Unit 7 Short Questions

Q.1. Define metabolism. Differentiate between catabolism and anabolism.
Ans. Metabolism
Definition: Metabolism is the sum of all chemical reactions that occur within an organism to sustain life.

Catabolism	**Anabolism**
Definition	**Definition**
It involves the breakdown of complex molecules into simpler ones, releasing energy in the process.	It involves building up complex molecules fron simpler ones. This process consumes energy
Examples	**Examples**
i) Cellular respiration, i.e., oxidation of food (glucose) into and to get energy.	i) Photosynthesis, i.e., conversion of carbon d and water into glucose and oxygen using sunl
ii) Lipolysis, i.e., breakdown of lipids (fats) into fatty acids and glycerol, which can be used for energy production.	ii) Protein synthesis, i.e., formation of proteins amino acids, which are vital for cell structure a function.

Q.2. Which type of metabolism demands input of energy? Give an example.
Ans. Anabolism demands input of energy. Example: Photosynthesis, i.e., conversion of carbon dioxide and water into glucose and oxygen using sunlight.

Q.3. Define an enzyme. What is its role in metabolism?
Ans. Definition:
Enzymes are biological catalysts that speed up chemical reactions in living organisms without being consumed in the process. They are primarily proteins and highly specific to their substrates.
Role:
Enzymes play an important role in controlling cellular metabolism. An enzyme functions by lowering the activation energy of a chemical reaction inside the cells. Activation energy is the minimum amount of energy needed to form or break chemical bonds and convert reactants to products.

Q.4. What is the active site of an enzyme? State its importance in enzyme specificity.
Ans. Only a small portion of the enzyme molecule is directly involved in catalysis. This catalytic region is known as the active site. It recognizes and binds substrates and then carries out biochemical reactions.

Q.5. Provide an example of a specific enzyme-substrate pair.
Ans. The enzyme protease (which breaks peptide bonds in proteins) will not work on starch (which is broken down by the enzyme amylase).

Q.6. How does pH affect enzyme activity?

Ans. Enzymes are sensitive to the hydrogen ion concentration () of the fluid in which they work. They show maximum activity at a specific pH called their optimum pH.

Effect of change in pH:

A change in pH can affect the ionization of the amino acids at the active site of the enzyme. It slows down enzyme activity or blocks it completely. Different enzymes have different optimum pH values. For example, pepsin (working in the stomach) works in an acidic medium (pH 1.5 to 2.0) while trypsin (working in the small intestine) works in an alkaline medium (pH 7.8).

Q.7. Provide two examples of enzymes that operate optimally at specific pH.

Ans. Pepsin (working in the stomach) works in an acidic medium (pH 1.5 to 2.0) while trypsin (working in the small intestine) works in an alkaline medium (pH 7.8).

Q.8. What do you mean by optimum temperature and pH?

Ans. Optimum temperature:

Each enzyme works at a maximum rate at a specific temperature called its optimum temperature. The optimum temperature for most human enzymes is .

Optimum pH:

Optimum pH is the specific pH at which an enzyme shows maximum activity. The pH scale measures how acidic or basic a substance or solution is, ranging from 0 to 14, with 7 being neutral.

Q.9. Which type of enzyme inhibitors inhibit the enzymes without attaching to the active site?

Ans. Non-competitive inhibitors do not attach to the active site of an enzyme. Rather, they attach to some other location on the enzyme.

Q.10. Differentiate between competitive and non-competitive inhibition.

Ans.

i. Competitive Inhibition

- **Introduction:** Some inhibitors resemble the enzyme's substrate. They compete with the substrate to attach to the active site of the enzyme. When the inhibitor is attached to the active site, it blocks it and does not allow the substrate to attach.
- **Examples:** Examples of competitive inhibitors are antibiotics. The antibiotic molecules compete with the substrates of bacterial enzymes. They attach to bacterial enzymes and inhibit them.

ii. Non-Competitive Inhibition

- **Introduction:** Some enzyme inhibitors do not have similarity to the substrate. They do not attach to the active site of the enzyme. Rather, they attach to some other location on the enzyme. This attachment changes the overall shape of the enzyme and the active site. So, this changed active site does not fit the substrate, and the enzyme is inhibited.
- **Examples:** Heavy metals like mercury and certain drugs used in cancer therapy.

Short Answer Questions (Additional)

Q.11. Why are enzymes called biological catalysts?

Ans. Enzymes are known as biocatalysts because they speed up and regulate the metabolic pathways in living organisms. Enzymes are mostly proteins that catalyze a chemical reaction in our body. They function as catalysts that speed up the reaction by lowering the activation energy.

Q.12. Why are enzymes specific and why can't each one speed up many different reactions?
Ans. Each enzyme is specific to a chemical reaction as it contains an active site which is the area of the enzyme that has a specific shape which differs from one enzyme to another.

Q.13. Why is a small quantity of enzyme enough for catalyzing a large number of substrate molecules into products?
Ans. Because enzymes have a high capability to convert giant quantities of substrate into product. Enzymes increase the rate of reaction and remain unaffected by the reaction which is being catalyzed.

Q.14. Define co-factors. Give two examples.
Ans. Some enzymes require non-protein molecules or ions to work; these molecules or ions are called cofactors. Cofactors can either be inorganic (e.g., metal ions like and) or organic (e.g., flavin and heme).

Q.15. What do you mean by saturation of active sites?
Ans. When all the active sites of the enzymes are occupied (at high substrate concentration) and adding more substrate molecules do not find free active sites, this state is called saturation of active sites and the reaction rate does not increase.

Q.16. Write the difference between:
a) Catalyst and enzyme
b) Intracellular and extracellular enzymes
Ans.
a) Catalyst and Enzyme

Catalyst	**Enzyme**
A catalyst is a substance that increases the rate of a chemical reaction without undergoing permanent change during the reaction.	Enzymes are proteins that speed up bioch reactions without being consumed during reaction.

b) Intracellular and Extracellular Enzymes

Intracellular Enzymes	**Extracellular Enzymes**
Enzymes which remain inside the cell to speed up the reaction are called intracellular enzymes. Example: Enzymes of glycolysis working in the cytoplasm.	Enzymes that work outside the cell are calle extracellular enzymes. Example: Pepsin enz working in the stomach cavity.

Mechanism of Enzyme Action
Q.17. According to the induced fit model, the active site is flexible. Does it mean that any substrate can attach with this flexible active site? If not, then explain.

Ans. Enzymes are very specific for the substrate. One enzyme can act on a particular substrate because active sites possess specific geometric shapes that fit with specific substrates. According to the induced fit model, the active site is slightly flexible but not flexible enough that any substrate can attach with the active site.

Q.18. Describe the lock and key model of enzyme action.

Ans. Emil Fischer proposed the lock and key model of enzyme action. The active site has a particular rigid shape into which the specific substrate fits exactly. The substrate is imagined as being like a key whose shape is complementary to the enzyme (lock). Once the product is formed, it no longer fits into the active site and escapes into the surrounding medium. The active site is free to combine again with another substrate molecule.

Q.19. Name the factors affecting enzyme activity.

Ans. The factors affecting enzyme activity are:

1. Temperature
2. Substrate Concentration
3. pH

Q.20. What happens to an enzyme when it is frozen below ?

Ans. At very low temperatures (below), the enzyme remains inactive due to a fall in available activation energy.

Q.21. Which protein-digesting enzyme functions in an acidic medium?

Ans. Pepsin is a protein-digesting enzyme which functions in an acidic medium (pH 1.5 to 2.0).