Biology

(Chapter – 9) (Biomolecules)

(Class – XI)

Exercises

Question 1:

What are macromolecules? Give examples.

Answer 1:

Macromolecules are large complex molecules that occur in colloidal state in intercellular fluid. They are formed by the polymerization of low molecular weight micromolecules. Polysaccharides, proteins, and nucleic acids are common examples of macromolecules.

Question 2:

What is meant by tertiary structure of proteins?

Answer 2:

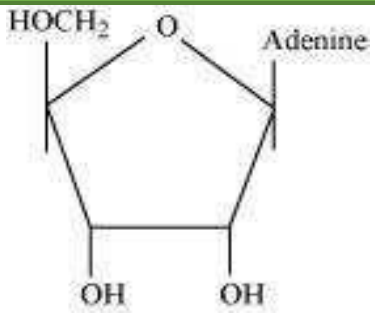
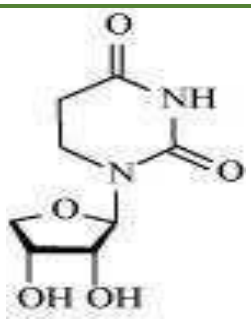
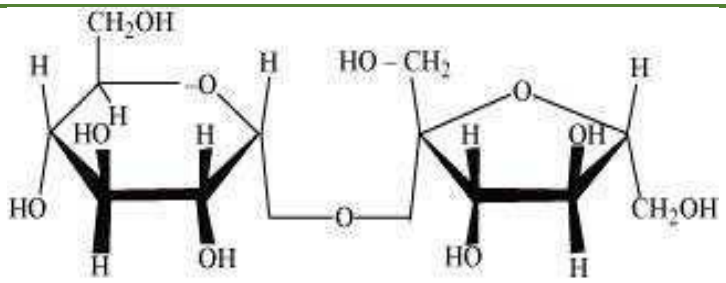
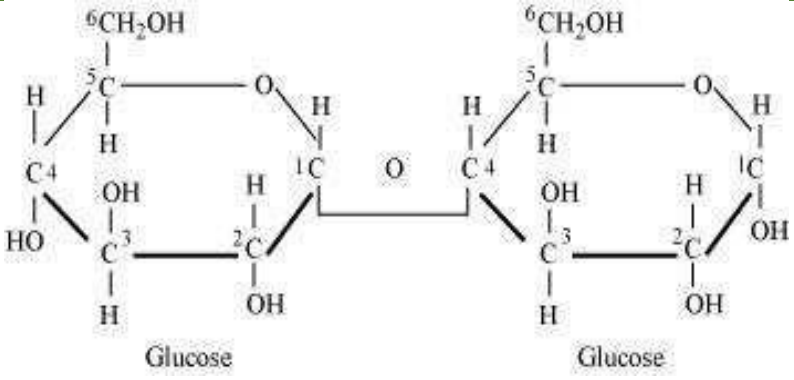
The helical polypeptide chain undergoes coiling and folding to form a complex three dimensional shape referred to as tertiary structure of proteins. These coils and folds are arranged to hide the non-polar amino acid chains and to expose the polar side chains. The tertiary structure is held together by the weak bonds formed between various parts of the polypeptide chain.

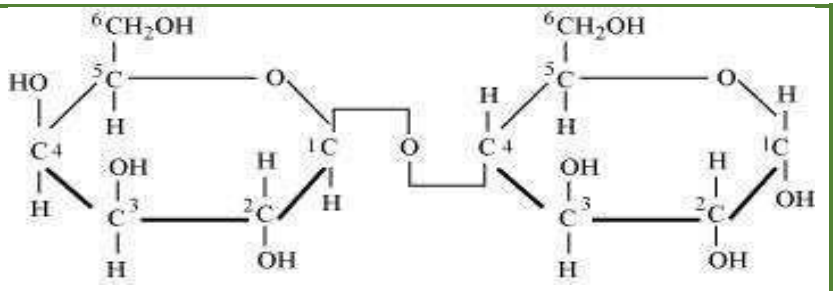
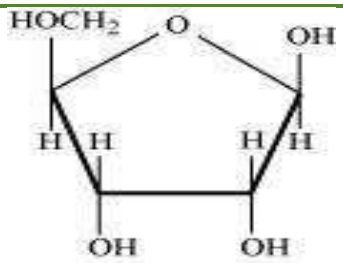
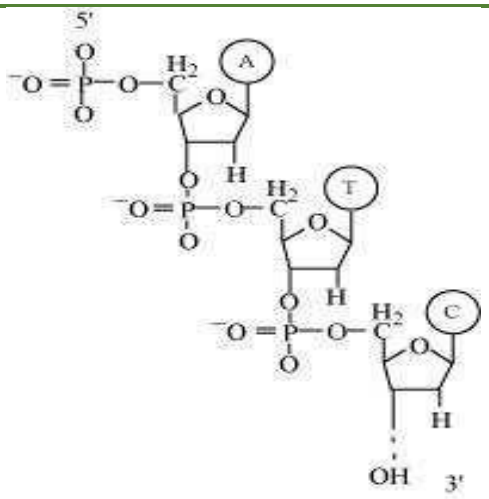
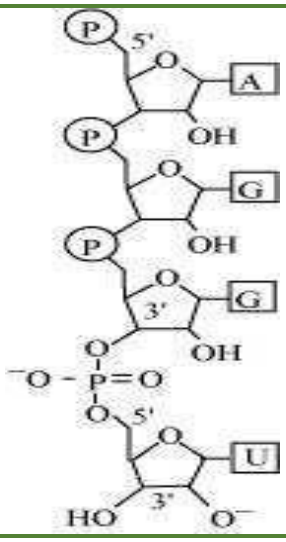
Question 3:

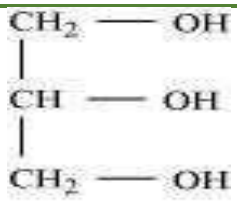
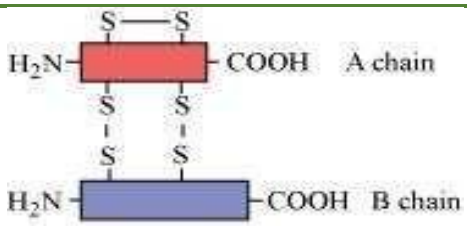
Find and write down structures of 10 interesting small molecular weight biomolecules. Find if there is any industry which manufactures the compounds by isolation. Find out who are the buyers.

Answer 3:

(a)

	Molecule	Structure
1.	**Adenosine**	
2.	**Thymidine**	
3.	**Sucrose**	
4.	**Maltose**	

5.	**Lactose**	
6.	**Ribose**	
7.	**DNA**	
8.	**RNA**	

9.	**Glycerol**	
10.	**Insulin**	

(b)

	Compound	Manufacturer	Buyer
1.	Starch products	Kosha Impex (P) Ltd.	Research laboratories, educational institutes, and other industries, which use biomolecules as a precursor for making other products.
2.	Liquid glucose	Marudhar apparels	
3.	Various enzymes such as amylase, protease, cellulase	Map (India) Ltd	

Question 4:

Find out and make a list of proteins used as therapeutic agents. Find other applications of proteins (e.g., cosmetics, etc.)

Answer 4:

Proteins used as therapeutic agents are as follows:

- Thrombin and fibrinogen – They help in blood clotting.
- Antigen (antibody) – It helps in blood transfusion.
- Insulin – It helps in maintaining blood glucose level in the body.
- Renin – It helps in osmoregulation.

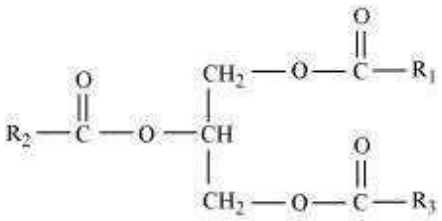
Proteins are also commonly used in the manufacture of cosmetics, toxins, and as biological buffers.

Question 5:

Explain the composition of triglyceride.

Answer 5:

Triglyceride is a glyceride, which is formed from a single molecule of glycerol, esterified with three fatty acids. It is mainly present in vegetable oils and animal fat.



Structure of triglyceride

The general chemical formula of triglyceride is

$$R_2COO-CH_2CH(-OOCR_1)CH_2-OOCR_3$$

Where R_1, R_2, and R_3 are fatty acids. These three fatty acids can be same or different.

Question 6:

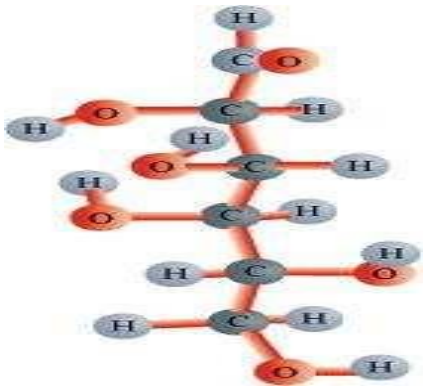
Can you attempt building models of biomolecules using commercially available atomic models (Ball and Stick models).

Answer 6:

Ball and stick models are 3-D molecular models that can be used to describe the structure of biomolecules.

In ball and stick model, the atoms are represented as balls whereas the bonds that hold the atoms are represented by the sticks. Double and triple bonds are represented by springs that form curved connections between the balls. The size and colour of various atoms are different and are depicted by the relative size of the balls.

It is the most fundamental and common model of representing biomolecular structures.



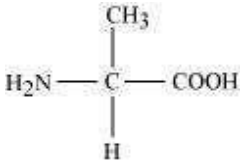
In the above ball and stick model of D-glucose, the oxygen atoms are represented by red balls, hydrogen atoms by blue balls, while carbon atoms are represented by grey balls.

Question 7:

Draw the structure of the amino acid, alanine.

Answer 7:

Structure of alanine



Question 8:

What are gums made of? Is Fevicol different?

Answer 8:

Gums are hetero-polysaccharides. They are made from two or more different types of monosaccharides. On the other hand, fevicol is polyvinyl alcohol (PVA) glue. It is not a polysaccharide.

Question 9:

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

Answer 9:

(a) Test for protein

Biuret's test – If Biuret's reagent is added to protein, then the colour of the reagent changes from light blue to purple.

(b) Test for fats and oils

Grease or solubility test

(c) Test for amino acid

Ninhydrin test – If Ninhydrin reagent is added to the solution, then the colourless solution changes to pink, blue, or purple, depending on the amino acid.

Item		Name of the test	Procedure	Result	Inference
1.	Fruit juice	Biuret's test	Fruit juice + Biuret's reagent	Colour changes from light blue to purple	Protein is present.
		Grease test	To a brown paper, add a few drops of fruit juice.	No translucent spot	Fats and oils are absent or are in negligible mounts.
		Ninhydrin test	Fruit juice + Ninhydrin reagent + boil for 5 minutes	Colourless solution changes to pink, blue, or purple colour	Amino acids are present.
2.	Saliva	Biuret's test	Saliva + Biuret's reagent	Colour changes from light blue to purple	Proteins are present.
		Grease test	On a brown paper, add a drop of saliva.	No translucent spot	Fats/oils are absent.
		Ninhydrin test	Saliva + Ninhydrin reagent + boil for 5 minutes	Colourless solution changes to pink, blue, or purple colour	Amino acids are present.
3.	Sweat	Biuret's test	Sweat + Biuret's reagent	No colour change	Proteins are absent.
		Solubility test	Sweat + Water	Oily appearance	Fats/oil may be present.
		Ninhydrin test	Sweat + Ninhydrin reagent + boil for 5 minutes	No colour change, solution remains colourless	Amino acids are absent.
4.	Urine	Biuret's test	Few drops of urine + Biuret's reagent	Colour changes from light blue to purple	Proteins are present.
		Solubility test	Few drops of urine + Water	Little bit of oily appearance	Fats may or may not be present.

		Ninhydrin test	Few drops of urine +	Colourless solution changes to pink,	Amino acids are present.
			Ninhydrin reagent + boil for 5 minutes	blue, or purple colour depending on the type of amino acid	

Question 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!

Answer 10:

Approximately, 100 billion tonnes of cellulose are made per year by all the plants in the biosphere and it takes 17 full grown trees to make one ton of paper. Trees are also used to fulfil the other requirements of man such as for timber, food, medicines, etc. Hence, it is difficult to calculate the annual consumption of plant material by man.

Question 11:

Describe the important properties of enzymes.

Answer 11:

Properties of enzymes

- Enzymes are complex macromolecules with high molecular weight.
- They catalyze biochemical reactions in a cell. They help in the breakdown of large molecules into smaller molecules or bring together two smaller molecules to form a larger molecule.
- Enzymes do not start a reaction. However, they help in accelerating it.
- Enzymes affect the rate of biochemical reaction and not the direction. **(5)** Most of the enzymes have high turnover number. Turnover number of an enzyme is the number of molecules of a substance that is acted upon by an enzyme per minute. High turnover number of enzymes increases the efficiency of reaction.
- Enzymes are specific in action.
- Enzymatic activity decreases with increase in temperature.
- They show maximum activity at an optimum pH of 6 – 8.
- The velocity of enzyme increases with increase in substrate concentration and then, ultimately reaches maximum velocity.