IMPORTANT QUESTIONS CLASS – 12
CHEMISTRY CHAPTER – 10 BIOMOLECULES

Question 1.
Define the following terms:
(i) Glycosidic linkage
Answer:
Glycosidic linkage: The condensation of hydroxyl groups of two monosaccharides to form a link between them is called glycosidic linkage.

(ii) Invert sugar
Answer:
Invert sugar: The sugar which on hydrolysis with dilute adds or enzymes gives mixture having specific rotation opposite to the original is called invert sugar. For example, sucrose is inverted sugar.

(iii) Oligosaccharides
Answer:
Oligosaccharides: These are the carbohydrates that give two to ten monosaccharide molecules on hydrolysis. These are further classified as disaccharides, trisaccharides, tetrasaccharides, etc. depending upon the number of monosaccharide units present in their molecules. For example, Disaccharides: Sucrose, lactose, maltose. All these have the molecular

Formula $C_{12}H_{22}O_{11}$.
Trisaccharide: Raffinose ($C_{18}H_{32}O_{16}$).
Tetrasaccharides: Stachyose ($C_{24}H_{42}O_{21}$).

Question 2.
Define the following terms:
(i) Nucleotide
Answer:
Nucleotide: A unit formed by the combination of a nitrogen-containing heterocyclic base, a pentose sugar and a phosphoric acid group.

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(ii) Anomers

Answer:

Anomers: The anomers are the isomers formed due to the change in the configuration of the -OH group at C-1 of glucose. For example, α-and β-forms of glucose are anomers.

(iii) Essential amino acids.

Answer:

Essential amino acids: The amino acids which cannot be made by our bodies and must be supplied in our diet for the growth of the body are called essential amino acids.

Question 3.

Differentiate between the following:

(a) Fibrous protein and Globular protein

Answer:

Difference between fibrous protein and globútar protein:

Fibrous	Globular
(i) The polypeptide chains run parallel and are held together by hydrogen and disulphide bonds.	1. The polypeptide chains colt around to give a spherical shape.
(ii) These are insoluble in water.	2. These are soluble in water.
(iii) For example, keratin in hair	3. For example, albumin in egg.

(b) Essential amino acids and Non-essential amino acids

Answer:

Difference between essential amino acids and non-essential amino acids:

Essential amino acids	Non-essential amino acids
These are not synthesìsed in our body and must be supplied in the diet.	These are synthesised in our body and not required in our diet.
For example, valine.	For example, alanine

(C) Amylose and Amylopectin (CBSE AI 2019)

Answer:

Difference between amylose and amylopectin:

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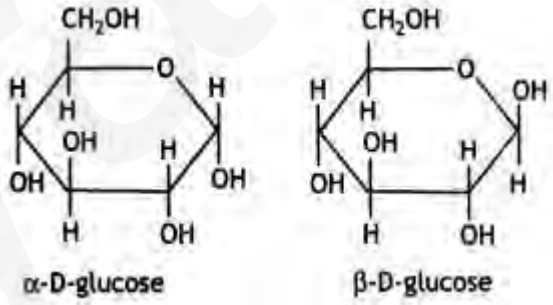
Amylose	Amylopectin
It consists of branched polymeric chains of α – D – glucose.	It consists of a long straight chain of α – D – glucose.
It is water-insoluble.	It is water-soluble.

Question 4.
What is essentially the difference between the α-form of D-glucose and β-form of D-glucose? Explain.
Answer:
α-form and β-form of glucose differ in the orientation of —H and —OH groups around the C_1 atom. The isomer having the -OH group on the right is called α-D-glucose while the one having -OH group on the left is called β-D-glucose. Such pairs of optical isomers which differ in the configuration only around C_1 are called anomers. The structures of these two may be shown below:

These two forms are crystalline and have different melting points and optical rotations. For example, α-form of glucose has m.p. 419 K and $|\alpha|_D = +111^\circ$ and the β-form of glucose has m.p. 423 K and $|\alpha|_D = +19.2^\circ$.



Question 5.
Explain the following:
(i) Amino acids behave like salts rather than simple amines or carboxylic acids. (CBSE 2018C)
Answer:
Due to the formation of zwitterion.

(ii) The two strands of DNA are complementary to each other.
Answer:
The two strands are complementary to each other because the hydrogen bonds are formed between specific pairs of bases.

(iii) Reaction of glucose indicates that the carbonyl group is present as an aldehydic group in the open structure of glucose.
Answer:

Glucose gets oxidised to gluconic acid on reaction with a mild oxidising agent like Bromine water.

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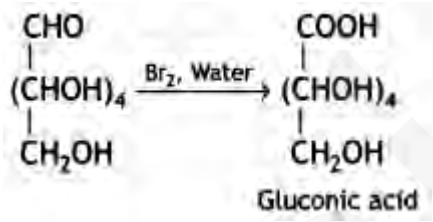
Question 6.

What is essentially the difference between α-glucose and β-glucose? What is meant by the pyranose structure of glucose?

Answer:



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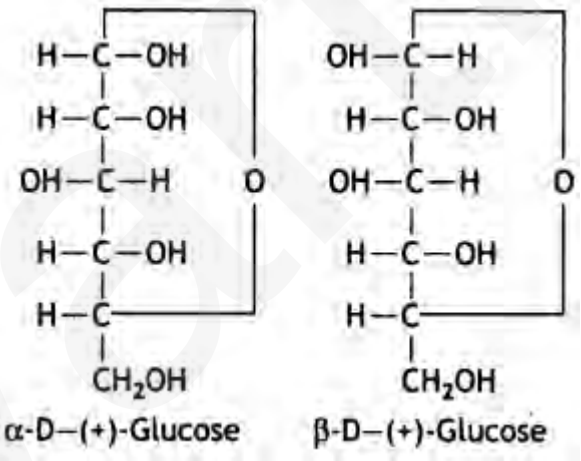


These two forms are crystalline and have different melting points and optical rotations. For example, α-form of glucose has m.p. 419 K and $|\alpha|_D$ = + 111° and the β-form of glucose has m.p. 423 K and $|\alpha|_D$ = + 19.2°.

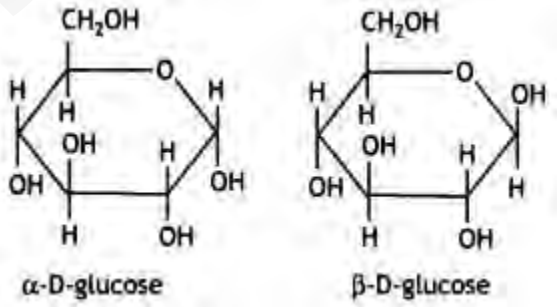
The α-D-glucose and β-D-glucose can be drawn in a simple six-membered ring form called pyranose structures. These resemble pyran which is a six-membered heterocyclic ring containing five carbon atoms and one oxygen atom.

These are known as pyranose structures and are shown below:

Question 7.

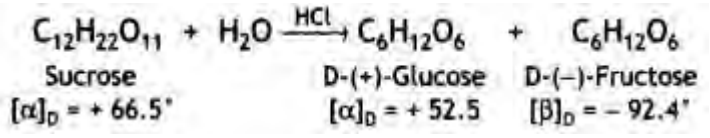
Which sugar is called invert sugar? Why is it called so?

Answer:



Sucrose is called invert sugar. The sugar obtained from sugar beet is a colourless, crystalline and sweet substance. It is very soluble in water and its aqueous solution is dextrorotatory having $[\alpha]_D$ = + 66.5°.

On hydrolysis with dilute acids or enzyme invertase, cane sugar gives an equimolar mixture of D-(+)-glucose and D-(-)-fructose.



So, sucrose is dextrorotatory but after hydrolysis, gives dextrorotatory glucose and laevorotatory fructose. D-

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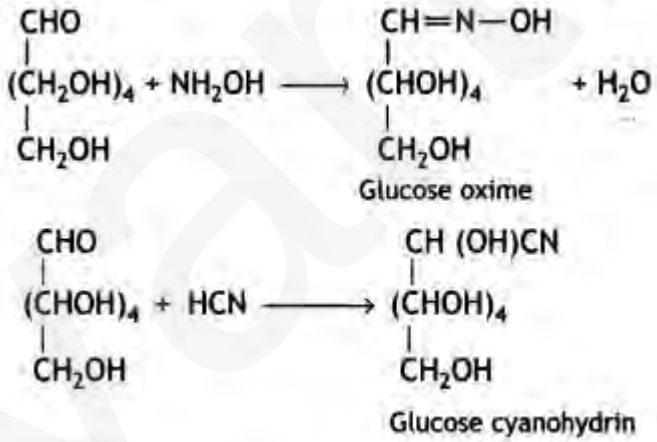
(-)-fructose has a greater specific rotation than D-(+)- glucose. Therefore, the resultant solution upon hydrolysis is laevorotatory in nature with a specific rotation of (-39.9°). Since there is a change in the sign of rotation from Dextro before hydrolysis to Laevo after hydrolysis, the reaction is called Inversion reaction and the mixture (glucose and fructose) is called invert sugar.

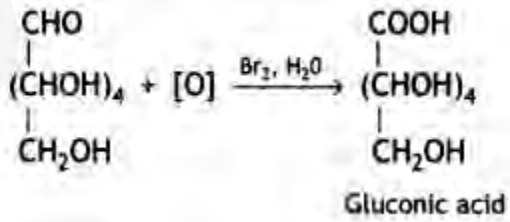
Question 8.
How do you explain the presence of an aldehydic group in a glucose molecule?
Answer:
Glucose reacts with hydroxylamine to form a monoxime and adds one molecule of hydrogen cyanide to give cyanohydrin.

Therefore, it contains a carbonyl group which can be an aldehyde or a ketone. On mild oxidation with bromine water, glucose gives gluconic acid which is a carboxylic acid-containing six carbon atoms.



This indicates that the carbonyl group present in glucose is an aldehydic group.

Question 9.
Define the following with an example of each: (CBSE 2018)
(i) Polysaccharides
(ii) Denatured protein
(iii) Essential amino acids
OR
(i) Write the product when D-glucose reacts with the cone. HNO_3.
(ii) Amino acids show amphoteric behaviour. Why?
(iii) Write one difference between a-helix and p-pleated structures of proteins.
Answer:



(i) Carbohydrates that give a large number of monosaccharide units on hydrolysis or a large number of monosaccharide units joined together by glycosidic linkage, e.g. starch, glycogen, cellulose.
(ii) Proteins that lose their biological activity or proteins in which secondary and tertiary structures are destroyed, e.g. curdling of milk.
(iii) Amino acids cannot be synthesised in the body. e.g. Valine / Leucine

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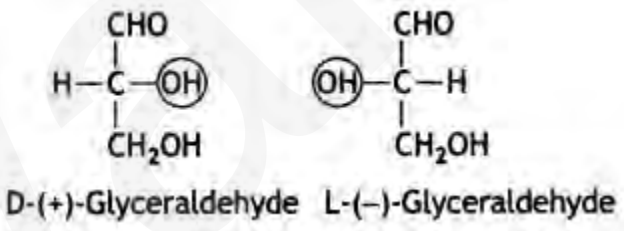
OR
(i) Saccharic acid / $COOH-(CHOH)_4-COOH$
(ii) Due to the presence of carboxyl and amino group in the same molecule or due to formation of zwitterion or dipolar ion.
(iii) a-helix has intramolecular hydrogen bonding while p-pleated has intermolecular hydrogen bonding / a-helix results due to regular coiling of polypeptide chains while in p-pleated all polypeptide chains are stretched and arranged side by side.

Question 10.
Describe the term D- and L-configuration used for sugars with examples.
Answer:
The sugars are divided into two families: the D-family and L-family which have definite configurations. These configurations are represented with respect to glyceraldehyde as the standard. The glyceraldehyde may be presented in two forms:

The D-configuration has —OH attached to the carbon adjacent to $—CH_2OH$ on the right while L-configuration has —OH attached to the carbon adjacent to $—CH_2OH$ on left.



D-(+)-Glyceraldehyde L-(–)-Glyceraldehyde

The sugars are calLed D- or L- depending upon whether the configuration of the molecule is related to D-glyceraldehyde or L-glyceraldehyde. It has been found that all naturally occurring sugars beLong to D-series, e.g. D-glucose, D-ribose and D-fructose.

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