Class - B.Sc. Part II (Subsidiary)
Subject - chemistry
Paper - Gr. C
Topic - constitution of Fructose
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Constitution of Fructose.

(i) The molecular formula of Fructose have been found to be $C_6H_{12}O_6$.

(ii) It contains one Ketone group because

(a) It forms cyano-hydrazine with HCN

$$C_6H_{12}O_6 + HCN \rightarrow C_6H_{12}O_5(OH)CN$$

(b) It reacts with hydroxyl amine forming oximes.

$$C_6H_{12}O_6 + H_2N-OH \rightarrow C_6H_{12}O_5(=N-OH) + H_2O$$

(c) It reacts with phenyl hydrazine in equimolecular amount forming hydrazones

$$C_6H_{12}O_6 + H_2N-NH-C_6H_5 \rightarrow C_6H_{12}O_5(=N-NH-C_6H_5) + H_2O$$

(iii) It contains 5(OH) groups because it forms penta acetyl derivative with acetyl chloride or acetic anhydride

As fructose is a stable compound all -OH gr are attached to different carbons.

ii) (d) Fructose on reaction forms a mixture of isomeric hexa hydric alcohol, sorbitol & Mannitol indicating the >C=O gr. Hence, it may be represented as $H_7(C-OH)_5CO$.

ii (e) Fructose on oxidation gives a mixture of acid each having lesser no. of C-atoms than fructose.

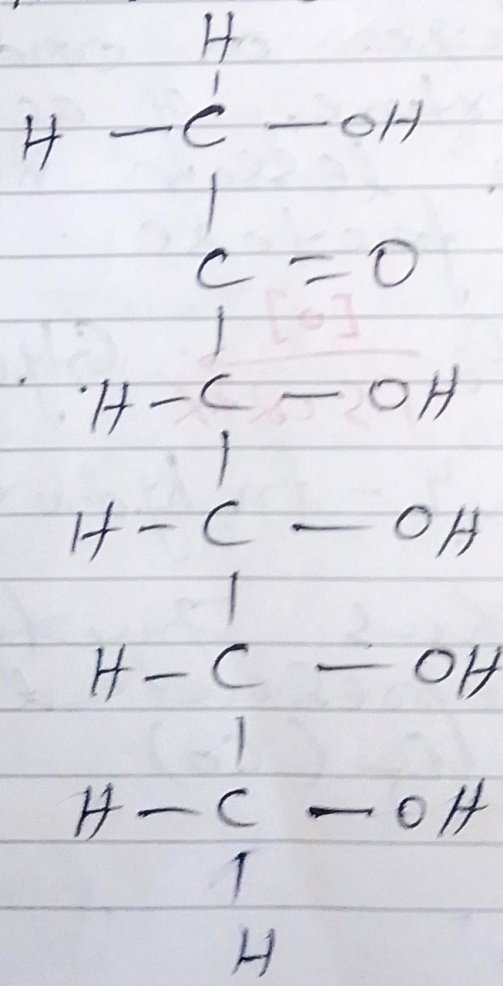
$$C_6H_{12}O_6 \xrightarrow[F.S\ OR\ T.R]{[O]} \text{Glycollic acid}$$

+ 2, 3, 4 - tri hydroxy butanoic acid.

Thus fructose may be represented as $C_5H_{12}O_5(CO)$.

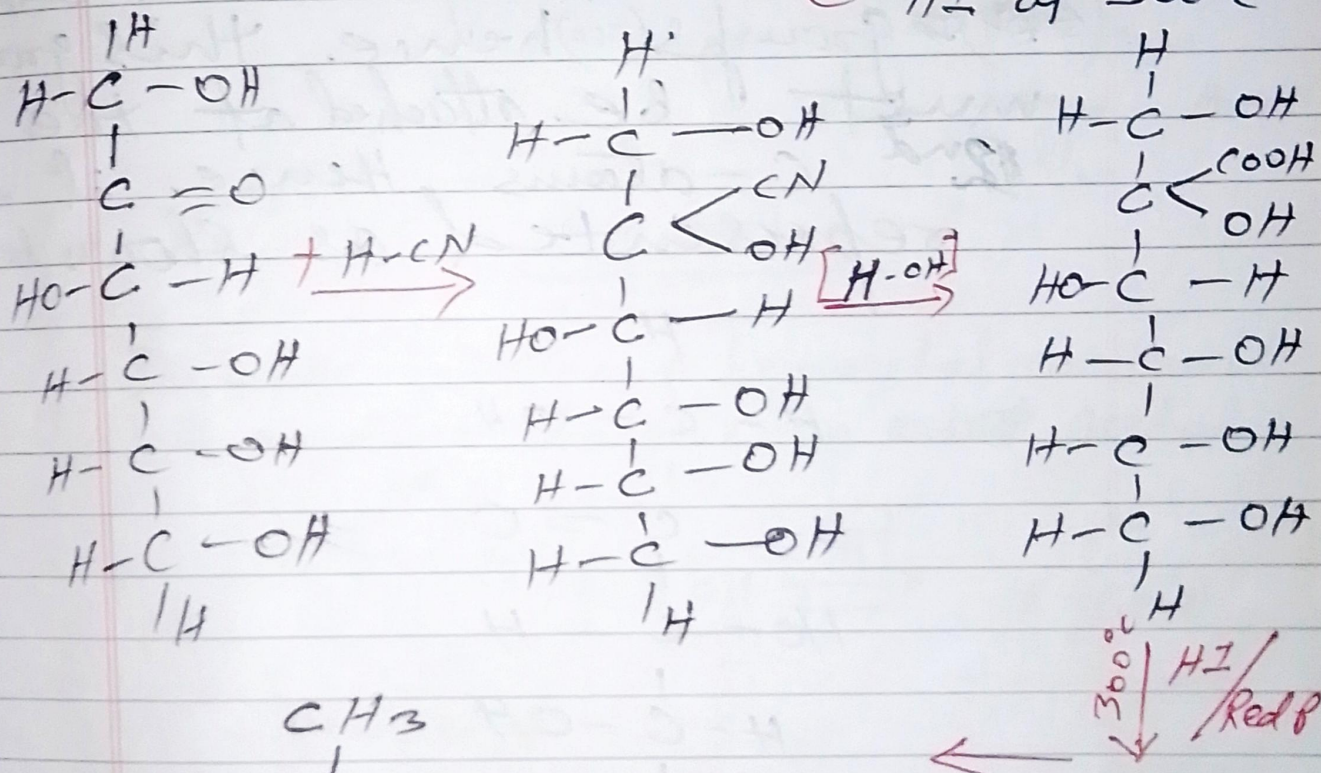
(iv) It is the straight chain compound of 6 c-atoms because on treatment with HCN followed by hydrolysis and reduction with HI gives 2-methyl Caproic acid (Hexanoic acid)

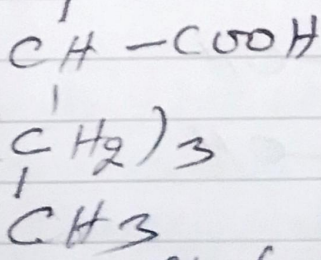
Keeping in view the tetra valency of c-atoms fructose has the structure given below



(V) Configuration of Fructose.

$$H_7(C-OH)_5(CO) \xrightarrow[\text{(2) } [H-OH] \text{ (3) } HI \text{ at } 300^\circ C]{\text{(1) } H-CN}$$





2-methyl Caproic acid.

Configuration of Fructose :— Glucose & Fructose form identical osazone.

The osazone formation takes place with first & second C-atoms only hence they have same form 3rd C-atoms.

As fructose contain (=O) groups (=O) hence this group must be attached at the 2nd C-atoms. Hence it is represented as shown below