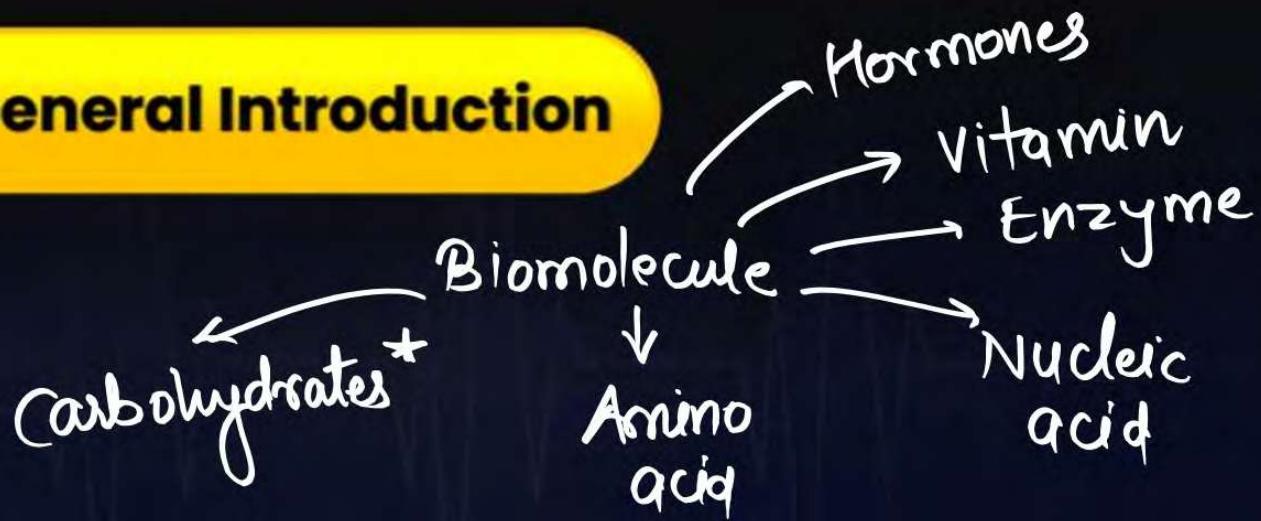




General Introduction





Carbohydrates



Hydrates of carbon are called carbohydrates.

- General formula: $C_x(H_2O)_y$

Example: $C_6(H_2O)_6 \Rightarrow C_6H_{12}O_6$  Monosac

- Exception: $C_2(H_2O)_2$

$C_2H_4O_2 \Rightarrow CH_3COOH$ (acetic acid) is not a carbohydrate.

- Rhamnose, $C_6H_{12}O_5$ is a carbohydrate but does not fit in this definition.



Definition of Carbohydrates

- The carbohydrates may be defined as optically active polyhydroxy aldehydes or ketones or the compounds which produce such units on hydrolysis.
- Some of the carbohydrate which are sweet in taste are also called sugars.
- The most common sugar used in our homes is named as sucrose whereas the sugar present in milk is known as lactose.

C.Q. 01 (NCERT Exemplar)

Assertion: Deoxyribose, $C_5H_{10}O_4$ is not a carbohydrate.

Reason: Carbohydrates are hydrates of carbon so compounds which follow $C_x(H_2O)_y$ formula are carbohydrates. (*Hamesha sali nahi hai*)

- A** Assertion and reason both are correct statements and reason explains the assertion.
- B** Both assertion and reason are wrong statements.
- C** Assertion is correct statement and reason is wrong statement.
- D** Assertion is wrong statement and reason is correct statement.



Classification of Carbohydrate

Classification-1: Based on hydrolysis

(i) Monosaccharide
does not hydrolyse further.

Exp: Glucose

fructose

Galactose etc.

(ii) Oligosaccharides
produces 2 to 10 monosac
units on hydrolysis

• Disac → 2 unit

Exp: sucrose, maltose,
Lactose etc.

• Trisac → 3 unit

Exp: Raffinose

(iii) Polysaccharides

• Carbohydrates which yield
a large number of
monosaccharide units on
hydrolysis are called
polysaccharides. Some
common examples are
starch, cellulose, glycogen,
gums etc.

• Polysaccharides are not
sweet in taste, hence they
are also called non-sugars.

Classification-2: Reducing and non-reducing sugars

1. Reducing → Reduces

Tollen's reagent

Fehling's reagent

Benedict's reagent.

2. Non-reducing → Do not reduce

Tollen's reagent

Fehling's reagent

Benedict's reagent.

Exp. : 1. monosaccharides like glucose,
fructose, Galactose etc.

Exp. : Sucrose etc.

2. Disaccharides like maltose, Lactose etc.

C.Q. 02 (NCERT Exemplar)



Carbohydrates are classified on the basis of their behaviour on hydrolysis and also as reducing or non-reducing sugar. Sucrose is a _____.

- A** monosaccharide
- C** non-reducing sugar

- B** disaccharide
- D** Both (B) & (C)

Classification-3: Based on number of carbon atoms

No. of carbons	Aldehyde	Ketone
3	Aldotriose	Ketotriose
4	Aldotetrose	Ketotetrose
5	Aldopentose	Ketopentose
6	Aldohexose	Ketohexose

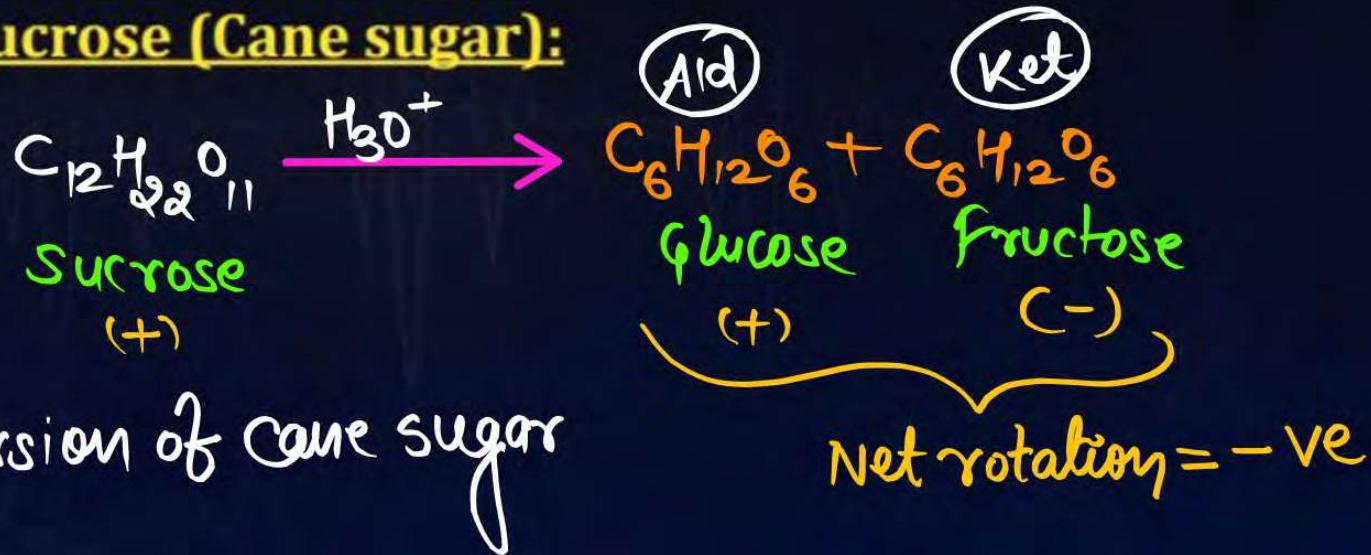
Glucose
 $(C_6H_{12}O_6)$

fructose
 $(C_6H_{12}O_6)$



Methods of Preparation of Glucose

1. From sucrose (Cane sugar):

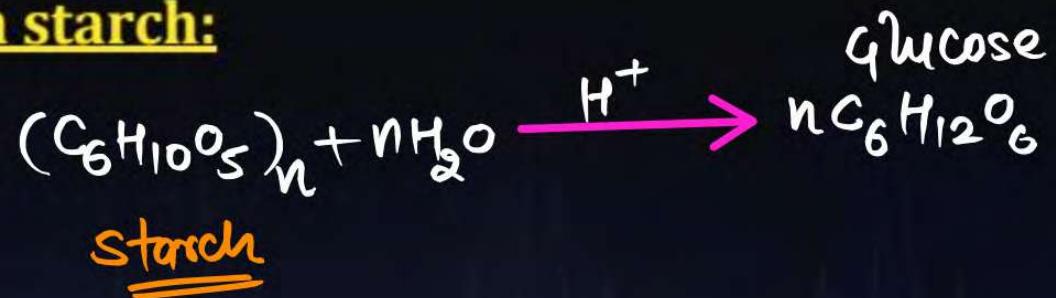


C.Q. 03 (NEET 2020)



Sucrose on hydrolysis gives:

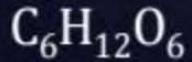
- A** $\alpha\text{-D-Glucose} + \beta\text{-D-Glucose}$
- B** $\alpha\text{-D-Glucose} + \beta\text{-D-Fructose}$
- C** $\alpha\text{-D-Fructose} + \beta\text{-D-Fructose}$
- D** $\alpha\text{-D-Glucose} + \alpha\text{-D-Fructose}$

2. From starch:

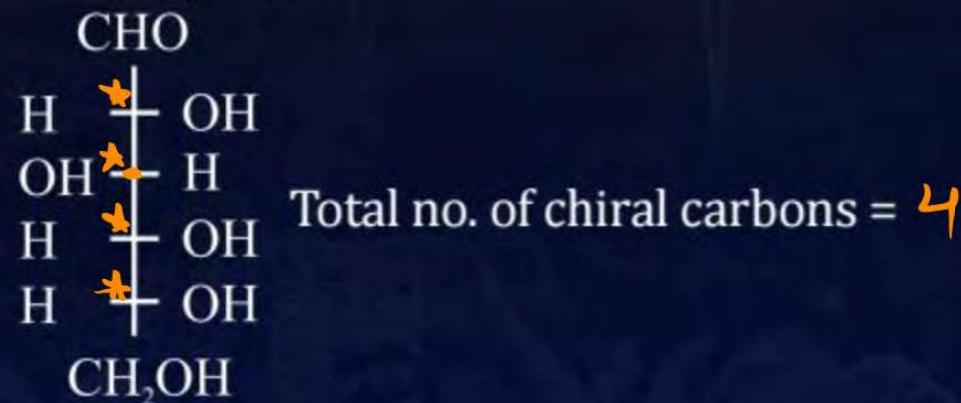


Properties of Glucose

1. Glucose is also known as dextrose (+) or Aldohexose.
2. Structure



Fischer projection formula

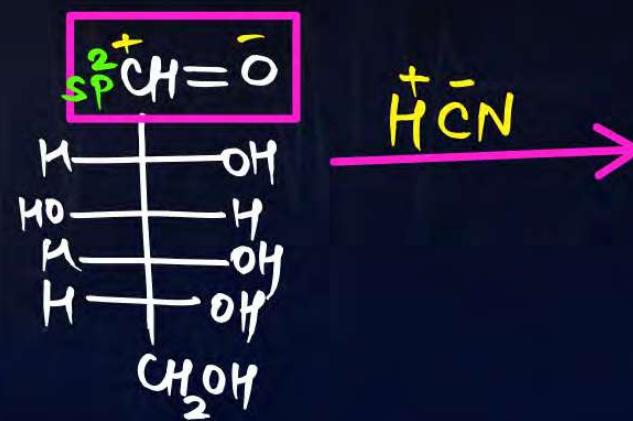
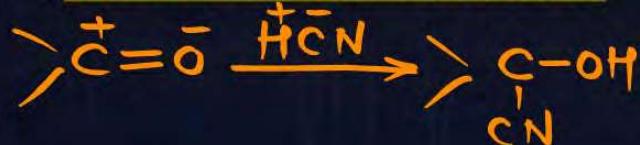




Chemical Reaction of Glucose

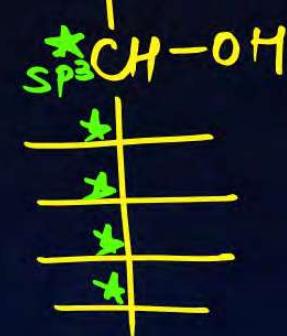


A. Reaction with HCN:

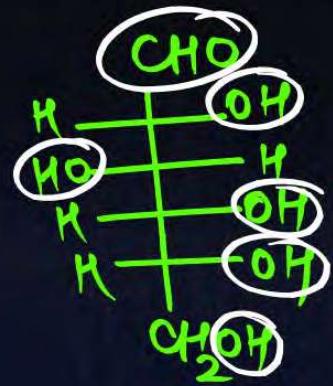


glucose cyanohydrin

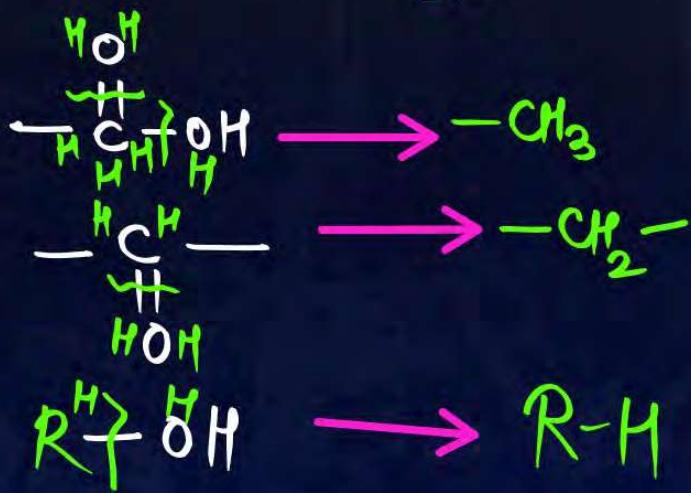
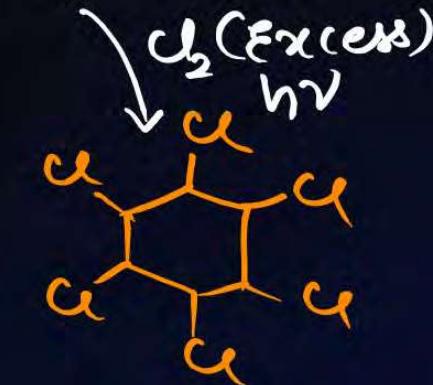
CN Chiral carb = 5



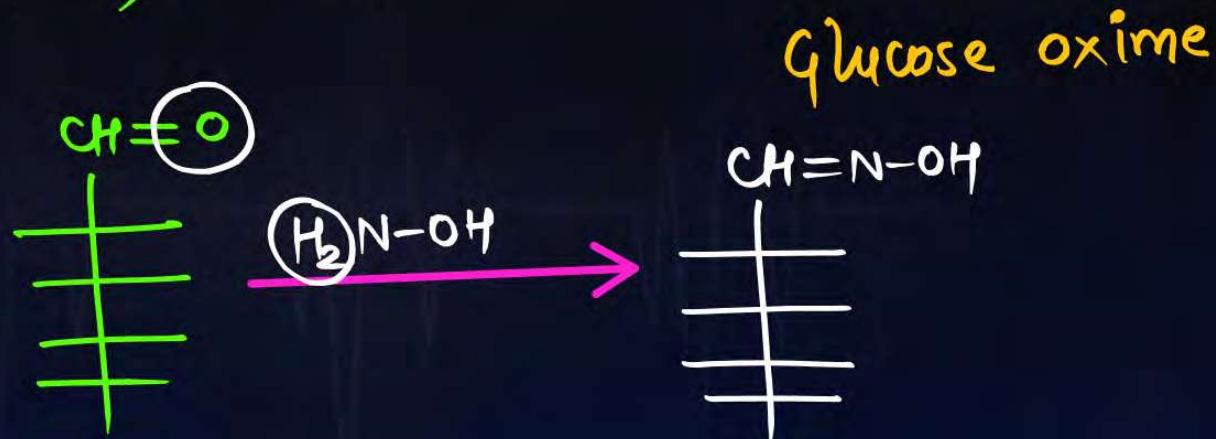
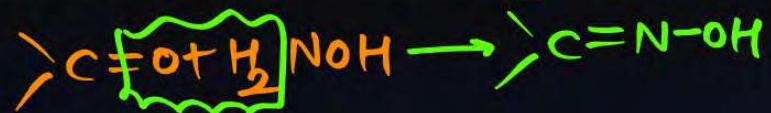
B. Reaction with HI/Red P:



n-hexane



C. Reaction with NH_2OH :

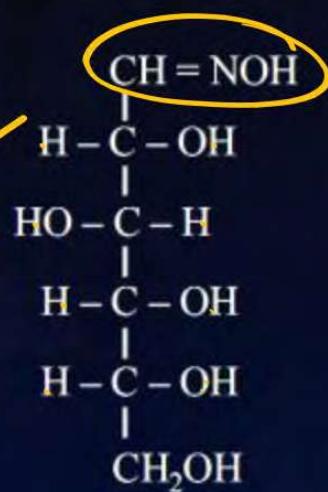
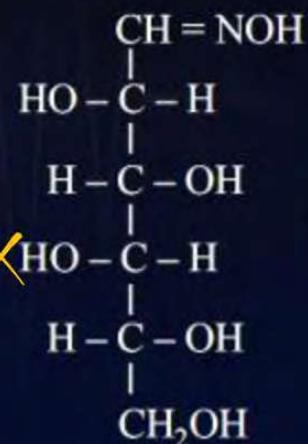
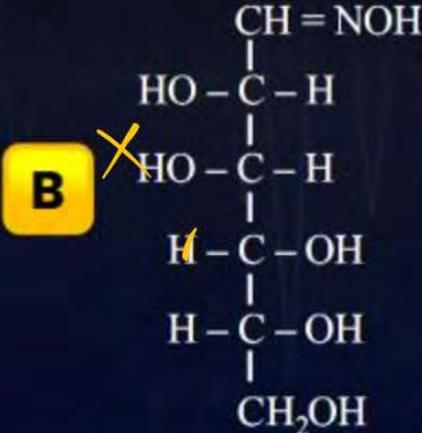
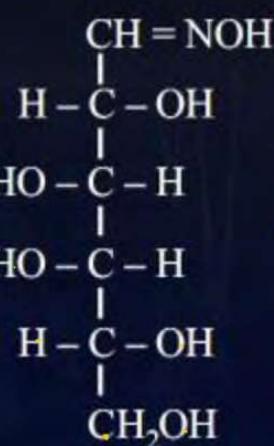


C.Q. 04 (NEET 2014)

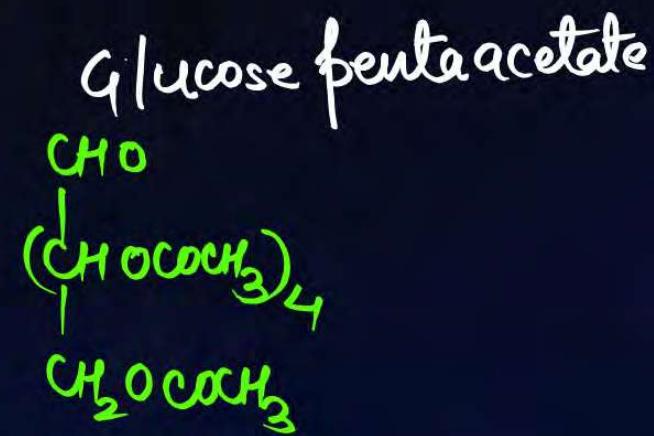
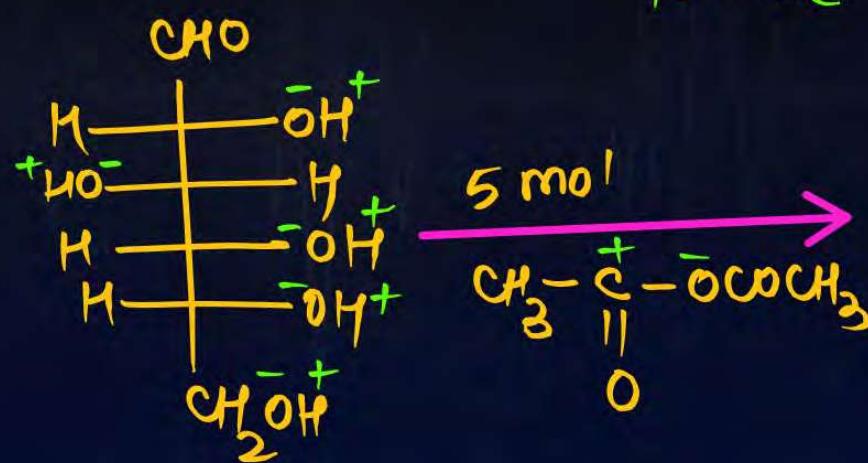
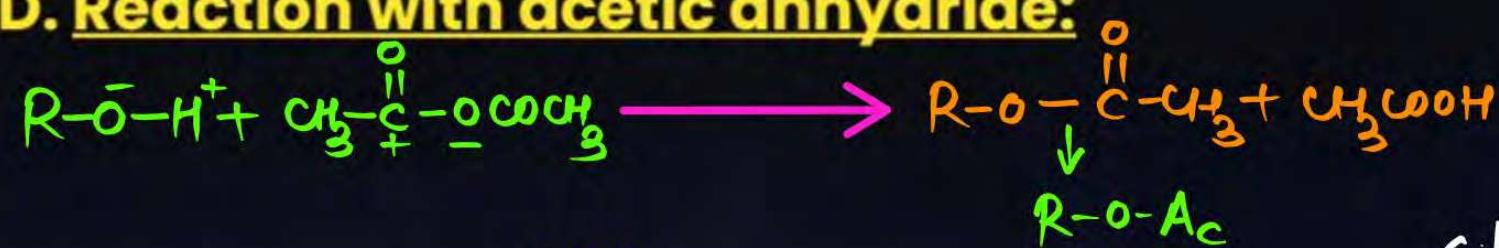
PW



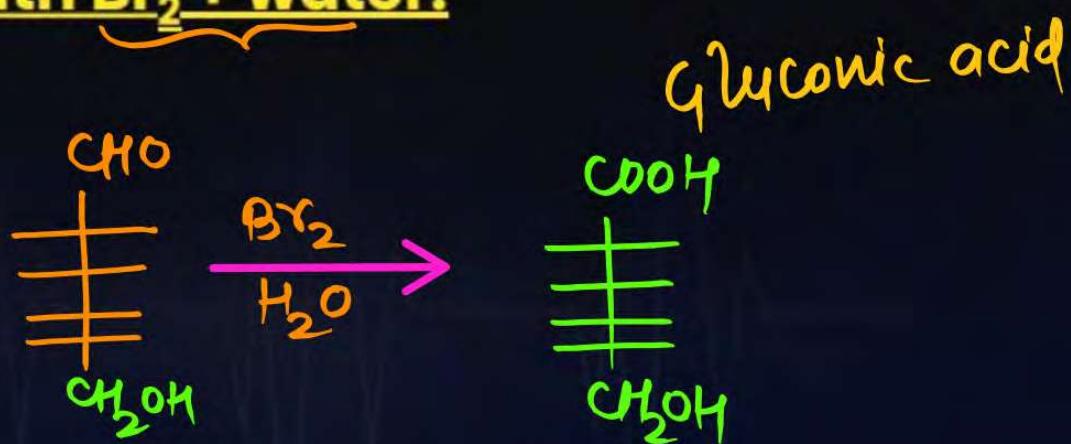
D (+) glucose reacts with hydroxylamine and yields an oxime. The structure of the oxime would be:



D. Reaction with acetic anhydride:



E. Reaction with $\text{Br}_2 + \text{water}$:



C.Q. 05 (AIIMS 2018)

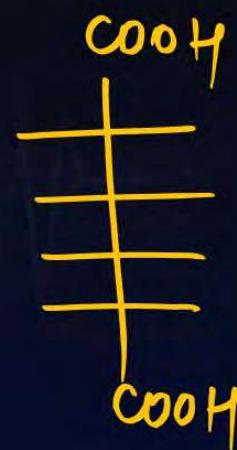
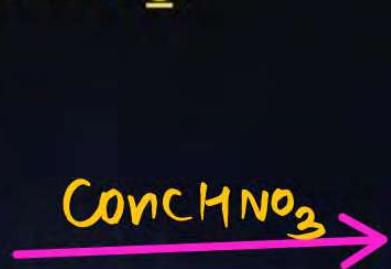


Assertion: Oxidation of glucose by Br_2 water gives saccharic acid X

Reason: Br_2 water oxidizes $-\text{CHO}$ and alcohol. X

- A** If both Assertion and Reason are correct and the Reason is the correct explanation of Assertion.
- B** If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C** If Assertion is correct but Reason is incorrect.
- D** If both the Assertion and Reason are incorrect. ✓

F. Reaction with Conc. HNO_3 :



Saccharic acid

C.Q. 06 [27 July, JEE Mains 2022 (Shift-II)]



Match the column.

	Column-I		Column-II
A.	Glucose + HI ✓ ④	I.	Gluconic acid
B.	Glucose + Br ₂ /water ①	II.	Glucose pentaacetate
C.	Glucose + acetic anhydride ⑪	III.	Saccharic acid
D.	Glucose + HNO ₃ ⑩	IV.	n-Hexane

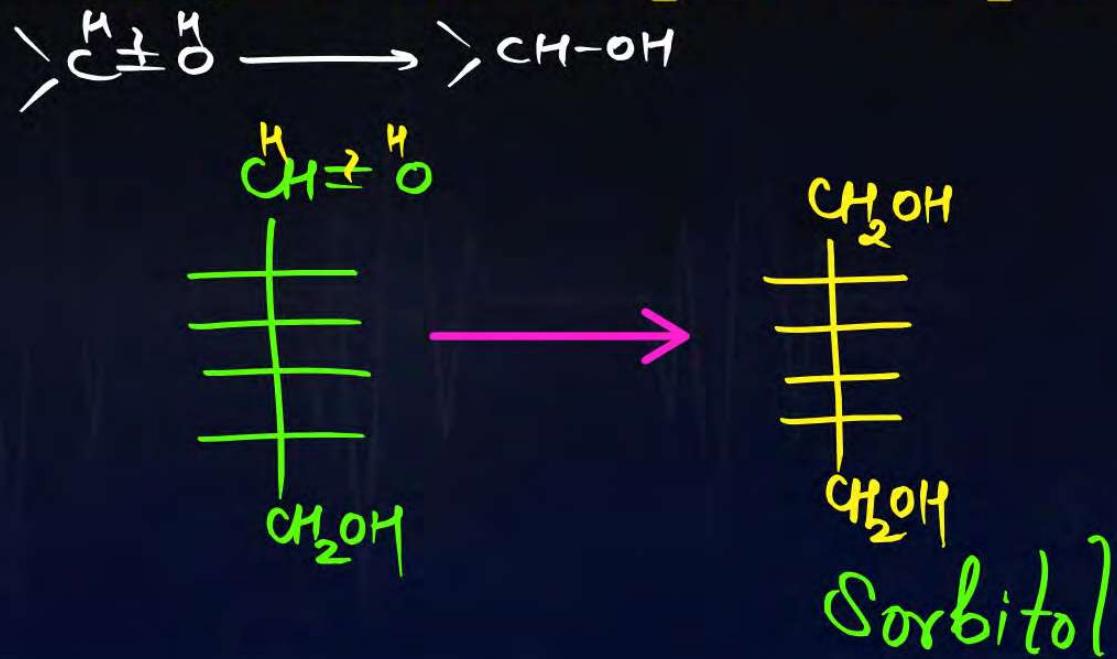
Choose the most appropriate answer from the options given below:

A A-(IV); B-(I); C-(II); D-(III)

B A-(IV); B-(III); C-(II); D-(I)

C A-(III); B-(I); C-(IV); D-(II)

D A-(I); B-(III); C-(IV); D-(II)

G. Reaction with $\text{Na}(\text{Hg}) + \text{ROH}$ or $\text{NaBH}_4/\text{MeOH}$ or $\text{H}_2 + \text{Catalyst}$:

Reactions which support cyclic structure of Glucose:

1. No reaction with NaHSO_3
2. No reaction with Schiff's Test
3. No reaction with 2, 4-DNP test
4. No reaction of Glucose pentaacetate with NH_2OH

The reagents with which glucose does NOT react to give the corresponding tests/products are:

- A. Tollen's reagent
- B. Schiff's reagent
- C. HCN
- D. NH_2OH
- E. NaHSO_3

Choose the correct options from the given below:

- A** B and E
- C** B and C

- B** E and D
- D** A and D

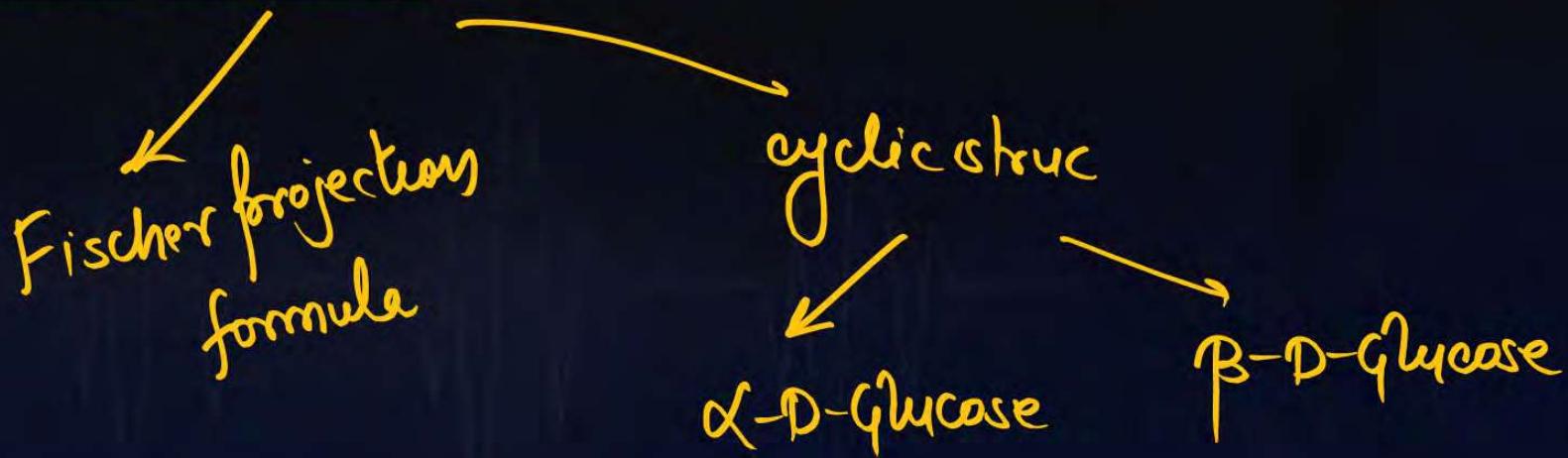
C.Q. 08 (NEET 2020)



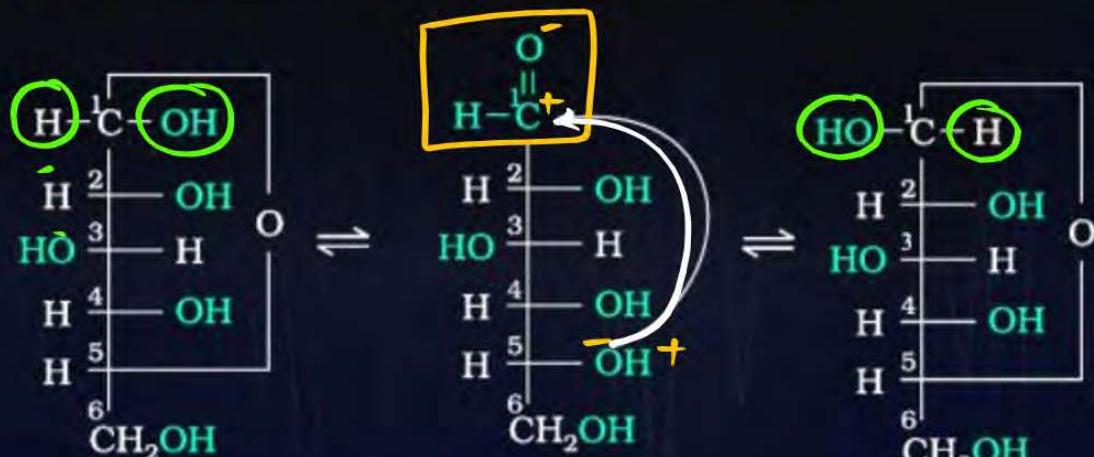
Which of the following statement is not true about glucose?

- A It contains five hydroxyl groups.
- B It is a reducing sugar.
- C It is an aldopentose.
- D It is an aldohexose.

Structure of Glucose:

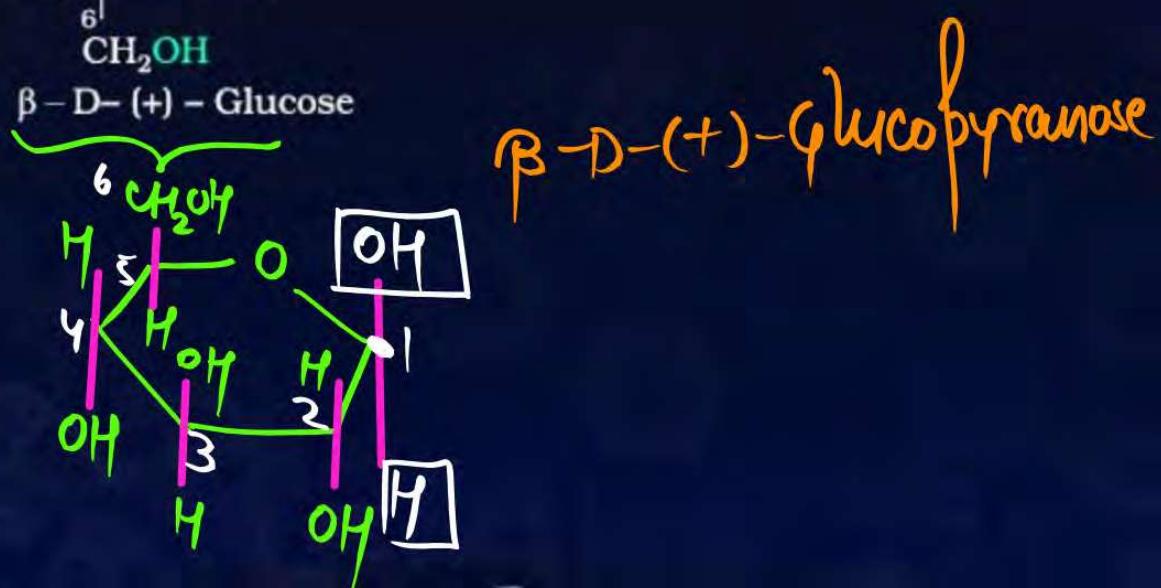
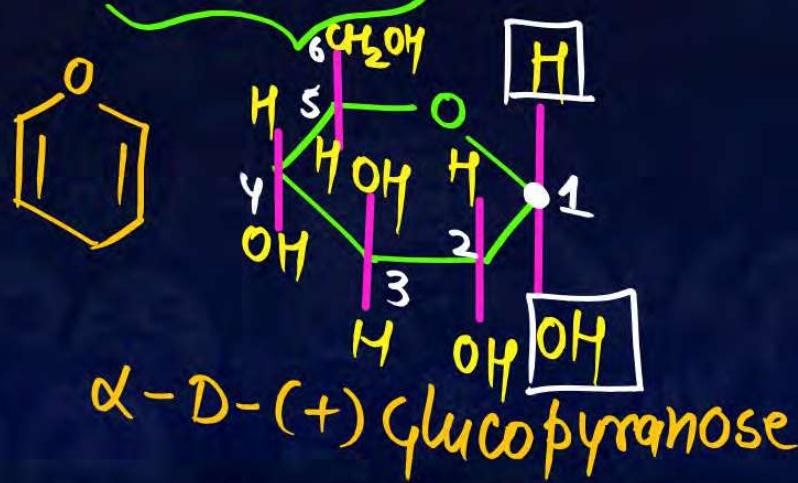


Cyclic Structure of Glucose:



α -D-(+)-Glucose

β -D-(+)-Glucose



Which of the following reactions of glucose can be explained only by its cyclic structure?

- A Glucose forms pentaacetate.
- B Glucose reacts with hydroxylamine to form an oxime.
- C Pentaacetate of glucose does not react with hydroxylamine.
- D Glucose is oxidized by nitric acid to gluconic acid.

Glucose exists in two Cyclic crystalline forms

1. Conc. Solution gives α -Glucose (M.P 419K) at 303K
2. Aq. Solution gives β -Glucose (MP 423K) at 371K

Glucose exists in 3 forms in liquid solution



Mutarotation:

Interconversion of α & β in acidic or basic medium is called mutarotation (due to hemiacetal).

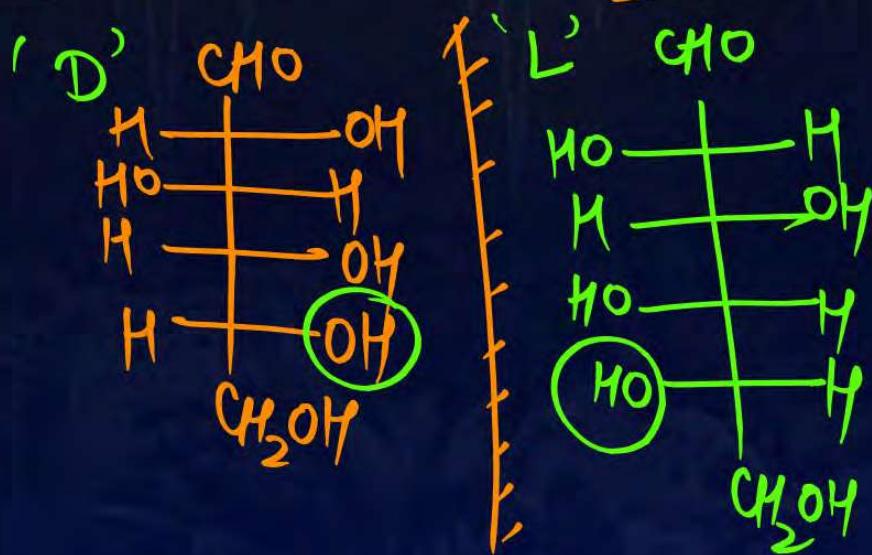
C.Q. 10 (AIPMT 2010)

Which one of the following does not exhibit the phenomenon of mutarotation?

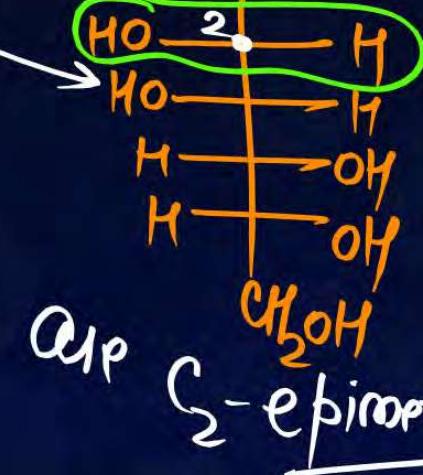
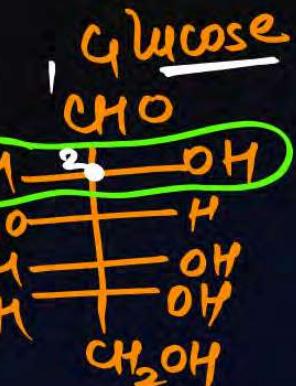
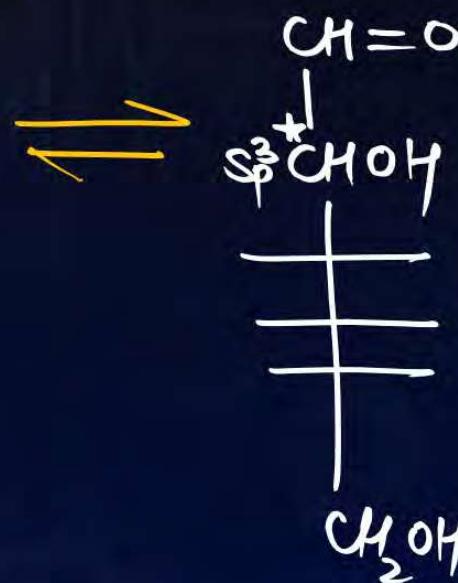
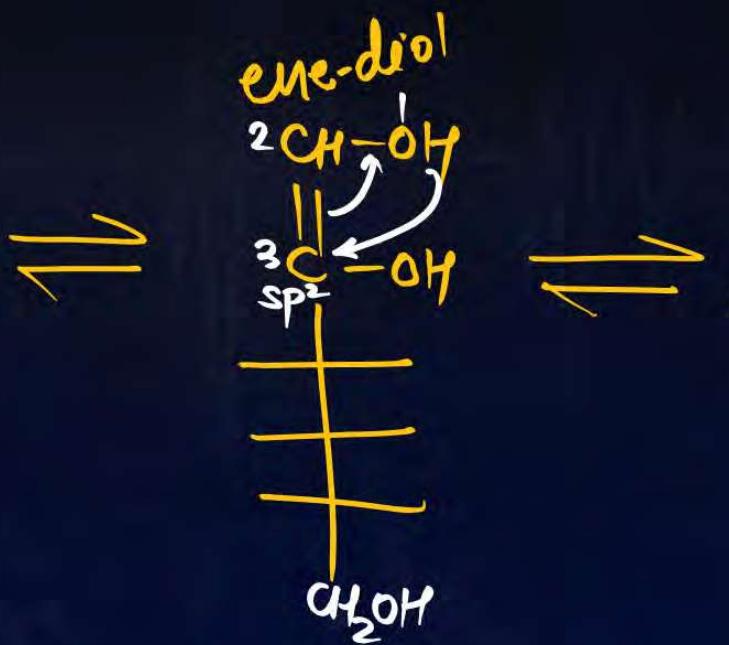
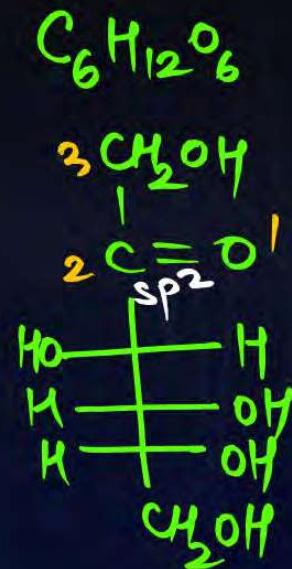
- A (+) - Sucrose ✓
- B (+) - Lactose
- C (+) - Maltose
- D (-) - Fructose

OP Points:

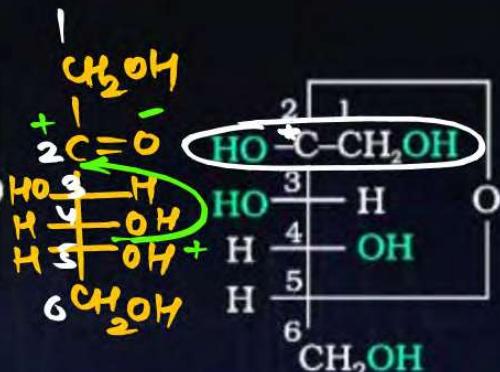
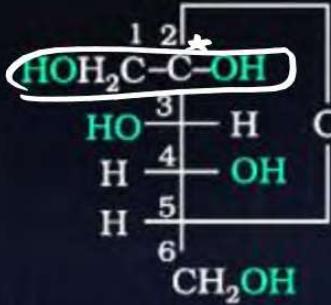
1. Net optical Rotation of Glucose = $+52.4^\circ$ ✓
2. $\% \alpha = 36\%$ (Specific Rotation = 112°)
 $\% \beta = 63.8\%$ (Specific Rotation = 19°)
3. α & β are Diastereomer Anomer. ★ → C₁
4. L-Glucose is the mirror image of D-Glucose.



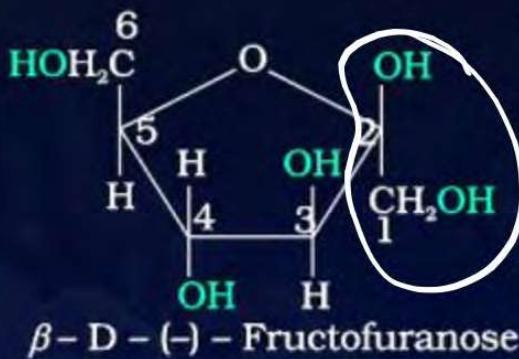
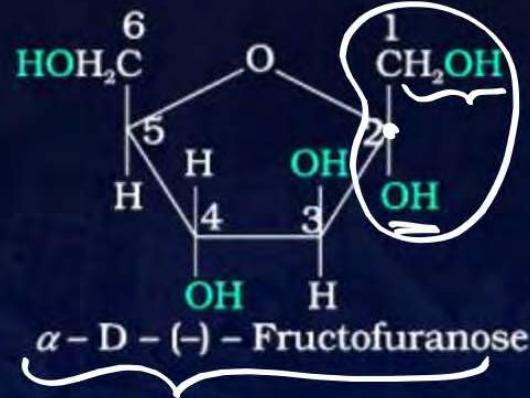
Fructose: Reducing sugar & ketohexose



Structure of Fructose:



β -D-(-)-Fructofuranose



α & β are anomers

C.Q. 11 (JEE Mains 2025, 23 January Shift-1)



Given below are two statements:

Statement-I: Fructose does not contain an aldehydic group but still reduces Tollen's reagent.

Statement-II: In the presence of base, fructose undergoes Tautomerization to give glucose.

In the light of the above statements, choose the correct answer from the options given below

- A** Both Statement I and Statement II are true.
- B** Both Statement I and Statement II are false.
- C** Statement I is false but Statement II is true.
- D** Statement I is true but Statement II is false.

C.Q. 12 (JEE Mains 4th April 2024, Evening Shift)

Match List-I with List-II

	LIST-I	LIST-II
A.	α -Glucose and α -Galactose	I. Functional isomers
B.	α -Glucose and β -Glucose	II. Homologous
C.	α -Glucose and α -Fructose	III. Anomers
D.	α -Glucose and α -Ribose	IV. Epimers

Choose the correct answer from the options given below:

A A – III, B – IV, C – II, D – I**B** A – III, B – IV, C – I, D – II**C** A – IV, B – III, C – I, D – II**D** A – IV, B – III, C – II, D – I

C.Q. 13



Glucose and fructose are:

A Optical isomers

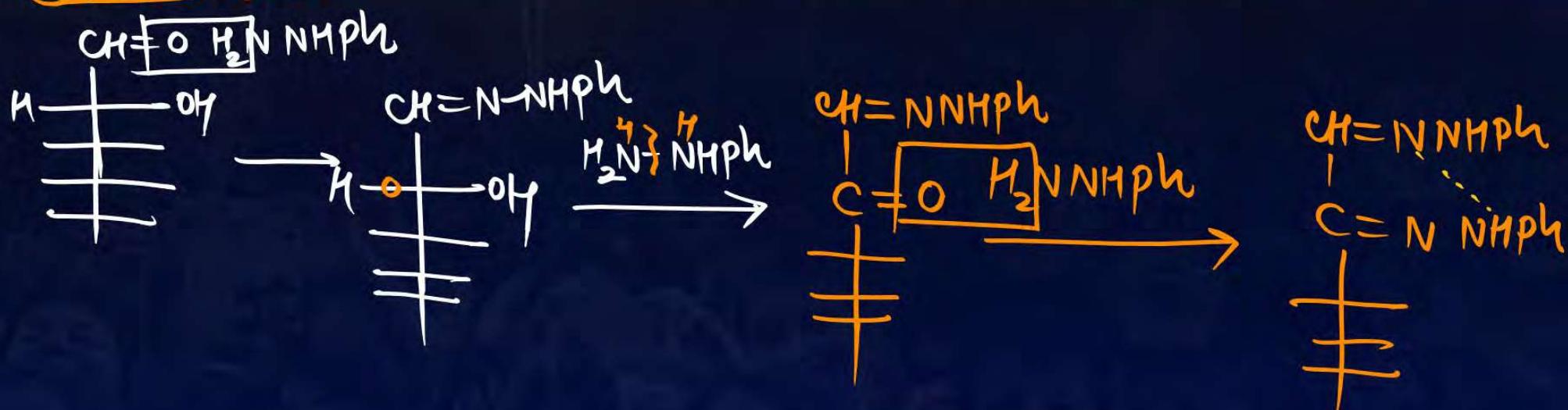
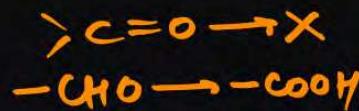
B Tautomers

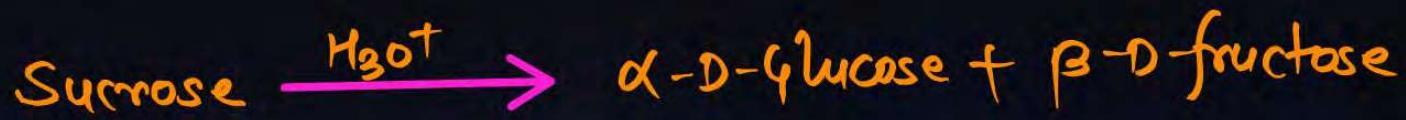
C Functional isomers

D Chain isomers

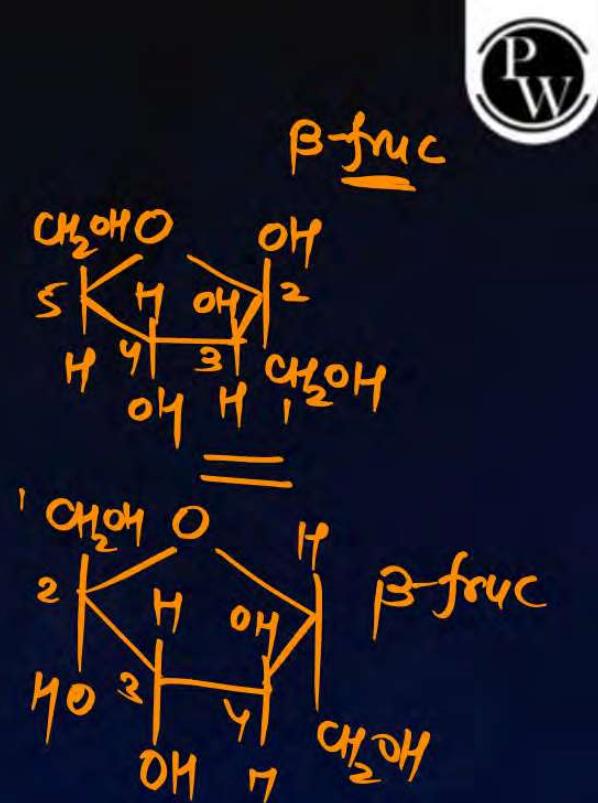
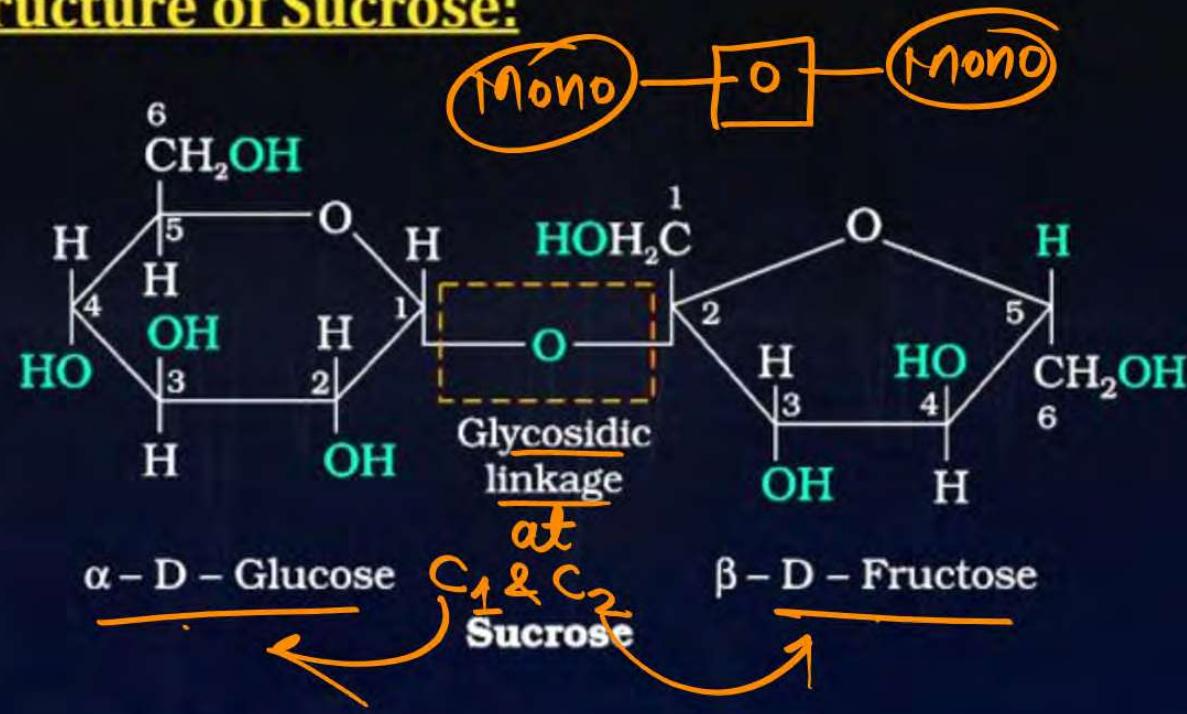
OP Points:

- Glucose and fructose can be distinguished by bromine water not by T.R, F.R, B.R.
- Glucose, fructose and mannose give same osazone because in osazone formation take place at first two carbon atoms.
- Osazone is stable by intramolecular H bonding.
- Glucose/fructose is converted to ethyl alcohol by fermentation in presence of zymase enzyme.

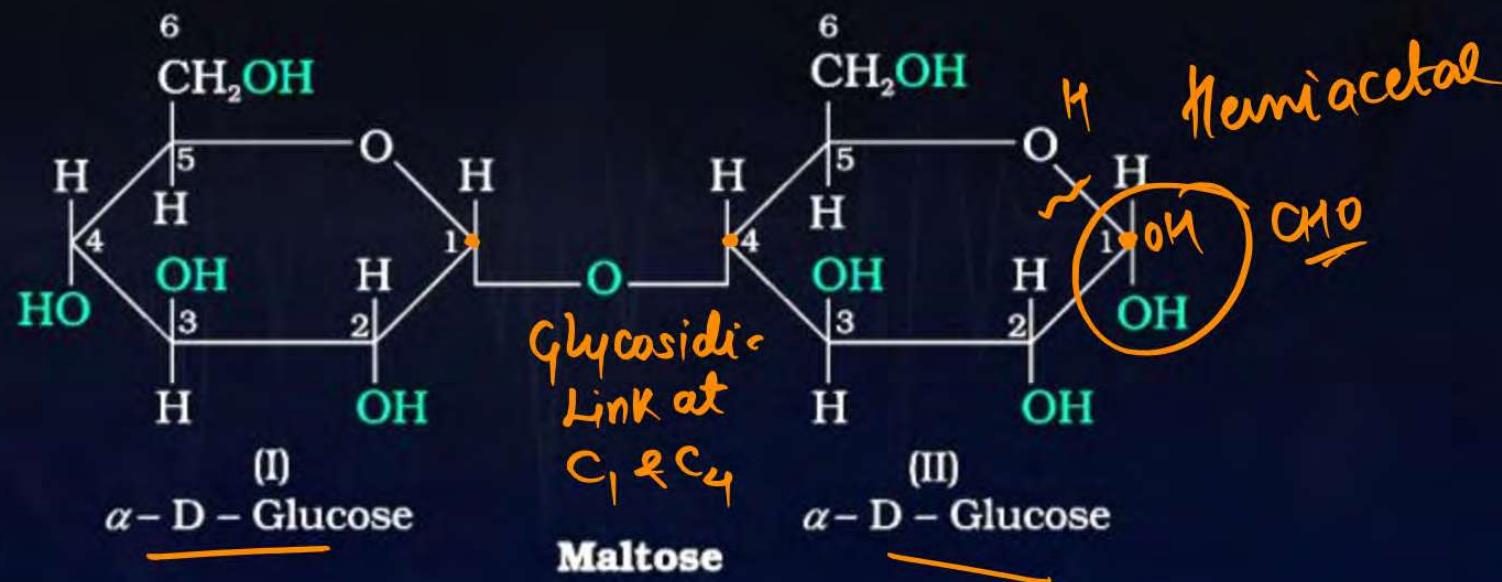


Disaccharides:

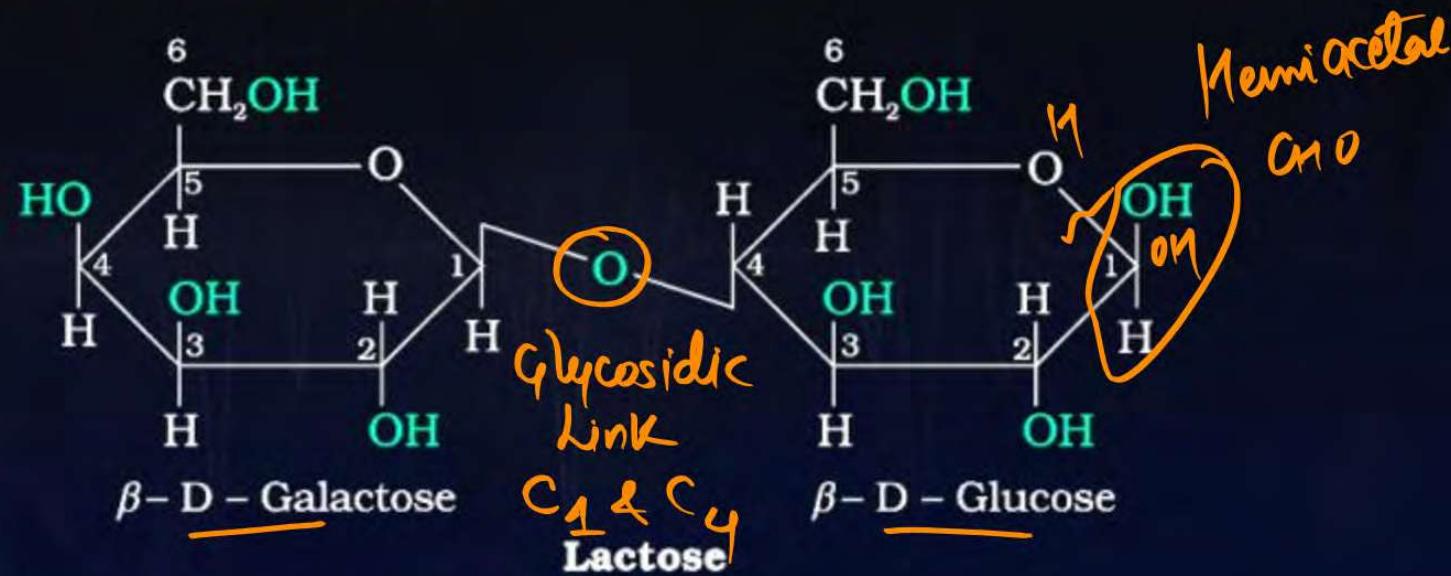
A. Structure of Sucrose:



B. Structure of Maltose:



C. Structure of Lactose:



C.Q. 14 (JEE Mains 30th January 2024, Morning Shift)

Sugar which does not give reddish brown precipitate with Fehling's reagent is:

- A Sucrose
 - B Lactose
 - C Glucose
 - D Maltose
- Non reducing sugar*

C.Q. 15 [27 July, JEE Mains 2021 (Shift-II)]

Compound A give D-Galactose and D-Glucose on hydrolysis. The compound A is:

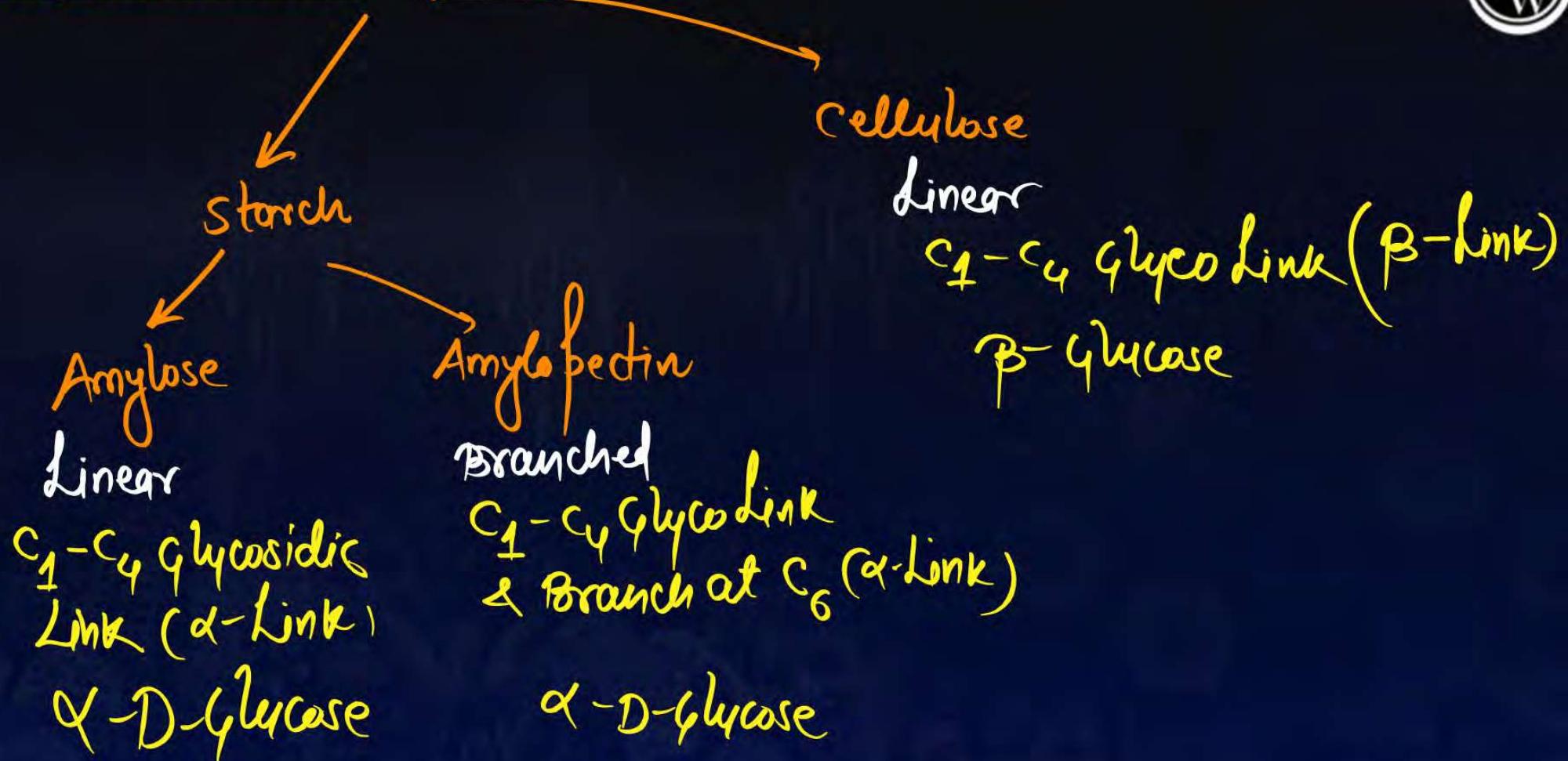
A Amylose

B Sucrose

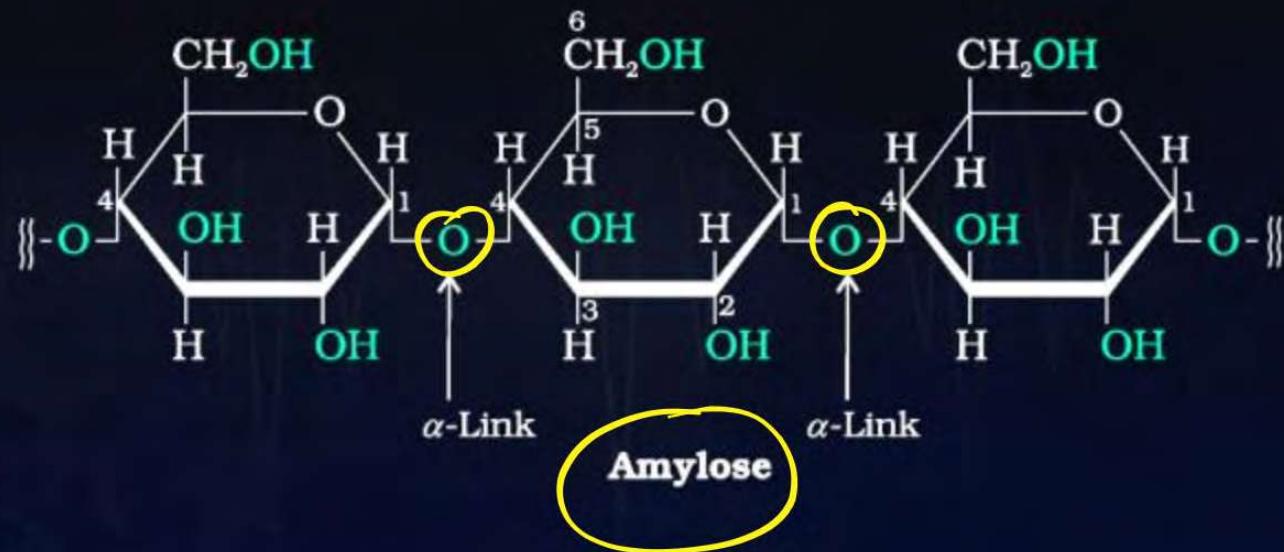
C Maltose

D Lactose

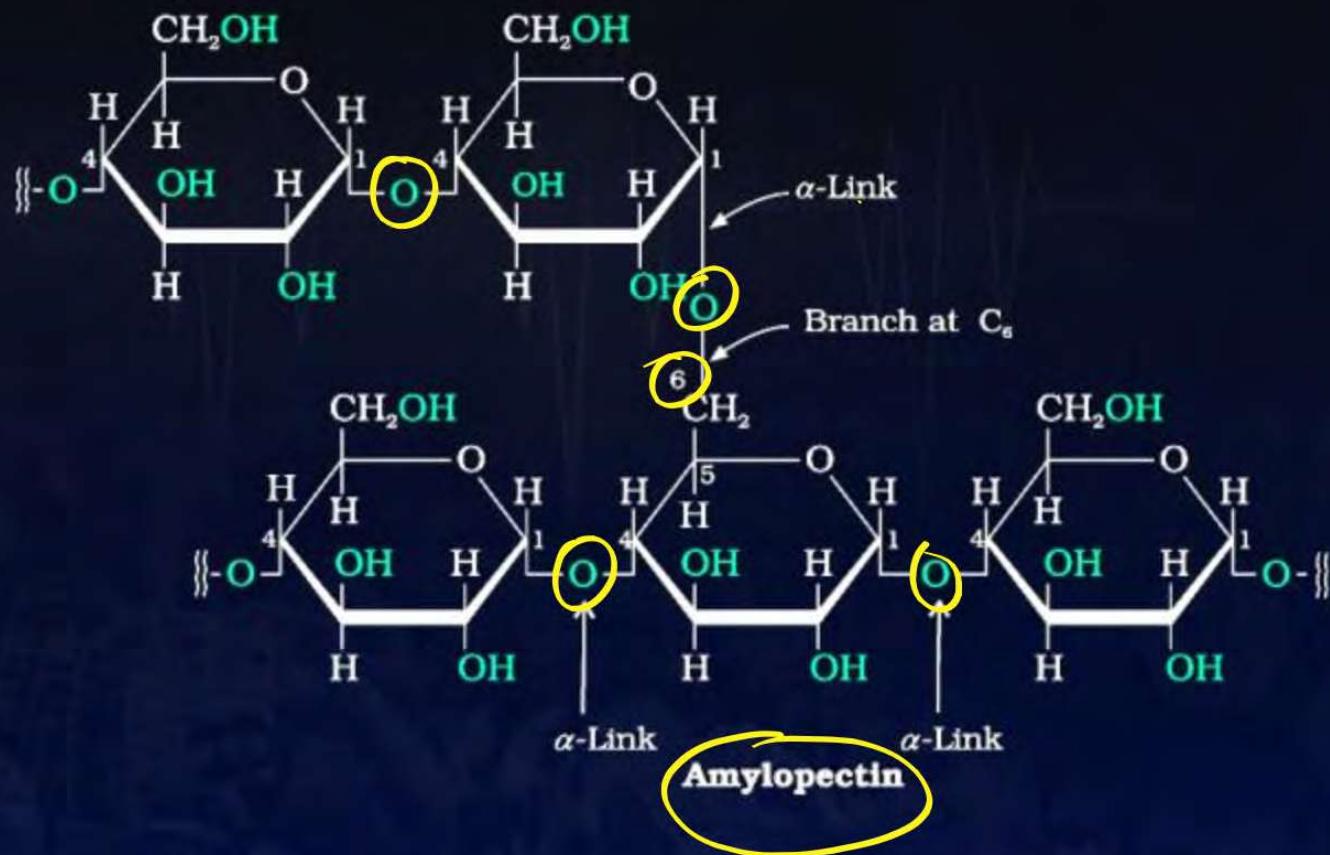
Polysaccharides:



A. Structure of Starch:



A. Structure of Starch:



Difference b/w Amylose and Amylopectin:

Amylose

1. Linear polymer
2. 15-20% Starch
3. Water soluble
4. Glycosidic linkage at C_1 and C_4

Amylopectin

1. Branched Polymer
2. 80-85% starch
3. Water insoluble
4. Glycosidic linkage at C_1 and C_4 and Branch at C_6

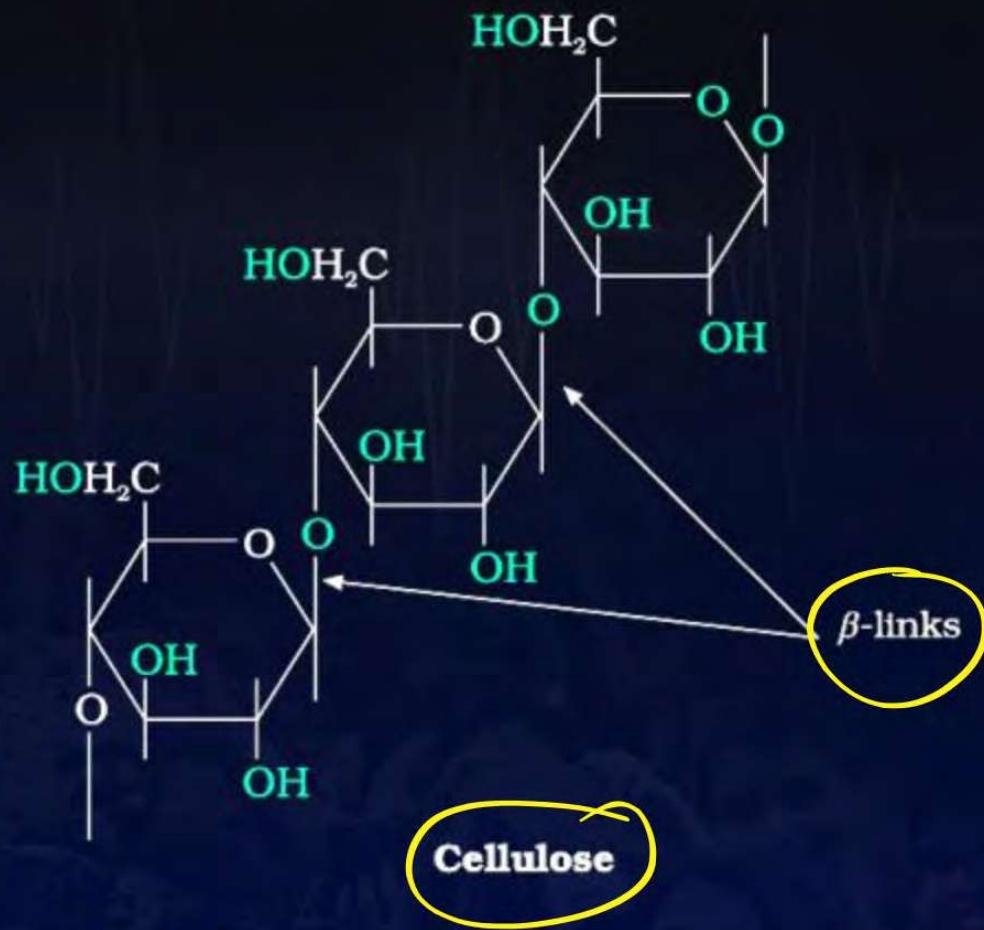
Match List-I with List-II.

List-I (Saccharides)		List-II (Glycosidic-linkages found)	
(A) Sucrose	$\text{C}_1 - \text{C}_2$ (II)	(I)	$\alpha 1-4$
(B) Maltose	$\text{C}_1 - \text{C}_4$ (I)	(II)	$\alpha 1-4$ and $\alpha 1-6$
(C) Lactose	$\text{C}_1 - \text{C}_4$ (IV)	(III)	$\alpha 1-\beta 2$
(D) Amylopectin	(II)	(IV)	$\beta 1-4$

Choose the correct answer from the options given below:

- A** (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
- B** (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
- C** (A)-(II), (B)-(IV), (C)-(III), (D)-(I)
- D** (A)-(IV), (B)-(II), (C)-(I), (D)-(III)

B. Structure of Cellulose:



C. Structure of Glycogen:

Struc like Amylopectin but more heavily branch

Identify correct conversion during acidic hydrolysis from the following:

- (A) starch gives galactose X
- (B) cane sugar gives equal amount of glucose and fructose. ✓
- (C) milk sugar gives glucose and galactose. ✓
- (D) amylopectin gives glucose and fructose. X
- (E) amylose gives only glucose. ✓

Choose the correct answer from the options given below:

- A** (C), (D) and (E) only
- B** (B), (C) and (E) only
- C** (B), (C) and (D) only
- D** (A), (B) and (C) only

Match List-I with List-II.

List-I

(Carbohydrate)

(A) Amylose **IV**

(B) Cellulose **I**

(C) Glycogen **II**

(D) Amylopectin **III**

List-II

(Linkage Source)

(I) $\beta\text{-C}_1\text{-C}_4$, plant

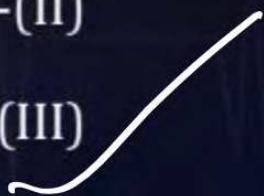
(II) $\alpha\text{-C}_1\text{-C}_4$, animal

(III) $\alpha\text{-C}_1\text{-C}_4$, $\alpha\text{-C}_1\text{-C}_6$, plant

(IV) $\alpha\text{-C}_1\text{-C}_4$, plant

Choose the correct answer from the options given below:

- A** (A)-(II), (B)-(III), (C)-(I), (D)-(IV)
- B** (A)-(III), (B)-(II), (C)-(I), (D)-(IV)
- C** (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
- D** (A)-(IV), (B)-(I), (C)-(II), (D)-(III)



C.Q. 19 [20 July, JEE Mains 2021 (Shift-I)]

Identify the incorrect statement from the following:

- A Amylose is a branched chain polymer of glucose.
- B Starch is a polymer of α -D-glucose.
- C β -Glycosidic linkage makes cellulose polymer.
- D Glycogen is called as animal starch.

C.Q. 20 (NCERT Exemplar)



Glycogen is a branched chain polymer of α -D-glucose units in which chain is formed by C1—C4 glycosidic linkage whereas branching occurs by the formation of C1-C6 glycosidic linkage. Structure of glycogen is similar to _____.

A Amylose

C Cellulose

B Amylopectin

D Glucose

Importance of Carbohydrates:

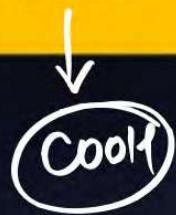


Amylose
Amylopectin
Cellulose
(Plants)

Glycogen
(Animal)



Amino Acids



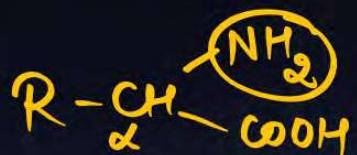
α - Amino acids are monomer of proteins



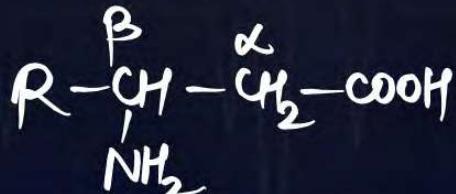
Classification:

Based on relative position of -COOH and -NH₂ groups

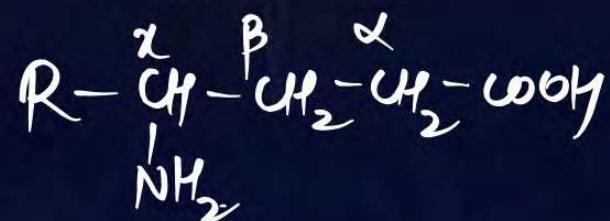
1. α-amino acid



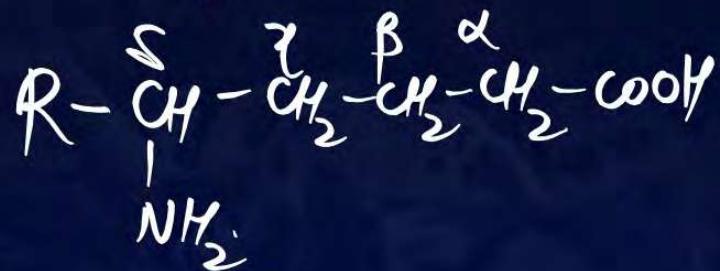
2. β-amino acid



3. γ-amino acid

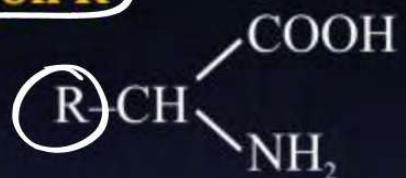


4. δ-amino acid

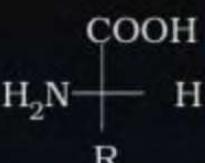


Amino acid (α -amino acids):

Based on R



1. If R contains -COOH Acidic amino acid
2. If R contains -NH₂ Basic amino acid
3. If R contains neither -COOH nor -NH₂ Neutral amino acid

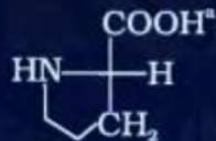
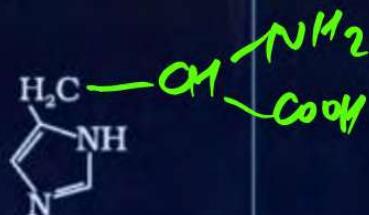
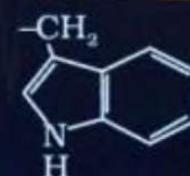
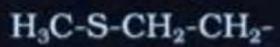
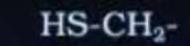
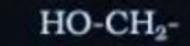
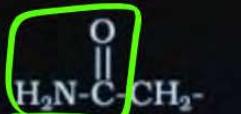
Natural Amino Acids		Name of the amino acids	Characteristic feature of side chain, R	Three letter symbol	One letter code
* = essential amino acid		1. Glycine	H	Gly	G
2. Alanine			- CH ₃	Ala	A
3. Valine*			(H ₃ C) ₂ CH-	Val	V
4. Leucine*			(H ₃ C) ₂ CH-CH ₂ -	Leu	L
5. Isoleucine*			H ₃ C-CH ₂ -CH- CH ₃	Ile	I
6. Arginine*			HN=C-NH-(CH ₂) ₃ - NH ₂	Arg	R
7. Lysine*			H ₂ N-(CH ₂) ₄ -	Lys	K
8. Glutamic acid			HOOC-CH ₂ -CH ₂ -	Glu	E
9. Aspartic acid			HOOC-CH ₂ -	Asp	D
10. Glutamine			H ₂ N-C(=O)-CH ₂ -CH ₂ -	Gln	Q

11. Asparagine
12. Threonine*
13. Serine
14. Cysteine
15. Methionine*
16. Phenylalanine*
17. Tyrosine

18. Tryptophan*

19. Histidine*

20. Proline



Asn

Thr

Ser

Cys

Met

Phe

Tyr

Trp

His

Pro

N

T

S

C

M

F

Y

W

H

P

* = essential amino acid

Tyrosine

serine

Glycine $\xrightarrow{\text{OIA}}$

Alanine

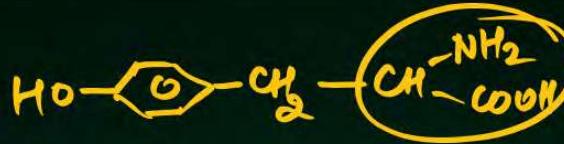
phenylalanine

valine

leucine

isoleucine

Non essen



Essen



Lysine $\xrightarrow{*}$ $\text{H}_2\text{N}-(\text{CH}_2)_4-$

Aspartic acid $\text{HOOC}-\text{CH}_2-$

Glutamic acid $\text{HOOC}-\text{CH}_2\text{CH}_2-$

Arginine $\xrightarrow{*}$ $\text{H}_2\text{N}-\overset{\text{NH}}{\underset{\text{II}}{\text{C}}}-\text{NH}-(\text{CH}_2)_3-$

Guanidine group.

Identify the essential amino acids from below:

- (A) Valine
- (B) Proline
- (C) Lysine
- (D) Threonine
- (E) Tyrosine

Choose the correct answer from the options given below:

- A** (A), (C) and (D) only
- B** (B), (C) and (E) only
- C** (C), (D) and (E) only
- D** (A), (C) and (E) only

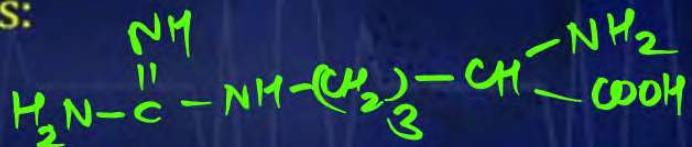
C.Q. 22 [13 April, JEE Mains 2023 (Shift-II)]



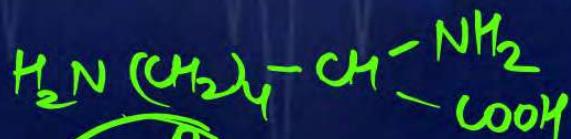
R
1° 2° amine Basic

The naturally occurring amino acid that contains only one basic functional group in its chemical structure is:

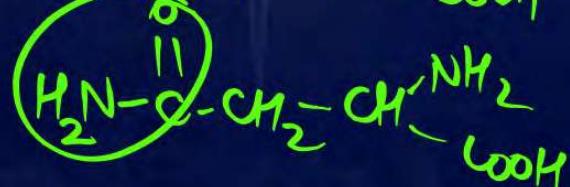
A arginine



B lysine



C asparagine



D histidine

C.Q. 23 [06 April, JEE Mains 2023 (Shift-II)]

Match List-I with List-II

List-I

Natural Amino acid

- A. Arginine IV
- B. Aspartic acid I
- C. Asparagine II
- D. Alanine III

List-II

One letter Code

- I. D
- II. N
- III. A
- IV. R

Choose the correct answer from the options given below:

A A → IV, B → I, C → III, D → II

C A → III, B → I, C → II, D → IV

B A → I, B → III, C → IV, D → II

D A → IV, B → I, C → II, D → III

C.Q. 24 (NEET 2020)



Which of the following is a basic amino acid?

- A Alanine Neutral
- B Tyrosine Neutral
- C Lysine Basic
- D Serine Neutral

The non-essential amino acid among the following is:

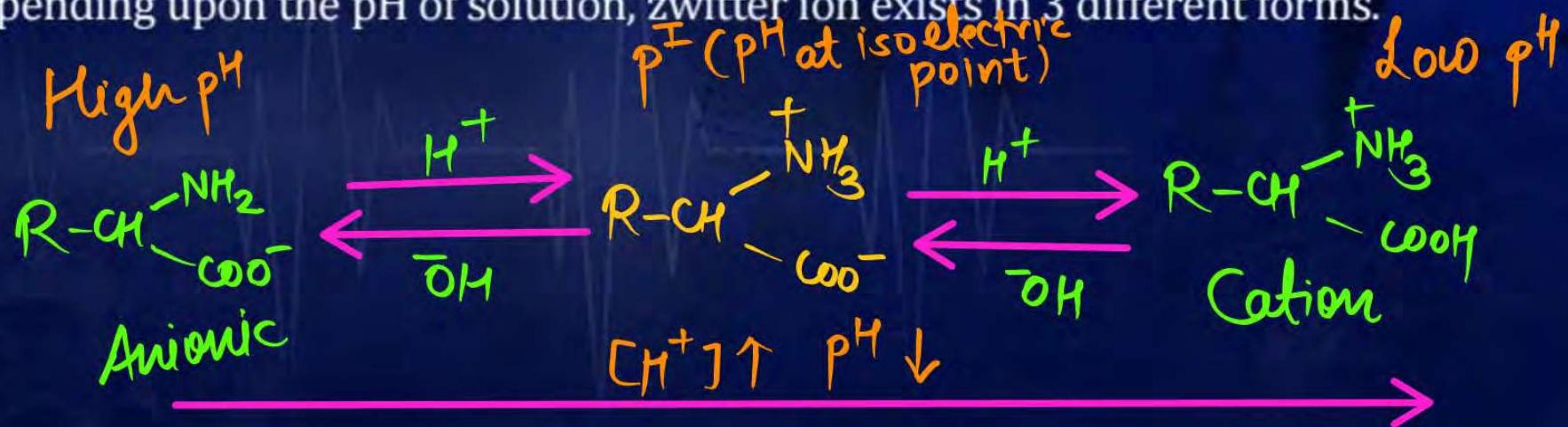
- A valine
- B leucine
- C alanine
- D lysine

Tyr
Ser
Gly
Ala

Zwitter ion:

Bipolar ion $\xrightarrow{\oplus} \ominus$

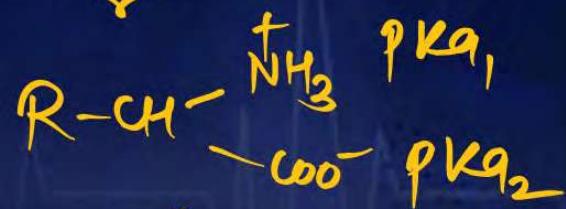
Depending upon the pH of solution, zwitter ion exists in 3 different forms.



Anion Zwitter Cat
High Inter Low pH

Calculation of pH at Isoelectric points (P^I):

Case-1: For neutral amino acid (usually 6)

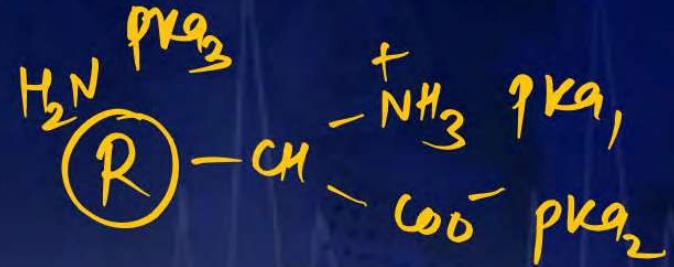


$$\text{pH} = \text{pI} = \frac{\text{pK}_{\text{a}_1} + \text{pK}_{\text{a}_2}}{2}$$

Case-2: For Acidic Amino acid (usually 2)

$$pH = \frac{pK_a_1 + pK_a_2}{2}$$

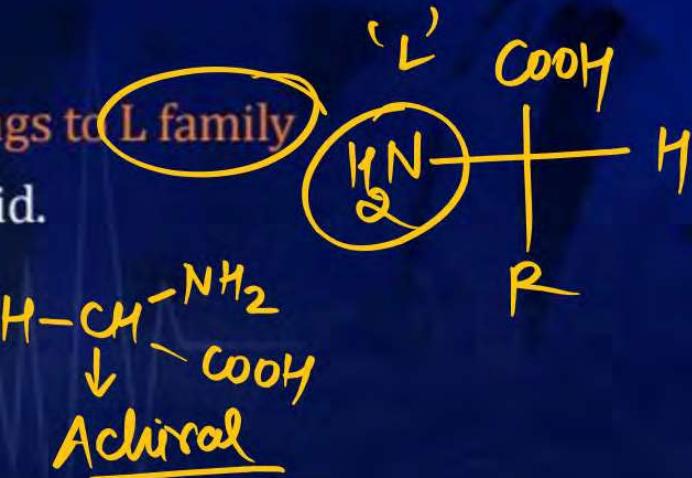
Case-3: For Basic Amino acid (Usually 10)



$$\text{pH} = \frac{\text{pK}_{\text{a}_1} + \text{pK}_{\text{a}_3}}{2}$$

OP Points of α -Amino Acids:

1. Most natural occurring amino acids Belongs to L family
2. Glycine is only optically inactive amino acid.
3. High M.P and B.P (due to zwitter ion)
4. Water soluble (salt form)
5. Behave like salt
6. α -amino acid is monomer of Protein.



C.Q. 26 (NEET 2018)



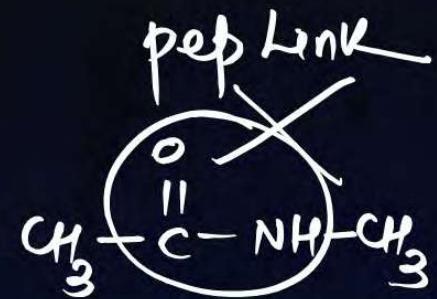
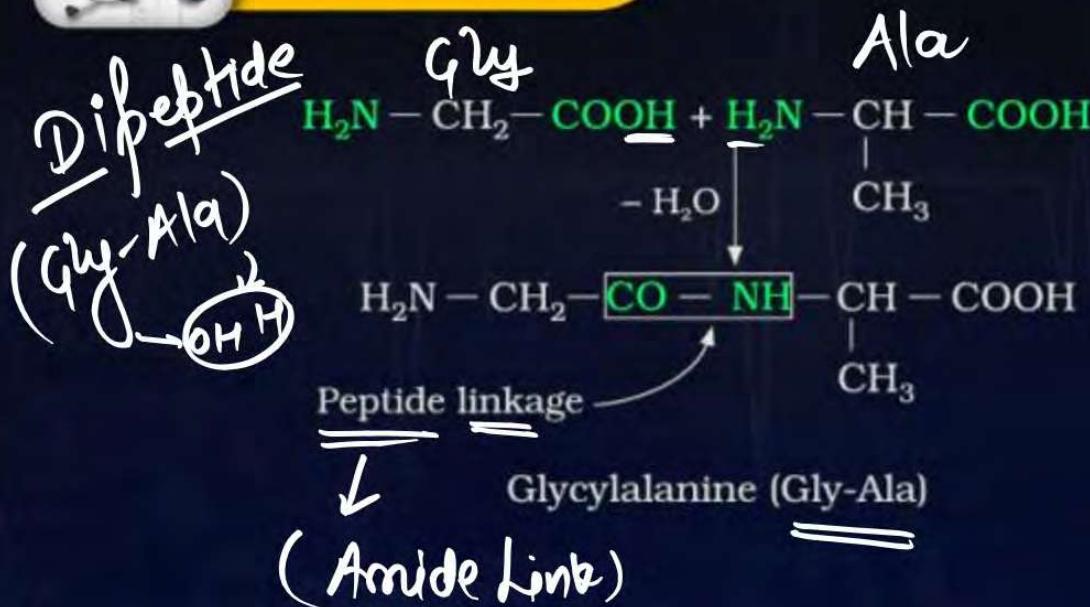
Which of the following compounds can form a zwitter ion?

- A ✗ Aniline PhNH_2
- B ✗ Acetanilide $\text{Ph}-\text{NH}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{CH}_3$
- C ✓ Glycine $\text{H}_2\text{N}-\text{CH}_2-\text{COOH}$
- D ✗ Benzoic acid PhCOOH



Proteins

polymer
of (α -amino acid)



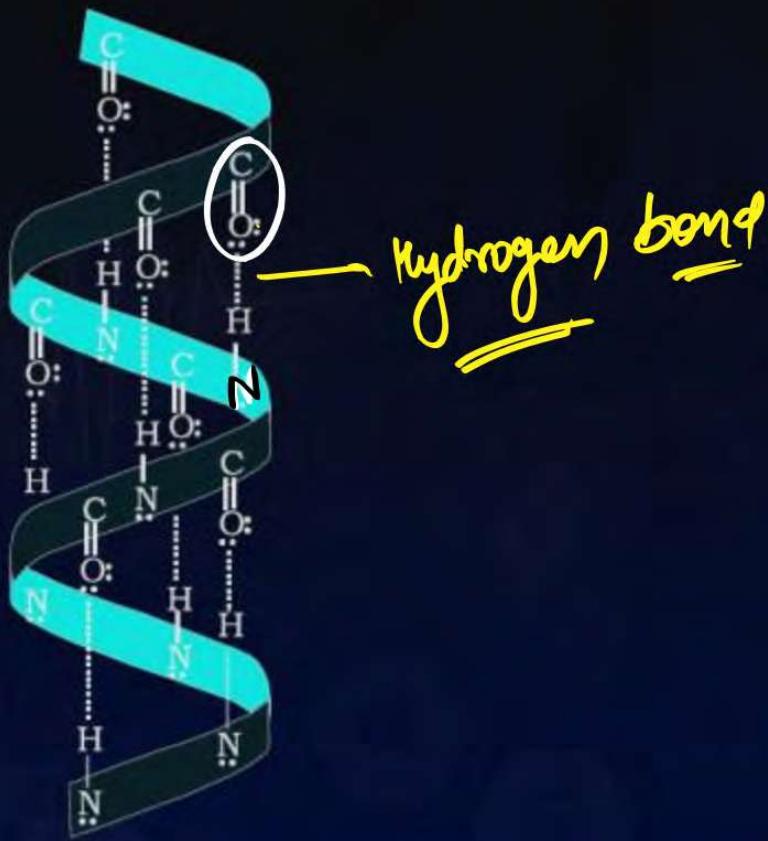
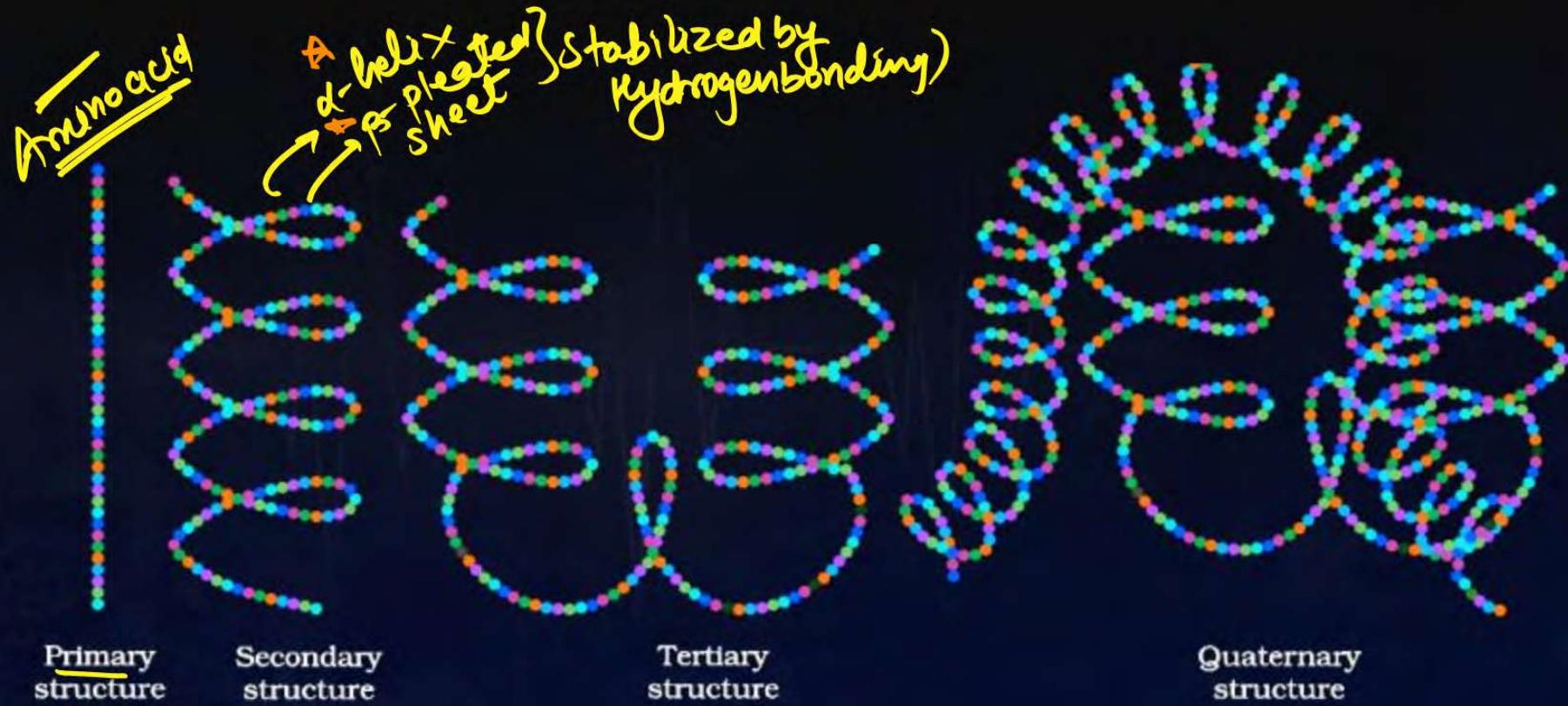


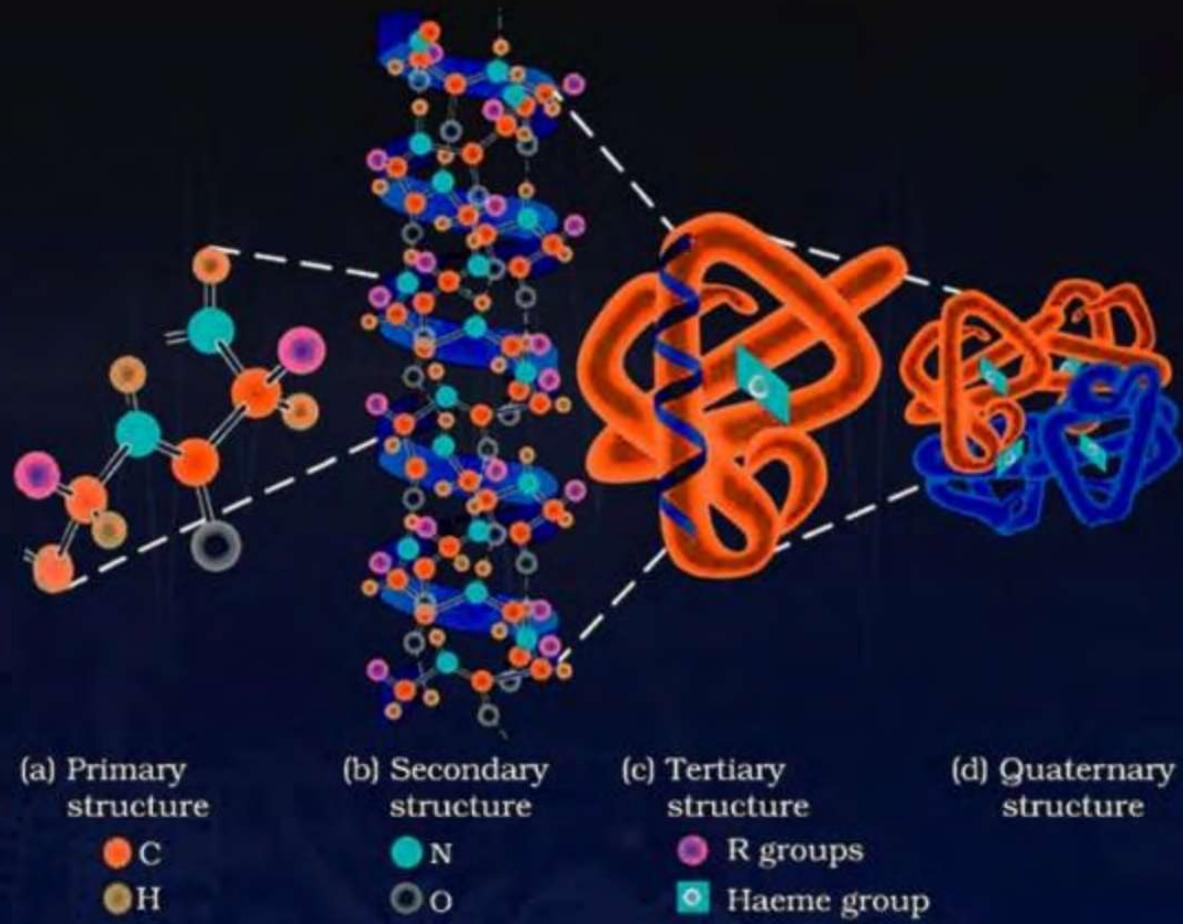
Fig. 10.1: α -Helix structure of proteins

Globular & Fibrous Protein:

Globular and Fibrous are 2 main types of proteins.

	<u>Fibrous (Collagen)</u>	<u>Globular (Myoglobin)</u>
Molecules	Long, thin Lie side by side to form fibres.	Fold into spherical 3-D shape.
Examples	Collagen (in skin and bone). Keratin (present in hair, wool, silk) and myosin (present in muscles).	Haemoglobin Insulin (51 amino acid) Enzymes albumins
Solubility in water	Insoluble	Soluble
Roles	Structural: <ul style="list-style-type: none">Collagen in bone and cartilage.Keratin in fingernails and hair.	Metabolic: <ul style="list-style-type: none">Enzymes in all organismsPlasma proteins, antibodies in mammals.





Denaturation of PROTEINS:

2° & 3° struc $\xrightarrow{\text{pH change}}$ ①
Hydrogen or T change
bond too do

1. Protein found in a biological system with a unique 3D structure and biological activity is called a native protein.
2. When a protein in its native form, is subjected to physical change like change in temperature or chemical change like change in pH, the hydrogen bonds are disturbed. Due to this globules unfold and helix get uncoiled and protein loses its biological activity. **This is called denaturation of protein.**
3. During denaturation secondary and tertiary structures are destroyed by primary structure remains intact.
4. **Example:** Coagulation of egg white on boiling, curdling of milk which is caused due to the formation of lactic acid by the bacteria present in milk.



C.Q. 27 (JEE Mains 2025, 23 January Shift-2)



The α -Helix and β -Pleated sheet structures of protein are associated with its:

- A** primary structure
- B** tertiary structure
- C** secondary structure
- D** quaternary structure

C.Q. 28 [10 April, JEE Mains 2023 (Shift-I)]

The one that does not stabilize 2° and 3° structures of proteins is:

A H-bonding

C -O - O - linkage ✓

B -S - S - linkage

D van der Waals forces

C.Q. 29 [29 June, JEE Mains 2022 (Shift-II)]

The structure of protein that is unaffected by heating is:

- A Secondary structure
- B Tertiary structure
- C Primary structure
- D Quaternary structure



Nucleic Acids

(Nucleoside)
1) sugar
2) base

PW

Mono sacc → polysacc Carbohydrate

α -amino acid → Protein Amino acid

Nucleotide → Nucleic Acid Nucleic acid

Nucleotide

- 1) sugar
- 2) base
- 3) phosphate

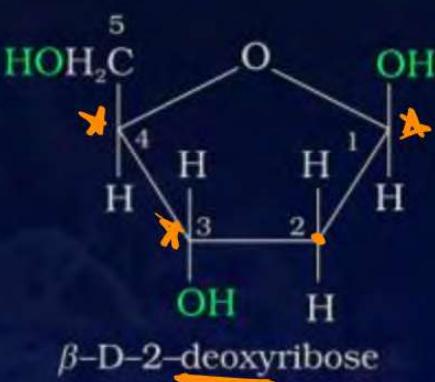
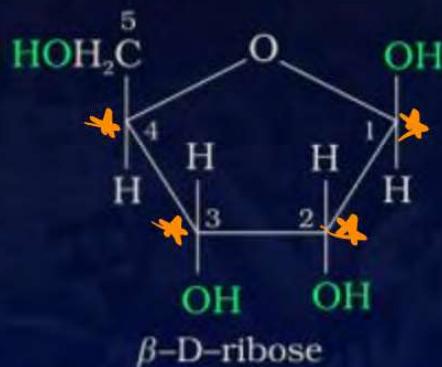
[
base
|
sugar-phosphate]
nw

1. It has been observed that nucleus of a living cell is responsible for this transmission of inherent characters, also called heredity.
2. The particles in nucleus of the cell, responsible for heredity, are called chromosomes which are made up of proteins.
3. Another type of biomolecules called nucleic acids. These are mainly of two types, the deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
4. Nucleic acids are long chain polymers of nucleotides, so they are also called polynucleotides.

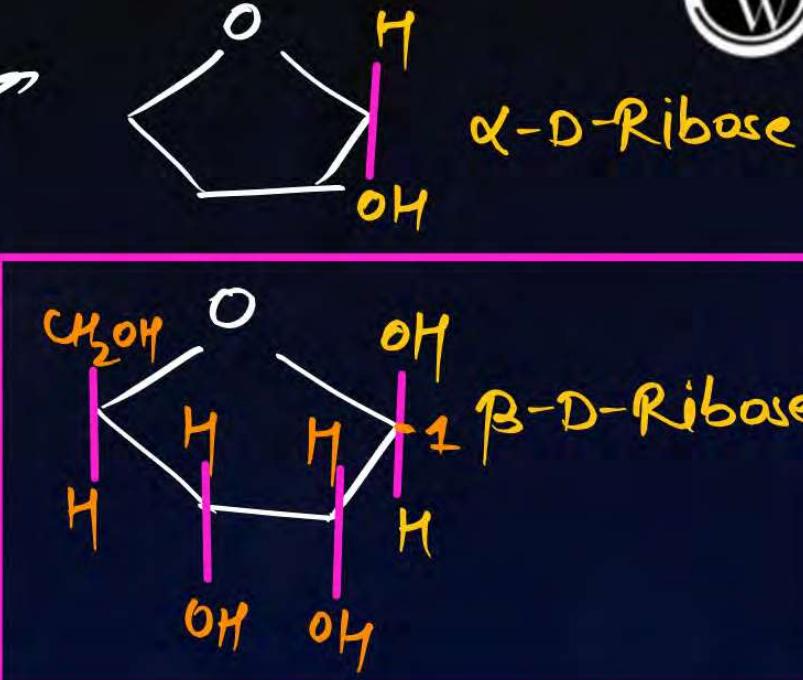
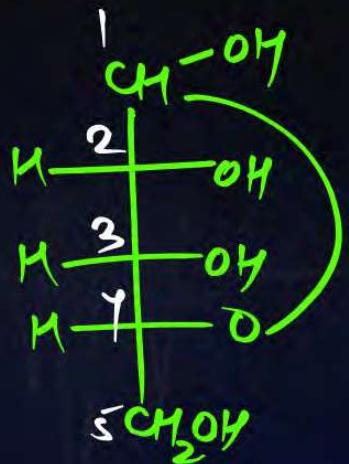
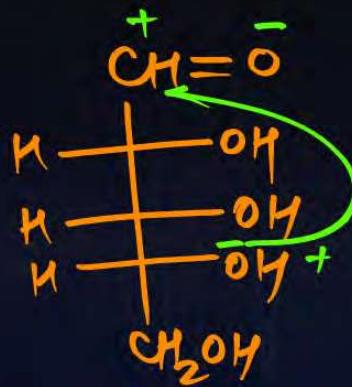


Chemical Composition of Nucleic Acids

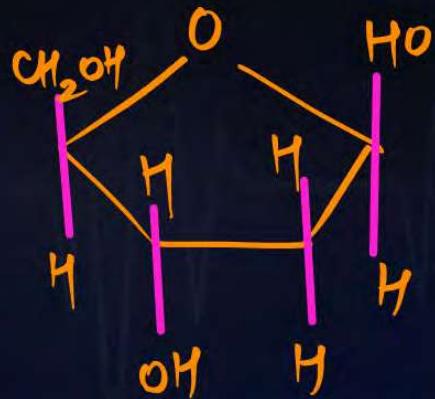
1. Complete hydrolysis of DNA (or RNA) yields a pentose sugar, phosphoric acid and nitrogen containing heterocyclic compounds (called bases).
2. The DNA molecules, the sugar moiety is β -D-2-deoxyribose whereas in RNA molecule, it is β -D-ribose.



Formation of a ribose sugar



Formation of a deoxyribose sugar



β -D-2-deoxyribose

C.Q. 30 (JEE Mains 29 January 2024, Evening Shift)

Match List-I with List-II.

List-I (Bio Polymer)		List-II (Monomer)	
A.	Starch II	I.	nucleotide
B.	Cellulose III	II.	α -glucose
C.	Nucleic acid I	III.	β -glucose
D.	Protein IV	IV.	α -amino acid

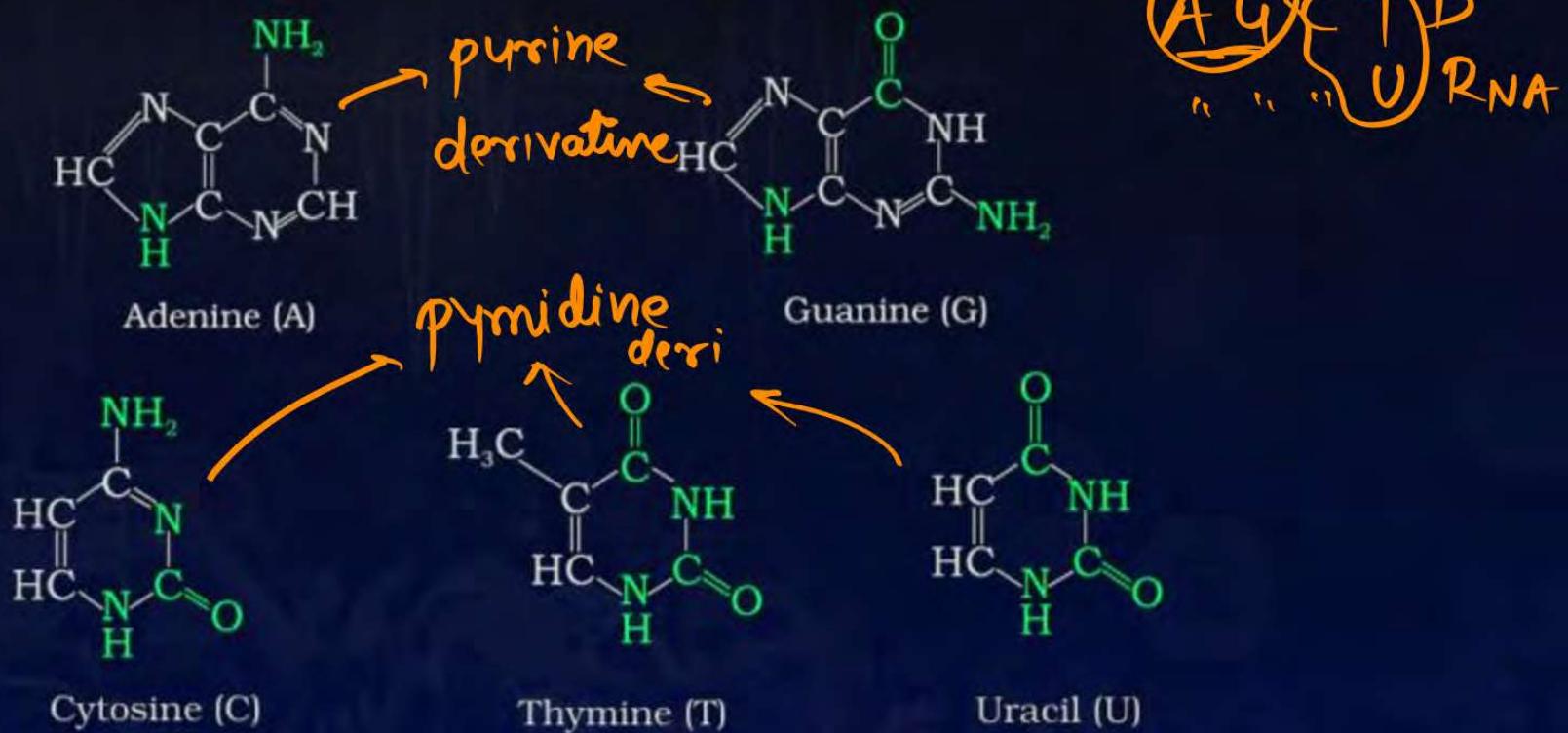
Choose the correct answer from the options given below:

- A** A-II, B-I, C-III, D-IV
- B** A-IV, B-II, C-I, D-III
- C** A-I, B-III, C-IV, D-II
- D** A-II, B-III, C-I, D-IV



Bases in DNA & RNA

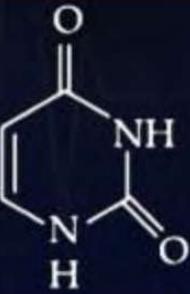
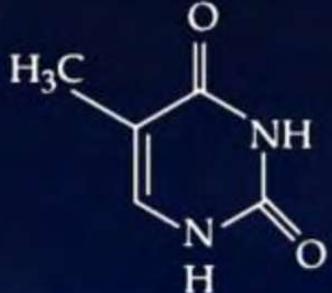
1. DNA adenine (A), guanine (G), cytosine (C) and thymine (T).
2. RNA adenine (A), guanine (G), cytosine (C) and uracil (U).



C.Q. 31 (JEE Mains 2025, 24 January Shift-2)

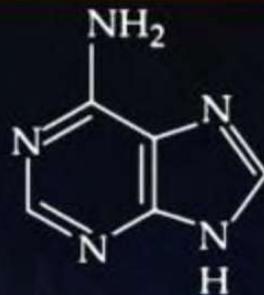


Match the List-I with List-II.

List-I		List-II	
(A)	Adenine	(I)	 Chemical structure of Cytosine: A purine ring system with an amino group (NH2) at position 4 and a carbonyl group (C=O) at position 2.
(B)	Cytosine	(II)	 Chemical structure of Adenine: A purine ring system with a methyl group (H3C) at position 6, an amino group (NH2) at position 4, and a carbonyl group (C=O) at position 2.

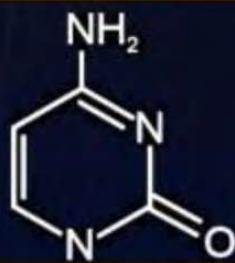
(C) Thymine

(III)



(D) Uracil

(IV)



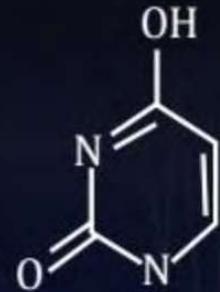
Choose the correct answer from the options given below:

- A** (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
- B** (A)-(IV), (B)-(III), (C)-(II), ~~(D)-(I)~~
- C** (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
- D** ~~(A)-(III), (B)-(IV), (C)-(II), (D)-(I)~~

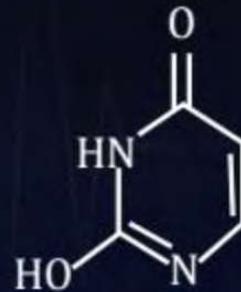
C.Q. 32 [27 Aug, JEE Mains 2021 (Shift-I)]

Out of following isomeric forms of uracil, which one is present in RNA?

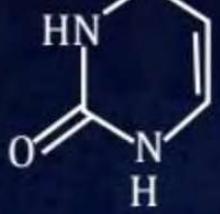
A



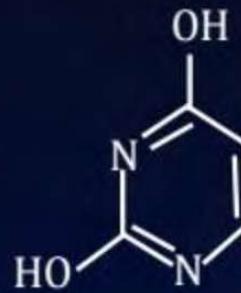
B



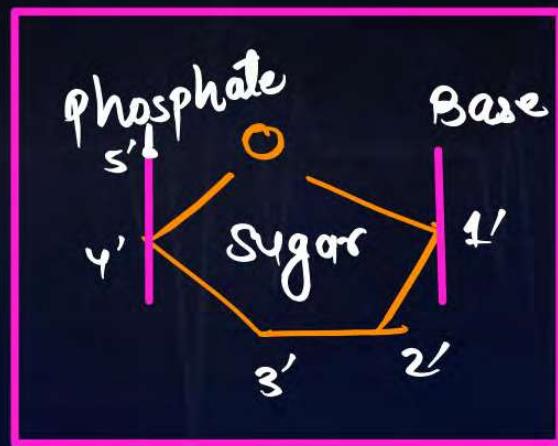
C



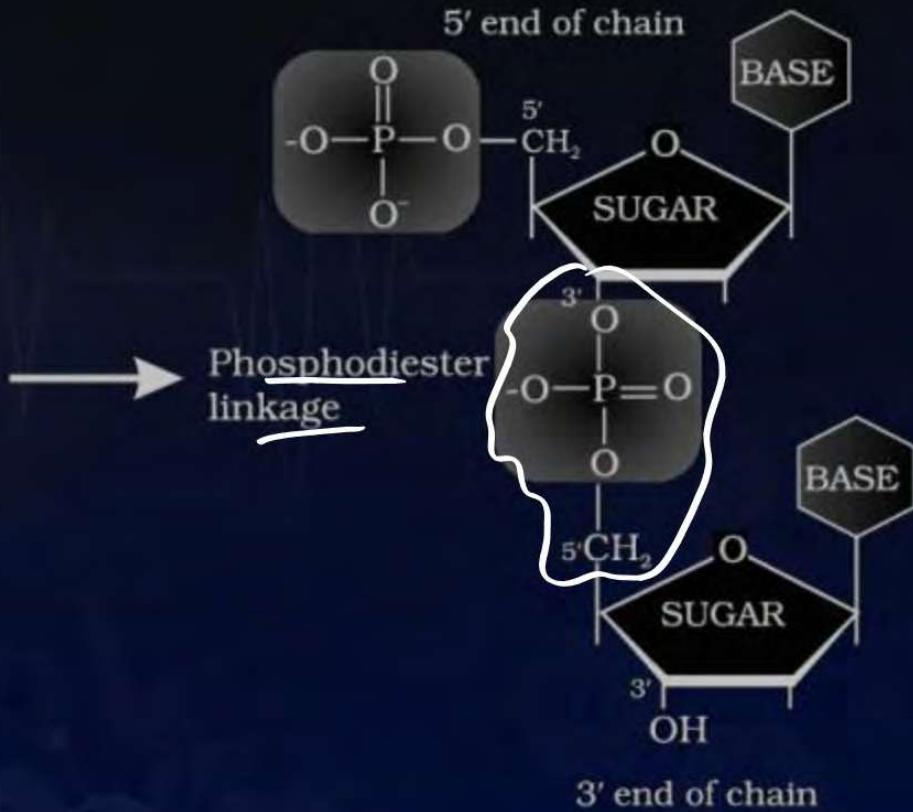
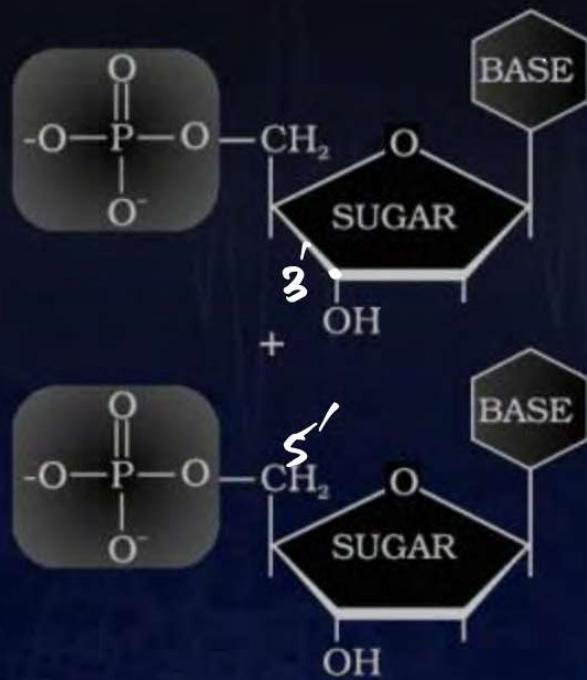
D



Structure of Nucleic Acid:



Dinucleotide:



Formation of a dinucleotide

C.Q. 33 (JEE Mains 27th January 2024, Morning Shift)

Two nucleotides are joined together by a linkage known as:

A Phosphodiester linkage ✓

B Glycosidic linkage

C Disulphide linkage

D Peptide linkage

Given below are two statements:

Statement-I: A unit formed by the attachment of a base to 1' position of sugar is known as nucleoside.

Statement-II: When nucleoside is linked to phosphorous acid at 5'-position of sugar moiety, we get nucleotide.

- A** Statement I is false but Statement II is true.
- B** Both Statement I and Statement II are true.
- C** Both Statement I and Statement II are false.
- D** Statement I is true but Statement II is false

The correct statement regarding RNA and DNA, respectively is:

- A The sugar component in RNA is ~~arabinose~~ and the sugar component in DNA is 2'-deoxyribose.
- B The sugar component in RNA is ribose and the sugar component in DNA is 2'-deoxyribose.
- C The sugar component in RNA is arabinose.
- D The sugar component in RNA is 2'-deoxyribose and the sugar component in DNA is arabinose.

Double strand helix structure for DNA

1. Nucleic acids have a secondary structure also.
2. Two nucleic acid chains are wound about each other and held together by hydrogen bonds between pairs of bases.
3. The two strands are complementary to each other because the hydrogen bonds are formed between specific pairs of bases.
4. Adenine forms 2 hydrogen bonds with thymine whereas cytosine forms 3 hydrogen bonds with guanine.



C.Q. 36 (JEE Mains 1st Feb 2024, Morning Shift)



If one strand of a DNA has the sequence ATGCTTCA, sequence of the basis in complementary strand is:

TACGAAGT

- A** CATTAGCT
- C** GTACTTAC

- B** TACGAAGT
- D** ATGCGACT

Secondary Structure for RNA

1. In secondary structure of RNA single stranded helics is present which sometimes folds back on itself.
2. RNA molecules are of three types and they perform different functions.
3. They are named as messenger RNA (m-RNA), ribosomal r-RNA and transfer RNA (t-RNA).

DNA fingerprinting

1. It is known that every individual has unique fingerprints.
2. These occur at the tips of the fingers and have been used for identification for a long time but these can be altered by surgery.
3. A sequence of bases on DNA is also unique for a person and information regarding this is called DNA fingerprinting.
4. It is same for every cell and cannot be altered by any known treatment.
5. DNA fingerprinting is now used
 - (i) in forensic laboratories for identification of criminals.
 - (ii) to determine paternity of an individual.
 - (iii) to identify the dead bodies in any accident by comparing the DNA's of parents or children.
 - (iv) to identify racial groups to rewrite biological evolution.



Vitamins



1. It has been observed that certain organic compounds are required in small amounts in our diet but their deficiency causes specific diseases. These compounds are called vitamins.
2. Vitamins are designated by alphabets A, B, C, D etc. Some of them are further named as sub-groups e.g. B₁, B₂, B₆, B₁₂ etc.
3. Excess of vitamins is also harmful and vitamin pills should not be taken without the advice of doctor.
4. The term "Vitamine" was coined from the word vital + amine since the earlier identified compounds had amino groups. Later work showed that most of them did not contain amino groups, so the letter 'e' was dropped and the term vitamin is used these days.

Fat Soluble Vitamins

- Vitamin K
- Vitamin E
- Vitamin D
- Vitamin A (Retinol)
- **B₁₂**

Water Soluble Vitamins

Vitamin	Name
B ₁	<u>Thiamine</u>
B ₂	<u>Riboflavin</u>
B ₃	<u>Niacin</u>
B ₅	Pantothenic Acid
B ₆	Pyridoxine
B ₇	Biotin
B ₉	Folate
C	Ascorbic Acid



Sl. No.	Name of Vitamins	Sources	Deficiency diseases
1.	Vitamin A	Fish liver oil, carrots, butter and milk	Xerophthalmia (hardening of cornea of eye) Night blindness
2.	Vitamin B ₁ (Thiamine)	Yeast, milk, green vegetables and cereals	Beri beri (loss of appetite, retarded growth)
3.	Vitamin B ₂ (Riboflavin)	Milk, eggwhite, liver, kidney	Cheilosis (fissuring at corners of mouth and lips), digestive disorders and burning sensation of the skin.
4.	Vitamin B ₆ (Pyridoxine)	Yeast, milk, egg yolk, cereals and grams	Convulsions
5.	Vitamin B ₁₂	Meat, fish, egg and curd	Pernicious anaemia (RBC deficient in haemoglobin)
6.	Vitamin C (Ascorbic acid)	Citrus fruits, amla and green leafy vegetables	Scurvy (bleeding gums)
7.	Vitamin D	Exposure to sunlight, fish and egg yolk	Rickets (bone deformities in children) and osteomalacia (soft bones and joint pain in adults)
8.	Vitamin E	Vegetable oils like wheat germ oil, sunflower oil, etc.	Increased fragility of RBCs and muscular weakness
9.	Vitamin K	Green leafy vegetables	Increased blood clotting time

Which of the following acids is a vitamin?

- A Adipic acid
- B Aspartic acid
- C Ascorbic acid ✓ Vitamin C'
- D Saccharic acid

C.Q. 38 (JEE Mains 31st January 2024, Evening Shift)



From the vitamins A, B₁, B₆, B₁₂, C, D, E and K, the number vitamins that can be stored in our body is 5.

K E D A B₁₂

C.Q. 39 [22 July, JEE Mains 2021 (Shift-II)]

Thiamine and pyridoxine are also known respectively as:

- A Vitamin B₂ and Vitamin E
- B Vitamin E and Vitamin B₂
- C Vitamin B₆ and Vitamin B₂
- D Vitamin B₁ and Vitamin B₆

C.Q. 40 (NEET 2021)



The RBC deficiency is deficiency disease of:

- A** Vitamin B₆
- B** Vitamin B₁
- C** Vitamin B₂
- D** Vitamin B₁₂

Assertion: Vitamin D can be stored in our body.

Reason: Vitamin D is fat soluble vitamin.

- A Assertion and reason both are correct statements and reason explains the assertion.
- B Both assertion and reason are wrong statements.
- C Assertion is correct statement and reason is wrong statement.
- D Assertion is wrong statement and reason is correct statement.



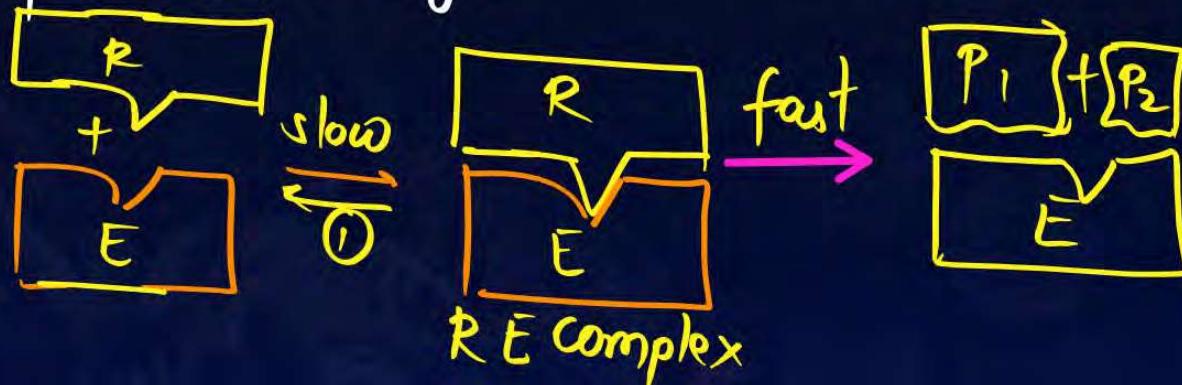
Enzymes



- 1) Biochemical catalyst
- 2) Enzyme reduces Activation energy
- 3) Specific
- 4) Activate at optimum temp & pH
- 5) one enzyme can catalyse millions of the reaction



Lock & key model



C.Q. 42 (JEE Mains 6th April 2024, Evening Shift)



The **incorrect** statements regarding enzymes are:

- (A) Enzymes are biocatalysts.
- (B) Enzymes are non-specific and can catalyse different kinds of reactions.
- (C) Most Enzymes are globular proteins.
- (D) Enzyme-oxidase catalyses the hydrolysis of maltose into glucose.

Choose the correct answer from the option given below:

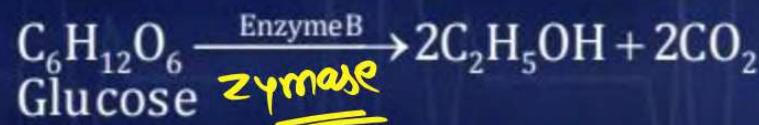
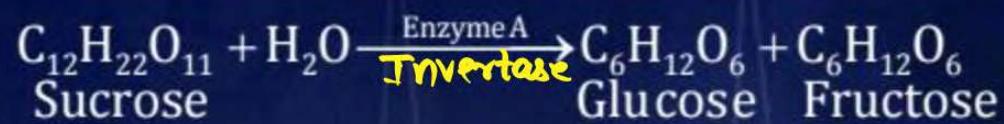
A (B) and (C)

B (B), (C) and (D)

C (B) and (D) ✓

D (A), (B) and (C) ✗

C.Q. 43 [17 March, JEE Mains 2021 (Shift-II)]



In the above reactions, the enzyme A and enzyme B, respectively are:

- A** Amylase and Invertase
 - B** Invertase and Amylase
 - C** Invertase and Zymase
 - D** Zymase and Invertase

The incorrect statement regarding enzymes is:

- A Enzymes are very specific for a particular reaction and substrate.
- B Enzymes are biocatalysts.
- C Like chemical catalysts enzymes reduce the activation energy of bio process.
- D Enzymes are polysaccharides.

High molecular mass protein



Hormones



1. Hormones are molecules that act as intercellular messengers.
2. These are produced by endocrine glands in the body and are poured directly in the blood stream which transports them to the site of action.
3. Some of these are steroids, e.g., estrogens and androgens; some are poly peptides for example insulin and endorphins and some others are amino acid derivatives such as epinephrine and norepinephrine.
4. Hormones have several functions in the body. They help to maintain the balance of biological activities in the body.
5. The role of insulin in keeping the blood glucose level within the narrow limit is an example of this function. Insulin is released in response to the rapid rise in blood glucose level.

6. Hormone glucagon tends to increase the glucose level in the blood.
7. Steroid hormones are produced by adrenal cortex and gonads (testes in males and ovaries in females).
8. Hormones released by the adrenal cortex play very important role in the functions of the body.
9. Testosterone is the major sex hormone produced in males.
10. It is responsible for development of secondary male characteristics (deep voice, facial hair, general physical constitution).
11. Estradiol is the main female sex hormone.
12. It is responsible for development of secondary female characteristics and participates in the control of menstrual cycle.
13. Progesterone is responsible for preparing the uterus for implantation of fertilized egg.

C.Q. 45 (AIPMT 2009)



Which of the following hormones contains iodine?

- A Testosterone
- B Adrenaline
- C Thyroxine
- D Insulin

C.Q. 46 (AIPMT 2008)



Which one of the following is an amine hormone?

- A Thyroxine
- B Oxypurin
- C Insulin
- D Progesterone

SI amino acid

Which one of the following is a peptide hormone?

- A Testosterone
- B Thyroxin
- C Adrenaline
- D Glucagon

✓



Biomolecules

Practice Problems

QUESTION-1



Which of the following is a disaccharide?

- A Lactose
- B Glucose
- C Galactose
- D Fructose

QUESTION-2



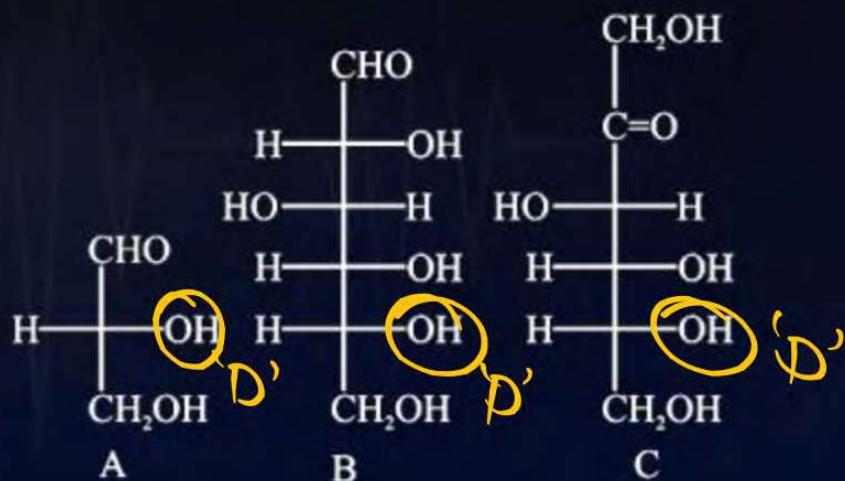
Some compound with their structures are given below. Which of them have D configuration.

A A, B and C

B B and C

C A and B

D C only



QUESTION-3



The amino acids that can be synthesized in the body are known as;

A essential amino acids

B non-essential amino acids

C α -amino acids

D acidic amino acids

QUESTION-4



Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R)

Assertion (A): Carbohydrates may be defined as optically active polyhydroxy aldehydes or ketones or the compounds which produce such units on hydrolysis.

Reason (R): Sugar present in milk is known as maltose 

In the light of the above statements, choose the correct answer from the options given below:

- A A is true but R is false. 
- B A is false but R is true.
- C Both A and R are true and R is the correct explanation of A.
- D Both A and R are true but R is NOT the correct explanation of A.

QUESTION-5



Given below are two statements:

Statement I: In DNA molecules, the sugar moiety is β -D-2-deoxyribose.

Statement II: In RNA molecules, the sugar moiety is β -D-ribose.

In the light of the above statements, choose the correct answer from the options given below:

- A Statement I is incorrect, but Statement II is correct.
- B Statement I is correct, but Statement II is incorrect.
- C Both Statement I and Statement II are correct.
- D Both Statement I and Statement II are incorrect.

QUESTION-6



Cyclic structure of fructose resembles with

A pyran

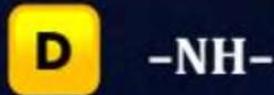
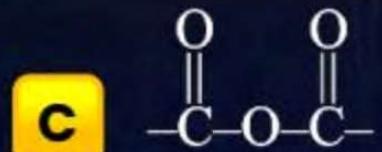
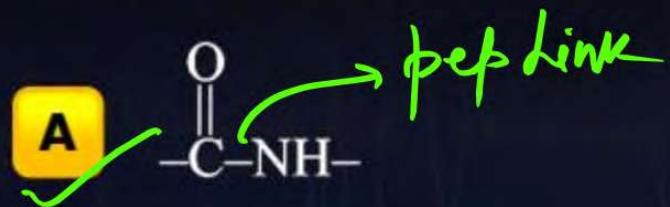
B furan

C pyridine

D oxiran

QUESTION-7

The peptide linkage present in proteins is:



QUESTION-8

Given below are two statements:

Statement I: Amino acids are building blocks of proteins.

Statement II: In aqueous solution, the carboxyl group of amino acid can lose a proton and amino group can accept a proton, giving rise to zwitter ion.

In the light of the above statements, choose the correct answer from the options given below:

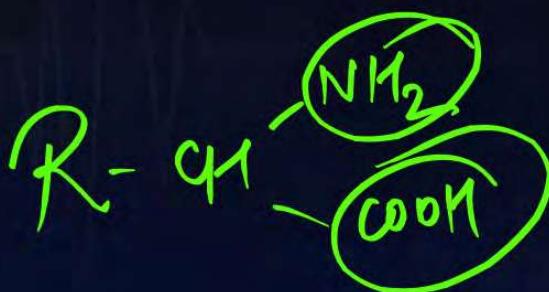
- A Statement I is incorrect, but Statement II is correct.
- B Statement I is correct, but Statement II is incorrect.
- C Both Statement I and Statement II are correct.
- D Both Statement I and Statement II are incorrect.

QUESTION-9



Two functional groups that are present in all amino acids are:

- A alcohol, amine
- B alcohol, amide
- C carboxylic acid, amine ✓
- D carboxylic acid, alcohol



QUESTION-10



Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): During denaturation secondary and tertiary structures are destroyed but primary structure remains intact.

Reason (R): When a protein in its native form, is subjected to physical change like change in temperature or pH, the hydrogen bonds are disturbed. Due to this, globules unfold and helix get uncoiled and protein loses its biological activity.

In the light of the above statements, choose the correct answer from the options given below:

- A** A is true but R is false.
- B** A is false but R is true.
- C** Both A and R are true and R is the correct explanation of A.
- D** Both A and R are true but R is NOT the correct explanation of A.

QUESTION-11



In DNA, the complimentary bases are:

- A Adenine and thymine; guanine and cytosine
- B Adenine and thymine; guanine and uracil
- C Adenine and guanine; thymine and cytosine
- D Uracil and adenine; cytosine and guanine

A G C T

QUESTION-12



Among the following vitamins the one whose deficiency causes rickets (bone deficiency) is:

- A Vitamin A
- B Vitamin B
- C Vitamin D ✓
- D Vitamin C

QUESTION-13



Given below are two statements:

Statement I: Sucrose is dextrorotatory but after hydrolysis gives dextrorotatory glucose and laevorotatory fructose.

Statement II: Hydrolysis of sucrose brings about a change in the sign of rotation, from dextro to laevo and the product is named as invert sugar.

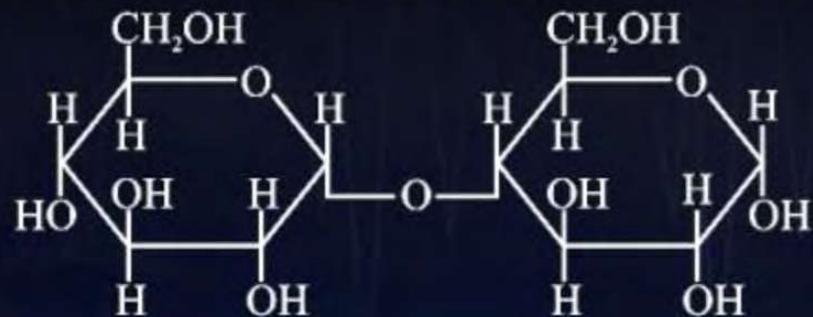
In the light of the above statements, choose the correct answer from the options given below:

- A Both Statement I and Statement II are correct.
- B Statement I is correct but Statement II is incorrect.
- C Statement I is incorrect but Statement II is correct.
- D Both Statement I and Statement II are incorrect.

QUESTION-14

Given below are two statements:

Statement I: The structure of maltose is:



Statement II: Maltose is composed of two α -D-glucose units in which C-1 of one glucose unit is linked to C-4 of another glucose unit.

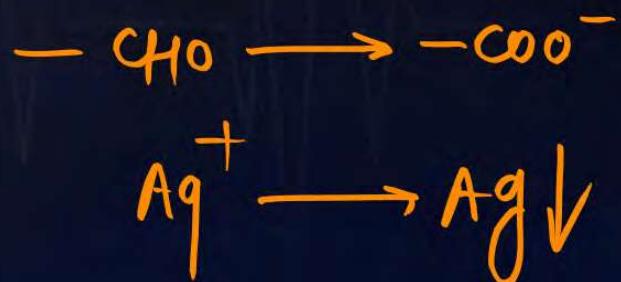
In the light of the above statements, choose the correct answer from the options given below:

- A Statement I is incorrect, but Statement II is correct.
- B Statement I is correct, but Statement II is incorrect.
- C Both Statement I and Statement II are correct.
- D Both Statement I and Statement II are incorrect.

QUESTION-15

Glucose gives silver mirror test with Tollen's reagent. It shows the presence of:

- A** anhydride group
- B** alcoholic group
- C** ketonic group
- D** aldehyde group



QUESTION-16

When glucose reacts with bromine water, the main product is:

- A gluconic acid ✓
- B glyceraldehyde
- C glucaric acid
- D acetic acid



QUESTION-17



Glucose cannot be classified as:

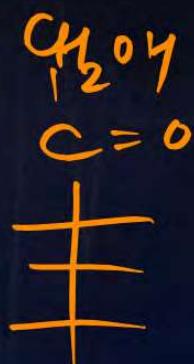
- A hexose
- B carbohydrate
- C aldose
- D ketose

QUESTION-18



Fructose is:

- A aldohexose
- B ketohexose
- C aldopentose
- D ketopentose



QUESTION-19



A carbohydrate that cannot be hydrolyzed into simpler units is called:

- A** polysaccharide
- B** disachharide
- C** trisaccharide
- D** monosaccharide



QUESTION-20



A disaccharide which gives glucose and galactose on hydrolysis is:

- A** Lactose
- B** Fructose
- C** Sucrose
- D** Maltose



NEET Syllabus (POC)



Unit 20: Principles Related to Practical Chemistry

- Detection of extra elements (Nitrogen, Sulphur, Halogens) in organic compounds; Detection of the following functional group; hydroxyl (alcoholic and phenolic), carbonyl (aldehyde and ketones) carboxyl and amino groups in organic compounds.
- The chemistry involved in the preparation of the following:
Organic compounds: Acetanilide, p-nitro acetanilide, aniline yellow, iodoform.

- The chemistry involved in the preparation of the following:
~~Inorganic compounds: Mohr's salt, potash alum.~~
- ~~The chemistry involved in the titrimetric exercises - Acids, bases and the use of indicators, oxalic acid vs KMnO_4 , Mohr's salt vs KMnO_4 .~~
- Chemical principles involved in the qualitative salt analysis:
~~Cations - Pb^{2+} , Cu^{2+} , Al^{3+} , Fe^{3+} , Zn^{2+} , Ni^{2+} , Ca^{2+} , Ba^{2+} , Mg^{2+} , NH_4^+~~
~~Anions- CO_3^{2-} , S^{2-} , SO_4^{2-} , NO_3^- , NO_2^- , Cl^- , Br^- , I^- (Insoluble salts excluded).~~

Chemical principles involved in the following experiments:

1. Enthalpy of solution of CuSO_4 .
2. Enthalpy of neutralization of strong acid and strong base.
3. Preparation of lyophilic and lyophobic sols.
4. Kinetic study of the reaction of iodide ions with hydrogen peroxide at room temperature.