unit - XIV

Biomolecules

Biomolecules → The complex lifeless substances which builds the living organism and are required for their growth and maintainance are known as biomolecules.

The biomolecules are carbohydrates, protein, nucleic acid, vitamins etc.

Carbohydrates → Initially, carbohydrates are consider as hydrates of carbon with general formula $C_x(H_2O)_y$

This defination could not hold good for following reason →

(1) There are certain compounds such as formaldehyde, acetic acid which are not carbohydrates but they have formula of hydrates of carbon.

(2) There are certain compounds such as deoxyribose ($C_5H_{10}O_4$) etc. which are carbohydrates but they do not have a formula of hydrate of carbon.

Now days, carbohydrates are defined as poly hydroxy aldehydes or poly hydroxy ketone or compounds which gives these compounds on hydrolysis.

Eg ⇒ Glucose, Fructose, Sucrose.

Important functions of carbohydrates →
The main functions of the carbohydrates are: →

① Carbohydrates act as a main source of energy in living organism. The energy required by the living organisms for various activities is provided by carbohydrates.

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + Energy$
(Glucose)

② The carbohydrate forms the structural material for cell.
Eg ⇒ Cellulose is present in cell wall of plants.

③ Carbohydrates are required for the growth and the maintaintance of living organisms.

④ carbohydrates provides raw material for various industry such as paper industry, textile industries.

Classification of carbohydrates →
There are three types of carbohydrates
① monosaccarides
② ~~mono~~ oligosaccarides
③ Polysaccarides

Monosaccarides → These are the simplest Carbohydrates which can't

be hydrolysed into similar Compounds. They contains simplest single unit. eg:⇒ Glucose, Fructose

The carbohydrates contains aldehyde or ketone as a functional group. If aldehyde functional group is present then it is known as aldoses. If ketone FG is present then it is known as ketoses.

These aldoses or ketoses are further classified as trioses, tetroses, pentoses, hexoses etc. depending upon the no. of carbon atom present in it.
eg ⇒ Glucose is aldohexoses and fructose is ketohexoses.

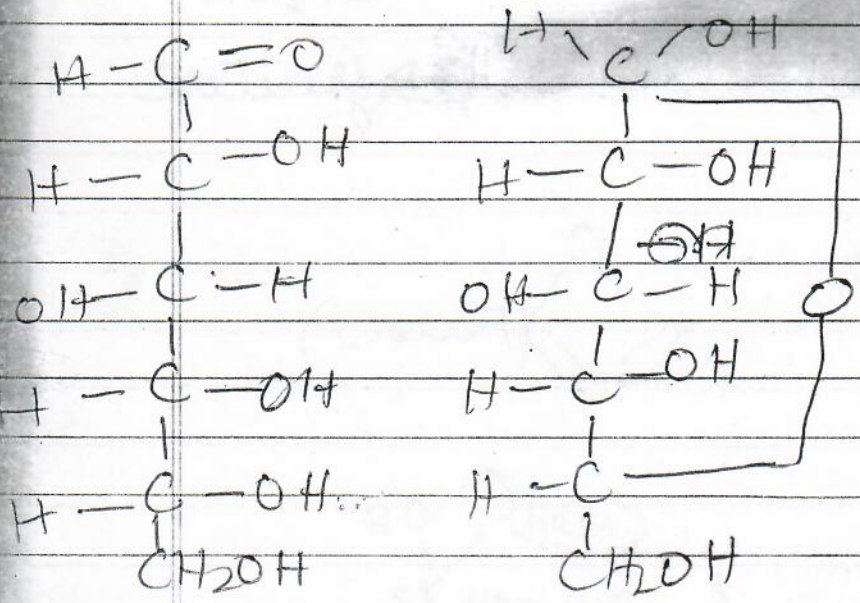
Oligosaccharides → These are the carbohydrates which gives 2 to 10 monosaccharides molecules on hydrolysis.

They are further classified as disaccharides, trisaccharides, tetrasaccharides etc. depending upon the no. of monosaccharides present in it.
eg ⇒ Sucrose, Maltose and Lactose are disaccharides carbohydrates.

Polysaccharides → These are the carbohydrates which gives large no. of monosaccharides on hydrolysis.

These carbohydrates are also known as polymer of monosaccharides carbohydrates.
Eg → cellulose, starch.

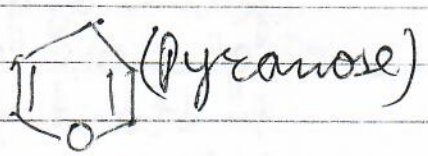
Structures →
Monosaccharides →
Glucose ($C_6H_{12}O_6$) → is aldohexoses.

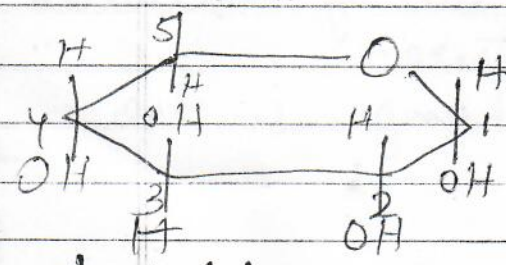


D-Glucose α D Glucose β - D Glucose

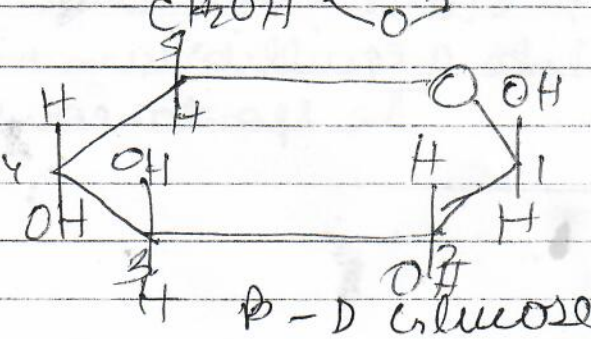
Anomers → α D Glucose & β - D Glucose are known as anomers.
Anomers are the isomers having differ configuration around first carbon (C1)

Pyranose struc. →



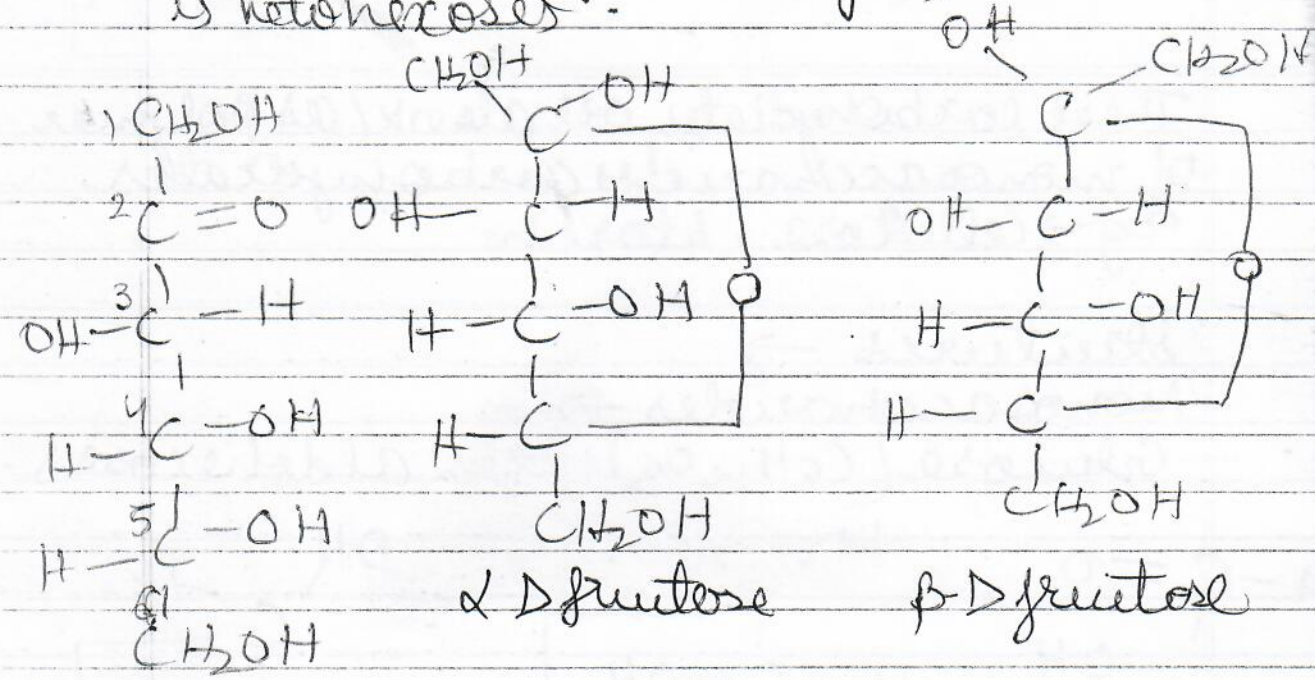


α - D Glucose

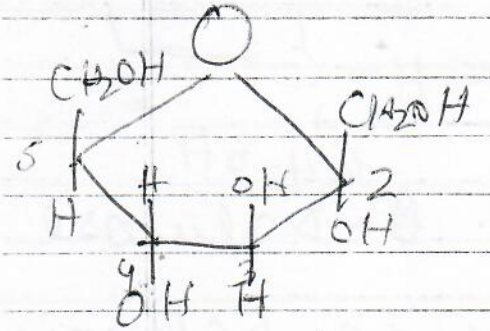


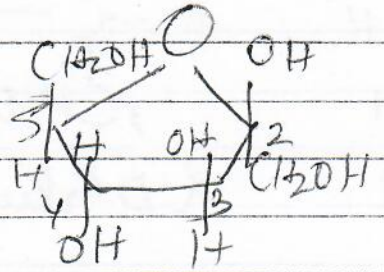
β - D Glucose

Fructose → (fruit sugar) ($C_6H_{12}O_6$)
is ketohexoses.



Furanose →





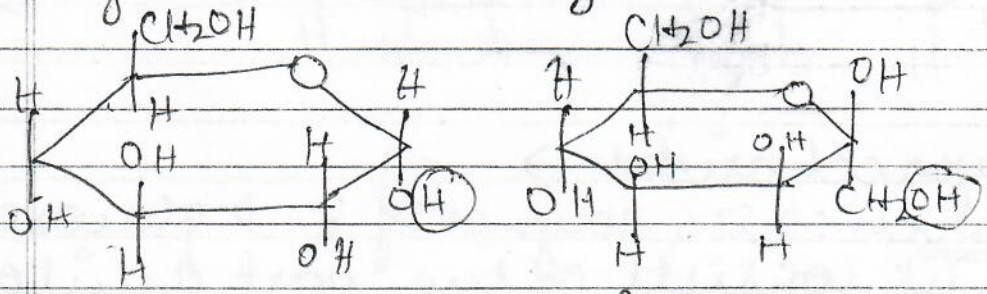
Mutarotation → when either of the two forms of glucose i.e. α D glucose & β D glucose are dissolve in water and allow to stand. Then these get slowly converted into a equilibrium mixture.

The spontaneous change in the

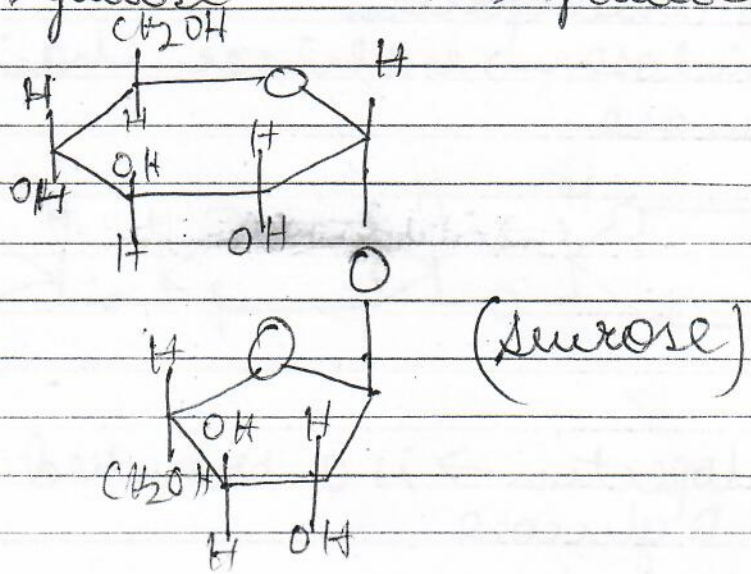
Specific rotation of an optical active compound with time to equilibrium value is called as mutarotation.

Structure of disaccharides →

Sucrose → On hydrolysis gives α D glucose and β D fructose.

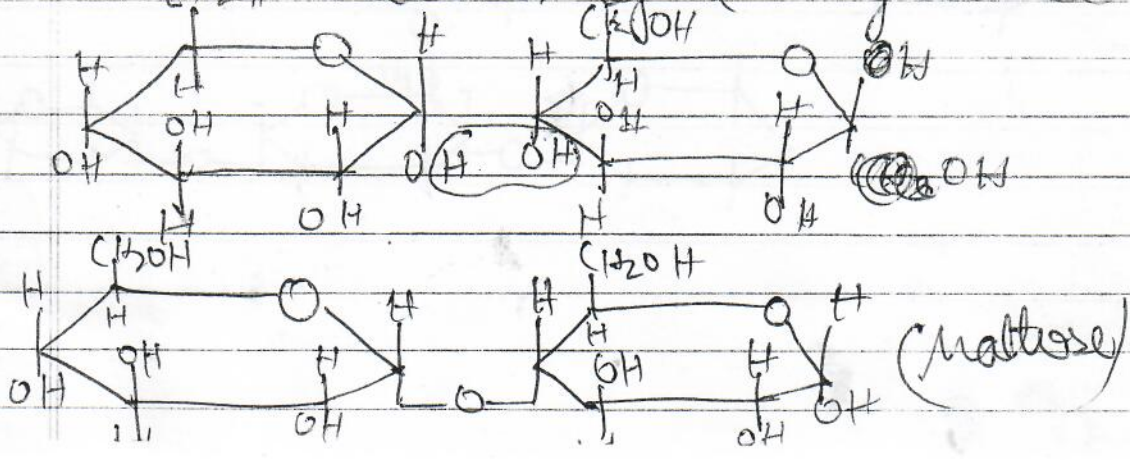


α-D glucose β-D fructose



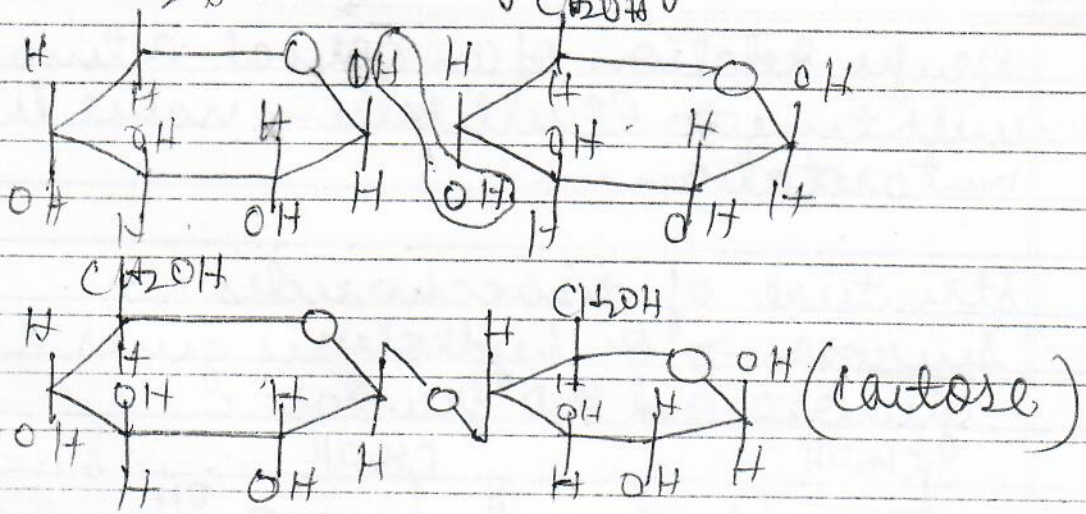
(Sucrose)

Maltose ⇒ On hydrolysis gives two molecules of α-D glucose.



(Maltose)

Lactose → On hydrolysis gives two molecules of β-D glucose

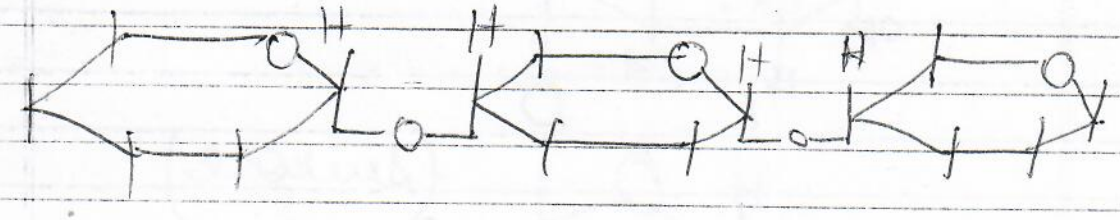


(lactose)

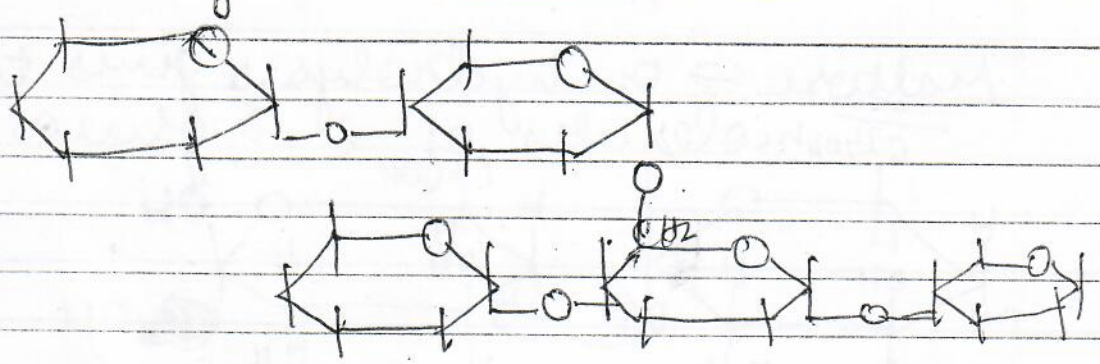
Polysaccharides →

Starch → is a polymer of α-D glucose which consists of two part amilose and amilopectin -

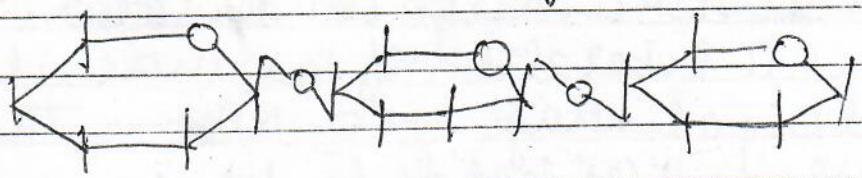
Amilose → is a linear chain of α D glucose.



Amilopectin → is a branched chain of α-D glucose

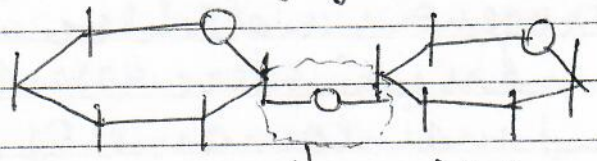


Cellulose → is a polymer of β- glucose.

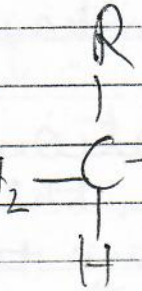


Glycosidic linkage → —O— linkage through which molecules of monosaccharides are joined together by the loss of water molecules to form a molecule of disaccharides or polysaccharides is called glycosidic linkage.

eg ⇒

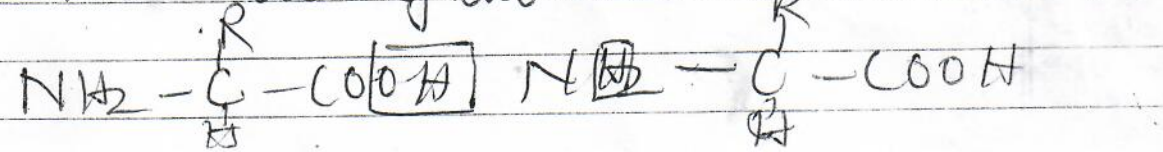


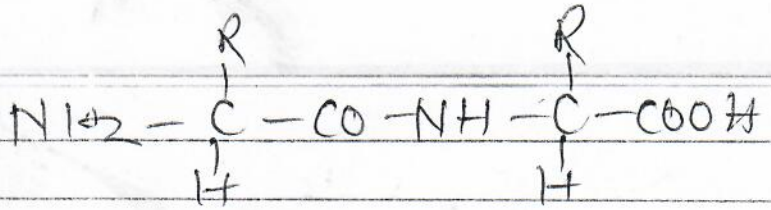
Amino Acid →



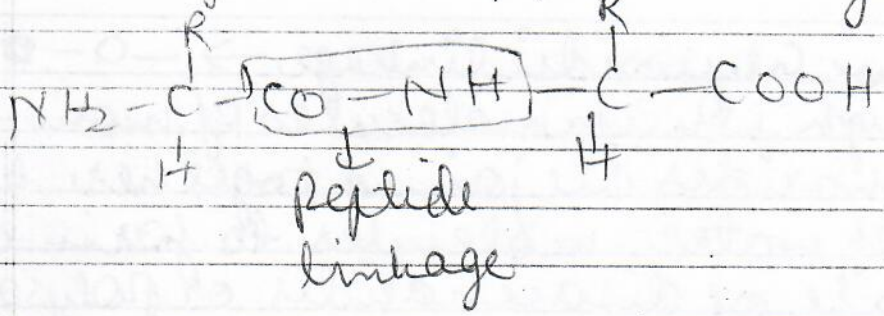
are the organic compound containing both amino group and carboxylic group represent by a general formula.

Peptide → ~~are the compounds containing both amino group and carboxylic group~~ are the compounds formed by the combination of two or more Amino acids.





Peptide linkage → When two molecules of amino acids undergo condensation then there is a liberation of H_2O molecule resulting a linkage $-CO-NH-$. This linkage is known as peptide linkage.



Proteins ⇒ are the complex organic nitrogenous molecule with high molecular mass which are essential for growth and maintainance of body.

Structurally, proteins are long polymers of amino acids linked by peptide linkage.

Classification of protein →
Based upon the molecular structure we have two types of protein:
(R) (2) Fibrous protein
Globular protein

Fibrous protein → These type of protein consist of linear thread like molecule which tends to lie side by side to form fibre. eg → keratin (oil)

Globular protein → In these type of protein the molecules are folded together into compact units forming spherical shape
Eg → Albumin (egg)

Difference →

Fibrous protein	Globular protein
1. These type of protein consist of linear thread like molecule which tends to lie side by side to form fibre.	In these type of protein the molecules are folded together into compact units forming spherical shape.
2. It is a linear polymer of amino acid.	It is a crossed linked polymer of amino acid.
3. They are insoluble in water.	They are soluble in water.
4. Eg → keratin	Eg → Albumin

Structure of proteins → Protein has complex structure and structure of protein is studied in three levels.
① 1° stru. ② 2° stru. ③ 3° stru.

1° structure → The sequence in which amino acid are linked in one or more peptide chain is called 1° structure of protein.

② 2° structure → Gives the manner in which polypeptide chain is folded or arranged. X-ray studied ~~is~~ as shown that there two common 2° structures i.e.
α helix
β sheet structure

③ 3° structure → arises due to folding and bending of polypeptide chain in 3-Dimensional structure. This structure gives the overall shape of protein.

Denaturation of protein → A process of that changes the physical & the biological properties of protein without effecting its chemical composition is known as denaturation of protein.

Denaturation is carried out by changing temp., PH & presence of a salt etc.

eg:- The coagulations of albumin present in the white ~~egg~~ of an egg. Proteins present in white egg are globular & soluble. When egg is boiled in water the globular proteins present in it change to a rubber like insoluble mass.

Nucleic acid :- are the biomolecules which are present in all living organism. They play an

important role in the development and the reproduction of all forms of life.

Structurally, the nucleic acid are the polymer of nucleotides.

There are two types of nucleic acid

① DNA (Deoxyribonucleic acid) ② RNA Ribonucleic acid

	DNA	RNA
①	~~is deox~~ DNA is deoxyribonucleic acid.	RNA is ribonucleic acid.
②	The sugar present in it is deoxyribose.	The sugar present in it is ribose.
③	DNA has double helix structure	RNA has single helix structure.
④	DNA is present in the nucleus of cell.	RNA is present in the cytoplasm of the cell.
⑤	DNA is responsible for the transmission of heridatory character.	RNA helps in protein synthesis
⑥	Uracil is not present in DNA.	Thymine is not present in RNA.
⑦	DNA shows replication	RNA do not RNA replication.

Biological function of nucleic acid → Replication → It is a property of DNA molecule to synthesize another molecule. Replication of a DNA is enzyme catalysed process.

Protein synthesis → Nuclei acid perform an important function of protein synthesis the genetic information coated in DNA in the form of specific base sequence is move to cytoplasm by mRNA. This genetic information is the transfer to another RNA is tRNA.

The tRNA translate the genetic information of DNA into a sequence of amino acids and thus synthesis specific protein.

vitamin → are the organic compounds which cannot be produced by a body and are supplied in small amount in the form of diet to perform specific biological function for growth and maintenance of body.

The deficiency of vitamin causes various types of diseases.

eg ⇒ vitamin A → Night blindness
vitamin B → Bery-Bery
vitamin C → Scurvy
vitamin D → Richets
vitamin K →