GLUCOSE

Glucose is also known as Dextrose because optically active dextro rotatory isomess. It is also called grapes sugar because found in grapes, it is present in honey also. Glucose essential constituents of human blood. The blood normally contains 65-110 mg of glucose per 100 ml (named blood sugar). The level may be much highes in diabetic person. The urine of diabetic person also contain considerable amount of glucose.

Preparation :-

(1) Laboratory method: It is prepared in laboratory by acid hydrolysis of cane sugar in presence of ethanol.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{H^+} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

HCl is used for hydrolysis of glucose being much soluble in alcohol than fructose which is separated by crystallizing or cooling.

(2) Glucose is also obtained from starch in a large scale. Starch came from corn or potato with dil. H_2SO_4.

$$(C_6H_{10}O_5)_n + nH_2O \xrightarrow{H^+} (C_6H_{12}O_6)_n$$

Physical propesties :-

(1) It is colourless, crystalline solid.
(2) Melting point 146°C.
(3) Absolutely soluble in water.
(4) It is less sweet (3/4) than cane sugar.
(5) It is optically active and ordinary naturally occuring from (+) glucose or dextro form. It shows mutarotation.

Mutarotation :- Glucose exist in two stereo isomeric form such as α and β-glucose. α-glucose with specific rotation +110° is obtained by crystallizing

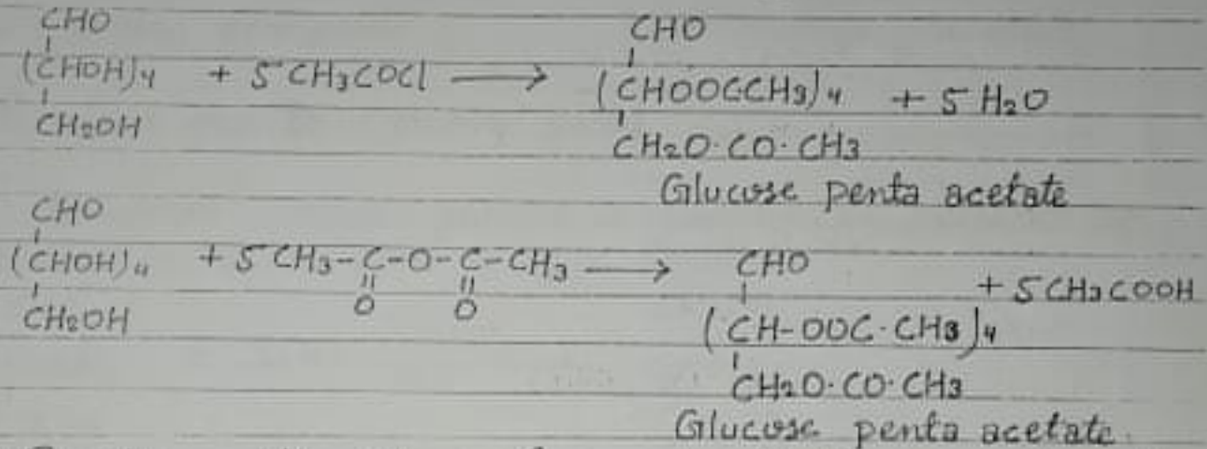
glucose from alcohol and acetic acid solution. Whereas β-glucose with specific rotation +19.7° is obtained by crystallizing glucose from pyridine solution.

In aq solution of glucose shows mutarotation because its specific rotation gradually decreases from +110° to 52.5° in case of α-glucose and increases from +19.7° to +52.5° in case of β-glucose.

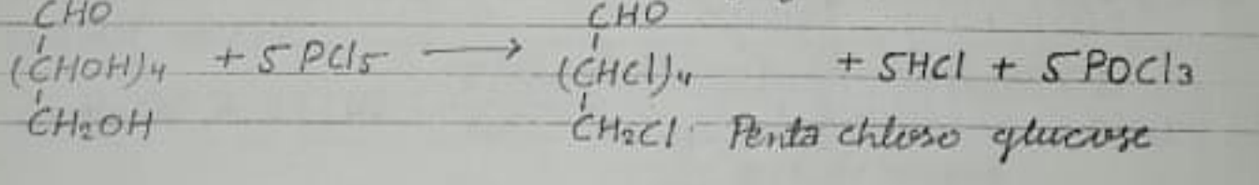
Chemical properties :

Glucose is a polyhydroxy aldehyde that is the Aldohexose. It has five hydroxy group and one aldehydic group. It shows characteristics of hydroxy and aldehydic group.

(i) Reaction with Acetyl chloride and Acetic anhydride :- When glucose reacts with acetyl chloride and acetic anhydride. They combine with five mols. of these compounds in presence of $ZnCl_2$ to give glucose penta acetate.



(ii) Reaction with PCl_5 :- Five mols of PCl_5 reacts with glucose to give glucose penta chloride which is indicated that glucose mol. have five hydroxy group.



(3) Reaction with metallic hydsoxides :- Glucose is a weak acid and reacts with base (metallic hydsoxide) to form metallic glucosate which is soluble in water.

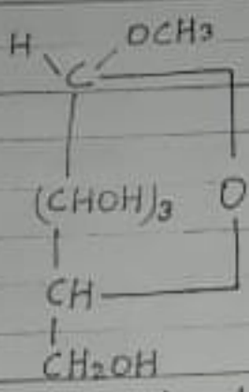
$C_6H_{11}O_5-OH + HO-Ca-OH \longrightarrow C_6H_{11}O_5-O-CaOH + H_2O$

Calcium glucosate

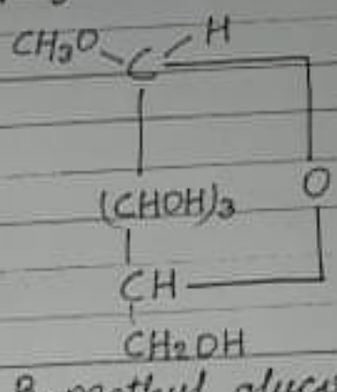
(4) Formation of Glucosides :- When glucose reacts with methyl alcohol in presence of HCl to give α- and β- methyl glucosides.

$C_6H_{11}O_5-OH + CH_3OH \longrightarrow C_6H_{11}O_5-O-CH_3 + H_2O$

Methyl glucosides



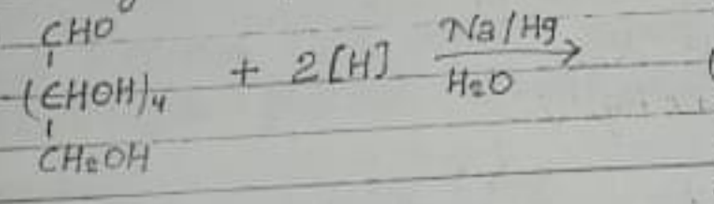
α- Methyl glucosiele



β- Methyl glucosiele

Reaction due to Carbonyl group :

(5) Reduction :- When glucose is reduced in presence of Na/Hg in aq. solution to give Sorbitol.



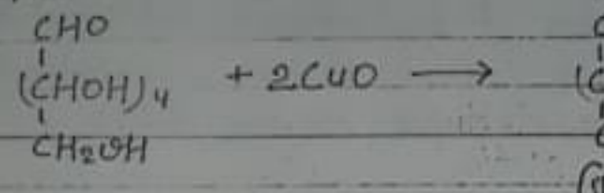
On prolonged heating with conc. HI and red phosphorous at 110°C. Glucose forms a mixture of 2-Iodo hexane and normal hexane.

2-Iodo hexane

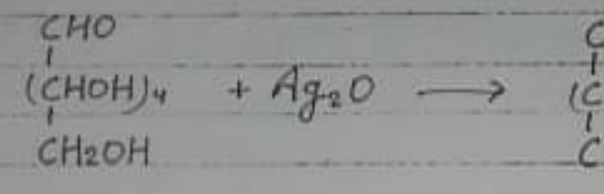
$CH_3-\underset{\underset{I}{|}}{CH}-(CH_2)_2-CH_3 + 2[H] \xrightarrow{-HI} CH_3CH_2CH_2CH_2CH_2CH_3$

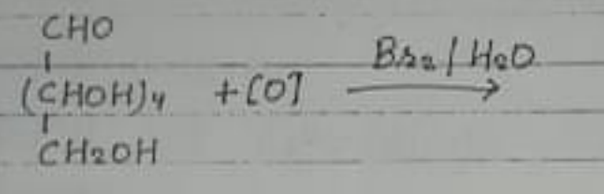
Normal hexane

(6) Oxidation :- Glucose undergoes readily oxidised with various oxidising agent like fehling solution, tollen's reagent and Br_2/H_2O give gluconic acid with different product.

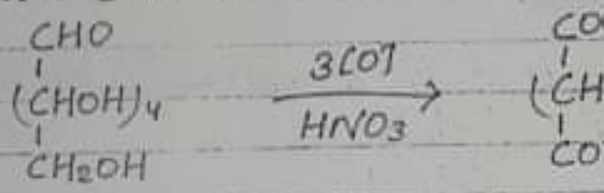


Gluconic acid



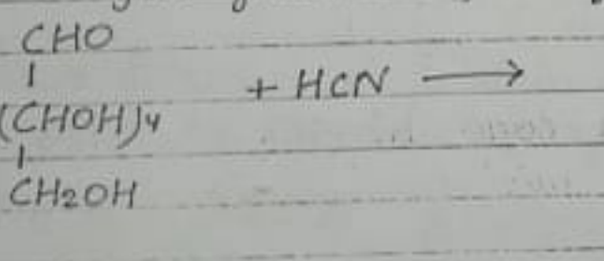


In presence of strong oxidising agent glucose oxidised into saccharic acid.



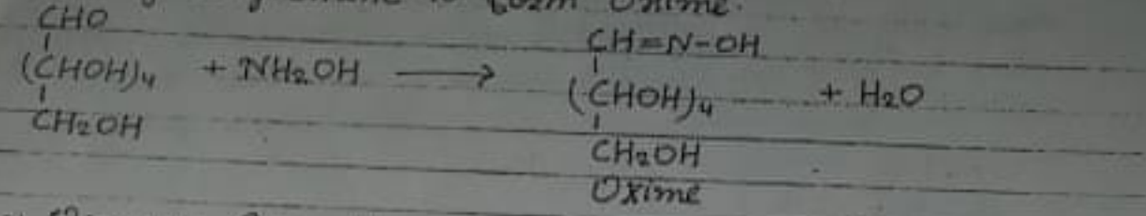
Glucaric acid

(7) Reaction with HCN :- When glucose reacts with HCN to give glucose cyanohydrine.



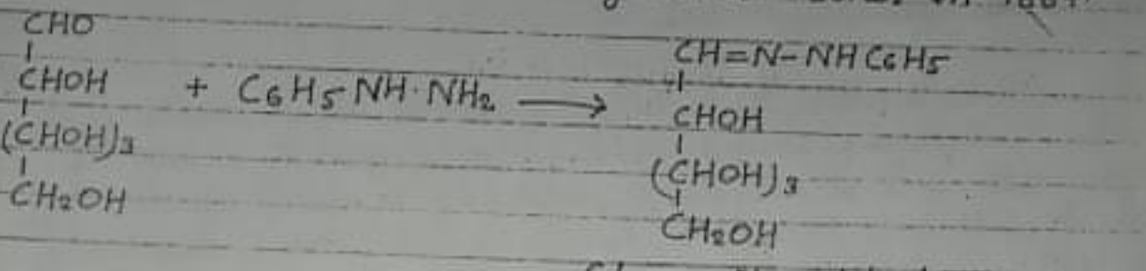
Glucose cyanohydrine

(8) Reaction with hydroxylamine :- When glucose reacts with hydroxylamine to form Oxime.

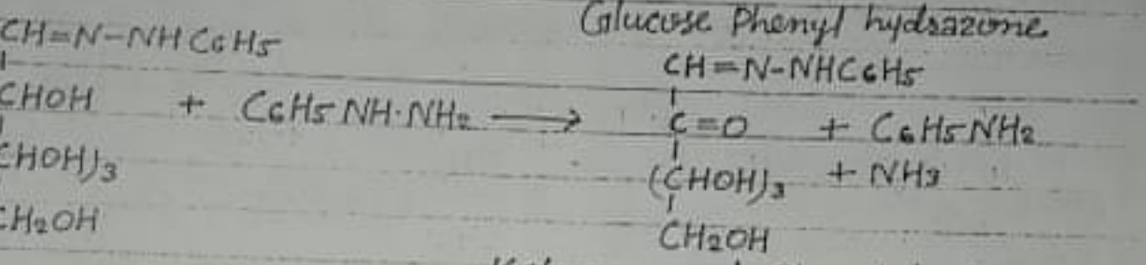


Oxime

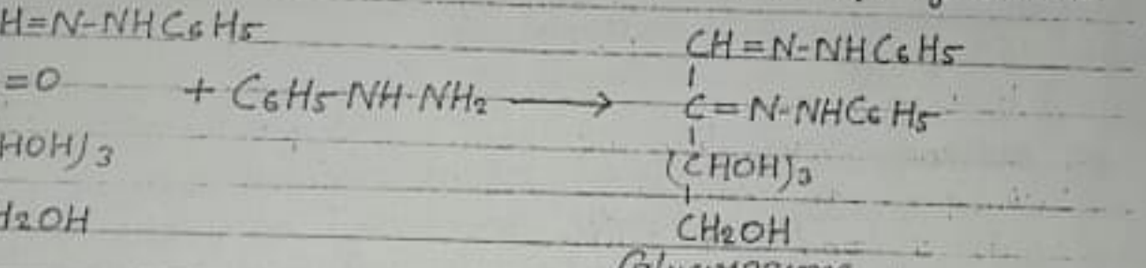
(9) Osazone Formation :- When three mols of phenyl hydrazine reacts with glucose to give glucosazone. This reaction was discovered by Emil Fisches in 1887.



Glucose Phenyl hydrazone



Keto comp. of Phenyl hydrazone

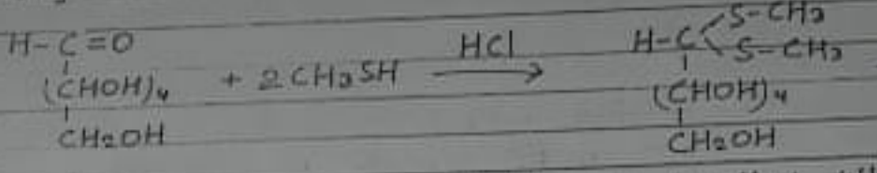


Glucosazone

(10) Fermentation :- A solution of glucose is readily fermented by enzyme. Zymage to form ethanol and CO_2.

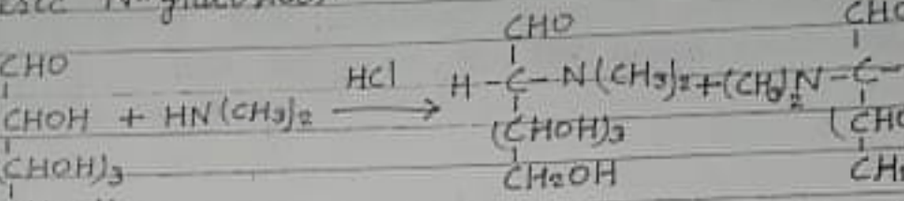
$$C_6H_{12}O_6 \xrightarrow{\text{Zymage}} 2C_2H_5OH + 2CO_2$$

(iii) Reaction with thiols :- D-Glucose reacts with thiols to form dithioacetals. When D-Glucose is treated with methane thiol in the presence of an acid, it forms dimethyl dithioacetal.



D-glucose dimethyl dithioacetal

(iv) Reaction with amines (N-Glucoside formation) :- Instead of giving schiff's base amine condense with glucose to form N-glucosides analogous to the ordinary glucosides from alcohols. Thus D-Glucose reacts with dimethylamine in the presence of an acid to form two isomeric N-glucosides.



N-Dimethyl α-D-Glucoside

N-Dimethyl β-D-Glucoside.

Uses :-

1. In the preservation of fruits and preparation of vinegar, in flavouring syrups, jellies.
2. As a food for patient.
3. In the form of calcium glucosate as a medicine in treatment of calcium deficiency.
4. Industrial preparation of Vitamin C
5. In the processing tobacco.