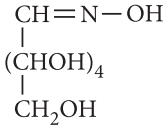
Detailed Solutions

1. Lactose on hydrolysis gives β-*D*-glucose and β-*D*-galactose.

2. The basic structural difference between starch and cellulose is of linkage between the glucose units. In starch, there is α-*D*-glycosidic linkage. Both the components of starch-amylose and amylopectin are polymer of α-*D*-glucose. On the other hand, cellulose is a linear polymer of β-*D*-glucose in which C_1 of one glucose unit is connected to C_4 of the other through β-*D*-glycosidic linkage.

3. Maltose is a disaccharide as it consists of two α-*D*-glucose units.

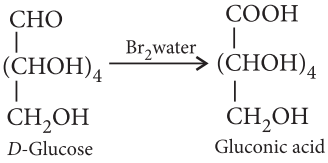
4. *D*-Glucose reacts with $H_2N—OH$ to give glucose oxime.



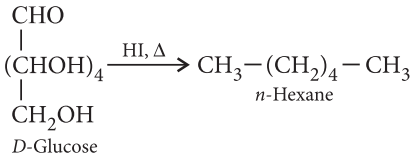
5. Fructose is a monosaccharide because it cannot be hydrolysed to simpler polyhydroxy aldehydes or ketones.

6. Amylose is water soluble and amylopectin is insoluble in water.

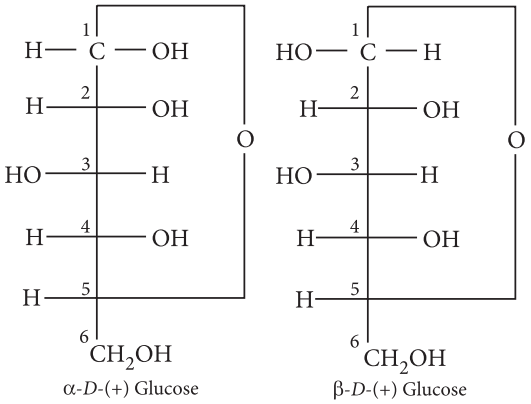
7. *D* - Glucose gets oxidised to six carbon carboxylic acid (gluconic acid) on reaction with bromine water.



8. On prolonged heating with HI, *D*-Glucose forms *n*-hexane.



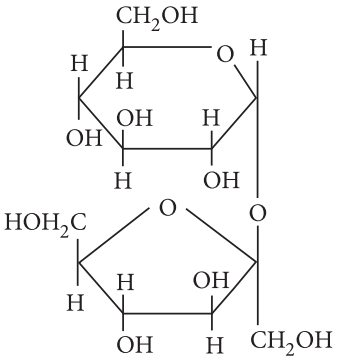
9. The pair of stereoisomers which differ only in the configuration of the hydroxyl group at C_1 are called anomers.



10. Carbohydrates which yield a large number of monosaccharide units on hydrolysis are called polysaccharides.

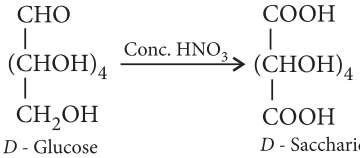
11. An equimolar mixture of glucose and fructose, obtained by hydrolysis of sucrose in presence of an acid or the enzyme invertase is called invert sugar.

12. The two monosaccharides are joined together by an oxide linkage formed by the loss of water molecule. Such linkage is called glycosidic linkage.



13. Amylose and amylopectin are the two components of starch.

14. On oxidation with nitric acid, *D* - glucose yields saccharic acid.



15. Glucose when heated with red P and HI gives *n*-hexane.

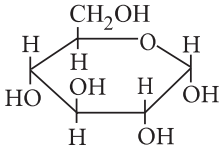
$$C_6H_{12}O_6 \xrightarrow[\Delta]{\text{Red P-HI}} \underset{n\text{-Hexane}}{CH_3CH_2CH_2CH_2CH_2CH_3}$$

It indicates presence of straight chain of six carbon atoms in glucose.

16. (i) Carbohydrates act as storage molecules as starch in plants and glycogen in animals.

(ii) They act as constituent of cell membrane.

17. The six membered cyclic structure of glucose is called pyranose structure (α-or β –), in analogy with heterocyclic compound pyran.



α-*D*-(+)-Glucopyranose

18. Carbohydrates which reduce Tollen's reagent are reducing sugars. All monosaccharides, aldoses or ketoses are reducing sugars.

19. Glucose and fructose.

$$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{H^+} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

20. *Refer to answer 1.*

21. The reducing sugars have free aldehydic or ketonic groups.

22. *Refer to answer 12.*

23. The following reactions of *D*-glucose cannot be explained on the basis of its open chain structure :

(i) *D*-Glucose does not react with sodium bisulphite ($NaHSO_3$).

(ii) It does not give 2, 4-DNP test and Schiff's test.

(iii) The pentaacetate of *D*-glucose does not react with hydroxylamine.

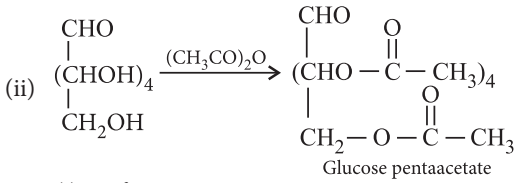
(iv) *D*-Glucose shows the phenomenon of mutarotation, *i.e.*, when its aqueous solution is kept for sometime its optical activity changes.

(v) On reaction with 1 mole of methanol, it yield two monomethyl derivatives which are known as methyl α-*D*-glucoside and methyl-β-*D*-glucoside.

24. *Refer to answer 23.*

25. (i) *Refer to answer 4.*

(ii)

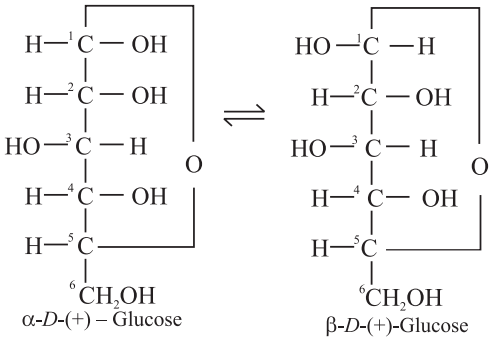


Glucose pentaacetate

26. (i) *Refer to answer 7.*

(ii) *Refer to answer 8.*

27. In α-*D* Glucose, the –OH group at C1 is towards right whereas in β-glucose, the –OH group at C1 is towards left. Such a pair of stereoisomers which differ in the configuration only at C1 are called anomers.



α-*D*-(+) – Glucose β-*D*-(+)-Glucose

28. *Refer to answer 23.*

29. (i) *Refer to answer 19.*

(ii) *Refer to answer 1.*

30. (i) *Refer to answer 19.*

Sucrose is not a reducing sugar because reducing groups of glucose and fructose are involved in glycosidic bond formation.

31. (i) *Refer to answer 8.*

(ii) *Refer to answer 7.*

32. On the basis of hydrolysis, carbohydrates can be divided in three major classes :

(i) **Monosaccharides :** These cannot be hydrolysed into simpler molecules. These are further classified as aldoses and ketoses.

(ii) **Oligosaccharides :** These are the carbohydrates which on hydrolysis give 2 - 10 monosaccharides. For example, sucrose, lactose, maltose, etc.

(iii) **Polysaccharides :** These are high molecular mass carbohydrates which give many molecules of monosaccharides on hydrolysis. For example starch and cellulose.

33. (i) *Refer to answer 12.*
(ii) *Refer to answer 11*
(iii) *Refer to answer 32 (ii)*

34. *Refer to answers 27 and 17.*

35. Reducing sugar : The sugars which reduce Fehling's solution and Tollen's reagent are called reducing sugars. For example, all monosaccharides containing free $-CHO$ or $-\overset{|}{C}=O$ group are reducing sugars.

36. (i) *Refer to answer 8.*
(ii) *Refer to answer 7.*
(iii) *Refer to answer 14.*

37. *Refer to answer 32.*

38. Globular protein – Insulin
Fibrous protein – Keratin

39. Characteristic differences between globular and fibrous proteins can be given as :

S. No.	Globular proteins	Fibrous proteins
1.	These are cross-linked proteins and are condensation product of acidic and basic amino acids.	These are linear condensation polymer.
2.	These are soluble in water, mineral acids and bases.	These are insoluble in water but soluble in strong acids and bases.
3.	These proteins have three dimensional folded structure. These are stabilised by internal hydrogen bonding. *e.g.*, egg albumin, enzymes.	These are linear polymers held together by intermolecular hydrogen bonds. *e.g.*, hair, silk.

40. As amino acids have both acidic (carboxy group) and basic groups (amino group) in the same molecule, they react with both acids and bases. Hence, they show amphoteric behaviour.

41. Acidic amino acids are those which contain more number of carboxyl groups as compared to amino groups whereas basic amino acids are those which contains more number of amino groups than carboxyl groups.

42. Peptide linkage.

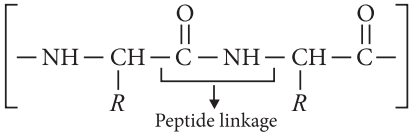
43. Essential amino acids : Amino acids which cannot be synthesized in the body and must be obtained through diet are known as essential amino acids. *e.g.*, valine, leucine, etc.

44. Denaturation : The loss of biological activity of a protein by changing the pH, temperature or by adding some salt due to disruption of the native structure of protein is called denaturation.
During denaturation secondary and tertiary structure of protein is destroyed but primary structure remains intact.

45. Organic compounds containing both amino ($— NH_2$) and carboxy ($— COOH$) functional groups are called amino acids.

$$R-\underset{\underset{NH_2}{|}}{CH}-COOH$$

46. Proteins are the polymers of α-amino acids linked by amide formation between carboxyl and amino group. This is called peptide linkage or peptide bond *e.g.*,



47. An egg contains a soluble globular protein called allumin which is present in the white part. On boiling, denaturation (loss of biological activity) of this protein takes place which results in the formation of insoluble fibrous proteins. The water molecules are utilized in this process.

48. Polypeptides are the macromolecules formed by combination of 10 or more amino acids.

49. Primary structure : The specific sequence in which the various amino acids present in a protein are linked to one another is called its primary structure. Any change in the primary structure creates a different protein.
Secondary structure : The conformation of the polypeptide chain is known as secondary structure. The two types of secondary structure are α-helix and β-pleated sheet structure.
In α-helix structure, the polypeptide chain forms all the possible hydrogen bonds by twisting into a right

handed screw (helix) with the — NH groups of each amino acid residue hydrogen bonded to the $\diagdown C=O$ group of an adjacent turn of the helix. In β-pleated sheet structure, all peptide chains are stretched out to nearly maximum extension and then laid side by side which are held together by intermolecular hydrogen bonds.

50. (i) *Refer to answer 46.*

51. *Refer to answer 49.*

52. (i) *Refer to answer 46.*

(ii) *Refer to answer 44.*

53. (i) *Refer to answer 49.*

(i) *Refer to answer 44.*

54. Amino acids which cannot be synthesised in the body and must be obtained through diet are known as essential amino acids, *e.g.*, valine and leucine. There are ten essential amino acids. Amino acids which can be synthesised in the body are known as non-essential amino acids, *e.g.*, alanine and glutamic acids.

55.

(i)	Primary structure of protein	–	Peptide bond (linkage)
(ii)	Cross linkage of polypeptide chain	–	Hydrogen bonds, disulphide linkage, electrostatic force of attraction
(iii)	α-helix formation	–	Hydrogen bond
(iv)	β-sheet structure	–	Intermolecular hydrogen bonds

56. (i) *Refer to answer 42.*

(ii) Protein synthesis takes place in cytoplasm.

57. (i) *Refer to answer 46.*

(ii) *Refer to answer 49.*

(iii) *Refer to answer 44.*

58. *Refer to answer 54.*

59. (a) *Refer to answer 39.*

(b) Protein is denatured and its biological activity is lost.

60. Amino acids are classified as acidic, basic or neutral depending upon the relative number of amino and carboxyl groups in their molecules.

(a) Equal number of amino and carboxyl groups makes it neutral (b) more number of amino groups than carboxyl groups make it basic and (c) more carboxyl groups as compared to amino groups make it acidic.

Refer to answer 54.

61. *Refer to answers 39 and 44.*

62. (a) Hydrogen bonding

(b) *Refer to answer 39.*

63. Macromolecules formed by the combination of 100-1000 amino acid groups in a proper conformation are called proteins.

Refer to answer 39.

64. Enzymes : Most of the chemical reactions which occur in living systems process at very slow rates under mild condition of temperature and pH. These reactions are catalysed by a group of biomolecules called enzymes.

65. *Refer to answer 64.*

66. Substances which catalyse chemical reactions taking place in living organisms are called biocatalysts. *e.g.*, enzymes

67. (i) Enzymges are highly specific for a particular reaction and for a particular substrate.

(ii) Very small amount of enzyme is required for the process of a reaction.

68. Vitamin C is soluble in water and regularly excreted in urine and hence cannot be stored in body.

69. Vitamin D

70. Vitamin C

71. Vitamin A

72. Vitamin D

73. Vitamin C

74. Organic compounds required in the diet in small amounts to perform specific biological functions for normal maintainance of optimum growth and health of the organism are called vitamins.

75. The deficiency of vitamin A leads to xerophthalmia and night blindness. The deficiency of vitamin C leads to scurvy.

76. Vitamin – A : Night blindness

Vitamin E : Muscular weakness.

77. Vitamin C is water soluble and powerful antioxidant. Natural source of vitamin C is amla.

5.

78.

	Hormones	Vitamins
(i)	The biomolecules which transfer information from one group of cell to distant tissue or organ.	These are essential dietary factors required by an organism in minute quantities.
(ii)	They are produced in the body in ductless glands.	They are supplied to the body from the food eaten.

79. Vitamin D
Disease caused due to deficiency of Vitamin D is rickets.

80. *Refer to answer 76.*

81. Vitamin B_{12}

82. *Refer to answer 74.*
(i) *Refer to answer 81.*
(ii) Vitamin B_6

83. Examples of water soluble vitamins :
Vitamin B and vitamin C.

Name of vitamins	Source	Deficiency diseases
Vitamin B_1	Yeast, milk, green vegetables, cereals etc.	Beri beri
Vitamin C	Citrus fruits, *amla*, and leafy vegetables.	Scurvy (bleeding gums)

84. Examples of fat soluble vitamins are vitamin A and D.

Name of vitamins	Source	Deficiency diseases
Vitamin A	Fish liver oil, carrots, butter, milk	Night blindness
Vitamin D	Fish and egg yolk	Rickets and osteomalacia

85. Vitamins are classified into two groups depending upon their solubility in water or fat.
(i) Fat soluble vitamins.
(ii) Water soluble vitamins.
Sources of vitamin A : Fish, liver oil, carrots, butter and milk.
Sources of vitamin C : Citrus fruits, amla and green leafy vegetables.

86. B-complex is a group of vitamins which contains vitamins B_1, B_2, B_6, B_{12}, biotin, folic acid, pantothenic acid and nicotinic acid. It is required to release energy from food and to promote healthy skin and muscles. Its deficiency causes beri beri and pernicious anaemia.

87. (i) Milk and butter are two good sources of vitamin A.
(ii) *Refer to answer 84.*

88. *Refer to answer 85.*
Vitamin K is responsible for the coagulation of blood.

89. (a) Awareness and social thinking
(b) Vitamin B complex and vitamin C.

90. (i) Humanitarian (kindness and caring)
(ii) *Refer to answer 81.*
(iii) *Refer to answer 83.*

91. Nucleoside contains pentose sugar, and base whereas nucleotide contains pentose sugar, base as well as phosphate group.
Nucleoside = Base + Sugar
Nucleotide = Base + Sugar + Phosphate.

92. Ester linkage

93. Uracil

94. *Refer to answer 91.*

95. DNA is reserve of genetic information and responsible for heredity transmission.

96. Adenine and guanine

97. Structural differences between DNA and RNA
(i) The sugar in DNA is deoxyribose while that in RNA is ribose.
(ii) DNA has a double-stranded helical structure, while RNA has a single-stranded helical structure.
Functional differences between DNA and RNA
(i) DNA is the chemical basis of heredity and is responsible for maintaining the identity of different species.
(ii) RNA molecules are responsible for protein synthesis but the message for the synthesis of a particular protein is present in DNA.

98. *Refer to answer 97.*
In DNA, thymine is present.

99. The bases present in RNA are adenine (A), guanine (G) cytosine (C) and Uracil (U).
Uracil is not present in DNA

100. *Refer to answer 97* (Structural difference).
Common bases in DNA and RNA are adenine, guanine and cytosine.

101. DNA contains four bases viz adenine (A) guanine (G), cytosine (C), and thymine (T). RNA also contains four bases but thymine is not present in RNA.

102. (a) *Refer to answer 91.*
(b) DNA is a double helix in which the two strands of DNA are held by the hydrogen bonds between the bases on the two strands. Thymine (T) pairs with adenine through two hydrogen bonds and cytosine (C) pairs with guanine (G) through three H–bonds. Hence, the two strands of DNA are complementary to each other.

103. When a RNA molecule is hydrolysed then there is no relationship between the quantities of four bases viz. adenine (A), guanine (G), cytosine (C), and uracil (U). This fact suggests that RNA has single stranded structure.

104. RNA are of three types :

(i) **Messenger RNA (*m*-RNA) :** Function as messenger carrying the information in a gene to the protein synthesizing machinery.
Transfer RNA (*t*-RNA) : They transfer the amino acids from cytoplasm to the protein synthesizing machinery.

(ii) **Ribosomal RNA (*r*RNA) :** They associates with a set of proteins to form ribosomes. These complex structures, which physically move among an *m*RNA molecule, catalyze the assembly of amino acids into protein chains. They also bind *t*-RNAs and various molecules necessary for protein synthesis.

105. (a) *Refer to answer 97* (Structural difference).
(b) DNA an hydrolysis gives pentose sugar, Phosphoric acid and nitrogen containing heterocyclic bases *viz*. adenine, guanine, cytosine and thymine.