PH optimum

Lipase (pancreas)	8.0
Lipase (stomach)	4.0-5.0
Lipase (castor oil	4.7
Pepsin	1.5-1.6
Trypin	7.8-8.7
Urease	7.0
Invertase	4.5
Maltase	6.1-6.8
Amylase (pancreas)	6.7-7.0
Amylase (malt)	4.6-5.2
Catalase	7.0

Enzyme inhibitor

• Enzyme Inhibitors reduce the rate of an enzyme catalysed reaction by interfering with the enzyme in some way. This effect may be permanent or temporary.
• Competitive Enzyme Inhibitors work by preventing the formation of Enzyme-Substrate Complexes because they have a similar shape to the substrate molecule.
• This means that they fit into the Active Site, but remain unreacted since they have a different structure to the substrate. Therefore less substrate molecules can bind to the enzymes so the reaction rate is decreased.
• Competitive Inhibition is usually temporary, and the Inhibitor eventually leaves the enzyme. This means that the level of inhibition depends on the relative concentrations of substrate and Inhibitor, since they are competing for places in enzyme Active Sites.

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Enzyme inhibitor (cont)

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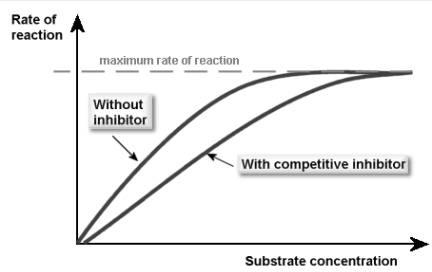
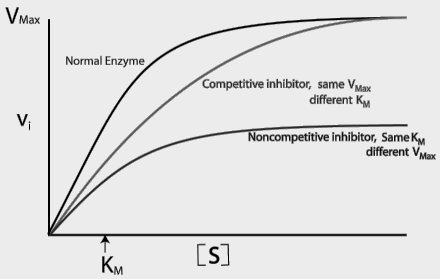
Enzyme inhibitor



Enzyme inhibitor- non competitive

• Non-competitive Enzyme Inhibitors work not by preventing the formation of Enzyme-Substrate Complexes, but by preventing the formation of Enzyme-Product Complexes. So they prevent the substrate from reacting to form product.
• Usually, Non-competitive Inhibitors bind to a site other than the Active Site, called an Allosteric Site. Doing so distorts the 3D Tertiary structure of the enzyme, such that it can no longer catalyse a reaction.
• Since they do not compete with substrate molecules, Non-competitive Inhibitors are not affected by substrate concentration.

Non-competitive inhibition



Variables

Controlled variable	Temperature, size of the liver, amount of hydrogen peroxide (5mL) timing and test-tube size
Independant variable	PH, presence of hydrogen peroxide
Dependant variable	rate of reaction, height of bubbles, gas given off

Basic functions

Enzymes are proteins that do the everyday work within a cell. Their basic function is to speed up the process and efficiency of a reaction without themselves being consumed in the process. Enzymes are responsible for moving large parts of a cell's internal structure, such as pulling chromosomes apart when a cell divides. Enzymes make the energy molecules that are constantly needed for the cell to survive. And they break down molecules, recycle the old parts and make new molecules that allow the cell to grow.. Enzymes are catalysts, meaning they speed up the rate at which reactants interact to form products in a chemical reaction, while not being consumed in the reaction. They physically combine chemical reactants in a way that lowers the energy required for bonds to break and new bonds to form, making the formation of a product much faster.

Basic functions (cont)

They lower what is called the activation energy of the reaction, or the amount of energy required for a hybrid of the reactants and products to form. The hybrid then becomes the product. Without enzymes, these chemical reactions would proceed at a rate that is hundreds to thousands of times slower..

Concentration inhibition

• Changing the Enzyme and Substrate concentrations affect the rate of reaction of an enzyme-catalysed reaction. Controlling these factors in a cell is one way that an organism regulates its enzyme activity and so it's Metabolism.
• Changing the concentration of a substance only affects the rate of reaction if it is the limiting factor: that is, it the factor that is stopping a reaction from preceding at a higher rate.
• If it is the limiting factor, increasing concentration will increase the rate of reaction up to a point, after which any increase will not affect the rate of reaction. This is because it will no longer be the limiting factor and another factor will be limiting the maximum rate of reaction.
• As a reaction proceeds, the rate of reaction will decrease, since the Substrate will get used up. The highest rate of reaction, known as the Initial Reaction Rate is the maximum reaction rate for an enzyme in an experimental situation.
Substrate Concentration
• Increasing Substrate Concentration increases the rate of reaction. This is because more substrate molecules will be colliding with enzyme molecules, so more product will be formed.
• However, after a certain concentration, any increase will have no effect on the rate of reaction, since Substrate Concentration will no longer be the limiting factor. The enzymes will effectively become saturated, and will be working at their maximum possible rate.
Enzyme Concentration

Concentration inhibition (cont)

• Increasing Enzyme Concentration will increase the rate of reaction, as more enzymes will be colliding with substrate molecules.
• However, this too will only have an effect up to a certain concentration, where the Enzyme Concentration is no longer the limiting factor.

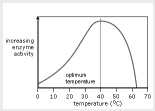
pH affecting enzymes

• Acid solutions have pH values below 7, and Basic solutions (alkalis are bases) have pH values above 7. Deionised water is pH7, which is termed 'neutral'.
• H+ and OH- Ions are charged and therefore interfere with Hydrogen and Ionic bonds that hold together an enzyme, since they will be attracted or repelled by the charges created by the bonds. This interference causes a change in shape of the enzyme, and importantly, it's Active Site.
• Different enzymes have different Optimum pH values. This is the pH value at which the bonds within them are influenced by H+ and OH- Ions in such a way that the shape of their Active Site is the most Complementary to the shape of their Substrate. At the Optimum pH, the rate of reaction is at an optimum.
• Any change in pH above or below the Optimum will quickly cause a decrease in the rate of reaction, since more of the enzyme molecules will have Active Sites whose shapes are not (or at least are less)Complementary to the shape of their substrate.

Enzyme inhibitor

• Many Non-competitive Inhibitors are irreversible and permanent, and effectively denature the enzymes which they inhibit. However, there are a lot of non-permanent and reversible Non-competitive Inhibitors which are vital in controlling Metabolic functions in organisms.
• Enzyme Inhibitors by organisms are used in controlling metabolic reactions. This allows product to be produced in very specific amounts.

Temperature affecting enzymes graph



PH affecting enzymes graph

Temperature affecting enzymes

• Increasing temperature increases the Kinetic Energy that molecules possess. In a fluid, this means that there are more random collisions between molecules per unit time.
• Since enzymes catalyse reactions by randomly colliding with Substrate molecules, increasing temperature increases the rate of reaction, forming more product.
• However, increasing temperature also increases the Vibrational Energy that molecules have, specifically in this case enzyme molecules, which puts strain on the bonds that hold them together.
• As temperature increases, more bonds, especially the weaker Hydrogen and Ionic bonds, will break as a result of this strain. Breaking bonds within the enzyme will cause the Active Site to change shape.
• This change in shape means that the Active Site is less complementary to the shape of the Substrate, so that it is less likely to catalyse the reaction. Eventually, the enzyme will become denatured and will no longer function.
• As temperature increases, more enzymes' molecules' Active Sites' shapes will be less complementary to the shape of their Substrate, and more enzymes will be denatured. This will decrease the rate of reaction.
• In summary, as temperature increases, initially the rate of reaction will increase, because of increased Kinetic Energy. However, the effect of bond breaking will become greater and greater, and the rate of reaction will begin to decrease.