

#424431

Topic: Biomolecules

What are macromolecules? Give examples of it.

**Solution**

Macromolecules are large complex molecules present in the colloidal state in the intercellular fluid. They are formed by the condensation of low molecular weight micromolecules and hence, are polymeric in nature.

Polysaccharides, proteins, and nucleic acids are common examples of macromolecules.

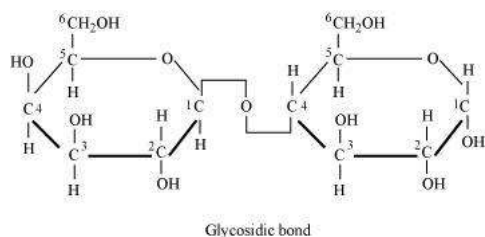
#424432

Topic: Biomolecules

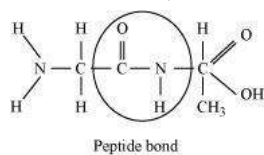
Illustrate a glycosidic, peptide and a phospho-diester bond.

**Solution**

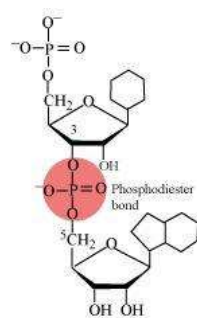
(a) A glycosidic bond is formed normally between C-1 and C-4, of adjacent monosaccharide units.



(b) Peptide bond is a covalent bond that is formed between two adjacent amino acids by condensation of  $\text{NH}_2$  gp of one amino acid and  $\text{C=O}$  group of other amino acid and hence, it can be depicted as



(c) Phosphodiester bond is a strong covalent bond formed between phosphate and two adjacent sugar groups. Such bonds form the sugar-phosphate backbone of nucleic acids.



#424433

Topic: Biomolecules

What is meant by tertiary structure of proteins?

**Solution**

Tertiary structures are formed by coiling and folding of chains of proteins. The folding of the tertiary chains leads to the exposure of polar ends while it hides the non-polar amino acid chains. The tertiary structure is held together by the weak non-covalent interactions formed between various parts of the polypeptide chain.

#424435

Topic: Biomolecules

Proteins have primary structure. If you are given a method to know which amino acid is at either of the two termini (ends) of a protein, can you connect this information to purity or homogeneity of a protein?

#### Solution

Yes, if we are given a method to know the sequence of proteins, we can use this information to determine the purity of a protein. It is known that an accurate sequence of a certain amino acid is very important for the functioning of a protein. If there is any change in the sequence, it would alter its structure, thereby altering the function. So by knowing the sequence of a given protein, we can determine its structure and compare it with any of the known correct protein sequences. Any change in the sequence can be linked to the purity or homogeneity of a protein.

For example, a single change in the sequence of haemoglobin in P chain at the 6th position can alter the normal haemoglobin structure to an abnormal structure that can cause sickle cell anaemia.

---

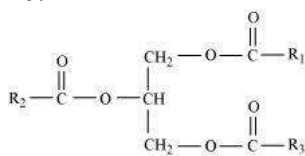
**#424437**

**Topic:** Biomolecules

Explain the composition of triglyceride?

#### Solution

Triglyceride which is formed by esterification of a single molecule of glycerol, with three molecules of fatty acids. It is mainly present in vegetable oils and animal fat. Structure of triglyceride :



These three fatty acids can be same or different.

---

**#424439**

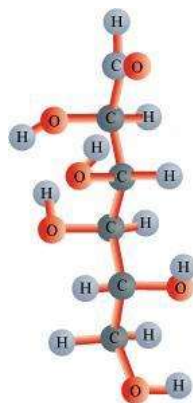
**Topic:** Biomolecules

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

#### Solution

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.

---

**#424440**

**Topic:** Biomolecules

Attempt titrating an amino acid against a weak base and discover the number of dissociating (ionizable) functional groups in the amino acid.

#### Solution

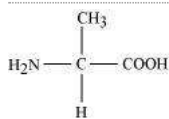
Titration of a neutral or basic amino acid against a weak base will dissociate only one functional group, whereas titration between an acidic amino acid and a weak base will dissociate two or more functional groups.

#424441

Topic: Biomolecules

Draw the structure of the amino acid, alanine.

Solution



Structure of alanine

#424444

Topic: Biomolecules

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.

Solution

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 fulfill 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.

#424445

Topic: Enzyme properties

Describe the important properties of enzymes?

Solution

Properties of enzymes :

- (1) Enzymes are complex macromolecules with high molecular weight.
- (2) 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 large molecule.
- (3) Enzymes do not start a reaction. However, they help in accelerating it.
- (4) Enzymes affect the rate of biochemical reaction and not the direction of the reaction.
- (5) Most of the enzymes have a 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 under saturated substrate concentration. High turnover number of enzymes increases the efficiency of the reaction.
- (6) Enzymes are specific in action.
- (7) Enzymatic activity decreases with increase in temperature and all enzymes show maximum activity at an optimum of 30-40°C.
- (8) They show maximum activity at an optimum pH of 6 – 8.
- (9) The velocity of enzyme increases with increase in substrate concentration and then, ultimately reaches maximum velocity.

#526148

Topic: Biomolecules

From what you have learnt, can you tell whether enzymes are bigger or DNA is bigger in molecular size? How did you know?

Solution

Enzymes are smaller than DNA molecules in terms of size. DNA contains genetic information for the development and functioning of all living organisms. It contains all the information of the synthesis of proteins necessary for the proper functioning of the cells. The part of the DNA that contains all this information constitutes only 5-7% of the entire DNA in a cell. So, it clearly shows that DNA is many times bigger than the enzymes.

#526217

Topic: Enzyme properties

Does our blood have proteases and nucleases?

Solution

Proteases and nucleases are the enzymes that digest proteins and nucleic acids respectively. Blood does not contain either of these enzymes, rather protease inhibitor is present in blood serum to protect blood proteins from protease action.