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# XII UNIT 14

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Biomolecules



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CHEMISTRY MANTRA

105 Dilbagh Nagar Extension Jalandhar

## Unit 14

## Short & Long Answer Questions - Biomolecules

**Q.101 In what way enzymes differ from ordinary catalysts?**

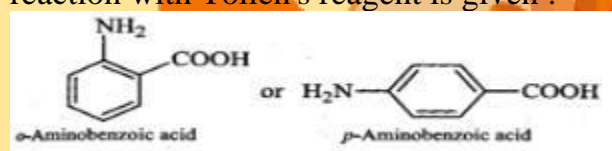
**Answer:** Enzymes are biochemical catalysts. They have high molecular mass whereas a catalyst may not be a biomolecule and may not have high molecular mass. Enzymes are required in very small quantity and work at optimum temperature and pH whereas ordinary catalyst works in all conditions.

**Q.102 D-glucose is an aldohexose? Why does it react with HCN but not with NaHSO<sub>3</sub>?**

**Answer:** D-glucose exists in two cyclic forms  $\alpha$ - and  $\beta$ - in which the aldehydic group is involved in the formation of a ring and is not free. Therefore, it does not react with  $\text{NaHSO}_3$ . However, with reagents like HCN and phenylhydrazine, the ring structure cleaves and the aldehydic group becomes free. Therefore, D-glucose does react with HCN.

**Q.103** How will you show that D-glucose is a reducing sugar?

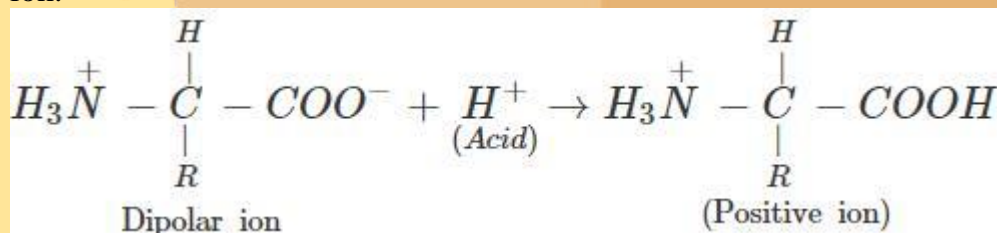
**Answer:** D-glucose forms silver mirror with Tollen's reagent and gives a red precipitate with Fehling's solution. This shows that D-glucose is a reducing sugar. The reaction with Tollen's reagent is given :



**Q.104 (a) Name the type of linkages responsible for the formation of primary and secondary structures of proteins. (b) On electrolysis in acidic solution,  $\alpha$ -amino acids migrate towards cathode while in alkaline medium, they migrate towards anode. Explain. (c) What are essential and non-essential amino acids? Give two examples of each.**

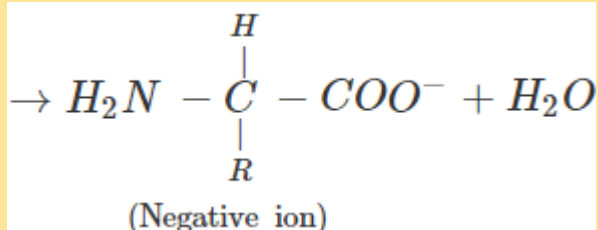
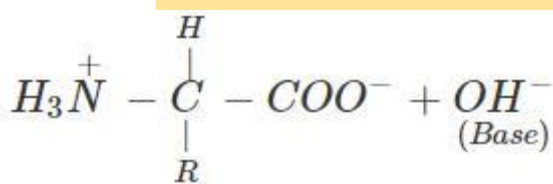
**Answer:** (a) Peptide linkages ( $-\text{CO}-\text{NH}-$ ) are present in the primary structures of proteins while the secondary structures of proteins involve hydrogen bonding.

(b) An  $\alpha$ -amino acid has a dipolar structure. In acidic medium, it exists as a positive ion.



In electric field, the positive ion moves towards cathode. In alkaline medium, the dipolar ion changes to anion and moves towards anode under the influence of applied electric field.





(c) Amino acids which are not synthesized by the body are called essential acids. For example, Leucine and Lysine. Amino acids which are synthesized by the body are known as non-essential amino acids. For example, Glycine and Alanine.

**Q.105 A tripeptide on complete hydrolysis gives glycine, alanine and phenylalanine. Using three letter symbols, write the possible sequence of the tripeptide.**

**Answer:** Three letters symbols of the amino acids are Gly, Ala and Phe. The possible sequences of the amino acids are: (i) Gly-Ala-Phe (ii) Gly-Phe-Ala (iii) Ala-Gly-Phe (iv) Ala-Phe-Gly (v) Phe-Gly-Ala (vi) Phe-Ala-Gly.

**Q.106 What is isoelectric point of amino acid? How does it help in the separation of amino acids?**

**Answer:** The pH at which a particular amino acid does not migrate under the influence of an electric field is called isoelectric point of amino acid. For example, isoelectric point of glycine is 6.1. At the isoelectric point, an amino acid does not dissolve in water. This property helps in the separation of different amino acids formed by the hydrolysis of proteins.

**Q.107 Name three vitamins which are water soluble and three which are soluble in fat.**

**Answer:** Water soluble vitamins: Vitamin C, B<sub>1</sub> and B<sub>2</sub>. Fat soluble vitamins: Vitamin A, D and E.

**Q.108 Name the diseases caused due to the deficiency of vitamin B<sub>12</sub> and Vitamin C.**

**Answer:** Vitamin B<sub>12</sub> deficiency causes pernicious anaemia. Vitamin C deficiency causes diseases relating to teeth such as Scurvy, Pyorrhea etc.

**Q.109 What type of substance is phenyl alanine hydroxylase? What is its importance for us?**

**Answer:** It is an enzyme. The deficiency of the enzyme causes disease phenyl ketouria.

**Q.110 Why are carbohydrates generally optically active?**

**Answer:** Carbohydrates are generally optically active as they contain one or more chiral carbon atoms in their molecules.

**Q.111 What are the constituents of sucrose?**

**Answer:** Sucrose (C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>) has two constituents glucose and fructose linked to each other by glycosidic linkage.

**Q.112 Name two classes of nitrogen containing bases present in nucleic acids.**

**Answer:** These are purines and pyrimidines. For structures, consult section 15.9.

**Q.113 What are polysaccharides. Name one polysaccharide and mention its importance?**



**Answer:** For the definition, consult section 15.4. Starch is a polysaccharide. It is a reserve food material.

**Q.114 Name two different types of RNA molecules found in the cells of organisms.**

**Answer:** These are: Messenger RNA (m-RNA) and Ribosomal RNA (r-RNA).

**Q.115 State one use of enzyme streptokinase in medicines.**

**Answer:** The enzyme streptokinase can dissolve blood clots. It is a useful medicine for checking heart attacks due to the blood clotting.

**Q.116 What is the structural feature characterizing reducing sugars?**

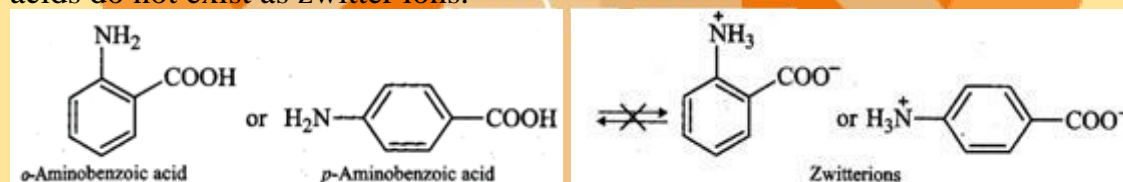
**Answer:** The main structural feature of reducing sugars is the presence of an aldehyde group ( $-\text{CHO}$ ) such as in glucose, mannose, galactose, etc. or the  $\alpha$ -ketol grouping ( $-\text{CO}-\text{CH}_2\text{OH}$ ) as present in fructose.

**Q.117 Fructose contains a keto group but still it reduces Tollens' reagent. Explain.**

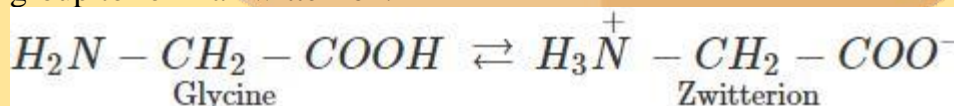
**Answer:** Under the basic conditions of Tollens' reagent, fructose undergoes Lobry de Bruyn van Ekenstein rearrangement (refer to 'Competition Focus', page 14/88). As a result, fructose gives an equilibrium mixture of fructose, glucose and mannose. Since both glucose and mannose contain -CHO group, therefore, they reduce Tollens' reagent.

**Q.118 Glycine exists as a zwitter ion but o-and p-aminobenzoic acids do not. Explain.**

**Answer:** In o- or p-aminobenzoic acids, the lone pair of electrons on the  $\text{NH}_2$  group is donated towards the benzene ring. As a result, acidic character of  $\text{-COOH}$  group and basic character of  $\text{-NH}_2$  group decreases. Therefore, the weakly acidic  $\text{-COOH}$  group cannot transfer a  $\text{H}^+$  ion to the weakly basic  $\text{-NH}_2$  group. Thus, o- or p-aminobenzoic acids do not exist as zwitter ions.



However, in glycine, no such electron withdrawing benzene ring is present. As a result,  $\text{-NH}_2$  group is sufficiently basic and hence accepts a proton form  $\text{-COOH}$  group to form a zwitter ion.

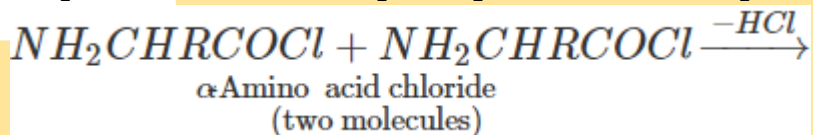
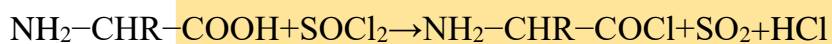


**Q.119 Can the acid chloride of an  $\alpha$ -amino acid be made by treating it with  $\text{SOCl}_2$ ?**

**Answer:** No. Two molecules of the initially formed  $\alpha$ -amino acid chloride react with each other to form a dipeptide acid chloride which, in turn, reacts further to form tetrapeptide acid chloride, etc.







**Q.120 Is a diet consisting mainly of rice an adequate diet? Why or Why not?**

**Answer:** A diet consisting mainly of rice is not an adequate diet because it is deficient in lysine and threonine which are essential amino acids required for growth and maintenance of health and hence their deficiency has to be supplemented by other protein rich diets like pulses, etc.

