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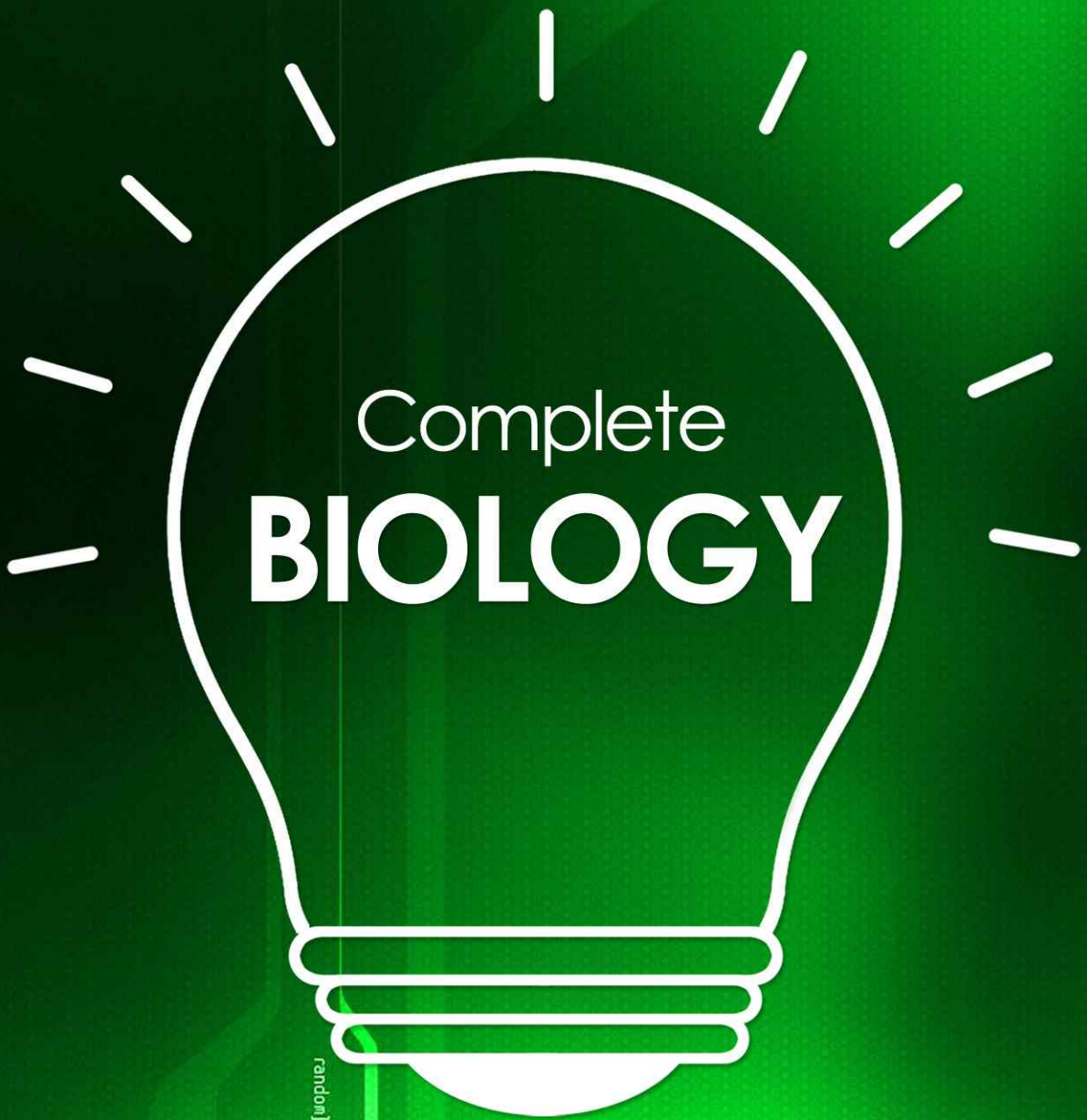

Complete BIOLOGY

NEET · CBSE eBOOKS

CLASS 11&12th

Learning Inquiry
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CLASS 11th

Biomolecules

01. Carbohydrates

These are the compound of carbon, hydrogen and oxygen having hydrogen and oxygen in the same ratio as that of water, i.e. 2 : 1. They are among the most widely distributed compound both in plant as well as animal kingdom.
On the basic of their reducing properties carbohydrates can be of two types, i.e. reducing sugar and non-reducing sugar.

Carbohydrates

Reducing sugar

- These are the sugars with free aldehyde (−CHO) or keto groups > C=0
- They can reduce (Cu^{2+}) to cuprous Cu^{+} ion.
- They reduce Fehling's solution and Benedict reagent. e.g. all monosaccharides,

Non-reducing sugar

- These sugar do not have free aldehyde or keto group.
- They cannot reduce the Fehling solution and Benedict reagent. e.g. sucrose.
- They do not reduce the Fehling solution and Benedict reagent. e.g. sucrose.

On the basis of hydrolysis, products of carbohydrates, products of carbohydrates can be monosaccharides, oligosaccharides and polysaccharides

Monosaccharides

These are simple carbohydrates that cannot be hydrolysed further into smaller units. They consists of a single polyhydroxy aldehyde or ketone unit. These are mostly made up of 3-7 carbon atoms.
Monosaccharides are soluble in water, sparingly soluble in alcohol and insoluble in ether.

(i) Based on the functional group attached to them they are of two types

(a) **Aldoses** When the functional group in

monosaccharide is aldehyde $\left(\begin{array}{c} O \\ \| \\ -C-H \end{array}\right)$, they are

Known as aldoses, e.g. glyceraldehyde, glucose, ribose erythrose, etc.

(b) **Ketose** When the functional group in the

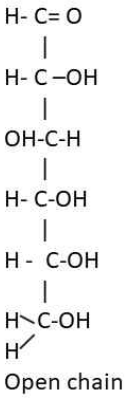
monosaccharide is aldehyde $\left(\begin{array}{c} | \\ -C=O \end{array}\right)$, they are

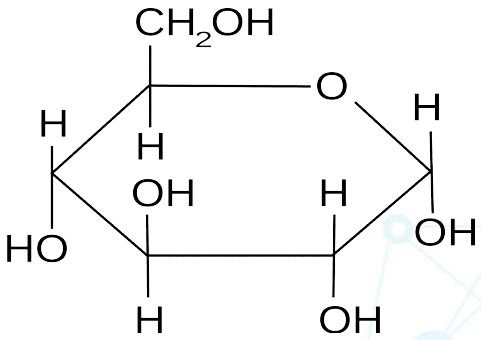
referred as ketones, e.g. ribulose, fructose, etc

(ii) Based on the number of carbon atom the monosaccharides are regarded as

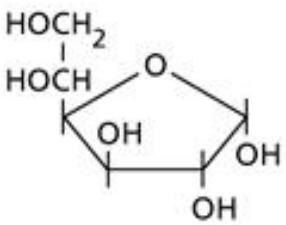
(a) **Trioses** having 3C atoms, e.g. glyceraldehyde and dihydroxyacetone.
(b) **Tetroses** having 4C atoms, e.g. thriose and erythrose
(c) **Pentose** having 5C atoms, e.g. ribose, ribulose
(d) **Hexoses** having 6C atoms, e.g. glucose, galactose and mannose

(i) **Pyranose** ring which has hexagonal shape with 5C and 1 oxygen atoms.

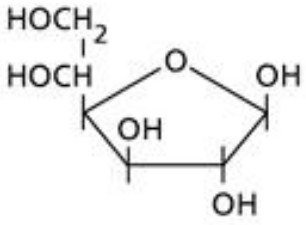




(ii) **Furanose ring** which has pentagonal shape with 4C atom and 1 oxygen atom.



α -D glucofuranose



β -D glucofuranose

Oligosaccharide

These are formed by the condensation of 2-9 monosaccharide units. In oligosaccharides these units are held together by glycosidic bonds.

(i) Disaccharide, e.g. sucrose, maltose, lactose, trehalose, etc.
(ii) **Trisaccharide,** e.g. raffinose.
(iii) **Tetrasaccharide,**, e.g. stachyose.

Examples of Oligosaccharide

(i) **Lactose or Milk sugar** present in the milk of mammals. On hydrolysis it gives one glucose and one $\beta-D$ galactose unit. The glycosidic linkage of lactose is $\beta-1,4$type
(ii) On hydrolysis it gives$2-\alpha-D$ glucose unit. The glycosidic linkage of maltose is $2-\alpha-D$Glucose unit. The glycosidic linkage of maltose is $\alpha-1,4$ type
(iii) **Sucrose or Cane sugar** On hydrolysis it produces one $\alpha-D$ glucose and one $\beta-D$ fructose unit. The glycosidic linkage in sucrose is $\alpha-1,2$ type
(iv) **Trehalose** it is another disaccharide, Which is found in insects and fungi. In trehalose, Two glucose units are liked with $\alpha-,1-$ glycosidic linkage.
(v) **Raffinose** it is a trisaccharide sugar made up of three molecules, i.e. D- glucose, D-fructose and d- galactose.

Polysaccharide or Glycans

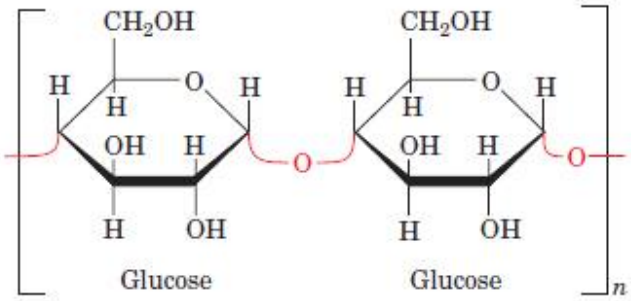
These are polymers or chains of monosaccharides (usually more than9) bound in linear or branched chain pattern.

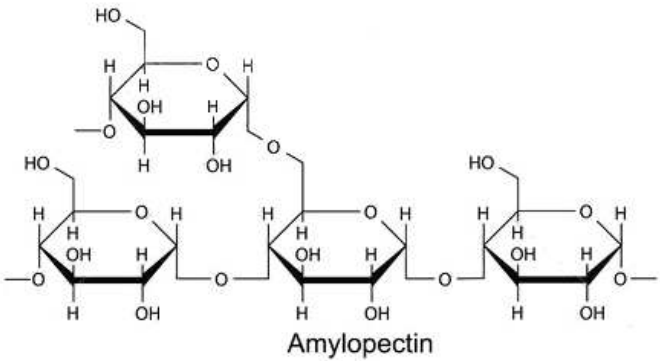
Homoglycans or Homopolysaccharide

They are the polysaccharide, which are formed by the polymerisation of only one type of monosaccharide unit, e.g. starch, glycogen, cellulose, callose, etc.

(i) **Starch**

It is a polymer of D-glucopyranose units liked by $\alpha-1,4$- glycosidic linkages. It consists of a mixture of amylose and amylopectin in 1 : 4 ratio. Amylose is linear and consists of about 200-500 glucose unit, on the other hand amylopectin is branched and consists of over 1000 glucose units.





(ii) **Glycogen**

It found mainly in mainly in liver and muscles. About 5000-15000 glucose units make up a glycogen molecule. It is a non-reducing sugar that gives red colour with iodine.

(iii) **Cellulose**

It is the most important structural component of the cell wall o plants. It is a linear polymer of $\beta-D$ glucose unit connected through $\beta-1$, 4- glycosidic linkages.

Heteroglycans or Heteropolysaccharide

They are the complex polysaccharide, Which are formed by the polymerisation of two or more types of monosaccharide unit,