

CARBOHYDRATES

18-05-2020 Lecture-3 Deg-II (H&S)

P-IV Ch-3
Ch-3 G-'C'
G-'B'

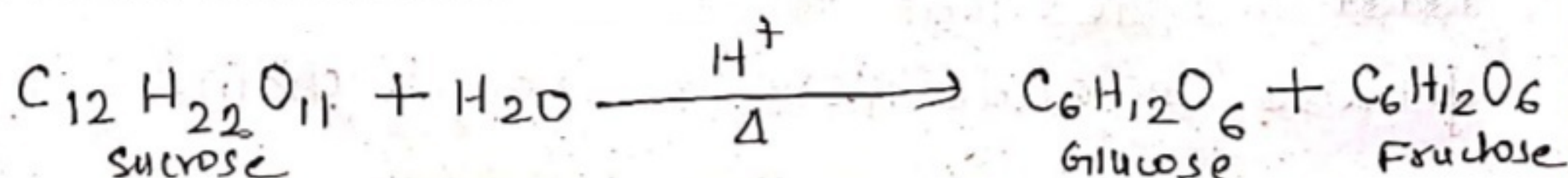
Topic - Occurrence, Preparation
And Structure of Glucose.

Occurrence :

- * Glucose occurs naturally both in combined and free state.
- * In free state, it is present in most sweet fruits & in honey.
- * Ripe grapes often contain as much as 20-30% of glucose and for this reason it is sometimes called Grape sugar.
- * In this combined state it forms a major component of many disaccharides, (eg; sucrose, maltose and lactose), and polysaccharides (eg; starch, cellulose and glycogen).

Preparation

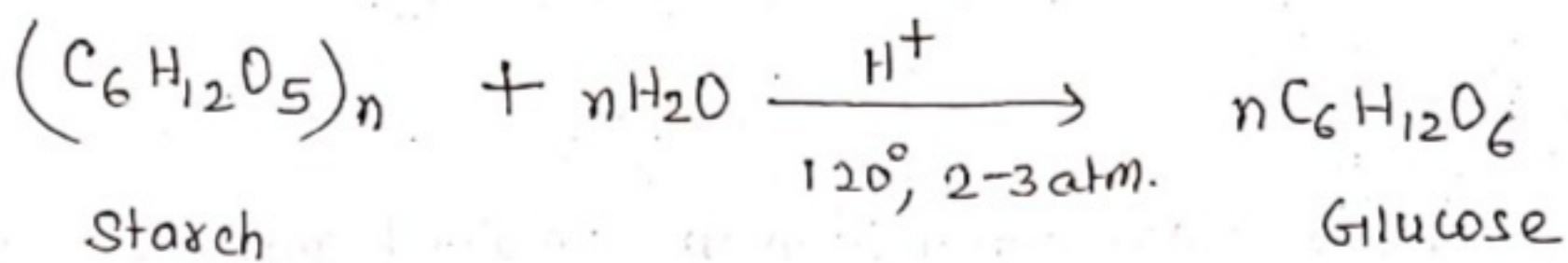
1. From Sucrose



2. From Starch

2.

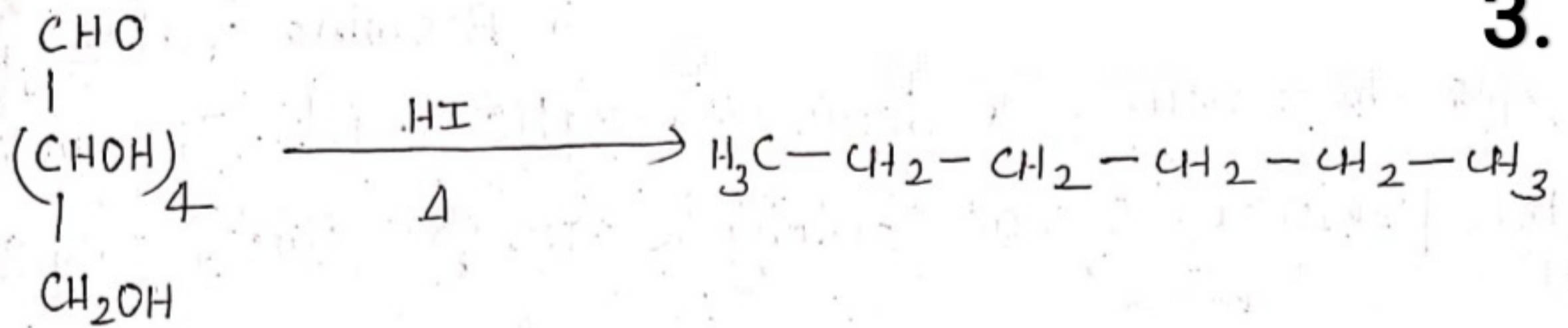
Commercially, glucose is obtained by the hydrolysis of starch by heating with very dilute sulphuric acid at 120°C under a pressure of 2 to 3 atm.



Structure of D-Glucose

The structure of glucose has been derived from a consideration of facts and conclusions such as the following :-

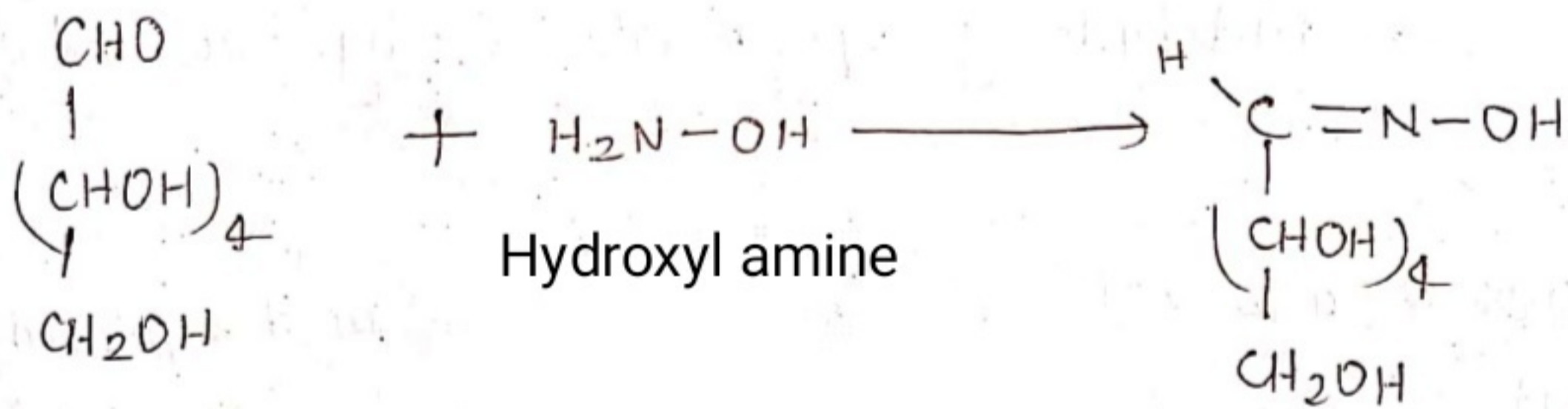
1. Elemental analysis and molecular weight determination show that the molecular formula of glucose is $\text{C}_6\text{H}_{12}\text{O}_6$.
2. Reduction of glucose with conc. HI, produces n-hexane. This indicates that the six carbon atoms in the glucose molecule form a straight-chain.



Glucose

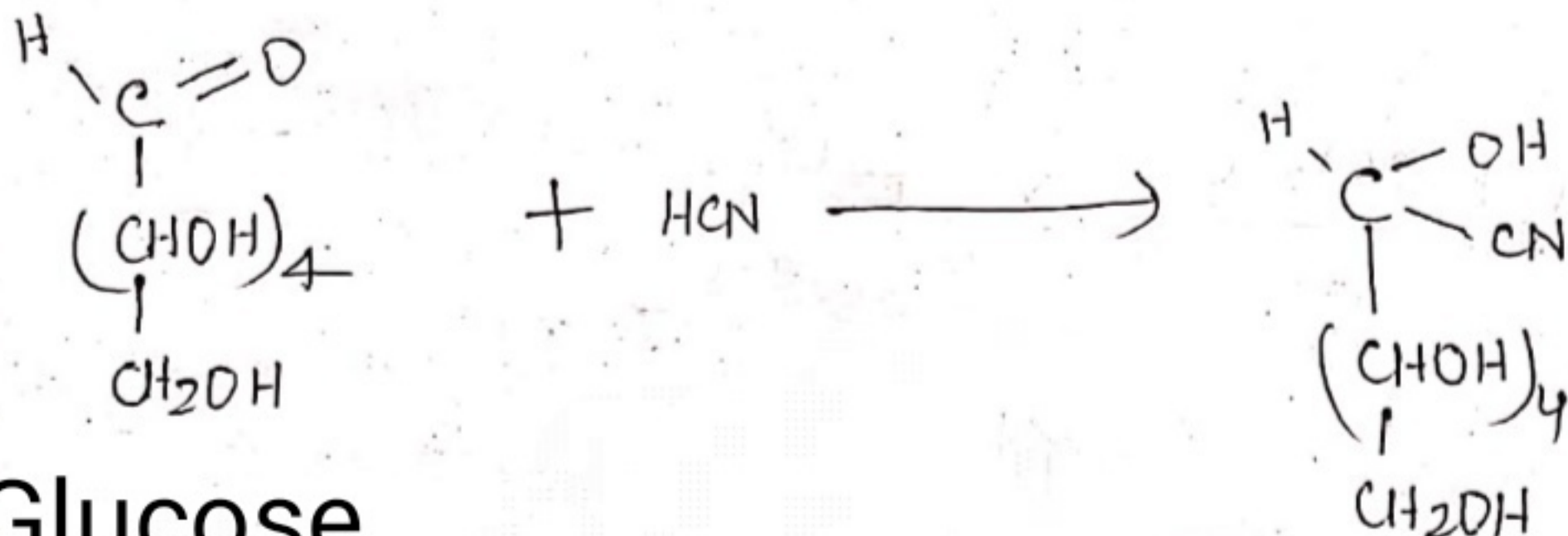
3. Glucose reacts with hydroxyl amine to form mono oxime and on addition of HCN give cyanohydrin.

These reaction indicates the presence of either an aldehyde or a ketone group.



Glucose

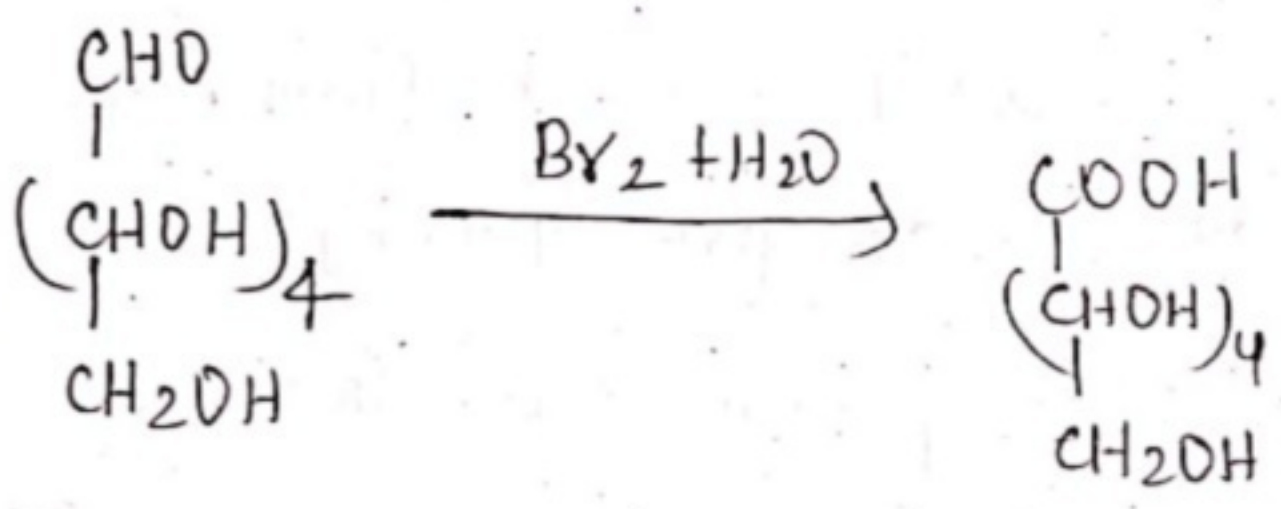
Oxime



Glucose

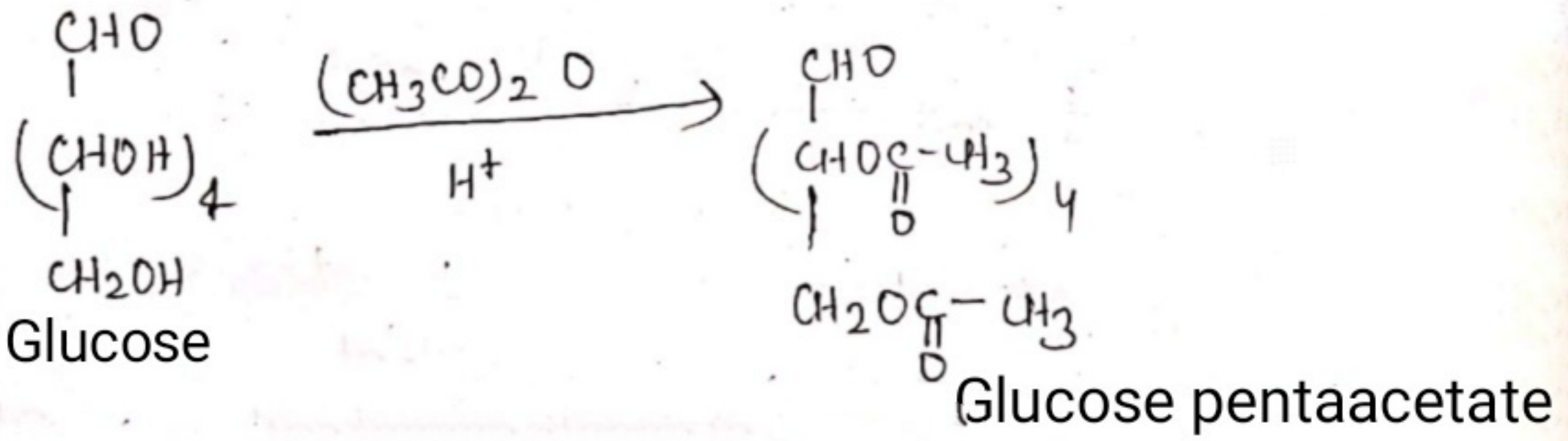
Cyanohydrin

4. Mild oxidation of glucose with Bromine water gives gluconic acid, a monocarboxylic acid. This indicates the presence of an aldehyde group since, only the aldehyde group can be oxidised to acid with mild O.A.



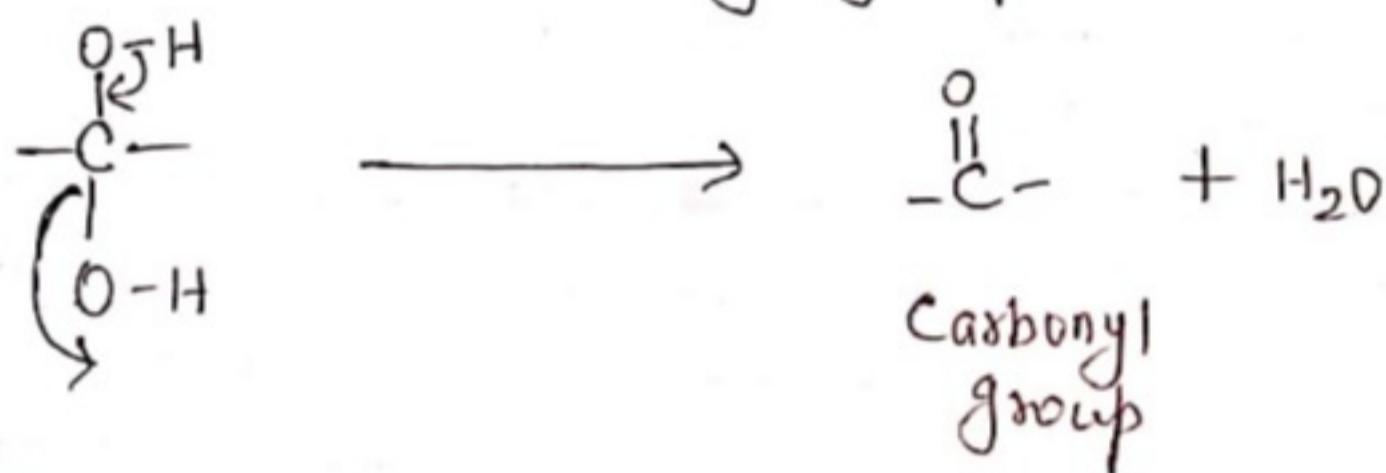
Since six carbon atoms in glucose are in straight chain, hence aldehyde group, must occupy one end of this chain.

5. Glucose reacts with acetic anhydride in the presence of H^+ and give Glucose pentaacetate. This reaction indicates that five $(-\text{OH})$ group is present in glucose molecules.



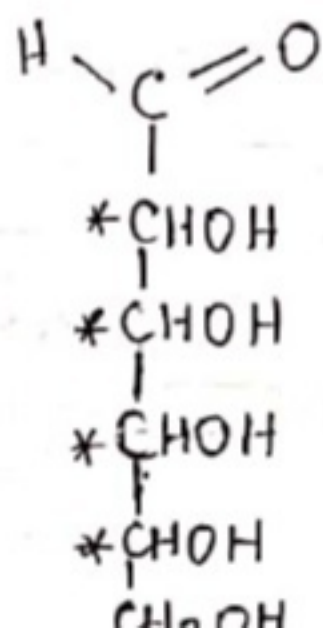
6. Oxidation of gluconic acid with HNO_3 gives 5. Saccharic acid. This indicates that the presence of one primary alcohol group in glucose.

7. Organic compounds with two hydroxyl group ($-\text{OH}$) attached to a single carbon atom are rare, and those which are known usually lose water to produce a carbonyl group.



This suggest that in glucose molecule, each one of the five hydroxyl groups is attached to different carbon atom.

From the above evidence we conclude that glucose is a pentahydroxyhexanal and can be represented by the following gross structure.



* All star marked carbon is asymmetric carbon atom.

Completed...