Q 1. What are monosaccharides?

Solution:
Monosaccharides known as simple sugars comprise one sugar unit that cannot be further broken down into simple sugars.

We can classify a monosaccharide on the basis of the number of carbon atoms and the functional group present in them. The monosaccharide which contains an aldehyde group is termed as aldoses and those which have keto group are called ketoses. Depending on the number of carbon atoms present in a monosaccharide it is further classified as trioses, tetroses, pentoses, hexoses and heptoses. For example, we can call an aldose which contains 3 carbon atoms as aldotriose and a keto which contains 3 carbon atoms as ketotriose.

Q 2. What are reducing sugars?

Solution:

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

Q 3. Write two main functions of carbohydrates in plants.

Solution:

The two main functions of carbohydrate in a plant are:

(a) Polysaccharides like starch act as a storage molecule.

(b) Cellulose is used to build the cell wall, and it is a polysaccharide

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

Solution:

Monosaccharides: 2-deoxyribose, galactose, Ribose, fructose

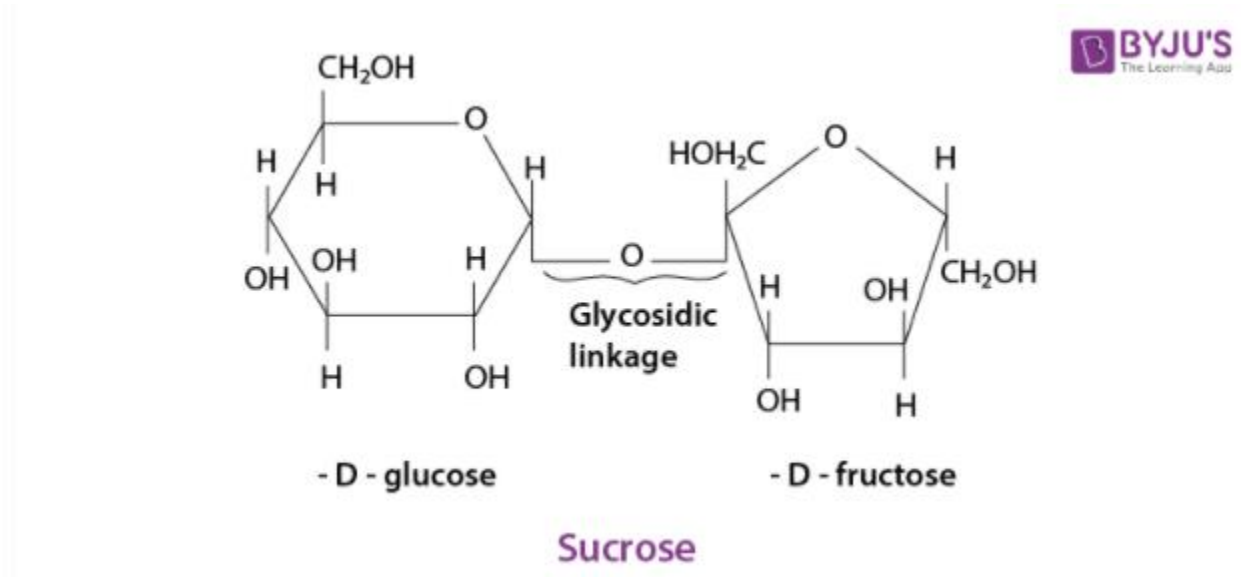
Disaccharides: lactose, Maltose

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

Solution:

The linkage which forms by the loss of water between two monosaccharide units through an oxygen atom is known as glycosidic linkage.

For example, in a sucrose molecule, two monosaccharide units, α -glucose and β – fructose, are joined together by a glycosidic linkage.



Sucrose

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

Solution:

Glycogen, also termed as animal starch, is found only in animals. It is a polysaccharide.

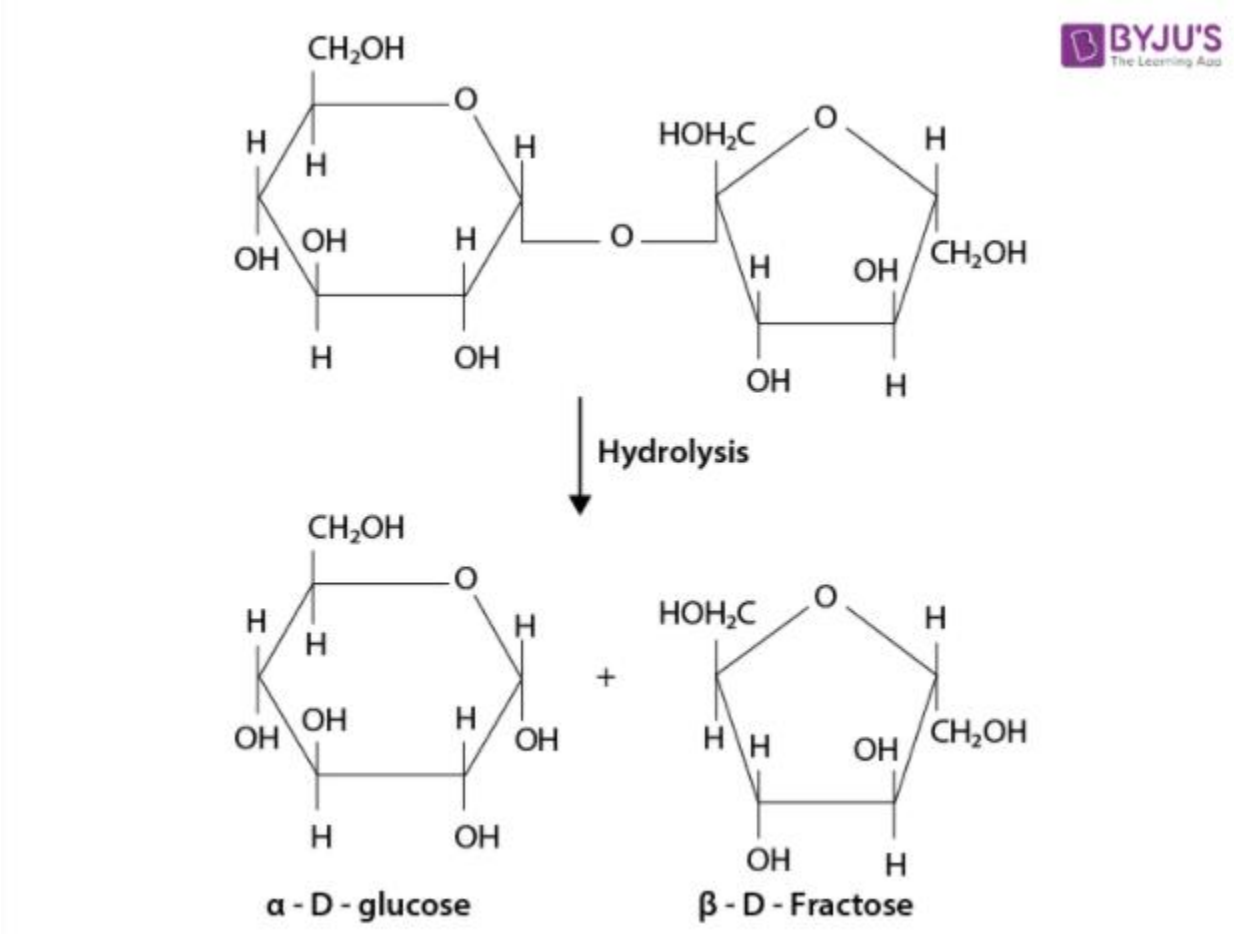
Both Glycogen and starch are the main sources of glucose that provides energy to humans that are later converted into carbohydrates.

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

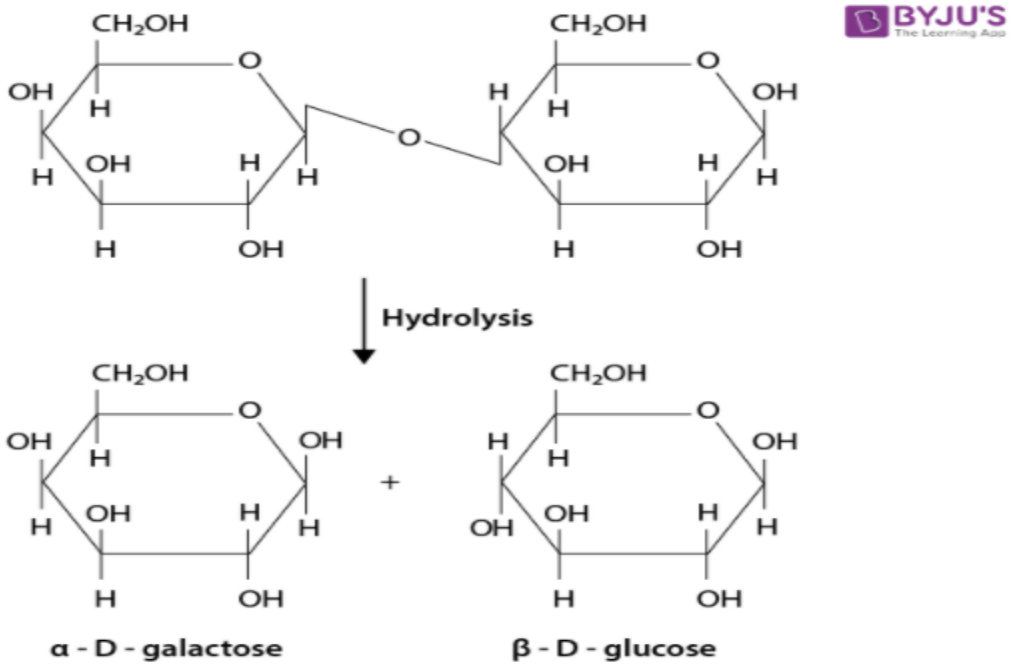
Q 7. What are the hydrolysis products of (i) sucrose and (ii) lactose?

Solution:

(a) The hydrolysis of sucrose will give one molecule of α -D glucose and one molecule of β –D fructose.



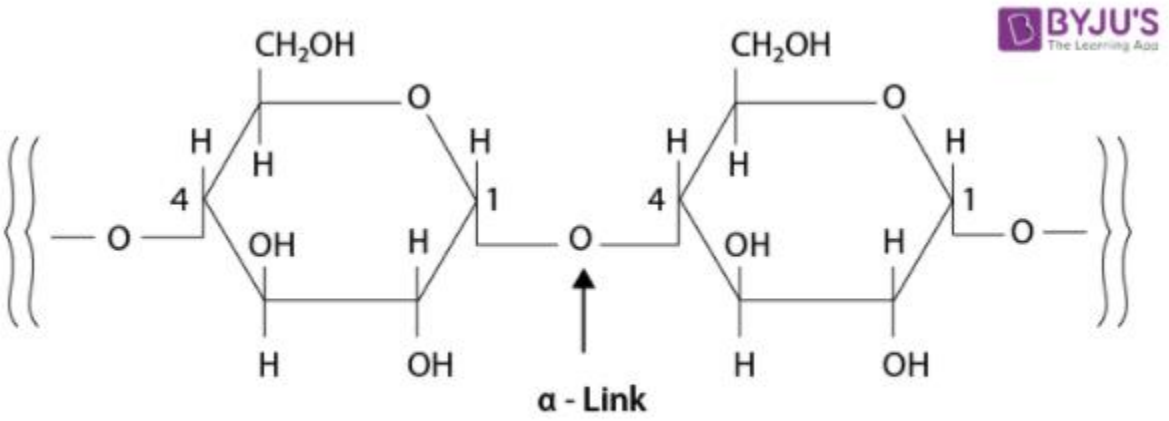
(b) On hydrolysis of lactose, it will give β -D-galactose and β -D-glucose.



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

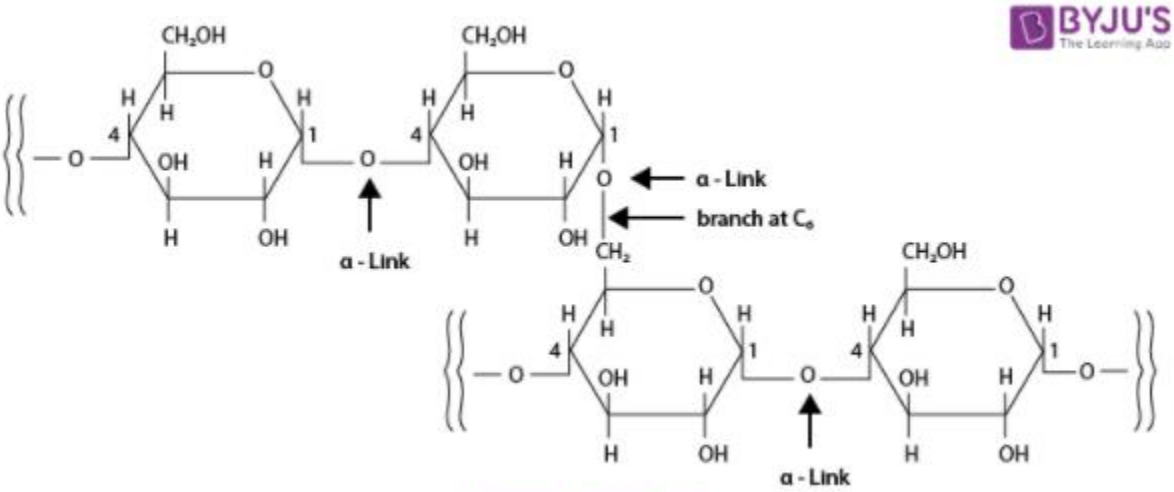
Solution:

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).



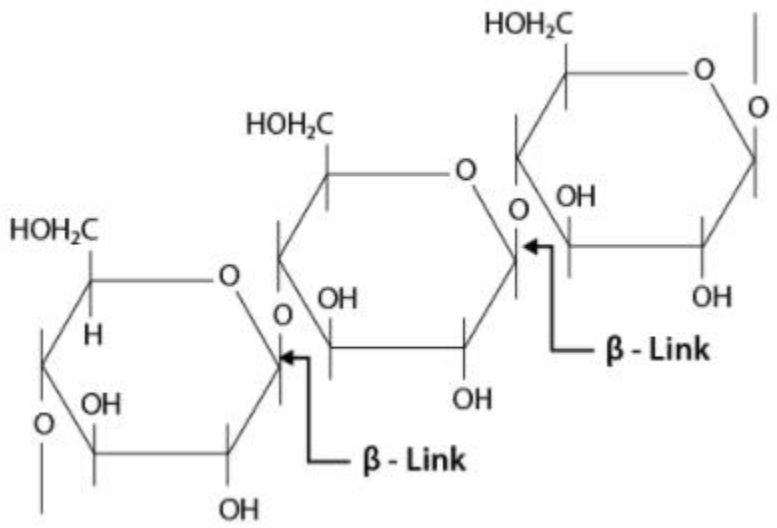
Amylose

While amylopectin is a 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

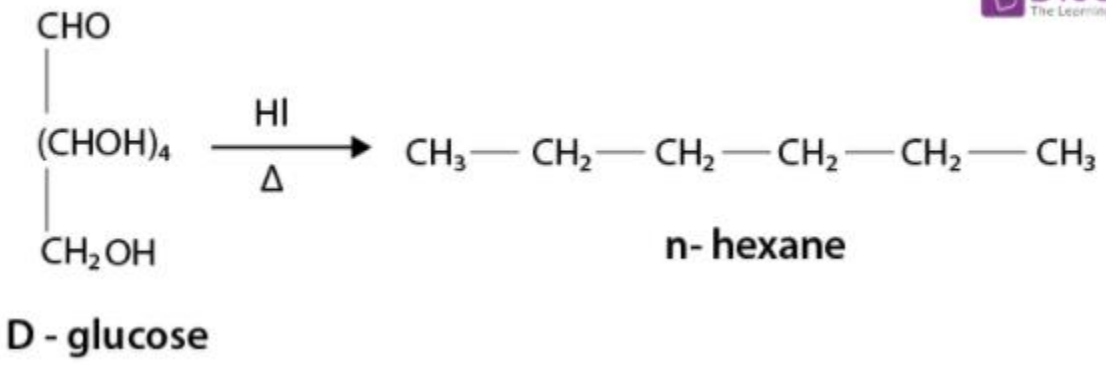
While, cellulose is a straight-chain polysaccharide of β – D-glucose units joined by C_1–C_4 glycosidic linkage (β – link).



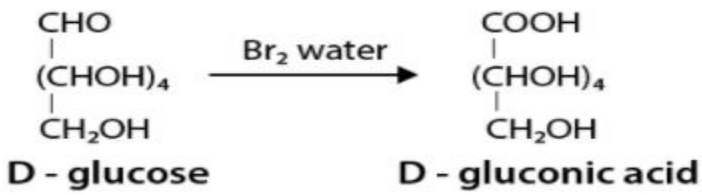
Q 9. What happens when D-glucose is treated with the following reagents?
(i) HI (ii) Bromine water (iii) HNO_3

Solution:

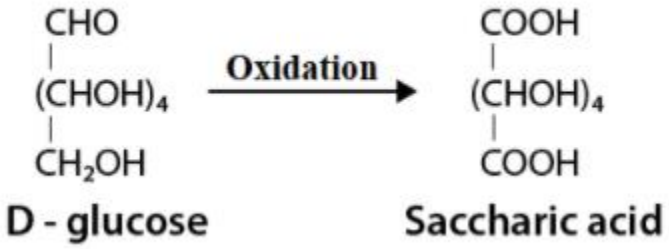
(i) After heating a D-glucose with HI for a long time, n-hexane is formed.



(ii) After treating a D-glucose with Br_2 water, D- gluconic acid is produced.



(iii) After treating with HNO_3, D – glucose get oxidised to give saccharic acid.



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

Solution:

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

(ii) Aldehydes form the hydrogen sulphite additional product by giving 2,4 – DNP test, Schiff's test and react with $NaHSO_4$. But glucose does not undergo these reactions.

(iii) Glucose is available in two crystalline forms α – and β. The α – form (m.p. = 419 K) crystallises from a concentrated solution of glucose at 303 K and the β -form (m.p = 423 K) crystallises from a hot and saturated aqueous solution at 371 K. This behaviour can't be explained by the open chain structure of glucose.

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

Solution:

Those amino acids which are required by the human body are called essential amino acids, but these cannot be produced inside the human body. They must be taken from any external source like food. As for example leucine and valine.

Those acids which are required by the human body but these type of acids can be produced inside the body are called non – essential amino acids. Example: glycine and alanine.

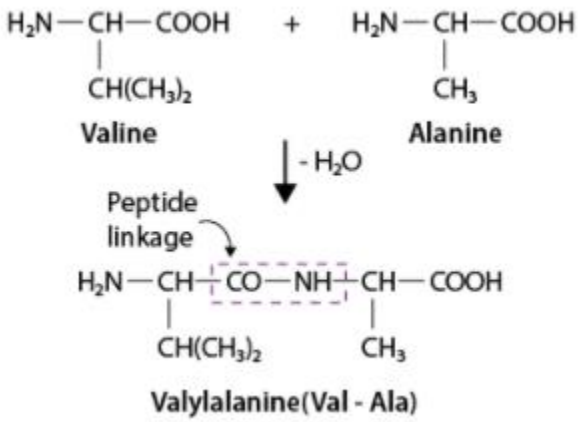
Q 12. Define the following as related to proteins
(i)Primary structure (ii) Peptide linkage (iii) Denaturation.

Solution:

(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.



(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 ad 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.

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

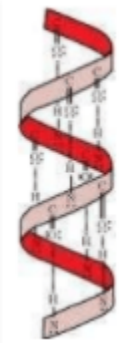
Solution:

Secondary structures of proteins are of two types:

(a) α – helix structure

(b) β – pleated sheet structures.

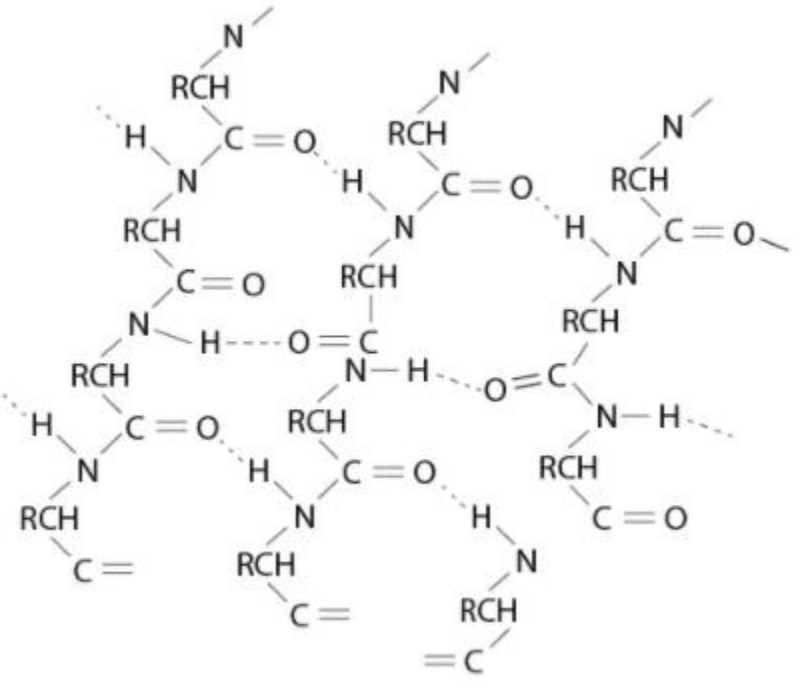
α – helix structure



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).

β – pleated sheet structures.



This structure is called so because it looks like the pleated folds of drapery. In this structure, the peptide chains are laid side by side after stretching out near to the maximum extension. The intermolecular hydrogen bond keeps the peptide chain together.

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

Solution:

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 stabilising the helix.

Q 15. Differentiate between globular and fibrous proteins.

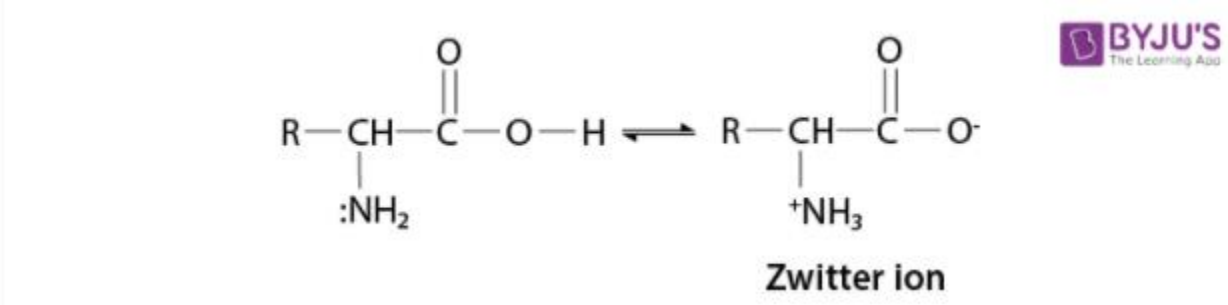
Solution:

	Globular protein		Fibrous protein
1.	The polypeptide chain in this protein is folded around itself, giving rise to a spherical structure.	1	It is a fibre-like structure formed by the polypeptide chain. These are the proteins which are held together by strong hydrogen and disulphide bonds.
2.	It is usually soluble in water.	2.	It is usually not soluble in water.
3.	Fibrous proteins are usually used for structural purposes. For example, keratin is present in nails and hair; collagen in tendons; and myosin in muscles.	3.	All enzymes are globular proteins. Some hormones such as insulin are also globular proteins.

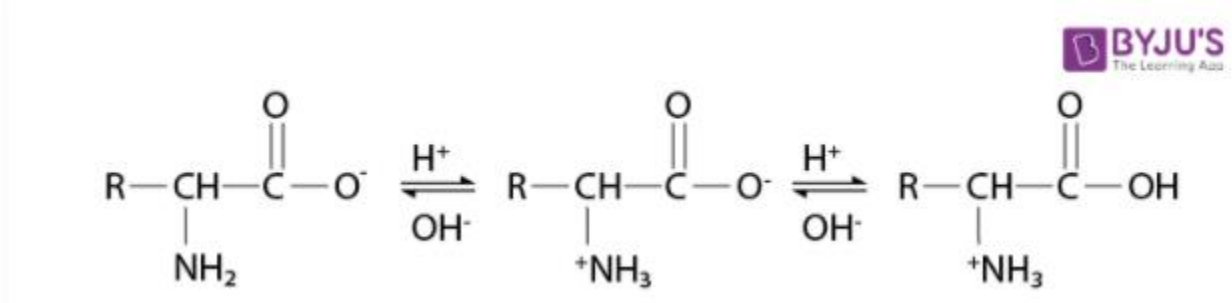
Q 16. How do you explain the amphoteric behaviour of amino acids?

Solution:

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.



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.

Q 17. What are enzymes?

Solution:

The protein that catalyses the biological reactions are called enzymes. They are very particular in nature and for some specific substrate, they catalyse particular reactions.

The enzymes are named after a particular reaction or in common bases, they are named after a particular class of substrate.

Example: Maltase is the enzymes which are used to catalyse the hydrolysis of maltose into glucose.

Also, oxidoreductase enzymes are those which are used to catalyse the oxidation of one substrate with the simultaneous reaction of another substrate.

The name of an enzyme ends with " – ase "

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

Solution:

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.

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

Solution:

We can classify vitamins on the basis of solubility in water or fat into two categories.

(a) Water-Soluble vitamins: Vitamins which are soluble in water comes in the category.

For example, B group vitamins (B_1, B_2, B_{12}, etc.) and vitamin C.

(b) Fat-soluble vitamins: Those vitamins which are soluble only in fat, not in water come under this group. For example Vitamins A, D, E, and K

However, biotin or vitamin H is neither soluble in water nor in fat.

The vitamin which is responsible for coagulation of blood is Vitamin K.

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

Solution:

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.

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

Solution:

It is a molecule which is found as one of the constituents of chromosomes which is found in the nuclei of all the living cells.

Nucleic acid can be categorised into two categories: ribonucleic acid (RNA) and deoxyribonucleic acid (DNA).

Nucleic acids are long-chain polymers of nucleotides, so they are also known as polynucleotides.

(i) It is responsible for heredity. In heredity, there is a transfer of inherent characters from one generation to another. This process is held by the DNA.

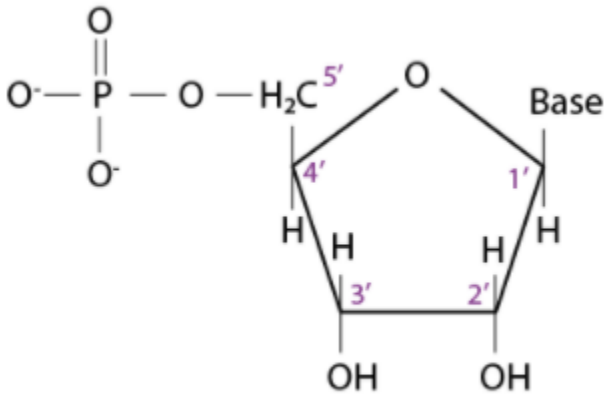
(ii) The protein cell synthesis is held by the Nucleic acid (both RNA and DNA). The protein synthesis is majorly done by the various RNA molecules in a cell while DNA contains the message for the synthesis of a specific protein.

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

Solution:

A Nucleotide is formed by the combination of all the three basic components of nucleic acids (i.e., base, a pentose sugar, and phosphoric acid).

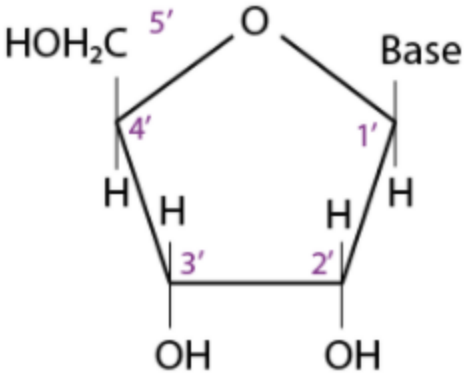
Therefore, Nucleotide = Base + Sugar + Phosphoric acid



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

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

Solution:

In the helical structure of DNA, the hydrogen bond holds the two strands between specific pairs of bases. Adenine forms a hydrogen bond with thymine, while cytosine forms a hydrogen bond with guanine. SO, as its result, the two strands acts as a complementary for each other.

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

Solution:

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 deoxyribose.	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 RNA is single-stranded.

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

Solution:

(i) Messenger RNA (m-RNA)

(ii) Ribosomal RNA (r-RNA)

(iii) Transfer RNA (t-RNA)