Biomolecules

9 Chapter

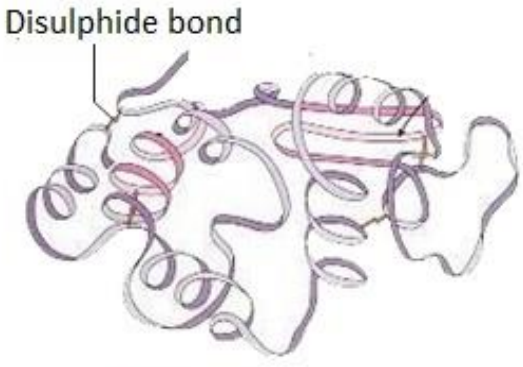
1. What are macromolecules? Give examples?

Ans: Chemical compounds, which are found in the acid-insoluble fraction are called macromolecules or biomacromolecules. As suggestive of its name, its molecular weights lie above 1000 Dalton. Consequently, micro molecules have molecular weights of less than 1000 Daltons.

Examples of macromolecules are—proteins, lipids, and carbohydrates, etc. Except for lipids, all the other macromolecules including carbohydrates, proteins, and nucleic acids are polymeric substances.

2. What is meant by tertiary structure of proteins?

Ans: Tertiary structure specifies the spatial layout of amino acids that are far apart in the linear structure as well as those remains that are adjacent. The arrangement of amino acids specifies the ultimate 3-D structure of any specific protein. The polypeptide chain folds spontaneously so that the majority of its hydrophobic side chains are buried in the interior, and the majority of its polar charged chains are on the surface. The tertiary structure of a protein is stabilized by hydrophobic interactions, electrostatic forces (salt bridges), and disulfide links.

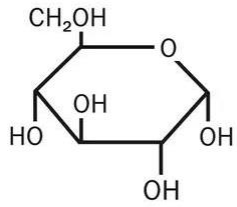


Tertiary structure

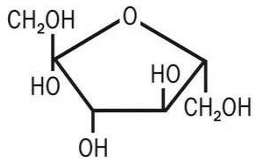
3. Find and write down structures of ten fascinating small molecular weight biomolecules. Find there is any industry that produces the compounds by isolation. Find out who are the buyers.

Ans: The structures of ten different small molecular weight biomolecules are given below.

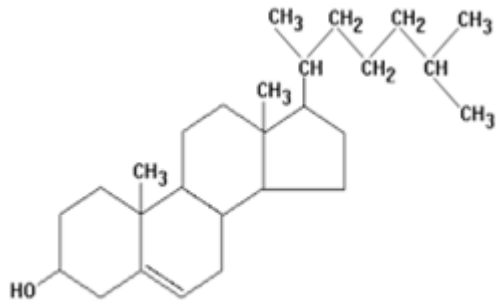
Glucose:



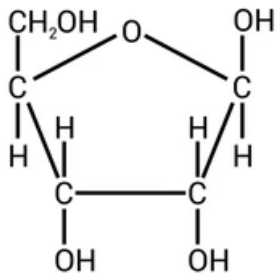
Fructose:



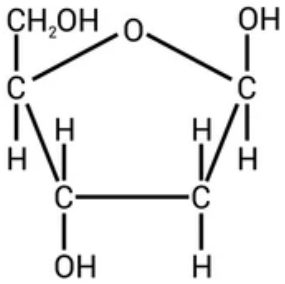
Cholesterol:



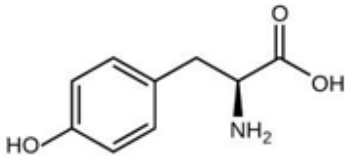
Ribose:



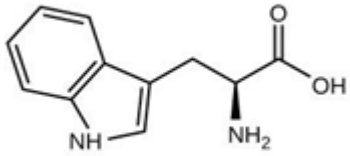
Deoxyribose:



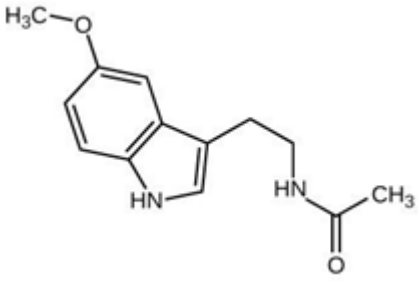
Tyrosine:



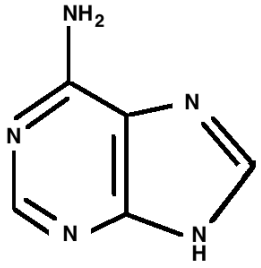
Tryptophan:



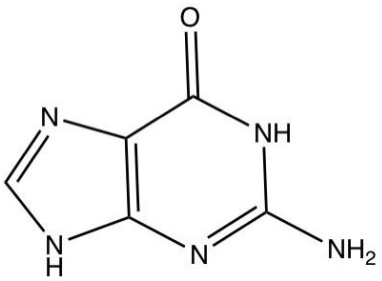
Melatonin:



Adenine:



Guanine:



Many industries manufacture compounds by the process of isolation. Some examples are given below.

Industry	Compounds	Buyer
Pharmaceuticals manufacturing industries	Enzymes	Agriculture based food industries, such as companies manufacturing juices, jams, etc., research institutes, cosmetics, medicine companies, paper industry, clothing industry, etc.
Liquid glucose manufacturing industry	Liquid Glucose	Food companies, Drug and pharmaceutical companies.

4. Find out and create a list of proteins utilized as therapeutic agents. List additional uses of proteins (e.g., cosmetics, etc.)

Ans: A list of proteins used as therapeutic agents are given below.

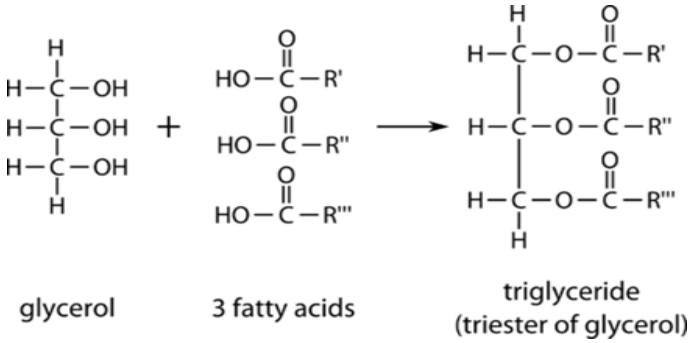
Proteins	Therapeutic use
i. Insulin	Diabetes
ii. Vasopressin	Treatment of diabetes insipidus.
iii. Interleukin II	Used to prevent low platelets counts and to decrease the requirement for blood transfusions following cancer treatments.
iv. Oxytocin	Used for inducing uterine contractions to induce labour during pregnancy.

- Both plants and animals give the appropriate proteinaceous materials for the preparation of cosmetic items. Proteins from algae and fungi, though, are also increasingly being utilized as protein sources.

- High-protein plants most widely used as beginning material for making vegetable proteins are wheat and corn gluten, rice, soy, and oat protein concentrates, and defatted oilseeds (almond, peanuts, sunflower). Among the larger variety of vegetable proteins, soy globulins and wheat gluten are by far of the widest use. Wheat gluten (often just known as wheat protein) is a distinctive cereal protein of high elasticity when hydrated. Soy proteins are useful because of their thickening and emulsifying effects.

5. Explain the composition of triglyceride.

Ans: Triglycerides are a type of lipids found in living beings, that are synthesised due to the esterification of three fatty acids with a glycerol molecule. These are also called fats and oils based on their melting points.



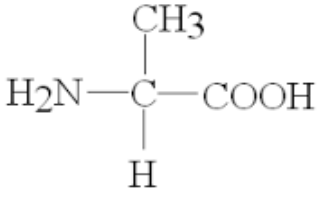
Oils have lower melting points as compared to fats. The three fatty acids may be different or the same. Therefore, they may be known as simple or mixed.

6. Can you try the structure of biomolecules utilizing commercially available atomic models (Ball and stick models).

Ans: Yes, we can create models of biomolecules using commercially available atomic models.

7. Draw the structure of the amino acid alanine.

Ans: The structure of alanine is given below.



alanine

8. What are gums made of? Is fevicol different?

Ans: Gums are made up of carbohydrates and chemically they are heteropolysaccharides.

Fevicol is polyvinyl alcohol glue. It is different from natural gums as it is a synthetic product.

9. Find out a qualitative test for proteins, fats and oils, and starch amino acids and test any fruit juice, saliva, sweat, and urine for them.

Ans:

i. A qualitative test for proteins: Xanthoproteic test

Experimental Material	**Observation**	**Inference**
(a) Urine	Yellow precipitate	The formation of yellow precipitate suggests the presence of protein in the food material
(b) Water	No precipitate	

ii. A qualitative test for fats: Emulsification test

Experimental Material	**Observation**	**Inference**
(a) Sweat	Oil droplets	Formation of oil droplets i.e., emulsification signifies the presence of fats in the provided food material.
(b) Water	No oil droplet	

iii. A qualitative test for oils: Paper test

Experimental Material	**Observation**	**Inference**

(a) Food material (sample)	Paper turns into a Translucent	Opaque paper becomes translucent which suggests the presence of fats in the food material
(b) Water	Paper gets soggy	

iv. A qualitative test for starch: Iodine test

Experimental Material	**Observation**	**Inference**
(a) Fruit juices	Blue-black colour when few drops of iodine are added.	The formation of blue-black colour suggests the presence of starch in the provided food material.
(b) Water	No change in colour	

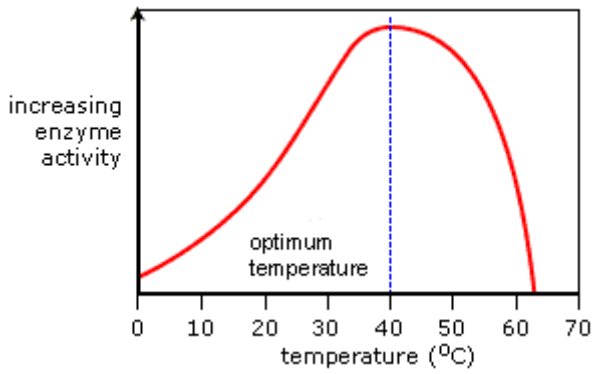
10. Find out how much cellulose is made by all the plants in the biosphere and compare it with how much of paper is manufactured by man and hence what is the consumption of plant material by man annually. What a loss of vegetation!

Ans: Most paper is formed from wood pulp. The major component of wood pulp is cellulose, a polymer made of several glucose molecules linked together. The cellulose molecules and their bonding to each other give the paper its properties. Nearly 33% of everything in the plant matter is cellulose. The cellulose content of wood is $40-50\%$ and that of cotton is 90% For industrial use, cellulose is mostly obtained from cotton and wood pulp. It is used primarily to produce paper and paperboard; to a smaller extent. It is converted into a large variety of derivative products like rayon and cellophane.

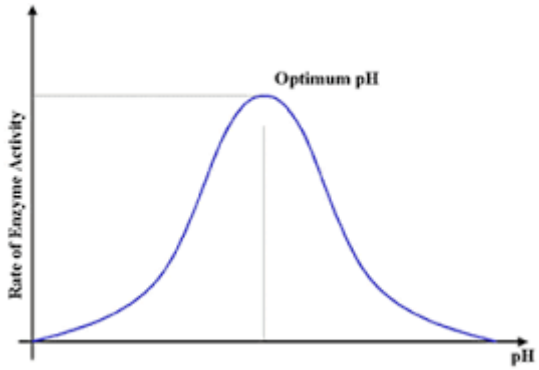
11. Describe the important properties of enzymes.

Ans: Enzymes are proteins that catalyse biochemical reactions in cells. So, usually, enzymes are proteins but sometimes RNA also behaves catalytically. Catalytic RNAs are called Ribozymes. Each enzyme works best at its optimum

temperature. Subsequently, enzymes are proteins, they are denatured at high temperatures.



Enzymes work most excellent at their optimal pH

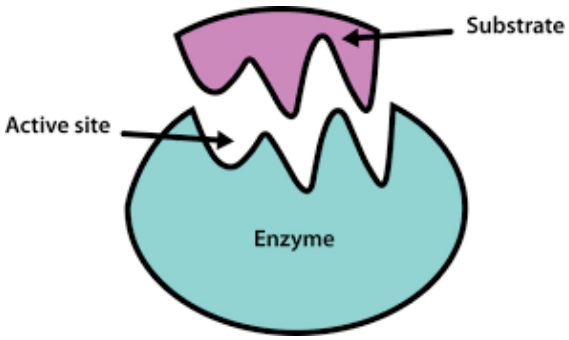


Graph that displays the effect of pH on enzyme activity

i. With the rise in substrate concentration, the velocity of the enzymatic reaction increases at first. The reaction ultimately achieves a maximum velocity (v max) which is not exceeded by any additional increase in the concentration of the substrate.

ii. The activity of an enzyme is also sensitive to the presence of particular chemicals (maybe modulators or inhibitors of enzyme action) that bind to the enzyme.

iii. Enzymes are substrate-specific. Due to the three-dimensional folding of the enzyme, it forms pockets or crevices. One such pocket is called the active site. An active site of the enzyme is a crevice or a pocket at which the substrate binds.



Substrates bind to enzymes at the active site