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**CHEMISTRY**

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CLASS 11 & 12th



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CLASS 12th

# Biomolecules

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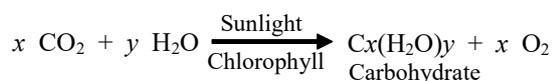


## 01. Introduction

**Biomolecules** may be defined as complex lifeless chemical substances which form the basis of life. i.e. they not only build up living system (creatures) but are also responsible for their growth, maintenance and their ability to reproduce.

## 02. Carbohydrates

One of the most important classes of biomolecules is carbohydrates. These include compounds like sugars, starch, glycogen, cellulose, dextrans and gums. Although they are widely distributed both in animal and plant kingdom yet they are obtained mainly from plants. They are formed in plants by a process known as *Photosynthesis* and make up about 70% of the solid plants material.



Carbohydrates play a vital role in our daily life. They provide us with three basic necessities of life, i.e., **food** (in the form of starch), **clothing** (cotton, lines and rayon are essentially cellulose) and **shelter** (wood in making houses and furniture is almost cellulose) and **shelter** (wood in making house and furniture is almost cellulose)

*Carbohydrates are defined as optically active polyhydroxy aldehydes or polyhydroxy ketones or substances which give these on hydrolysis.*

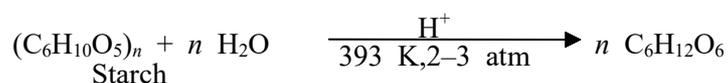
### Classification of Carbohydrates

Carbohydrates are also known as **saccharides** (Greek: **Sakcharon** means sugar). These are classified into the following three classes depending upon their behaviour towards hydrolysis.

- (i) **Monosaccharides** : Their are the simplest carbohydrates which cannot be hydrolysed to smaller molecules. Their general formula is  $(\text{CH}_2\text{O})_n$  where  $n = 3-7$ .
- (ii) **Oligosaccharides** : (Greek, *oligo* means a few). These are carbohydrates which on hydrolysis given 2-10 molecules of monosaccharides. Depending upon the number of monosaccharide molecules actually obtained upon hydrolysis, they are further classified as di, tri, tetrasaccharides, etc. For example,
  - **Disaccharides** : Carbohydrates which upon hydrolysis given two molecules of the same or different monosaccharides are called **disaccharides**. For example, sucrose, maltose, lactose, etc Their general formula is  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ .
  - **Trisaccharides** : Carbohydrates which on hydrolysis give three molecules of the same or different monosaccharides are called **trissaccharides**. For example, raffinose upon hydrolysis given one molecule each of glucose, fructose and galactose. Their general fructose and galactose. Their general formula is  $\text{C}_{18}\text{H}_{32}\text{O}_{16}$ .
  - **Tetrasaccharides** : Carbohydrates which upon hydrolysis give four molecules of the same or different monosaccharides are called **tetrassaccharides**. For example, stachyrose upon hydrolysis gives one molecule each of glucose and fructose and two molecules of glycogen. Their general formula is  $\text{C}_{24}\text{H}_{42}\text{O}_{21}$ .
- (iii) **Polysaccharides** : carbohydrates which upon hydrolysis give a large number of monosaccharide molecules are called polysaccharides. The most commonly occurring polysaccharides are starch, cellulose and glycogen. Their general formula is  $(\text{C}_6\text{H}_{10}\text{O}_5)_n$  where  $n = 100-3000$ .

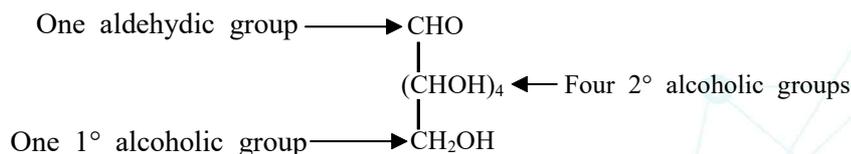


(ii) **From starch**



### Open Chain Structure of Glucose

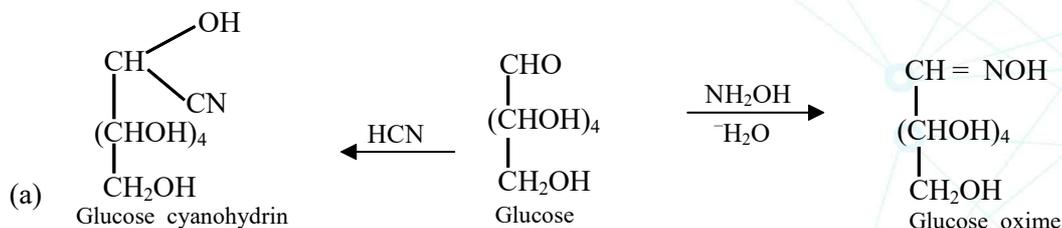
The open chain structure of glucose was proposed by Baeyer. It contains one aldehyde ( $-CHO$ ) group, one primary alcoholic ( $-CH_2OH$ ) group and four secondary alcoholic ( $-CHOH$ ) groups.



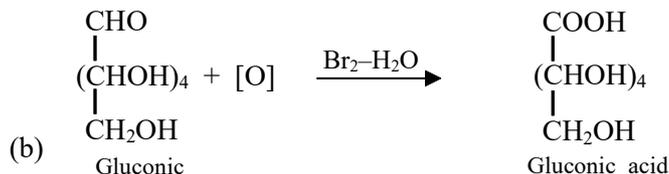
This structure was assigned on the basis of following evidence.

(i) **Molecular formula** : The molecular formula of glucose is  $C_6H_{12}O_6$ .

(ii) **Presence of an aldehyde group** :

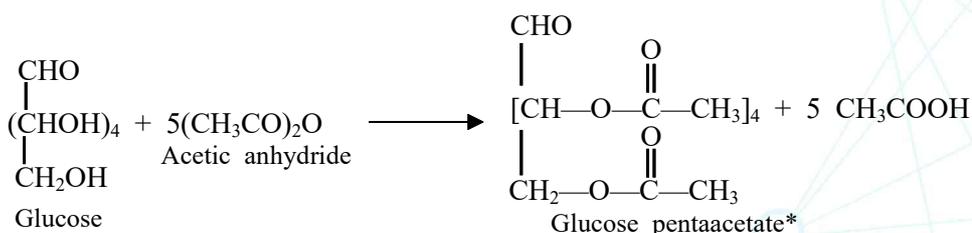


These reactions suggest that glucose contains a carbonyl group ( $C=O$ ) group.

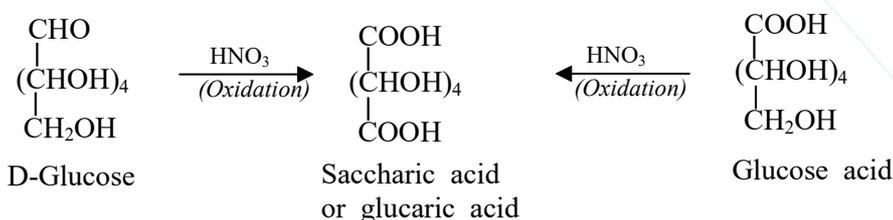


Since aldehyde ( $-CHO$ ) is monovalent, it is always present at the end of the carbon chain.

(iii) **Presence of five hydroxyl groups** :



(iv) **Presence of one primary alcoholic group**:



The primary alcoholic group ( $-CH_2OH$ ) is always present at the end of the carbon chain.