

SUBJECT - CHEMISTRY

CLASS - B.Sc (Hons) PART - II

PAPER - IV

TOPIC - The open chain structure of glucose.

Dr. Hari Mohan Prasad Singh

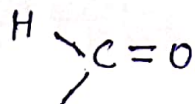
Department of Chemistry

Dr. L.K.V.D College Tarapur Samastipur

Q Discuss the open chain structure of glucose.

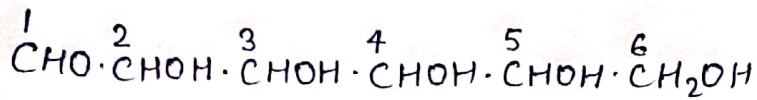
Ans on the basis of ~~exp~~ elemental analysis and molecular weight determination, the molecular formula of glucose comes $C_6H_{12}O_6$.

- (1) It forms n-hexane on complete reduction with red P & HI, Therefore all six C-atoms in glucose are in a straight chain.
- (2) It forms a penta acetyl derivative on acetylation which shows the presence of 5-OH groups. Since it does not dehydrate easily, therefore each -OH group is attached to a separate C-atom.
- (3) It forms a cyanohydrin with HCN and an oxime with hydroxy-lamine, hence it contains $>C=O$ group.
- (4) on mild oxidation with Br_2 water, glucose gives gluconic acid (monobasic acid) and contains the same number of C-atoms as glucose. So the $>C=O$ groups in glucose must be an aldehyde.



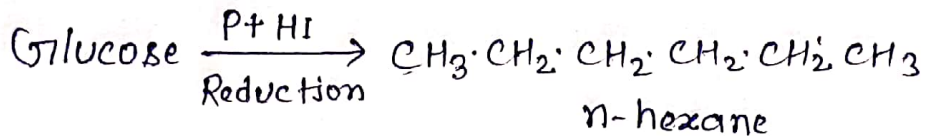
- (5) Gluconic acid on further oxidation with dilute HNO_3 yields glucaric acid (dibasic acid) containing the same number of C-atoms as glucose. As glucose has only one aldehydic group, hence the 2nd -COOH must have arisen from the oxidation of a primary (or 1°) alcoholic group $-CH_2OH$. considering above facts and supplying necessary H-atoms.

We can safely say that glucose has the following open chain structure.

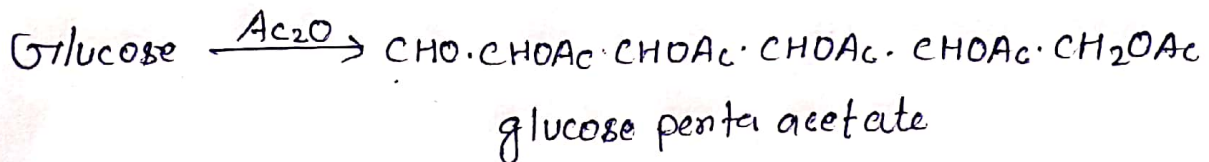


This structure explains very satisfactorily all the foregoing facts, as shown below:

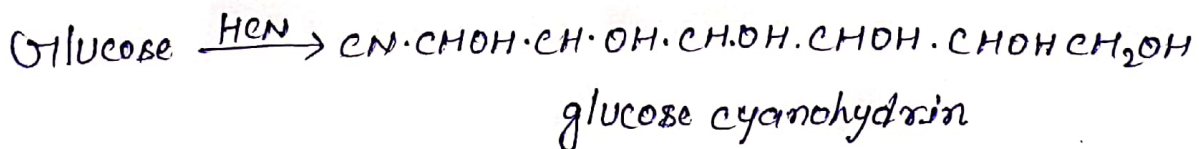
(1) Presence of straight chain of six C-atoms:



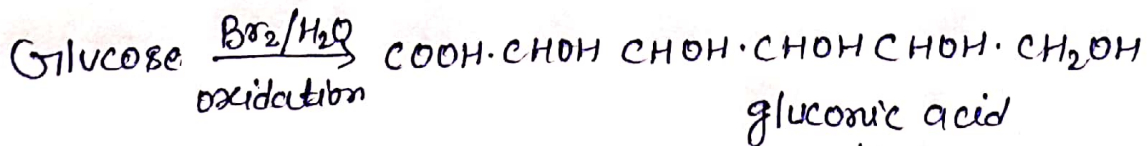
(2) Presence of 5 - OH groups:



(3) Presence of a >C=O group:



(4) Presence of a $\begin{matrix} \text{H} \\ > \\ \text{C} = \text{O} \end{matrix}$ group:



oxidation \downarrow $\text{KMnO}_4 \cdot \text{HNO}_3$

