Short Answer Questions-I

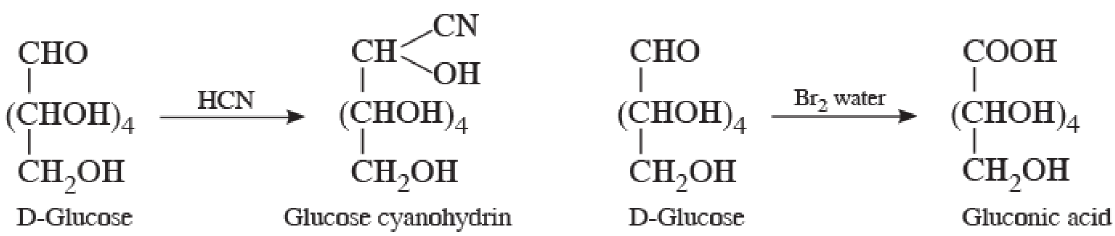
Short Answer Questions-I (PYQ)

Q.1. Write the reactions involved when D-glucose is treated with the following reagents:

(*i*) HCN (*ii*) Br_2 water

[*CBSE (F) 2013*]

Ans. (*i*) HCN **(*ii*)** Br_2 water



Q.2. Explain what is meant by the following:

[*CBSE (AI) 2011; (F) 2011*]

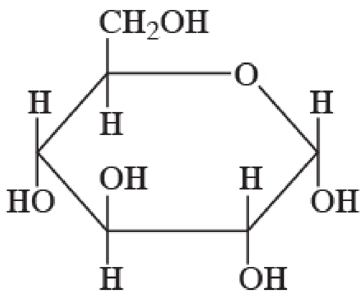
Q. peptide linkage

Ans.

The amide $(-\overset{\overset{O}{\|}}{C}-NH-)$ linkage between two a-amino acids formed with the loss of a water molecule is called a peptide linkage.

Q. pyranose structure of glucose.

Ans. The six-membered cyclic structure of glucose is called pyranose structure (a- or b-), in analogy with heterocylic compound pyran.



α-D-(+)-Glucopyranose

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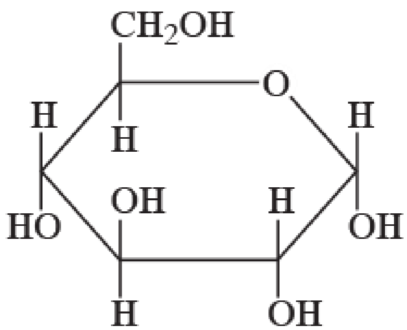


α-D-(+)-Glucopyranose

Q.3. Name the four bases present in DNA. Which one of these is not present in RNA? [*CBSE (AI) 2009*]

Ans. The four bases present in DNA are adenine (A), guanine (G), cytosine (C) and thymine (T).

Thymine (T) is not present in RNA.

Q.4. Name the bases present in RNA. Which one of these is not present in DNA?

[*CBSE Delhi 2011*]

Ans. The bases present in RNA are adenine (A), guanine (G), cytosine (C) and uracil (U). Uracil is not present in DNA.

Q.5. Describe what you understand by primary structure and secondary structure of proteins.

[*CBSE Delhi 2011; (F) 2011*]

Ans. Primary structure: The specific sequence in which the various a-amino acids present in a protein are linked to one another is called its primary structure. Any change in the primary structure creates a different protein.

Secondary structure: The conformation which the polypeptide chain assumes as a result of hydrogen bonding is known as secondary structure. The two types of secondary structures are a-helix and b-pleated sheet structures.

In a-helix structure, the polypeptide chain forms all the possible hydrogen bonds by twisting into a right-handed screw (helix) with the —NH group of each amino acid residue hydrogen bonded to the $>C=O$ groups of an adjacent turn of the helix. In b-pleated structure, all peptide chains are stretched out to nearly maximum extension and then laid side by side and are held together by hydrogen bonds.

Q.6. Answer the following the questions.

[*CBSE Allahabad 2015*]

Q. Write one difference between a**-helix and** b**-pleated sheet structures of protein.**

Ans. In a-helix structure of proteins, the polypeptide chains are stabilized by intramolecular hydrogen bonding whereas b-pleated sheet structure of proteins is stabilized by intermolecular hydrogen bonding.

Q. Write the name of the disease caused by the deficiency of vitamin B_{12}.

Ans. Pernicious anaemia is caused due to deficiency of vitamin B_{12}.

Q.7. Answer the following questions.

[*CBSE Central 2016*]

Q. What type of linkage is present in nucleic acids?

Ans. Phosphodiester linkage.

Q. Give one example each for fibrous protein and globular protein.

Ans. Fibrous protein: Myosin, keratin, collagen, etc.

Globular protein: Insulin, haemoglobin, etc.

Q.8. What are the following substances?

[*CBSE (F) 2009*]

Q. Invert sugar

Ans. Invert Sugar: Sucrose is dextrorotatory, on hydrolysis in the presence of HCl or enzyme invertase, it produces a mixture of D–C(+)–glucose and D–(–)–fructose which is laevorotatory called invert sugar.

Q. Polypeptides

Ans. Polypeptide: If more than ten a-amino acids are joined together by peptide bond (–CONH–) the polyamide thus formed is called polypeptide.

Q.9. Write such reactions and facts about glucose which cannot be explained by open chain structure.

[*CBSE (AI) 2011*]

Ans. The following facts and reactions cannot be explained by open chain structure of glucose.

- **i.** Despite having the aldehyde group, glucose does not give 2, 4-DNP test, Schiff's test and it does not form the hydrogen sulphite addition product with $NaHSO_3$.
- **ii.** The penta-acetate of glucose does not react with hydroxylamine indicating the absence of free aldehydic group.

Q.10. Name two water soluble vitamins, state their sources and the diseases caused due to their deficiency in diet.

[*CBSE (F) 2009*]

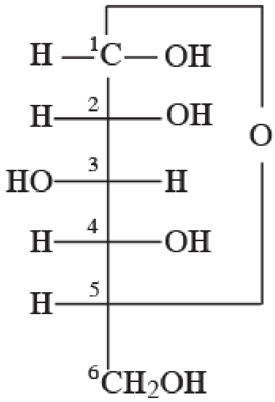
Ans. B group vitamin and vitamin C are soluble in water.

	Name of Vitamins	**Sources**	**Deficiency diseases**
(*i*)	Vitamin B_{12}	Meat, fish, egg and curd	Pernicious anaemia
(*ii*)	Vitamin C	Citrus fruits and *amla*	Scurvy

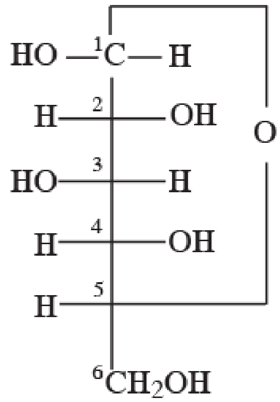
Q.11. What is essentially the difference between α-form of glucose and β-form of glucose? Explain.

[*CBSE Delhi 2011*]

Ans.



α-D-(+)-Glucose



β-D-(+)-Glucose

Q.12. Write the main structural difference between DNA and RNA. Of the four bases, name those which are common to both DNA and RNA.

[*CBSE (AI) 2011*]

Ans. Structural difference between DNA and RNA

	DNA	**RNA**
(*i*)	The sugar present in DNA is 2-deoxy-D-(–)-ribose.	The sugar present in RNA is D-(–)-ribose.
(*ii*)	DNA has double stranded a-helix structure.	RNA has single a-helix structure.

The common bases present in both DNA and RNA are adenine (A), guanine (G) and cytosine (C).

Q.13. Answer the following questions.

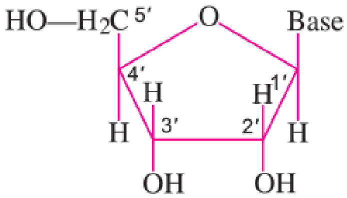
[*CBSE (F) 2013*]

Q. What type of bonding helps in stabilising the a**-helix structure of proteins?**

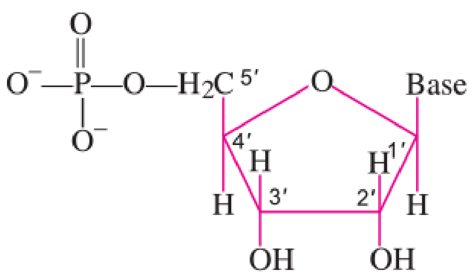
Ans. Hydrogen bonds (intermolecular) between the C==O of one amino acid residue and N—H of the fourth amino acid residue in the chain give stability to the structure.

Q. What is the structural difference between a nucleoside and a nucleotide?

Ans. A nucleoside is formed of pyrimidine or purine base connected to C-1 of sugar (ribose or deoxyribose) by a b-linkage.



A nucleotide contains all the three basic components of nucleic acids, *i.e.*, a phosphoric acid group, a pentose sugar and a nitrogenous base.

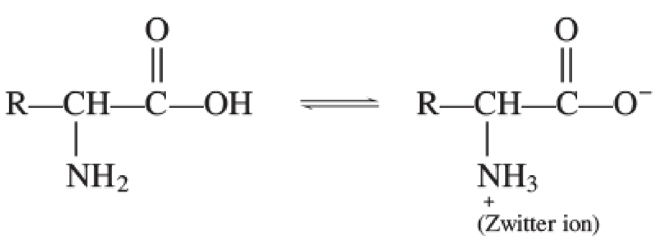


Short Answer Questions-I (OIQ)

Q.1. Amino acids behave like salts rather than simple amines or carboxylic acids. Explain.

[*NCERT Exemplar*]

Ans. In aqueous solution, the carboxyl group loses a proton and amino group accepts a proton to form a zwitter ion.



Q.2. Which forces are responsible for the stability of α-helix? Why is it named as 3.6_{13} helix?

Ans. Hydrogen bonds between —N—H and —C(=O)— groups of peptide bonds give stability to the structure. Thus, a structure having maximum hydrogen bonds shall be favoured. a-Helix is one of the most common ways in which a polypeptide chain forms all possible hydrogen bonds by twisting into a right-handed screw (helix) with the —NH group of each amino acid residue hydrogen bonded to the —C ═ O of an adjacent turn of the helix.

The a-helix is also known as 3.6_{13} helix, since each turn of the helix has approximately 3.6 amino acid residue and a 13-member ring is formed by hydrogen bonding.

Q.3. How do you explain the presence of an aldehydic group in a glucose molecule?

[*NCERT Exemplar*]

Ans. Glucose reacts with hydroxylamine to form a monoxime and adds one molecule of hydrogen cyanide to give cyanohydrin so it contains a carbonyl group which can be an aldehyde or a ketone. On mild oxidation with bromine water, glucose gives gluconic acid which is a six carbon carboxylic acid. This indicates that carbonyl group present in glucose is an aldehydic group.

Q.4. Give reasons for the following:

Q. On electrolysis in acidic solution amino acids migrate towards cathode, while in alkaline solution these migrate towards anode.

Ans. In acidic solution, the carboxylate anion accepts a proton and gets converted into carboxylic group resulting in the formation of a positive ion.

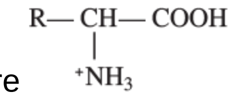
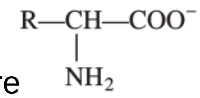
$$\underset{\text{Zwitter ion}}{H_3\overset{+}{N}-\underset{\substack{|\\R}}{CH}-COO^-} \xrightarrow[(acid)]{H^+} \underset{(\text{Positive ion})}{H_3\overset{+}{N}-\underset{\substack{|\\R}}{CH}-COOH}$$

In presence of a base, the NH_3^+ ion changes to $-NH_2$ group by losing a proton and this gives a negative ion.

$$\underset{\text{Zwitter ion}}{H_3\overset{+}{N}-\underset{\substack{|\\R}}{CH}-COO^-} \xrightarrow[(base)]{OH^-} \underset{(\text{Negative ion})}{H_2N-\underset{\substack{|\\R}}{CH}-COO^-} + H_2O$$

This means that in acidic medium, the amino acid migrates towards the cathode while in alkaline solution, it migrates towards anode on electrolysis.

Q. The monoamino monocarboxylic acids have two pK_a values.

Ans. In aqueous solution, monoamino monocarboxylic acid behave like salt at isoelectric point. At a pH lower than isoelectric point (*i.e.*, in acidic medium) it shows one *pK_a* value which corresponds to structure  and at a pH higher than isoelectric point (*i.e*., basic medium), it shows another pK_a value which corresponds to structure .

Q.5. Define enzymes. How do enzymes differ from ordinary chemical catalysts?

Ans. Enzymes are naturally occurring simple or conjugate proteins acting as specific catalysts in cell processes. The enzyme facilitates a biochemical reaction by providing alternative lower activation energy pathways thereby increasing the rate of reaction.

Enzymes are different from ordinary chemical catalysts in following ways:

- **i.** They are highly specific in their action, *i.e*., each enzyme can catalyse only a specific type of reaction.
- **ii.** Enzymes can speed up reactions to the extent of about ten million times.
- **iii.** Enzymes function at a moderate temperature (about 310 K) and moderate pH (6–8).
- **iv.** Even a small quantity of an enzyme can catalyse the reaction of a large quantity of the substrate. This is because in chemical reactions the catalyst (enzyme) is regenerated after the reaction.

Q.6. If one strand of a DNA has the sequence —ATGCTTCA—, what is the sequence of the bases in the complementary strand?

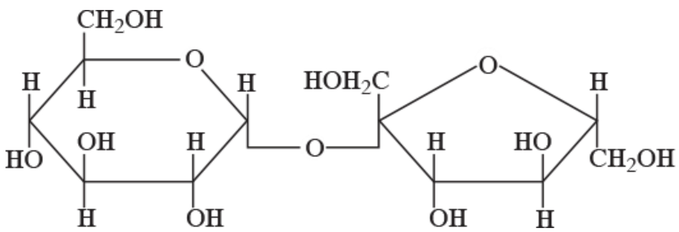
Ans. As we know that in DNA molecule, adenine (A) always pairs with thymine (T) and cytosine (C) always pairs with guanine (G). Thus,

Sequence of bases in one strand: A T G C T T C A

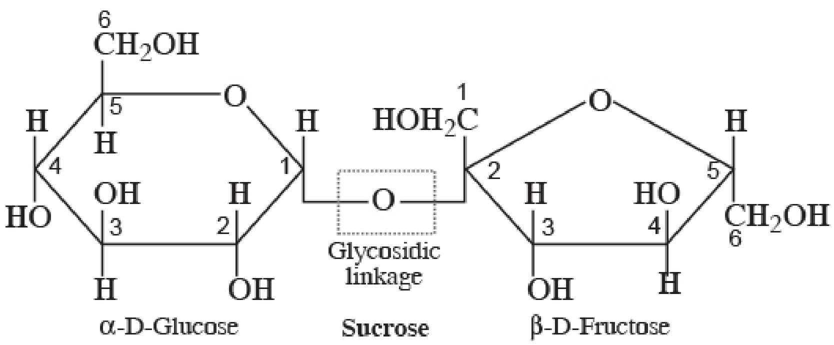
Sequence of bases in the complementary strand:T A C G A A G T

Q.7. Label the glucose and fructose units in the following disaccharide and identify anomeric carbon atoms in these units. Is the sugar reducing in nature? Explain.

[*NCERT Exemplar*] [*HOTS*]

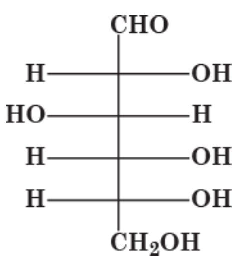


Ans. C-l of glucose unit and C-2 of fructose unit are anomeric carbon atoms in the given disaccharide. The disaccharide is non-reducing sugar because —OH groups attached to anomeric carbon atoms are involved in the formation of glycosidic bond.

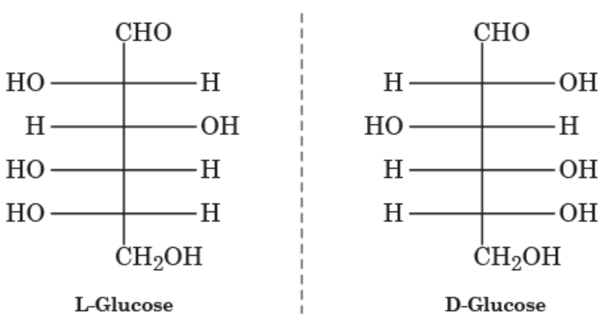


Q.8. The Fischer projection of D-Glucose is given alongside.

Q. Give the Fischer projection of L-Glucose.

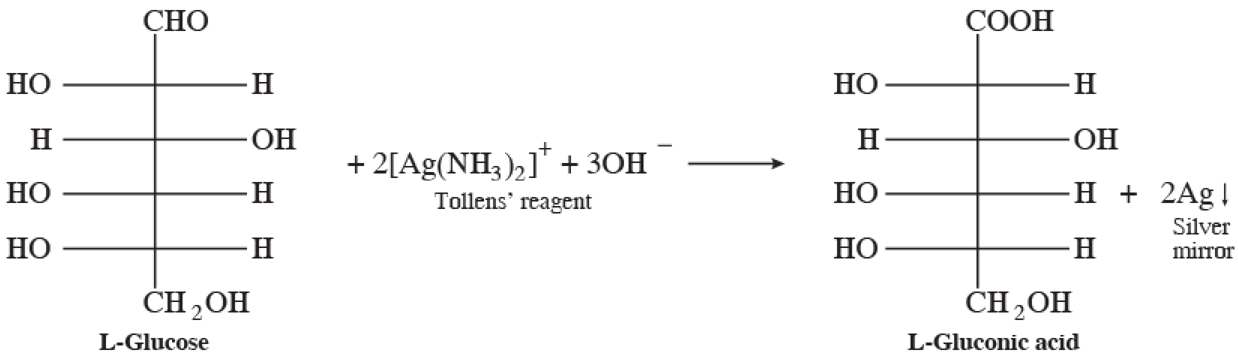


Ans. The Fischer projection of L-Glucose is the mirror image of D-Glucose.



Q. What happens when L-Glucose is treated with Tollens' reagent?

Ans. L–Glucose reduces Tollens' reagent to metallic silver.



Q.9. Give reasons for the following:

Q. Glucose and fructose give the same osazone.

Ans. During osazone formation, the reaction occurs only at C-1 and C-2. As glucose and fructose differ from each other only in the arrangement of atoms at C-1 and C-2, therefore they give the same osazone.

Q. Amino acids are amphoteric in nature.

Ans. Since amino acids have both acidic ($—^{+}NH_3$) as well as basic ($—COO^{-}$) groups, therefore, they are amphoteric in nature.