Question 14.1:

Glucose or sucrose are soluble in water but cyclohexane or benzene (simple six membered ring compounds) are insoluble in water. Explain.

Answer

A glucose molecule contains five –OH groups while a sucrose molecule contains eight –OH groups. Thus, glucose and sucrose undergo extensive H-bonding with water.

Hence, these are soluble in water.

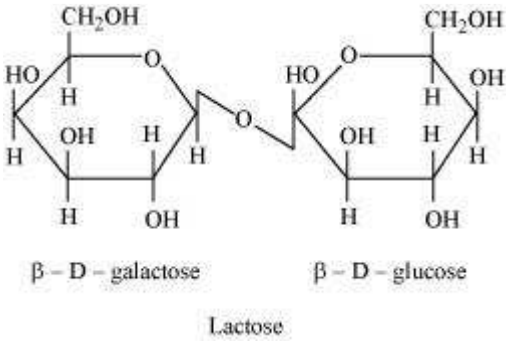
But cyclohexane and benzene do not contain –OH groups. Hence, they cannot undergo H-bonding with water and as a result, are insoluble in water.

Question 14.2:

What are the expected products of hydrolysis of lactose?

Answer

Lactose is composed of β-D galactose and β-D glucose. Thus, on hydrolysis, it gives β-D galactose and β-D glucose.



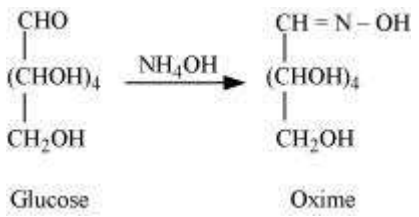
$$\underset{\text{Lactose}}{C_{12}H_{22}O_{11}} + H_2O \longrightarrow \underset{\text{D-(+)-Glucose}}{C_6H_{12}O_6} + \underset{\text{D-(+)-Galactose}}{C_6H_{12}O_6}$$

Question 14.3:

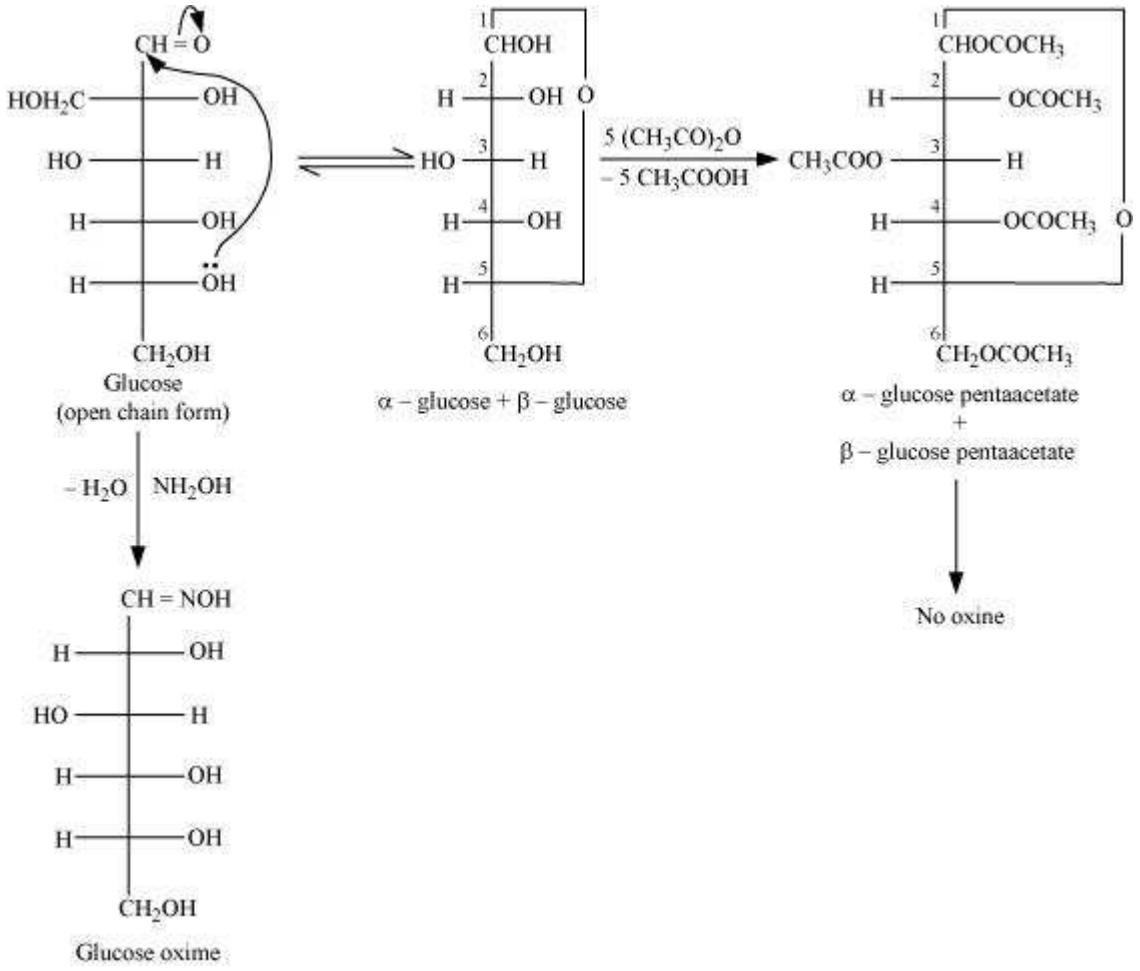
How do you explain the absence of aldehyde group in the pentaacetate of D-glucose?

Answer

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.

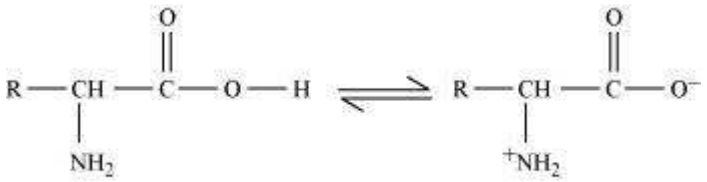


Question 14.4:

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

Answer

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.

Question 14.5:

Where does the water present in the egg go after boiling the egg?

Answer

When an egg is boiled, the proteins present inside the egg get denatured and coagulate. After boiling the egg, the water present in it is absorbed by the coagulated protein through H-bonding.

Question 14.6:

Why cannot vitamin C be stored in our body?

Answer

Vitamin C cannot be stored in our body because it is water soluble. As a result, it is readily excreted in the urine.

Question 14.7:

What products would be formed when a nucleotide from DNA containing thymine is hydrolysed?

Answer

When a nucleotide from the DNA containing thymine is hydrolyzed, thymine β-D-2-deoxyribose and phosphoric acid are obtained as products.

Question 14.8:

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?

Answer

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.

Question 14.1:

What are monosaccharides?

Answer

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.

Question 14.2:

What are reducing sugars?

Answer

Reducing sugars are carbohydrates that reduce Fehling's solution and Tollen's reagent. All monosaccharides and disaccharides, excluding sucrose, are reducing sugars.

Question 14.3:

Write two main functions of carbohydrates in plants.

Answer

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.

Question 14.4:

Classify the following into monosaccharides and disaccharides.

Ribose, 2-deoxyribose, maltose, galactose, fructose and lactose

Answer

Monosaccharides:

Ribose, 2-deoxyribose, galactose, fructose

Disaccharides:

Maltose, lactose

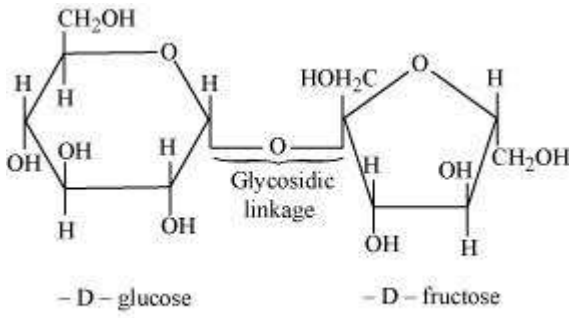
Question 14.5:

What do you understand by the term glycosidic linkage?

Answer

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

Question 14.6:

What is glycogen? How is it different from starch?

Answer

Glycogen is a carbohydrate (polysaccharide). In animals, carbohydrates are stored as glycogen.

Starch is a carbohydrate consisting of two components – amylose (15 – 20%) and amylopectin (80 – 85%).

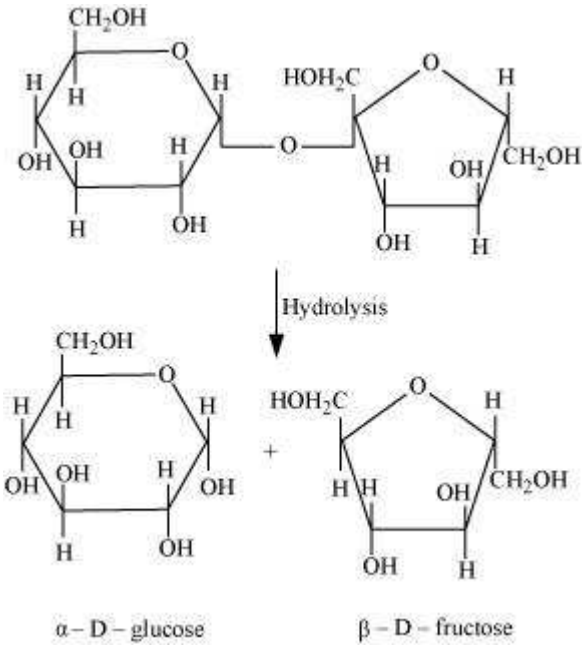
However, glycogen consists of only one component whose structure is similar to amylopectin. Also, glycogen is more branched than amylopectin.

Question 14.7:

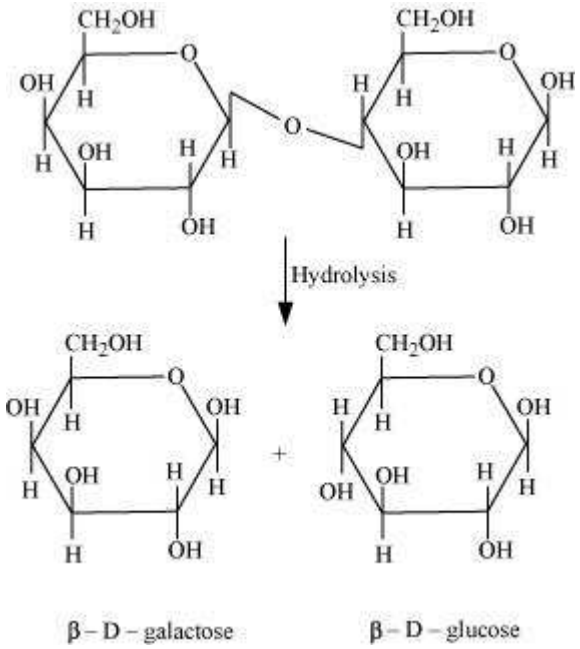
What are the hydrolysis products of **(i)** sucrose and **(ii)** lactose?

Answer

(i) On hydrolysis, sucrose gives one molecule of ∝-D glucose and one molecule of β- D-fructose.



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

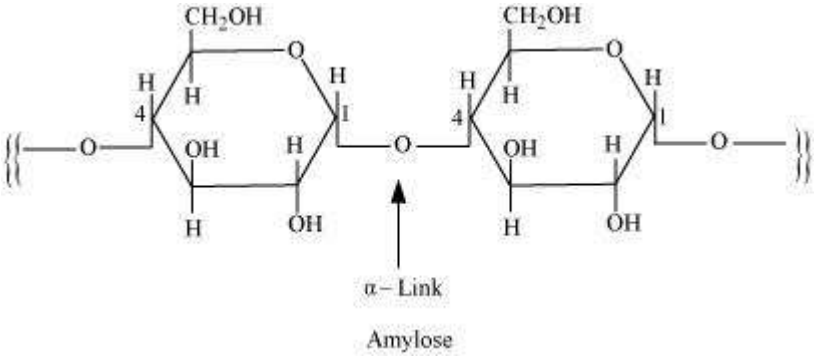


Question 14.8:

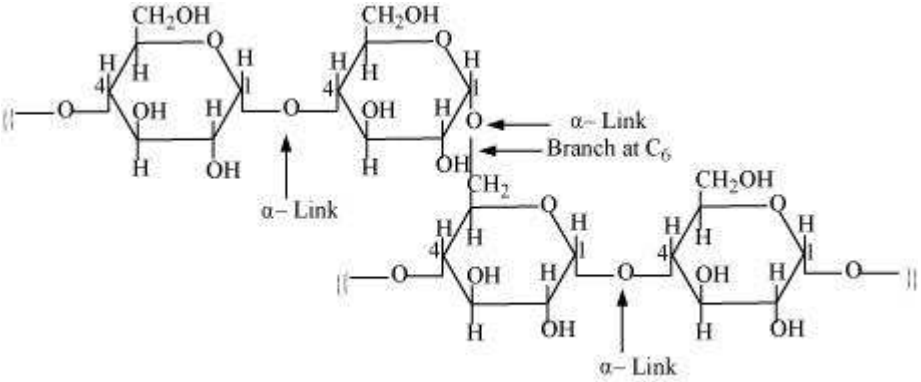
What is the basic structural difference between starch and cellulose?

Answer

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).

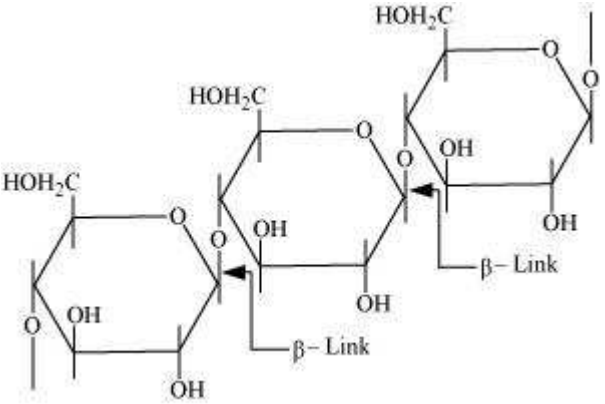


Amylopectin is a branched-chain polymer of ∝-D-glucose units, in which the chain is formed by C1–C4 glycosidic linkage and the branching occurs by C1–C6 glycosidic linkage.



Amylopectin

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



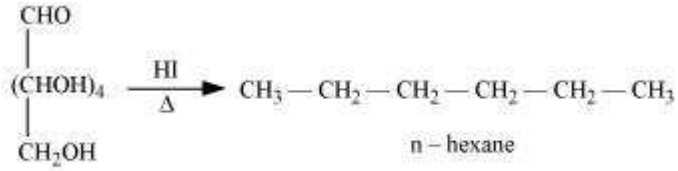
Question 14.9:

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

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

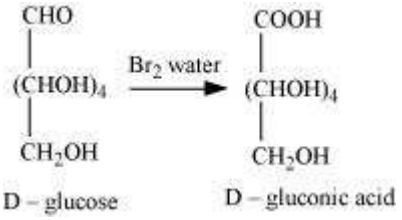
Answer

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

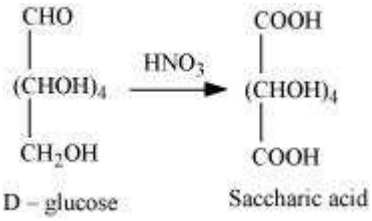


D – glucose

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



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



Question 14.10:

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

Answer

(1) Aldehydes give 2, 4-DNP test, Schiff's test, and react with $NaHSO_4$ to form the hydrogen sulphite addition product. However, glucose does not undergo these reactions.

(2) The pentaacetate of glucose does not react with hydroxylamine. This indicates that a free –CHO group is absent from glucose.

(3) Glucose exists in two crystalline forms – ∝ andβ. The ∝-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 cannot be explained by the open chain structure of glucose.

Question 14.11:

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

Answer

Essential amino acids are required by the human body, but they cannot be synthesised 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 synthesised in the body. For example: glycine, and alanine

Question 14.12:

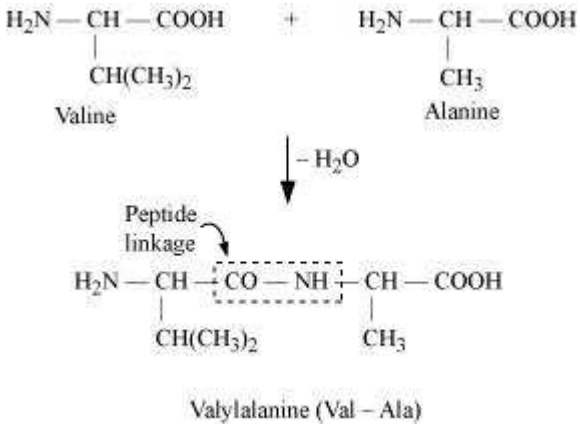
Define the following as related to proteins

(i) Peptide linkage **(ii)** Primary structure **(iii)** Denaturation.

Answer

(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.

Question 14.13:

What are the common types of secondary structure of proteins?

Answer

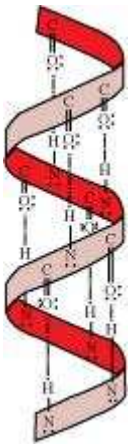
There are two common types of secondary structure of proteins:

(i) ∝-helix structure

(ii) β-pleated sheet structure

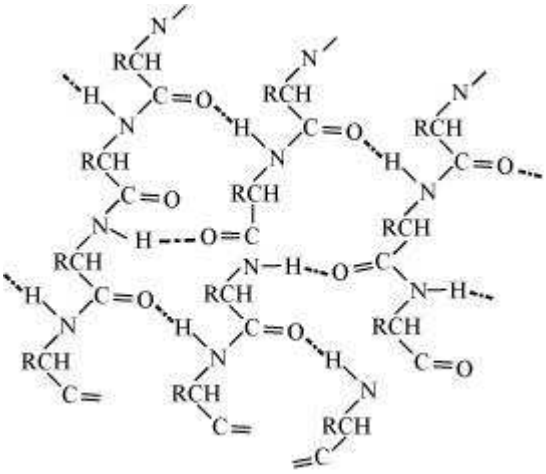
∝- Helix structure:

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.



Question 14.14:

What type of bonding helps in stabilising the ∝-helix structure of proteins?

Answer

The H-bonds formed between the –NH group of each amino acid residue and the $>C=O$ group of the adjacent turns of the ∝-helix help in stabilising the helix.

Question 14.15:

Differentiate between globular and fibrous proteins.

Answer

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 a 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

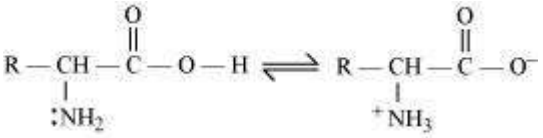
	tendons; and myosin in muscles.		proteins.

Question 14.16:

How do you explain the amphoteric behaviour of amino acids?

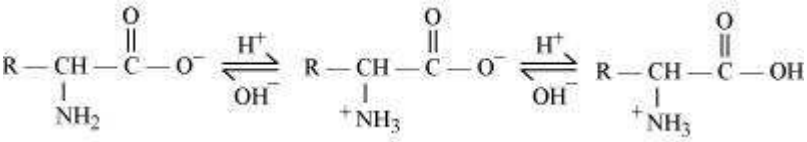
Answer

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 14.17:

What are enzymes?

Answer

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'.

Question 14.18:

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

Answer

As a result of denaturation, globules get unfolded and helixes get uncoiled. Secondary and tertiary structures of protein are destroyed, but the primary structures remain unaltered. It can be said that during denaturation, secondary and tertiary-structured proteins get converted into primary-structured proteins. Also, as the secondary and tertiary structures of a protein are destroyed, the enzyme loses its activity.

Question 14.19:

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

Answer

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.

Question 14.20:

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

Answer

The deficiency of vitamin A leads to xerophthalmia (hardening of the cornea of the eye) and night blindness. The deficiency of vitamin C leads to scurvy (bleeding gums).

The sources of vitamin A are fish liver oil, carrots, butter, and milk. The sources of vitamin C are citrus fruits, *amla*, and green leafy vegetables.

Question 14.21:

What are nucleic acids? Mention their two important functions.

Answer

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.

Two main functions of nucleic acids are:

(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 synthesised by the various RNA molecules in a cell, the message for the synthesis of a particular protein is present in DNA.

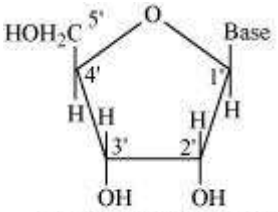
Question 14.22:

What is the difference between a nucleoside and a nucleotide?

Answer

A nucleoside is formed by the attachment of a base to $1'$ position of sugar.

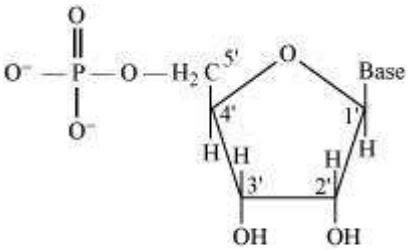
Nucleoside = Sugar + Base



Structure of a nucleoside

On the other hand, all the three basic components of nucleic acids (i.e., pentose sugar, phosphoric acid, and base) are present in a nucleotide.

Nucleotide = Sugar + Base + Phosphoric acid



Structure of a nucleotide

Question 14.23:

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

Answer

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.

Question 14.24:

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

Answer

The structural differences between DNA and RNA 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.	DNA contains uracil (U). It does not contain thymine (T).	**2.**	RNA contains thymine (T). It does not contain uracil (U).
3.	The helical structure of DNA is double-stranded.	**3.**	The helical structure of RNA is single-stranded.

The functional differences between DNA and RNA are as follows:

DNA		RNA	
1.	DNA is the chemical basis of heredity.	**1.**	RNA is not responsible for heredity.
2.	Proteins are synthesised by RNA molecules in the cells.	**2.**	DNA molecules do not synthesise proteins, but transfer coded message for the synthesis of proteins in the cells.

Question 14.25:

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

Answer

(i) Messenger RNA (m-RNA)

(ii) Ribosomal RNA (r-RNA)

(iii) Transfer RNA (t-RNA)

Website: www.vidhyarjan.com *Email: contact@vidhyarjan.com* *Mobile: 9999 249717*

Head Office: 1/3-H-A-2, Street # 6, East Azad Nagar, Delhi-110051
(One Km from 'Welcome' Metro Station)

CHAPTER-14 BIOMOLECULES

4 Marks Chapter

Key Points

1.Carbohydrates- These are optically active polyhydroxy aldehydes or ketones due to presence of chiral `C' or the compounds which produce these on hydrolysis except dihydroxy acetone is not optically active.

2. Classification-

(i) Monosaccharide's – Those carbohydrates which cannot get hydrolysed e.g. glucose ,fructose, galactose etc.

(ii) Oligosaccharides- Those carbohydrates which give to or more monosaccharide's on hydrolysis e.g. sucrose on hydrolysis gives glucose and fructose. Raffinose on hydrolysis gives glucose, fructose and galactose.

(iii) Polysaccharides- Those carbohydrates which on hydrolysis give large number of monosaccharide's hydrolysis.eg starch, cellulose, glycogen.

3. Sugar-

(i)Reducing Sugars- Those which reduce Fehling's or Tollen's reagent. They have free aldehydic groups, eg , glucose, fructose , galactose

(ii)Non Reducing Sugars- Those which do not reduce Fehling's or Tollen's reagent. They do not have free functional group ,e.g., sucrose

4. Glucose- It is a monosaccharide's with molecular formula $C_6H_{12}O_6$

(ii) Cyclic Structure OF Glucose: the straight chain is unable to explain the following reactions.

(a) It does not give the 2, 4-DNP test, Schiff's Test and does not form the hydrogensulphite product with $NaHSO_3$.

(b) The pentacetate of glucose does not react with NH_2OH, indicating the absence of free aldehydic group.

(iii) Glucose exist in 2 different crystalline forms α and β forms. These are called anomers. They differ in optical rotation, they also differ in melting point.

Anomers are isomers which have a different configuration across C-1 (first chiral 'C' atom).

7. Glycosidic Linkage: The linkage between two monosaccharide units through oxygen is called the glycosidic linkage.

8. Proteins: These are micro molecules made up of amino acids joined via a peptide link (-(-CONH-)- is the peptide linkage). These are required for growth and development of the body.

9. Amino Acids: These contain an amino ($-NH_2$) and an acidic (-COOH) group and are therefore amphoteric in nature. In solution they exist in the form of zwitter ion.

10. Classification

Fibrous Protein	**Globular Protein**
(i) Polypeptide chains run parallel or anti-parallel and held together by hydrogen and disulphide bonds.	(i) Chains of Polypeptide coil around to give a spherical shape.
(ii) Generally insoluble in water. e.g. Keratin, collagen,myosin,fibroin.	(ii) Usually soluble in water. e.g., insulin, thyroglobin,albumin, haemoglobin and fibrinogen gets converted into fibrous protein fibroin on clotting of blood.

11. Structure And Shape of Protein

Primary Strutcure	**Secondary Structure**	**Tertiary Structure**	**Quaternary Structure**
The specific sequence of amino acids in the polypeptide chain. Change in amino acids sequence changes the protein. They have covalent bonds.	It is the shape in which the long polypeptide chain can exist. It is of two types : α-helix and β- pleated. These structures arise due to regular folding of the backbone of the polypeptide chain due to H-bonding between the C=o and –NH- groups of the peptide bond.	Represents overall folding of the polypeptide chain. It gives rise to the fibrous or globular molecular shapes. Forces stabilizing the 2° and 3° structures are hydrogen bonds, disulphide linkages, van der waal's and electrostatic forces of attraction.	Protein can be composed of two or more polypeptide chains called sub units. The spatial arrangement of these sub units with respect to each other quaternary structure of the protein.

12. Denaturaion of Protein: The protein in native state, when subjected to a physical change like temperature, pH etc undergoes uncoiling and looses it's biological activity. The 2° and 3° structures are destroyed, only 1° structure is retained.

Renaturation of Protein:

Some proteins regain their biological activity by reversible process it is called Renaturation of Proteins. In such a cases, when temperature in pH of a denatured proteins is brought back to conditions in which the native protein is stable, secondary and tertiary structures of proteins are restored to which leads to recovery of biological activity.

13. Enzymes: These are biocatalyst and generally globular proteins e.g., invertase,zymase,phenyl, alaninehydroxylase, urease etc.

14. Vitamins: They are organic compounds required in the diet in small amounts to perform specific biological functions for maintenance of optimum growth and health of the organism. They are classified as follows

(i) Fat Soluble Vitamins: Vitamin A,D,E and K. They are stored in liver and adipose tissues.

(ii) Water Soluble Vitamins: B group vitamins and vitamin C. They need to supplied regularly in diet as they are excreted in urine and cannot be stored(except vitamin B_{12}) in our body.

Their deficiency causes diseases.

Biotin (Vit H) is however neither fat nor water soluble. It's deficiency leads to loss of hair.

15. Nucleic Acids: These are biomolecules which are long chain polymers of nucleotides. They are:

(i) Deoxyribonucleic acid (DNA)

(ii) Ribonucleic acid (RNA)

They are responsible for protein synthesis and transfer of genetic characteristics to offspring's.

16. Composition of Nucleic Acid:

They are made up of pentose sugar(β-D-2-deoxyribose in DNA and β-D-ribose in RNA), phosphoric acid and a nitrogen containing heterocyclic compound(base).

DNA- Bases present are Adenine(A), Thymine(T),Guanine(G) and Cytosine(C).

RNA- contains Adenine(A), Guanine(G), Cytosine(C) and Uracil(U).

17. Nucleoside: The unit formed by the attachment of a base to n1'-position of sugar (Base+Sugar).

18. Nucleotide: Nucleoside and phosphoric acid at 5'-position. Nucleotides are bonded by phosphodiester linkages between 5' and 3' carbon atoms of pentose sugar (Base+ Sugar+ Phosphoric Acid).

19.DNA : has a double helical structure with AT and GC linked together through 2 and 3 hydrogen bonds respectively. It is responsible for transfer of genetic characteristics.

20. RNA: is of three types- messenger RNA(m-RNA), ribosomal RNA(r-RNA) and transfer RNA (t-RNA). RNA helps in protein synthesis.

21. Biological Functions of Nuclei Acid: DNA is chemical basis of hereditary and have the coded message for proteins to be synthesized in the cell. RNA carry out the protein synthesis in the cell.

VSA Type Questions – (1 Mark)

Q1 – Which functional groups are present in monosaccharides?

Ans - —OH and —CHO or —OH and >CO

Q2 – Name an aldopentose, aldohexose and ketohexose.

Ans – Ribose,glucose and fructose respectively.

Q3 – What is animal starch?

Ans – Glycogen.

Q4 – Which types of bonds are present in a protein molecule?

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

Q5 – Which is more stable? and why

α-helix , β-helix

Ans – α-helix is right handed coil and is more stable due to intermolecular H bonding between first and fourth amino acid.

Q6 – The sequence of bases in one strand of DNA is TACGGACA. What is the sequence of bases of complementary strand of DNA.

Ans – ATGCCTGT.

Q7 – Name the vitamin whose deficiency causes rickets?

Ans – Vitamin D.

Q8 – Name the purines present in DNA.

Ans – Adenine and guanine.

Q9 – Give an example of (a)water soluble (b)fat soluble vitamins.

Ans – (a)Vitamin C (b)Vitamin D.

Q10 – Name a protein which is insoluble in water.

Ans – Keratin.

SAI Type Questions – (2 Marks)

Q1 – Write the components of starch and what is the difference between them?

Ans – Amylose which is linear polymer of α-glucose and amytopectin which is branched polymer of α-

glucose. Amylose is water soluble where as amylopectine is water insoluble.

Q2 – What are anomers?

Ans – Monosaccharides which differ only in the orientation of the —OH group at C-1.e.g, α-glucose and β-

glucose.

Q3 – Where does the water present in the egg go after boiling the egg?

Ans – On boiling during denaturation process water makes inter molecular H- bond with denatured protein

molecule.

Q4 – What do you understand by glycosidic linkage?

Ans – During condensation of two monosaccharides, a water molecule given out and two

monosaccharides get linked together by an oxide or ethereal linkage (—O—) called as glycosidic

linkage.

Q5 – What are essential and non essential amino acid? Give two examples of each type.

Ans – Essential amino acids are those which are not produced in our body.e.g.,valine,leucine.

Non-essential amino acids are those which are produced by our body.e.g.glycine and alanine.

Q6 – How do you explain the amphoteric behavior of amino acids?

Ans – Amino acids have both acidic as well as basic group and they react both with acids as well as

bases,therefore they are amphoteric in nature.

Q7 – What is the structural difference between a nucleoside and a nucleotide?

Ans - Nucleoside = sugar + base

Nucleotide = sugar + base + phosphoric acid

Q8– Define (a)Enzymes (b)Antibody

Ans – (a)Enzymes – they are biological catalyst which catalyse biochemical reactions.e.g.,

$$\underset{\text{sucrose}}{C_{12}H_{22}O_{11}} + H_2O \text{ ----------> } \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{fructose}}{C_6H_{12}O_6}$$

This reaction is catalysed by the enzyme invertase.

(b)Antibody – they are chemical substances which destroy antigens that cause infections.e.g.,vaccination for typhoid produces antibodies in our body to prevent typhoid.

Q9 – What is invert sugar?

Ans – An equimolar aqueous solution of glucose and fructose is called invert sugar.

SAII Type Questions – (3 Marks)

Q1 – Give three differences between DNA and RNA.

Ans –

DNA	RNA

1. it has deoxyribose as sugar. 2. it contains thymine along with adenine, cytosine and guanine as bases. 3. it is responsible for maintaining heredity traits from generation to generation.	1.it contains ribose as sugar. 2.it contains uracil in place of thymine with other bases. 3. it is responsible for protein synthesis.

Q2 – Difference between globular protein and fibrous protein.

Ans –

Globular Protein	Fibrous Protein
1. they form α-helix structure. 2. they are water soluble. 3. they involve intra molecular H bonding.	1. they have β-pleated structure. 2. they are water insoluble. 3. they have strong intermolecular forces of attraction.

Q3 – Give reactions with support cyclic structure of glucose.

Ans – (a)Glucose does not give 2,4-DNP test, Schiff`s test and sodium hydrogen suphide test.

(b)The pentaacetate of glucose does not react with NH_2OH indicating absence of free —CHO group.

(c)Glucose exists in two crystalline form α and β.

Q4 – Define with example

(a)Isoelectric point (b)Mutarotation (c)Transcription

Ans –

(a)Isoelctric point – the pH at which there is no net migration of any ion towards electrode.e.g,amino acids have isoelectric point at pH = 5.5-6.3

(b)Mutarotation - it is spontaneous change in optical rotation when an optically active substance is dissolved in water.e.g, α-glucose when dissolved in water changes its optical rotation from 111° to $52.5^{o.}$

(c)Transcription – it is process by which m—RNA is generated from DNA.

Q5 – What happens when glucose reacts with

(a)HI (b) HNO_3 (c)Br_2 water (d) NH_2OH (e) Acetic anhydride

Ans –

(a) $C_6H_{12}O_6$ + HI ------> n-hexane C_6H_{14}
(b) $C_6H_{12}O_6$ + HNO_3 -------> saccharic acid / Glucric acid
(c) $C_6H_{12}O_6$ +Br_2 water --------> gluconic acid
(d) $C_6H_{12}O_6$ +Br_2 water --------> gluconic acid
(e) $C_6H_{12}O_6$ + NH_2OH --------> Oxime
(f) $C_6H_{12}O_6$ + Acetic anhydride --------> glucose penta acetate

Q6. Mention structural differences between amylopectin and cellulose.

Ans.

Amylopectin	Cellulose
1. It is linear polymer of α-glucose. 2. It consists of branched chains of α-glucose.	1. It is linear polymer of β-glucose. 2. In cellulose, the chains are arranged to form bundles and held together by hydrogen bond between glucose and adjacent strands.

Q7. What deficiency diseases are caused due to lack of vitamins B_1, B_6 and K in human diet.

Ans.

Vitamins	Deficiency Disease
B_1	Beri beri (loss of appetite)
B_6	Convulsions
K	Increased blood clotting time

Q8. Glucose or Sucrose are soluble in water but cyclohexane and benzene are insoluble in water. Explain.

Ans. Glucose contains five-OH groups and Sucrose contains eight-OH groups, because of this they form intermolecular hydrogen bonding, so they are soluble in water. But benzene and

cyclohexane does not contain –OH groups, hence does not form intermolecular hydrogen bonding, so they are not soluble in water.

HOTS Questions

VERY SHORT ANSWER QUESTIONS

Q1. Write the formula of Zwitter ion for Glycine.

Ans.

$R\text{-}CH\text{-}COO^-$	$CH_2\text{-}COO^-$
|	|
NH_3^+	NH_3^+
General Formula	Zwitter ion of glycine

Q2. Which proteins possess α-Helix structure?

Ans. Keratin and myosin possess α-Helix structure.

Q3. What is the native state of protein?

Ans. The energetically most stable shape of the protein at normal pH and temperature is called native state.

Q4. Fresh tomatoes are a better source of Vitamin C that which have been stored for some time. Explain.

Ans. Vitamin C is destroyed on prolonged exposure to air due to its oxidation.

Q5. Why are carbohydrates generally active?

Ans. It is due to the presence of Chiral Carbon atoms in their molecules.

Q6. What type of linkages hold together monomers in DNA?

Ans. Monomers in DNA are linked by phosphate linkages.

Q7. Why is cellulose not digested in human body?

Ans. It is due to the fact that human beings do not have enzyme to digest cellulose.

Q8. Name the enzyme that is used to dissolve blood clots?

Ans. Streptokinase.

Q9. Name two diseases caused due to deficiency of enzymes.

Ans. Albinism and phenylketonuria.

<u>SA Type I (2 Marks)</u>

Q1. Give reasons for the following-

(i) On electrolysis in acidic solution amino acids migrate towards cathode, while in alkaline solution these migrate towards anode.

(ii) The monoamino monocarboxylic acids have two pK_a values.

Ans. (i) In acidic solution, the carboxylate anion accept a proton and gets converted into carboxylic group resulting in the formation of positive ion.

In presence of a base the NH_3^+ ion changes to —NH_2 group by losing a proton and this gives a negative ion.

This means that in acidic medium, the amino acid migrates towards the cathode while in alkaline solution it migrates towards anode on electrolysis.

(ii) In aqueous solution, monoamino monocarboxylic amino acid behave like salt at isoelectric point. At a pH lower than isoelectric point (i.e. in acidic medium) it act as cation and

and at a pH higher than isoelectric point,it acts as anion.

Q2. Which forces are responsible for the stability of α-helix? Why is it named as 3.6_{13} helix?

Ans. Hydorgen bonds between – N-H and —C=O groups of peptide bonds give stability to the structure.

It is known as 3.6_{13} helix, since each turn of helix has approximately 3.6 amino acid residue and a 13 member ring is formed by hydrogen bonding.

Q3. Write about the following protein synthesis-

(i) Name the location where the protein synthesis occurs?

Ans. Protein synthesis occurs at the ribosome in cytoplasm.

(ii) How do 64 codones code for only 20 amino acids?

Ans. The 64 codones for 20 amino acids; more than one codon can code for same amino acids, e.g., CUU and CUU both can code leucine. Proline is encoded by CCU, CCA, CCG, and CCC.

Q4. What is replication of DNA.

Ans. The process by which a DNA molecule produces two identical copies of itself is called replication of

DNA

Q5. Answer the following queries about proteins-

(i) How are proteins related to amino acids?

Ans. Proteins consist of large number of amino acids linked to each other by peptide linkage, having 3- dimensional structure. Thus, proteins are biopolymers of amino acids.

(ii) When is protein said to be denatured?

Ans. When nature proteins are subjected to the action of heat, acids or alkalies, they are coagulated or precipitated. The protein in this state is said to be denatured. During denaturation process the water soluble form of globular protein change to water insoluble fibrous protein.

Q6. Draw simple Fischer projections of D and L- glucose. Are these enantiomers?

Refer NCERT Book.

Yes , these two fischer projections are called enatiomers.

Q7. Glycine exists as a Zwitter ion but 0-and p-amino benzoic acids do not. Explain.

Ans. The lone pair of N-atom in O- and p-aminobenzoic acid is involved in resonance. The lone pair of N-atom in transferred towards benzene ring. This decreases the acidic character of $–NH_2$ group. Therefore these groups do not transfer and accept H^+ ions, respectively.

Q8. The melting points and solubility in water of amino acids are generally higher than that of the corresponding halo acids. Explain.

Ans. The amino acids exists as zwitter ion ($H_3N—CHR—COO^-$). They have salt like structure. There are strong dipole-dipole and electrostatic attractions. Therefore, amino acids have high melting points. Amino acids strongly interact with water molecules and are soluble in it. The halo-acids do not have salt like structure and have low melting points. Halo-acids do not

interact as strongly with water molecules as do amino acids. Therefore, solubility of amino acids in water is more than those of halo-acids.

Q9. A tripeptide on complete hydolysis gives glycine, alanine and phynylalanine using three letter symbols write down the possible sequence of tripeptide.