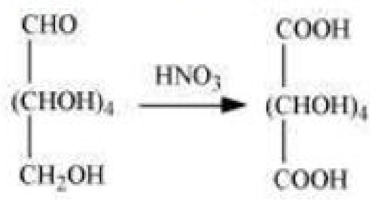


(ii) When D-glucose is treated with Br_2 water, D- gluconic acid is produced.



D – glucose D – gluconic acid

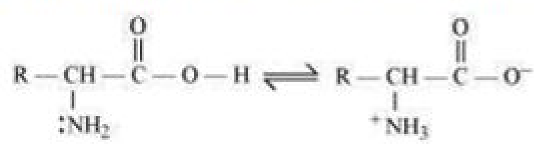
(iii) On being treated with HNO_3, D-glucose get oxidised to give saccharic acid.



6.

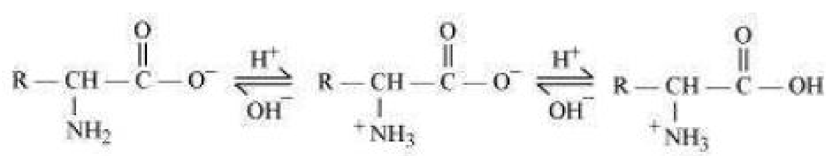
How do you explain the amphoteric behaviour of amino acids?

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



Thus, amino acids show amphoteric behaviour.

Question bank

Questions carrying 1 Mark :

1. Name the functional groups which are present in monosaccharides?

   —OH and —CHO or —OH and >CO

2. Which one is more stable α-helix or β-helix and why?

   α-helix is more stable due to intermolecular H bonding between first and fourth amino acid.

3. The sequence of bases in one strand of DNA is TAGCGACA. What will be the sequence of bases of its complementary strand?

   ATCGCTGT

4. What causes the disease beri beri, scurvy and rickets?

   Deficiency of vitamin B, C and D causes beri beri, scurvy and rickets respectively.

5. Which types of bonds are present in a protein molecule?

   Peptide bonds, hydrogen bonds, sulphide bonds, ionic bonds etc.

6. How are carbohydrates stored in animal body?

   In the form of glycogen.

7. What is isoelectric point ?

   Isoelectric point is the pH at which a particular molecule or surface carries no net electrical charge.

8. Differentiate between Keratin and Insulin.

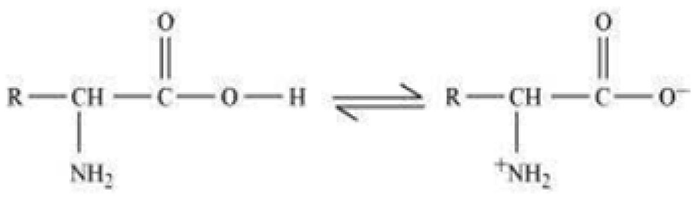
   Keratin is fibrous protein while insulin is globular protein.

9. Define co-enzymes. Give one example.

   Coenzymes are organic cofactors that are required for an enzyme to be catalytically active. An example of this is NAD.

10. What are Zwitter ions? Give one example.

A zwitterion formerly called a dipolar ion is a neutral molecule with a positive and a negative electrical charge, distinct from dipoles, at different locations within that molecule. Amino acids are the best-known examples of zwitterions.



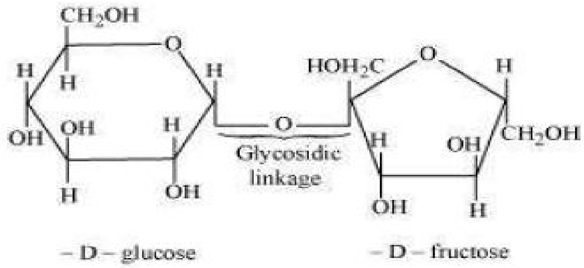
Questions carrying 2 Marks :

1. When RNA is hydrolysed, there is no relationship among the quantities of different bases obtained. What does this fact suggest about the structure of RNA?
   A DNA molecule is double-stranded in which the pairing of bases occurs. Adenine always pairs with thymine, while cytosine always pairs with guanine. Therefore, on hydrolysis of DNA, the quantity of adenine produced is equal to that of thymine and similarly, the quantity of cytosine is equal to that of guanine. But when RNA is hydrolyzed, there is no relationship among the quantities of the different bases obtained. Hence, RNA is single-stranded.
2. What are monosaccharides?
   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.
3. Sucrose is dextrorotatory but the mixture obtained after hydrolysis is laevorotatory. Explain.
   After hydrolysis sucrose produce equimolar mixture of D-(+)-glucose and D-(-)- fructose since laevorotation of fructose ($-92.4^{O}C$) is more than dextrorotation of glucose ($+52.5^{O}$) hence the mixture is laevorotatory.

4. What do you understand by the term glycosidic linkage?
   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, ∝-glucose and β-fructose, are joined together by a glycosidic linkage.

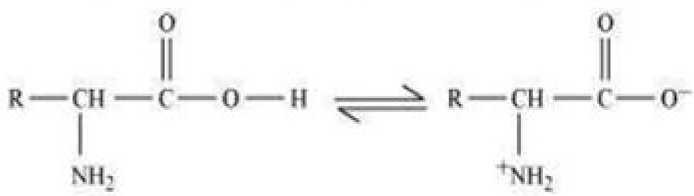


Surcose

5.

The melting points and solubility in water of amino acids are generally higher than that of the corresponding halo acids. Explain.

Both acidic (carboxyl) as well as basic (amino) groups are present in the same molecule of amino acids. In aqueous solutions, the carboxyl group can lose a proton and the amino group can accept a proton, thus giving rise to a dipolar ion known as a zwitter ion.



(Zwitter ion)

Due to this dipolar behaviour, they have strong electrostatic interactions within them and with water. But halo-acids do not exhibit such dipolar behaviour.

For this reason, the melting points and the solubility of amino acids in water is higher than those of the corresponding halo-acids.

6. Why is cellulose in our diet not nourishing but is nourishing in grazing animals ?

Humans are unable to digest cellulose because the appropriate enzymes (cellulose) to breakdown the beta acetal linkages are lacking while grazing animals possess the necessary enzymes in their rumen to digest cellulose. Thus cellulose is nourishing for grazing animals.