



BIOMOLECULES

- **Carbohydrates**
- **Oils & Fats**
- **Amino Acids & Proteins**



CARBOHYDRATES

Points to Remember

- 1. These are naturally occurring organic compounds which are essential for the growth of plants and animals.**
- 2. Carbohydrates are also called “hydrates of Carbon” and general formula is $C_x[H_2O]_y$**



3. Carbohydrates are bifunctional organic compounds containing

- i) Carbonyl group aldehyde or ketone
- ii) Hydroxyl group (-OH)

4. Carbohydrates are polyhydroxy aldehydes or polyhydroxy ketones or the compounds which give carbohydrates on hydrolysis and contain at least one chiral carbon atom.

5. Classification of Carbohydrates:

i) **Monosaccharides:** These are the simplest carbohydrates containing C_3 and C_7 carbon atoms which cannot be hydrolysed to smaller molecules.

- **Aldoses :** Glucose, Galactose
- **Ketoses :** Frucotse

ii) Oligosaccharides: These are the carbohydrates which give two to nine monosaccharides molecules on hydrolysis

- **Disaccharides**
- **Trisaccharides**

iii) Polysaccharides (Non-Sugars) :

These are the carbohydrates which on hydrolysis give large number of monosaccharides.

Ex: starch , cellulose, glycogen

6. Anomers and Epimers:

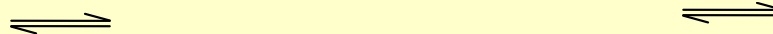
Anomers : A pair of stereoisomers which differ in the configuration at C-1 are known as “**anomers**”.

Ex : α and β -D-glucose

Epimers: A pair of stereoisomers which differ in the configuration at C-2 are known as “**Epimers**”

Ex: Glucose and galactose are C₄ epimers.

7. Mutarotation : The change in specific rotation of an optically active compound in solution. With time to an equilibrium value is known as "**muta rotation**"



Ex: α_1 D-glucose	equilibrium mixture	β -D-
glucose		
$[\alpha]_D = +112^\circ$	$[\alpha]_D = +152.7^\circ$	$[\alpha]_D = +19^\circ$

8. Inversion: [Invert Sugar]:

Sucrose is dextrorotatory ($+66.5^\circ$) and does not show mutarotation. On hydrolysis, it gives an equimolar mixture of dextrorotatory and laevorotatory fructose. Since the specific rotation of fructose (-92.4°) is more than that of glucose ($+52.7^\circ$) the mixture is laevorotatory. Thus, this reaction is accompanied by a change in the sign of optical rotation from dextro(+) to Laevo(-) and such a change is known as “inversion”.

9. Starch: Starch is a mixture of two components- water soluble amylose (20%) and water insoluble component amylopectin(80%)

10. Glycogen: It is the storage polysaccharide in animals called “**animal starch**”.

11. Cellulose: It is a straight chain polysaccharide made up of only D-glucose units. D-glucose units are joined by β -glycoside linkages between C-1 of one glucose unit and C-4 of the next glucose unit

Derivatives of cellulose :

- 1) **Gun cotton :** It is cellulose nitrate
- 2) **Acetate rayon :** It is cellulose diacetate

12. Relative sweetness of sugars :

Cane Sugar	:	10
Lactose	:	1.6
Galactose	:	3.2
Maltose	:	3.2
Glucose	:	7.4
Fructose	:	17.3

13. Test for carbohydrates :

Molich Test :

“Seliwanoff” test for ketone sugars

Iodine test for starch

1. Hydrolysis of sucrose gives

(1) Glucose only

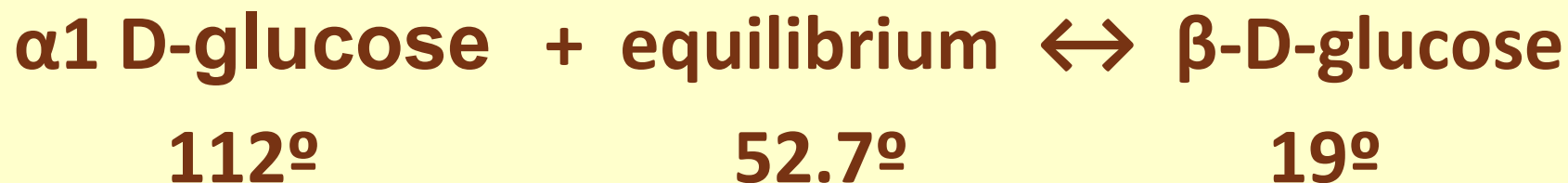
(2) Glucose + Fructose

(3) glucose and galactose

(4) Maltose

Ans. 2

This interconversion is also accompanied by change in specific rotation and is called mutarotation.



2. Complete hydrolysis of cellulose gives

(1) L-glucose

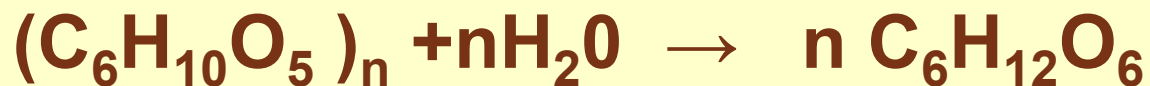
(2) D-fructose

(3) D-ribose

(4) D-glucose

Ans. **4**

**Bitmap Cellulose on complete hydrolusis
gives D-glucose**



3. The pair of compounds in which both the compounds give positive test with Tollen's reagent is

(1) Glucose and sucrose

(2) Glucose and fructose

(3) Acetophenone and hexanal

(4) Fructose and sucrose

Ans. 2

Both Glucose and fructose are reducing agents.

Glucose due to the presence of -CHO group while

fructose in the presence of basic medium (provided by Tollen's reagent) forms glucose which reduces Tollen's reagent.



4. The two structures of D-glucopyranose forms are

(1) enantiomers

(2) anomers

(3) epimers

(4) geometrical isomers

Ans. 2

The two forms of D-glucopyranose are α -D (+) – glucopyranose and β -D(+)-glucopyranose. These differ in the configuration at C₁ so these are anomers.



5. The two functional groups present in a typical carbohydrate are :

(1) $>C=O$ and $-OH$

(2) $-OH$ and $-CHO$

(3) $-OH$ and $-COOH$

(4) $-CHO$ and $-COOH$



Ans. **1**



6. Among the naturally occurring carbohydrates, furanose ring is found in the

- (1) glucose unit of cane sugar**
- (2) fructose unit of cane sugar**
- (3) glucose unit of cellulose**
- (4) galactose unit of lactose**



Ans. 2



7. Molisch's test is answered by :

(1) Glucose

(2) Fructose

(3) Sucrose

(4) All carbohydrates



Ans. 4

**Molisch's test is given by all
carbohydrates**



8. Glucose cannot be classified as

- (1) a hexose
- (2) a carbohydrate
- (3) an oligosaccharide
- (4) an aldose



Ans. 3

Glucose is not an oligosaccharide



9. The calorific value is maximum in case of

(1) Milk

(2) Minerals

(3) Carbohydrates

(4) Proteins



Ans. 3

10. A Sugar that is not a disaccharide among the following is

(1) Maltose

(2) Sucrose

(3) Galactose

(4) Lactose



Ans. 3

Galactose is a monosaccharide



11. Energy is stored in our body in the form of

(1) fats

(2) carbohydrates

(3) ATP

(4) ADP



Ans. 3

Energy is stored in the body as ATP

12. Number of possible isomers of glucose are

(1) 4

(2) 14

(3) 16

(4) 24



Ans. 3

There are four chiral C-atoms

$$2^4 = 16$$



13. Water insoluble component of starch is

(1) amylopectin

(2) amylose

(3) cellulose

(4) none of these



Ans. 1

Amylopectin is water insoluble component of starch while amylose is water soluble.

14. Glucose contains in addition to aldehyde group

- (1) one secondary OH and four primary OH groups
- (2) One primary OH and four secondary OH groups
- (3) two primary OH and three secondary OH groups
- (4) three primary OH and two secondary OH groups



Ans. 2



15. A diabetic person carries a packet of Glucose with him always, because

- (1) Glucose reduces the blood sugar level slowly
- (2) Glucose increases the blood sugar level slowly
- (3) Glucose reduces the blood sugar level almost instantaneously
- (4) Glucose increases the blood sugar level almost instantaneously



Ans. 4

The sugar level of diabetic person sometimes suddenly falls. So immediate intake of glucose increases the sugar level to normal



16. Sucrose is a non reducing sugar because

- (1) sucrose is a disaccharide**
- (2) aldehydic group of glucose is blocked**
- (3) ketonic group of fructose and aldehydic group of glucose are blocked**
- (4) Ketonic group of fructotse is blocked**

Ans. 3

Sucrose is a non-reducing sugar as the two monosaccharide units i.e., glucose and fructose are linked through their reducing centres. C₁ of α glucose is linked to C₂ of β-fructose. Thus 1-2 linkage is present in sucrose



17. The enzyme which converts starch into maltose is

(1) Maltase

(2) Pepsin

(3) Ptyalin

(4) Lipase



Ans. 3

The enzyme ptyalin is present in saliva. It converts starch into maltose.



18. Sucrose is a non reducing sugar due to

(1) 1-2 linkage

(2) 1-4 linkage

(3) 1-5 linkage

(4) 1-6 linkate

Ans. 1

Sucrose is a non-reducing sugar as the two monosaccharide units i.e., glucose and fructose are linked through their reducing centres.

C_1 of α glucose is linked to C_2 of β -fructose.

Thus 1-2 linkage is present in sucrose

19. In the Molisch reagent, the substance used is

- (1) β naphthol in alcohol
- (2) α naphthol in alcohol
- (3) resorcinol in alcohol
- (4) rosaniline in water



Ans. 2

Molisch reagent is a solution of α -naphthol in alcohol.

It is a reagent to test carbohydrate.



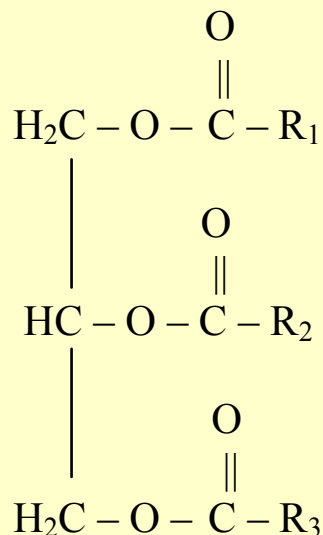
OILS & FATS

Points to Remember

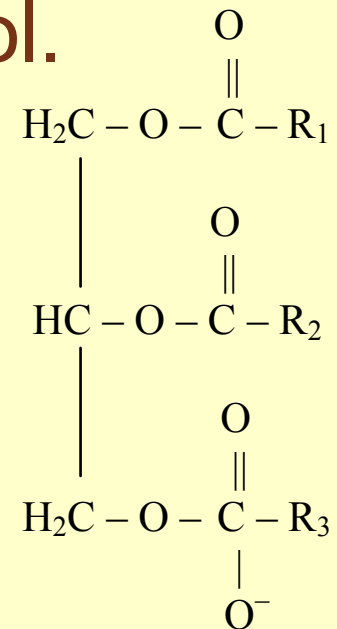
Lipids are naturally occurring esters of long chain fatty acids and alcohols.

Classification :

a) Oils and fats : These are trimesters of glycerol with higher fatty acids (triglycerides)



- b) **Phospholipids:** Phospholipids are derivatives of fats in which only two –OH groups of glycerol are esterified by fatty acids and third one is esterified by derivative of phosphoric acid with some amino alcohol.



c) Waxes: Waxes are lipids which are esters of long chain fatty acids and long chain monohydric alcohols

Acrolein Test:

An oil or fat is added to a little of pot bisulphate (KHSO_4) or P_2O_5 in a test tube and heated slowly.

An offensive odours of acrolein is formed



1. Lipids are

(1) long chain fatty acid esters

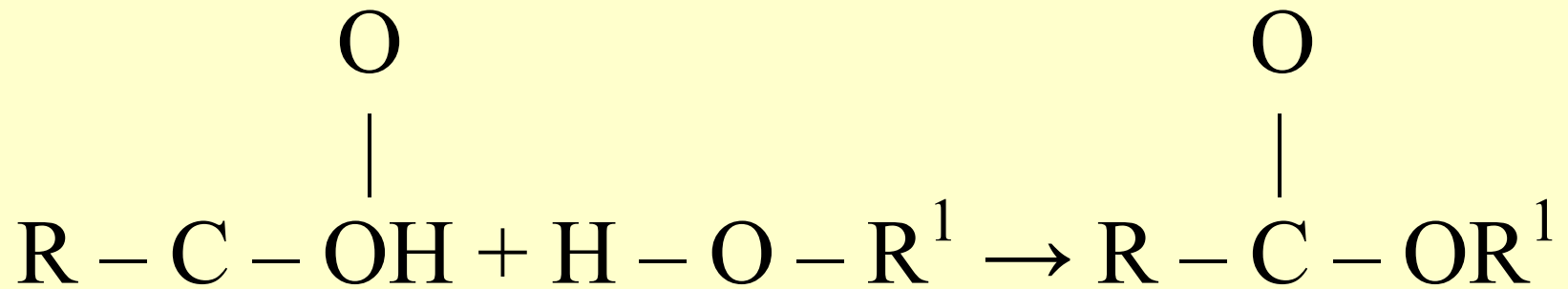
(2) long chain sulphonic acid esters

(3) polymeric hydrocarbons

(4) polymeric aldehydes

Ans. 1

Lipids are esters of long chain fatty acids



2. The group present in waxes are

(1) Ester group

(2) alcohol group

(3) ether group

(4) acid group

Ans. 1

**Waxes are esters of monocarboxylic acids
and monohydric alcohols**

3. When tristearin is saponified with NaOH, we get

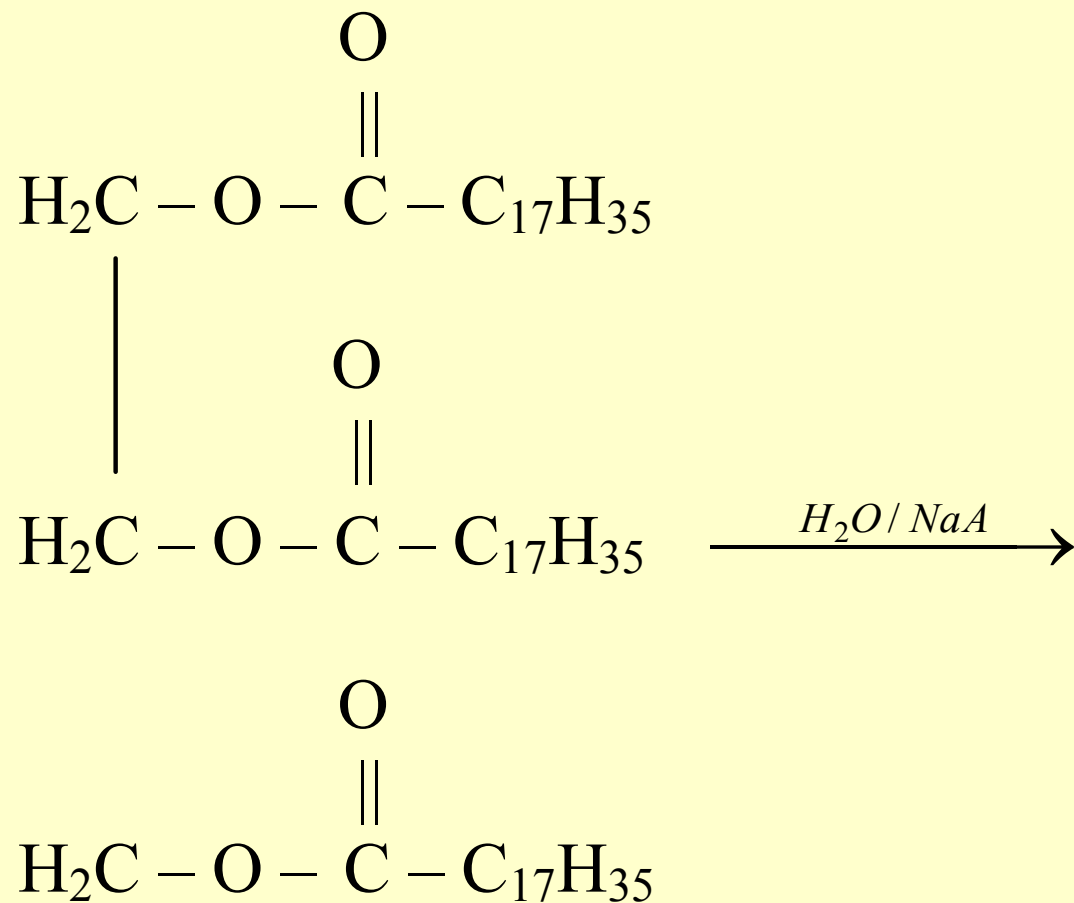
(1) glycerol and hard soap

(2) glycerol and toilet soap

(3) only glycerol

(4) only toilet soap

Ans. 1



4. The cell membrane are mainly composed of

(1) proteins

(2) fats

(3) carbohydrates

(4) phospholipids

Ans. 4

Phospholipids are structural components of cell membranes

5. Phospholipids are esters of glycerol with

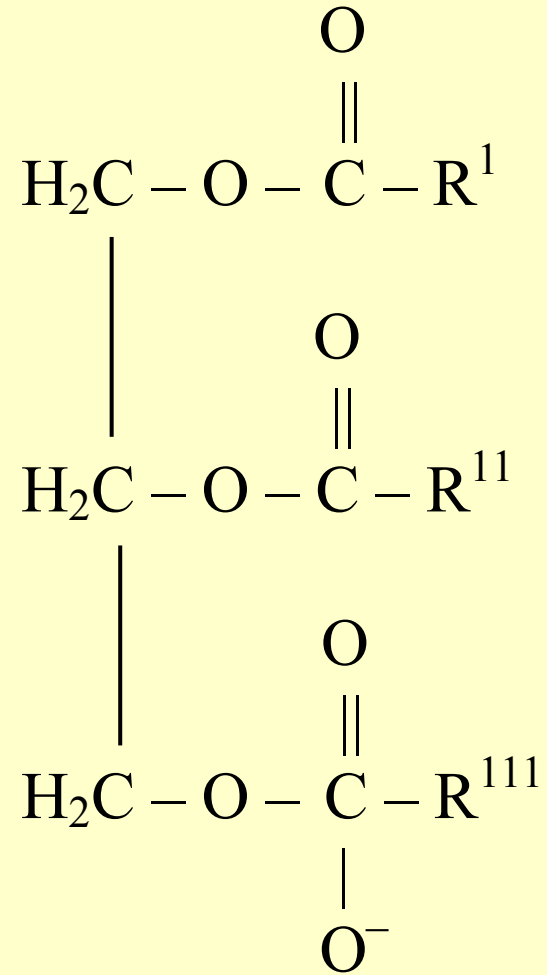
(1) three carboxylic acid residues

(2) three phosphate groups

(3) two carboxylic acid residue and one phosphate group

(4) one carboxylic acid residue and two phosphate groups

Ans. 3



6. The vitamin used in the preservation of oils and fats is

(1) Vitamin A

(2) Vitamin B

(3) Vitamin C

(4) Vitamin D

Ans. 3

7. Candles are made up of a mixture of

(1) Carnauba wax + Paraffin wax

(2) Paraffin wax + Stearic acid

(3) Bees wax + Spermaceti

(4) Plastic + Adhesive + Wax

Ans. 2

Candles are prepared by mixing paraffin wax (90%) with higher fatty acids like stearic and palmitic acid which provides strength

8. Which is incorrect?

- (1) Toilet soap is potassium salt of higher fatty acid**
- (2) Vegetable oils are glycerides of saturated aliphatic monocarboxylic acids**
- (3) Phospholipids have hydrophilic and hydrophobic parts**
- (4) All the three**

Ans. 2

Actually vegetable oils are glycerides of unsaturated aliphatic monocarboxylic acids

9. Drying oils are called so because

(1) they are volatile and evaporate fast

(2) they have a high proportion of unsaturated acids and they undergo oxidation in air and polymerisation to hard solid resin

(3) they get dry and explode easily

(4) none of these

Ans. 2

10. Rancidity of oils and fats is caused by

(1) hydrolysis of triglycerides

(2) oxidation of the unsaturated glycerides

(3) both (1) and (2)

(4) none of these

Ans. 3

11. The oils tend to be liquid at room temperature if they contain more of

(1) glycerol

(2) unsaturated fatty acid

(3) saturated fatty acid

(4) non-fatty acid

Ans. 2

12. The vitamins present in oils and fats are

(1) A and D

(2) B and C

(3) A and B

(4) A and C

Ans. **1**

13. A distinctive and characteristic functional group of fats is

(1) a peptide group

(2) an ester group

(3) an alcoholic group

(4) a ketonic group

Ans. 2

Ester group

14. Treatment of fats with strong alkali is an example for

(1) dehydrogenation

(2) hydrogenation

(3) decarboxylation

(4) saponification

Ans. 4

15. Acrolein test is positive for

(1) polysaccharides

(2) proteins

(3) oils and fats

(4) reducing sugars

Ans. 3

Fat on being heated strongly in the presence of KHSO_4 or P_2O_5 gives acrolein (formed from the glycerol part due to dehydration) which has a characteristic smell.

This test is known as acrolein test for fats.

16. Iodine value is used to determine

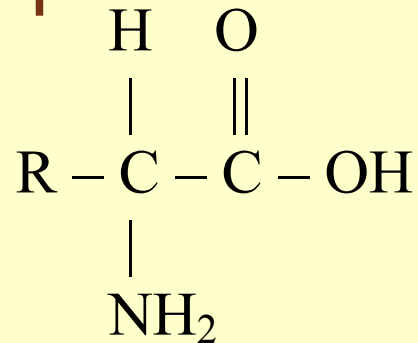
- (1) degree of rancidity
- (2) degree of unsaturation
- (3) degree of saponification
- (4) degree of esterification

Ans. 2

AMINO ACIDS & PROTEINS

1. Amino acids are compounds containing amino and carboxylic functional groups in the same molecule.

- They can be represented by the general formula. Amino acids are the building blocks of proteins.



- In nature more than 100 amino acids are found to exist out of which 20 α -amino acids take part in protein synthesis. These are called standard amino acids

2. Classification of amino acids:

i) Based on the nature, amino acids are classified into 3 types.

a) **Neutral amino acids:** Contains one amino group & one carbonyl group .
Ex: Glycine, alanine, serine

b) **Acidic amino acids :** These contain more no. of carboxylic groups than the amino groups.
Ex: Aspartic acid, Glutamic acid

c) **Basic aminoacids:** These contain more no. of amino group than the carboxylic groups.
Ex: Lysine, Arginine, Histidine.

ii) Based on the structure, amino acids can be

Aliphatic Amino acids :

Ex 1: Monoamino monocarboxylic acid –
Glycine , Alanine , etc.

Ex 2: Monoamino dicarboxylic acid – Asparagine,
Glutamine & Lysine

Ex 3: Diamino monocarboxylic acid – Asparagine,
Glutamine & Lysine.

Ex 4: Hydroxy amino acid : serine

Ex 5 : Sulphur containing amino acid : Cysteine
and methionine.

iii) **Aromatic amino acid** : Tyrosine

Heterocyclic amino acid : Proline

Note: Proline contains iminogroup and hence called imino acid.

iv) Based on the biological importance, amino acids can be

a) Essential amino acids: They are not synthesized by our body and hence must be supplied through our diet.

They are Methionine, Arginine, Tryptophan, Threonine, Valine, Isoleucine, Leucine, Phenylalanine, Histidine Lysine.

b) Non-essential amino acids : The rest 10 amino acids can be synthesized in our body and hence called non-essential amino acids.

Ex: Glycine , alanine, Serine, Proline, Etc.

4. Isoelectric point :

Isoelectric point for an amino acid is the PH value at which the amino acids do not move either to the anode or to the cathode under the influence of the electric field. PH at isoelectric point for a few amino acids are given below:

Glycine	: 6.1
Cysteine	: 5.0
Aspartic acid	: 3.0
Lysine	: 9.8

1. How many amino acids a human body can synthesize?

(1) 5

(2) 10

(3) 15

(4) 20

Ans. 2

These are non-essential amino acids

2. Sulphur containing amino acid is/are

(1) Methionine

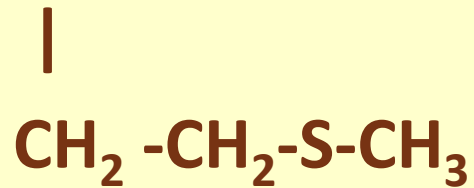
(2) Serine

(3) Tyrosine

(4) Lysine

Ans. 3

Methionine $\text{H}_2\text{N}-\text{CH}-\text{COOH}$ and Cysteine



3. Lysine is a /an

(1) neutral amino acid

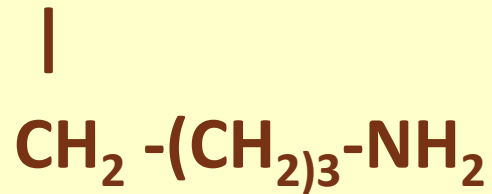
(2) acidic amino acid

(3) basic amino acid

(4) heterocyclic amino acid

Ans. 3

Lysine $\text{H}_2\text{N}-\text{CH}-\text{COOH}$ has two $-\text{NH}_2$ groups



4. Which of the following is a non-essential amino acid ?

(1) Leucine

(2) Lysie

(3) Phenylalanine

(4) Proline

Ans. 4

Proline

5. Enzymes are made up of

(1) edible proteins

(2) proteins with specific structure

(3) nitrogen containing carbohydrates

(4) carbohydrates

Ans. 2

6. The hormone which controls the process of burning of fats, proteins and carbohydrates to liberate energy in the body is

(1) Cortisone

(2) Adrenaline

(3) Thyroxine

(4) Insulin

Ans. 4

7. Insulin contains _____ amino acids

(1) 51

(2) 72

(3) 86

(4) 92

Ans. **1**

8. Insulin and carboxypeptidase contain respectively

(1) Cu, Zn

(2) Zn , Cu

(3) Cu, Cu

(4) Zn , Zn

Ans. 4

Both insulin and carboxypeptidase contain zinc

9. The functional group, which is found in amino acid is

(1) -COOH group

(2) -NH₂

(3) -CH₃ group

(4) both (1) and (2)

Ans. 4

Both -COOH and -NH₂ functional groups are present in amino acids

10. Insulin production and its action in human body are responsible for the level of diabetes. This compound belongs to which of the following categories ?

(1) An enzyme

(2) A hormone

(3) A coenzyme

(4) An antibiotic

Ans. 2

11. The secondary structure of protein refers to :

(1) hydrophobic interactions

(2) sequence of α -amino acids

(3) fixed configuration of the polypeptide backbone

(4) α -helical backbone

Ans. 4

12. Amino acids are produced by the hydrolysis of :

(1) Proteins

(2) Fats

(3) Carbohydrates

(4) Nucleic acids

Ans. **1**

Proteins upon hydrolysis form amino acids

13. Aromatic amino acid is

(1) Cysteine

(2) Lysine

(3) Tyrosine

(4) Alanine

Ans. 3

Tyrosine has a benzene ring

14. Amino acid among the following is

(1) proline

(2) lysine

(3) serine

(4) tyrosine

Ans. **1**

Proline is an amino acid

15. Ninhydrin test is used in identification of

(1) Carbohydrates

(2) Amino Acids

(3) Ketones

(4) Oils and fats

Ans. 2

Ninhydrin test is used for identification of amino acids

16. The biological function of antibodies is

(1) catalysing the biochemical reaction

(2) carrier of oxygen

(3) developing immunity

(4) structure proteins

Ans. 3

THANK YOU