UNIT 14

BIOMOLECULES

1. **Carbohydrates :** These are optically active polyhydroxy aldehydes or ketones or the compounds which produce these on hydrolysis.

2. **Classification :**

   (i) Monosaccharides : Those carbohydrates which cannot be hydrolysed into further simpler carbohydrates. *E.g.,* glucose, fructose, galactose etc.

   (ii) Disaccharides : Those carbohydrates which produces two monosaccharides on hydrolysis. *E.g.,* sucrose, maltose and lactose.

   (iii) Oligosaccharides : Those carbohydrates which give two to ten monosaccharides on hydrolysis.

   (iv) Polysaccharides : Those carbohydrates which on hydrolysis give large number of monosaccharides hydrolysis. *E.g.,* starch, cellulose, glycogen.

3. **Sugar :** Carbohydrates which are sweet in taste.

   (i) Reducing sugars : Those which reduce Fehling's or Tollen's reagent due to availability of free aldehydic groups. *E.g.,* glucose, fructose, galactose.

   (ii) Non-reducing sugars : Those which do not reduce Fehling's or Tollen's reagent. They do not have free aldehydic group. *E.g.,* sucrose.

4. **Glucose :** It is a monosaccharide with molecular formula $C_6H_{12}O_6$.

5. **Preparation :**

   (i) From sucrose :

$$C_{12}H_{22}O_{22} + H_2O \xrightarrow{H^+} \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6} \quad \text{(only from sucrose)}$$

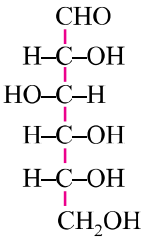
   (ii) From starch :

$$(C_6H_{10}O_5)_n + nH_2O \rightarrow C_{12}H_{22}O_{11} + H_2O \rightarrow \underset{\text{glucose}}{2C_6H_{12}O_6}$$

6. **Structure :**

   Fischer structure :

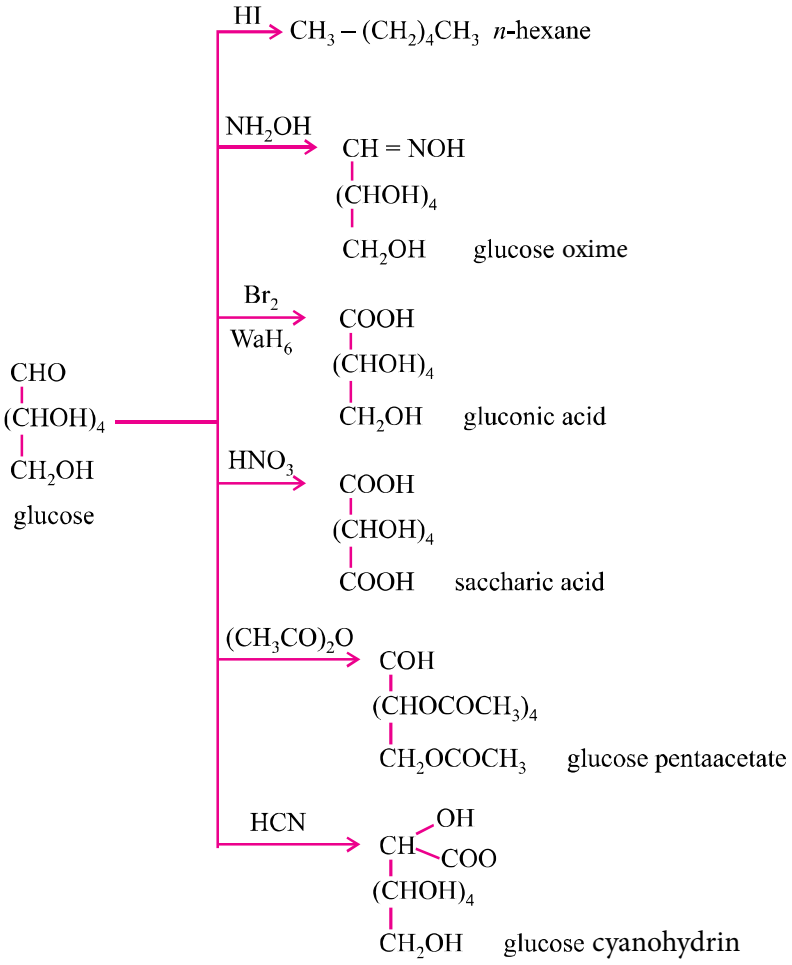
   (+) glucose has 'D' configuration as shown :



D-(+)-glucose

'D'- means – OH group on first chiral 'C' from the bottom is on right hand and (+) means it is dextrorotatory *i.e.,* it rotates plane polarized light towards right.

Reactions of glucose :



Objections against open chain structure of glucose

The open chain structure was unable to explain the following reactions :

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

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

(c) 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.

After which a close chain (cyclic) structure of glucose was proposed by Haworth.

* Anomers are isomers which have a different configuration at C-1 functional group c-atom

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

8. **Proteins :** These are macro molecules made up of amino acids joined by amide linkage [– (– CONH –) –] is here called as 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 (a dipolar ion).

10. **Classification**

Fibrous Protein	Glubular Protein
(i) Polypeptide chains run par`allel 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 (Ref. page no. 416 NCERT Book)**

Primary structure	Secondary structure	Tertiary structure	Quaternary structure
The specific sequence of amino acids in the polypepide chain. Change in amino acids sequence changes the protein completely. 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 2º and 3º 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 is quaternary structure of the protein.

12. **Native state of protein :** The parental state or the natural state in which the protein is found.

13. **Denaturation of protein :** Destruction of the native state of protein is denaturation. It can be brought by physical and chemical methods. The 2º and 3º structures are destroyed, only 1º structure is retained.

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

Main characteristics of enzymes :

(i) It speed up the biological reaction upto million times.

(ii) It is highly specific and work on lock and key theory.

(iii) It is highly sensitive to pH and temperature.

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. (Ref. table in page no. 418 of NCERT Book)

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

15. **Nucleic acids :** These are biomolecules which are long chain polymers of nucleotides. They are of two types :

(i) Deoxyribonucleic acid (DNA)

(ii) Ribonucleic acid (RNA)

16.

Vitamin	**Deficiency disease**
A	Xerophthalmia, night blindness
B_1	Beri-beri
B_2	Ariboflavinosis, cheilosis, burning sensation of skin
B_{12}	Pernicious anaemia, inflammation of tongue and mouth
C	Scurvy
D	Rickets & osteomalacia
E	Increased fragility of RBC and muscular weakness
K	Increased blood clotting time
H	Loss of hair

17. Hormones are chemical substances which are produced in ductless glands in the body.

18. Nuceloside = Base + Sugar

Nucleotide = Base + Sugar + Phosphate

19.

	DNA		**RNA**
(i)	Double helical.	(i)	Single stranded.
(ii)	Sugar is 2-deoxyribose.	(ii)	Sugar is ribose.
(iii)	Bases : A, T, G, C.	(iii)	Bases : A, U, G, C.
(iv)	Property of replication.	(iv)	Do not replicate.
(v)	It is responsible for transmission of heredity character.	(v)	Helps in protein biosynthesis.

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

Q. 1. Name polysaccharides which is stored in the liver of animals.

Ans. Glycogen.

Q. 2. What structural feature is required for a carbohydrate to behave as reducing sugar ?

Ans. The carbonyl group of any one monosaccharide present in carbohydrate should be free.

Q. 3. Give the significance of (+) sign in the name D-(+)-glucose.

Ans. (+) sign indicates dextro-rotatory nature of glucose.

Q. 4. Glucose is an aldose sugar but it does not react with sodium hydrogen sulphite. Give reason.

Ans. The – CHO group reacts with – OH group at C-5 to form a cyclic hemiacetal.

Q. 5. Why is sucrose called invert sugar ?

Ans. When sucrose is hydrolysed by water, the optical rotation of solution changes from positive to negative.

Q. 6. Name the amino acid which is not optically active.

Ans. Glycine.

Q. 7. Give reason :

Amylase present in the saliva becomes inactive in the stomach.

Ans. HCl present in stomach decreases the pH.

Q. 8. Which forces are responsible for the stability of α-helical structure of proteins ?

Ans. Hydrogen bonding.

Q. 9. Which nucleic acid is responsible for carrying out protein synthesis in the cell ?

Ans. RNA (Ribonucleic acid)

Q. 10. When RNA is hydrolysed, there is no relationship among quantities of different bases obtained. What does this fact suggest about structures of RNA ?

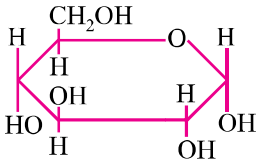
Ans. RNA is single stranded.

Q. 11. What type of linkage holds together the monomers of DNA and RNA ?

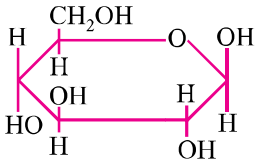
Ans. Phosphodiester linkage.

Q. 12. Give the Howarth projection of D-glucopyranose.

Ans.



α-D(+) Glucopyranose



β-D(+) Glucopyranose

Q. 13. Name the vitamin responsible for coagulation of blood.

Ans. Vitamin K.

Q. 14. Where does the water present in the egg go after boiling the egg ?

Ans. On boiling, during denaturation process water gets absorbed in denaturated proteins.

Q. 15. What is native state of protein ?

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

Q. 16. 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.

Q. 17. Name the enzyme that is used to dissolve blood clots ?

Ans. Streptokinase.

Q. 18. Name two diseases caused due to deficiency of enzymes.

Ans. Albinism and phenyl keto urea.

Q. 19. Give one example of : (a) water soluble, (b) fat soluble vitamins.

Ans. (a) Vitamin C (b) Vitamin D

Q. 20. Name a protein which is insoluble in water.

Ans. Keratin.

Q. 21. Name the deficiency disease resulting from lack of Vitamin 'A' in the diet.

Ans. Night blindness, Xerophthalmia.

Q. 22. Mention two important functions of carbohydrates in plants.

Ans. Major energy source, storage molecules like starch in plants.

Q. 23. Name two of the different types of RNA molecules found in cells of organisms.

Ans. tRNA, mRNA, rRNA.

Q. 24. The deficiency of which vitamin causes the disease pernicious anaemia ?

Ans. Vitamin B_{12}.

Q. 25. Why are carbohydrates generally optically active ?

Ans. Because they contain one or more chiral atom.

Q. 26. During curdling of milk, what happens to sugar present in it ?

Ans. Lactose changes to lactic acid.

Q. 27. What are the products of hydrolysis of lactose ?

Ans. β-D-galactose and β-D-glucose.

Q. 28. The two strands in DNA are not identical but complementary. Explain.

Ans. Base pairing rule is followed; A = T and G ≡ C.

Q. 29. If one strand of DNA has the sequence 5'-G-G-A-C-T-A-C-T-3', what is the sequence of bases in the complementary strand ?

Ans. 3'-C-C-T-G-A-T-G-A-5'

Q. 30. What are monosaccharides ?

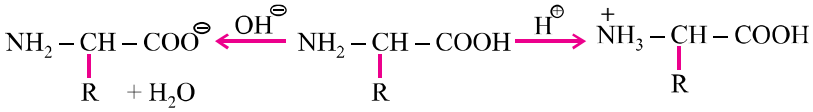
Ans. Sugars which cannot be hydrolysed to give simpler units or compounds.

Q. 31. What is the difference between native protein and denatured protein ?

Ans. Proteins found in a biological system with unique 3D-structure and biological activity is called native protein. When native protein is subjected to physical and chemical change, protein loses its biological activity and is called denatured protein.

Q. 32. Amino acids are amphoteric in nature. Explain.

Ans. It can react with acid and base both as per the following reaction :



SHORT ANSWER-I TYPE QUESTIONS (2 Marks)

Q. 1. Define the following terms in relation to proteins :

(i) Peptide linkage (ii) Denaturation

Ans. (i) Peptide linkage : A link between two amino acids with loss of water /– CO – NH – peptide linkage.

(ii) A process that changes the three dimensional structure of native protein is called denaturation of protein. It results into breaking of hydrogen bonds and disulphide linkages. Thus, a completely denatured protein has a shape of random coil.

Q. 2. List the reactions of glucose which cannot be explained by its open chain structure.

Ans. (i) Despite having the aldehyde group, glucose does not give 2, 4 DNP test or Schiff's test.

(ii) It does not form hydrogensulphite addition product with $NaHSO_3$.

(iii) The penta acetate of glucose does not react with hydroxylamine indicating the absence of free – CHO group.

Q. 3. Explain what is meant by :

(i) Biocatalyst (ii) Peptide linkage

Ans. (i) Biocatalysts are the catalysts which increases the rate of metabolism/ biochemical reactions.

(ii) Peptide linkage : A link between two amino acids with loss of water/– CO – NH – peptide linkage.

Q. 4. Explain the following terms :

(i) Invert sugar (ii) Polypeptides

Ans. (i) An equimolar mixture of glucose and fructose produced on hydrolysis of sucrose is called invert sugar. It is called so because sucrose is dextro rotator whereas its hydrolysis product is laevo rotatory.

(ii) Polypeptides are polymers of amino acids containing less than 100 amino acids. For example, oxytocin, vasopressin, etc.

Q. 5. Explain what is meant by :

(i) Peptide linkage (ii) Glycosidic linkage

Ans. (i) Refer Q1 of SA-I type question

(ii) The linkage between the monosaccharide units through oxygen is called glycosidic linkage.

Q. 6. Name the product of hydrolysis of sucrose. Why is sucrose not a reducing sugar ?

Ans. On hydrolysis, sucrose gives equimolar mixture of D-(+)-glucose and D-(−)-fructose. Sucrose is not a reducing sugar as glucose and fructose are linked through their reducing centres in structure of sucrose.

Q. 7. State clearly what are known as nucleotides and nucleosides.

Ans. A nucleoside contain only two basic components of nucleic acids *i.e.,* pentose sugar and nitrogenous base.

A nucleotide contains all the three basic components of nucleic acids *i.e.,* a phosphoric acid group, pentose sugar and nitrogenous base.

Q. 8. Describe what do you understand by primary structure and secondary structure of proteins.

Ans. Primary structure of proteins : The protein in which amino acids linked with each other in a specific sequence is said to be the primary structure of that protein.

Secondary structure of proteins : It refers to the shape in which a long polypeptide chain can exist *i.e.,* α-helix and β-pleated structure.

Q. 9. What is essentially the difference between α-form of glucose and β-form of glucose ? Explain.

Ans. α-form of glucose and β-form of glucose differ only in the configuration of the hydroxyl group at C_1 in cyclic structure of glucose/hemiacetal form of glucose.

Q. 10. Explain :

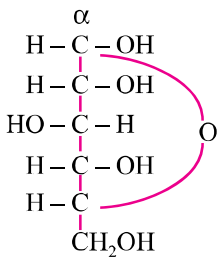
(i) Mutarotation **(ii) Avitamineosis**

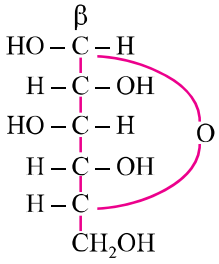
Ans. (i) Mutarotation : Spontaneous change in specific rotation of an optically active compound with time, to an equilibrium value is called mutarotation.

(ii) Avitamineosis : Multiple deficiencies caused by lack of more than one vitamin is called avitamineosis.

Q. 11. What are anomers ? Give the structures of two anomers of glucose.

Ans. Monosaccharides which differs in configuration at C-1, *e.g.,* α-glucose and β-glucose.


α-Glucose


β-Glucose

Q. 12. Write the hydrolysed product of :

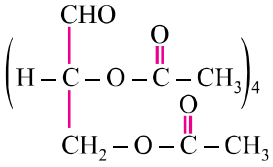
(i) Maltose **(ii) Cellulose**

Ans. (i) α-D-glucose (ii) β-D-glucose

Q. 13. (i) Acetylation of glucose with acetic anhydride gives glucose penta-acetate. Write the structure of penta acetate.

(ii) Explain why glucose penta acetate does not react with hydroxylamine ?

Ans. (i)


Glucose pentaacetate

(ii) The molecule of glucose penta acetate has a cyclic structure in which – CHO is involved in ring formation with – OH group at C-5.

Q. 14. What are vitamins ? How are they classified ?

Ans. Vitamins are a group of biomolecules (other than carbohydrates, fats and proteins) most of which cannot be produced by body but must be supplied in small amount to perform specific biological functions of the body.

Types :

(i) Water soluble vitamins : Vitamin B and C.

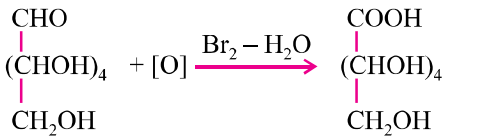
(ii) Fat soluble vitamins : Vitamin A, D, E and K.

Q. 15. Write the products of oxidation of glucose with :

(i) Bromine water

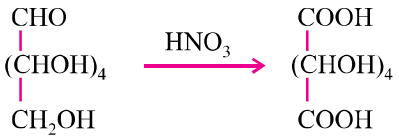
(ii) Nitric acid

Ans. (i)



Glucose Glycolic acid

(ii)



Glucose Saccharic acid

Q. 16. State two main differences between globular and fibrous proteins.

Ans.

	Globular protein		**Fibrous protein**
(i)	They form a α-helix structure.	(i)	They have β-pleated structure.
(ii)	They are water soluble.	(ii)	They are water insoluble.

Q. 17. (i) Name the disease caused by deficiency of vitamin D.

(ii) Why cannot vitamin C be stored in our body ?

Ans. (i) Rickets.

(ii) Vitamin C is a water soluble vitamin which is excreted in urine and cannot be stored in our body.

Q. 18. Name the constituents of starch and what is the difference between them ?

Ans. Amylase : A linear polymer of α-glucose, water soluble.

Amylopectin : Branched polymer of α-glucose, water insoluble.

Q. 19. What are essential and non-essential amino acid ? Give two examples of each type.

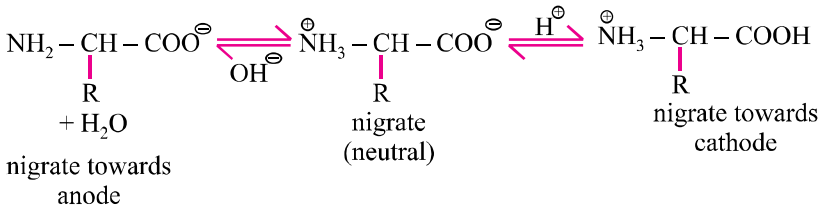
Ans. Essential amino acids are those which are not produced in our body and required to be supplied from outside, *e.g.,* valine, leucine.

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

Q. 20. Give reasons :

(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 values.

Ans. (i) 

(ii) Due to zwitter ion formation.

Q. 21. Coagulation of egg white on boiling is an example of denaturation of protein. Explain it in terms of structural changes.

Ans. Protein albumin present in egg white gets denatured *i.e.,* 2º & 3º structures are destroyed and 1º structure is retained.

Q. 22. Describe two important functions of nucleic acids.

Ans. (i) DNA is responsible for transfer of heredity information from one generation to another.

(ii) RNA is responsible for protein synthesis.

Q. 23. Hormones are called chemical messengers. Explain.

Ans. Hormones are molecules that act as intercellular messengers. These are produced by endocrine glands in the body and are poured directly in the blood stream which transports them to the site of action.

For example,

(i) Glucocorticoids control carbohydrate metabolism.

(ii) Testosterone is responsible for development of 2º male characteristics like deep voice, facial hair or general physical constitution.

SHORT ANSWER-II TYPE QUESTIONS (3 Marks)

Q. 1. (i) Deficiency of which vitamin causes scurvy ?

(ii) What type of linkage is responsible for the formation of proteins ?

(iii) Write the product formed when glucose is treated with HI.

Ans. (i) Vitamin C.

(ii) Peptide linkage.

(iii) n-hexane.

Q. 2. (i) Write the name of two monosaccharides obtained by hydrolysis of lactose sugar.

(ii) Why vitamin C cannot be stored in our body ?

(iii) What is the difference between nucleotide and nucleoside ?

Ans. (i) β-D-glucose and β-D-galatose.

(ii) Water soluble, excreted out of body.

(iii) In nucleotide, phosphoric acid/phosphate group attached to the nucleoside/ nucleotide = base + sugar + phosphate group, nucleoside = base + sugar.

Q. 3. (i) Deficiency of which vitamin causes night blindness ?

(ii) Name the base that is found in nucleotide of RNA only.

(iii) Glucose on reaction with HI gives n-hexane. What does it suggest about structure of glucose ?

Ans. (i) Vitamin A.

(ii) Uracil.

(iii) This reaction suggests that all six carbon atoms in glucose are arranged in a straight chain.

Q. 4. Differentiate between the following :

(i) Secondary and tertiary structure of protein

(ii) α-helix and β-pleated sheet structure of protein

(iii) Fibrous and globular protein

Ans. (i) Secondary structure is responsible for the shape of protein α-helix and β-pleated sheets in which polypeptide chains have peptide bonds.

Tertiary structure represents overall folding of polypeptide chain and give rise to the fibrous or globular molecular shape.

(ii) α-helix structure : The peptide chains coiled up to form right handed helix involving H-bonding (Intramolecular).

β-pleated sheets : The peptide chains lie side by side together by intermolecular hydrogen bonding.

(iii) Same as Q. 16 (Two marks questions)

Q. 5. (i) Name the four bases present in DNA.

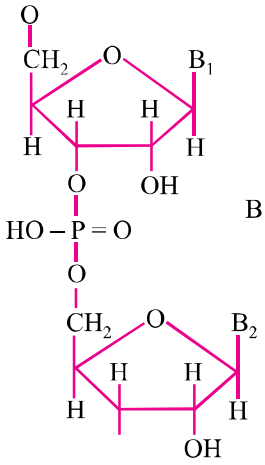
(ii) Which of them is not present in RNA ?

(iii) Give the structure of a nucleotide of DNA.

Ans. (i) Adenine, Guanine, Thymine, Cytosine.

(ii) Thymine.

(iii)



B_1 & B_2 = Nitrogeneous bone (Adeninine, guanine, Cytasine or thymine)

Q. 6. Define with example :

(i) Isoelectric point **(ii) Mutarotation** **(iii) Transcription**

Ans. (i) Isoelectric 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.

(ii) 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°.

(iii) Transcription : It is process by which m-RNA is generated from DNA *e.g.,* if DNA has base sequence ATACA then m-RNA has base sequence UAUCGU

Q. 7. Glucose or sucrose are soluble in water but cyclohexane and benzene are insoluble in water. Explain.

Ans. Glucose contain 5 – OH groups and sucrose contain eight – OH groups, because of this they form intermolecular hydrogen bonding, so they are soluble in water.

But benzene and cyclohexane doesn't contain – OH groups hence doesn't form intermolecular hydrogen bonding, so they are not soluble in water.

Q. 8.(i) Fructose contains a keto group but still it reduces Tollen's reagent. Explain.

(ii) Give the chemical name and sources of :

(a) Vitamin C **(b) Vitamin B_1**

Q.9.Name the components of starch. How do they differ from each other structurally ?

Ans. Amylose and Amylopectin.

Amylose is long unbranched chain with α-D-glucose units held by C1-C4 glycosidic linkage.

Amylopectin is branched chain polymer of α-D-glucose formed by C1-C4 glycosidic linkage and branching occurs by C1-C6 glycosidic linkage.

LONG ANSWER TYPE QUESTIONS (5 Marks)

Q. 1. (i) Give one example each of fibrous protein and globular protein.

(ii) What happens when D-glucose reacts with Br_2 water ?

(iii) What type of linkage is responsible for the formation of protein ?

(iv) Explain mutarotation with suitable example.

Ans. (i) Fibrous protein : Keratin

Globular protein : Hormone

(ii) $C_6H_{12}O_6 + Br_2$ water $\rightarrow$ gluconic acid

(iii) Peptide bond

(iv) Spontaneous change in specific rotation of an optically active compound with time, to an equilibrium value is called mutarotation. For example,

α-D glucose $\rightleftharpoons$ Equilibrium mixture $\rightleftharpoons$ β(D) glucose

$[\alpha]_D = +111^\circ$ $[\alpha]_D = +52.5^\circ$ $[\alpha]_D = +19.2^\circ$

Q. 2. (i) Name the three major classes of carbohydrates and give an example of each of these classes.

(ii) Answer the following :

(a) What type of linkage is responsible for primary structure of proteins ?

(b) Name the location where protein synthesis occurs in our body

Ans. (i) Carbohydrates are classified as :

(a) Monosaccharides *e.g.,* Glucose.

(b) Oligosaccharides *e.g.,* Sucrose

(c) Polysaccharides *e.g.,* Starch

(ii) (a) Peptide bond

(b) Protein synthesis occurs in cytoplasm of cell by mRNA with the help of rRNA and tRNA.

HOTS

Q. 1. An optically active compound having molecular formula $C_6H_{12}O_6$ is found in two isomeric forms [A] and [B] in nature. When [A] and [B] are dissolved in water, they show the following equilibrium :

A $\rightleftharpoons$ Equilibrium mixture $\rightleftharpoons$ B

$[\alpha]_D$ = 111° 52.2° (19.2°)

(i) What are such isomer called ?

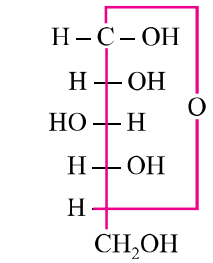
(ii) Can they be called enantiomers ? Justify your answer.

(iii) Draw cyclic structure of isomer (A).

Ans. (i) Such isomers are called **anomers.**

(ii) These anomers cannot be called enantiomers because they are not mirror images of each other (or they do not rotate the plane polarized light equally but in opposite directions).

(iii) Cyclic structure of A [α-D(+)-glycopyranose] is given as :



α-D(+)–Glucopyranose

Q. 2. Name the vitamins whose deficiency is responsible for :

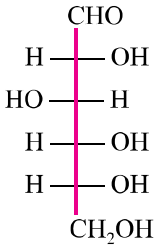
(i) Night blindness **(ii) Poor coagulation of blood**

(iii) Sterility

Ans. (i) Vitamin A (ii) Vitamin K

(iii) Vitamin E

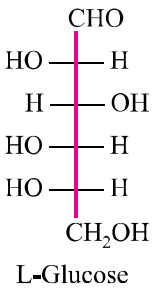
Q. 3. The Fischer projection of D-glucose is :



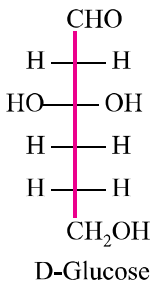
(i) Give the Fischer projection of L-glucose.

(ii) What happens when L-glucose is treated with Tollen's reagent ?

Ans. (i) The Fischer projection of L-glucose is the mirror image of D-glucose.

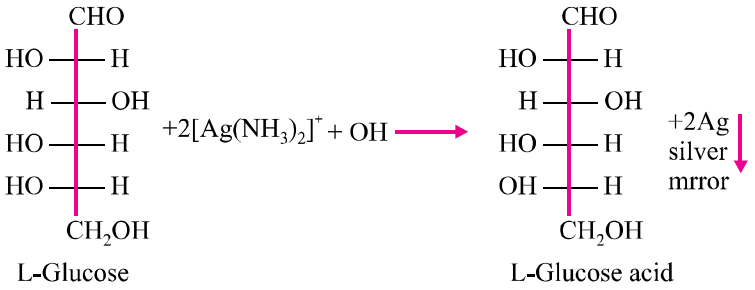


L-Glucose



D-Glucose

(ii) L-glucose reduces Tollen's reagent to silver mirror.



L-Glucose L-Glucose acid

Q. 4. An optically active amino acid (A) can exist in three forms depending on the pH of the medium. The molecular formula of (A) is $C_3H_7NO_2$.

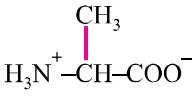
(i) Write the structure of compound (A) in aqueous medium. What are such ions called ?

(ii) In which medium will the cationic form of compound (A) exist ?

(iii) In alkaline medium, towards which electrode will the compound (A) migrate in electric field ?

Ans. A = Alanine.

(i) An aqueous medium alanine exists as Zwitter ion.



Alanine

(ii) In acidic medium.

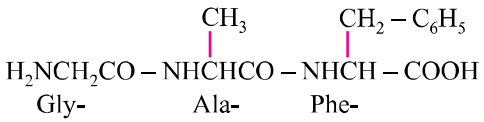
(iii) In alkaline medium, it will exist in anionic form and will migrate towards anode in electric field.

Q. 5. If three amino acids viz., glycine, alanine and phenyl alanine react together, how many possible tripeptides can be formed ? Write down the structures and names of each one. Also write their names using three and one letter abbreviations for each amino acid.

Ans. If each of the amino acids is used only once, then six tripeptides are possible :

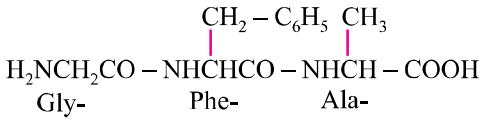
(i) Glycylalanyl phenylalanine.

(Gly-Ala-Phe) (G–A–F).



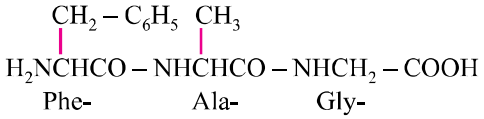
(ii) Glycylphenylalanyl alanine.

(Gly-Phe-Ala) (G–F–A).



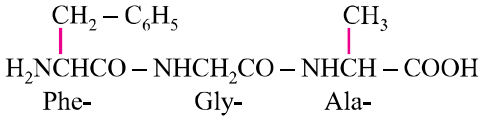
(iii) Phenylalanylalanyl glycine.

(Phe-Ala-Gly) (F–A–G).



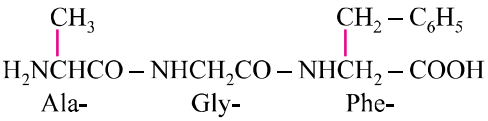
(iv) Phenylalanylglycyl alanine.

(Phe-Gly-Ala) (F–G–A).



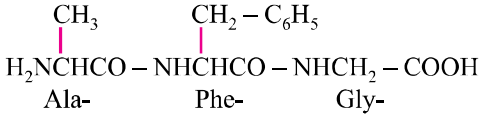
(v) Alanylglycyl phenylalanine.

(Ala-Gly-Phe) (A–G–F).



(vi) Alanylphenylalanyl glycine.

(Ala-Phe-Gly) (A–F–G).



Q. 6. Alanine has the structure $NH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - COOH$ Write its structure at pH = 2 & pH = 10.

Q. 7. What forces are responsible for the stability of α-helix ? Why is it also known as 3.6_{13} helix ?

Q. 8. Activation energy for the acid catalysed hydrolysis of sucrose is 6.22 kJ/mol, while the activation energy is only 2.15 kJ/mol when hydrolysis is catalysed by enzyme sucrose. Explain.

Q. 9. Which moieties of nucleosides are involved in the formation of phosphodiester linkages present in dinucleotides ? What does the word 'diester' in the name of linkage indicate ? Which acid is involved in the formation of this linkage ?

Q. 10. What is the smallest aldose which can form a cyclic hemiacetal ? Which functional groups are involved in its formation ?

MULTIPLE CHOICE QUESTIONS

Q. 1. Which one is the complementary base in RNA strand to the thymine base in DNA during protein synthesis ?

(a) Adenine (b) Uracil

(c) Cytosine (d) Guanine

Ans. (a)

Q. 2. Which of the vitamin deficiency causes Xerophthalmia ?

(a) A (b) B

(c) E (d) K

Ans. (a)

Q. 3. Which one is not present in RNA ?

(a) Uracil (b) Thymine

(c) Ribose (d) Phosphate

Ans. (b)

Q. 4. Which of the following is a disaccharide ?

(a) Fructose (b) Glucose

(c) Sucrose (d) Xylose

Ans. (c)

Q. 5. Fructose is a :

(a) Aldose (b) Ketose

(c) Both aldose and ketose (d) None of these

Ans (b)

VALUE BASED QUESTIONS (4 Marks)

Q. 1. After watching a programme on TV about the adverse effects of junk food and soft drinks on the health of school children, Sonali, a student of class XII, discussed the issue with principal. They instructed canteen person to replace fast food with fibre & vitamin rich food like salad, fruits, sprouts etc. This decision was welcomed by the parents and students.

After reading above passage, answer the following :

(i) What values are expressed by Sonali & Principal of school ?

(ii) Give two examples of water soluble vitamins. *(DSB, 2013; CBSE, 2013)*

Ans. (i) Sonali : Concerned for society, socially active and helpful to others.

Principal : Caring, commanding and serious about the welfare of students.

(ii) Vitamin B and C.