

Class: 11
Subject: Biology
Topic: Enzymes
No. of Questions: 25

Q1. Differentiate between allosteric and competitive inhibition.

Sol.

DIFFERENCE BETWEEN COMPETITIVE AND ALLOSTERIC INHIBITION		
	Competitive inhibition	Allosteric inhibition
1.	No regulatory function.	Regulation of metabolic activity by stopping the excess formation of product.
2.	Binds with active site.	Binds to some other site except active site
3.	Inhibitor – not a product of metabolic pathway.	Inhibitor – a product of metabolic pathway.
4.	Inhibitor shows close resemblance to the substrate in structure.	Inhibitor shows no resemblance to the substrate.

Q2. Differentiate between cofactor and prosthetic group.

Sol.

Difference between cofactor and prosthetic group		
	Co- Factor	Prosthetic Group
1.	It is non-protein substance or group which gets attached to the enzyme .	It is the non-protein part or group which gets attached to the open enzyme.
2.	It is essential for functioning. It may be organic or inorganic or metallic cofactor	Some prosthetic group have metals. e.g. Iron porphyrin of the cytochromes.

Q3. Write the similarities between enzymes and catalysts.

Sol. SIMILARITIES BETWEEN ENZYMES AND CATALYSTS

- Both remain unchanged chemically and quantitatively at the end of a reaction. They can be used over and over again.
- Both are required in small quantity as compared to their substrates.
- Both do not change the equilibrium of chemical reaction.
- Reactions controlled by catalysts and enzymes are reversible.

- (e) Both enhance the rate of chemical reaction and do not initiate the reaction.
- (f) They lower the activation energy needed to start the reaction.
- (g) They form short-lived complexes with the substrate molecules.
- (h) They do not change the end products of the reaction.

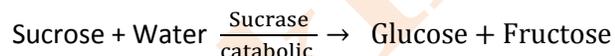
Q4. What is the role of enzymes in metabolism?

Sol. ROLE OF ENZYMES IN METABOLISM:

- (a) Metabolism is the sum totals of all the living processes which take place in the body.
- (b) The metabolic pathways are directed by enzymes
- (c) Enzymes act as catalysts.
- (d) They are highly specialized organic catalysts produced by living cells.
- (e) Biochemical pathways refer to the reactions occurring inside the cells in sequences.
- (f) Enzymes give proper direction to the biochemical pathways.
- (g) They have active sites
- (h) A particular enzymes interacts with the substrate.
- (i) The substrate binds to the active site of the enzyme to form the enzyme-substrate complex.
- (j) The product of the reaction is released which makes the enzyme free to bind to the other substrate.

Example:

Enzyme Sucrase will act only on sucrose to produce glucose and fructose. Sucrase would be non-functional on other disaccharides such as maltose.



Q5. Differentiate between apoenzyme and coenzyme

Sol. Difference between apoenzyme and coenzyme

	Apoenzyme	Coenzyme
1.	It is the protein part of the enzyme composed of only amino acids.	It is the non-protein organic part of the enzyme which is attached to the apoenzyme to form conjugate protein.
2.	It is heat sensitive i.e. Thermolabile.	It is heat stable.
3.	It is larger in size	It is smaller in size.
4.	It is specific for an enzyme.	It can function as a cofactor for a number of enzymes carrying out specific functions.
5.	It is responsible for catalytic activity of the enzyme.	It takes part in the removal of the products of the reaction.

Q6. Differentiate between chemical reaction and enzymatic reaction

Sol. Difference between chemical Reaction and Enzymatic Reaction.

	Chemical Reaction	Enzymatic Reaction
1.	It does not require enzymes.	It requires some specific enzymes.
2.	Simple molecules are required to carry out the chemical reaction.	Complex protein molecules are required to carry out the chemical reaction.
3.	A chemical reaction can occur at very high temperature.	High temperature denatures the enzymes.
4.	When activation energy is lowered, rate of chemical reaction increases.	Activation energy is essential for initiation.

Q7. Differentiate between enzymes and catalysts

Sol. DIFFERENCE BETWEEN ENZYME AND CATALYST

	Enzyme	Catalyst
1.	All enzymes are made up of protein	Catalysts are small inorganic molecules.
2.	They have complex three dimensional structure.	They have a simple structure.
3.	Enzymes are highly specific in their action	They catalyze diverse reactions.
4.	They can be regulated by specific molecules which can change conformation and therefore activity.	They are not regulated by any regulator molecules.
5.	They are more sensitive to change in PH and temperature	They are less sensitive to change in PH and temperature.

Q8. Differentiate between enzyme and hormones

Sol. Difference between Enzymes and Hormones

	Enzymes	Hormones
1.	Secreted by exocrine or ducted glands.	Secreted by endocrine or ductless glands.
2.	They are catalytic in chemical reactions.	They do not catalyze specific chemical reactions.
3.	They are secreted in an organ where they carry out their function.	They are secreted in an organ other than where they carry out their function.
4.	They are not secreted directly into the blood stream.	They are released directly into the blood stream
5.	They are not used in metabolism but as catalyst.	They are used in metabolism

Q9. What is non-competitive inhibition?

Sol. Non-competitive Inhibition

- In this type of inhibition, the inhibitor is not structurally similar to the substrate molecule so the inhibitor does not compete with the substrate for binding to the active site of the enzyme.
- It binds at a site other than the active site on the surface of the enzyme.
- This binding alters the physical structure of the enzyme.
- The inhibitor does not interfere with enzyme- substrate binding.
- But, catalysis is prevented, due to distortion in the enzyme conformation.
- Non-competitive inhibition cannot be reversed by increasing the substrate concentration.

Examples:

Cyanides inhibiting the activity of cytochrome oxidase which is essential for nearly all mammalian cells. This results in cyanide poisoning.

Heavy metal ions (Hg^{2+} , Ag^+ , Pb^{2+}) can non-competitively inhibit the enzymes by binding to the cysteine sulfhydryl group.

Q10. Give examples of digestive enzymes with their substrates and products

Sol.

Group of Enzyme	Substrate	Product	Examples
1. Proteolytic enzyme	Proteins	Amino Acids	Trypsin, Pepsin, Erepsin, Chymotrypsin
2. Amylolytic enzymes	Complex carbohydrates	Glucose	Amylase, Sucrase, Lactase, Maltase
3. Lipolytic enzymes	Lipids		

Q11. What is the clinical significance of competitive inhibitors?

Sol. CLINICAL SIGNIFICANCE OF COMPETITIVE INHIBITORS

1. Competitive inhibitors are used to control bacterial pathogens.
2. Sulpha drugs such as sulphanilamide work as competitive inhibitors of folic acid synthesis in bacteria as substitute p-amino benzoic acid.

Q12. What are antimetabolites?

Sol. ANTIMETABOLITES

1. Antimetabolites are chemical compounds that block the metabolic reactions by their inhibitory action of enzymes.
2. Antimetabolites are usually structural analogues of substance and thus are competitive inhibitors.

Q13. What is ribozyme?

Sol. RIBOZYME:

1. Ribozyme is an RNA molecule that has catalytic activity.
2. It is a type of enzyme in which RNA can catalyze changes in its own molecular structure.
3. Ribozymes were first discovered in the year 1981 by Cech et.al. in a ciliate protozoa called Tetrahymena thermophile.
4. The common examples of ribozymes are RNase-P and self-splicing group I intron.

Q14. What is the name of the inactive form of pepsin?

Sol. Pepsinogen is the inactive form of Pepsin.

Q15. What are enzyme inhibitors?

Sol. 1. Enzyme Inhibitors are those chemical compounds which decrease or stop the biological activity of enzymes.

2. It is defined as a substance which binds to the enzyme and brings about a decrease in catalytic activity of the enzyme.

3. They may be organic or inorganic in nature."

Q16. What is saturation of enzymes?

Sol. SATURATION OF ENZYMES

1. The point where all the active sites in an enzyme are completely occupied by substrate molecules is meant by saturation of enzymes.

2. Further increase in substance concentration does not increase the rate of chemical reaction.

3. This stage of maximum velocity of the enzyme is called as V_{max} .

Q17. What is denaturation of enzyme?

Sol. DENATURATION OF ENZYMES

1. The permanent loss of tertiary conformation and biological activity of an enzyme at a very high temperature is called as denaturation of enzymes.

2. Denaturation of enzymes is a permanent phenomenon and cannot be reversed.

Q18. Which is the fastest known enzyme?

Sol. The fastest known enzyme is Carbonic anhydrase.

Q19. Which is the slowest known enzyme?

Sol. The slowest known enzyme is Lysozyme.

Q20. What is competitive inhibition?

Sol. COMPETITIVE INHIBITION (ENZYME)

1. In the type of inhibition, the inhibitor shows structural resemblance to the substrate molecules and is regarded as a substrate analogue.

2. The inhibitor competes with the substrate to bind at the active site of the enzyme.
3. When an inhibitor binds to the active site of the enzyme, then a stable enzyme –inhibitor complex is formed and the enzyme activity is reduced.
Enzyme + Inhibitor - - - - - → Enzyme –Inhibitor Complex.
4. As long as the inhibitor occupies the active site, the enzymes is not available for the active site to bind.
5. In competitive inhibition, the value of K_m increase, while V_{max} remains unchanged.
6. Competitive inhibition is a reversible type of inhibition which can be reversed by increasing the substrate concentration.

Example:

A classic example of competitive inhibition is the enzyme Succinate dehydrogenase (SDH) which oxidizes succinic to fumaric acid.

Malonic acid (Malonate) shows succinic acid to fumaric acid and competes with substrate for binding to the active site of Succinate dehydrogenase (SDH).

Q21. The first enzyme to be purified and crystallized was

- (a) Urease
- (b) Diastase
- (c) Insulin
- (d) Zymase

Sol. (a)

Q22. Beadle and Tatum showed that each kind of mutant bread mould they studied lacked a specific enzyme. Their experiments demonstrated that

- (a) Cells need specific enzymes in order to function
- (b) Genes are made of DNA
- (c) Genes carry information for making proteins
- (d) Enzymes are required to repair damaged DNA information

Sol. (c)

Q23. Many enzymes are secreted in inactive form to protect

- (a) Cell Membrane
- (b) Mitochondria
- (c) Cell proteins
- (d) Cell DNA

Sol. (c)

Q24. Most of the members of vitamin B complex act as

- (a) Cofactor
- (b) Coenzyme
- (c) Prosthetic group
- (d) Apoenzyme

Sol. (a)

Q25. Restriction endonuclease is employed for

- (a) Cutting RNA
- (b) Cutting single stranded DNA
- (c) Cutting double stranded DNA
- (d) Joining strands of DNA

Sol. (c)

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