

I. Multiple Choice Questions (Type-I)

1. Glycogen is a branched-chain polymer of α -D-glucose units in which chain is formed by C1—C4 glycosidic linkage whereas branching occurs by the formation of C1-C6 glycosidic linkage. Structure of glycogen is similar to _____.

- (i) Amylose
- (ii) Amylopectin
- (iii) Cellulose
- (iv) Glucose

Solution:

Option (ii) is the answer.

2. Which of the following polymer is stored in the liver of animals?

- (i) Amylose
- (ii) Cellulose
- (iii) Amylopectin
- (iv) Glycogen

Solution:

Option (iv) is the answer.

3. Sucrose (cane sugar) is a disaccharide. One molecule of sucrose on hydrolysis gives _____.

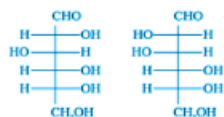
- (i) 2 molecules of glucose
- (ii) 2 molecules of glucose + 1 molecule of fructose
- (iii) 1 molecule of glucose + 1 molecule of fructose
- (iv) 2 molecules of fructose

Solution:

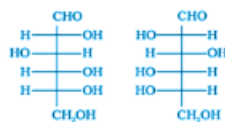
Option (iii) is the answer.

4. Which of the following pairs represents anomers?

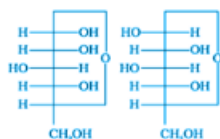
A.



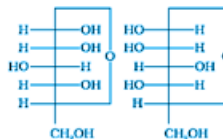
B.



C.



D.



Solution:

Option (C) is the answer.

5. Proteins are found to have two different types of secondary structures viz. α -helix and β -pleated sheet structure. α -helix structure of the protein is stabilised by :

- (i) Peptide bonds
- (ii) van der Waals forces
- (iii) Hydrogen bonds
- (iv) Dipole-dipole interactions

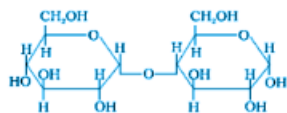
Solution:

Option (iii) is the answer.

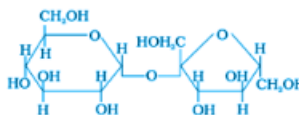
6. In disaccharides, if the reducing groups of monosaccharides i.e. aldehydic or ketonic groups are bonded, these are non-reducing sugars. Which of the following disaccharide is a non-reducing sugar?

Solution:

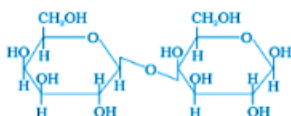
A.



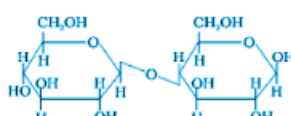
B.



C.



D.



Option (B) is the answer.

7. Which of the following acids is a vitamin?

- (i) Aspartic acid
- (ii) Ascorbic acid
- (iii) Adipic acid
- (iv) Saccharic acid

Solution:

Option (ii) is the answer.

8. Dinucleotide is obtained by joining two nucleotides together by phosphodiester linkage. Between which carbon atoms of pentose sugars of nucleotides are these linkages present?

- (i) 5' and 3'

- (ii) 1' and 5'
- (iii) 5' and 5'
- (iv) 3' and 3'

Solution:

Option (i) is the answer.

9. Nucleic acids are the polymers of _____.

- (i) Nucleosides
- (ii) Nucleotides
- (iii) Bases
- (iv) Sugars

Solution:

Option (ii) is the answer.

10. Which of the following statements is not true about glucose?

- (i) It is an aldohexose.
- (ii) On heating with HI, it forms n-hexane.
- (iii) It is present in furanose form.
- (iv) It does not give 2,4-DNP test.

Solution:

Option (iii) is the answer.

11. Each polypeptide is a protein has amino acids linked with each other in a specific sequence. This sequence of amino acids is said to be _____.

- (i) primary structure of proteins.
- (ii) secondary structure of proteins.
- (iii) the tertiary structure of proteins.
- (iv) quaternary structure of proteins.

Solution:

Option (i) is the answer.

12. DNA and RNA contain four bases each. Which of the following bases is not present in RNA?

- (i) Adenine
- (ii) Uracil
- (iii) Thymine
- (iv) Cytosine

Solution:

Option (iii) is the answer.

13. Which of the following B group vitamins can be stored in our body?

- (i) Vitamin B1
- (ii) Vitamin B2
- (iii) Vitamin B6
- (iv) Vitamin B12

Solution:

Option (iv) is the answer.

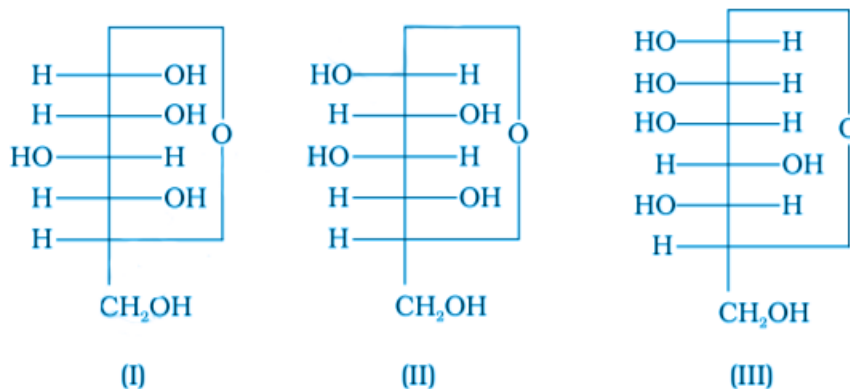
14. Which of the following bases is not present in DNA?

- (i) Adenine
- (ii) Thymine
- (iii) Cytosine
- (iv) Uracil

Solution:

Option (iv) is the answer.

15. Three cyclic structures of monosaccharides are given below which of these are anomers.



- (i) I and II
- (ii) II and III
- (iii) I and III
- (iv) III is anomer of I and II

Solution:

Option (i) is the answer.

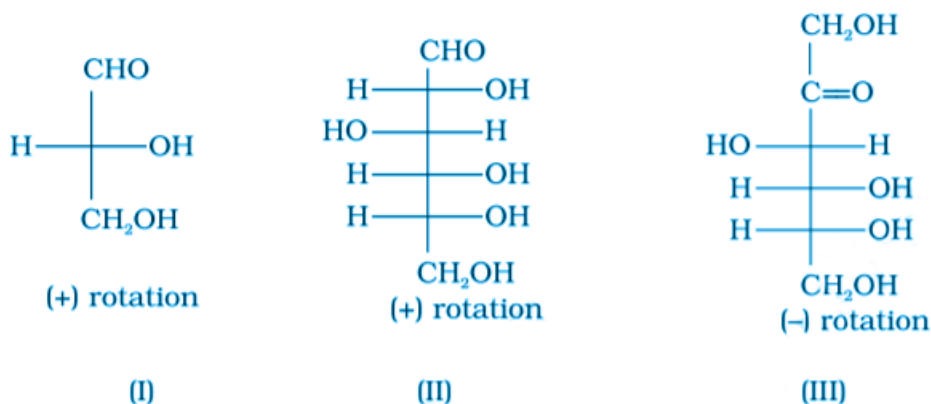
16. Which of the following reactions of glucose can be explained only by its cyclic structure?

- (i) Glucose forms pentaacetate.
- (ii) Glucose reacts with hydroxylamine to form an oxime.
- (iii) Pentaacetate of glucose does not react with hydroxylamine.
- (iv) Glucose is oxidised by nitric acid to gluconic acid.

Solution:

Option (iii) is the answer.

17. Optical rotations of some compounds along with their structures are given below which of them have D configuration.



(i) I, II, III

(ii) II, III

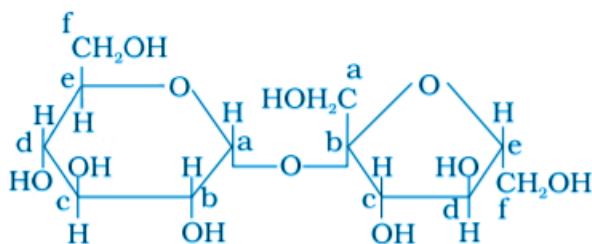
(iii) I, II

(iv) III

Solution:

Option (i) is the answer.

18. Structure of a disaccharide formed by glucose and fructose is given below. Identify anomeric carbon atoms in monosaccharide units.



(i) 'a' carbon of glucose and 'a' carbon of fructose.

(ii) 'a' carbon of glucose and 'e' carbon of fructose.

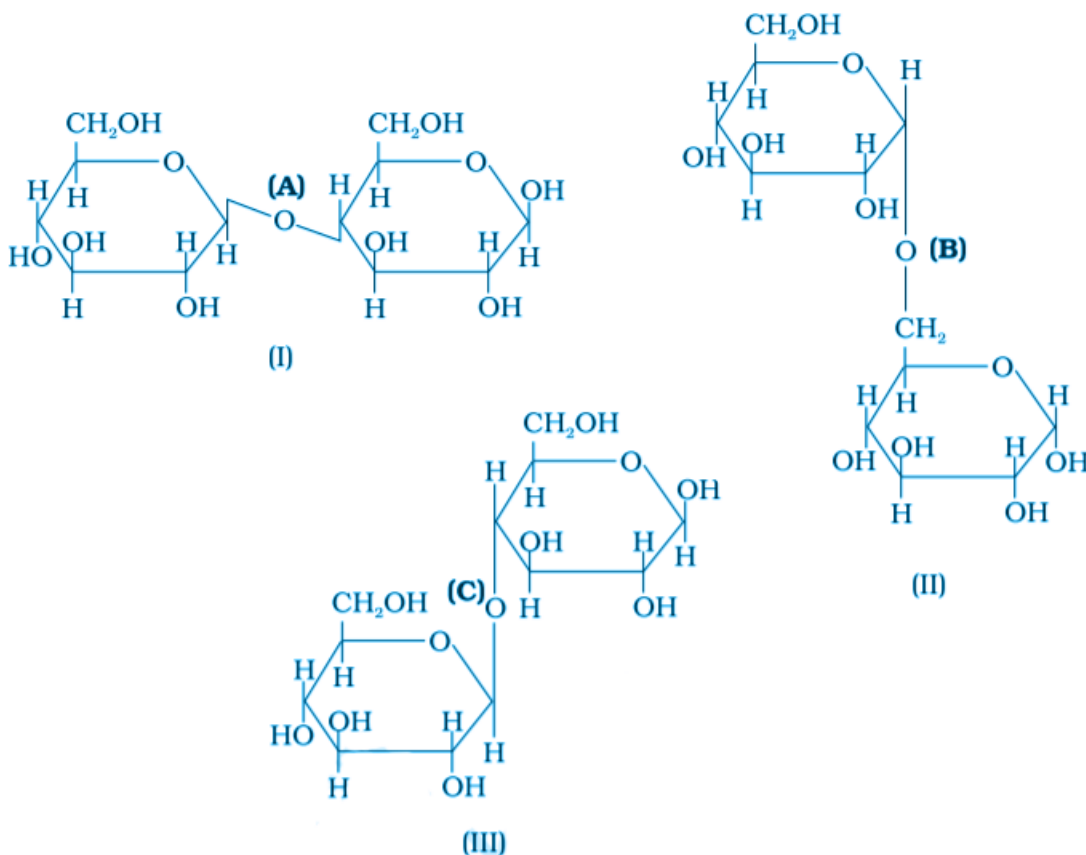
(iii) 'a' carbon of glucose and 'b' carbon of fructose.

(iv) 'f' carbon of glucose and 'f' carbon of fructose.

Solution:

Option (iii) is the answer.

19. Three structures are given below in which two glucose units are linked. Which of these linkages between glucose, units are between C1 and C4 and which linkages are between C1 and C6?



- (i) (A) is between C1 and C4, (B) and (C) is between C1 and C6
 (ii) (A) and (B) are between C1 and C4, (C) is between C1 and C6
 (iii) (A) and (C) is between C1 and C4, (B) is between C1 and C6
 (iv) (A) and (C) is between C1 and C6, (B) is between C1 and C4

Solution:

Option (iii) is the answer.

II. Multiple Choice Questions (Type-II)

Note: In the following questions two or more options may be correct.

20. Carbohydrates are classified on the basis of their behaviour on hydrolysis and also as reducing or non-reducing sugar. Sucrose is a _____.

- (i) monosaccharide
 (ii) disaccharide
 (iii) reducing sugar
 (iv) non-reducing sugar

Solution:

Option (ii) and (iv) are the answers.

21. Proteins can be classified into two types on the basis of their molecular shape i.e., fibrous proteins and globular proteins. Examples of globular proteins are :

- (i) Insulin
- (ii) Keratin
- (iii) Albumin
- (iv) Myosin

Solution:

Option (i) and (iii) are the answers

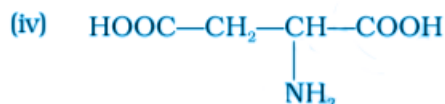
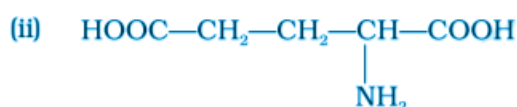
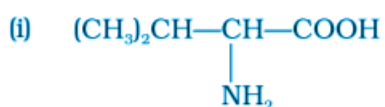
22. Which of the following carbohydrates are branched polymer of glucose?

- (i) Amylose
- (ii) Amylopectin
- (iii) Cellulose
- (iv) Glycogen

Solution:

Option (i) and (iii) are the answers.

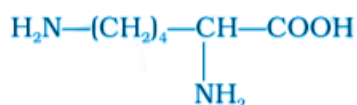
23. Amino acids are classified as acidic, basic or neutral depending upon the relative number of amino and carboxyl groups in their molecule. Which of the following is acidic?



Solution:

Option (ii) and (iv) are the answers.

24. Lysine, is _____.



- (i) α -Amino acid
- (ii) Basic amino acid
- (iii) Amino acid synthesised in the body
- (iv) β -Amino acid

Solution:

Option (i) and (ii) are the answers.

25. Which of the following monosaccharides are present as five-membered cyclic structure (furanose structure)?

- (i) Ribose
- (ii) Glucose
- (iii) Fructose
- (iv) Galactose

Solution:

Option (i) and (iii) are the answers.

26. In fibrous proteins, polypeptide chains are held together by _____.

- (i) van der Waals forces
- (ii) disulphide linkage
- (iii) electrostatic forces of attraction
- (iv) hydrogen bonds

Solution:

Option (ii) and (iv) are the answers.

27. Which of the following are purine bases?

- (i) Guanine
- (ii) Adenine
- (iii) Thymine
- (iv) Uracil

Solution:

Option (i) and (iii) are the answers.

28. Which of the following terms are correct about enzyme?

- (i) Proteins
- (ii) Dinucleotides
- (iii) Nucleic acids
- (iv) Biocatalysts

Solution:

Option (i) and (iv) are the answers.

III. Short Answer Type

29. Name the sugar present in milk. How many monosaccharide units are present in it? What are such oligosaccharides called?

Solution:

The sugar present in milk is lactose. Lactose contains two monosaccharides, glucose and galactose. Oligosaccharides containing two monosaccharide units are called disaccharides.

30. How do you explain the presence of all the six carbon atoms in glucose in a straight chain?

Solution:

When glucose is heated for a prolonged time with HI, it forms n-hexane, suggesting that all the six carbon atoms are linked in a straight chain.

31. In nucleoside, a base is attached at 1C position of the sugar moiety. A nucleotide is formed by linking the phosphoric acid unit to the sugar unit of a nucleoside. At which position of sugar unit is the phosphoric acid linked in a nucleoside to give a nucleotide?

Solution:

A nucleoside is formed when a nitrogenous base is attached to a 1' position of a five-carbon sugar. Phosphoric acid is linked to the 5' carbon of the sugar in a nucleoside molecule to give a nucleotide molecule.

32. Name the linkage connecting monosaccharide units in polysaccharides.

Solution:

The monosaccharide units in polysaccharides are linked by glycosidic bonds. A glycosidic linkage is when an oxide linkage is formed between two monosaccharide units with the loss of a water molecule.

33. Under what conditions glucose is converted to gluconic and saccharic acid?

Solution:

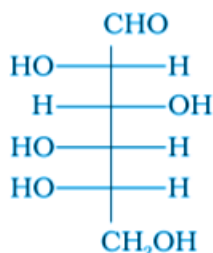
Glucose is converted to gluconic acid which is a six-carbon carboxylic acid, on treatment with a mild oxidizing agent like Br₂ water. Glucose is converted to saccharic acid, which is a dicarboxylic acid, on treatment with nitric acid.

34. Monosaccharides contain carbonyl group hence are classified, as aldose or ketose. The number of carbon atoms present in the monosaccharide molecule is also considered for classification. In which class of monosaccharide will you place fructose?

Solution:

The molecular formula of fructose is C₆H₁₂O₆. It also contains a ketone group, hence it is placed in the class of ketohexoses. Monosaccharides are classified depending on the number of carbon atoms the molecule contains.

35. The letters 'D' or 'L' before the name of a stereoisomer of a compound indicates the correlation of configuration of that particular stereoisomer. This refers to their relationship with one of the isomers of glyceraldehyde. Predict whether the following compound has 'D' or 'L' configuration.



Solution:

The –OH group is linked on the left side of the C5 carbon atom. Hence, the given compound has ‘L’ configuration.

36. Aldopentoses named as ribose and 2-deoxyribose are found in nucleic acids. What is their relative configuration?

Solution:

The configuration of both the aldopentoses is D-configuration. Ribose is named β -D-ribose and 2-deoxyribose is β -D-2-deoxyribose.

37. Which sugar is called invert sugar? Why is it called so?

Solution:

Sucrose is also known as invert sugar. It is a naturally occurring sugar derived from sugarcane and sugarbeet. The hydrolysis of sucrose brings about a change in the sign of rotation, from Dextro (+) to laevo (–) and thus the product is named as invert sugar.

38. Amino acids can be classified as α -, β -, γ -, δ - and so on depending upon the relative position of the amino group concerning the carboxyl group. Which type of amino acids forms polypeptide chain in proteins?

Solution:

α -amino acids, alpha-amino acids, where the amino acid is linked to the α -carbon in the molecule are the type of amino acids which form a polypeptide chain.

39. α -Helix is a secondary structure of proteins formed by twisting of the polypeptide chain into right-handed screw-like structures. Which type of interactions is responsible for making the α -helix structure stable?

Solution:

A stable α -Helix is formed as a right-handed screw helix structure as the –NH group of each amino acid residue hydrogen is bonded to the –C=O of an adjacent turn of the helix.

40. Some enzymes are named after the reaction, where they are used. What name is given to the class of enzymes which catalyse the oxidation of one substrate with simultaneous reduction of

another substrate?

Solution:

The name given to the class of enzymes which catalyse redox reactions is known as enzyme oxidoreductases. An example is Alcohol Dehydrogenase, which helps in reducing alcohol levels in the human body when alcohol is ingested.

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

Solution:

During curdling of milk, which is caused due to bacteria, the sugar present in milk lactose, is converted to lactic acid.

42. How do you explain the presence of five —OH groups in the glucose molecule?

Solution:

When glucose is treated with acetic anhydride $(\text{CH}_3\text{CO})_2\text{O}$, in the presence of ZnCl_2 , it undergoes acetylation to form glucose pentaacetate which confirms the presence of five —OH groups.

43. Why does compound (A) give below not form an oxime?

Solution:

The given compound is glucose pentaacetate. Glucose contains a free —C=O group, and formation of oxime from glucose confirms the presence of a free carbonyl group. The given compound does not have a free carbonyl group and thus does not form an oxime on reaction with hydroxylamine.

44. Why must vitamin C be supplied regularly in diet?

Solution:

Vitamin C is a water-soluble vitamin, and hence the excess is excreted regularly from the body. Since it cannot be stored in the body, vitamin C must be supplied regularly in the diet.

45. Sucrose is dextrorotatory but the mixture obtained after hydrolysis is laevorotatory. Explain.

Solution:

Sucrose is dextrorotatory in its aqueous solution and rotates plane-polarized light entering the solution 66.5° to the right. When sucrose is hydrolysed with dilute acids or invertase enzyme, it gives two products in equimolar concentration, dextrorotatory D-(+)-glucose and laevorotatory D-(-)-fructose. Thus, hydrolysis of sucrose brings about a change in the sign of rotation, from Dextro (+) to laevo (-). So the hydrolysed mixture is laevorotatory.

46. Amino acids behave like salts rather than simple amines or carboxylic acids. Explain.

Solution:

An amino acid contains an —NH_2 group as well as —COOH . In aqueous solution of the amino acid, the —COOH group loses a proton $[\text{H}]^+$ and the —NH_2 gains a proton to form a zwitterion which is a salt.

47. Structures of glycine and alanine are given below. Show the peptide linkage in glycylalanine.

Solution:

The hydroxyl group of glycine is linked to the amine group of alanine by peptide (—CONH) linkage to form glycylalanine.

48. Protein found in a biological system with a unique three-dimensional structure and biological

activity is called a native protein. When a protein in its native form, is subjected to a physical change like change in temperature or a chemical change like change in pH, denaturation of protein takes place. Explain the cause.

Solution:

The amino acid residues of proteins are joined by hydrogen bonds and various other intermolecular forces. On physical or chemical change, the hydrogen bonds are disturbed and native protein unfolds. This process is called denaturation where secondary and tertiary structures are destroyed but the primary structure remains intact.

49. The activation energy for the acid catalysed hydrolysis of sucrose is 6.22 kJ mol^{-1} , while the activation energy is only 2.15 kJ mol^{-1} when hydrolysis is catalyzed by the enzyme sucrase.

Explain.

Solution:

Mainly the enzymes are biocatalyst which provides an alternative path to reduce the reactions activation energy. Using enzyme sucrase, the hydrolysis of sucrose is much faster than conventional acidic hydrolysis.

50. How do you explain the presence of an aldehydic group in a glucose molecule?

Solution:

Glucose can be treated with bromine water, which undergoes mild oxidation to give the carboxylic acid gluconic acid, which confirms the presence of an aldehyde group.