C H_2O

Carbohydrates

large

Macromolecules

It's Formula is $(C_n H_2O)_n$ $n \geq 3$

The simplest one is $C_3H_6O_3$

① MonoSaccharides

=> Glucose } doesn't need digestion
=> galactose
=> fructose

② Diasaccharide

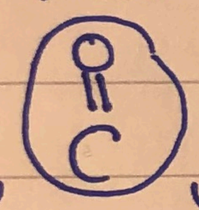
=> Sucrose
"Glucose + Fructose" need digestion

group

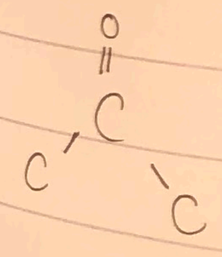
PolySaccharide

=> Stareh } Plants
=> Cellulose
=> glycogen } animals

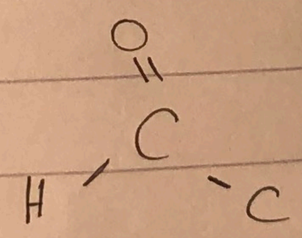
A Carbohydrate must Contain a Carbonyl group



- IF it was in the middle it's a Ketone



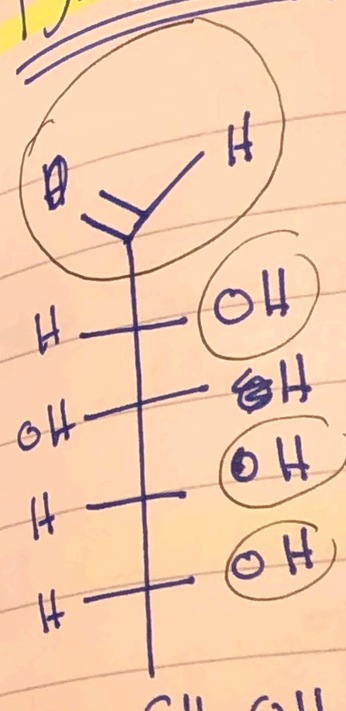
- IF it was at the edge it's an Aldehyde



Numbers

=> mono ①
=> Dia ②
=> Tri ③
=> Tetra ④
=> Penta ⑤
=> hexa ⑥
=> hebta ⑦
=> octa ⑧
=> nona ⑨
=> dcea ⑩

D-glucose.



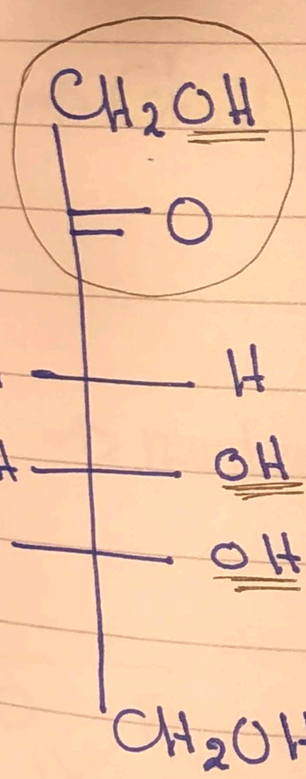
most of the OH are on the right side so it's Dextro-glucose

=> grape, blood Sugar

=> More glucose in the blood Causes Diabetes

=> The Carbonyl is at the edge So it's an Aldose, The number of C is 6 So it's hexo

=> hexoaldose / aldohexose



D-Fructose

=> Fruit Sugar

=> The Carbonyl group is in the middle so it's a Ketose, The number of C is 6 So it's hexo

=> hexoKetose / aldohexose

They are both hexoses because they contain 6 Carbons.

Isomerization

=> Same molecular formula
diffrent chemical structiores.

1. Constitutional (Structural)

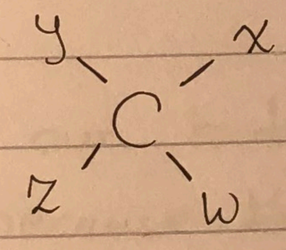
question { => Atoms are binded together in differeut ways Such as "glucose and fructose"

2. Stereoisomers (Spatial isomers)

=> The Same atomic Connectivity
differ in the Configuration of atoms in the Space

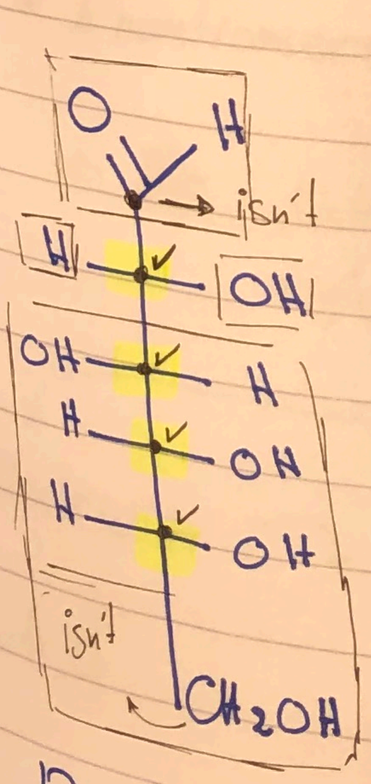
=> نفس التوصيل الذري ولكن يختلفان في الفضاء، فلا يتطابقان

=> Chiral Carbon :



=> Carbon which is attached with a 4 different groups

=> number of Stereoisomer is 2^{n} → number of chiral Carbon



D- glucose

How many Chiral Carbons Does D-fructos Contain?

(4)

So it Can make 2^{4} Stereoisomer

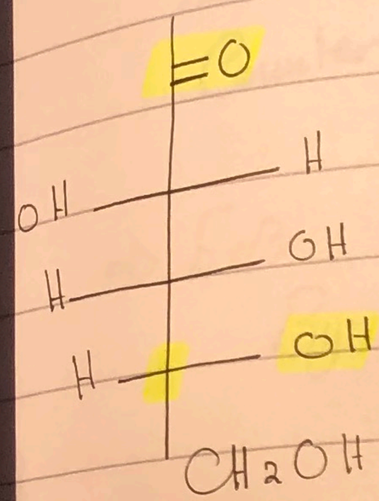
" Note that the firs C is attached to only 3 groups and the last is attached to 2 H "

D/L Monosaccharides

Dextro, levo لتحديد ما إذا كان الجزيء

=> تنظر إلى أبعد ذرة كيرالية عن المجموعة الوظيفية

وتنظر إلى OH



D-fructose

Dextro / levo

يمين يسار

=> one type of the Stereoisomers is the Enantiomers

- Two Stereoisomers that are a mirror images to each other but aren't superimposable.

=> The natural Sugar in our bodies is D-isomers, because they are " the biologically active form "

- Enantiomers are optically active

=> Note that not all dexros are going to turn right and levos to the left !!

Clockwise

+ d

Counter Clockwise

- L

=1> If one enantiomer rotates the light clockwise the secoued enantiomer is going to rotate counter clockwise

=1> Exp.

By Chance, it was found that D-Glucose is dextorany rotater. So, the L-glucose is levotory.

D-glyceraldehyde =1> dextrorotatory
D-Fructose =1> levorotatory
D-Glucose =1> dextrorotatory

- Dextrose =1> D-glucose } imp
- ~~Key~~ Laevulose =1> D-fractose }

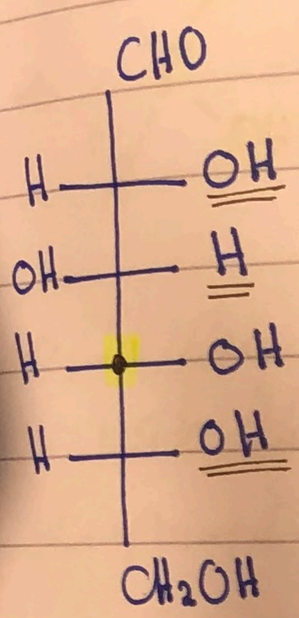
=1> Note:

imp { 50% Levorotatory + 50 % clextrorotatory "Racemic mixture"
= no rotation
"no polarization"

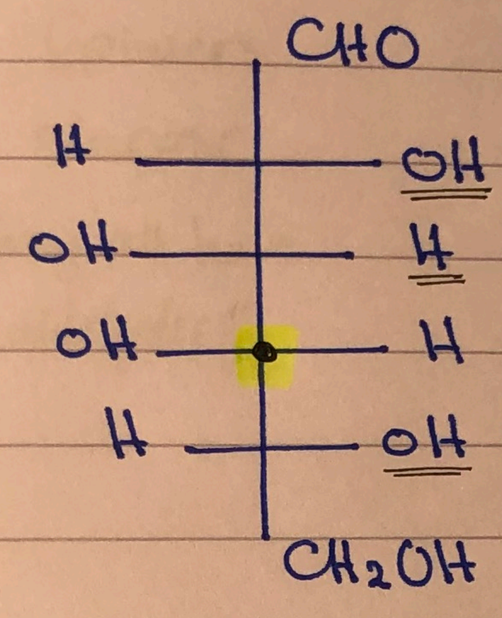
Another type of Stereoisomers is the

Epimers

It differs in the Configration of atoms at only one Chiral Center "not mirror image isomers"



D-glucose



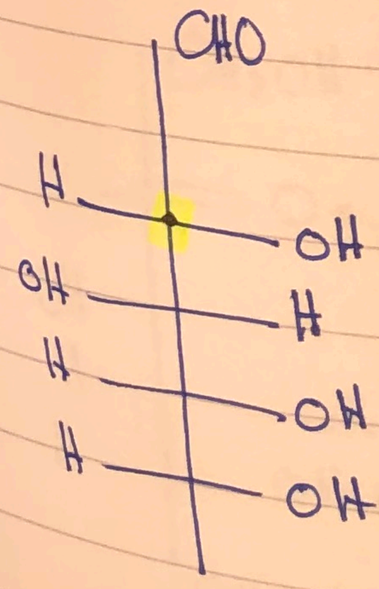
D-galactose

⇒ Only one Chiral Carbon is Changed

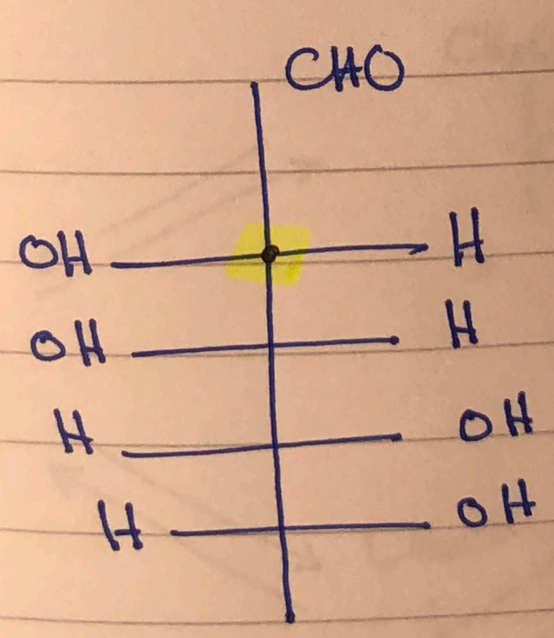
Epimers.

- The relationship between glucose and galactose is that they are Epimers
- They aren't mirror images to each other

They differ in C_4



D-glucose



D-mannose

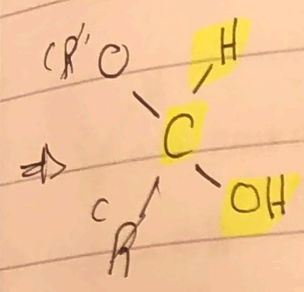
- glucose and galactose are C_4 Epimers

glucose and mannose are C_2 Epimers.

They differ in C_2

aldehyde

OH + Aldehyde
= hemiacetal



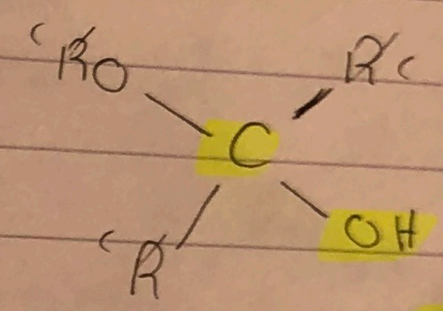
=> It can occur inside the same compound or suger

So we can pretend that the glucose will have a hemiacetal "it contains Aldehyde"

mannose & galactose are Epimers of glucose "They all have aldelydes"

Ketone

OH + Ketone
= hemiKetal

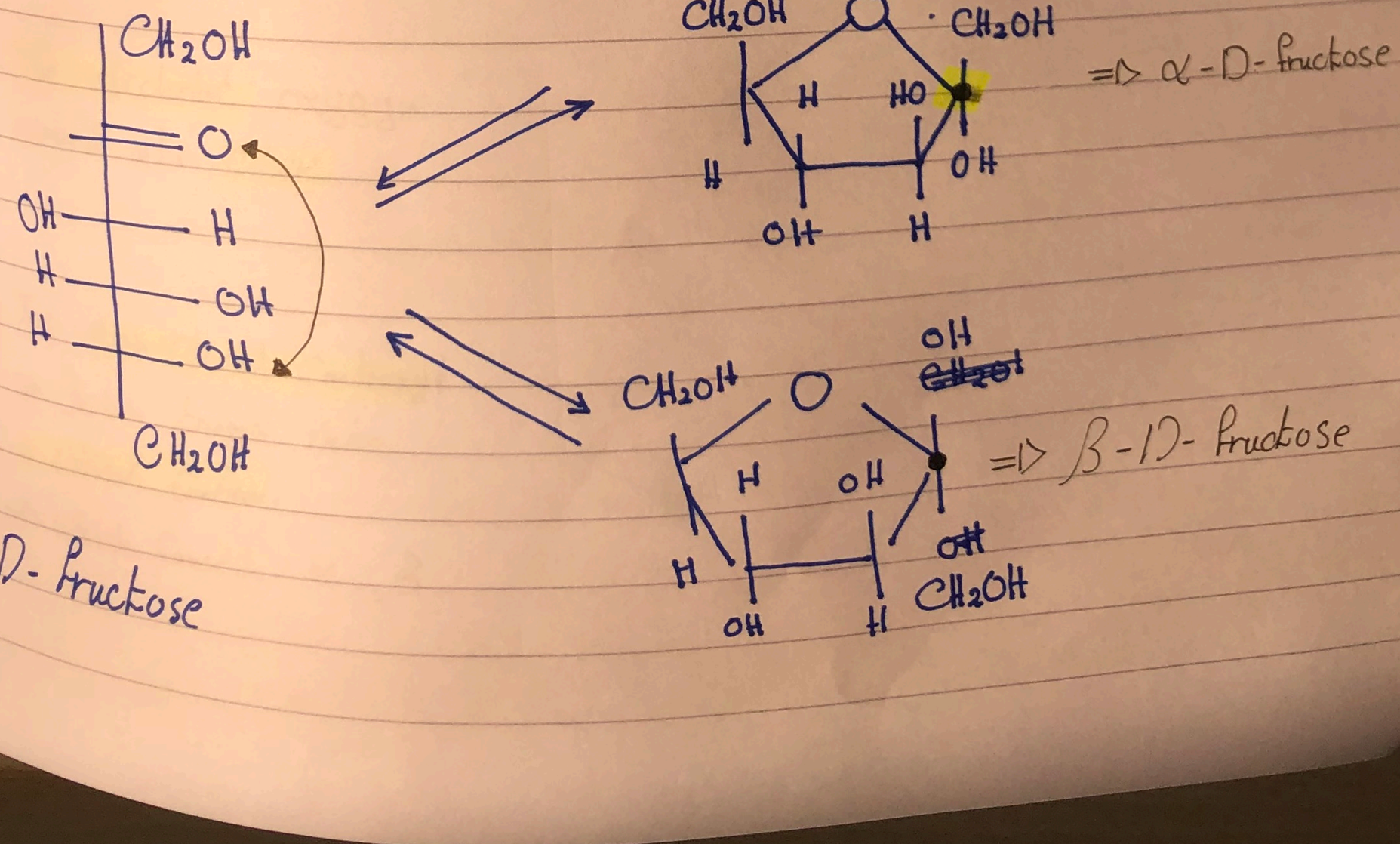


fructor

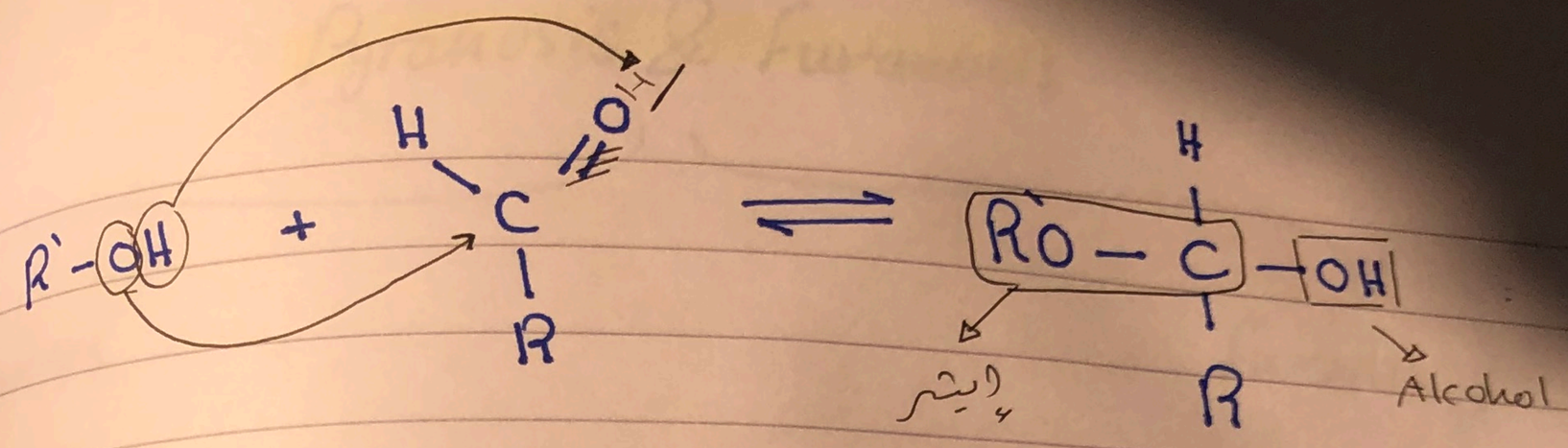
=> We can pretend ✱ will have hemiKetal "it contains a Keton"

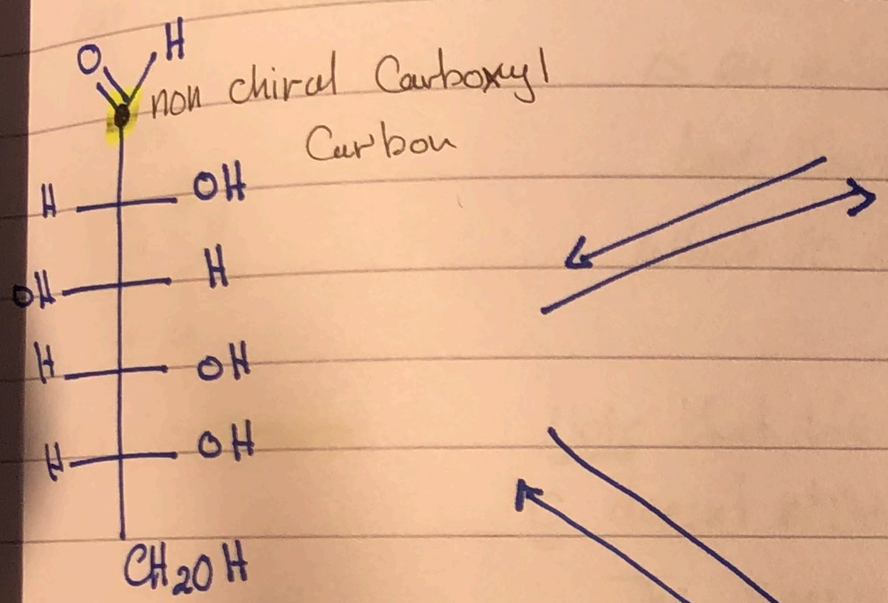
OH
"β"

OH
"α"

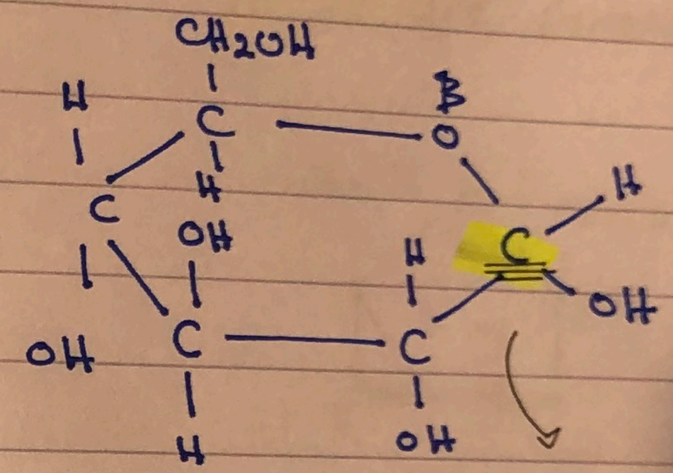


D-fructose



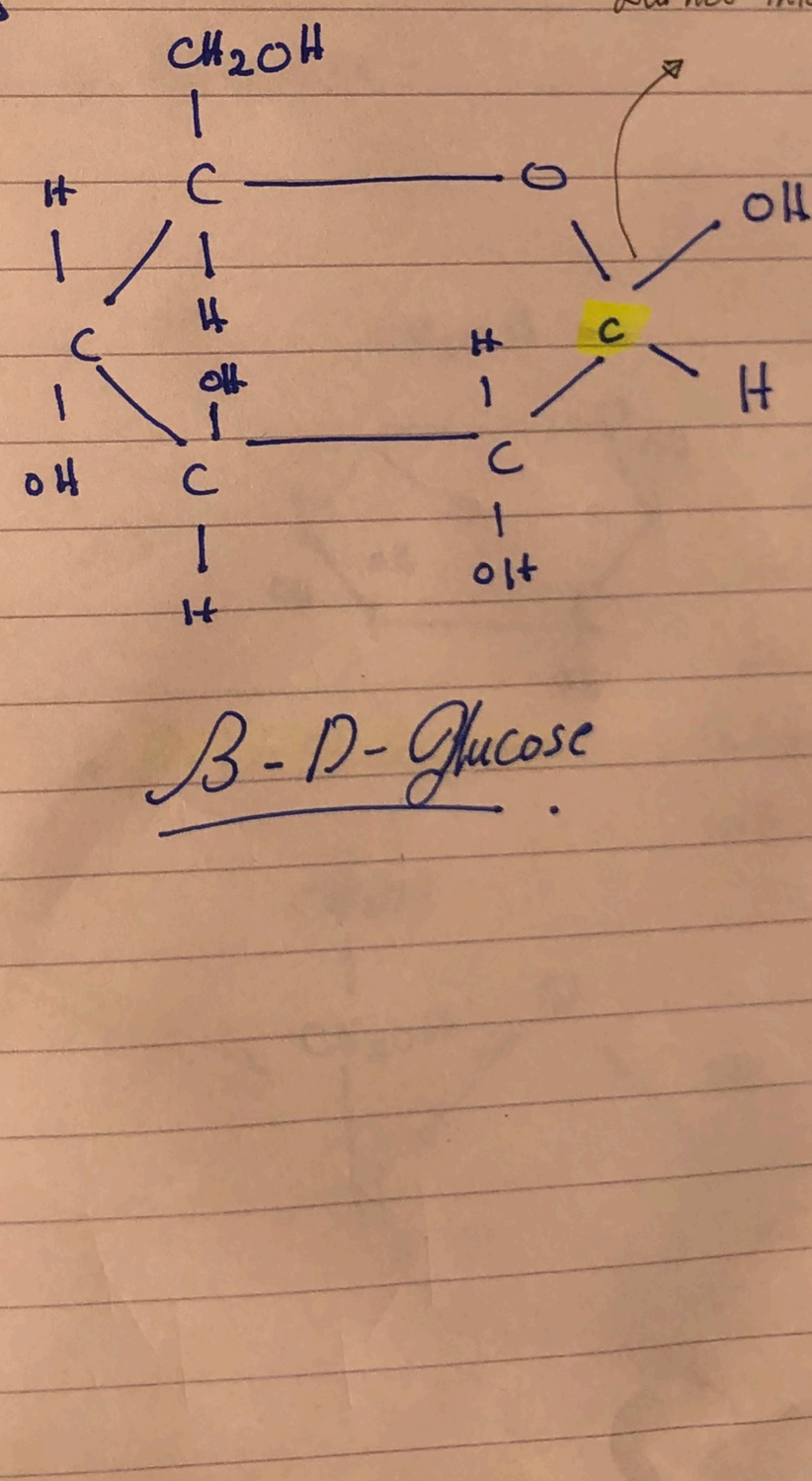


D-glucose



α-D-glucose

The non Chiral Carboxyl Carbon turned into a Chiral one



β-D-glucose.

=I> The Carbonyl oxygen Turned into alcoholic hydroxyl group.

=I> The alcoholic oxygen turned into ether

=I> The non Chiral Carboxyl Carbon turned into a Chiral Carbon.

=I> Which Caused α, β