

BIOLOGY - Optional extension task

Please read through the text and answer the questions below.

Enzymes are proteins which act as biology catalysts, speeding up the rate of chemical reactions. They do this by lowering the activation energy. This is the energy needed to start a chemical reaction. Enzymes have a very specific structure which allows them to bind to a substrate. There are two theories that explain how this happens. The first is the lock and key theory. This states that the active site of an enzyme is exactly complementary to the substrate and therefore the substrate will bind. The other theory is the induced fit theory which states that the enzymes active site will change shape slightly to mould around the substrate once it binds. There are several factors which can affect the rate at which enzymes function. Temperature and pH are two of these factors. If the temperature becomes too high the enzymes may denature. This means that the active site changes shape so the substrate can no longer bind and the reaction can no longer be catalysed. pH has a similar impact but can cause an enzyme to denature if it is too high or low. Substrate and enzyme concentration can also impact the rate along with the presence of an inhibitor. There are two types of inhibitor, competitive and non-competitive. A competitive inhibitor has a similar shape to the substrate so will bind to the enzymes active site, blocking it so the substrate can no longer bind. A non-competitive inhibitor will bind to the allosteric site (a site which isn't the active site) and change the shape of the active site so that the substrate can no longer bind.

1. What role do enzymes play in chemical reactions, and how do they achieve this?
2. Explain the concept of activation energy and its significance in the context of enzyme function.
3. Describe the lock and key theory of enzyme activity. How does this theory illustrate the relationship between an enzyme and its substrate?
4. Contrast the lock and key theory with the induced fit theory. What are the key differences between these two theories?

5. How do temperature and pH affect enzyme activity according to the text? Provide specific examples.

6. What does it mean for an enzyme to denature, and what are the consequences of this process on enzyme activity?

7. Define competitive and non-competitive inhibitors. How does each type affect the enzyme's ability to catalyse a reaction?

8. Why might substrate and enzyme concentration impact the rate of enzyme reactions?

9. Discuss the significance of the allosteric site in non-competitive inhibition. How does binding at this site influence enzyme function?

10. Based on the information presented, why is it important to understand the factors that affect enzyme activity in biological systems?