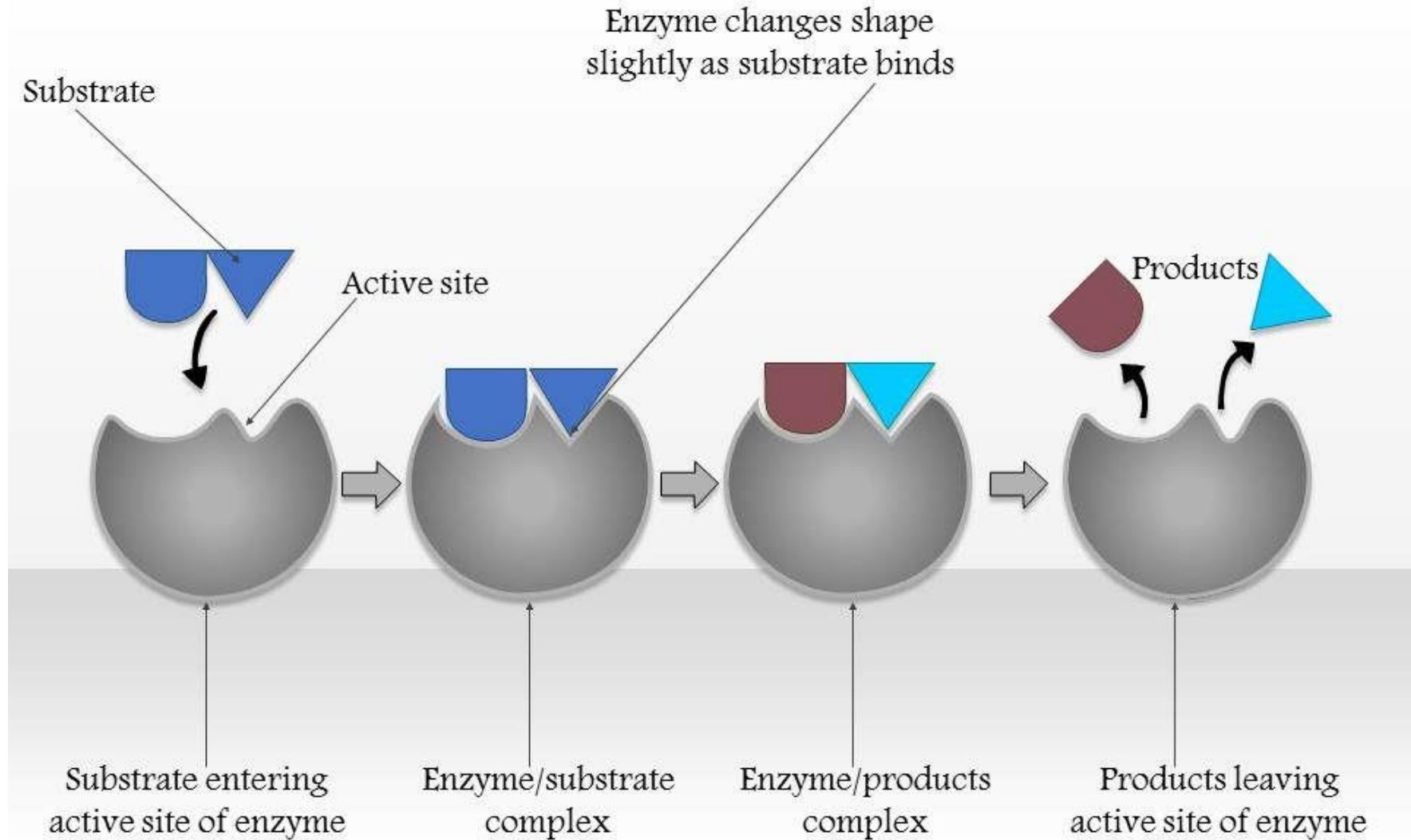




# MECHANISM OF ENZYME ACTION

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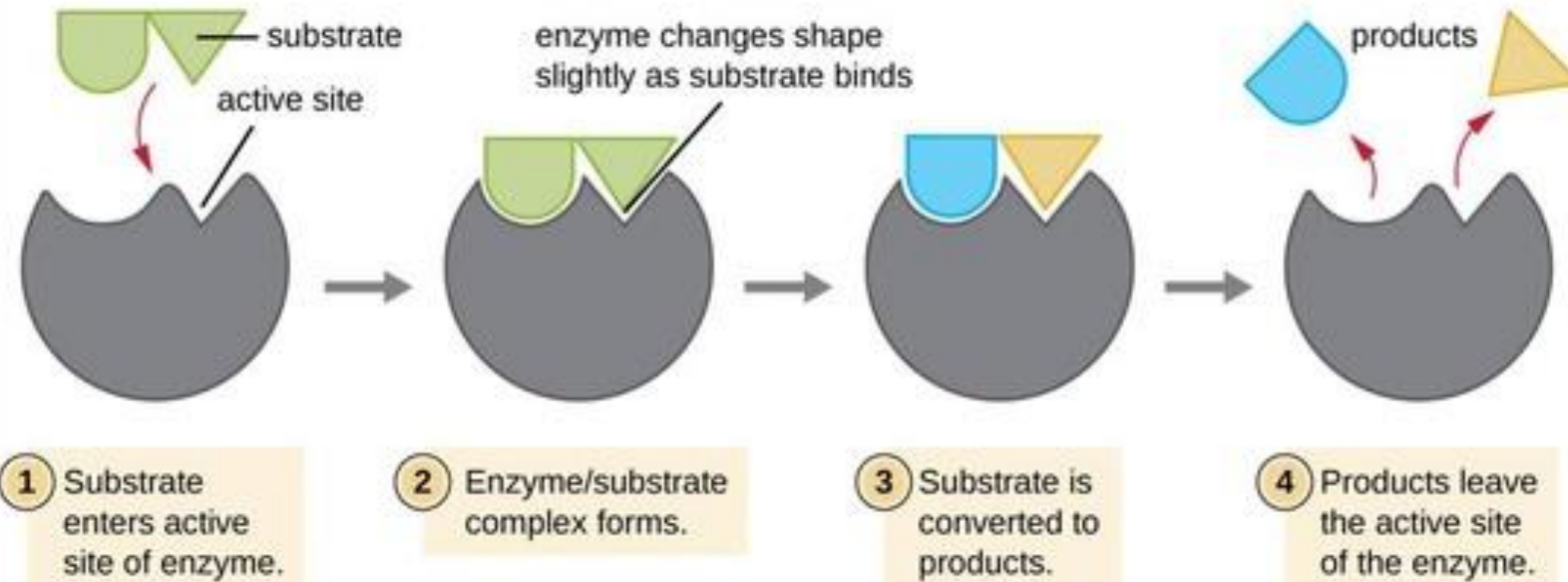
# The Mechanism of enzyme action



# LOCK AND KEY HYPOTHESIS

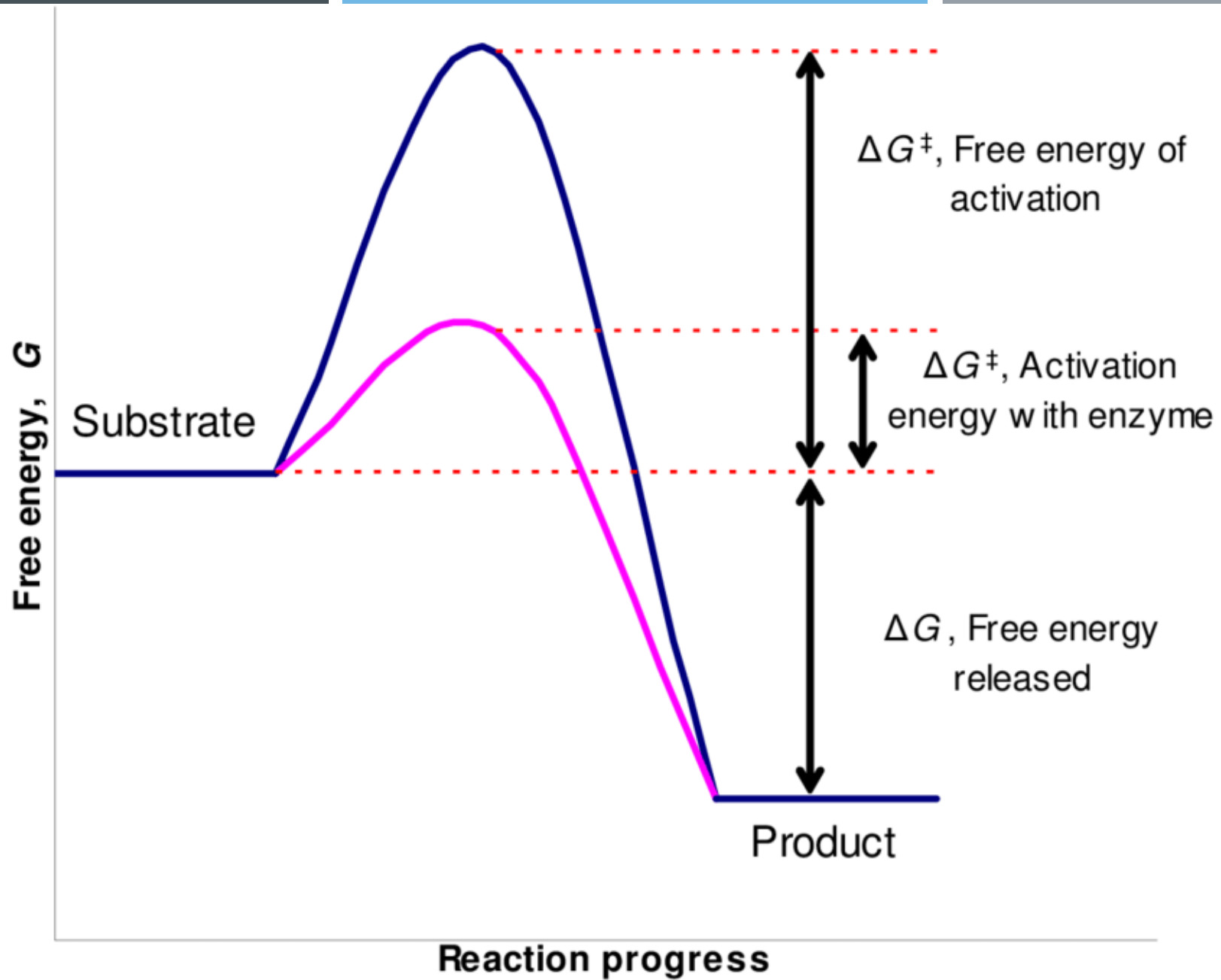
- Enzymes are very specific and it was suggested by Fischer in 1890 that this was because the enzyme had a particular shape into which the substrate or substrates fit exactly. This is often referred to as **Lock and Key hypothesis**.
- **Lock and Key model:**
  - According to this model, the shape of the active site of an enzyme is complementary to the shape of substrate molecules. I.e. the substrate is like a key whose shape is complementary to the enzyme which is supposed to be a lock and they fit perfectly.
  - Enzymes catalyze only those substrates which fit perfectly on the active site of that enzyme.
  - Most enzymes are far larger than the substrate molecules that act on and the active site is usually a very small portion of the enzyme, between 3 and 12 amino acids. The remaining amino acids which make up the bulk of the enzyme, function to maintain the correct globular shape of the enzyme.
  - Once the product is formed, they no longer fit into the active site and escape into the surrounding medium.
  - According to the lock and key model, enzymes behave as rigid molecules. However, most enzymes are globular and are flexible with varying shapes.

# INDUCED FIT MODEL



# INDUCED FIT MODEL

- In 1959, **Koshland** suggested a modification to the 'Lock and Key' hypothesis which is known as 'Induced fit' hypothesis.
- Working from evidence that suggested that some enzymes and their active site are more flexible. To this, he proposed that the active site can modify its shape as the substrate interact with the enzyme.
- The amino acids which make up the active site are moulded into precise shape which enable the enzyme to perform its catalytic function most efficiently.
- For instance, a suitable analogy to describe Induced fit model would be that of a hand changing the shape of the glove as the individual put on the glove. Therefore in this case, glove is the active site of enzyme and the hand is substrate.
- However, in some cases, the substrate molecules changes slightly as it enters the active site before binding



# HOW ENZYME CATALYSE A REACTION?

- Enzymes are catalyst that accelerate the rate of biochemical reaction by decreasing the energy of activation.
- Every chemical reaction have energy barrier that must be crossed by the reactant molecules in order to convert itself into the product.
- The amount of energy supplied to reactant molecules in order to cross the energy barrier to from product is known as Energy of activation.
- If energy of activation is higher, rate of reaction is slower and if it is lower, the rate of reaction is faster.
- The role of enzyme in biochemical reaction is to reduce the amount of energy of activation such that the rate of reaction increases.
- During enzyme catalysis, active site of enzyme binds with substrate molecules to form Enzyme-substrate (ES) complex. During this binding some binding energy is released which is utilized to activate the substrate (reactant) molecules to form product. Thus the requirement of the amount of activation energy is decreased such that rate of reaction increases. The amount of activation decrease is equal to the amount of binding energy released during binding of enzyme and substrate.



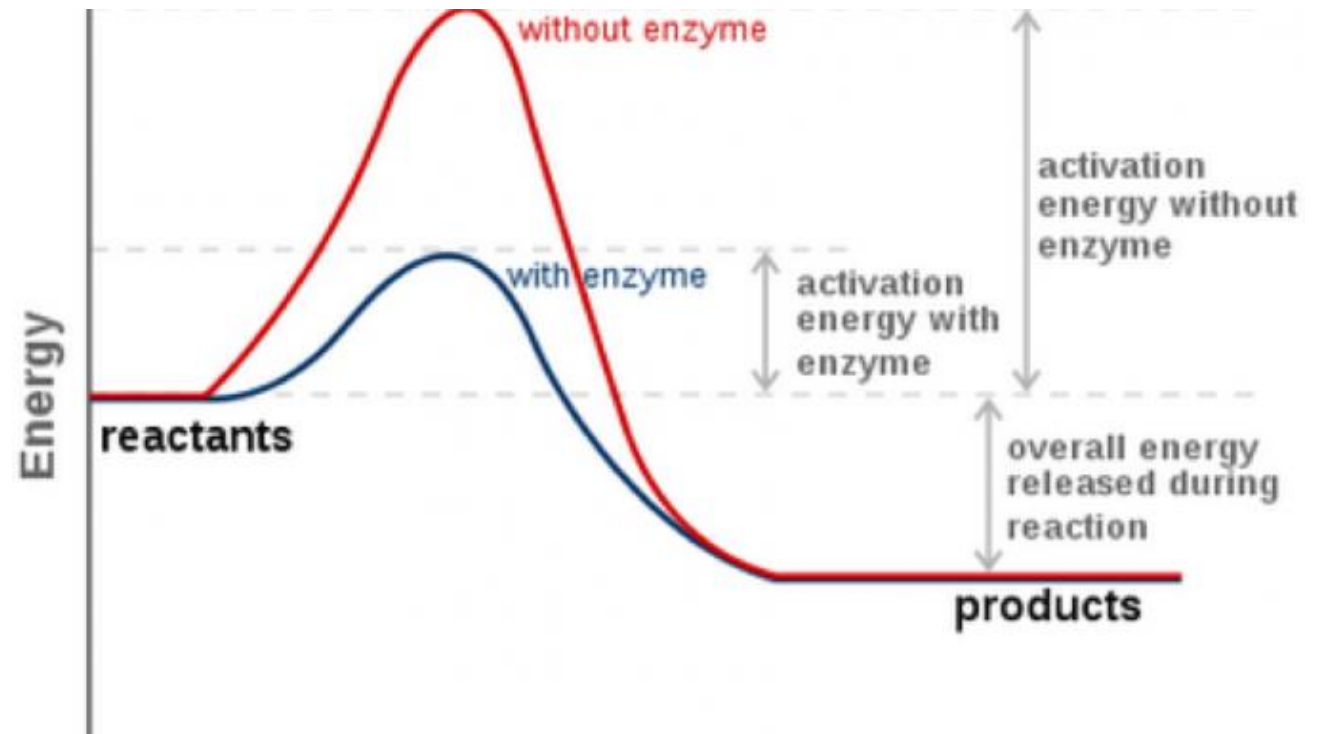
# **RATE OF ENZYME REACTIONS**





## RATE OF ENZYME REACTIONS

- The rate of enzyme reaction is measured by the amount of substrate changed or amount of product formed during a period of time.
- The rate is determined by measuring the slope of the tangent to the curve in the initial stage of the reaction. The steeper the slope, the greater is the rate.
- If enzyme activity is measured over a period of time, the rate of reaction usually falls, most commonly as a result of a fall in the substrate concentration.





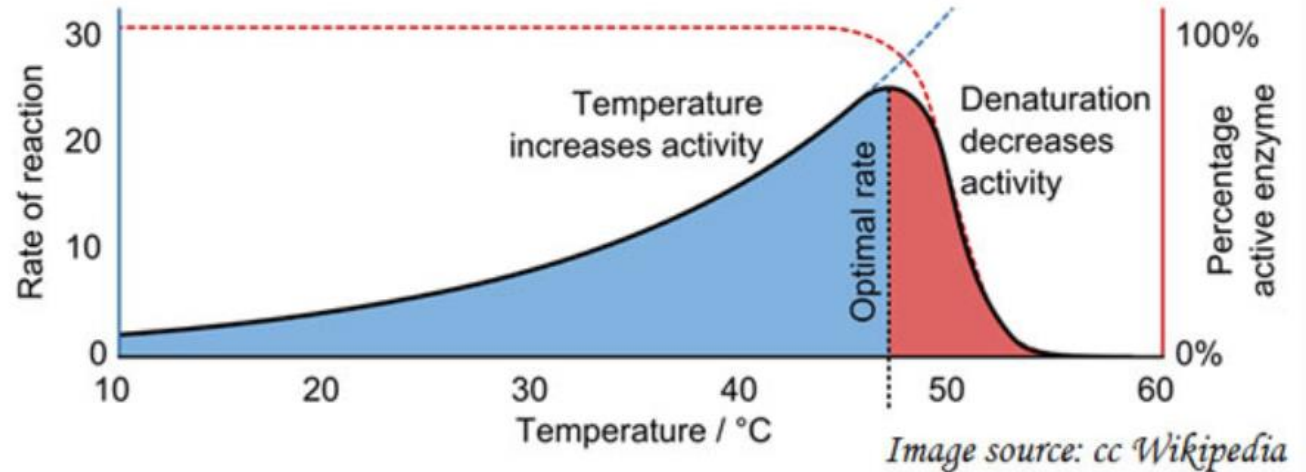
# **FACTORS AFFECTING THE RATE OF ENZYME REACTIONS**



# TEMPERATURE

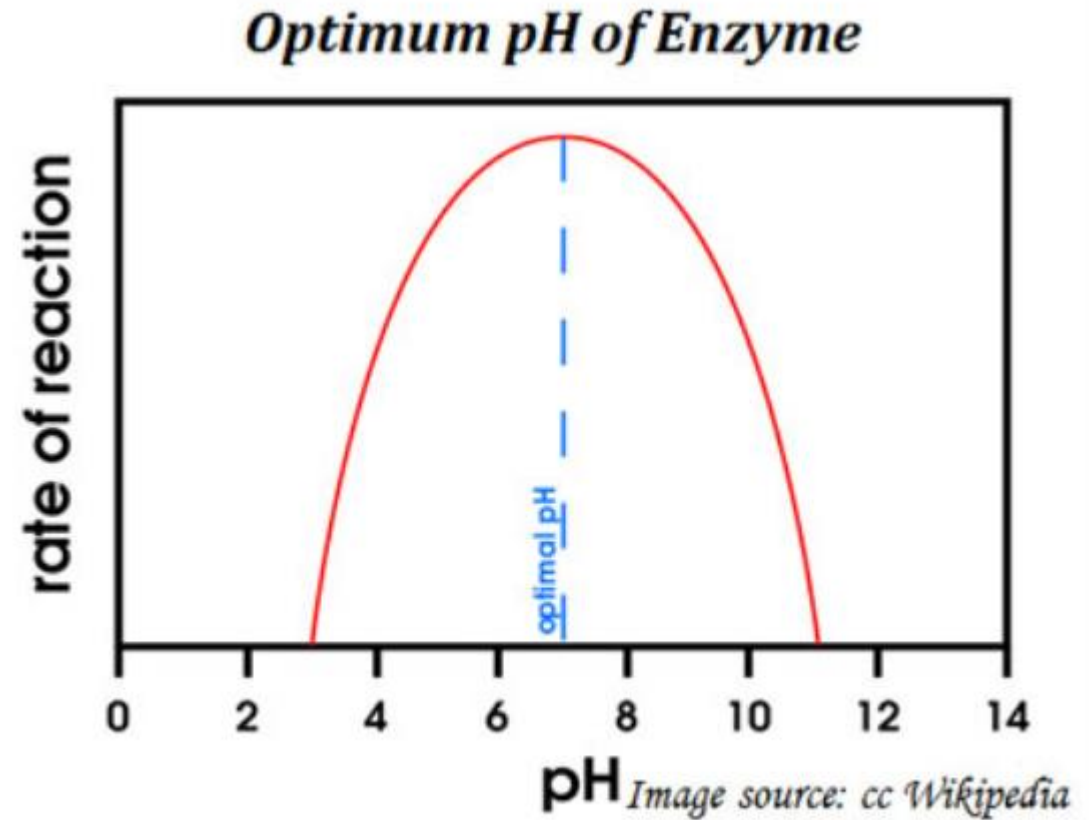
Temperature: Raising temperature generally speeds up a reaction, and lowering temperature slows down a reaction. However, extreme high temperatures can cause an enzyme to lose its shape (denature) and stop working.

### Optimum Temperature of Enzyme



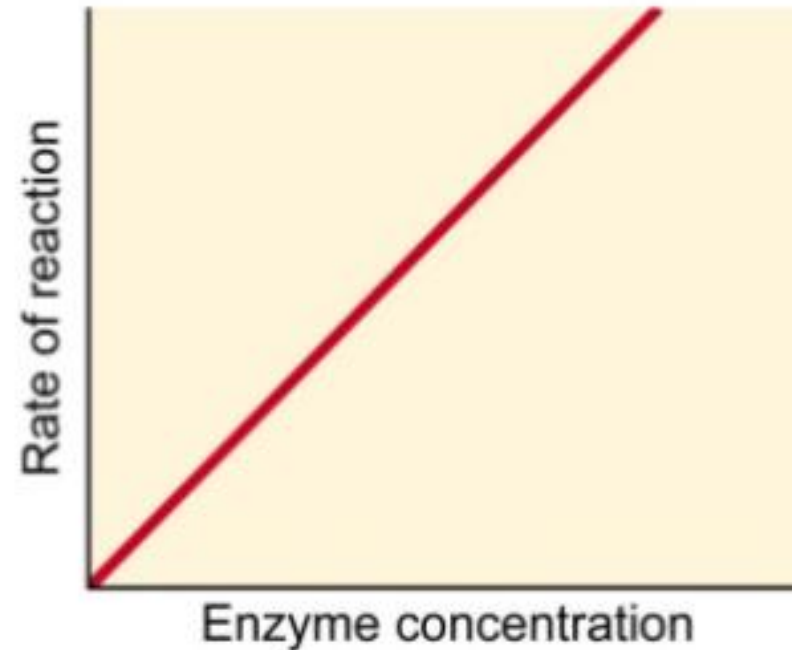
## PH

pH: Each enzyme has an optimum pH range. Changing the pH outside of this range will slow enzyme activity. Extreme pH values can cause enzymes to denature.



## ENZYME CONCENTRATION

Enzyme concentration:  
Increasing enzyme concentration will speed up the reaction, as long as there is substrate available to bind to. Once all of the substrate is bound, the reaction will no longer speed up, since there will be nothing for additional enzymes to bind to.



## SUBSTRATE CONCENTRATION

Substrate concentration: Increasing substrate concentration also increases the rate of reaction to a certain point. Once all of the enzymes have bound, any substrate increase will have no effect on the rate of reaction, as the available enzymes will be saturated and working at their maximum rate.

