14/12/21

Reactions of Monosaccharides

Cont....

6) Osazone formation

Monosaccharides when treated with phenyl hydrazine form osazones

Eg Glucose + phenyl hydrazine $\xrightarrow{CH_3COOH}$ Glucohydrazone

Glucohydrazone $\xrightarrow{\text{phenyl hydrazine}}$ Glucosazone

7) Formation of Esters

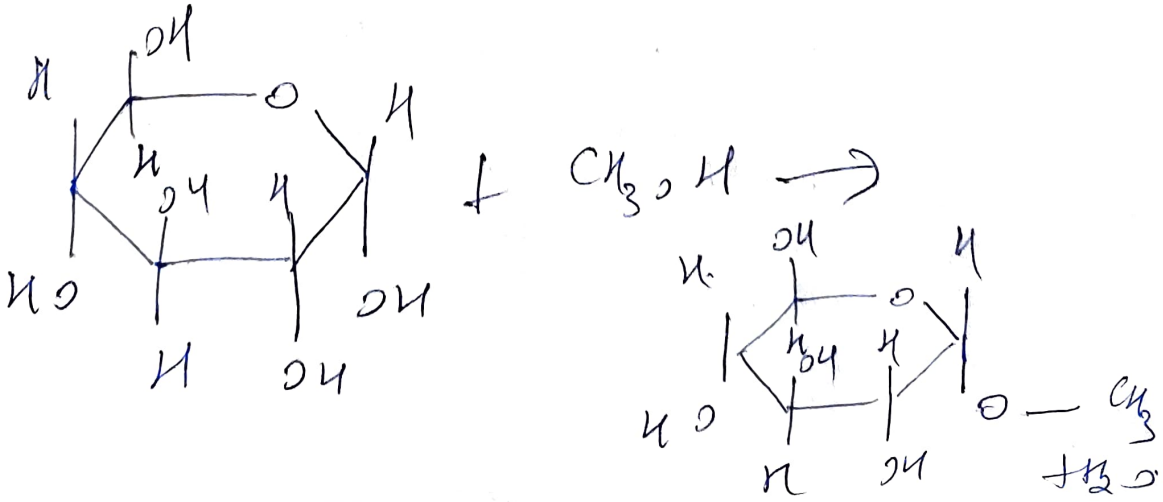
→ The alcoholic groups of monosaccharides may be esterified by non-enzymatic or enzymatic reactions.

Eg Glucose + phosphoric acid → Glucose 6 phosphate.

8) Glycoside formation

→ Glycosides are formed when the hemiacetal or hemiketal hydroxyl group of anomeric carbon of a carbohydrate reacts with a hydroxyl group of another carbohydrate or non carbohydrate.

→ The bond so formed is known as glycosidic bond and the non carbohydrate moiety (when present) is referred to as aglycone.)



Eg Cardiac glycosides

Digoxin, Digitoxin

Amino glycosides - eg streptomycin

Derivatives of Monosaccharides

There are several derivatives of monosaccharides, some of which are physiologically important

They are

1) Sugar acids
2) Sugar alcohols
3) Alditols
4) Amino sugars
5) Deoxy sugars
6) L ascorbic acid

(1) Sugar acids

→ Oxidation of aldehyde or primary alcohol group in monosaccharides results in sugar acids

Eg Gluconic acid is produced from glucose by oxidation of aldehyde (C1 grp) whereas glucaronic acid is formed when primary group (C6) is oxidized

2) Sugar alcohols

→ They are produced by reduction of aldoses or ketoses

Eg. Sorbitol is formed from glucose
Mannitol is formed from Mannose

3) Alditols

→ The monosaccharides, on reduction yield polyhydroxy alcohols

Eg Ribitol is a constituent of flavin coenzymes

glucerol and myo-inositol are components of lipids

4) Aminosugars

→ When one or more hydroxyl groups of the monosaccharides are replaced by amino groups the products formed are aminosugars

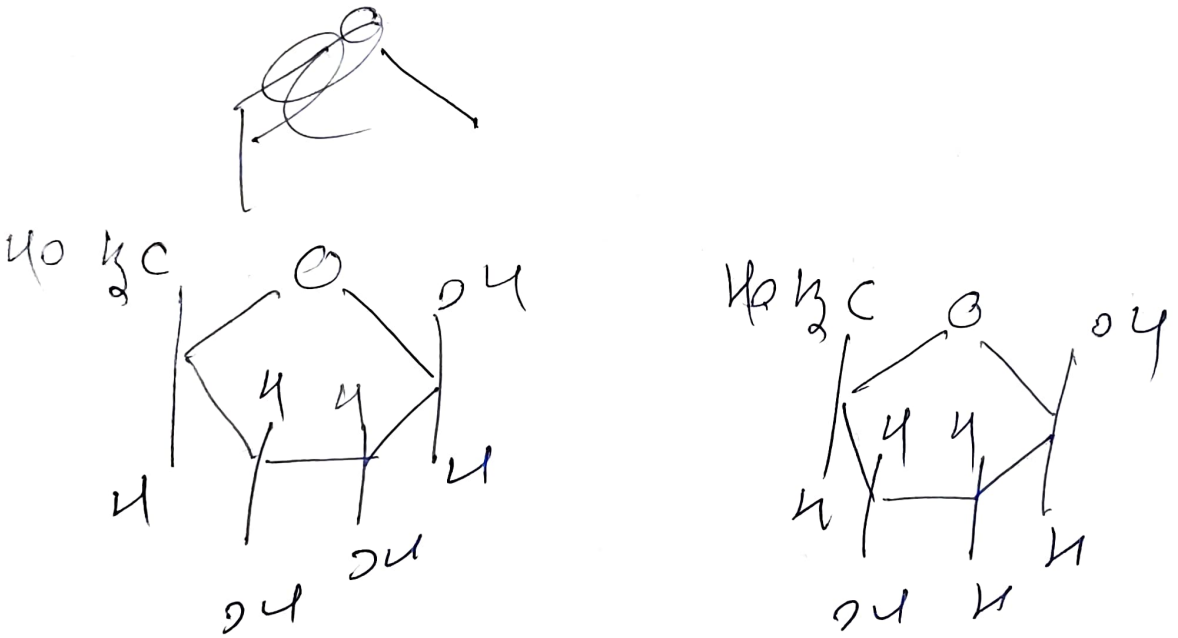
Eg. D-glucose → D-glucosamine.

D-galactose - D-galactosamine

→ They are present as constituents of heteropolysaccharides

5) Deoxy sugars

→ These are the sugars that contain one oxygen less than that present in the parent molecule



Ribose

6. ~~Ascorbic acid~~

Disaccharides

→ Disaccharides consists of two monosaccharide units (similar or dissimilar) held together by a glycosidic bond

→ They are crystalline, water soluble and sweet to taste

They are of two types

1. Reducing Sugars — Disaccharides with free aldehyde or ketogroup

Eg Maltose

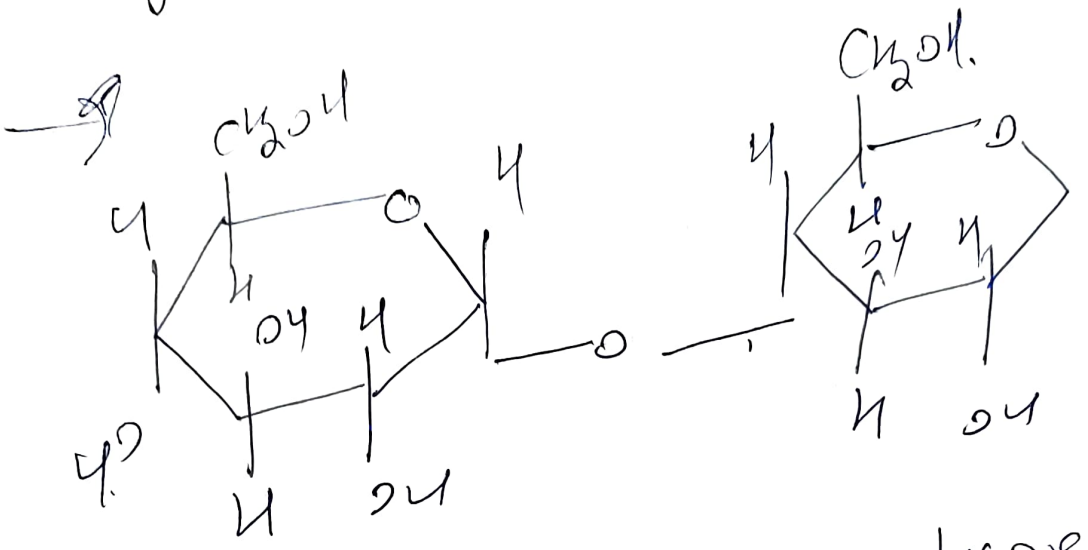
2 Non-Reducing — Disaccharides with no free aldehyde or ketogroup

Eg Sucrose.

① Maltose.

→ Maltose is composed of two α-D-glucose units held together

by a 1-4 glycosidic bond -



Glucose

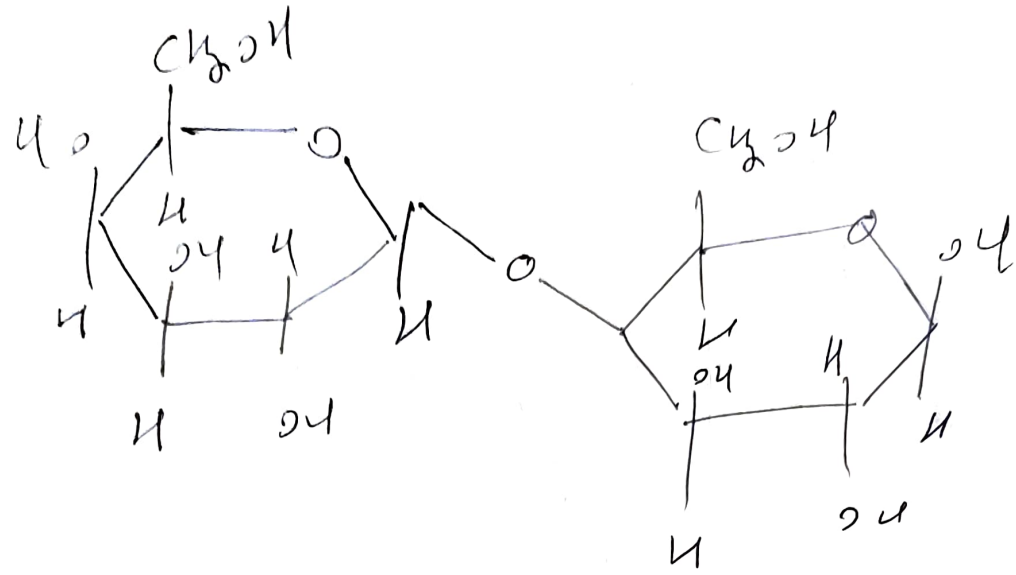
Glucose

Maltose

2. Lactose

→ Lactose is more commonly known as milk sugar since it is the disaccharide found in milk.

→ Lactose is composed of β-D-galactose and β-D-glucose held together by β(1-4) glycosidic bond



Lactose.

Sucrose (Cane Sugar)

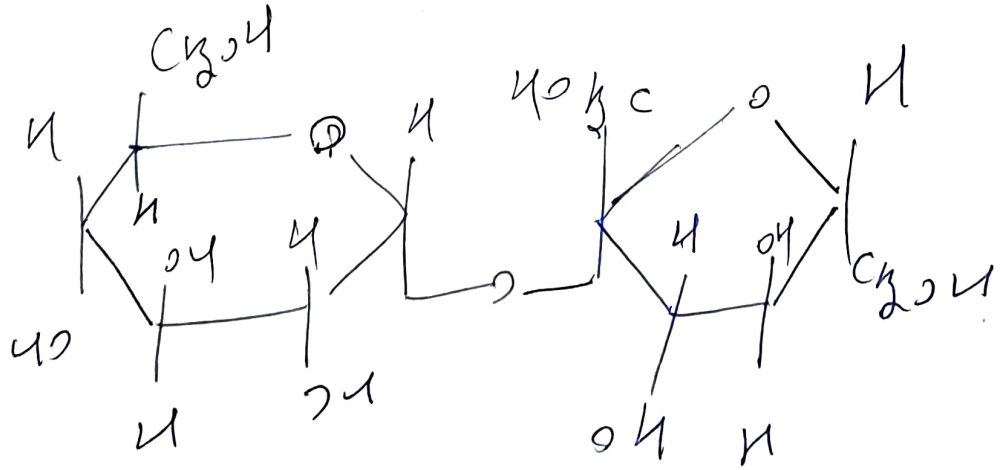
→ Sucrose is the sugar of Commerce

→ Sucrose is made up of α-D-glucose and β-D-fructose

→ The two monosaccharides are held together by a glycosidic bond ($\alpha_1 - \beta_2$) between C_1 of α-glucose and C_2 of β-fructose

→ The reducing groups of glucose and fructose are involved in glycosidic bond, hence sucrose is a non-reducing sugar,

→ The intestinal enzyme (sucrase) hydrolyses to glucose and fructose which are absorbed



α-glucose. β-D fructose

Sucrose

Inversion of Sucrose

→ Sucrose as such dextrorotatory. $(+66.5^{\circ})$

→ But when hydrolysed, Sucrose become levorotatory (-28.2°).

→ The process of change in optical rotation from dextrorotatory (+) to levorotatory (−) is referred to as inversion.

→ The hydrolysed mixture of ~~glucose~~ Sucrose containg glucose and fructose, is known as Invert Sugar