Nishant Jindal

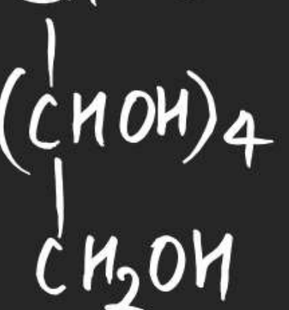
Monosaccharides (Glucose)

$\Rightarrow$ M.F. $C_6H_{12}O_6$

$\Rightarrow$ Aldohexose

$\Rightarrow$ $(\alpha \text{ or } \beta)$ Glucose $= +52.7^\circ$

$\Rightarrow$ dextrose



(#) Rxn with Red P/HI :-

Glucose $\xrightarrow[HI]{\text{Red P}}$  (n-Hexane)

[Acyclic str of Glucose]

$\Rightarrow$ Confirm presence of 6 Carbon straight chain.

(#) Rxn with Acetyl chloride :-

Glucose $\xrightarrow[\text{Excess}]{\text{  }}$ Product (mol wt = 390)

No. of –OH group $= \frac{390-180}{42} = 5$

$\Rightarrow$ Confirm presence of "5" OH group.

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(#) Facts supporting Cyclic form of Glucose :

(i) No Rxn of Glucose with NH_3

(ii) No Rxn of Glucose with $NaHSO_3$

(iii) No Rxn of Glucose with Schiff's Regent

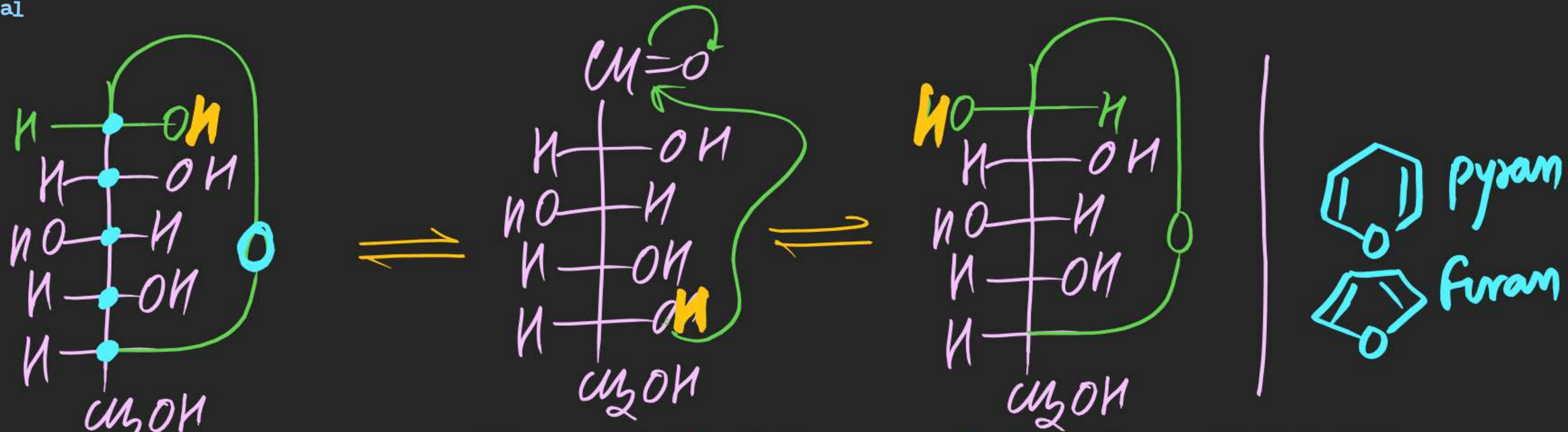
} Confirm No free $-C(=O)-H$ group

(iv) Glucose $\xrightarrow[\text{Excess}]{\text{mIng}}$ Glucose penta Acetate $\xrightarrow[\text{or } HCN]{NH_2OH}$ No Rxn

} Cyclic Glucose without $-CHO$ group

(v) Crystallizes in two different forms.

- α-Glucose
- β-Glucose



α-D-Glucopyranose (I)

D-Glucose (II)

β-D-Glucopyranose (III)

I & II ⇒ Ring-chain Tautomers

II & III ⇒ Ring-chain Tautomers

I & III ⇒ Anomers

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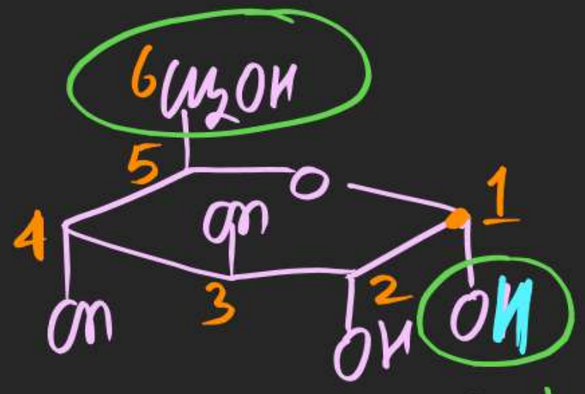
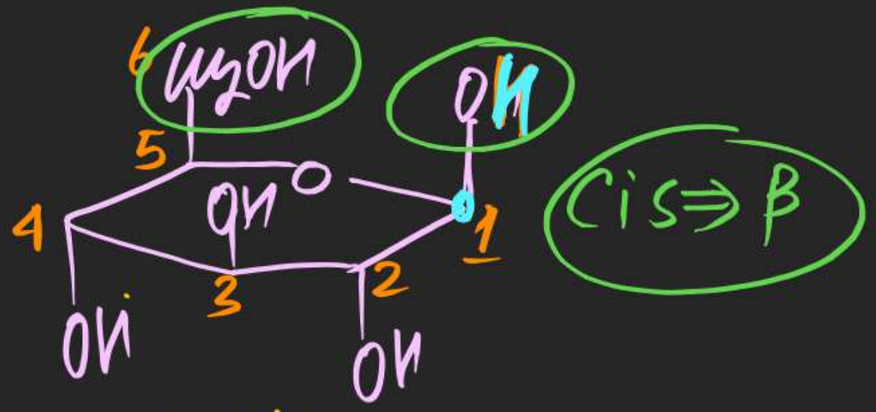
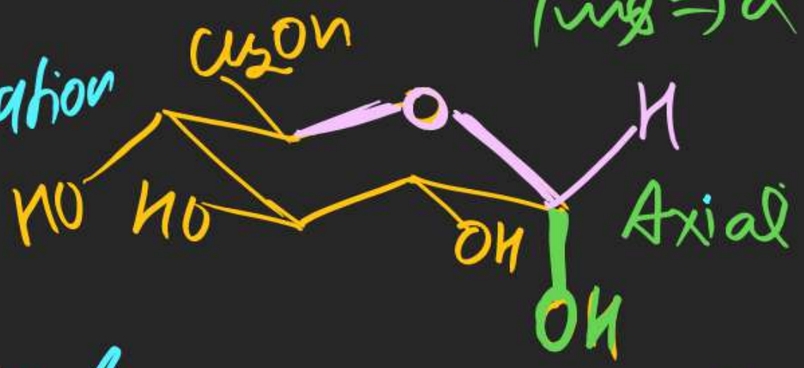
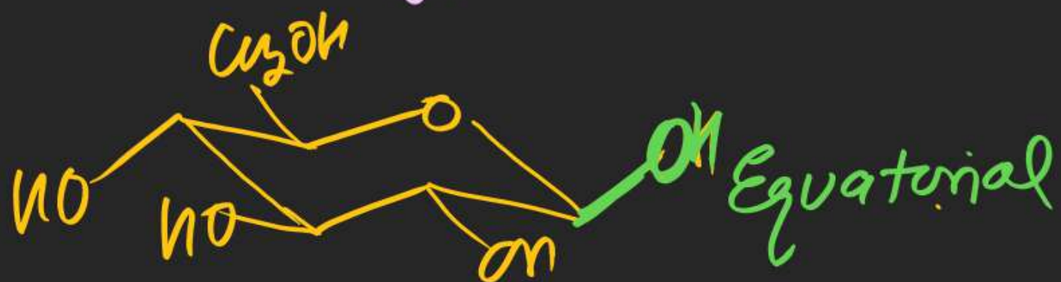
Haworth Projection





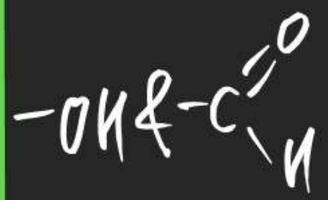
Chair Conformation

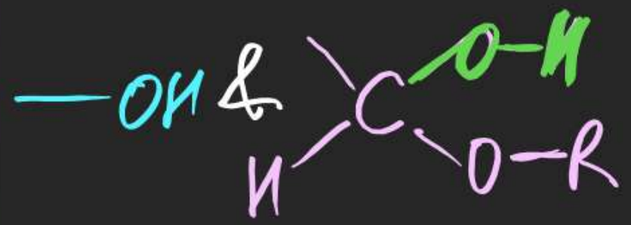




Functional Group

Hemiacetal





Hemiacetal

%	36%	0·2%	63·8%
(α_{obs})	112°		19°

$$\alpha_{obs} = 0.36 \times 112^\circ + 0.638 \times 19^\circ$$

$\therefore$

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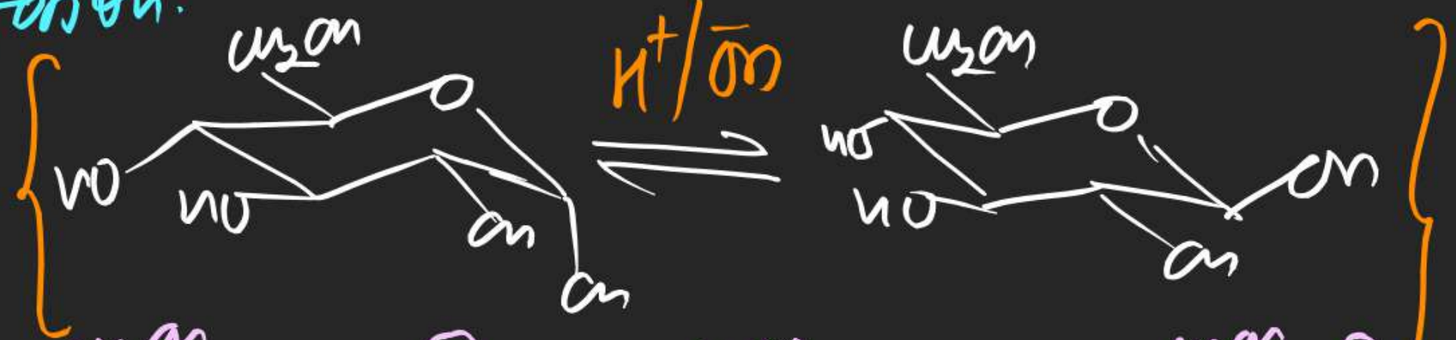
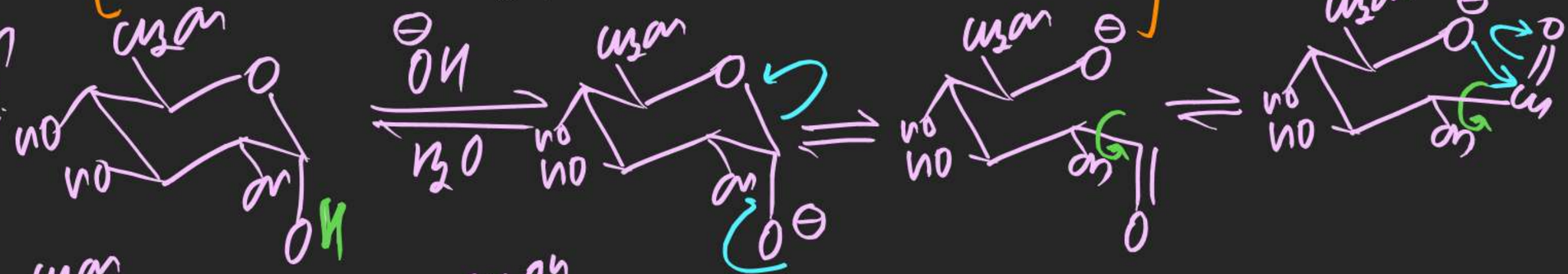
Mutarotation: Mutual change in angle of Rotation or Conversion of α-Form into β or β into α is known as mutarotation.



Mech^n:



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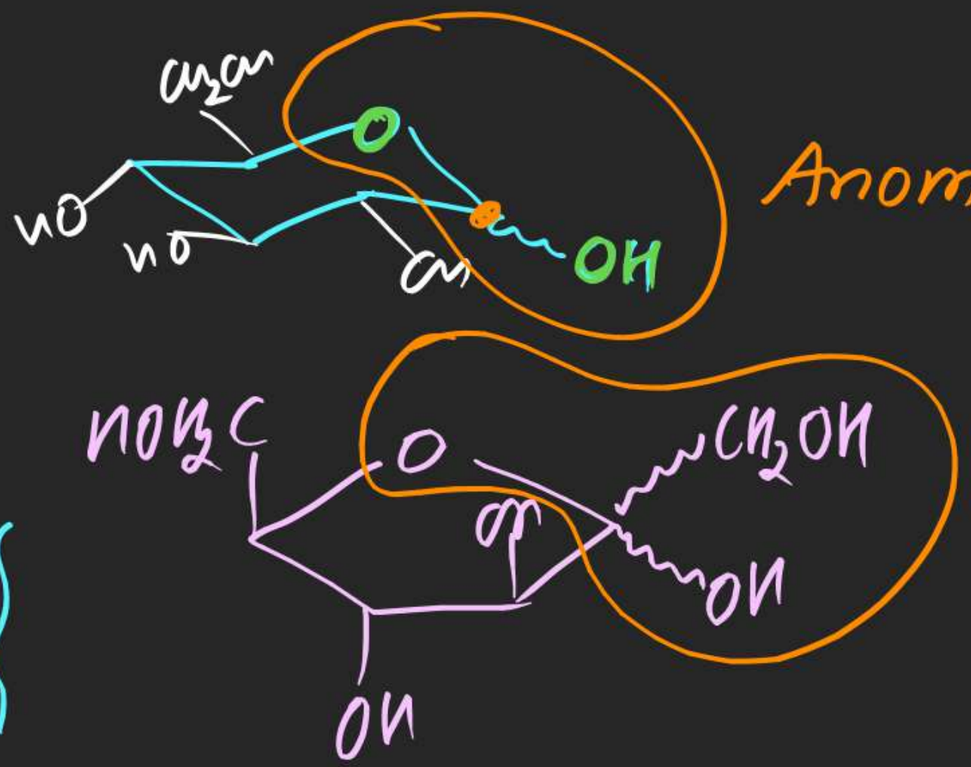
Condⁿ for

(*) Mutarotation

(*) Reducing Sugar

(*) Osazone formation

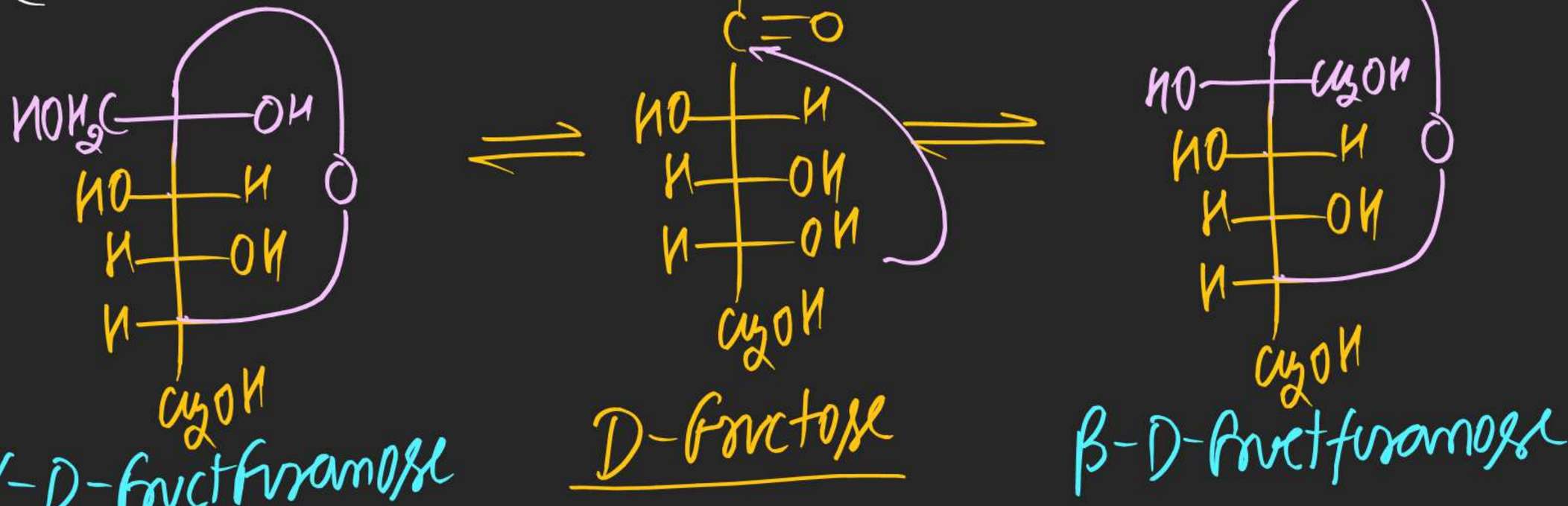


(#) Fructose :-

⟹ MF $C_6H_{12}O_6$

⟹ Keto hexose

⟹ $(\alpha)_{obs} = -92.7°$



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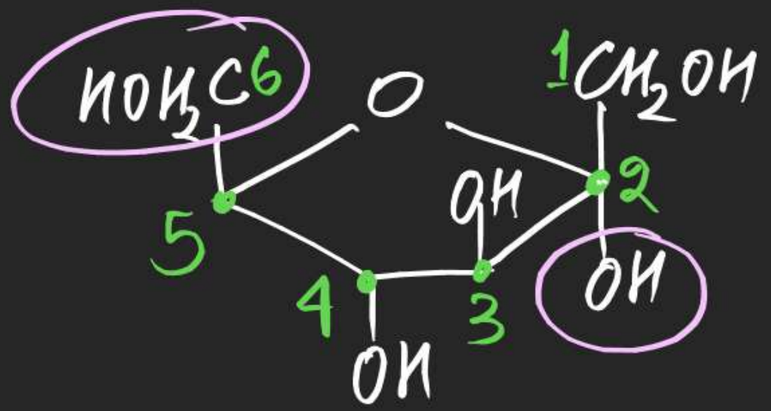

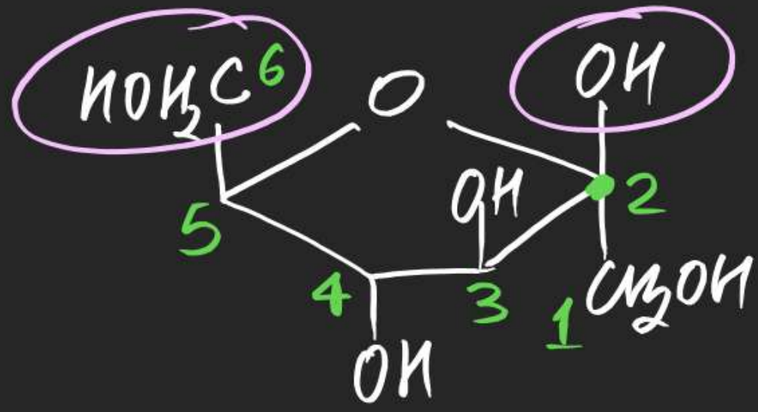

$\Rightarrow$ Fructose is a Reducing sugar

$\Rightarrow$ ——— showing mutarotation

$\Rightarrow$ ——— forms osazone.

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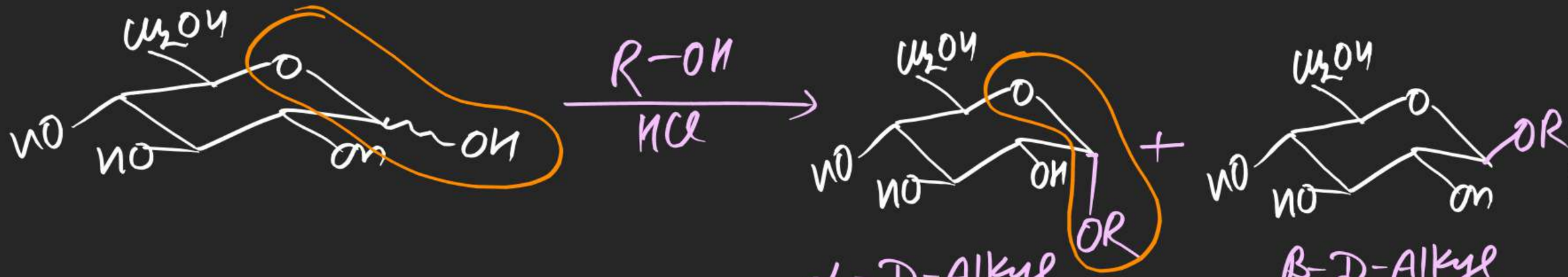
(#) Formation of Glycosides:

(1)



α-D-Alkyl
-Glucopyranoside

β-D-Alkyl
-Glucopyranoside

(*)

Reducing sugar
Shows mutorotation
Form Osazone
due to having hemi Acetal

Non Reducing
No mutorotation
No Osazone formation.
due to having Acetal group.

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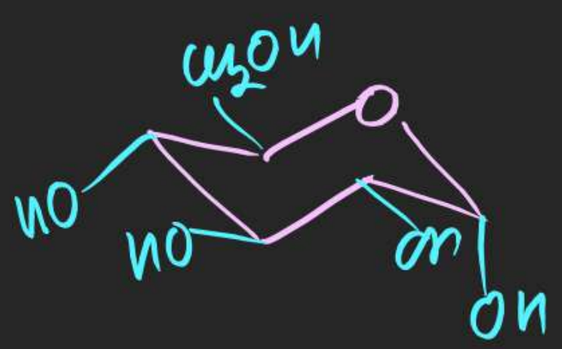
Ex: Explain following stability order

(a)



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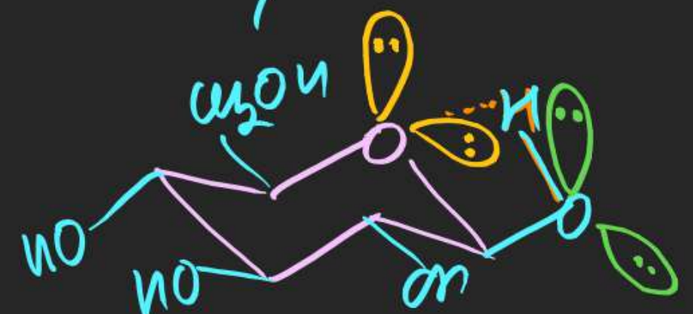
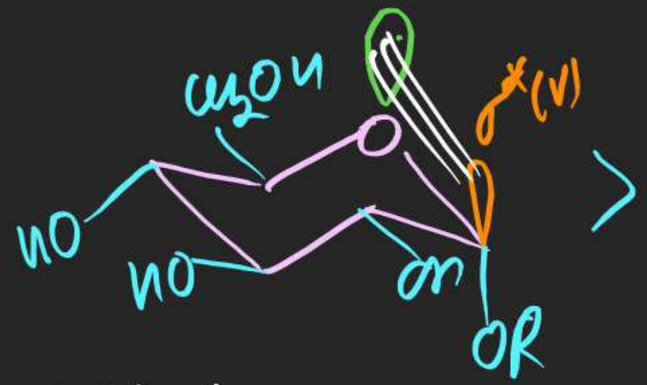


(α < β Glucopyranose)

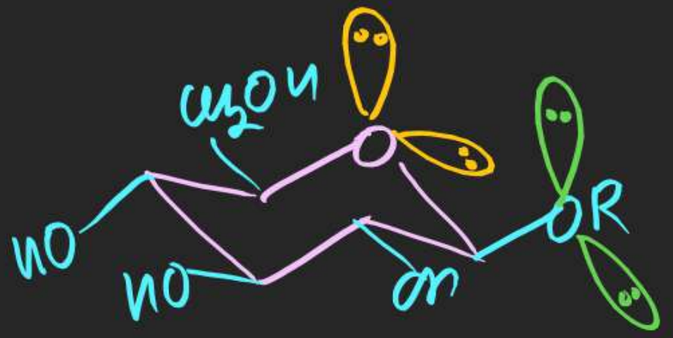
More stable due to Compensation in lp-lp Repulsion due to H Bond formation

(b)



Stable due to Anomeric effect

>



(α > β Glycopyranoside)

less stable due to Repulsion

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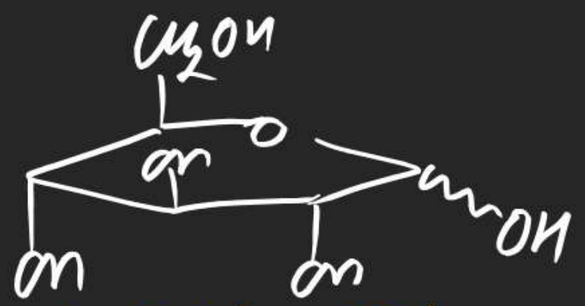
Reactions of Glucose & Fructose :-

(1)



Glucose (Aldohexose)

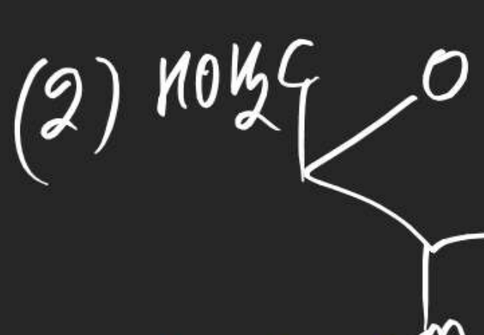
Tollen's → Gluconic Acid or Aldonic Acid + 2Ag

Fehling → Gluconic Acid or Aldonic Acid + Cu_2O

HNO_3 → Glucaric Acid or Aldaric Acid or Saccharic Acid

Br_2/H_2O → Gluconic Acid or Aldonic Acid

(2)



Fructose (Ketohexose)

→ Gluconic Acid

→ Gluconic Acid

→ 

→ No Rxn

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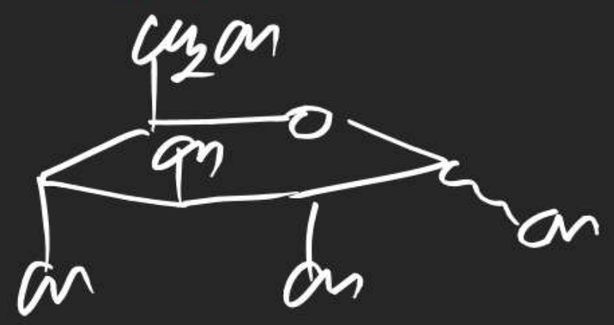
Note: Br_2/H_2O is used for distinguishing b/w Aldohexose & Ketohexose

(3)



HCN

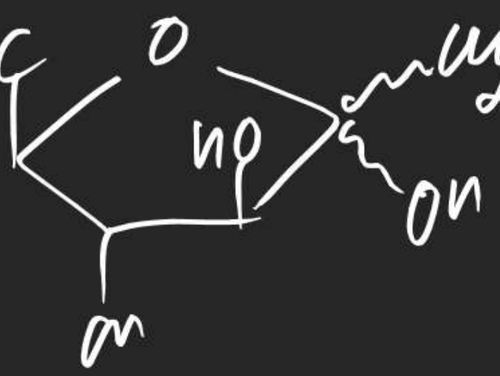
HIO_4

H_2/Cat

$NaBH_4$

NH_2OH

(4) HOH_2C



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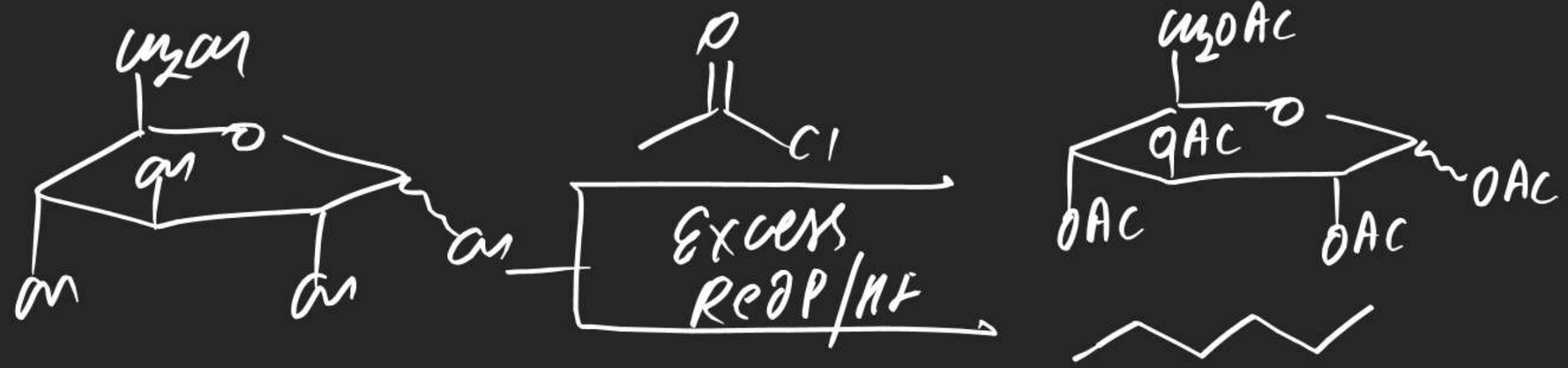
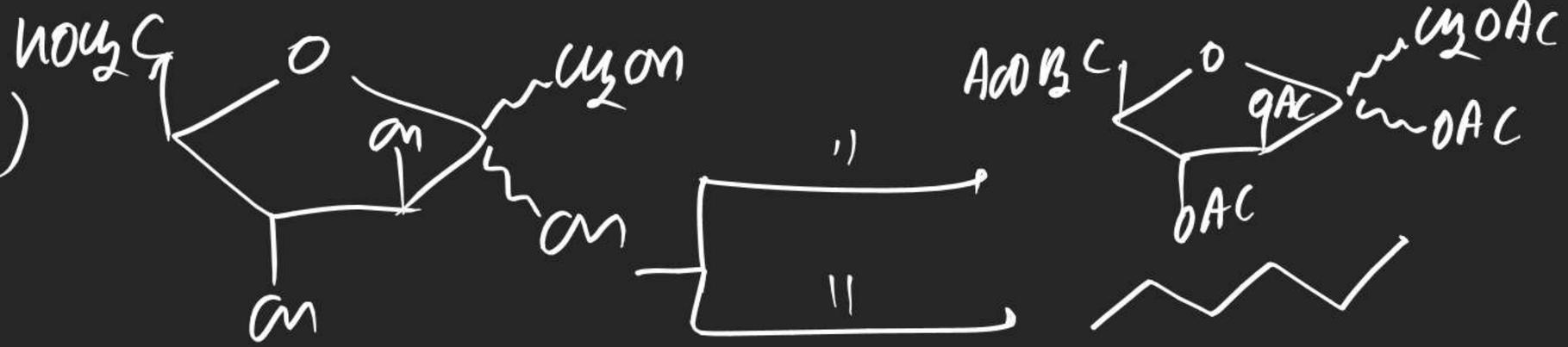
(5)



(6)



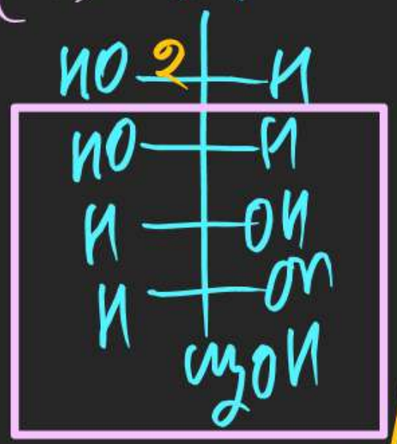
(#) Glucosazone formation

M.I.P

⇒ It includes C_1 & C_2 Carbon of sugar

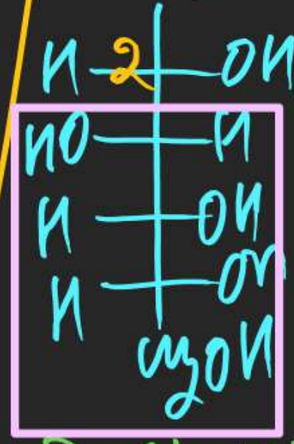
⇒ It's oxidation Rx^n

(7) 1 CH=O



D-mannose

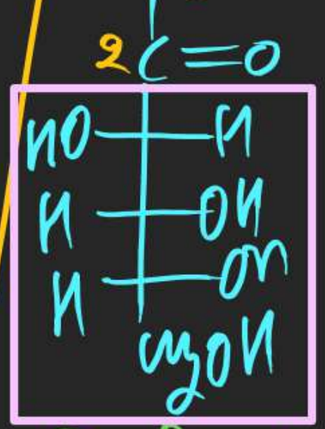
1 CH=O



D-Glucose

1 CH_2OH

2 C=O



D-fructose

Glucosazone

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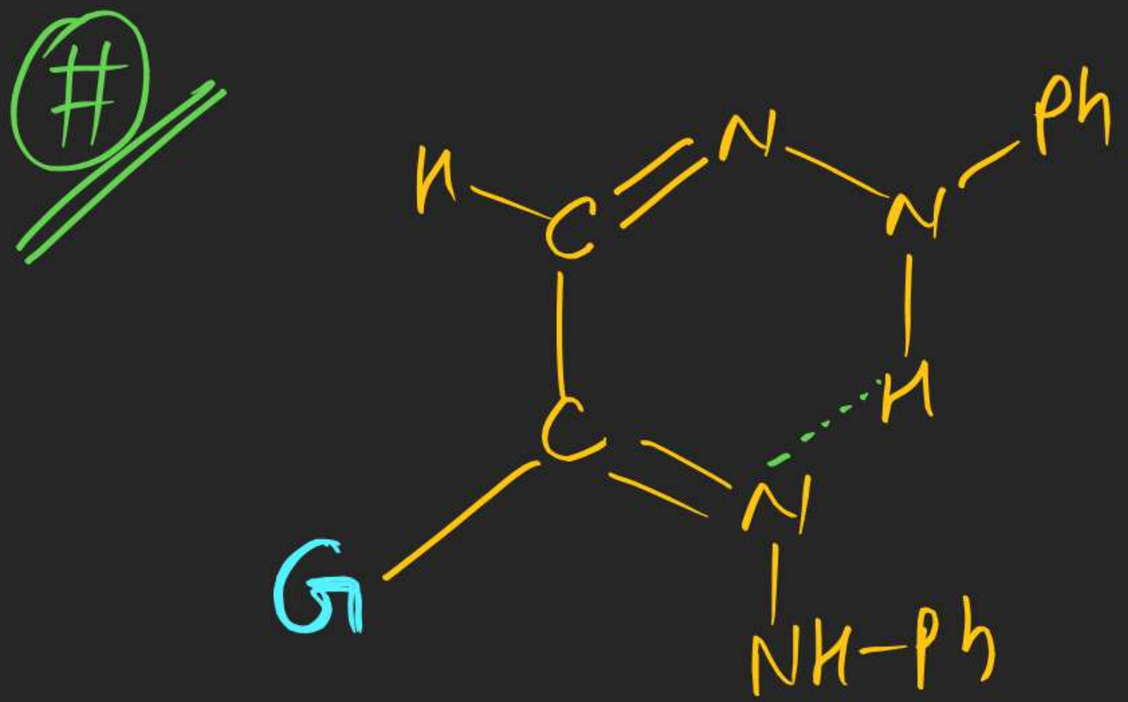

Osazone Stablised By chelation