# Chapte - 9 Biomolecules

## Question-1

**What is the importance of magnesium and iodine in living organisms?**

**Solution:**

The importance of magnesium and iodine in living organism are as follows:

**Magnesium:**

(i) It is an essential component of chlorophyll.

(ii) It helps in respiration and fat synthesis.

(iii) It is involved in the binding of ribosome components.

(iv) It acts as an enzyme-activator.

**Iodine:**

(i) It is a constituent of thyroxine hormone.

(ii) It regulates the general metabolism of the body.

## Question-2

**Monosaccharides are called 'reducing sugars' but disaccharides are not. Why? Write an example of each type of sugar.**

**Solution:**

Monosaccharides are called reducing sugars because they have a free aldehyde or ketone group and can reduce $Cu^{++}$ to $Cu^{+}$. Example: Glucose. But disaccharides like sucrose do not reduce $Cu^{++}$ to $Cu^{+}$. Hence, it is not a reducing sugar.

## Question-3

**Differentiate between competitive inhibition and allosteric inhibition of enzyme action.**

### Solution:

| Competitive Inhibition | Allosteric Inhibition |
|---|---|
| (i) Regulatory function is absent. | (i) Regulatory function is present. |
| (ii) Inhibitor binds with active site. | (ii) Inhibitor does not bind with active site. |
| (iii) Inhibitor shows very close resemblance to the substrate in structural organisation. | (iii) Inhibitor shows no resemblance to substrate. |
| (iv) Inhibitor is not a product of metabolic pathway. | (iv) Inhibitor is a product of metabolic pathway. |

## Question-4

**In the stomach and small intestine, the enzymes for digestion of proteins are secreted in an inactive form. Why?**

### Solution:

In the stomach and intestine, the enzymes, which act on proteins are pepsin and trypsin. These are secreted in the inactive form. The inactive form of pepsin is pepsinogen and the inactive form of trypsin is trypsinogen. These require the help of certain activators to become active. For example, when food reaches the stomach, another set of glands secrete HCl in small quantities. HCl activates the pepsinogen and converts it into pepsin. It can act only in an acidic medium on proteins in order to digest them. Similarly, trypsin secreted by the pancreas in an inactive form is known as trypsinogen. When it comes in contact with another enzyme, enterokinase secreted by the mucosal layer of the duodenum, it gets converted into active trypsin. In the intestine, trypsin can act only in the alkaline medium.

## Question-5

**What is contact catalysis?**

**Solution:**

In biochemical reactions, the enzyme absorbs the reactant or substrate molecules over its active sites so as to bring them closer for chemical reaction. This phenomenon is called contact catalysis.

## Question-6

**Write the difference between saturated fatty acids and unsaturated fatty acids.**

**Solution:**

| Fatty Acid | Unsaturated Fatty Acid |
|---|---|
| (i) This is found mostly in animal fats. | (i) This is found mostly in plant fats. |
| (ii) It has high melting point. | (ii) It has low melting point. |
| (iii) At ordinary temperature, they are solid. | (iii) At ordinary temperature, they are liquid. |
| (iv) They are carbon atoms linked by single bonds and have hydrogen atoms. | (iv) They are carbon atoms linked by double bonds and do not have hydrogen atoms. |

## Question-7

**What is activation energy?**

**Solution:**

Activation energy is the energy required to initiate a chemical or biochemical reaction. It overcomes the energy barrier of reactants, which occurs due to

(i) The presence of electrons over their surface,

(ii) absence of precise and forceful collisions, essential for bringing the reactive sites of the chemical together.

(iii) The requirement of activation energy is usually very high, **e.g.**, 32000 cal/mole for hydrolysis of sucrose. Ordinarily, such an amount of energy cannot be provided by living systems.

(iv) Enzymes reduce the amount of activation energy required for a chemical reaction, **e.g.**, 9400 cal/mole for hydrolysis of sucrose. They also bring the reactants together over their surface for precise collisions of their reactive sites.

## Question-8

**What does an enzyme do in terms of energy requirement for a reaction? What would happen if the enzyme did not play this role?**

**Solution:**

(i) The substrate molecules have average kinetic energy. However some of the molecules possess higher kinetic energy because of collisions. These are referred to as energy-rich molecules. Only energy-rich molecules will take part in an ordinary reaction at normal temperature. Such a reaction will take place at a very slow pace because it is impeded by a high-energy barrier. The energy required for a reaction to take place is called activation energy. For example, the energy required for the decomposition of $H_2O_2$ into water and oxygen is 18000 calories per mole. In this reaction, 5500 calories of energy is needed for the decomposition of $H_2O_2$.

(ii) Obviously, if the enzyme does not play a role in lowering the activation of energy in the reactions, most of the biochemical reactions will either not take place or will take place at a very slow rate of body temperature.

## Question-9

**Why doesn't oil dissolve in water. Give a scientific explanation.**

**Solution:**

Water molecules are interconnected with hydrogen bonds giving a lattice structure. Its fluidity is maintained by rapid formation and dissociation of hydrogen bonds between the water molecules. Now in order to dissolve a substance in water, it should be able to form a new hydrogen bond with a water molecule so as to become a part of its lattice. But this is possible only for hydrophilic groups. Oils being hydrophilic and non-polar compounds, they are unable to join with the lattice structure of water. Hence, it doesn't dissolve but floats on water.

## Question-10

**What is activation energy?**

**Solution:**

Activation energy is the initial input required to start a reaction.

## Question-11

**What are the two advantages of storing carbohydrates in the form of polysaccharides?**

**Solution:**

The two advantages of storing carbohydrates in the form of polysaccharides are,

(i) The polysaccharides are starch and glycogen. Starch is found in rice, wheat, etc. Glycogen is stored in liver. During the formation of molecules, the water is removed from the monosaccharides.

(ii) If necessary, polysaccharides are broken down by enzymes for release of energy.

## Question-12

**Write the differences between enzymes and catalysts.**

### Solution:

| Enzymes | Catalysts |
|---|---|
| All enzymes are made up of proteins having complex structure. | Catalysts are inorganic and small molecules having simple structure. |
| Enzymes are specific in their action. | They catalyse many reactions. |

## Question-13

**Give the differences between oligosaccharides and polysaccharides.**

### Solution:

| Oligosaccharides | Polysaccharides |
|---|---|
| Soluble in water. | Insoluble in water. |
| Consists of 2-9 monosaccharide units. | Consists of many monosaccharide units. |
| It tastes sweet. | It is tasteless. |
| They are the micromolecules of the cells. | They are the macromolecules of the cells. |

## Question-14

**What is the name given to the part of enzyme where catalystic work is carried out?**

### Solution:

Active site is that part of enzyme where catalytic work is carried out. An enzyme may have one or more active sites. The active site of aldolase contains glycine, histidine and alanine a group of three amino acids.

## Question-15

**Why are enzymes called as biocatalysts?**

### Solution:

The substance, which changes the rate of chemical reaction without altering the equilibrium point of reaction, is called catalyst. The catalyst of the organisms is called enzymes and they are synthesized in the living cells, hence called as biocatalysts.

## Question-16

**How do Animals digest cellulose?**

**Solution:**

A number of mammals – ruminants such as cows and other herbivorous animals are capable of digesting the cellulose with the help of microorganisms present in their digestive tract. Snail and termites also digest cellulose with the help of microorganisms present in them in the digestive tract.

## Question-17

**List the main differences between the reducing sugar and non-reducing sugars.**

**Solution:**

The differences between the reducing sugar and non-reducing sugar are

| Reducing Sugar | Non-reducing Sugar |
|---|---|
| Reducing sugars have a free aldehyde or ketone group. | Non-reducing sugars are without aldehyde or ketone groups. |
| They reduce $Cu^{++}$ to $Cu^{+}$ of Benedict solution. E.g Glucose | They are unable to reduce $Cu^{++}$ to $Cu^{+}$. E.g. Sucrose |

## Question-18

**What is an apo-enzyme?**

**Solution:**

A protein that combines with a coenzyme to form an active enzyme is called apo-enzyme.

## Question-19

**What is ligase?**

**Solution:**

An enzyme that can rejoin a broken phosphodiester bond in a nucleic acid is called ligase.