Chapter 1

Carbohydrates

Q.1. Define carbohydrates.

Ans. These are defined as either polyhydric, aldehydic or ketonic alcohols or their derivatives.

As the word **'carbohydrates'** indicates, these are the compounds usually made-up of carbon, hydrogen and oxygen, sometimes they may also contain nitrogen and sulphur in their molecules as in the case of higher carbohydrates like mucopolysaccharides (hyaluronic acid, chondroitin sulphates, heparin, etc.).

Q.2. Name the important carbohydrates.

Ans. Important examples include glucose, fructose, galactose, sucrose, starch and glycogen.

Q.3. Name the important hexoses.

Ans. Glucose, galactose, fructose and mannose

Q.4. Name the important pentoses.

Ans. Ribose, ribulose, xylose and xylulose

Q.5. Name the important tetroses.

Ans. Erythrose and erythrulose

Q.6. Name the important trisaccharide.

Ans Raffinose

Q.7. Which is the most important class of monosaccharides?

Ans. Hexoses

Q.8. What is the classification of carbohydrates?

Ans. Carbohydrates have been classified into three main categories:

a. Monosaccharides
b. Oligosaccharides
c. Polysaccharides

Q.9. What are oligosaccharides?

Ans. These are the carbohydrates made-up of 2–5 simple sugar units which include disaccharides, trisaccharides, and so on.

Q.10. What are polysaccharides?

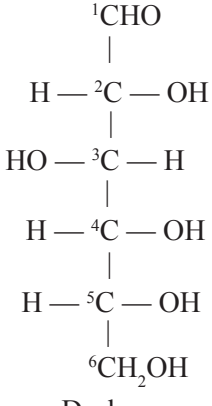
Ans. These are the carbohydrates made-up of > 5 simple sugar units which include starch, dextrins, glycogen, inulin, etc.

Q.11. What are reducing sugars?

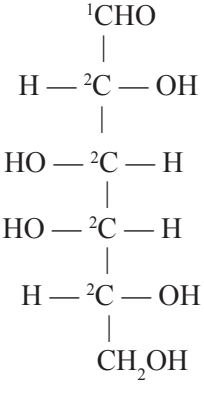
Ans. Reducing sugars are those which possess free aldehydic or ketonic group in their structures.

Q.12. What are epimers? Give examples.

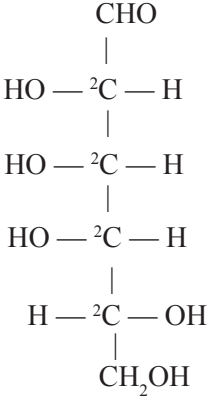
Ans. Carbohydrates that differ in their configuration around a specific carbon atom other than the carboxyl carbon atom are called epimers. Glucose and galactose are epimers as they differ in their configuration around C-4 carbon atom. Similarly, glucose and mannose are epimers as they differ around C-2 carbon atom.



D-glucose



D-galactose



D-mannose

Q.13. What is mutarotation?

Ans. The change in specific rotation of an optically active solution without any change in other properties is known as mutarotation.

Q.14. Which property of reducing sugars best explains the ring or cyclic structure of the carbohydrates?

Ans. Mutarotation

Q.15. Which is the main sugar of the blood?

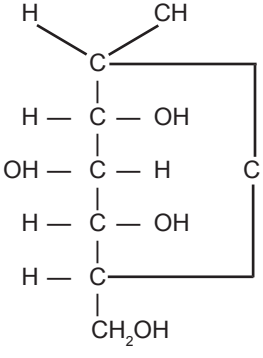
Ans. Glucose (dextrose)

Q.16. Is there any difference between glucose and dextrose?

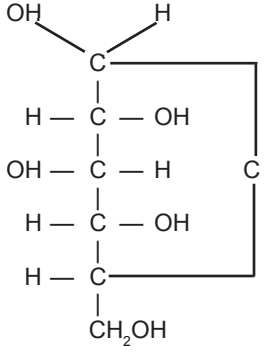
Ans. No.

Q.17. What are anomers? Give examples.

Ans. Carbohydrates that differ only in their configuration around the carboxyl carbon atom are called anomers. The carboxyl carbon atom is called the anomeric carbon atom. α-D-glucose and β-D-glucose are the anomeric forms of D-glucose.



α -D-glucose



β-D-glucose

Q.18. What is the percentage of glucose in honey?

Ans. 30–40%.

Q.19. What is another name of glucose?

Ans. Dextrose

Q.20 Which is the most important polysaccharide of the human body?

Ans. Glycogen.

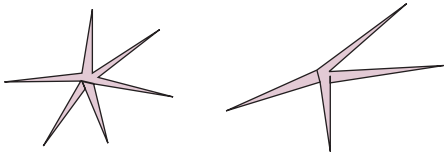
Q.21. What are the components of lactose sugar?

Ans. Glucose and galactose.

Q.22. What is the shape of osazones of glucose, fructose, lactose and maltose?

Ans.

Glucose:	Needle shape
Fructose:	Needle shape
Lactose :	Cotton ball shape/Powder puff shape
Maltose:	Sunflower shape



Osazones of glucose and fructose (Needle shaped)

Osazones of lactose (Cotton ball or powder puff shaped)

Osazones of maltose (Sunflower shaped)

Q.23. Why sucrose is a non-reducing sugar?

Ans. Sucrose sugar is made-up of one molecule each of glucose and fructose in which these remain linked to each other through the aldehyde group of glucose and keto group of fructose as a result of this linkage, both the reducing groups get blocked. Hence, sucrose is a non-reducing sugar.

Q.24. What is inversion?

Ans. The process by which dextrorotatory sucrose gets converted to a levorotatory mixture of glucose and fructose is called inversion.

$$\underset{(+\,65.5)}{\text{Sucrose}} \xrightarrow{H^+} \underset{(+\,52.7)}{\text{Glucose}} + \underset{(-\,92)}{\text{Fructose}}$$

Q.25. Why sucrose is called an invert sugar?

Ans. Sucrose upon hydrolysis yields glucose and fructose. Fructose has greater specific rotation than glucose. The resulting mixture is levorotatory. The mixture is known as invert sugar.

Q.26. What is the fate of sucrose when injected into the blood?

Ans. It will be excreted as such in the urine as there is no enzyme (sucrase) present in the blood to hydrolyze it.

Q.27. In which fluid lactose is found most?

Ans. Milk.

Q.28. What are the components of starch?

Ans. • Amylose • Amylopectin

Q.29. What is aglycone?

Ans. The non-carbohydrate portion of a glycoside is called aglycone.

Q.30. What are dextrins?

Ans. Dextrins are the partially degraded breakdown products of starch.

Q.31. What is the difference between starch and cellulose?

Ans. In starch, the glucose units remain linked by α (l, 4) glucosidic linkages, whereas in the cellulose, the glucose units remain linked by β (l, 4) glucosidic linkages.

Q.32. What is the difference between amylose and amylopectin?

Ans.

Amylose	Amylopectin
1. Low molecular weight (10,000-1,00,000)	1. High molecular weight (50,000-10,00,000)
2. About 3,00 glucose units	2. About 1,000 glucose units
3. 10–20% in starch	3. 80–90% in starch
4. Linear molecule containing α (1, 4) linkages	4. Branched molecules containing α (l, 4) and α (1, 6) linkages at branching site
5. Gives blue colour with iodine solution	5. Gives violet colour with iodine solution
6. Soluble in water	6. It is sparingly soluble in water

Q.33. Which polysaccharides are eaten mostly by the human beings? Name any two.

Ans. Starch and cellulose.

Q.34. Why cellulose is not utilized by the human body?

Ans. The enzyme responsible for the cleavage of β (l, 4) linkages in the cellulose molecule remains absent in the human beings. This enzyme is called **cellulase,** hence it is not utilized.

Q.35. What is the advantage of consuming cellulose in the diet by the human beings?

Ans. Cellulose contributes **'roughage'** to the fecal matter as a result of which there is comparatively less risk of gastrointestinal and colon cancers. Stool is also passed easily.

Q.36. Which is the most important carbohydrate for humans/animals?

Ans. Glucose

Q.37. Which is the most important monosaccharide?

Ans. **Glucose** (**dextrose**)

Q.38. Which is the most important polysaccharide of humans?

Ans. Glycogen.

Q.39. What is 'mannitol' which is transfused to the patients?

Ans. It is a sugar alcohol and is obtained by the reduction of mannose.

Q.40. What is the percentage of fructose in honey?

Ans. 30–40%

Q.41. Name some disaccharides.

Ans. Maltose, sucrose and lactose.

Q.42. Which disaccharides does mother's milk contain?

Ans. Lactose.

Q.43. How lactose is prepared commercially?

Ans. From milk

Q.44. What is lactosuria?

Ans. Lactosuria is a pathological condition in which appreciable amount of lactose is found in the urine.

Q.45. Is there any difference between glycosuria and glucosuria?

Ans. No difference. They are synonymous words.

Q.46. What do you mean by glucosuria and glycosuria?

Ans. Both mean that the appreciable amount of glucose is appearing in the urine.

Q.47. What is fructosuria?

Ans. It is a pathological condition in which appreciable amount of fructose sugar appears in urine.

Q.48. What is galactosuria?

Ans. It is a pathological condition in which appreciable amount of galactose sugar appears in urine.

Q.49. Name mucopolysaccharides.

Ans. Hyaluronic acid, chondroitin sulphates and heparin.

Q.50. What are the constituent units of sucrose?

Ans. Glucose and fructose.

Q.51. What is pentosuria?

Ans. It is a pathological state in which appreciable amount of pentose sugar appears in the urine.

It is also said to occur in normal individuals after the ingestion of large amount of certain fruits.

Q.52. Name any four homopolysaccharides?

Ans. Glycogen, starch, cellulose and inulin.

Q.53. Where is glycogen found in the human body?

Ans. Liver, muscles, kidney and other tissues but is not found in brain.

Q.54. Name any three heteropolysaccharides.

Ans. Hyaluronic acid, chondroitin sulphates and heparin.

Q.55. Name any carbohydrate which acts as an anticoagulant.

Ans. Heparin

Q.56. Can you name any such polysaccharide which may be used as a plasma substitute?

Ans. Dextran

Q.57. What are the substances that give false Benedict's test?

Ans. Large concentration of uric acid, creatinine, salicylates (aspirin), vitamin C, etc.

Q.58. What is the difference between Benedict's Qualitative test and Barfoed's test?

Ans. ***Benedict's qualitative test*** is a reduction test carried out in the alkaline medium whereas **Barfoed's test** is a reduction test carried out in acidic medium.

Q.59. What is the general test for carbohydrates?

Ans. Molisch test

Q.60. What is the first breakdown product of glycogen metabolism?

Ans. Glucose-1-phosphate

Q.61. Name the vitamin whose structure closely resembles that of a monosaccharide?

Ans. Vitamin C (ascorbic acid)

Q.62. From nutrition point of view, which carbohydrate is of importance for infants?

Ans. Lactose (found in milk).

Q.63. What is the importance of hyaluronic acid?

Ans. It is the **ground substance of synovial fluid of joints and serves as lubricant and shock absorbent in joints** which otherwise become dry and create a sound which one can hear easily.

Q.64. Name any two amino sugars.

Ans. Glucosamine and galactosamine.

Q.65. Name complex carbohydrate derivatives.

Ans. Sialic acid and muramic acid. (structural component of bacterial cell walls).

Q.66. Define glycoconjugates.

Ans. These may be referred to as the carbohydrates which are found in combination with a non-carbohydrate moiety.

Q.67. What is the main property of pectins?

Ans. They are used as **gelling agent**, particularly in Jams, Jellies and Marmalades.

Q.68. Which sugar is the energy source of sperms?

Ans. Fructose