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## Unit - 14

### BIOMOLECULES

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#### POINTS TO REMEMBER

1. Carbohydrates are optically active polyhydroxy aldehydes or ketones or molecules which provide such units on hydrolysis.
2. Carbohydrates are classified into three groups (i) monosaccharides, (ii) oligosaccharides and (iii) polysaccharides.
3. Glucose, the most important source of energy for mammals, is obtained by the digestion of starch.
4. Monosaccharides are held together by glycosidic linkages to form disaccharides or polysaccharides.
5. Proteins are the polymers of about twenty different amino acids which are linked by peptide bonds. Ten amino acids are called essential amino acids because they can not be synthesised in our body, hence must be provided through diet.
6. Proteins perform various structural and dynamic functions in the organisms. Proteins which contain only amino acids, are called simple proteins.
7. 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.
8. Enzymes are biocatalysts which speed up the reactions in biosystems. They are very specific and selective and efficient in their actions and chemically all enzymes are proteins.
9. Vitamins are necessary food factors required in the diet. They are classified as fat soluble (A, D, E and K) and water soluble (B group and C).
10. Nucleic acid are responsible for the transfer of characters from parents to offsprings.
11. There are two types of nucleic acids DNA and RNA. DNA contains a five carbon sugar molecule called 2-deoxyribose and RNA contains ribose.
12. Both DNA and RNA contain adenine, guanine and cytosine. The fourth base is thymine in DNA and uracil in RNA. The structure of DNA is double

stranded while that of RNA is a single stranded molecule.

13. DNA is the chemical basis of heredity and has the coded message for proteins to be synthesised.
14. There are three types of RNA, *i.e.*, m-RNA, r-RNA and t-RNA which actually carry out the protein synthesis in the nucleus.
15. Human stomach does not have any enzyme capable of breaking cellulose molecules and thus we cannot digest cellulose.

## QUESTIONS

### VSA TYPE QUESTIONS (1 - MARK QUESTIONS)

1. Name polysaccharide which is stored in the liver of animals.
2. What structural feature is required for a carbohydrate to behave as reducing sugar?  
[Hint : The carbonyl group of any one monosaccharide present in carbohydrate should be free]
3. How many asymmetric carbon atoms are present in D (+) glucose?
4. Name the enantiomer of D-glucose.  
[Hint : L-glucose]
5. Give the significance of (+)-sign in the name D-(+)-glucose.  
[Hint : (+) sign indicates dextrorotatory nature of glucose].
6. Give the significance of prefix 'D' in the name D-(+)-glucose.  
[Hint : 'D' Signifies that –OH group on C-5 is on the right hand side]
7. Glucose is an aldose sugar but it does not react with sodium hydrogen sulphite. Give reason.  
[Hint : The –CHO group reacts with –OH group at C-5 to form a cyclic hemiacetal].
8. Why is sucrose called invert sugar?  
[Hint : When sucrose is hydrolysed by water, the optical rotation of solution changes from positive to negative.]
9. Name the building blocks of proteins.
10. Give the structure of simplest optically active amino acid.
11. Name the amino acid which is not optically active.
12. Write the Zwitter ionic form of aminoacetic acid.

13. Name the enzyme which catalyses the hydrolysis of maltose into glucose.
14. Give reason : Amylase present in the saliva becomes inactive in the stomach.  
[Hint : HCl present in stomach decreases the pH]
15. How would you explain the amphoteric behavior of amino acids.  
[Hint : Amino acids are amphoteric due to the presence of both acidic and basic functional groups.]
16. Which forces are responsible for the stability of  $\alpha$  – helical structure of proteins.
17. How are polypeptides different from proteins.
18. Which nucleic acid is responsible for carrying out protein synthesis in the cell.
19. The two strands in DNA are not identical but complementary. Explain.  
[Hint : H-bonding is present between specific pairs of bases present in stands.]
20. 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.  
[Hint : RNA is single stranded].
21. What type of linkage holds together the monomers of DNA and RNA.  
[Hint : Phosphodiester linkage]
22. Mention the number of hydrogen bonds between adenine and thymine.
23. A child diagnosed with bone deformities, is likely to have the deficiency of which vitamin?
24. What is meant by the term DNA fingerprinting?
25. List two important functions of proteins in human body.
26. Name the vitamin responsible for coagulation of blood.
27. Except vitamin B<sub>12</sub>, all other vitamins of group B, should be supplied regularly in diet. Why?
28. How is glucose prepared commercially?
29. What is the structural difference between glucose and fructose?
30. What is the difference between an oligosaccharide and a polysaccharide.
31. Give the Haworth projection of D-glucopyranose.

**SA (I) TYPE QUESTIONS (2 - MARK QUESTIONS)**

- What are anomers. Give the structures of two anomers of glucose.
  - Write the hydrolysed products of
    - maltose
    - cellulose.
  - Name the two components of starch? Which one is water soluble?
  - Acetylation of glucose with acetic anhydride gives glucose pentaacetate. Write the structure of the pentaacetate.
    - Explain why glucose pentaacetate does not react with hydroxylamine?

**[Hint :** The molecule of glucose pentaacetate has a cyclic structure in which  $-CHO$  is involved in ring formation with  $OH$  group at C-5]
  - What are vitamins? How are they classified?
  - Why is sucrose called a reducing sugar?
    - Give the type of glycosidic linkage present in sucrose.
  - Classify the following as monosaccharides or oligosaccharides.
    - Ribose
    - Maltose
    - Galactose
    - Lactose
  - Write the products of oxidation of glucose with
    - Bromine water
    - Nitric acid
  - State two main differences between globular and fibrous proteins.
  - Classify the following  $\alpha$ -amino acids as neutral, acidic or basic.
    - $HOOC - CH_2 - CH(NH_2)COOH$
    - $C_6H_5 - CH_2 - CH(NH_2)COOH$
    - $H_2N - (CH_2)_4 - CH(NH_2) - COOH$
    - $$\begin{array}{c}
 HN = C - (CH_2)_3 - CH(NH_2)COOH \\
 | \\
 NH_2
 \end{array}$$
  - You have two amino acids, *i.e.* glycine and alanine. What are the structures of two possible dipeptides that they can form?
  - What are essential and non essential amino acids? Give one example of each type.
  - Name four type of intermolecular forces which stabilize 2° and 3° structure of proteins.
- [Hint :** Hydrogen bonds, disulphide linkages, vander Waals and electrostatic forces of attraction.]

14. Classify the following as globular or fibrous proteins.
  - (i) Keratin
  - (ii) Myosin
  - (iii) Insulin
  - (iv) Haemoglobin.
15. What do you understand by
  - (a) denaturation of protein
  - (b) specificity of an enzyme.
16. On electrolysis in acidic solution amino acids migrate towards cathode while in alkaline solution they migrate towards anode.  
**[Hint : In acidic solution,  $\text{COO}^-$  group of zwitter ion formed from  $\alpha$ -amino acid is protonated and  $\text{NH}_3^+$  groups is left unchanged while in basic solution deprotonation converts  $\text{NH}_3^+$  to  $\text{NH}_2$  and  $\text{COO}^-$  is left unchanged.]**
17. (i) Name the disease caused by deficiency of vitamin D.  
 (ii) Why cannot vitamin C be stored in our body?
18. Define the terms hypervitaminosis and avitaminosis.  
**[Hint : Excess intake of vitamin A and D causes hypervitaminosis while multiple deficiencies caused by lack of more than one vitamins are called avitaminosis]**
19. Explain what is meant by :
  - (i) a peptide linkage
  - (ii) a glycosidic linkage?**[Hint : (i) Peptide linkage refers to the  $-\text{CONH}-$  linkage formed by reaction between  $-\text{COOH}$  group of one amino acid with  $-\text{NH}_2$  group of the other amino acid.  
 (ii) Glycosidic linkage refers to  $-\text{C}-\text{O}-\text{C}-$  linkage between two sugars formed by loss of  $\text{H}_2\text{O}$ .]**
20. Give the sources of vitamin A and E and name the deficiency diseases resulting from lack of vitamin A and E in the diet.
21. What are the main functions of DNA and RNA in human body.

### SA(II) TYPE QUESTIONS (3 - MARK QUESTIONS)

1. How are carbohydrate classified?
2. (i) Name four bases present in DNA.  
 (ii) Which of them is not present in RNA.  
 (iii) Give the structure of a nucleotide of DNA.
3. Differentiate between the following :
  - (i) secondary and tertiary structure of protein.
  - (ii)  $\alpha$ -Helix and  $\beta$ -pleated sheet structure of protein.
  - (iii) fibrous and globular proteins.

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