

Trypsin is a protease enzyme found in the human stomach. The graph below shows the effect of temperature on the rate of breakdown of protein by trypsin. Use the data from the graph to help explain why temperature affects the activity of trypsin.

Firstly, enzymes catalyse chemical reactions and to achieve this they have an active site where the substrate fits perfectly into and breaks it into the products. Enzymes are specific (lock and key theory). The graph clearly shows that as the temperature increases the activity of the enzyme increases- it gets faster. This is because as the temperature increases the enzyme and substrate are moving increasingly faster causing more collisions per second between the substrate and the active site of the enzyme. This can be evident in trypsin between around 10-40°C. However, at around 45°C there is a noticeable change. At a certain temperature, the enzyme is working at the fastest possible rate (optimum temperature) and in this case the temperature is around 45°C. At this point, it is the maximum frequency of successful collisions between the substrate and the active site. Now, if you increase the temperature past the optimum temperature, the relative activity rapidly decreases to 0. This is because at high temperatures, the enzyme molecule denatures- the shape of its active site changes due to the molecule vibrating. This means that the substrate no longer fits perfectly into the active site and the enzyme can no longer catalyse the reaction. The graph supports this as it shows that trypsin follows all of these steps.

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