

## NCERT Solutions for Class 12 Chemistry Chapter 14 Biomolecules

**Question 14.1** [Glucose or sucrose are soluble in water but cyclohexane or benzene \(simple six membered ring compounds\) are insoluble in water. Explain.](#)

**Answer :**

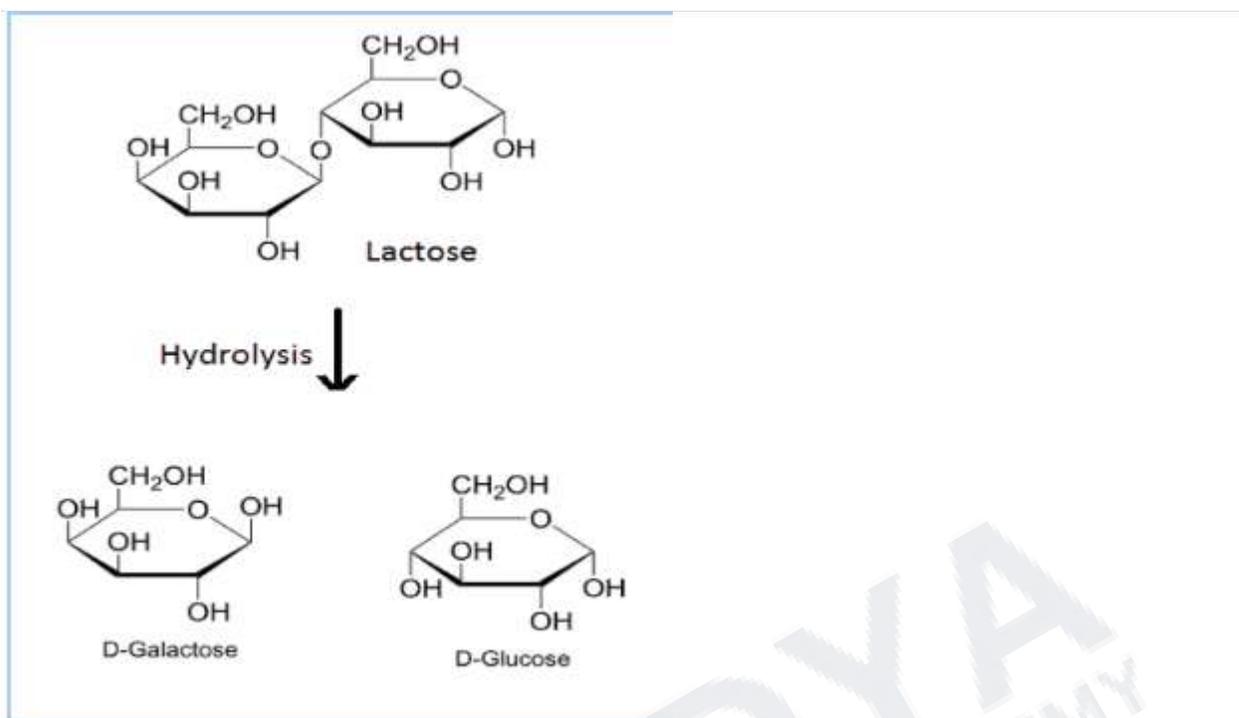
We know that water is a polar molecule. It is also known that "like dissolves like". So either polar molecule or the compounds which can form hydrogen bonds with water molecules will get dissolved in water.

Glucose and sucrose have five and eight -OH groups respectively. So they are likely to form hydrogen bonds with molecules with water. In the case of cyclohexane and benzene, these are non-polar molecules because of very low electronegativity difference. So these are not soluble in water.

**Question 14.2** [What are the expected products of hydrolysis of lactose?](#)

**Answer :**

The expected product in the hydrolysis of lactose is Galactose and Glucose.



**Question 14.3** [How do you explain the absence of aldehyde group in the pentaacetate of D-glucose?](#)

**Answer :**

When pentaacetate of glucose is made to react with **hydroxylamine**, it does not react indicating the absence of free —CHO group.

In aqueous solution, the cyclic structure (have -OH group at C-1) should get converted to open chain structure which has an aldehyde group at C-1. It then should react with hydroxylamine and give glucose oxime. But such case is not observed. This suggests that in aqueous solution open chain structure doesn't exist and as a result, the aldehyde group is absent in pentaacetate of glucose.

**Question 14.4** [The melting points and solubility in water of amino acids are generally higher than that of the corresponding halo acids. Explain.](#)

**Answer :**

Amino acids have both acidic and basic group (amine) which lead to the formation of zwitterions and make them dipolar compounds. Due to this property, they form strong molecular bonds themselves and also with water. This results in high melting point and good solubility in water as compared to haloacids.

Halo acids don't exhibit the property of dipolar compounds. Only the carboxyl group of haloacid is involved in H-bonding, not the halogen atom. That's why they have low melting points and less solubility than amino acids.

**Question 14.5** [Where does the water present in the egg go after boiling the egg?](#)

**Answer :**

Due to denaturation of proteins, globules unfold and helix gets uncoiled which changes its biological activity. In denaturation, secondary and tertiary structures are destroyed whereas primary structure remains the same.

Due to this process (denaturation of proteins) coagulation of egg takes place while boiling. In egg, the globular protein changes into a rubber-like structure which is responsible for absorption of water.

**Question 14.6** [Why cannot vitamin C be stored in our body?](#)

**Answer :**

Vitamin C is a **water-soluble vitamin** which is excreted from the body in the form of urine and cannot be stored. So they must be supplied in the diet regularly.

**Question 14.7** [What products would be formed when a nucleotide from DNA containing thymine is hydrolysed?](#)

**Answer :**

When a nucleotide from the DNA containing thymine is hydrolyzed, the products are thymine  $\beta$ -D-2-deoxyribose and phosphoric acid.

**Question 14.8** [When RNA is hydrolysed, there is no relationship among the quantities of different bases obtained. What does this fact suggest about the structure of RNA?](#)

**Answer :**

When RNA is hydrolysed, there is no relationship among the quantities of different bases obtained, this fact suggests that RNA is a single strand structure. Unlike DNA which is a double strand structure in which pairing of bases occurs (for e.g. adenine pairs with thymine). Thus, on hydrolysis, the amount of adenine produced will be the same as the amount produced by thymine. In RNA there is no relationship with quantities of bases, meaning bases don't occur in pairs or it is single strand structure.

**Question 14.1** [What are monosaccharides?](#)

**Answer :**

Monosaccharides are the carbohydrates that cannot be hydrolysed further to give simpler units of polyhydroxy aldehyde or ketone. Nearly 20 monosaccharides are known

to occur in nature. The general formula of monosaccharides is  $(CH_2O)_n$  where,  $n = 3$  to  $7$ . Some common examples of monosaccharides are glucose, fructose.

**Question 14.2** [What are reducing sugars?](#)

**Answer :**

The carbohydrate which can reduce Fehling's solution and Tollens' reagent is referred to as reducing sugar. Also, all monosaccharides whether ketose or aldose are reducing sugars.

**Question 14.3** [Write two main functions of carbohydrates in plants.](#)

**Answer :**

The importance of carbohydrates in plants:-

- (i) Carbohydrates are used as storage molecules as starch in plants.
- (ii) The cell wall of the plants is made up of cellulose

**Question 14.4 (1)** [Classify the following into monosaccharides and disaccharides.](#)

(1) [Ribose](#)

**Answer :**

Ribose is a monosaccharide carbohydrate since it doesn't give simpler units upon hydrolysis.

Question 14.4(2) [Classify the following into monosaccharides and disaccharides.](#)

(2) [2-deoxyribose](#)

Answer:

It is a monosaccharide carbohydrate because upon hydrolysis it doesn't break into simpler ketone or aldehyde.

Question 14.4(3) [Classify the following into monosaccharides and disaccharides.](#)

(3) [maltose](#)

Answer :

Maltose is a disaccharide carbohydrate i.e., upon hydrolysis it yields two monosaccharide units.

Question 14.4(4) [Classify the following into monosaccharides and disaccharides.](#)

(4) [galactose](#)

Answer :

Galactose is a monosaccharide carbohydrate.

**Question 14.4(5)** [Classify the following into monosaccharides and disaccharides.](#)

(5) [fructose](#)

**Answer :**

It is a monosaccharide carbohydrate because upon hydrolysis it doesn't break into simpler compounds of ketone and aldehyde.

**Question 14.4(6)** [Classify the following into monosaccharides and disaccharides.](#)

(6) [lactose.](#)

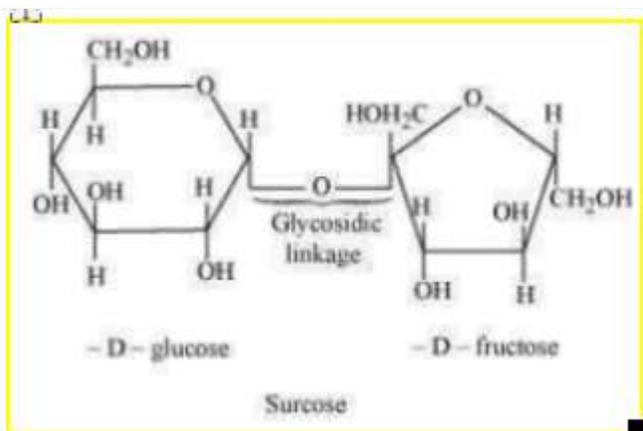
**Answer :**

Lactose is a disaccharide carbohydrate since it breaks into two simpler monosaccharide units.

**Question 14.5** [What do you understand by the term glycosidic linkage?](#)

**Answer :**

It is the linkage by which two monosaccharide units are joined together by an oxygen atom. This linkage is formed by loss of water molecule.



**Question 14.6** [What is glycogen? How is it different from starch?](#)

**Answer :**

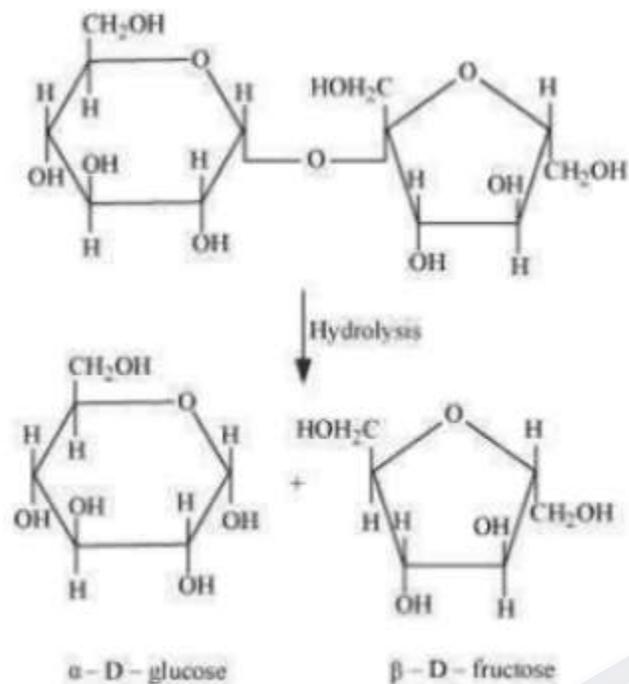
Glycogen is a polysaccharide carbohydrate which is stored in the body of animals or human beings. Whenever our body requires glucose (energy), glycogen breaks down to glucose with the help of the enzyme. It is present in liver, brain and muscles. Whereas starch is a polysaccharide carbohydrate stored in plants.

**Question 14.7(i)** [What are the hydrolysis products of](#)

(i) [sucrose](#)

**Answer :**

Upon hydrolysis sucrose breaks into  $\alpha$  - D Glucose and  $\beta$  - D Fructose .

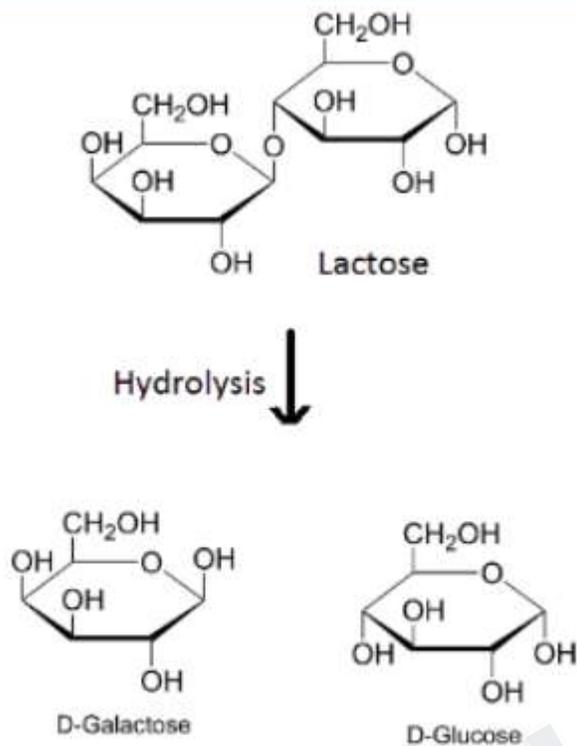


Question 14.7(ii) [What are the hydrolysis products of](#)

(ii) [lactose](#)

**Answer :**

Hydrolysis of lactose gives  $\beta$ -D Galactose and  $\beta$ -D Glucose.



**Question 14.8** [What is the basic structural difference between starch and cellulose?](#)

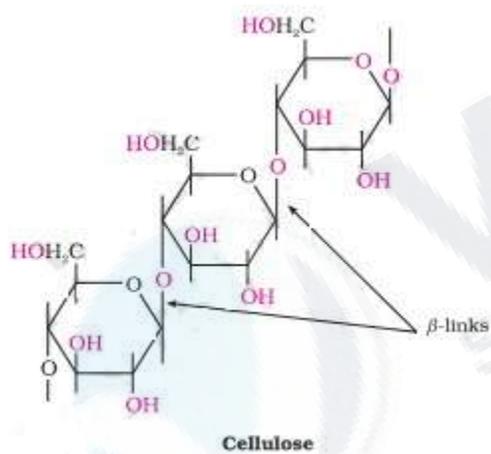
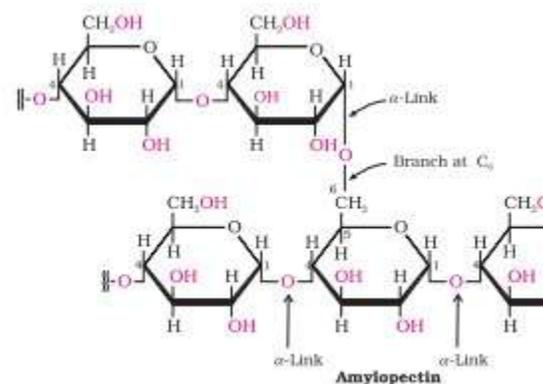
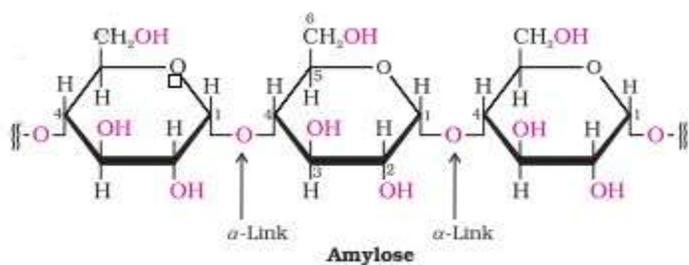
**Answer :**

Cellulose is a long straight-chain polysaccharide made of  $\beta$  - D - glucose units and has 1,4 - glycoside linkage.

Whereas starch is made up of 2 components:- Amylose and amylopectin.

Amylose is a long straight chain made of  $\alpha$  - D - glucose units and joined by 1,4 - glycosidic linkage.

Amylopectin is a branched structure and chains are formed at 1,4 - glycoside linkage and branching occurs at 1.6 - glycosidic linkage.

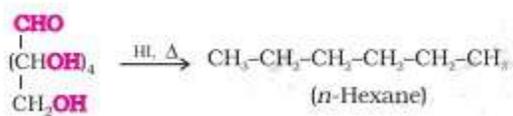


**Question 14.9(i)** [What happens when D-glucose is treated with the following reagents?](#)

(i) [HI](#)

**Answer :**

When glucose is treated with HI for long time, n - Hexane is formed.

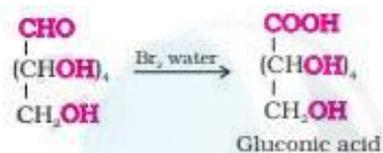


**Question 14.9(ii)** What happens when D-glucose is treated with the following reagents?

(ii) Bromine water

**Answer :**

Since bromine water is an oxidising agent so it will oxidise aldehyde group to carboxylic acid group. Thus glucose is converted to gluconic acid.

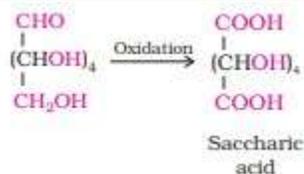


**Question 14.9(iii)** What happens when D-glucose is treated with the following reagents?

(iii) HNO<sub>3</sub>

**Answer :**

On reacting glucose with nitric acid, oxidation takes place and glucose is converted into saccharic acid.



**Question 14.10** [Enumerate the reactions of D-glucose which cannot be explained by its open chain structure.](#)

**Answer :**

Below are the few reactions which cannot be explained by the open structure of glucose:-

1. Even if glucose has an aldehyde group, it does not give Schiff's test and as a result, it does not form the hydrogen sulphite addition product with  $\text{NaHSO}_3$ .
2. The pentaacetate of glucose does not react with hydroxylamine, which indicates the absence of free  $\text{—CHO}$  group.
3. It is found that glucose exists in two different crystalline forms which are named as  $\alpha$  and  $\beta$ . This property can only be explained by the cyclic structure of glucose.

**Question 14.11** [What are essential and non-essential amino acids? Give two examples of each type.](#)

**Answer :**

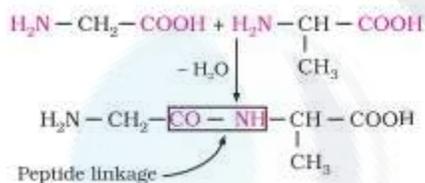
The amino acids which are required for the body and can be synthesised in the body are known as non-essential amino acids. E.g Glycine, Alanine. Whereas, the amino acids which are required for our body but cannot be synthesised by our body and should be taken through diet are known as essential amino acids. E.g. Valine, Leucine

Question 14.12(i) [Define the following as related to proteins](#)

i) [Peptide linkage](#)

Answer :

**Peptide linkage** is an amide bond formed between  $-\text{COOH}$  group and  $-\text{NH}_2$  group. The reaction between two molecules of either different or similar amino acids proceeds by the combination of the amino group of one molecule with the carboxyl group of the other molecule. This will result in the elimination of a water molecule and formation of a peptide bond  $-\text{CO}-\text{NH}-$ .



Question 14.12(ii) [Define the following as related to proteins](#)

(ii) [Primary structure](#)

Answer :

Primary structure of proteins: Each and every polypeptide present in a protein has amino acids linked with each other in a specific sequence and it is this sequence of

amino acids that are known to be the primary structure of that protein. Any change in this primary structure that is, the sequence of amino acids creates a different protein.

**Question 14.12(iii)** [Define the following as related to proteins](#)

**(iii)** [Denaturation](#)

**Answer :**

When a protein in its raw form, is subjected to change like change in temperature e.g boiling in hot water or chemical change like a variation in pH, the hydrogen bonds are disturbed. This results in unfolding of globules and uncoiling of the helix and thus protein loses its biological activity. This is called **denaturation of the protein** .

**Question 14.13** [What are the common types of secondary structure of proteins?](#)

**Answer :**

Secondary structures of proteins are found to exist in two types of structure:-

(i)  $\alpha$  – Helix structure:-  $\alpha$ -Helix is a way in which a polypeptide chain forms all possible hydrogen bonds by twisting into a right-handed screw or helix with the –NH group of each amino acid and residue hydrogen bonded to the of  $C = O$  an adjacent turn of the helix.

(ii)  $\beta$ -pleated sheet:- In this structure, all peptide chains are stretched out to maximum extension and then laid side by side which is held together by strong intermolecular hydrogen bonds.

**Question 14.14** [What type of bonding helps in stabilising the  \$\alpha\$ -helix structure of proteins?](#)

**Answer :**

Hydrogen bonding is the intermolecular bonding which helps in stabilising the  $\alpha$ -helix structure of proteins. Hydrogen bonds are formed between -NH- of amino acid and of the adjacent turn of helix.

**Question 14.15** [Differentiate between globular and fibrous proteins .](#)

**Answer :**

The difference between fibrous protein and globular protein is given below :-

Fibrous Protein	Globular Protein
When the polypeptide chains run parallel and are held together with the help of hydrogen and disulphide bonds.	In case of a globular protein, the chains of polypeptides coil around and give a spherical shape

These proteins are generally insoluble in water.	These proteins are generally soluble in water.
E.g. keratin, myosin	E.g., Insulin, albumins

**Question 14.16** [How do you explain the amphoteric behaviour of amino acids?](#)

**Answer :**

Amino acid has both acidic group ( $C=O$ ) and basic group ( $N-H$ ). Thus in aqueous solution, the carboxyl group can lose a proton and the basic group (amine group) can accept a proton. In this way, it forms zwitter ion which can act in both ways i.e., acidic as well as basic. Hence amino acids are amphoteric in nature.

**Question 14.17** [What are enzymes?](#)

**Answer :**

Enzymes are the biocatalysts i.e., they catalyse biological reactions. Enzymes are very specific in nature and a particular enzyme can be used for a particular substrate. They are generally named after the name of a compound on which they act. For e.g conversion of maltose to glucose requires enzyme maltase.

**Question 14.18** [What is the effect of denaturation on the structure of proteins?](#)

**Answer :**

In denaturation of protein, globules get unfolded and helix gets uncoiled and also globular protein converts into fibrous protein. The primary structure remains the same but secondary and tertiary structure of the protein are destroyed so its biological activity changes.

**Question 14.19** [How are vitamins classified? Name the vitamin responsible for the coagulation of blood.](#)

**Answer :**

On the basis of their solubility in water vitamins are classified as:-

1. Water-soluble vitamins:- Water soluble vitamins such as Vitamin C need to be taken through diet regularly as they are excreted in the form of urine.
2. water-insoluble and fat-soluble vitamin:- Since these vitamins are not soluble in water so we don't need to take them regularly through diet. They are stored in liver and adipose. E.g. Vitamin D

Vitamin K is responsible for the coagulation of blood.

**Question 14.20** [Why are vitamin A and vitamin C essential to us? Give their important sources.](#)

**Answer :**

**Vitamin A:-** Sources of this vitamin are carrots, butter and milk. Its deficiency causes Xerophthalmia (hardening of the cornea of the eye).

**Vitamin C:-** Sources of this vitamin are citrus fruits, amla and green vegetables. Its deficiency causes Scurvy (bleeding gums).

**Question 14.21** [What are nucleic acids? Mention their two important functions.](#)

**Answer :**

Nucleic acids are biomolecules found in nuclei of a cell. They are of two types

(i) DNA - Deoxyribonucleic acid

(ii) RNA - Ribonucleic acid.

The two important functions of nucleic acid are:-

(i) DNA present in chromosomes is responsible for heredity by transferring genes.

(ii) Both the nucleic acids are responsible for the protein synthesis in a cell.