CBSE [2018]

1. **Define the following with an example of each:** CBSE-2018 **3**

(*a*) Polysaccharides **(*b*) Denatured protein**

(*c*) Essential amino acids

Or

(*a*) Write the product when D-glucose reacts with conc. HNO_3.

(*b*) Amino acids show amphoteric behaviour. Why?

(*c*) Write one difference between α-helix and β-pleated structures of proteins.

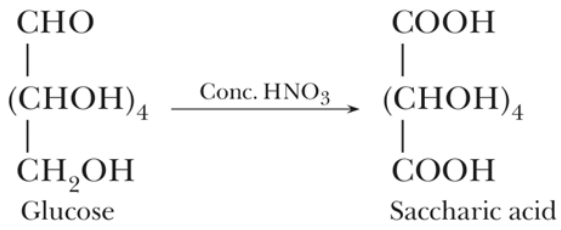
Ans (*a*) Those carbohydrate which on hydrolysis give large number of monosaccharides are called polysaccharide e.g. starch.

(*b*) The protein whose secondary and tertiary structure is ruptured but primary structure remains the same is called denatured proein e.g. Hard boiled egg contains denatured protein.

(*c*) Those amino acids which are not synthesized by our body and must be part of our diet are called essential amino acids e.g. Valine.

Or

(*a*)



Glucose Saccharic acid

(*b*) Those amino acids which have both acidic (—COOH) as well as basic ($—NH_2$) groups in their structure due to which they react with both acids as well as bases, i.e. show amphoteric behaviour. They form zwitter ion.

(*c*)

α-helix has a polypeptide chain which forms all possible H-bonds by twisting into right handed screw. It has intra-molecular H-bonding.	β-pleated structure has all polypeptide chains which are stretched to maximum extent and then laid side by side by intermolecular H-bonding.

CBSE 2019

1. **Differentiate between the following:** 2019

(*i*) Amylose and Amylopectin

(*ii*) Peptide linkage and Glycosidic linkage

(*iii*) Fibrous proteins and Globular proteins

OR

OR

Write chemical reactions to show that open structure of D-glucose contains the following:

(*i*) Straight chain

(*ii*) Five alcohol groups

(*iii*) Aldehyde as carbonyl group

Ans. (*i*) **Amylose:** It is a linear chain polymer of α-glucose, water soluble component of starch which constitute 15-20% of starch. It has $C_1 - C_4$ linkages.

Amylopectin: It is branched chain polymer of α-glucose, water insoluble component, form 80-85% of starch. It has $C_1 - C_4$ and $C_1 - C_6$ linkages.

(*ii*) **Peptide bond or peptide linkage:** The bond $-\left(-\overset{\overset{O}{\|}}{C}-NH-\right)-$ between two or more amino acids in polypeptides and proteins.

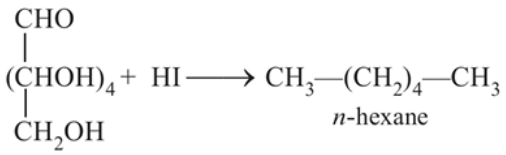
Glycosidic linkage: It is oxide linkage between two or more monosaccharide units in Polysaccharides.

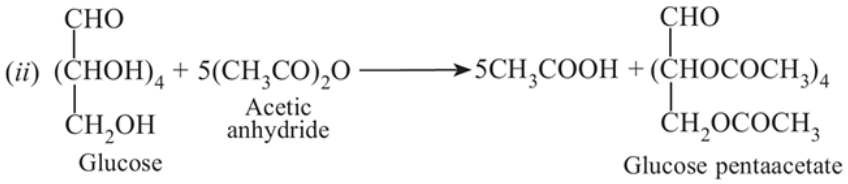
iii) **Fibrous proteins:** Thread like structure, insoluble in water, e.g. keratin (hair, wool, silk), myosin (muscles) etc, have β-placated structure.

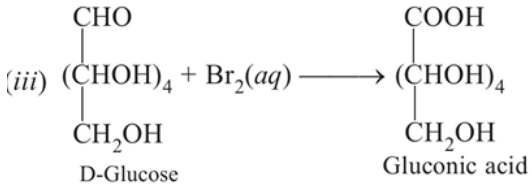
Globular proteins: Chains of polypeptidic coil around (α-helix), spherical shape, soluble in water, e.g. insulin, albumin.

OR

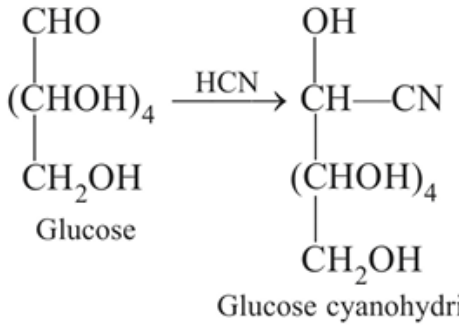
(*i*) *n*-hexane is formed, $CH_3—CH_2—CH_2—CH_2—CH_2—CH_3$



(*ii*)


(*iii*)


or



CBSE – 2020

1. Differentiate between following: CBSE - 2020

(*i*) **Amylose and Amylopectin**

(*ii*) **Globular protein and Fibrous protein**

(*iii*) **Nucleotide and Nucleoside** **1+1+1=3**

(*i*) **Amylose:** It is a linear chain polymer of α-glucose, water soluble component of starch which constitute 15-20% of starch. It has $C_1 - C_4$ linkages.

Amylopectin: It is branched chain polymer of α-glucose, water insoluble component, form 80-85% of starch. It has $C_1 - C_4$ and $C_1 - C_6$ linkages.

(*ii*) **Fibrous proteins:** Thread like structure, insoluble in water, e.g. keratin (hair, wool, silk), myosin (muscles) etc, have β-pleated structure.

Globular proteins: Chains of polypeptidic coil around (α-helix), spherical shape, soluble in water, e.g. insulin, albumin.

(*iii*) Nucleoside contains ribose or deoxyribose sugar and heterocyclic base, e.g. adenosine, whereas nucleotides contain phosphoric acid residue along with heterocyclic base and pentose sugar, e.g. adenosine triphosphate (ATP).

2. Define the following terms with a suitable example in each: CBSE - 2020

(*a*) **Polysaccharides**

(*b*) **Denatured protein**

(*c*) **Fibrous protein** **1+1+1=3**

(*a*) Those carbohydrate which on hydrolysis give large number of monosaccharides are called polysaccharide e.g. starch, glycogen, cellulose (*Any one*)

(*b*) **Denaturation of proteins:** On heating or change in pH, hydrogen bonds are disturbed, globules unfold and helix get uncoiled and leads to loss of biological activity, e.g. coagulation of egg white, curdling of milk.

(*c*) **Fibrous proteins:** Thread like structure, insoluble in water, e.g. keratin (hair, wool, silk), myosin (muscles) etc, have β-pleated structure.

or

Fibrous proteins: When polypeptide chain run parallel and are held together by H-bonds and have disulphide bonds, the thread like structure is called fibrous proteins, e.g.,Keratin, Myosine.

3. Which of the following is a disaccharide? CBSE - 2020

(*a*) Glucose **(*b*) Starch**

(*c*) Cellulose **(*d*) Lactose**

Ans. (*d*) Lactose

CBSE- 2023

1. Proteins are polymers of CBSE - 2023

(a) Nucleic acids (b) Amino acids

(c) Monosaccharides (d) Amines

2. (a) What is the difference between a nucleoside and nucleotide? CBSE - 2023

(b) What products would be formed when a nucleotide from DNA containing thymine is hydrolysed?

3. Carbohydrates are optically active polyhydroxy aldehydes and ketones. They are also called saccharides. All those carbohydrates which reduce Fehling's solution and Tollen's reagent are referred to as reducing sugars. Glucose, the most important source of energy for mammals, is obtained by the hydrolysis of starch. Vitamins are accessory food factors required in the diet. Proteins are the polymers of α-amino acids and perform various structural and dynamic functions in the organisms. Deficiency of vitamins leads to many diseases.

Answer the following:

(a) The penta-acetate of glucose does not react with Hydroxylamine. What does it indicate? **1**

(b) Why cannot vitamin C be stored in our body? **1**

(c) Define the following as related to proteins: **2×1**

(i) Peptide linkage (ii) Denaturation

OR

(c) Define the following as related to carbohydrates: CBSE - 2023 **2×1**

(i) Anomers (ii) Glycosidic linkage

CBSE- 2024

1. The vitamin which plays an important role in coagulating blood is :

CBSE - 2024

(A) Vitamin A

(B) Vitamin E

(C) Vitamin D

(D) Vitamin K

2. Give reaction of glucose with the following :

CBSE - 2024

(a) HCN

(b) Conc. HNO_3

3. Proteins are the most abundant biomolecules of the living system. Proteins are the polymers of about twenty different α-amino acids which are linked by peptide bonds. Ten amino acids are called essential amino acids. In zwitter ionic form, amino acids show amphoteric behaviour as they react both with acids and bases.

On the basis of their molecular shape, proteins are classified into two types : Fibrous and Globular proteins. Structure and shape of proteins can be studied at four different levels i.e., primary, secondary, tertiary and quaternary, each level being more complex than the previous one. The secondary or tertiary structure of proteins get disturbed on change of pH or temperature and they are not able to perform their functions. This is called denaturation of proteins.

Answer the following questions : CBSE - 2024

(a) What are essential amino acids ? *1*

(b) What is meant by zwitter ionic form of amino acids ? *1*

(c) (i) Give one example each for Fibrous protein and Globular protein.

(ii) What type of linkages hold monomers of proteins together ? *2×1=2*

OR

(c) (i) What is the structural feature which characterises a reducing sugar ?

(ii) What is the structural difference between nucleoside and nucleotide ? *2×1=2*

CBSE- 2025

1. Which of the following statements is not true about glucose ? 2025

(A) It is an aldohexose.

(B) On heating with HI it forms n-hexane.

(C) It exists in furanose form.

(D) It does not give Schiff's test.

2. **Assertion (A) :** All naturally occurring α-amino acids except glycine are optically active.

Reason (R) : Most naturally occurring amino acids have L-configuration.

3. Write the reactions involved when D-glucose is treated with the following reagents : CBSE - 2025 **(1 + 1 = 2)**

(a) HCN

(b) Br_2 water

4. (a) What is the difference between native protein and denatured protein ? **(1 + 1 + 1 = 3)**

(b) Which one of the following is a disaccharide ? CBSE-2025
Glucose, Lactose, Amylose, Fructose

(c) Which vitamin is responsible for the coagulation of blood ?

5. Which of the following is/are examples of denaturation of protein ? 2025

(A) Coagulation of egg white (B) Curdling of milk

(C) Clotting of blood (D) Both (A) and (B)

6. Nucleotides are joined together by CBSE - 2025

(A) Glycosidic linkage (B) Peptide linkage

(C) Hydrogen bonding (D) Phosphodiester linkage

7. Scurvy is caused due to deficiency of CBSE - 2025

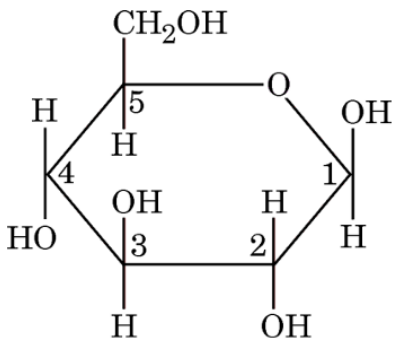
(A) Vitamin B1 (B) Vitamin B2

(C) Ascorbic acid (D) Glutamic acid

8. **Assertion (A) :** Vitamin D cannot be stored in our body.

Reason (R) : Vitamin D is fat soluble vitamin and is not excreted from the body in urine.

9. In the Haworth structure of the following carbohydrate, various carbon atoms have been numbered. The anomeric carbon is numbered as : CBSE - 2025



(A) 1

(B) 2

(C) 3

(D) 5

10. What is meant by essential amino acids ? Why are amino acids amphoteric in nature ? CBSE-2025

11. Ribose and 2-deoxyribose have an important role in biology. Among the most important derivatives are those with phosphate groups attached at the 5 position. Mono-, di- and tri-phosphate forms are important, as well as 3-5 cyclic monophosphates. Purines and pyrimidines form an important class of compounds with ribose and deoxyribose. When these purine and pyrimidine derivatives are coupled to a ribose sugar, they are called nucleosides.
Answer the following questions : CBSE-2025

(a) What products would be formed when DNA is hydrolysed ? How is DNA different from RNA with reference to a structure ? *2*

(b) Differentiate between nucleotide and nucleoside. *1*

(c) (i) Mention two important functions of nucleic acid. *1*

OR

(c) (ii) Name the linkage which joins two nucleotides. Name the base that is found in nucleotide of RNA but not in DNA. *1*

Important term

1. Amino acids: Those compounds, whose molecule contains both the carboxylic acid group and the amino group are called amino acids. There are twenty amino acids which form protein.

Essential Amino acids- The amino acids which are synthesised in body are known as non-essential amino acids, e.g., glycine, alanine.

Non-essential Amino acids: - Those amino acids which cannot be synthesised in body and must be obtained through diet are known as essential amino acids, e.g., valine, lysine.

Classification of - Amino acids have also been classified as neutral, acidic and basic amino acids.

- **Neutral-** Amino acids like glycine, valine, etc. which contain one —NH_2 and one —COOH group are called neutral amino acids.
- **Acidic-**Those amino acids such as aspartic acid, glutamic acid, etc. which contain one —NH_2 group and two —COOH groups are called acidic amino acids and amino acids such as lysine, histidine, etc.
- **Basic**- which contain two —NH_2 groups and one —COOH group are called basic amino acids.

2. Proteins: - These are complex nitrogenous organic molecules which are essential for growth and maintenance of body. Chemically, proteins are the polymers of a-amino acids which are linked by peptide bonds (—CO= NH—)

Types of proteins based on molecular shape:

(i) Fibrous proteins: They have thread-like molecules which tend to lie side by side to form fibres, e.g., keratin, collagen, myosin, fibroin, etc. In such proteins, the molecules are held together by hydrogen and disulphide bonds. They are insoluble in water. They are the chief structural materials of animal tissues.

(ii) Globular proteins: They have molecules which are folded into compact units that often form spheroidal shapes. The area of contact between molecules are small and inter-molecular forces are

comparatively weak, e.g., insulin, thyroglobulin, albumin, haemoglobin and fibrinogen. In clotting of blood, fibrinogen gets converted into fibrous protein, fibrin.

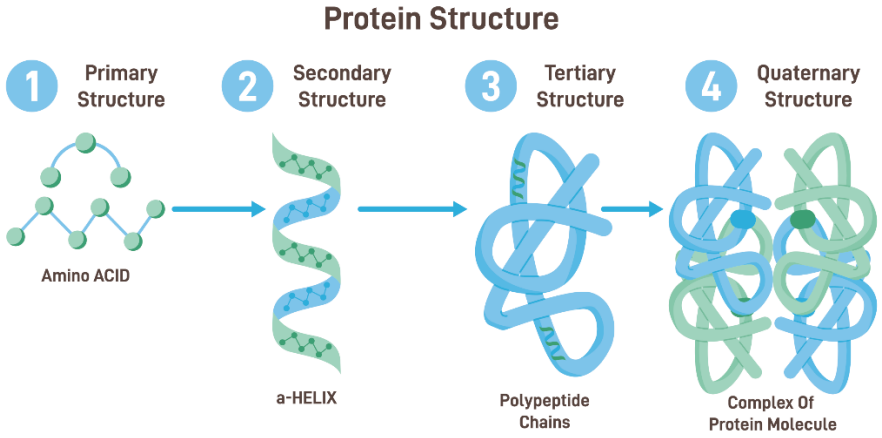
Structure of Proteins:

(i) Primary structure of proteins: The sequence in which various amino acids are arranged in a protein is called its primary structure. Any change in the sequence of amino acids creates different protein which alters biological functions.

(ii) Secondary structure of proteins: It refers to shape in which a long polypeptide chain exists. A protein may assume a-helix structure or b-pleated sheet structure. The a-helix structure results due to regular coiling of polypeptide chain which is stabilised by intramolecular hydrogen bonding. Keratin in hair, nails, wool and myosin in nucleus have a-helix structure. In b-pleated sheet structure, all peptide chains are stretched to nearly maximum extension and then arranged side by side and held together by intermolecular hydrogen bonding. Silk has b-pleated sheet structure.

(iii) Tertiary structure of proteins: The tertiary structure of proteins represents overall folding of the polypeptide chain, i.e., further folding of the secondary structure. It gives rise to two major molecular shapes, viz., fibrous and globular. The main forces which stabilise 2° and 3° structures of proteins are hydrogen bonds, disulphide linkages, van der Waals forces and electrostatic force of attraction.

(iv) Quaternary structure: Some of the proteins are composed of two or more polypeptide chains referred to as sub-units. The spatial arrangement of these subunits with respect to each other is known as quaternary structure.



Denaturation of Proteins: When a protein in its native form is subjected to a change, such as change in temperature or 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. During denaturation, 2° and 3° structures are destroyed but 1° structure remains intact, e.g., coagulation of egg while on boiling, curdling of milk, etc.

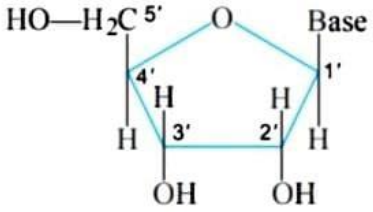
3. Nucleic Acids: Nucleic acids are long chain polymers of nucleotides. They play an important role in transmission of hereditary characteristics and biosynthesis of proteins. Types of nucleic acids: There are two types of nucleic acids. These are DNA and RNA.

(a) Constituents of nucleic acids: (i) Pentose sugar (ii) Phosphoric acid (iii) Nitrogenous bases. In DNA, b-D-2-deoxyribose sugar is present while in RNA b-D-ribose sugar is present.

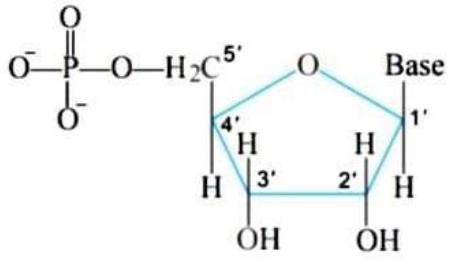
Nitrogen containing bases: There are two types of nitrogen containing bases found in nucleic acids. These are pyrimidines and purines. Pyrimidines: There are three bases derived from pyrimidines.

These are cytosine (C), thymine (T) and uracil (U). In DNA, T is present but in RNA, U is present.
Purines: There are two bases derived from purine. These are adenine (A) and guanine (G).

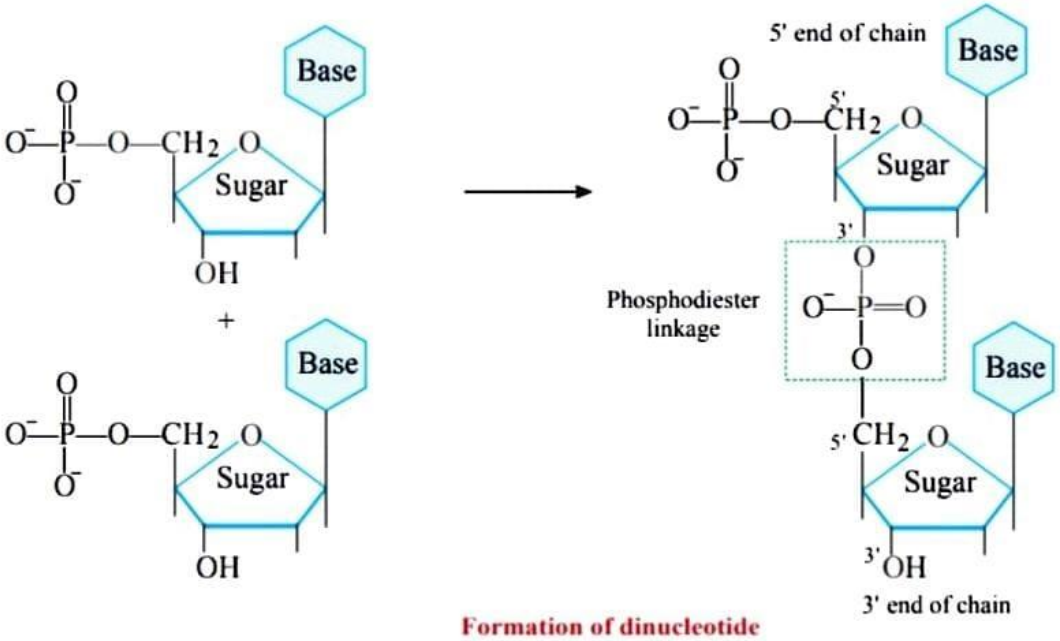
Nucleoside: A unit formed by the attachment of a base to 1′-position of sugar is known as nucleoside.



Nucleotide: When nucleoside is linked to phosphoric acid at 5′-position of sugar moiety, the unit obtained is called nucleotide.



Nucleotides are joined together by phosphodiester linkage between 5′ and 3′ carbon atoms of the pentose sugar.



Formation of dinucleotide

(*b*) Deoxyribonucleic acid (DNA): It contains a pentose sugar deoxyribose, and adenine, guanine, thymine and cytosine bases. A phosphate group is present at C-5 of the sugar unit. The repeating units, deoxyribonucleotides, are linked by phosphate group. Thus, they are the biopolymers of deoxyribonucleotides and have double helix structure of polynucleotides. The two strands of DNA are said to be complementary to each other. Adenine forms hydrogen bonds with thymine whereas cytosine forms hydrogen bonds with guanine. They are responsible for genetic characteristics and for sending information and instruction in the cell for the synthesis of specific protein.

(*c*) Ribonucleic acid (RNA): It contains ribose sugar, bases from pyrimidine bases—uracil and cytosine, and two bases from purine base—adenine and guanine. A phosphate group is present at C-5 of the sugar unit. The repeating units, ribonucleotides, are linked by phosphate group. They are the polymers of ribonucleotide and have a single helix structure. RNA is associated with the process of learning and memory storage, and helps in biosynthesis of protein.