AP Bio Lab #13 PreLab - Enzyme Activity

1. Give an overview of what we will be doing in this lab.

In this lab we will be acting as enzymes, who must break toothpicks. There will be three parts, each of which offers different conditions for the "enzyme". Each part will be timed in 10 second intervals for one minute and questions will be answered along with the lab.

2. Use yar text and explain what it means to be a catalyst.

A catalyst speeds up chemical reactions, without being consumed. The catalyst brings the reactants of a chemical reaction closer together, so they can be broken or put together and therefore used in the reaction. The catalyst is what allows reactions to occur in ar bodies.

3. Explain what this equation means: $E + S \longrightarrow ES \longrightarrow E + P$

This equation represents the substrate (S) binding to the enzyme (E) and forming an enzyme-substrate complex (ES), which produces the product (P) and releases the enzyme to be used again.

4. Identify the enzyme, substrate, and products in ar experiment.

The enzyme in the experiment is the person who breaks the toothpicks, the substrate is the toothpicks, and the products are the two broken parts of the toothpicks.

5. Explain how salt might affect an enzyme.

If the salt concentration is too low, the enzyme's charged amino acid side chains will attract to each other, causing denaturation. If it is too high, normal interaction of these groups will be inhibited, and the enzyme will not function. Either way, the enzyme could denature.

6. Explain how pH might affect an enzyme.

As pH rises, enzymes lose H^+ ions and as pH falls, enzymes accept H^+ ions. If the change in pH is drastic, the protein's conformation can be disrupted, meaning it will not function properly.

7. Explain how temperature affects enzymes.

As temperature rises, the rate of reaction increases, up to a certain point. Then the enzyme does not act as efficiently and the shape of it changes. This has a negative effect on the enzyme.

8. Explain how activators and inhibitors affect enzymes.

An activator is a molecule that speeds up the rate of reaction by binding with the enzyme and an inhibitor is one that slows down the rate of reaction by unfolding the enzyme or destabilizing it.

9. Why is the initial reaction rate usually faster than the rate as the reaction proceeds?

The initial rate of reaction is usually faster because there are many more reactant molecules that collide and react faster, than towards the end of a reaction, when there are fewer reactants.

10. What is the formula for determining initial rate of reaction?

$$\text{initial rate} = \frac{\text{amount of product}}{\text{time}}$$

11. Explain in words what the formula means.

The initial reaction rate can be calculated by dividing the amount of the product by the time.

12. In our experiment, what will we measure to determine the rate of reaction?

The time it takes to make a certain amount of product (broken toothpicks) will be measured, as will the number of toothpicks broken.

13. If catalase is added to hydrogen peroxide, how will it be apparent that a reaction is taking place?

The solution will become bubbly after catalase is added.

14. What causes the bubbling?

Since catalase breaks hydrogen peroxide down into oxygen and water, the bubbles that can be observed when catalase is added are pure oxygen bubbles.

15. What do you expect might happen if catalase is boiled?

Since catalase is an enzyme, it does not usually thrive at high temperatures. If it becomes too hot, the enzyme will denature and cease to function.

16. Name several substances/materials/things that would be expected to contain catalase.

Many living organisms contain catalase, so things like apple, potato, carrots, and organs like the liver contain catalase.