FRUCTOSE

Fructose is also known as Ketohexose or fruit sugar.

Methods of preparation:

(1) Fructose is obtained along with glucose after hydrolysis of cane sugar with dilute H_2SO_4.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{dil. } H_2SO_4} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

(2) When calcium fructosate is carboxylated to give fructose

$$C_6H_{11}O_5-O-Ca-OH + CO_2 \longrightarrow \underset{\text{Calcium fructosate}}{} C_6H_{12}O_6 + CaCO_3$$
Fructose

(3) Fructose is prepared on large scale by hydrolysis of inulin with dil. H_2SO_4.

$$\underset{\text{Inulin}}{n\,C_6H_{10}O_5} \xrightarrow[\text{dil. } H_2SO_4]{n H_2O} \underset{\text{Fructose}}{n\,C_6H_{12}O_6}$$

Physical properties:

(1) The anhydrous fructose is a colourless, crystalline compound.

(2) Its melting point 120°C

(3) Soluble in water but insoluble in benzene and ether

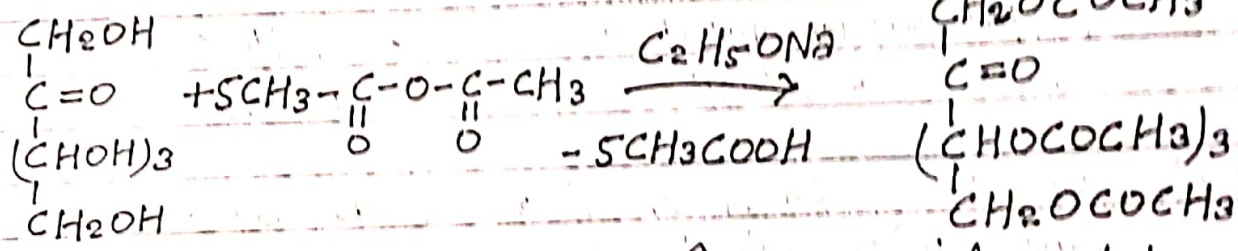
(4) It is less soluble in water than glucose.

(4) Like glucose, it also shows mutarotation.

Chemical properties:

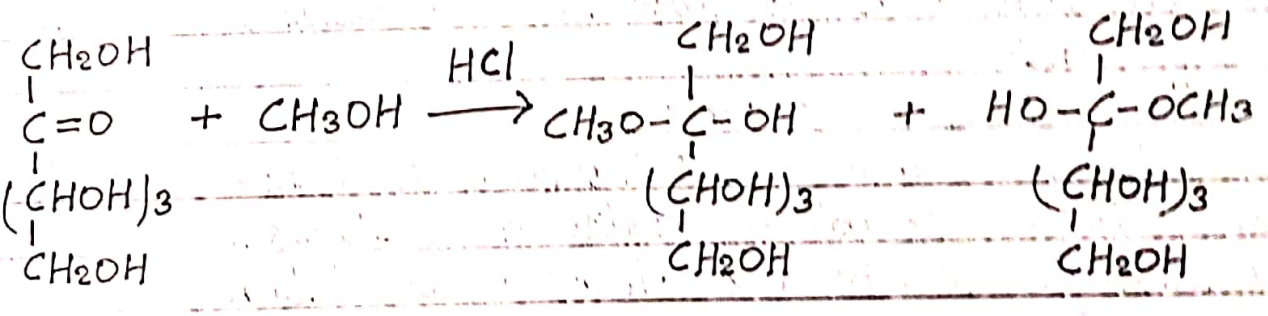
Fructose is a polyhydroxy ketone that is ketohexose. It has five hydroxy group and one ketonic group. It shows characteristics of hydroxy and ketonic gr. The important chemical reactions are given below:

1. Reaction with Acetic anhydride: When fructose reacts with acetic anhydride in the presence of C_2H_5ONa they combine with five mols. of these compounds to give fructose penta acetate.



Fructose — Fructose penta acetate.

2. Reaction with Alcohols: When fructose reacts with methyl alcohol in presence of HCl to give α and ~~β-fructosides~~ β- methyl fructosides.



Fructose

3. Fermentation :- Like glucose, fructose is readily fermented by zymase to give mainly ethyl alcohol and CO_2.

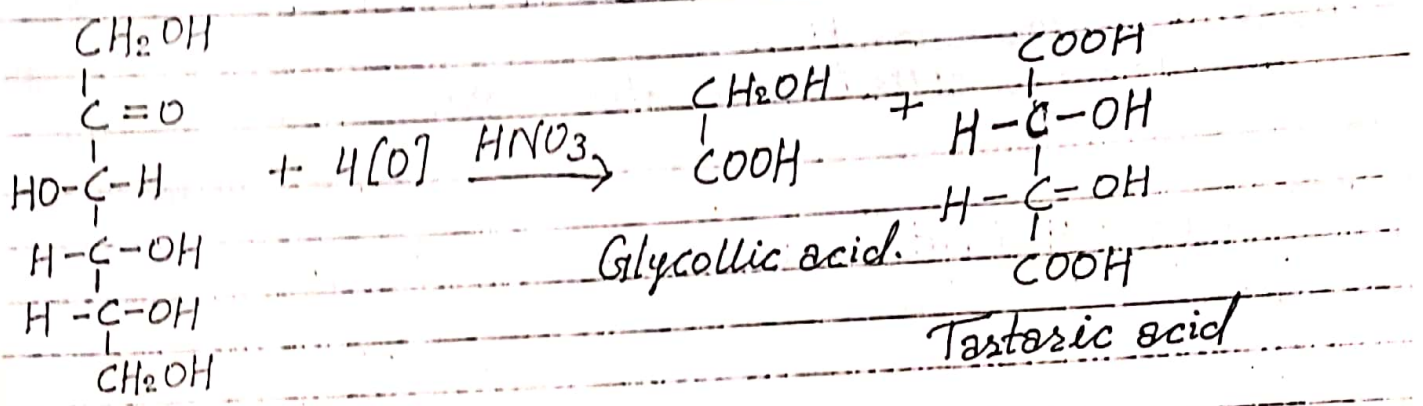
$$C_6H_{12}O_6 \xrightarrow{\text{zymase}} 2C_2H_5OH + 2CO_2 \uparrow$$

Fructose

Chemical Properties:

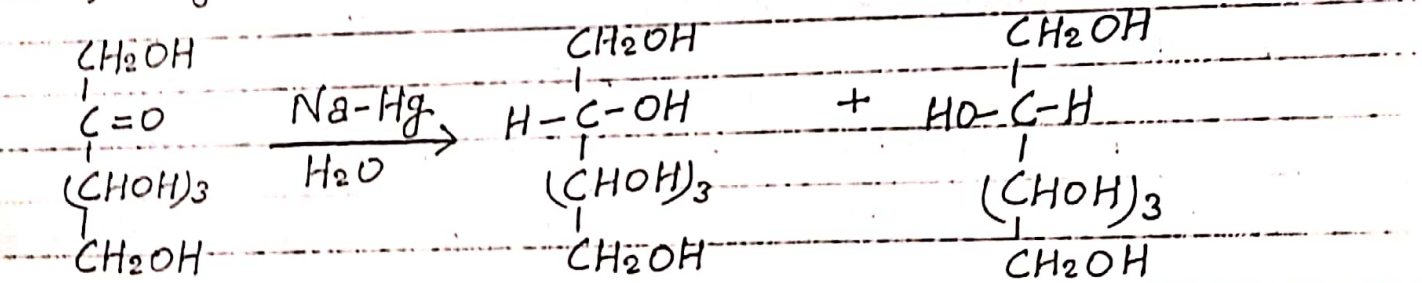
* Reactions characteristics of the open-chain keto form of D-fructose –

(4) Oxidation: D-fructose does not react with mild oxidising agents such as bromine water. With stronger O.A, such as conc. HNO_3, the C-chain is ruptured and a mixture of glycollic acid and tartaric acid is obtained.



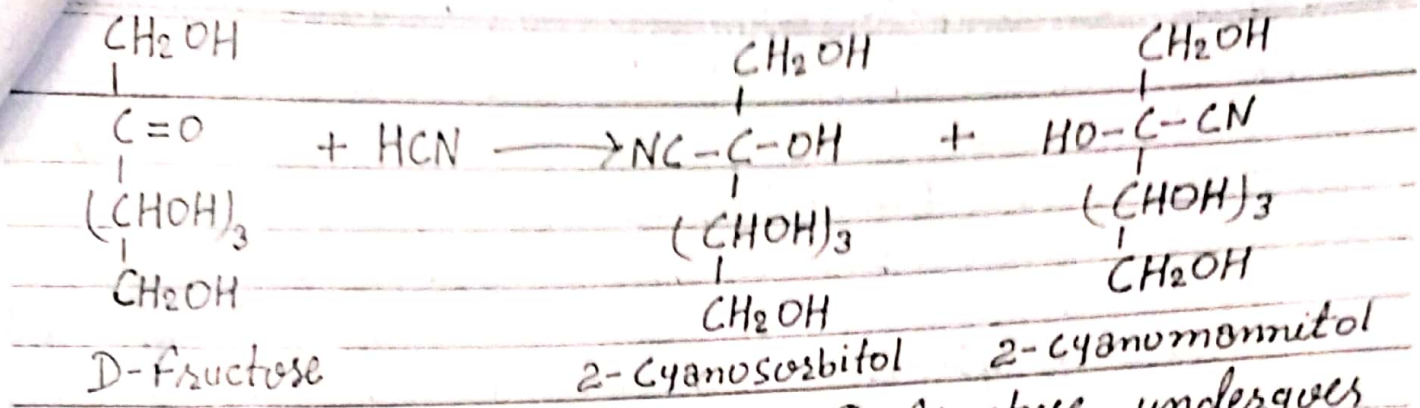
D-fructose — Glycollic acid — Tartaric acid

(5) Reduction: When D-fructose partially reduced with Na-Hg / H_2O produces a mixture of two epimeric poly-hydroxy alcohols, D-Sorbitol and D-mannitol.

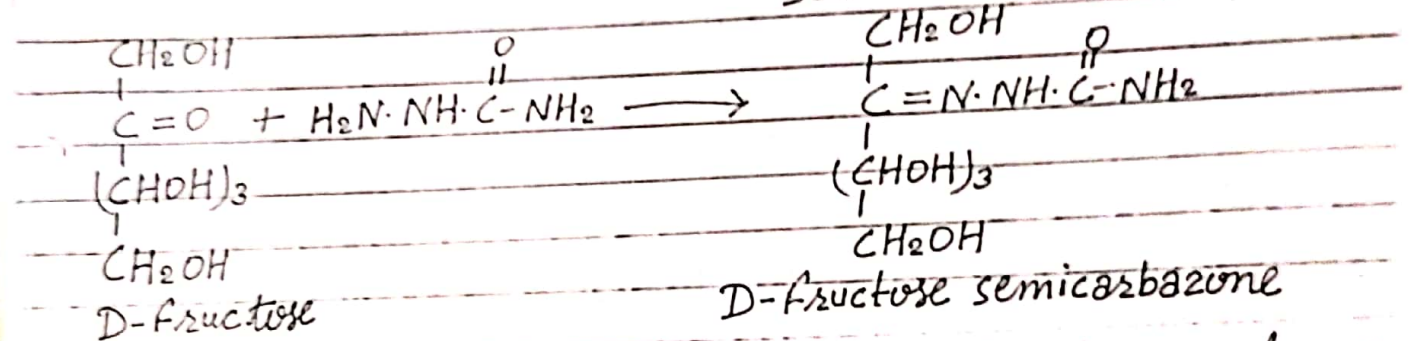


D-fructose — D-Sorbitol — D-mannitol

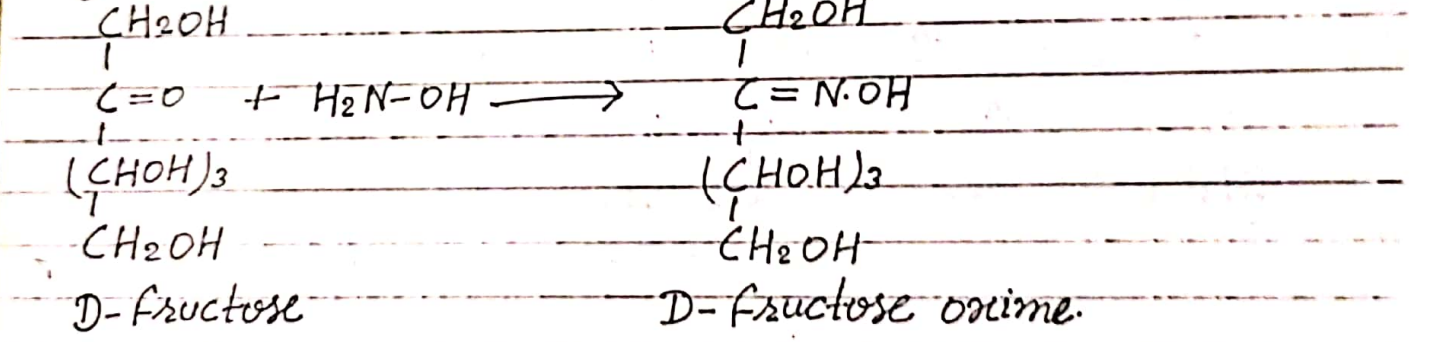
(6) Reaction with HCN: Like other carbonyl compounds fructose reacts with HCN to give ~~phen-fructose cyano hydrins~~ a mixture of two epimeric ~~poly~~ cyanohydrins, cyanoSorbitol and cyanomannitol. Two products are obtained due to the introduction of a new asymmetric centre.



(7) Reaction with Semicarbazide :- D-Fructose undergoes a condensation reaction with semicarbazide to form a semicarbazone called D-Fructose semicarbazone.

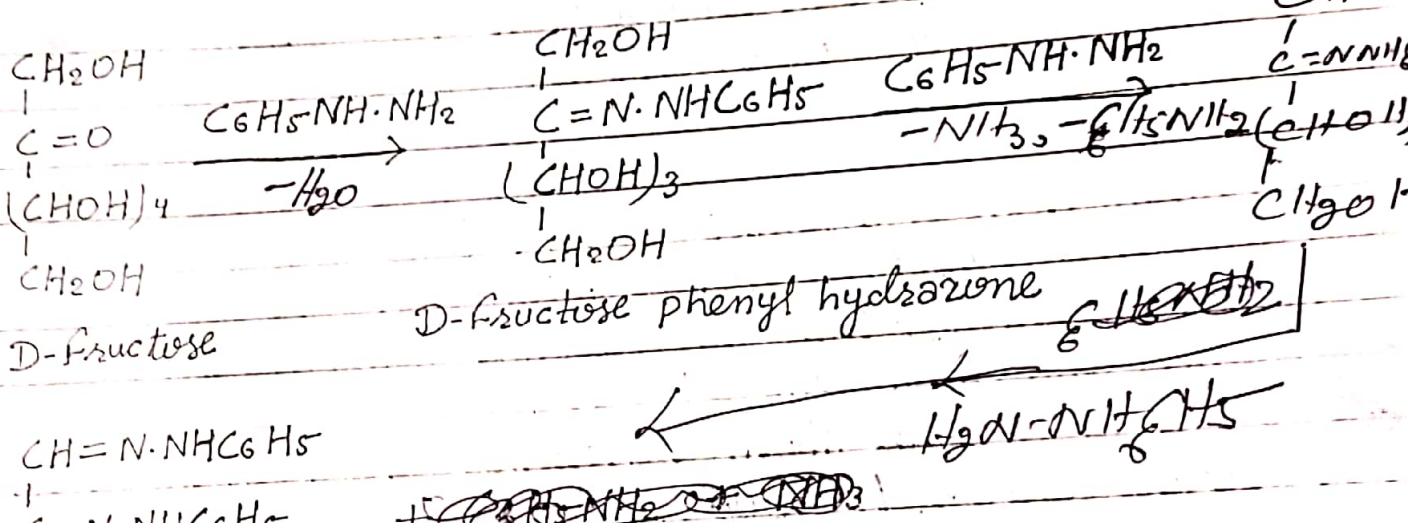


(8) Reaction with hydroxylamine :- D-Fructose undergoes a condensation reaction with ~~semica~~ hydroxylamine to form an oxime called D-Fructose oxime.



(9) Action of Alkalies :- The action of strong alkalies on D-Fructose leads to brown resinous products. However in weakly alkaline solutions it undergoes Lobry de Bruyn van Ekenstein rearrangement to yield a mixture of D-Glucose, D-mannose, and D-Fructose. Under the same conditions D-glucose and D-mannose are converted into the same mixture.

(10) Reaction with Phenylhydrazine :- D-fructose undergoes a condensation reaction with phenylhydrazine to give the soluble D-fructose phenyl hydrazone. However, in the presence of excess phenylhydrazine the phenylhydrazone reacts further to form D-fructosazone, aniline, ammonia



Uses :- 1. Fructose is used as a sweetening agent in confectionary.

2. It is used as a substitute of case for persons suffering from diabetics