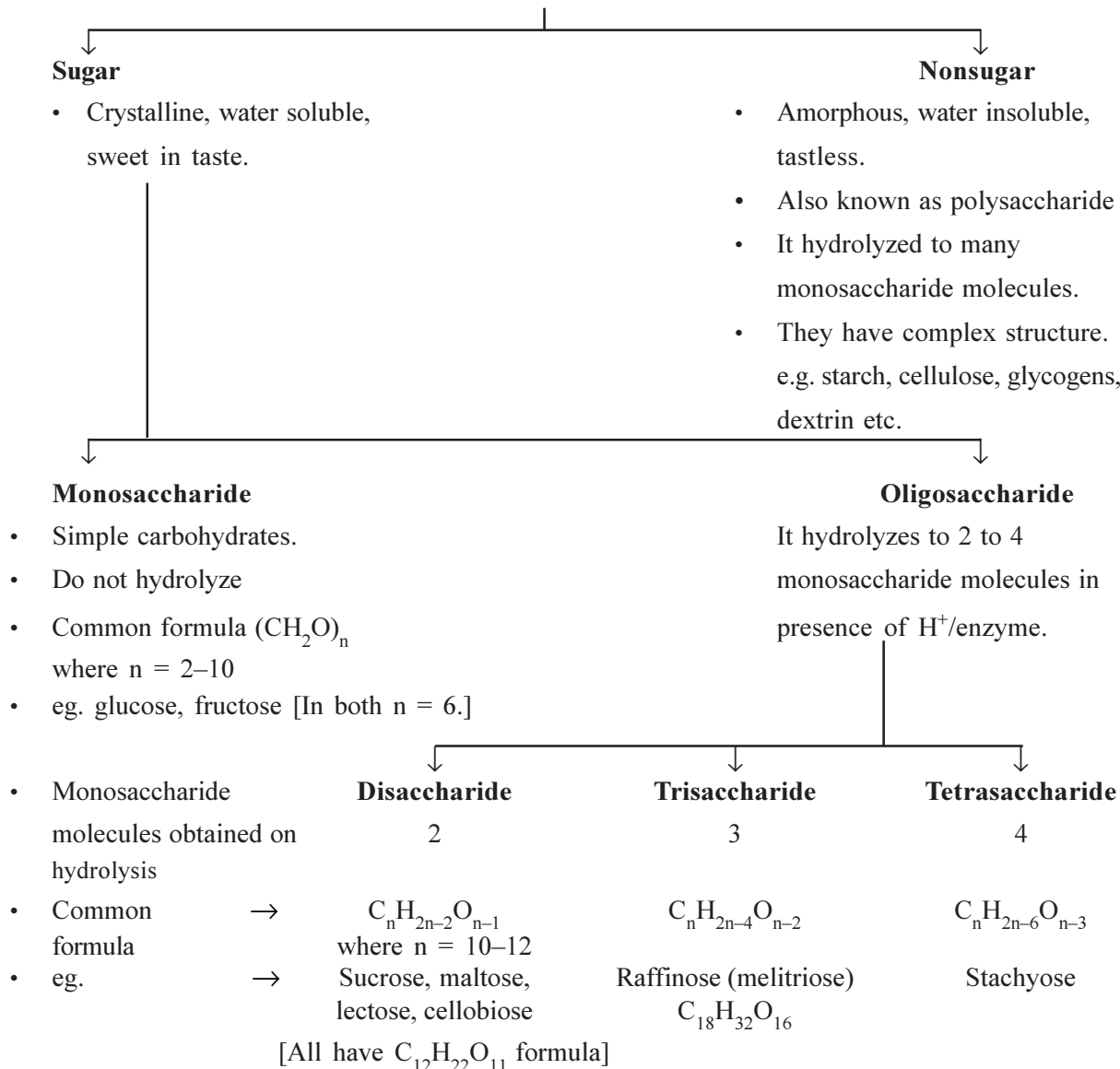


Classification of Carbohydrates



● Nomenclature of Carbohydrates

Generally the compounds of carbohydrate class contain 'ose' suffix in their names. e.g., glucose, fructose, lactose, sucrose, maltose, raffinose, stachyose.

Monosaccharides are classified according to number of carbon atoms and functional group.

Different types of monosaccharides

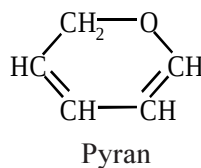
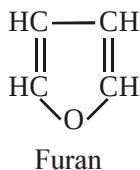
No. of carbon atoms	Common name	Aldehyde group	Keton group
3	triose	aldotriose	ketotriose
4	tetrose	aldotetrose	ketotetrose
5	pentose	aldopentose	ketopentose
6	hexose	aldohexose (eg. glucose)	ketohehexose (eg. fructose)
7	heptose	aldoheptose	ketoheptose

Six membered [5 “C” atoms and 1 “O” atom] and five membered [4 “C” atoms and 1 “O” atom] cyclic compounds are mentioned by word **pyranose** and **furanose** respectively.

Example : Glucose : glucopyranose

Fructose : Fructofuranose

• **Structure :**



- Which biomolecule fulfills basic requirements of human life like foods, clothes and abode ?
(A) Enzyme (B) Vitamin (C) Carbohydrate (D) Protein
- Which compound is not known as hydrate of carbon ?
P : starch Q : cellobiose R : melitriose S : rhamnose
(A) Only R (B) P and S (C) Q and R (D) Only S
- Carboydrate, which does not hydrolyze is
(A) $C_nH_{2n-4}O_{n-2}$ (B) $(CH_2O)_n$ (C) $C_nH_{2n-2}O_{n-1}$ (D) $C_nH_{2n-6}O_{n-3}$
- Stachyose + water $\xrightarrow[\text{enzyme}]{H^+ \text{ or}}$ x ‘monosaccharide molecules’. x =
(A) 3 (B) 4 (C) 2 (D) numerous
- In a cyclic structure of fructose there are four carbon atoms and one oxygen atom present in cyclic form, so what is called for it ?
(A) fructopyranose (B) fructotetrose (C) fructofuranose (D) fructooxose
- What is the ratio of σ and π in pyranose structure ?
(A) 6 : 1 (B) 5 : 2 (C) 4 : 1 (D) 8 : 3
- What element is x in a structure of furan ?

(A) N (B) S (C) P (D) O
- Which carbohydrate is different from others ?
(A) cellobiose (B) cellulose (C) glycogen (D) dextrin

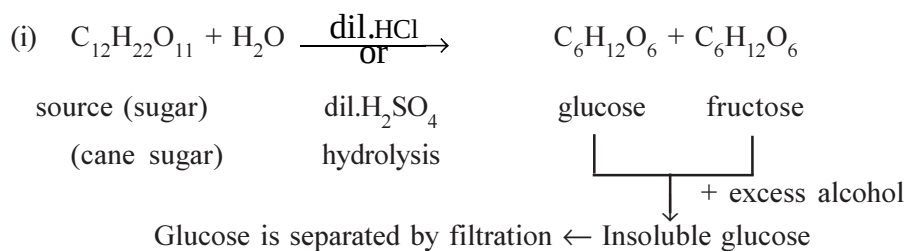
Answers : 1. (C), 2. (D), 3. (B), 4. (B), 5. (C), 6. (A), 7. (D), 8. (A)

• **Monosaccharide**

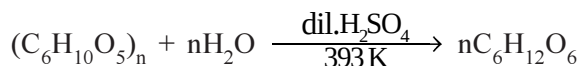
• **Glucose (grapesugar) :**

• **Source :** Ripe fruits, honey, grapes (20–25 % glucose)

• **Preparation :**



(ii) Industrial procedure :



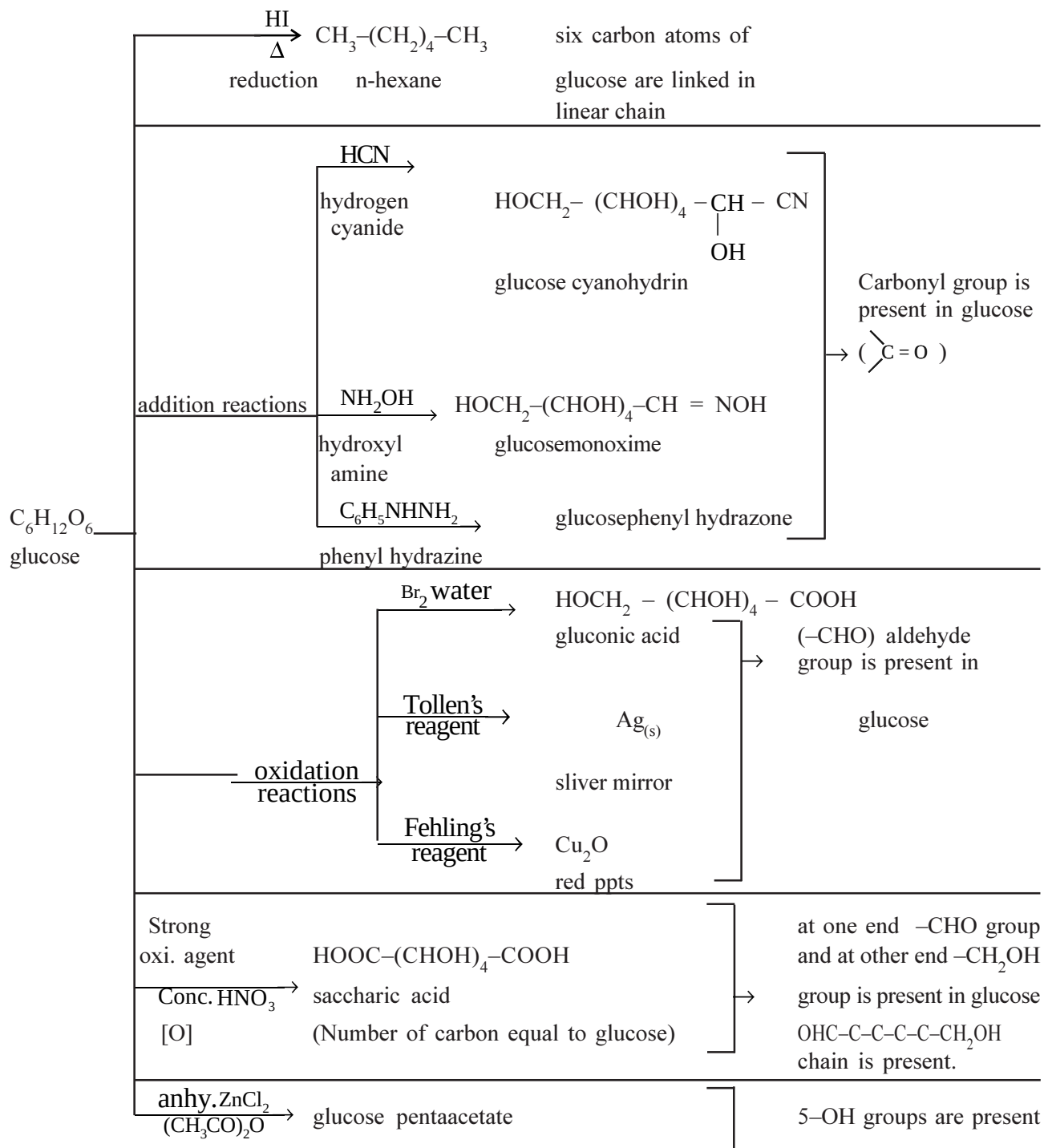
starch 2-3 bar pressure glucose
hydrolysis

• Structure of glucose

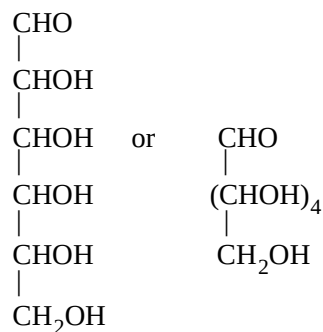
• Open chain structure of glucose :

• Empirical formula : CH_2O , molecular formula : $C_6H_{12}O_6$

Structure of glucose based on chemical properties



● From above chemical properties linear structure of glucose

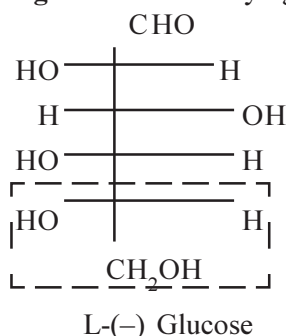
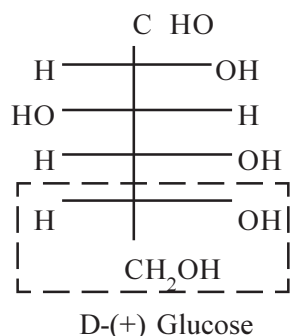


9. What happens when sucrose is reacted with dilute H_2SO_4 ?
 (A) dehydration (B) reduction (C) oxidation (D) hydrolysis
10. What empirical formula mass is obtained in gram unit on analysis of glucose ?
 (A) 30 (B) 60 (C) 90 (D) 180
11. With which reagent, presence of six carbon containing long chain is determined in glucose by reduction reaction ?
 (A) HCN (B) HI (C) Br_2 water (D) HNO_3
12. Glucose + HCN $\rightarrow$ cyanohydrin. This reaction shows presence of which group in glucose ?
 (A) $>\text{C}=\text{O}$ (B) $-\text{CHO}$ (C) $-\text{OH}$ (D) $-\text{COOH}$
13. By which reagent/reagents glucose can be identified ?
 P : CHCl_3 + alcoh. KOH Q : $[\text{Ag}(\text{NH}_3)_2]^+$ R : $\text{Cu}^{2+} + \text{OH}^-$
 (A) Only Q (B) Only R (C) P and Q (D) Q and R
14. In which of the following, glucose is not classified ?
 (A) carbohydrate (B) hexose
 (C) aldose (D) oligosaccharide
15. Glucose $\xrightarrow[\text{[O]}]{\text{conc. HNO}_3}$ "Z" product. What is molecular formula of "Z" ?
 (A) $\text{C}_6\text{H}_{12}\text{O}_7$ (B) $\text{C}_6\text{H}_{10}\text{O}_8$ (C) $\text{C}_6\text{H}_{12}\text{O}_8$ (D) $\text{C}_6\text{H}_{10}\text{O}_6$

Answers : 9. (D), 10. (A), 11. (B), 12. (A), 13. (D), 14. (D), 15. (B)

● Configuration of glucose

An arrangement of atoms or groups of molecule in space is called the configuration of that compound. Scientist **Emil Fischer** determined the **configuration of glucose** after studying many reactions.



The value of rotation of plane polarized light shown by optically active organic compound is measured by **polarimeter instrument**.

Enantiomers : (i) D and L objects

(ii) d or (+) or dextrorotatory and l or (–) or levorotatory substances

There is no direct relation of D and L with d or l.

● **Formula of specific rotation,**

$$[\alpha]_{\lambda}^T = \frac{\alpha}{l \times C}$$

where, (α) = specific rotation

l = length of tube (in decimeter)

λ = wavelength of the incident light

(10 cm = 1 dm)

(D symbol is used for wavelength of sodium light)

C = concentration of compound (gram ml⁻¹)

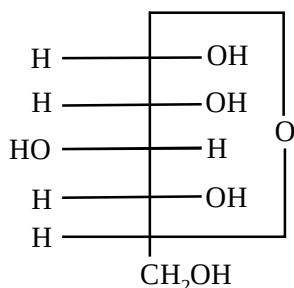
α = observed angle of rotation (by polarimeter) T = Temperature (K)

16. What indicates, symbol D in carbohydrate ?
 (A) dextrorotatory (B) process of synthesis (C) configuration (D) diamagnetic nature
17. If optically active organic substance shows anticlockwise rotation of plane polarized light then what is that substance ?
 (A) levorotatory (B) dextro rotatory (C) +ve (D) dextro
18. $\begin{array}{c} \text{CH}_2\text{OH} \\ | \\ \text{C} = \text{O} \\ | \\ \text{HO} - \text{C} - \text{H} \\ | \\ \text{H} - \text{C} - \text{OH} \\ | \\ \text{H} - \text{C} - \text{OH} \\ | \\ \text{CH}_2\text{OH} \end{array}$ Which is configuration of fructose ?
 (A) d (B) L (C) D (D) l
19. Fructose has a specific rotation of (–92.4°). An aqueous solution of a fructose has an observed angle of rotation of (–27.7°) when placed in a polarimeter tube 10 cm long. How much amount of fructose is dissolved in 100 ml of aqueous solution ?
 (A) 0.299 gm.ml⁻¹ (B) 3.33 gm.ml⁻¹ (C) 2.99 gm.ml⁻¹ (D) 33.3 gm.ml⁻¹
20. The observed angle of rotation of 15 g maltose containing 100 ml of aqueous solution in a polarimeter tube of 20 cm length is 40.8°. What is the specific rotation of this solution of maltose ?
 (A) + 122.4° (B) + 13.6° (C) + 12.24° (D) + 136°
21. Specific rotation value of 0.33 gm.ml⁻¹ aqueous solution is known (–92.4°) by polarimeter. If polarimeter tube used in the measurement has length of 10 cm then what is the observed value for rotation ?
 (A) –304.9° (B) –30.49° (C) –3.049° (D) –0.3049°

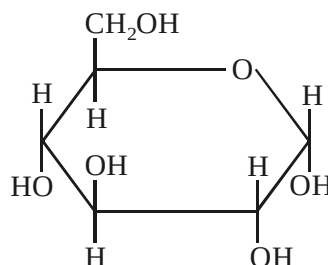
Answers : 16. (C), 17. (A), 18. (C), 19. (A), 20. (D), 21. (B)

● Cyclic structure of glucose

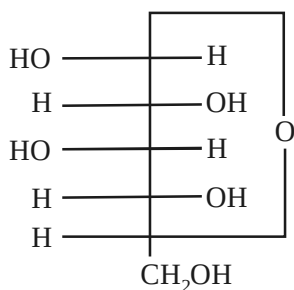
- Does not give violet colour $\xleftarrow{\text{schiff's reagent}}$ glucose $\xrightarrow{\text{NaHSO}_3}$ no addition reaction.
- Glucose shows mutarotation.
- Open chain structure of glucose cannot be explained by all these reactions.
- Fischer, Tollens, Tanret, Haworth and Hirst have suggested cyclic structure of glucose.



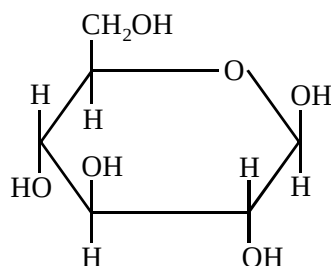
α -D-(+)-glucose
(Fischer projection)



α -D-(+)-glucose
(Haworth projection)

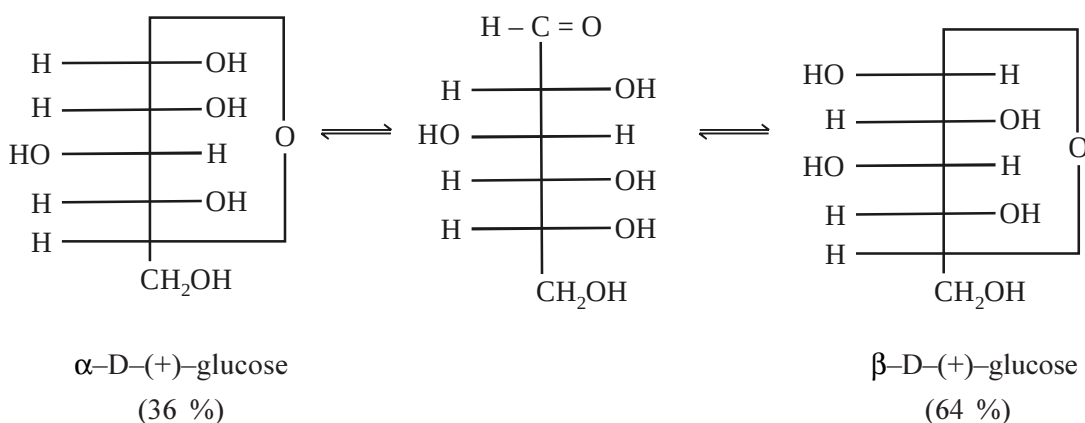


β -D-(+)-glucose
(Fischer projection)

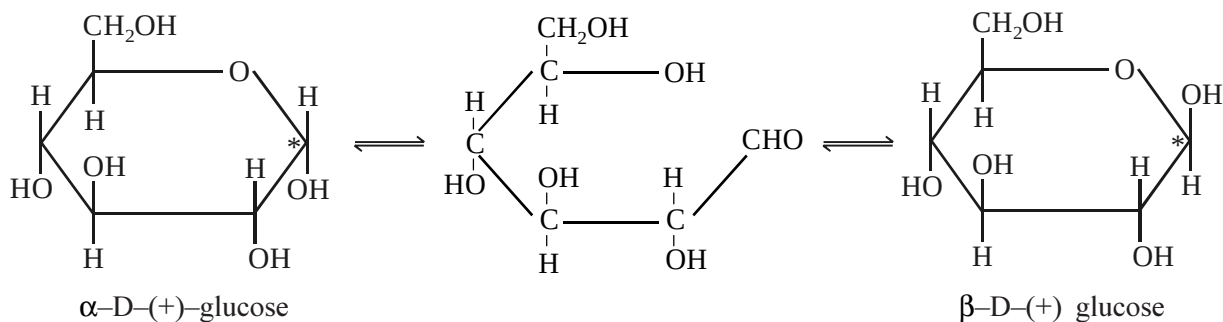


β -D-(+)-glucose
(Haworth projection)

- α and β -D-(+) glucose are anomers because they differ in configuration at (C-1) anomeric carbon.
- Aqueous solution of glucose shows mutarotation. Freshly prepared aqueous solution of α -D-(+) glucose (obtained by crystallization from ethyl alcohol or glacial acetic acid), shows specific rotation $+112^\circ$ which decreases after some time to $+52.5^\circ$, while freshly prepared aqueous solution of β -D-(+) glucose (obtained by crystallization from pyridine) shows specific rotation $+19^\circ$ which decreases after some time to $+52.5^\circ$. This observation shows that, in a molecule of glucose free -CHO group is not present.

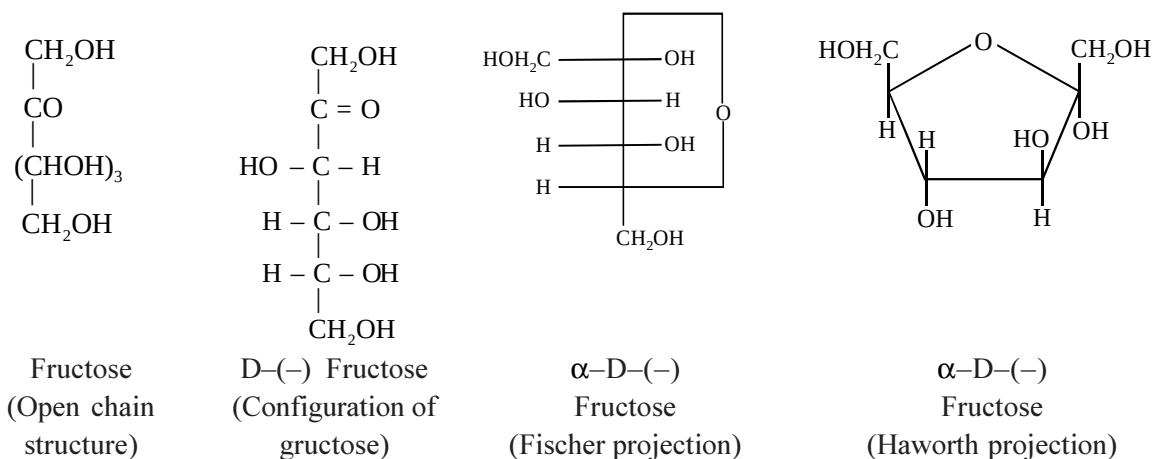


- It can be easily understood by haworth projection also

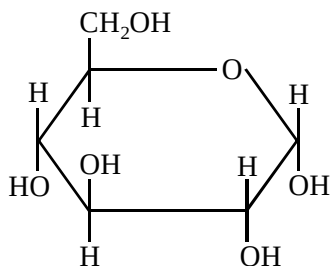


• Fructose

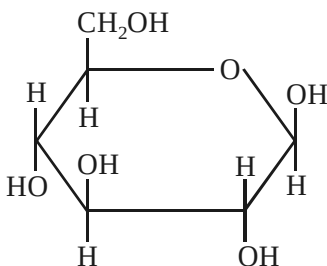
- White crystalline, water soluble, partially soluble in alcohol, insoluble in ether.
- Levorotatory
- Sweetness is higher compared to all other sugars
- Molecular formula is $\text{C}_6\text{H}_{12}\text{O}_6$, ketohexose
- C_2 is anomeric carbon
- Shows mutarotation property.



22. Which of the following statement is wrong for glucose ?
- (A) It shows mutarotation property.
- (B) It does not give addition product with HSO_3^- .
- (C) $\alpha\text{-D-(+)}$ and $\beta\text{-D-(+)}$ glucose are epimers.
- (D) It does not give violet colour with Schiff's reagent.
23. Which is true for structure (i) and (ii) ?



(i)



(ii)

- (A) (i) is $\beta\text{-D-(+)}$ glucose and (ii) is $\alpha\text{-D-(+)}$ glucose.
- (B) They are anomers of glucose
- (C) They are enantiomers of glucose
- (D) It is a mixture of D and L glucose

24. Freshly prepared aqueous solution of glucose obtained by crystallization from pyridine shows specific rotation
- (A) + 112° (B) + 52.5° (C) + 19° (D) – 52.5°
25. What is the proportion of α -D-(+) glucose and β -D-(+) glucose respectively in the solution of glucose having specific rotation value with +52.5° ?
- (A) 64 %, 36 % (B) 36 %, 64 % (C) 50 %, 50 % (D) 60 %, 40 %
26. How many numbers of chiral carbon is there in β -D-(+) glucose ?
- (A) 3 (B) 4 (C) 5 (D) 2
27. Which of the following characteristics is/are shown by fructose ?
- P : amorphous substance Q : levorotatory
- R : mutarotation S : soluble in alcohol
- (A) only R (B) P and S (C) Q and R (D) P, Q, R and S

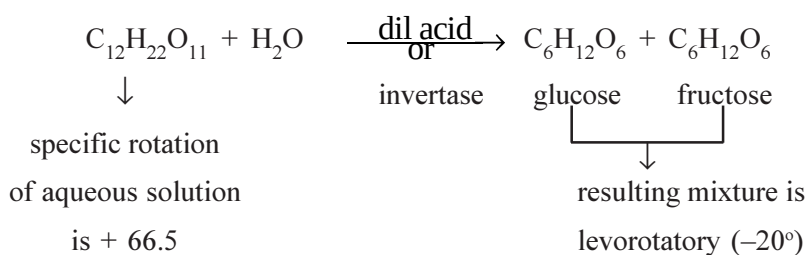
Answers : 22. (C), 23. (B), 24. (C), 25. (B), 26. (C), 27. (C)

• Disaccharides

- Hydrolysis of disaccharide by diluted acid or enzyme gives same type or two different types of monosaccharides.
- In disaccharides, the linkage of two monosaccharides joined with each other by linkage of oxygen atom is called glycosidic linkage.
- Disaccharides are sweet in taste, crystalline, water soluble, insoluble in alcohol. Except sucrose, maltose and lactose are reducing sugar and shows mutarotation.

(i) Sucrose (Sugar cane) :

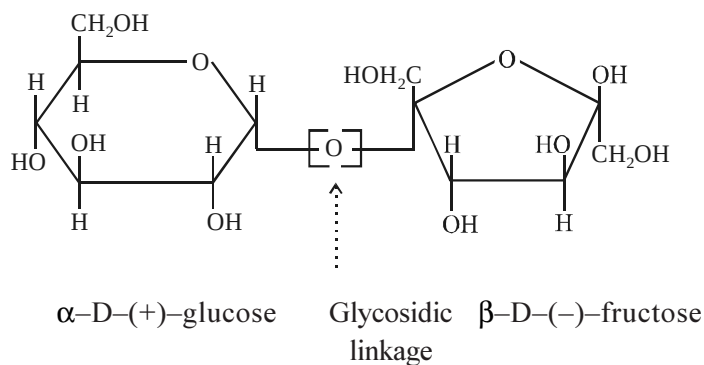
- Hydrolysis :**



Thus, the process of change in sign of rotation of sucrose solution is called inversion. The mixture of glucose and fructose obtained at the end of hydrolysis is called invert sugar.

Sugar	Sweetness-index
Sucrose (standard)	100
Glucose	74
Fructose	173
Lactose	16

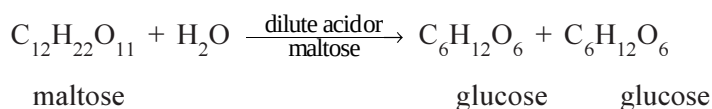
• **Structure :**



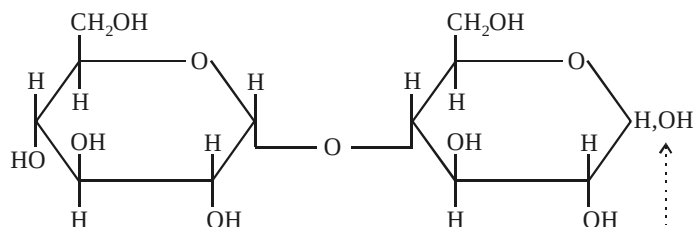
(+) Sucrose Haworth Projection

- In sucrose, glycosidic linkage is formed between C_1 of α -D-(+)-glucose and C_2 of β -D-(-) fructose.
- In sucrose, the reducing agent group ($-OH$) of glucose and fructose are involved in glycosidic bond. So it is non-reducing sugar. Does not show mutarotation.
- Sucrose $\xrightarrow[-H_2O]{483 K}$ Caramel (brown amorphous food colour)

(ii) **Maltose (malt sugar) :**



- In maltose, the glycosidic linkage (C_1-O-C_4) is formed between C_1 of α -D-(+)-glucose and C_4 of another D-(+) glucose.



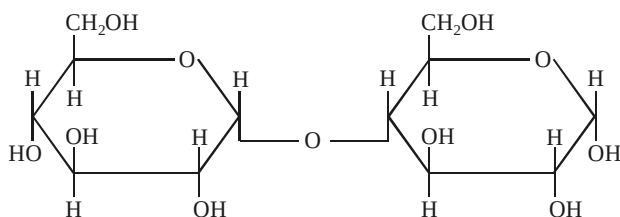
α -D-(+)-glucose

D-(+)-glucose

This anomeric carbon (C_1) does not have a definite configuration.

(+) Maltose

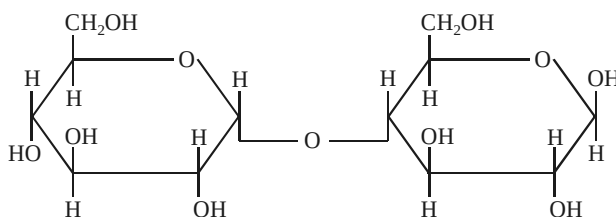
- The configuration on C_1 carbon of glucose is changed. So, two anomers α (+) and β (+) maltose is formed.



α -D-(+)-glucose

α -D-(+)-glucose

α -D-(+)-Maltose

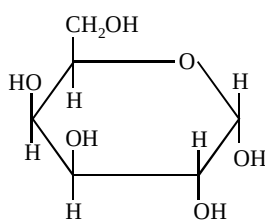
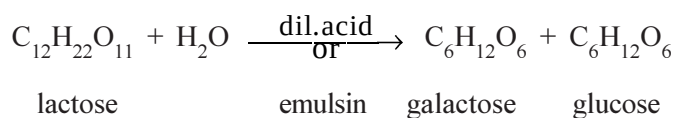


α -D-(+)-glucose

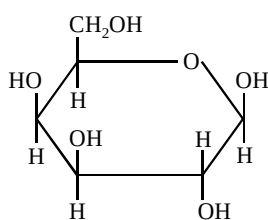
β -D-(+)-glucose

β -D-(+)-Maltose

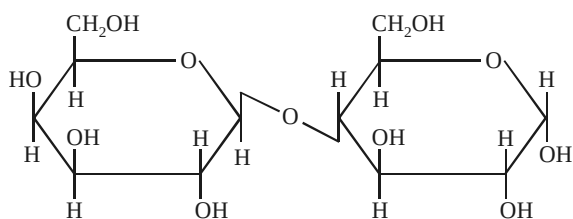
(iii) Lactose (milk sugar) :



α -D-(+)-Galactose



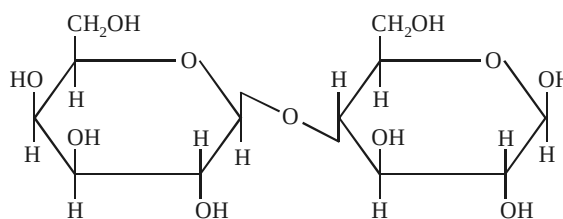
β -D-(+)-Galactose



β -D-(+)-galactose

α -D-(+)-glucose

α (+)-Lactose

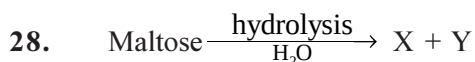


β -D-(+)-galactose

β -D-(+)-glucose

β (+)-Lactose

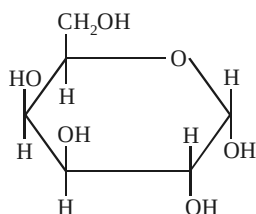
- In lactose, the glycosidic linkage is formed between C_1 of β -D-(+) galactose and C_4 of D-(+)-glucose.
- The configuration on C_1 carbon of glucose is changed. So, two anomers α (+) and β (+) lactose is formed.



Which substances are X and Y respectively ?

- (A) glucose, glucose (B) glucose, galactose (C) glucose, fructose (D) fructose, galactose
29. Which of the following groups of monosaccharide forms sucrose ?
- (A) α -D glucopyranose and β -D fructopyranose
 (B) β -D glucopy ranose and α -D fructofuranose
 (C) α -D glucopyranose and β -D fructofuranose
 (D) α -D galactopyranose and α -D glucopyranose
30. Mixture which is formed on hydrolysis of sucrose is
- (A) not optically active (B) levo rotatory (C) dextro rotatory (D) racemic mixture
31. Sucrose is not reducing agent because
- (A) reducing groups of both monosaccharides are not free
 (B) it does not reduce Fehling's solution
 (C) it does not react with phenylhydrazine
 (D) two monosaccharides units are joined by $\text{C}_1\text{-O-C}_4$ linkage in it

32. Sucrose $\xrightarrow[-H_2O]{483K}$ Z product, what is Z ?
 (A) food colour (B) food preservative (C) food additive substance (D) antioxidant
33. Which groups are involved in sucrose ?
 1. $\diagup C = O$ 2. $-CHO$ 3. $-OH$
 (A) 1, 2 and 3 (B) 1 and 2 (C) Only 3 (D) 2 and 3
34. Which glycosidic linkage is formed between two sugar in β -(+)-maltose ?
 (A) C_1 of α -D-(+) glucose and C_2 of α -D-(+) glucose
 (B) C_1 of α -D-(-) glucose and C_4 of α -D-(+) glucose
 (C) C_1 of α -D-(+) glucose and C_4 of β -D-(+) glucose
 (D) C_1 of α -D-(-) glucose and C_2 of β -D-(+) glucose
35. Which statement is wrong for (+) lactose ?
 (A) On hydrolysis of it equal proportion of D (+) glucose and D (+) galactose is formed
 (B) In (+) lactose 8 - OH groups are present
 (C) Two monosaccharides are joined by C_1-O-C_4 linkage in it
 (D) (+) lactose is reducing agent, but it does not show mutarotation.
36. Which of the following has Haworth projection mentioned below ?

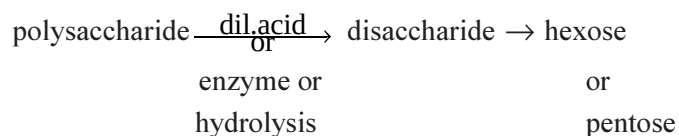


- (A) α -D (+) glucose (B) β -D (+) galactose (C) α -D (+) galactose (D) β -D (+) glucose
37. Which sugar is not present in plants ?
 (A) lactose (B) glucose (C) Sucrose (D) maltose
38. Which sugar is optically active and also shows mutarotation ?
 (1) glucose (2) sucrose (3) maltose (4) fructose
 (A) only 2 (B) 1 and 3 (C) 1, 3 and 4 (D) 2 and 4

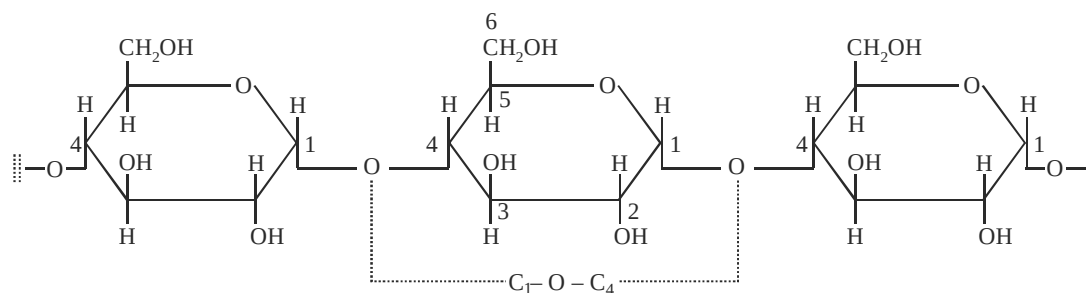
Answers : 28. (A), 29. (C), 30. (B), 31. (A), 32. (A), 33. (C), 34. (C), 35. (C), 36. (C), 37. (A), 38. (C),

• Polysaccharides

- They are formed by many monosaccharides molecules.
- High molecular mass.
- Common formula : $(C_6H_{10}O_5)_n$
- Tasteless, amorphous, insoluble in hot water also. Cellulose is soluble in ammonical cupric hydroxide solution.

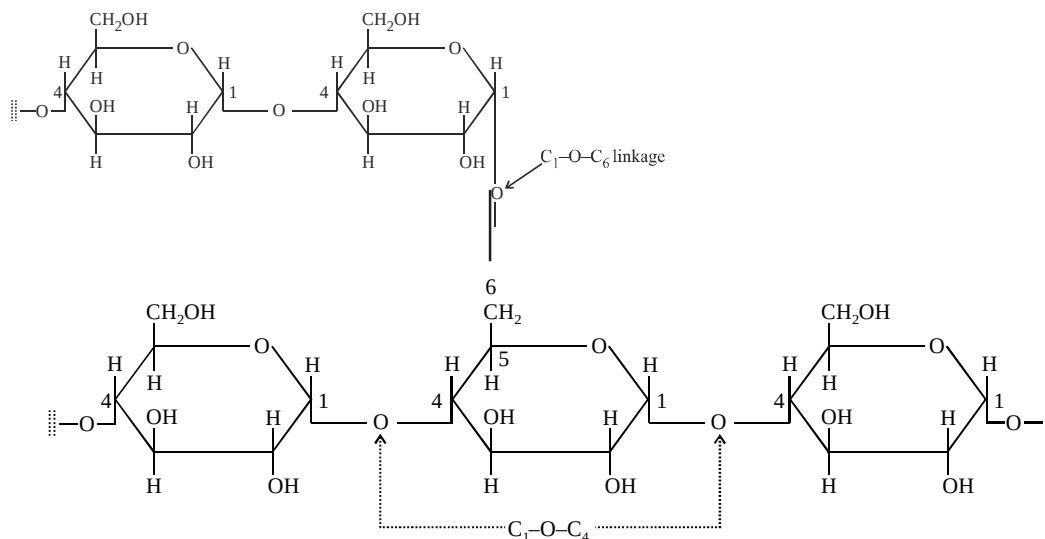


- Starch is polymer of α -D glucose. It is a mixture of amylose ($\cong 20\%$) and amylopectin ($\cong 80\%$).
- 200 to 1000 α -D-(+) glucose units are joined by C_1-O-C_4 linkage in amylose.



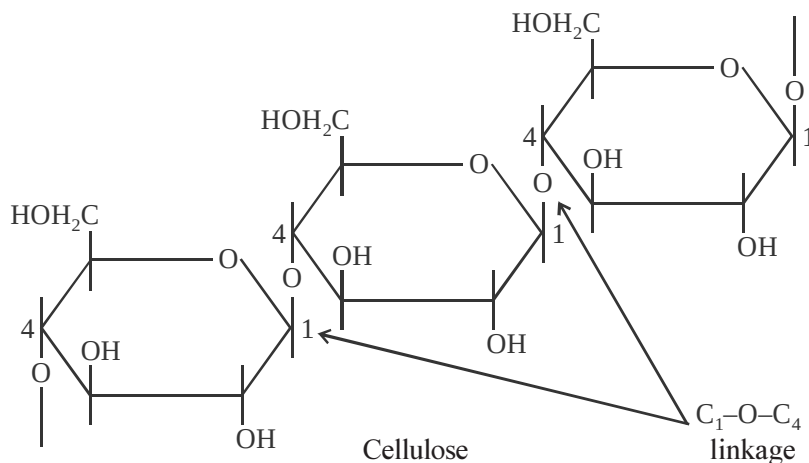
linkage
Amylose

- In amylopectin α -D-(+) glucose units are joined by C_1-O-C_4 linkage, but some α -D-(+) glucose units are joined by C_1-O-C_6 linkage and they make branches.



linkage
Amylopectin

- Cellulose is polymer of β -D-(+) glucose. In cellulose β -D-(+) glucose units are joined by C_1-O-C_4 linkage.



- **Importance of carbohydrates :**
- Cellwall of bacteria and plants is made up of cellulose.
- New growing plant uses the starch which is stored in seeds as food for their growth.
- The stored glycogen in animals is converted into glucose and gives energy when required.
- Major component of our food materials is carbohydrates. e.g., table sugar, jaggery, wheat, rice etc.
- Linen, rayon and acetate fibre are form of cellulose. They are used for making clothes.

39. Which of the following is not sugar ?
 (A) glycogen (B) dextrin (C) cellulose (D) all of these
40. Starch $\xrightarrow[\text{hydrolysis}]{\text{dil. acid}}$ Z $\rightarrow$ Y. Which compounds are Z and Y respectively ?
 (Intermediate compound) (final product)
 (A) maltose, glucose (B) sucrose, glucose (C) lactose, fructose (D) maltose, fructose
41. Which one is wrong about starch ?
 (A) It is amorphous, nonsugar.
 (B) It is a mixture of amylose and amylopectin.
 (C) In a structure of amylose glucose units are joined in branched chain.
 (D) Soluble in hot water.
42. When α -D-(+) glucose units are joined by C_1-O-C_4 and C_1-O-C_6 linkage, then gives structure of which compound ?
 (A) cellulose (B) amylopectin (C) amylose (D) cellobiose
43. Which one is most important constituents of cellwall of plants ?
 (A) protein (B) nucleic acid (C) cellulose (D) starch
44. Cellulose is soluble in
 (A) water (B) organic solvent
 (C) ammonical cupric hydroxide solution (D) all of these
45. Cellulose is a polymer of which unit ?
 (A) β -D (+) glucose (B) α -D (-) galactose (C) α -D (+) glucose (D) L-fructose
46. Which polymer is useful in a preparation of rayon ?
 (A) nylon (B) cellulose (C) decron (D) glycogen
47. Which substance is stored in animal is converted into glucose and gives energy when required ?
 (A) glycogen (B) sucrose (C) cellulose (D) protein

Answers : 39. (D), 40. (A), 41. (C), 42. (B), 43. (C), 44. (C), 45. (A), 46. (B), 47. (A)
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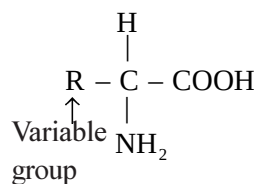
• Proteins

- They are biopolymer complexes of amino acids.
- Enzymes, hormones, antibodies are all proteins.
- All proteins contain C, H, O, N elements while some may also contain non-metal like S, P and metal elements like Fe, Cu, Zn, Mn in trace amount.
- Protein $\xrightarrow{\text{hydrolysis}}$ peptides $\xrightarrow{\text{hydrolysis}}$ amino acids

(obtained by scientist Emil Fischer)

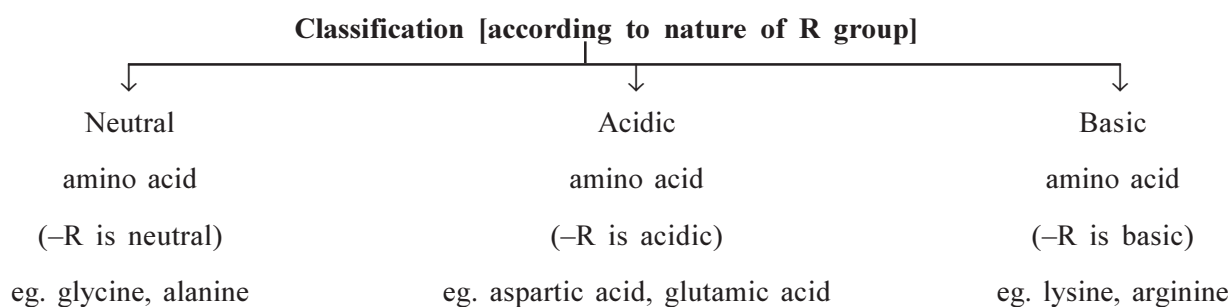
● Amino acids

- Building blocks of protein, in which amino ($-\text{NH}_2$) and carboxyl ($-\text{COOH}$), both groups are present.
- Common structure of α -amino acid.



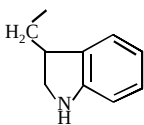
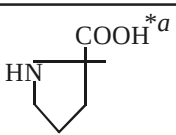
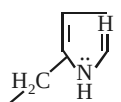
R : open chain, cyclic or aromatic hydrocarbon group, amino, carboxyl, hydroxyl or sulphur containing group.

- Secondary amino group is present. In proline in this compound nitrogen atom of amino group is involved in five membered ring.



- Amino acids which can be synthesised in body are known as **non-essential amino acids** and those which cannot be synthesised in the body and must be obtained through diet are called essential **amino acids**.
- **Name and structure of 20 important amino acids :**

Sr.	Name of the Neutral amino acids	Structure of R	Three letters symbol	One letter symbol
1.	Glycine	$-\text{H}$	Gly	G
2.	Alanine	$-\text{CH}_3$	Ala	A
*3.	Valine	$-\text{CH}(\text{CH}_3)_2$	Val	V
*4.	Leucine	$-\text{CH}_2\text{CH}(\text{CH}_3)_2$	Leu	L
*5.	Isoleucine	$ \begin{array}{c} -\text{CHCH}_2\text{CH}_3 \\ \\ \text{CH}_3 \end{array} $	Ile	I
*6.	Phenylalanine	$-\text{CH}_2-\text{C}_6\text{H}_5$	Phe	F
7.	Asparagine	$-\text{CH}_2\text{CONH}_2$	Asn	N
8.	Glutamine	$-\text{CH}_2\text{CH}_2\text{CONH}_2$	Gln	Q
9.	Serine	$-\text{CH}_2\text{OH}$	Ser	S
*10.	Threonine	$ \begin{array}{c} -\text{CHOH} \\ \\ \text{CH}_3 \end{array} $	Thr	T

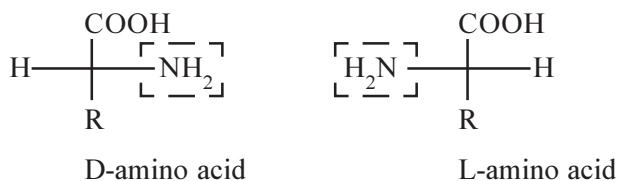
11.	Cysteine	$-\text{CH}_2\text{SH}$	Cys	C
*12.	Methionine	$-\text{CH}_2\text{CH}_2\text{SCH}_3$	Met	M
13.	Tyrosine	$-\text{CH}_2-\text{C}_6\text{H}_4-\text{OH(P)}$	Tyr	Y
*14.	Tryptophan		Trp	W
15.	Proline		Pro	P
Acidic amino acids				
16.	Aspartic acid	$-\text{CH}_2\text{COOH}$	Asp	D
17.	Glutamic acid	$-\text{CH}_2\text{CH}_2\text{COOH}$	Glu	E
Basic amino acids				
*18.	Lysine	$-(\text{CH}_2)_4\text{NH}_2$	Lys	K
*19.	Arginine	$-(\text{CH}_2)_3\text{NH}-\overset{\text{NH}}{\parallel}{\text{C}}-\text{NH}_2$	Arg	R
*20.	Histidine		His	H

Note : * symbolic amino acids are essential amino acids.

a – It is not only structure of R but it is entire structure of amino acid.

● D and L forms of amino acids

- Except glycine, all amino acids contain α -carbon as chiral carbon.

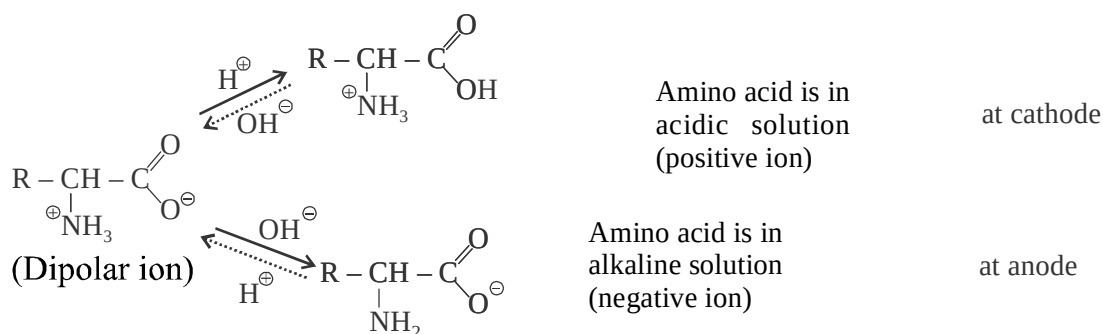


- Most of the amino acids found in nature have L-configuration.

● Amino acid as dipolar molecule

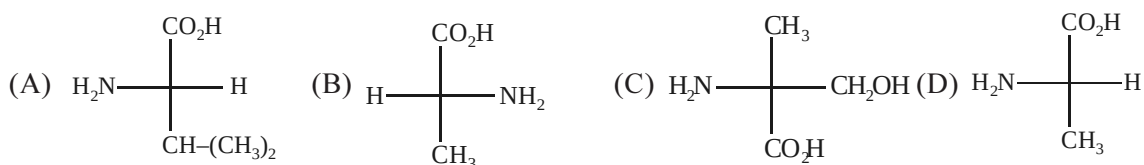
- In amino acid molecule acidic ($-\text{COOH}$) and basic ($-\text{NH}_2$) groups are present. So, they show **property like salt**.
- In aqueous solution proton donated by carboxyl group is accepted by amino group. So amino acid gives dipolar ion which is called zwitter ion.

● **Migration under electricfield**



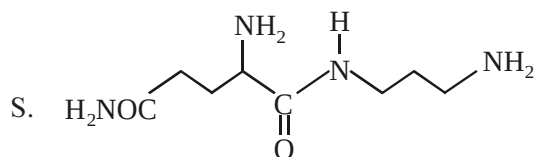
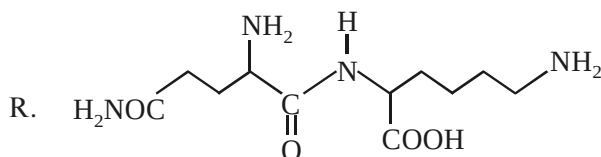
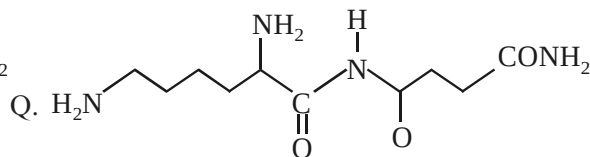
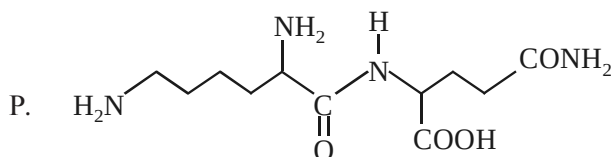
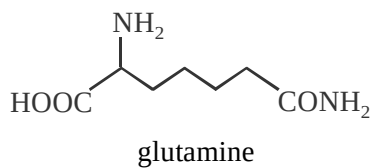
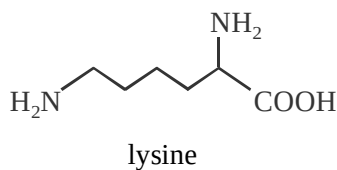
- In electric field, the pH value at which the amino acid does not migrate towards any electrode is called the **isoelectric point (PI)** of amino acid.
- Amino acids react with acid or base and form salt, so they are known as **amphoteric compounds**.
- A mixture of amino acids can be separated by electrophoresis and chromatographic techniques.

48. Protein is a condensation polymer of which substances ?
 (A) α -hydroxy acid (B) α -amino acid (C) β -amino acid (D) β -hydroxy acid
49. What are hormones and antibodies ?
 (A) Carbohydrate (B) Protein (C) Nucleic acid (D) Lipid
50. In which amino acid secondary amino group is present ?
 (A) prolin (B) alanine (C) glycine (D) phenylalanine
51. Which pair is improper ?
 (A) Neutral amino acid-lysine (B) Acidic amino acid-glutamic acid
 (C) Basic amino acid-arginine (D) Essential amino acid-valine
52. Which one is L-alanine ?



53. When $\text{pH} = 8$, then glycine will be in which form ?
 (A) $\text{H}_2\text{N} - \text{CH}_2 - \text{COO}^-$ (B) $\text{H}_3\text{N}^+ - \text{CH}_2 - \text{COO}^-$
 (C) $\text{H}_2\text{N} - \text{CH}_2 - \text{COOH}$ (D) $\text{H}_3\text{N}^+ - \text{CH}_2 - \text{COOH}$
54. Which statement is not proper ?
 (A) Form of amino acid in aqueous solution is $\text{H}_3\text{N}^+ - \text{CH}(\text{R}) - \text{COO}^-$
 (B) For all amino acids at isoelectric point, pH value is same.
 (C) Most of the amino acids are amphoteric.
 (D) Amino acid can be separated from its mixture by electrophoresis.

55. Which dipeptide are formed by given two amino acids ?



(A) Only P

(B) Q, R

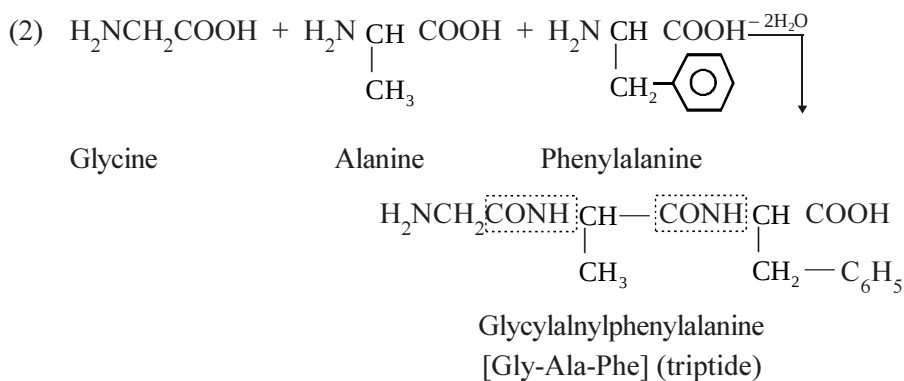
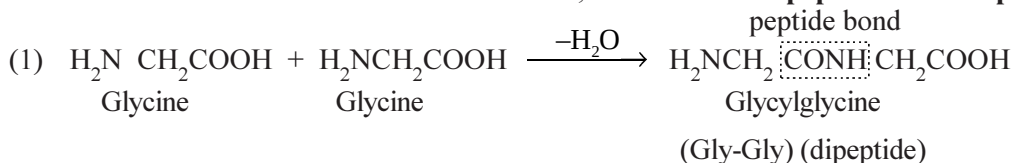
(C) Q, S

(D) P, R

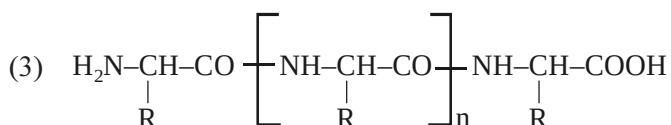
Answers : 48. (B), 49. (B), 50. (A), 51. (A), 52. (D), 53. (A), 54. (B), 55. (D)

● Peptide

- Reaction between $-\text{NH}_2$ group of one amino acid and $-\text{COOH}$ group of another amino acid loses the water molecule and forms amide, which is called **peptide bond** or **peptide linkage**.



- When 4 to 10 amino acids are joined by peptide bond and form a long chain then it is called the **oligopeptide**.

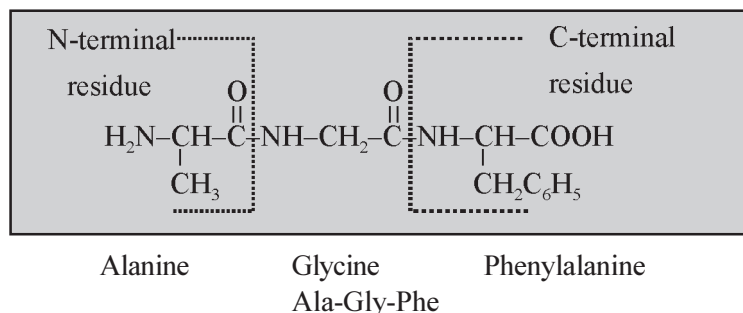


Polypeptide or proteins

Where, R may be similar or different groups.

End with free -NH_2 group

End of with -COOH group



- The sequence of amino acids is most important in peptide chain. eg. Three amino acids A, B, C are joined in different sequences to form six different types of tripeptides A-B-C, A-C-B, B-A-C, B-C-A, C-A-B, C-B-A.

Classification of protein (according to molecular shape)

fibrous	globular
- Polypeptide chains are arranged parallel and held together by H-bond or disulphide bond. - Insoluble in water - eg. keratin (present in hair, wool, silk) - myosin (present in muscles)	- When the chain of polypeptide coil around to give spherical shape this type of protein is formed. - Water soluble. - eg. insulin, albumin

● Structure of protein

(i) Primary :

- One or more chains of polypeptides are present.
- In this, **amino acids** present are joined in a **specific sequence**.
- Two polypeptide chains are joined with each other by **disulphide linkage** (-S-S-) in primary structure of **insulin** in human.

(ii) Secondary :

- Long chain of polypeptide is present.
- It has two types :

(a) α -helix shape :

- Polypeptide chain is coiled in helix shape. In this structure, H-bond is formed between O atom of C=O and H atom of -NH of peptide bond.
- At every **turn 3.6 amino acids** are included.

(b) β -pleated sheet shape :

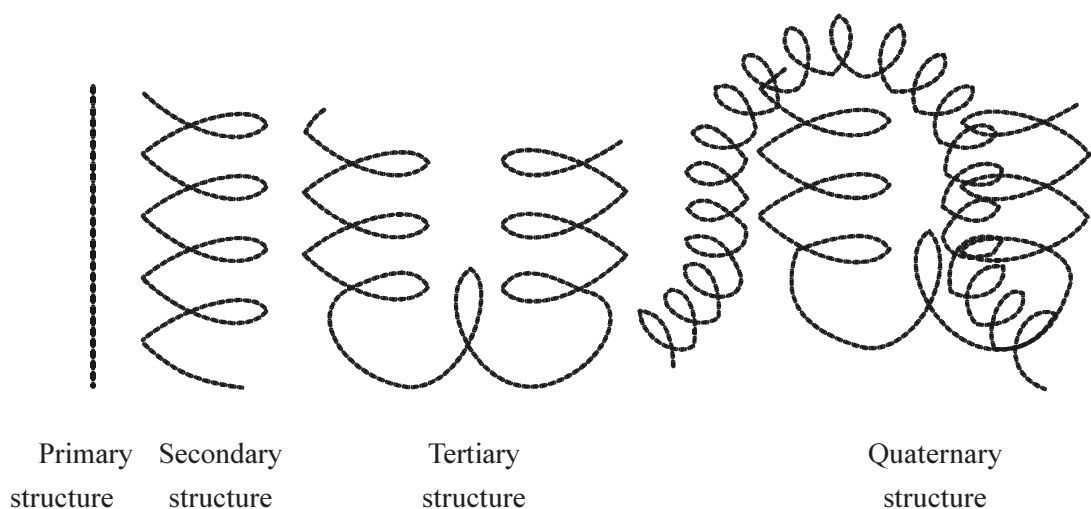
Adjacent two polypeptide chains are joined by **intermolecular H-bond**, so these protein chains are formed like zig zag shaped sheet.

(iii) Tertiary :

- Three dimensional arrangement of all atoms.
- Polypeptide long chain is folded at many points and form coil shape.
- **Side chains of amino acids** are joined to each other by **van der waal's attraction force, H-bond, ionic bond and disulphide bond**.
- **Myoglobin** protein.

(iv) Quaternary :

- Two or more polypeptide chains are present. They are joined with each other by H-bond, ionic bond and disulphide bond. Non protein components may also be present in them.
- **Haemoglobin**, which has two α and two β chains.



Structures of Proteins

• **Denaturation of Protein**

Biological activity of protein depends upon pH, temperature and solvent composition. Little change in all these create denaturation in protein.

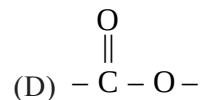
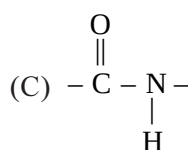
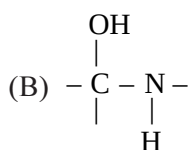
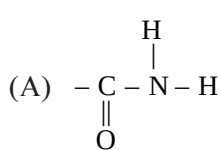
- If an egg is **fried or boiled** in water at 373 K or above then white protein becomes denatured, forming an insoluble mass.

- Adding conc. **acid or base** to a protein in aqueous solution, H-bond and different **attraction are broken down**.

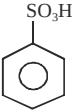
In certain clinical chemistry tests, to remove protein easily **trichloroacetic acid** is added.

- **Detergent** such as **sodium dodecyl sulphate** is associated with the non polar group of proteins. Same way alcohol, acetone and ether denature the proteins by interference of hydrophobic interactions.

56. Which one is correct form of peptide bond ?



57. When eight amino acids joined by peptide bond and form long chain then it is called
 (A) polypeptide (B) oligopeptide (C) protein (D) tripeptide
58. In tripeptide Gly-Ala-Phe, which one is N-terminal residue ?
 (A) Phe (B) Ala (C) Ala and Phe (D) Gly
59. How many tripeptides and peptide bonds are formed, when three different amino acids X, Y and Z are joined in different sequence ?
 (A) 3, 6 (B) 9, 6 (C) 6, 6 (D) 6, 12
60. Which statement/statements are true ?
 (P) Insulin is hormones.
 (Q) Alanine has optically active property.
 (R) Albumin is water insoluble protein.
 (S) In wool, polypeptide chains are joined by H-bond.
 (A) P, R (B) Q, S (C) R, S (D) P, Q and S
61. By which bond α -helix structure of protein is stable ?
 (A) H-bond (B) Vanderwall's attraction (C) peptide bond (D) -S-S- bond
62. What is called, when biological activity of protein is lost by heat and chemicals ?
 (A) inversion (B) denaturation (C) racemization (D) dehydration
63. Which chemical is added in sample to remove protein in clinical chemistry tests ?

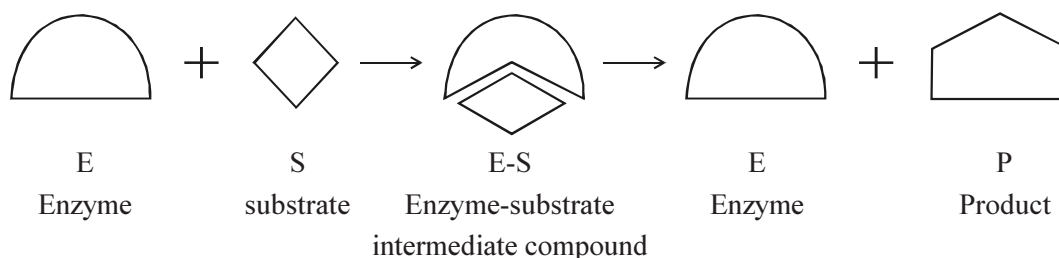
- (A) $\begin{array}{c} \text{COOH} \\ | \\ \text{COOH} \end{array}$ (B)  (C) CH_3COOH (D) $\text{CCl}_3\cdot\text{COOH}$

Answers : 56. (C), 57. (B), 58. (D), 59. (D), 60. (D), 61. (A), 62. (B), 63. (D)

● Enzymes

- Acts as a catalyst in biochemical reactions.
 - Globular protein.
 - Increases the rate of reaction by 10^{12} times.
 - Fat hydrolysis $\rightarrow$ carboxylic acid and alcohol. This reaction occurs rapidly in the presence of **lipase**.
 - In some enzymes, other component cofactor are present for their proper functioning.
 - **Inorganic components as cofactor :**
 Zn^{2+} , Mn^{2+} , Mg^{2+} , Fe^{2+} , Cu^{2+} metal ions.
- | | | | | |
|--------------------|---|------------|---------------|--------|
| Coenzyme | + | Apoenzyme | $\rightarrow$ | Enzyme |
| (Organic component | | (Protein) | | Active |
| as cofactor) | | (Inactive) | | |
| (Non-protein) | | | | |
| (Inactive) | | | | |

- **Mechanism :**



- Substrate, combine with such a part of enzyme (amino acid presence in protein part) is called active site.
- Each enzyme is specific for each specific reaction. eg.
 - maltase – hydrolysis of maltose
 - imulsin – hydrolysis of lectose
 - invertase – hydrolysis of sucrose

- **Nomenclature of enzyme is of two types**

- (i) Enzyme can be named by adding the suffix 'ase' to the root of its substrate name.
- | | | |
|---------|---|-----------|
| maltose | → | maltase |
| lipid | → | lypase |
| sucrose | → | invertase |
- (ii) The type of reaction on which enzyme is affected.
- | | |
|-----------------------------|---------------------|
| eg. hydrolysis — hydrolase, | oxidation — oxidase |
|-----------------------------|---------------------|

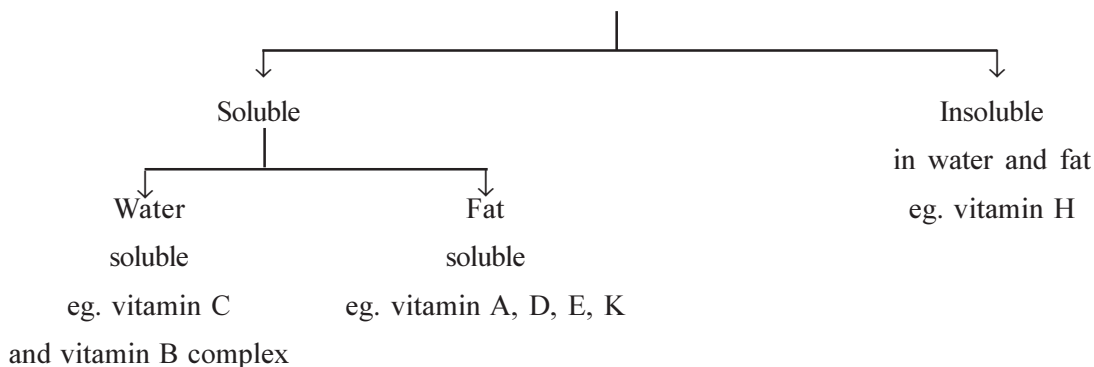
64. Which statement/statements are applicable to enzyme ?
 (1) Increase rate of biochemical process
 (2) Made of amino acids
 (3) Shows good activity in the range of 5 to 7 PH.
 (A) only 1 (B) 1, 2, 3 (C) 1, 3 (D) 2, 3
65. Lipid hydrolysis → carboxylic acid + alcohol. In presence of which enzyme this reaction occurs rapidly ?
 (A) Pepsin (B) Lypase (C) Invertase (D) Imulsin
66. What is called to nonprotein part of enzyme ?
 P. Apoenzyme Q. Metal ion as cofactor R. Coenzyme
 (A) Q, R (B) only P (C) only R (D) P, R
67. Which ion is presence as cofactor in enzyme ?
 (A) NH_4^+ (B) P^{3+} (C) SO_4^{2-} (D) Mn^{2+}
68. Which statements regarding to enzyme is not correct ?
 (A) Specific amino acids in enzymes are active site for combination of substrate.
 (B) Enzymes are specific for catalysis of reaction and for combination of substrate.
 (C) Enzyme increases activation energy and catalysed chemical reaction.
 (D) Enzymes contain two parts coenzymes and apoenzymes.
69. In which of the following structure of protein α -amino acids are joined in specific sequence ?
 (A) Primary (B) Secondary (C) Tetiary (D) Quarternary

Answers : 64. (B), 65. (B), 66. (C), 67. (D), 68. (C), 69. (A)

• Vitamins

- Certain organic compounds are required in small amounts in our diet. The deficiency of these compounds causes specific diseases in our body. These organic compounds are called vitamins.
- Human body synthesizes vitamin A from carotene and it also synthesizes vitamin D in skin with the help of sunlight.
- Vitamin B complex and vitamin K are formed by microorganism in intestine.

Classification (According to solubility)



No.	Vitamin	Source	Diseases caused by their deficiency
(1)	Vitamin A (Retinal)	Liver oil of fish, carrot, butter, cheese and milk	Xerophthalma
(2)	Vitamin B ₁ (Thiamine)	Yeast, milk, green vegetables and cereals	Beri-Beri
(3)	Vitamin B ₂ (Riboflavin)	Milk, egg white, liver, kidney	Dark-red tongue and skin diseases
(4)	Vitamin B ₆ (Pyridoxine)	Cereals, gram, milk, yeast, egg white	Skin diseases and convulsions
(5)	Vitamin B ₁₂ (Cyanocobalamine)	Egg, fish, liver, meat (not found in plants)	Pernicious anemia
(6)	Vitamin C (Ascorbic acid)	Tomato, green pepper, orange, citrus fruits and green vegetables	Scurvy
(7)	Vitamin D (Calciferol)	Sunlight, fish, egg white	Bone deformation in children and soft bones and joint pain in adults
(8)	Vitamin E (α -Tocopherol)	Vegetable oil, green vegetables, egg white, meat	Sterility
(9)	Vitamin K (Phylloquinone)	Green vegetables	Haemorrhage
(10)	Vitamin H (Biotin)	Milk, yeast, liver	Loses of hair, skin diseases, paralysis

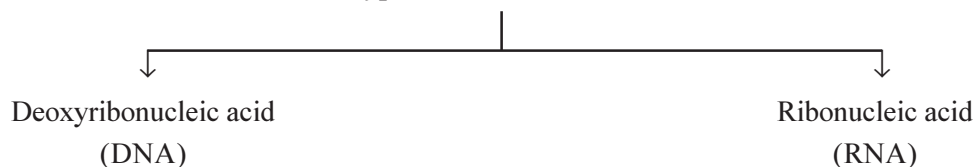
70. Which vitamins are formed by microorganism in intestine ?
 (A) D, K (B) A, H (C) B complex, C (D) B complex, K
71. Which vitamin is insoluble in water and fat ?
 (A) ratinol (B) calciferol (C) biotin (D) thiamine
72. Deficiency of which enzyme causes skin diseases ?
 (P) vitamin B₂ (Q) vitamin B₆ (R) vitamin H
 (A) Only Q (B) P, Q and R (C) only R (D) P and Q
73. Which vitamin is not obtained from plant ?
 (A) phylloquinone (B) ascorbic acid (C) α-tocopherol (D) cyanocobalamine
74. Which of the following is water soluble and antioxidant vitamin ?
 (A) E (B) C (C) K (D) D
75. Which one is same source for vitamin B₆, D and E ?
 1. egg white 2. tomato 3. sunlight
 (A) only 1 (B) 1, 3 (C) 1, 2, 3 (D) 1, 2

Answers : 70. (D), 71. (C), 72. (B), 73. (D), 74. (B), 75. (A)

● Nucleic acid

- Chromosomes which are present in nucleus of living cell are responsible for heredity. They are made up of protein and nucleic acid.

Types of Nucleic acid

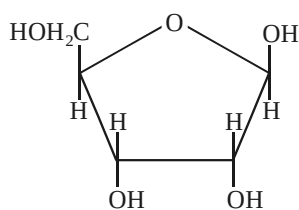


- Nucleic acid is known as polynucleotide.
- Nucleic acid $\xrightarrow[\text{hydrolysis}]{\text{complete}}$ pentose sugar + N containing heterocyclic compounds + phosphoric acid
 (DNA and RNA)

● Structure

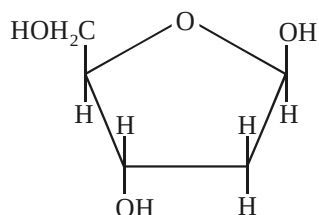
(i) Pentose sugar

In RNA



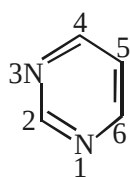
β-(D)-Ribose

In DNA



β-(D)-2-deoxyribose

(ii) Heterocyclic base :



Pyrimidine

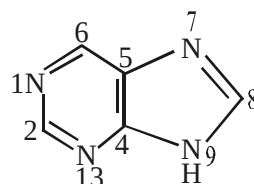


Derivatives :

cytosine (C)

thymine (T)

Uracil (U)



Purine



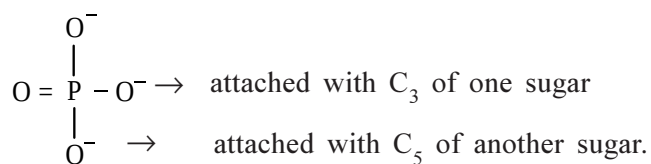
adenine (A)

guanine (G)

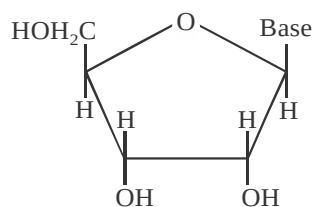
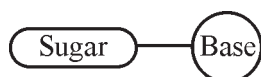
→ In DNA A, G, C, T base are present.

→ In RNA A, G, C, U base are present.

(iii) Phosphoric acid : In nucleic acid, sugars are joined together by phosphate ion (PO_4^{3-}) of phosphoric acid.



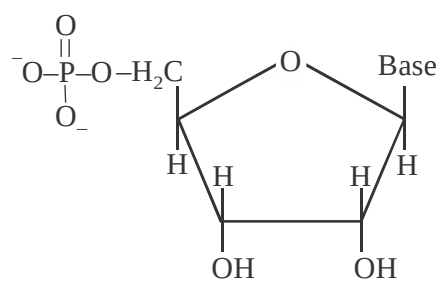
Nucleoside



Nucleoside

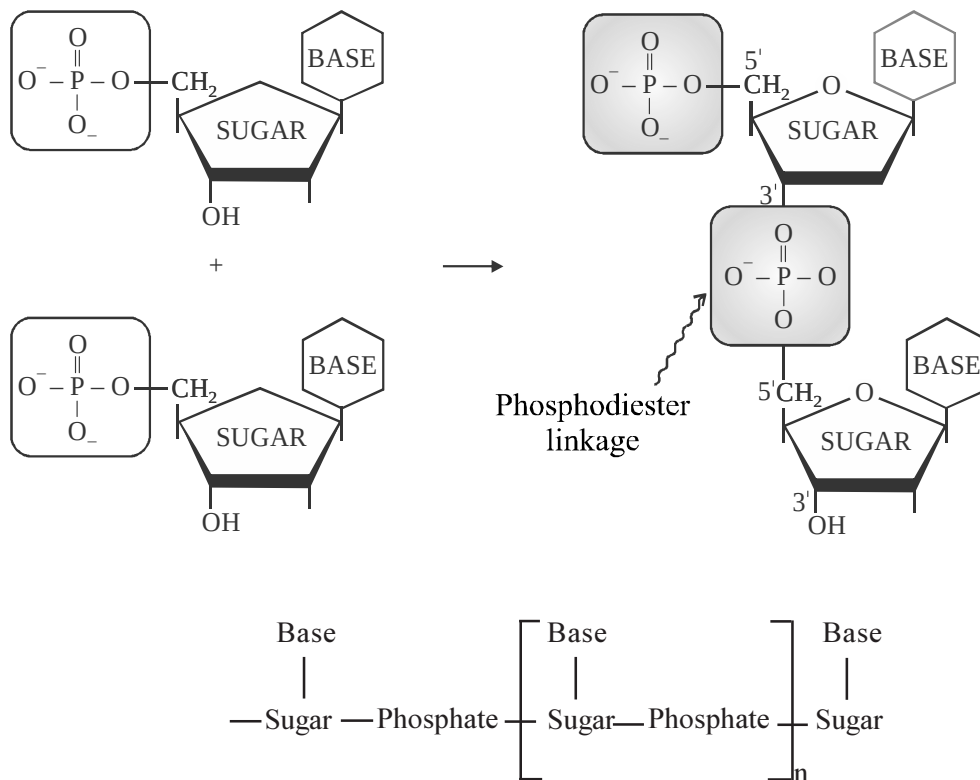


Nucleotide



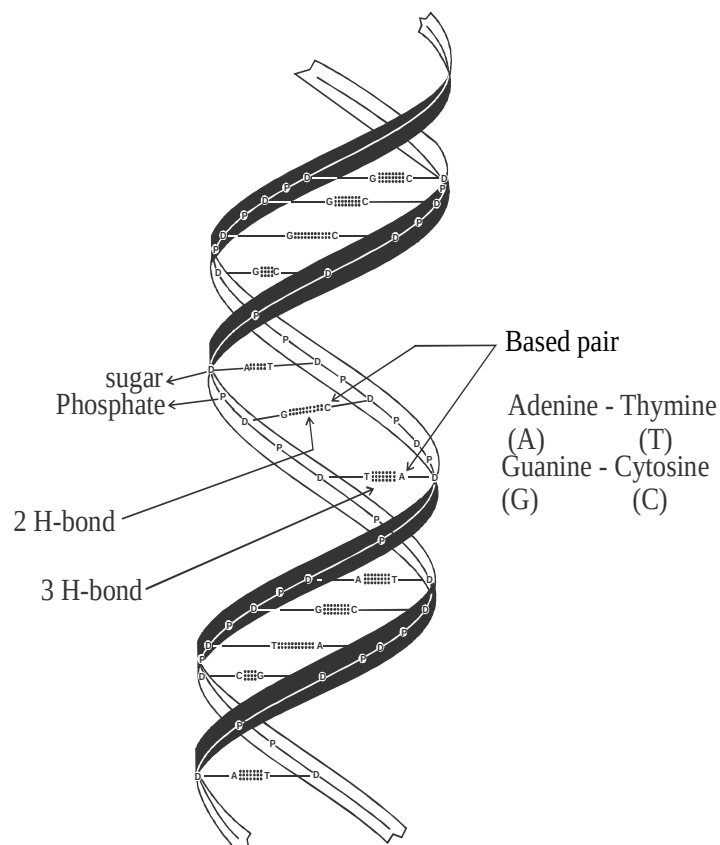
Nucleotide

- **Linkage of two nucleotides**



Nucleic acid (Simple structure)

- Double helix structure for DNA from X-ray diffraction studies was proposed by J. D. Watson and H.C. Crick.



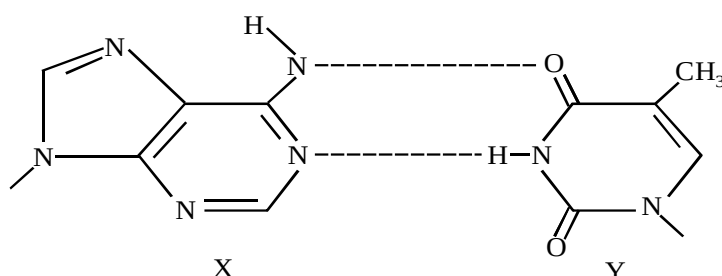
● **Biological importance of nucleic acid**

DNA :

- DNA is responsible chemical for heredity.
- It reserves the genetic information.
- It maintains the identity of different species of organisms over million of years.
- During cell division it duplicates and identical DNA strands are transferred to new cell.
- Proteins are synthesised by various RNA molecule in the cell but the message for synthesis of a specific protein is present in DNA.

-
76. Which chemical is responsible for heredity ?
(A) hormones (B) DNA (C) protein (D) RNA
77. Nucleic acid is a polymer of which substance ?
(A) α -amino acid (B) nucleotide (C) nucleoside (D) glucose
78. What is obtained on hydrolysis of nucleoside ?
(P) pentose sugar
(Q) nitrogen containing heterocyclic base
(R) phosphoric acid
(A) only P (B) P, Q, and R (C) P and R (D) Q and R
79. Which pyrimidine bases are present in RNA ?
(A) cytosine, thymine (B) cytosine, guanine (C) cytosine, uracil (D) cytosine, adenine

80.



What are X and Y components respectively present in DNA ?

- (A) Thymine, Adenine (B) Cytosine, Guanine (C) Guanine, Cytosine (D) Adenine, Thymine
81. What is the function of DNA in living organism ?
(A) It reserves the genetic information.
(B) It maintains the identity of different species of organism over millions of years.
(C) It gives the message for the synthesis of specific protein.
(D) All of these.
82. In a one chain of DNA, sequence of base is TACGAACT, then what will be the sequence of base present in its corresponding chain ?

- (A) CTGCTTGA (B) ATGCTTGA (C) ATGCTCGT (D) ATGCGTGA

83. RNA is different than DNA because in RNA is present.
 (A) deoxyribose sugar and uracil (B) ribose sugar and thymine
 (C) deoxyribose sugar and adenine (D) ribose sugar and uracil
84. By what are nucleosides joined in every chain of nucleic acid ?
 (A) peptide linkage (B) phosphate group
 (C) glycosidic linkage (D) H-bond
85. Which statement regarding ribose sugar is not true ?
 (A) It is polyhydroxy compound.
 (B) There are six carbons in it.
 (C) It is optically active.
 (D) $-OH$ group is present on C_2 , which differentiate it from deoxyribose sugar.
86. Which of the following statement is not true ?
 (A) Cyclic structure of glucose is made of five members so it is called glucose pyranose.
 (B) Starch is amorphous and tasteless.
 (C) Molecular formula of lactic acid follows common formula of carbohydrates.
 (D) Stachyose is oligosaccharide.
87. Which of the following is sweetest and levorotatory respectively ?
 (A) Sucrose, D-fructose (B) D-fructose, Invert sugar
 (C) D-fructose, D-fructose (D) D-glucose, D-fructose
88. Which functional groups are present in typical carbohydrate ?
 (P) $\begin{array}{c} \diagup \\ C=O \\ \diagdown \end{array}$ and $-OH$ (Q) $-OH$ and $-CHO$
 (R) $-OH$ (S) $-OH$ and $-COOH$
 (A) Only (Q) (B) Only (P) (C) (P), (S) (D) Only (S)
89. Glucose and fructose are
 (A) functional group isomers (B) anomers
 (C) enantiomers (D) geometrical isomers
90. Specific rotation of α and β form of one monosaccharide is $+29^\circ$ and -17° respectively. Specific rotation of equilibrium mixture by dissolving one form of it in water is measured to 14° , then what proportion of α and β form is present in that mixture ?
 (A) $\alpha = 50\%$, $\beta = 50\%$ (B) $\alpha = 60\%$, $\beta = 40\%$
 (C) $\alpha = 70\%$, $\beta = 30\%$ (D) $\alpha = 67.4\%$, $\beta = 32.6\%$
91. What is obtained on complete hydrolysis of cellulose ?

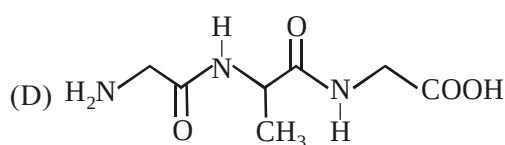
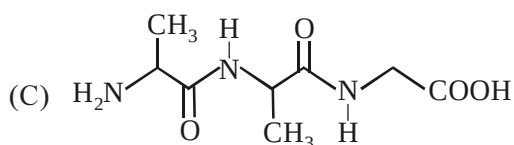
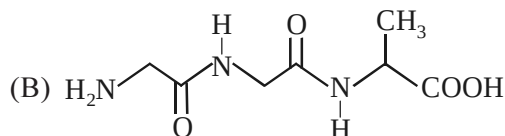
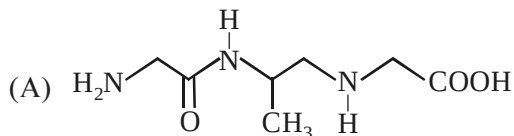
- (A) L-fructose (B) D-ribose (C) D-glucose (D) D-galactose

92. Which are essential amino acids ?

1. Valine 2. Serine 3. Tryptophan 4. Proline 5. Leucine

- (A) 1, 2, 3 (B) 1, 3, 5 (C) 2, 4, 5 (D) 1, 4, 5

93. What is correct structure of Gly-Ala-Phe ?



94. Which pair is not proper ?

- (A) Pepsin-digestive enzyme (B) Linen-form of starch
(C) Nucleic acid-genetic substance (D) Calciferol-vitamin

95. One carbohydrate is X whose molecular mass is 180 gmole^{-1} . One primary alcohol and 4 secondary alcoholic groups is present in it. When it is treated with acetic anhydride in presence of pyridine then it forms pentaacetate derivative. So what is molecular mass of pentaacetate derivative ?

- (A) 180 (B) 390 (C) 210 (D) 348

T(True), F(False) type question :

96. (i) Rhamnose is disaccharide sugar.

(ii) In sucrose, reducing group of β -D-(-) fructose is free, so it does not reduce Fehling's solution.

(iii) By acidic hydrolysis of cellulose, α -D-(+) glucose is obtained.

(iv) In Fischer's projection of α -D-(-) fructose, -OH group at anomeric carbon (C_1) is on left side, so it is levo rotatory.

- (A) T T F T (B) T F T F (C) F F F F (D) F F T T

97. (i) Alenine is neutral and non-essential amino acid.

(ii) Detergent such as sodium dodecyl sulphate associates with polar group of protein and forms denature protein.

(iii) Polypeptide chains are held together by H-bond in silk.

(iv) In tertiary structure of myoglobin, amino acids are joined in a specific sequence.

- (A) T F T F (B) T T T F (C) F T T F (D) T T F F

98. (i) Enzyme maltase affects on hydrolysis of maltose is also known as oxidase.

(ii) Particular amino acid of enzyme act as active site for substrate.

(iii) In presence of lypase enzyme, lectose hydralised into glucose and galactose.

(iv) Coenzyme is protein component, so enzyme becomes active.

- (A) T F T T (B) F T F F (C) T T T F (D) F T T T

99. (i) α -Tocopherol, Retinol are fat soluble vitamins.
 (ii) For prevention of haemorrhage Phylloquinon is necessary.
 (iii) Riboflavin vitamin is obtained from egg white.
 (iv) Due to deficiency of Pyridoxine skin diseases and convulsions causes.
 (A) T F T T (B) T T F F (C) F T F T (D) T T T T
100. (i) Chromosomes present in nucleus of living cell are responsible for heredity.
 (ii) In DNA nucleotide chains are joined with each other by diester bond.
 (iii) A unit formed by the attachment of base to fifth carbon of sugar is called nucleosid.
 (iv) Uracil pyridine base is present in RNA.
 (A) T T F F (B) T F F T (C) T F F F (D) F T T T

Column type questions :

101. Match column-I (carbohydrates) with column-II (examples) :

I	II
(1) Monosaccharide	(P) Cellobiose
(2) Trisaccharide	(Q) Rhamnose
(3) Tetrasaccharide	(R) Melitriose
(4) Polysaccharide	(S) Glycogen
	(T) Stachiose
	(U) Fructose

- (A) (1)-(U), (2)-(P),(T), (3)-(T), (4)-(S) (B) (1)-(Q),(U), (2)-(T), (3)-(R), (4)-(P)
 (C) (1)-(U), (2)-(R), (3)-(T), (4)-(S) (D) (1)-(Q),(U), (2)-(R), (3)-(T), (4)-(S)

102. In column-I reaction of glucose is given. In column-II name of reaction are given. In column-III information regarding to structure of glucose is given. Match column- I, II and III.

I	II	III
(i) Glucose + $C_6H_5NHNH_2$	(P) reduction	(S) Straight chain of 6 C atoms
(ii) Glucose + Fehling's solution	(Q) addition	(T) >C=O group is present
(iii) Glucose + HI	(R) oxidation	(U) $-CH_2OH$ group is present
(iv) Glucose + HNO_3		(V) $-CHO$ group is present

- (A) (i)-(Q),(T) (ii)-(R),(V) (iii)-(P),(U) (iv)-(R),(S)
 (B) (i)-(Q),(T) (ii)-(R),(V) (iii)-(P),(S) (iv)-(R),(U)
 (C) (i)-(P),(T) (ii)-(R),(U) (iii)-(P),(V) (iv)-(R),(U)
 (D) (i)-(Q),(U) (ii)-(R),(V) (iii)-(P),(T) (iv)-(R),(T)

103. Carbohydrates (given in column-I) are hydrolyzed in presence of enzymes (given in column-II) gives organic product (given in column-III). Match properly column-I, column-II and column-III.

I	II	III
(i) Sucrose	(P) Maltase	(S) Glucose
(ii) Maltose	(Q) Zymase	(T) Fructose
(iii) Lactose	(R) Invertase	(U) Ethanol
(iv) Glucose	(S) Maltase	(V) Galactose

- (A) (i)-(R),(S) (ii)-(S),(S),(V) (iii)-(P),(S),(T) (iv)-(R),(U)
 (B) (i)-(R),(S),(T) (ii)-(S),(S) (iii)-(P),(V) (iv)-(Q),(U)
 (C) (i)-(R),(S),(T) (ii)-(S),(S) (iii)-(P),(S),(V) (iv)-(Q),(U)
 (D) (i)-(R),(S),(T) (ii)-(P),(V) (iii)-(P),(S),(U) (iv)-(Q),(U)

104. Match column-I and column-II properly :

I Source/Synthesis of vitamin	II Vitamin
(i) Fat soluble vitamin	(P) Phylloquinone
(ii) Water soluble vitamin	(Q) Calciferol
(iii) Formed by micro organism in intestine	(R) α -Tocopherol
(iv) Formed by the help of sunlight in skin	(S) Biotin
(v) Synthesised from carotene in human body	(T) Ascorbic acid
	(U) Retinol

- (A) (i)-(P),(Q),(U) (ii)-(S) (iii)-(T),(P) (iv)-(S) (v)-(U)
 (B) (i)-(P),(Q),(R),(U) (ii)-(T) (iii)-(R) (iv)-(P) (v)-(U)
 (C) (i)-(P),(R),(U) (ii)-(S) (iii)-(P),(Q) (iv)-(Q) (v)-(U)
 (D) (i)-(P),(Q),(R),(U) (ii)-(T) (iii)-(P) (iv)-(Q) (v)-(U)

105. Match column-I, II and III properly.

I Vitamin	II Chemical name	III Diseases caused by deficiency
(1) B ₂	(P) Biotin	(V) Paralysis
(2) E	(Q) Pyridoxine	(W) Skin diseases
(3) K	(R) α -Tocopherol	(X) Haemorrhage
(4) H	(S) Phylloquinone	(Y) Beri-Beri
(5) B ₆	(T) Thiamine	(Z) Sterility
	(U) Riboflavin	

- (A) (1)-(U),(W) (2)-(R),(Z) (3)-(S),(X) (4)-(P),(W) (5)-(Q),(Y)
 (B) (1)-(T),(Y) (2)-(R),(Z) (3)-(S),(X) (4)-(P),(W) (5)-(Q),(V)
 (C) (1)-(U),(W) (2)-(R),(Z) (3)-(S),(X) (4)-(P),(V),(W) (5)-(Q),(W)
 (D) (1)-(T),(W) (2)-(R),(Z) (3)-(U),(X) (4)-(P),(V) (5)-(Q),(W)

106. Join column-I and II properly :

I (protein)	II (Types of bond)
(1) Insulin (primary structure)	(P) Van der waal's attraction force
(2) Myoglobin (tertiary structure)	(Q) ionic bond
(3) Haemoglobin (quaternary structure)	(R) -S-S-bond
(4) keratin	(S) H-bond

- (A) (1)-(R) (2)-(P),(Q),(R) (3)-(P),(R),(S) (4)-(R)
 (B) (1)-(P),(R) (2)-(P),(R),(S) (3)-(Q),(S) (4)-(P)
 (C) (1)-(R) (2)-(P),(Q),(R),(S) (3)-(P),(Q),(R) (4)-(S)
 (D) (1)-(S) (2)-(P),(Q),(R),(S) (3)-(P),(Q),(R) (4)-(Q)

107. Match column-I and II properly :

I	II
(i) glycosidic linkage	(P) combination between two nucleotide
(ii) peptide bond	(Q) insulin
(iii) disulphide linkage	(R) combination between two amino acids
(iv) phosphodiester linkage	(S) combination between two monosaccharids

- (A) (i)-(R), (ii)-(S), (iii)-(Q), (iv)-(P) (B) (i)-(S), (ii)-(R), (iii)-(P), (iv)-(Q)
 (C) (i)-(S), (ii)-(R), (iii)-(Q), (iv)-(P) (D) (i)-(R), (ii)-(S), (iii)-(P), (iv)-(Q)

- In each of the following questions two statements are given. One of them is assertion (A) and another is reason (R). Read the statements carefully and choose the correct option according to proper instructions given below :

- (A) Assertion (A) and reason (R) are correct reason (R) is proper answer of statement (A).
 (B) Assertion (A) and reason (R) are correct reason (R) is not proper answer of statement (A).
 (C) Assertion (A) is correct, reason (R) is wrong.
 (D) Assertion (A) and reason (R) are incorrect.

108. **Assertion (A) :** Glucose gives red ppts by reduction of Fehling's solution.

Reason (R) : Glucose gives CuO and glyconic acid with the reaction of Fehling's solution

109. **Assertion (A) :** On hydrolysis protein gives amino acids

Reason (R) : $-NH_2$ and $-COOH$ groups are present in amino acids.

110. **Assertion (A) :** Insulin is a globular protein.

Reason (R) : Globular proteins are water soluble.

111. **Assertion (A) :** Both chains in DNA are complementary.

Reason (R) : Cytosine always pairs with guanine and thymine pairs with adenine.

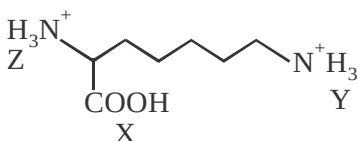
112. **Assertion (A) :** Activity of enzyme depends upon pH.

Reason (R) : Change in pH reflects solubility of enzyme in water.

113. **Assertion (A) :** All enzymes are proteins but all proteins are not enzymes.
Reason (R) : Enzymes are biocatalyst and possess a stable configuration having an active site.
114. **Assertion (A) :** Hydrolysis of sucrose is known as inversion of cane sugar.
Reason (R) : Sucrose shows mutarotation.
115. **Assertion (A) :** Glycine is optically active
Reason (R) : α -carbon in glycine is unsymmetrical.

● **Paragraph type :**

α -Amino acids are the building blocks of proteins. About 20 α -amino acids have been isolated by the hydrolysis of proteins. All these amino acids except glycine are chiral and have L-configuration. Ten amino acids (valine, leucine, isoleucine, phenylalanine, methionine, tryptophan, threonine, lysine, arginine and histidine) which the body cannot synthesize are called essential amino acids. The remaining ten are called non-essential amino acids. All α -amino acids exist as zwitterions each of which has a specific isoelectric point. Above isoelectric point, α -amino acid exists as an anion. Two, Three or many α -amino acids join together to form di-, tri- or polypeptides or proteins respectively. Each polypeptide or protein has a free amino group at one end called the N-terminal end and a free carboxyl group at the other end called the C-terminal end.

116. Which amino acid shows salt like character in aqueous solution ?
 (A) Formic acid (B) Benzoic acid
 (C) 2-Aminopropanoic acid (D) Propanoic acid
117. When pH = 4 then glycine will be in which form ?
 (A) positive ion (B) negative ion
 (C) positive and negative both ions (D) dimer
118. Which amino acid is C-terminal end in Tyr-His-lys-Met-Gly ?
 (A) Tyr (B) Gly (C) Met (D) His
119. 

Correct order of acid strength for, X, Y, Z is

- (A) $Z < X > Y$ (B) $X > Y > Z$ (C) $Z > X > Y$ (D) $X > Z > Y$

Answers : 76. (B), 77. (B), 78. (C), 79. (C), 80. (D), 81. (D), 82. (B), 83. (D), 84. (B), 85. (B), 86. (A), 87. (C), 88. (A), 89. (A), 90. (D), 91. (C), 92. (B), 93. (D), 94. (B), 95. (B), 96. (C), 97. (A), 98. (B), 99. (D), 100. (C), 101. (D), 102. (B), 103. (C), 104. (D), 105. (C), 106. (C), 107. (C), 108. (C), 109. (B), 110. (A), 111. (A), 112. (B), 113. (A), 114. (C), 115. (D), 116. (C), 117. (A), 118. (B), 119. (D).