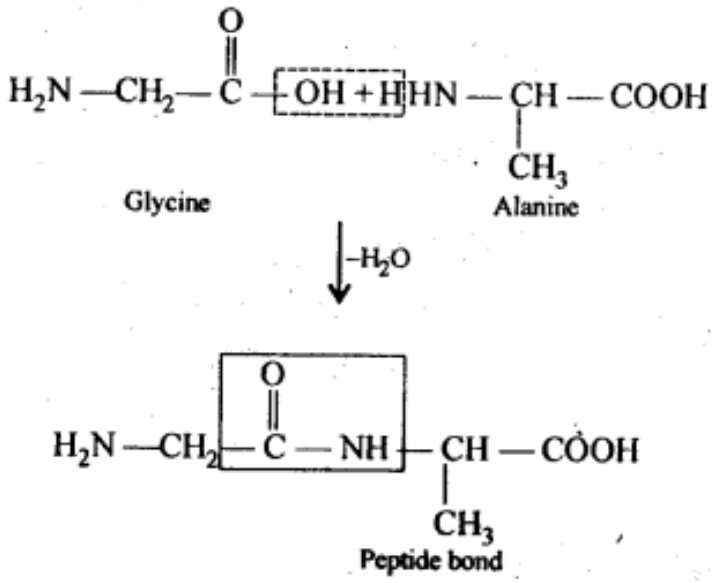
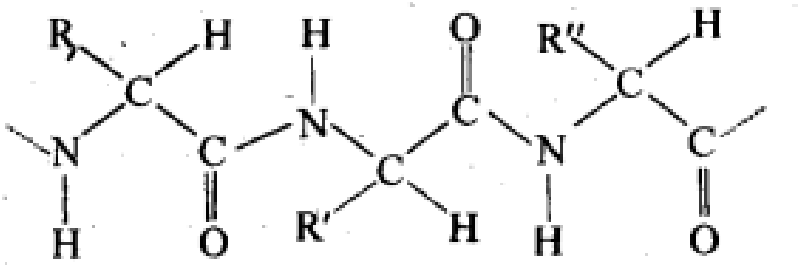
14.11. What are essential and non-essential amino acids? Give two examples of each type.
Ans: α-Amino acids which are needed for good health and proper growth of human beings but are not synthesized by the human body are called- essential amino acids. For example, valine, leucine, phenylalanine, etc. On the other hand, α-amino acids which are needed for health and growth of human beings and are synthesized by the human body are called non-essential amino acids. For example, glycine, alanine, aspartic acid etc.

14.12. Define the following as related to proteins:
(i) Peptide linkage
(ii) Primary structure
(iii) Denaturation
Ans:
(i) Peptide bond: Proteins are condensation polymers of α-amino acids in which the same or different α-amino acids are joined by peptide bonds. Chemically, a peptide bond is an amide linkage formed between - COOH group of one α-amino acid and -NH-, group of the other α-amino acid by loss of a molecule of water. For example,



(ii) Primary structure: Proteins may contain one or more polypeptide chains. Each . polypeptide chain has a large number of α-amino acids which are linked to one another in a specific manner. The specific sequence in which the various amino acids present in a protein linked to one another is called its primary structure. Any change in the sequence of α-amino acids creates a different protein.



(iii) Denaturation: Each protein in the biological system has a unique three-dimensional structure and has specific biologicalactivity. This is called native form of a protein. When a protein in its native form is subjected to a physical change such as change in temperature or a chemical change like change in pH, etc., hydrogen bonds gets broken. As a result, soluble forms of proteins such as globular proteins undergo coagulation or precipitation to give fibrous proteins which are insoluble in water. This coagulation also results in loss of biological activity of the proteins and this loss in biological activity, is called denaturation. During denaturation, 2° and 3° structures of proteins are destroyed but 1° structure remains intact. The most common example of denaturation of proteins is the coagulation of albumin present in the white of an egg. When the egg is boiled hard, the soluble globular protein present in it is denatured and is converted into insoluble fibrous protein.

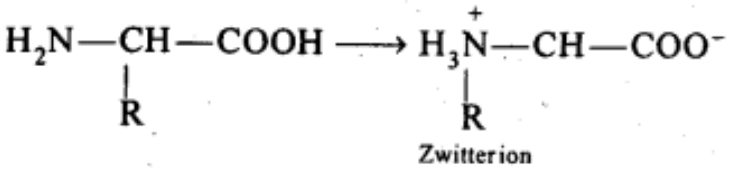
14.13. What are the common types of secondary structure of proteins?
Ans: The conformation which the polypeptide chains assume as a result of hydrogen bonding is called secondary structure of the proteins. The two types of secondary structures are α-helix and β-pleated sheet structure.

14.14. What type of bonding helps in stabilising the α-helix structure of proteins?
Ans: The α-helix structure of proteins is stabilized by intramolecular H-bonding between C = O of one amino acid residue and the N - H of the fourth amino acid residue in the chain. This causes the polypeptide chain to coil up into a spiral structure called right handed α- helix structure.

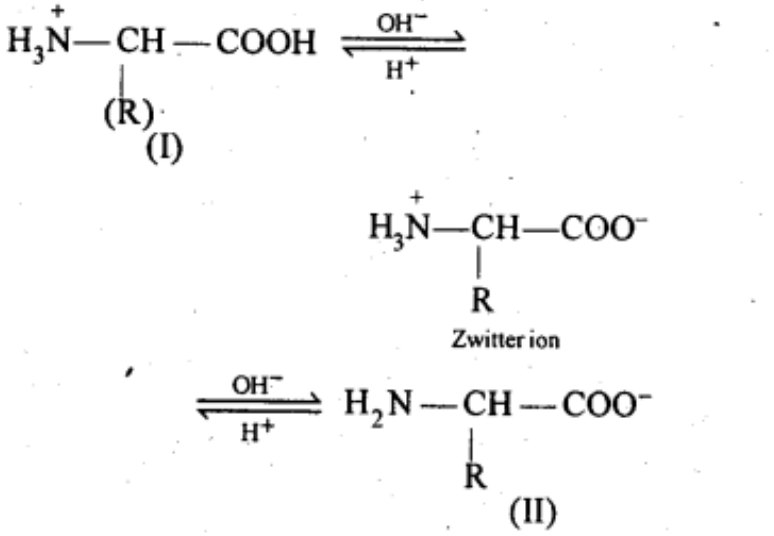
14.15. Differentiate between globular and fibrous proteins.
Ans:
(i) Fibrous proteins: These proteins consist of linear thread like molecules which tend to lie side by side (parallel) to form fibres. The polypeptide chains in them are held together usually at many points by hydrogen bonds and some disulphide bonds. As a result,intermolecular forces of attraction are very' strong and hence fibrous proteins are insoluble in water. Further, these proteins are stable to moderate changes in temperature and pH. Fibrous proteins serve as the chief structural material of animal tissues.For example, keratin in skin, hair, nails and wool, collagen in tendons, fibrosis in silk and myosin in muscles.
(ii) Globular proteins: The polypeptide chain in these proteins is folded around itself in such a way so as to give the entire protein molecule an almost spheroidal shape. The folding takes place in such a manner that hydrophobic (non-polar) parts are pushed inwards and hydrophilic (polar) parts are pushed outwards. As a result, water molecules interact strongly with the polar groups and hence globular protein are water soluble. As compared to fibrous proteins, these are very sensitive to small changes of temperature and pH. This class of proteins include all enzymes, many hormones such as insulin from pancreas, thyroglobulin from thyroid gland, etc.

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

Ans: Amino acids contain an acidic (carboxyl group) and basic (amino group) group in the same molecule. In aqueous solution, they neutralize each other. The carboxyl group loses a proton while the amino group accepts it. As a result, a dipolar or zwitter ion is formed.



In zwitter ionjc form, a-amino acid show amphoteric behaviour as they react with both acids and bases.



14.17. What are enzymes?
Ans. Enzymes are biological catalyst. Each biological reaction requires a different enzyme. Thus, as compared to conventional catalyst enzymes are very specific and efficient in their action. Each type of enzyme has its own specific optimum conditions of concentration, pH and temperature at which it works best.

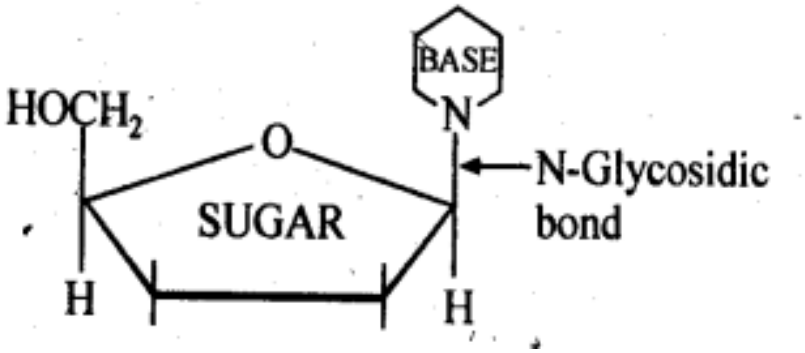
14.18. What is the effect of denaturation on the structure of proteins?
Ans. During denaturation, 2° and 3° structures of proteins are destroyed but 1° structure remains intact. As a result of denaturation, die globular proteins (soluble in H_2O) are converted into fibrous proteins (insoluble in H_2O) and their biological activity is lost. For example, boiled egg which contains coagulated proteins cannot be hatched.

14.19. How are vitamins classified? Name the vitamin responsible for the coagulation of blood.
Ans. Vitamins are classified into two groups depending upon their solubility in water or fat:
(i) Water soluble vitamins: These include vitamin B-complex (B_1, B_2, B_5, i.e., nicotinic acid,B_6, B_{12}, pantothenic acid, biotin, i.e., vitamin H and folic acid) and vitamin C.
(ii) Fat soluble vitamins: These include vitamins A, D, E and K. They are stored in liver and adipose (fat storing) tissues. Vitamin K is responsible for coagulation of blood.

14.20. Why are vitamin A and vitamin C essential to us? Give their important sources.
Ans. Vitamin A is essential for us because its deficiency causes xerophthalmia (hardening of cornea of eye) and night blindness. Sources: Fish liver oil, carrots, butter, milk, etc. Vitamin C is essential for us because its deficiency causes scurvy (bleeding of gums) and

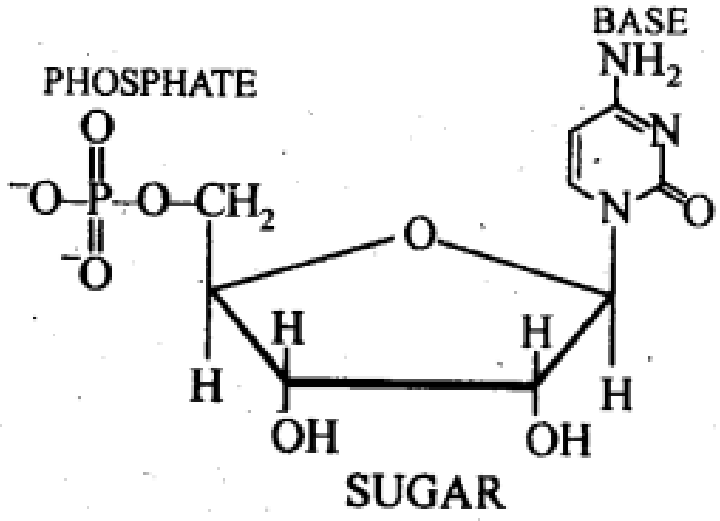
pyorrhea (loosening and bleeding of teeth). Sources: Citrous fruits, amla, green leafy vegetables etc.

14.21. What are nucleic acids ? Mention their two important functions.
Ans. Nucleic acids are biomolecules which are found in the nuclei of all living cell in form of nucleoproteins or chromosomes (proteins contains nucleic acids as the prosthetic group).



Nucleic acids are of two types: deoxyribonucleic acid (DNA) and ribonucleic acid.(RNA).
The two main functions of nucleic acids are:
(a) DNA is responsible for transmission of hereditary effects from one generation to another. This is due to its unique property of replication, during cell division and two identical DNA strands are transferred to the daughter cells.
(b) DNA and RNA are responsible for synthesis of all proteins needed for the growth and maintenance of our body. Actually the proteins are synthesized by various RNA molecules (r-RNA, m-RNA) and t-RNA) in the cell but the message for the synthesis of a particular protein is coded in DNA.

14.22. What is the difference between a nucleoside and a nucleotide?
Ans: A nucleoside contains only two basic components of nucleic acids i.e., a pentose sugar and a nitrogenous base. It is formed when 1- position of pyrimidine (cytosine, thiamine or uracil) or 9-position of purine (guanine or adenine) base is attached to C -1 of sugar (ribose or deoxyribose) by a β-linkage. Nucleic acids are also called polynucleotides since the repeating structural unit of nucleic acids is a nucleotide.
A nucleotide contains all the three basic . components of nucleic acids, i.e., a phosphoric acid group, a pentose sugar and a nitrogenous base. These are obtained by esterification of C_5, - OH group of the pentose sugar by phosphoric acid.



14.23. The two strands in DNA are not identical but are complementary. Explain.
Ans: The two strands in DNA molecule are held together by

hydrogen bonds between purine base of one strand and pyrimidine base of the other and vice versa. Because of different sizes and geometries of the bases, the only possible pairing in DNA are G (guanine) and C (cytosine) through three H-bonds, (i.e.,C = G) and between A (adenine) and T (thiamine) through two H-bonds (i.e., A = T). Due to this base -pairing principle, the sequence of bases in one strand automatically fixes the sequence of bases in the other strand. Thus, the two strands are complimentary and not identical.

14.24. Write the important structural and functional differences between DNA and RNA.
Ans:

Structural differences

DNA	RNA
(*a*) The sugar present in DNA is 2-deoxy-D - (–) - ribose.	(*a*) The sugar present in RNA is D-(–)- ribose.
(*b*) DNA contains cytosine and thymine as pyrimidine bases and, guanine and adenine as purine bases.	(*b*) RNA contains cytosine and uracil as pyrimidine bases and, guanine and adenine as purine bases.
(*c*) DNA has double stranded α-helix structure.	(*c*) RNA has a single stranded α-helix structure
(*d*) DNA molecules are very large, their molecular mass may vary from $6 \times 10^6 - 16 \times 10^6$ u.	(*d*) RNA molecules are comparitively much smaller with molecular mass ranging from 20,000 – 40,000 u.

Functional differences

(*a*) DNA has unique property of replication.	(*a*) RNA usually does not replicate.
(*b*) DNA controls the transmission of hereditary effects.	(*b*) RNA controls the synthesis of proteins.

14.25. What are the different types of RNA found in the cell?
Ans: There are three types of RNA:
(a) Ribosomal RNA (r RNA)
(b) Messenger RNA (m RNA)
(c) Transfer RNA (t RNA)

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