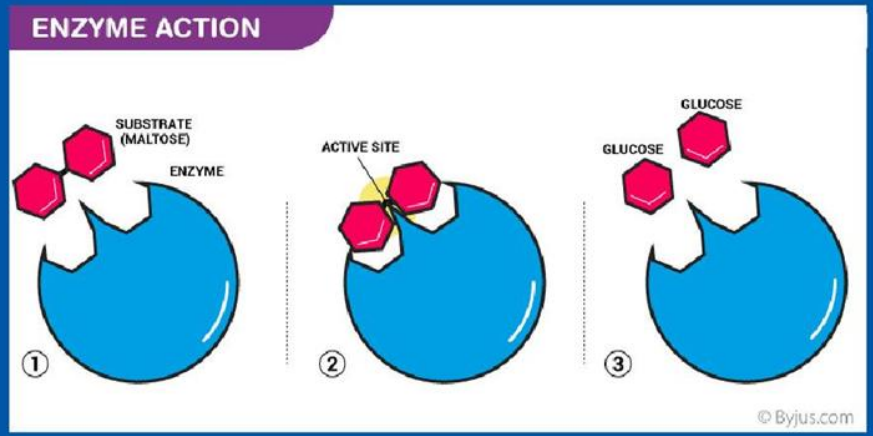
ENZYMES II

MISSION MBBS | NEET 2024

BIOMOLECULES - L7



CLASS 11 | ZOOLOGY

PUSHPENDU SIR

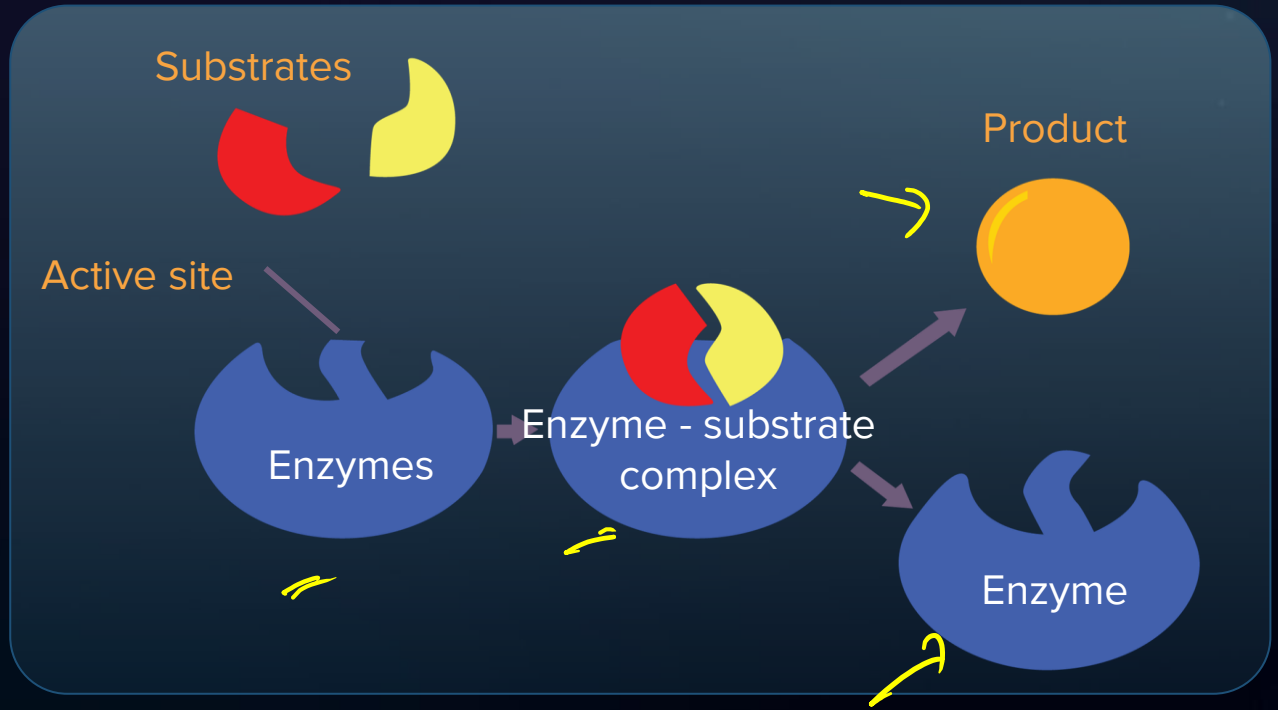
MISSION MBBS

MONDAY TO FRIDAY
4 PM - 8 PM

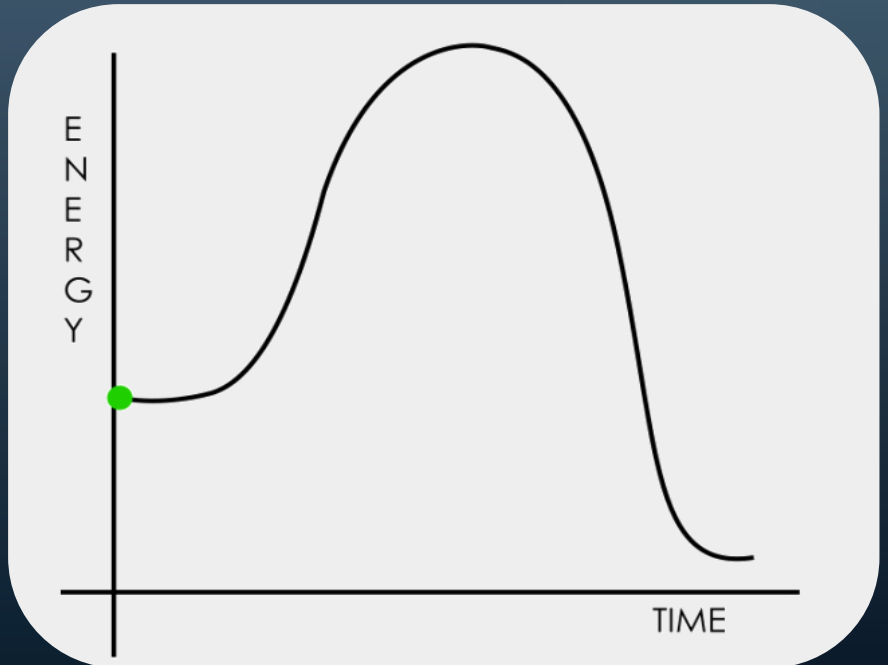
PUSHPENDU SIR	SACHIN SIR	VIVEK SIR	PANKHURI MA'AM	ANUSHRI MA'AM
ZOOLOGY	ZOOLOGY	CHEMISTRY	BOTANY	PHYSICS

Enzymes

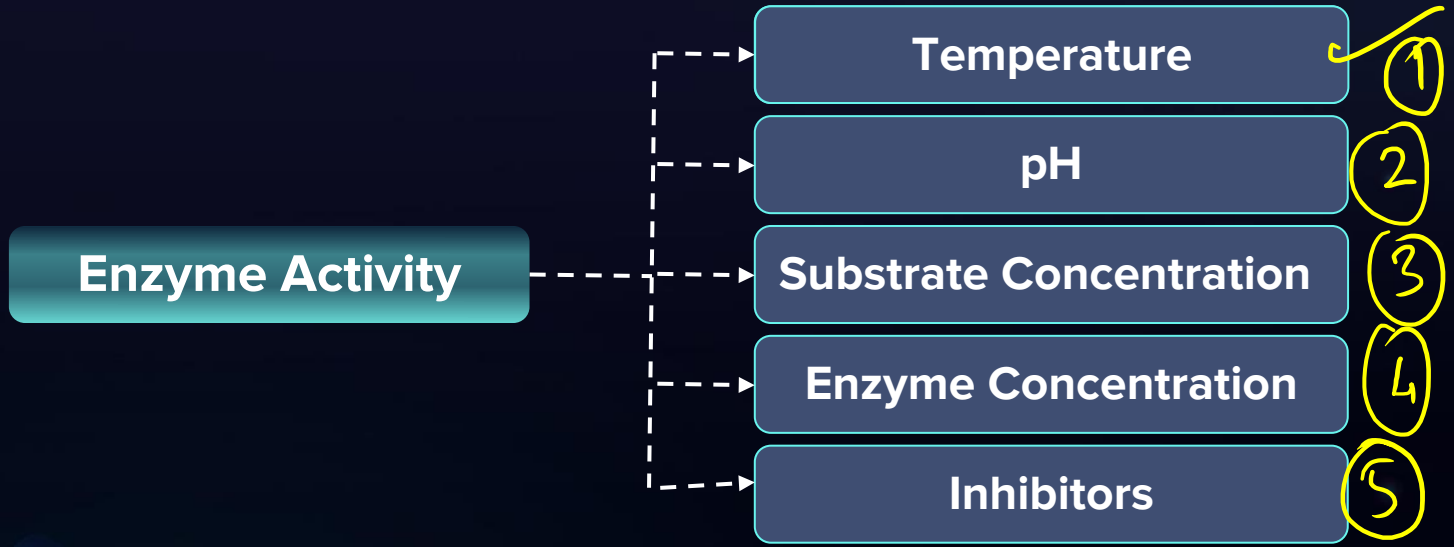
Recall! Enzymes



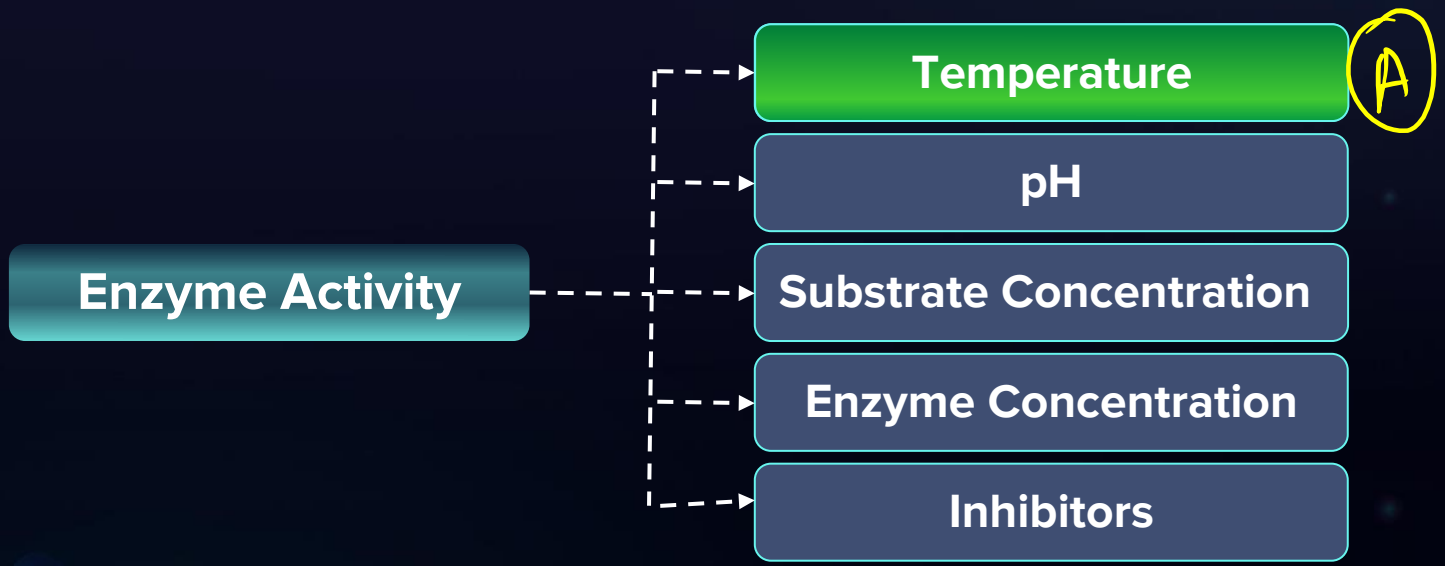
Recall! Enzymes



Factors Affecting Enzyme Activity



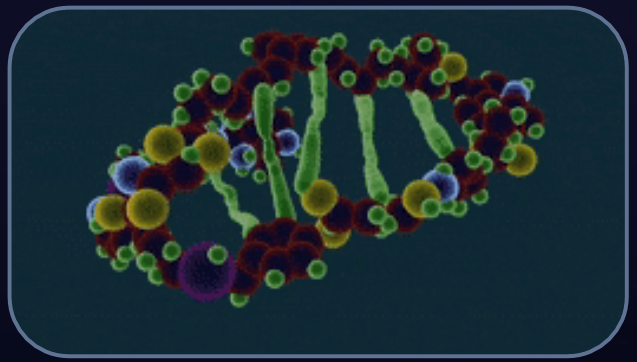
Factors Affecting Enzyme Activity



Temperature

- Narrow range of temperatures at which enzymes are active
- **Optimum temperature:** Temperature at which activity is maximum

Temperature



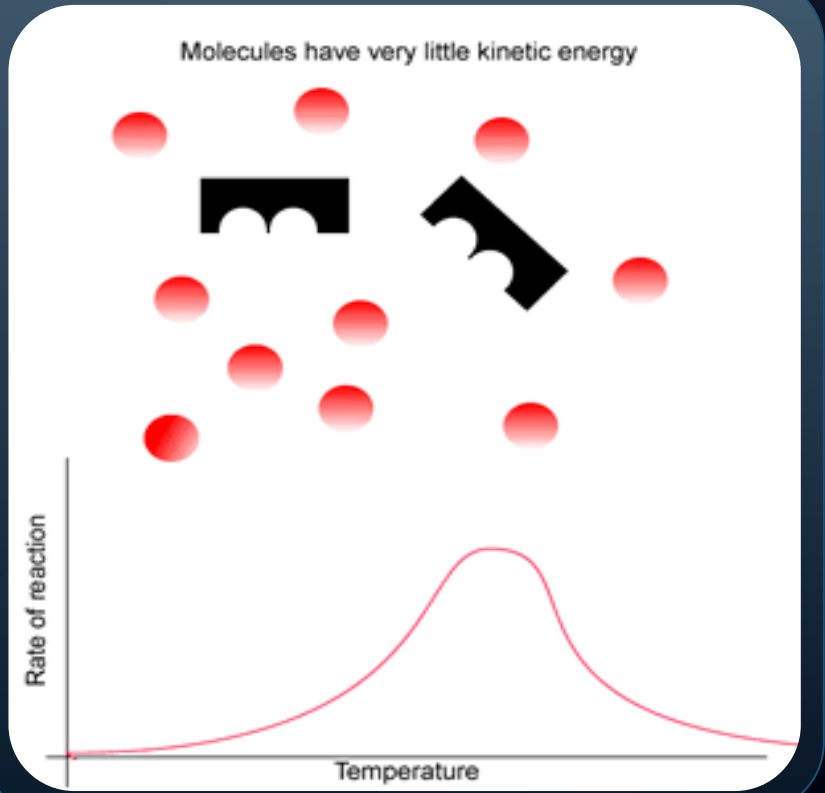
High temperature:

Denaturation

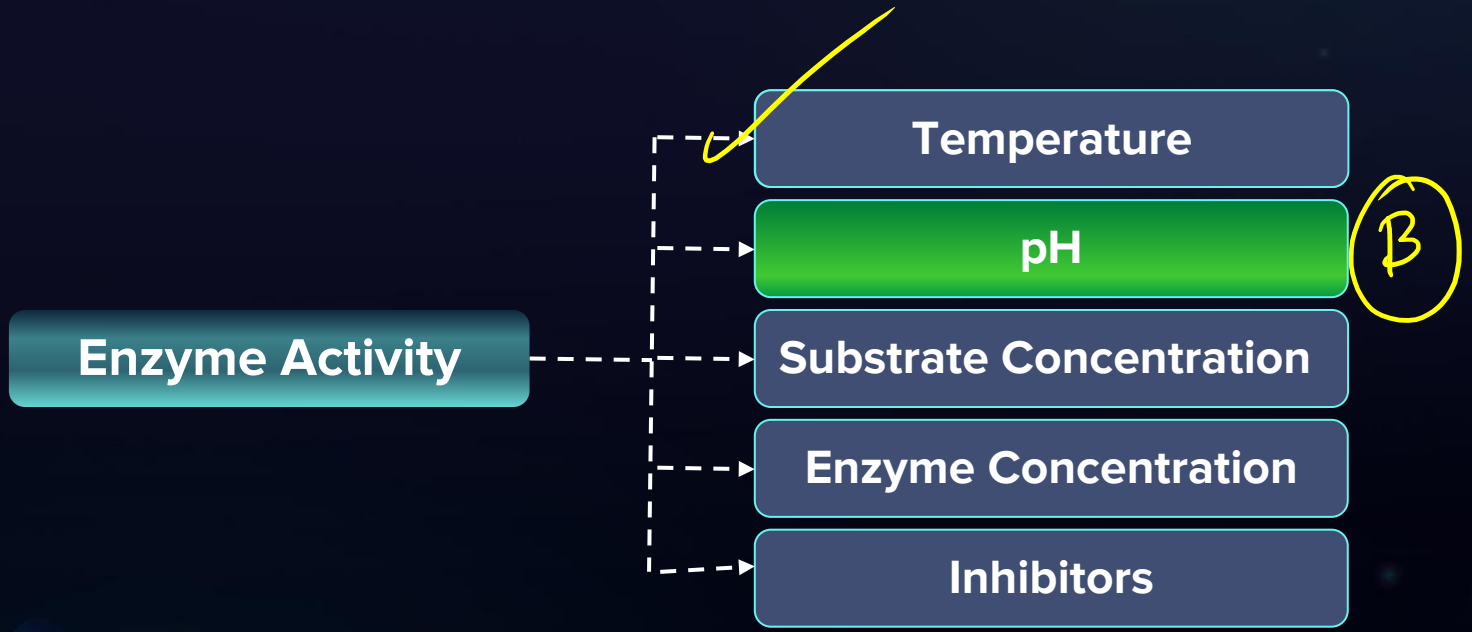
Low temperature:

Temporary inactive state

Temperature

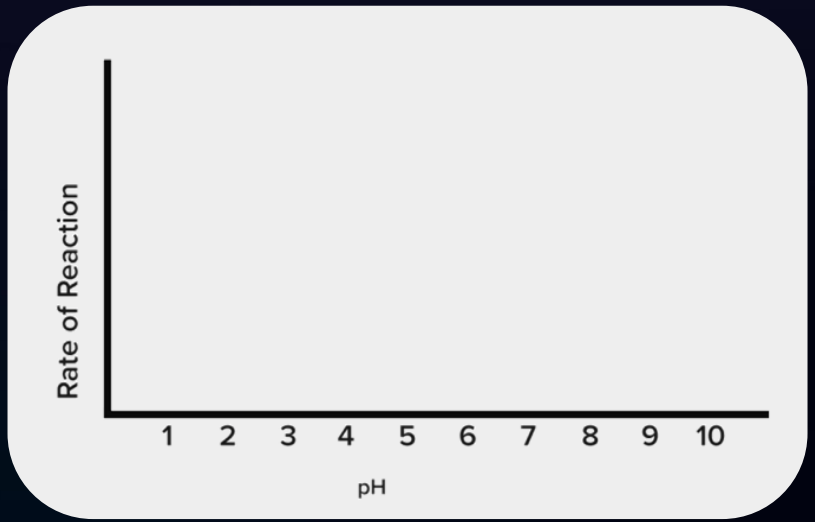


Factors Affecting Enzyme Activity

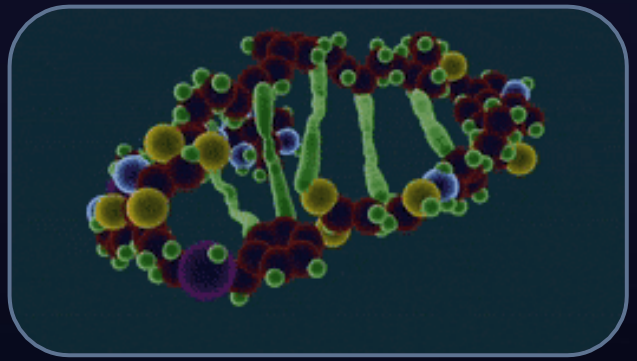


pH

- Enzymes are **sensitive to pH**
- Narrow range of pH at which enzymes are active
- **Optimum pH**: Maximum activity



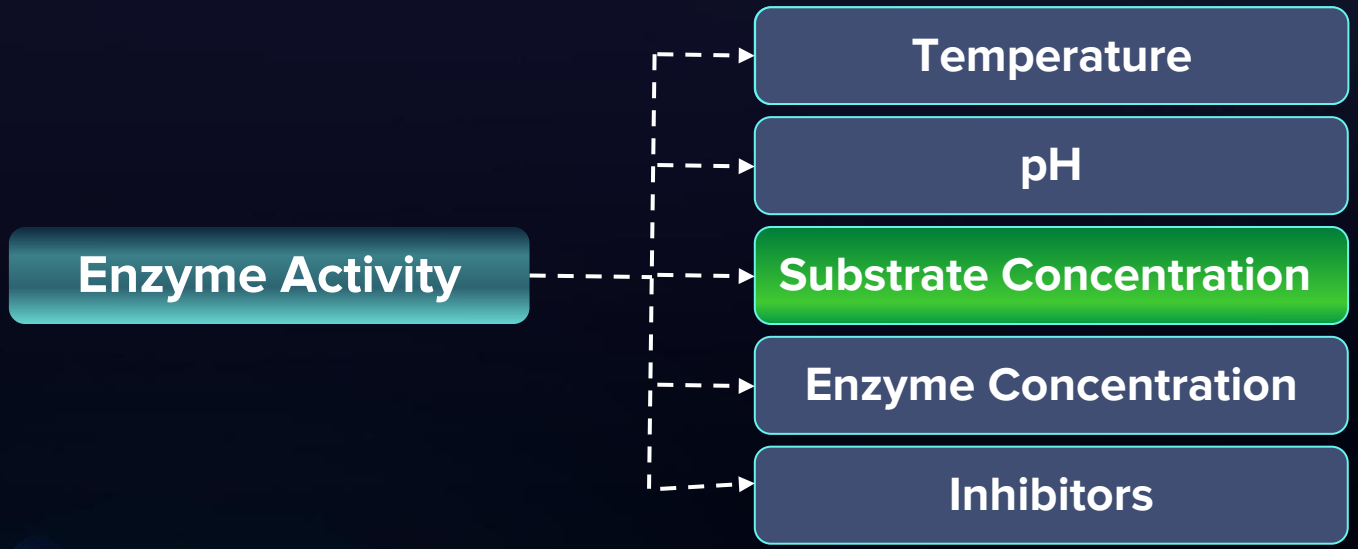
pH



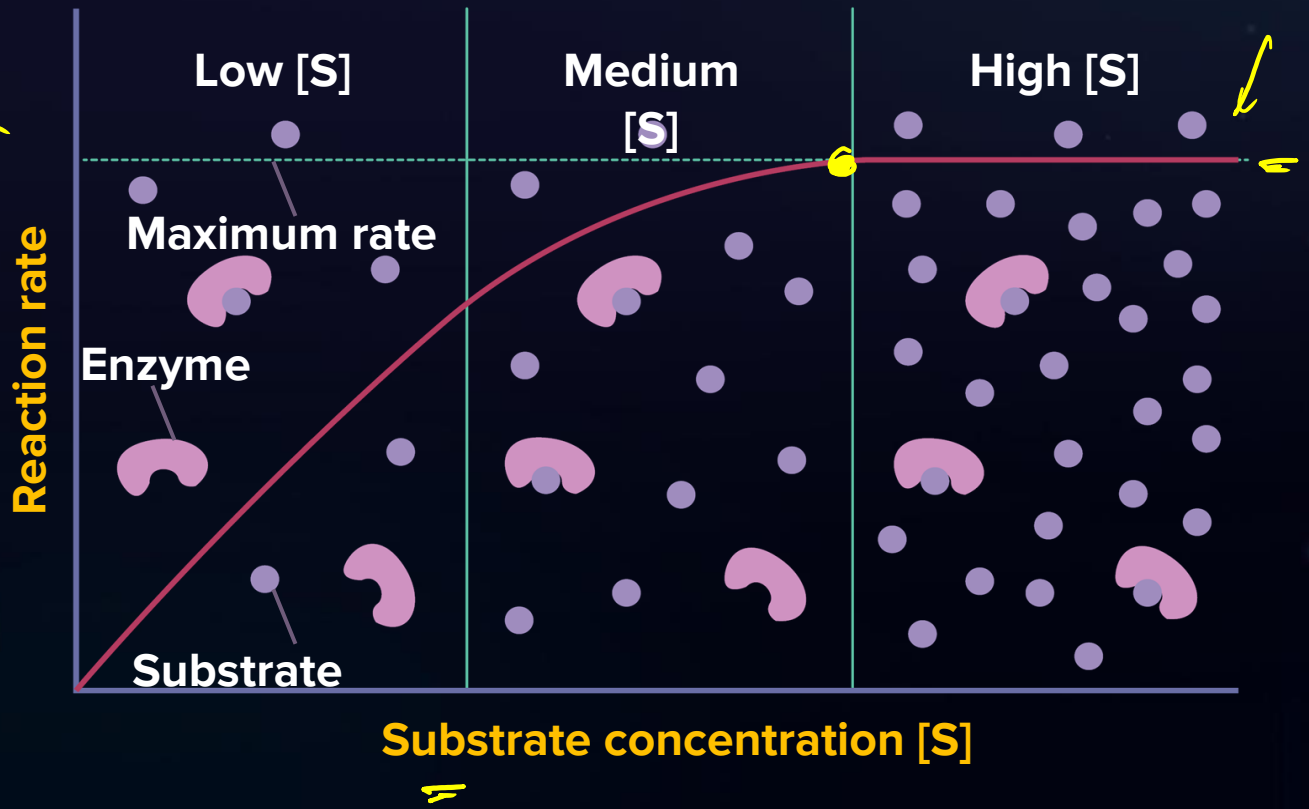
High pH:
Denaturation

Low pH:
Temporary inactive state

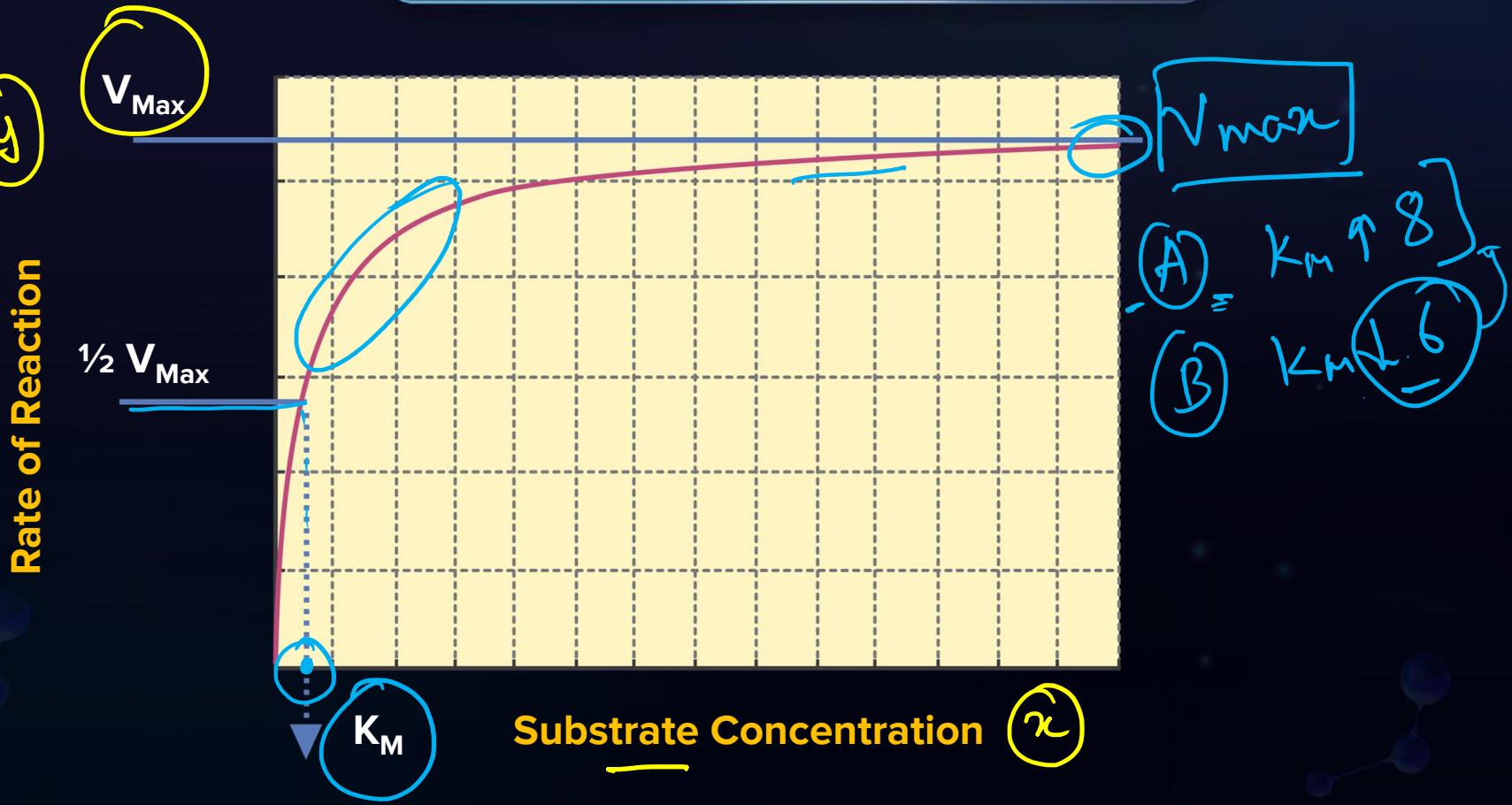
Factors Affecting Enzyme Activity



Substrate Concentration

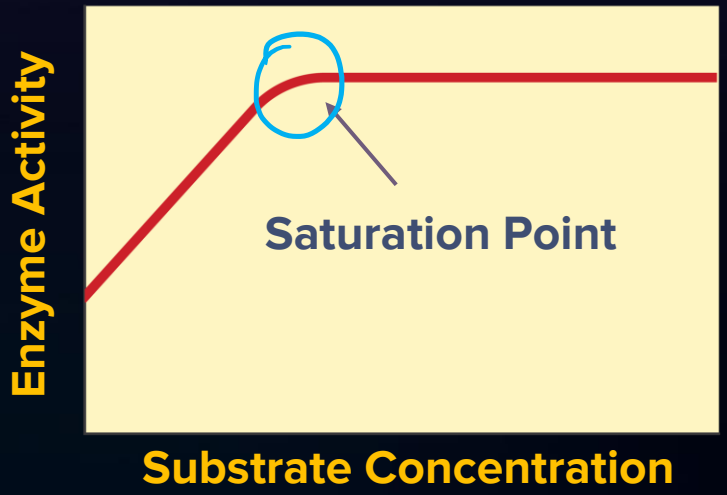


Substrate Concentration

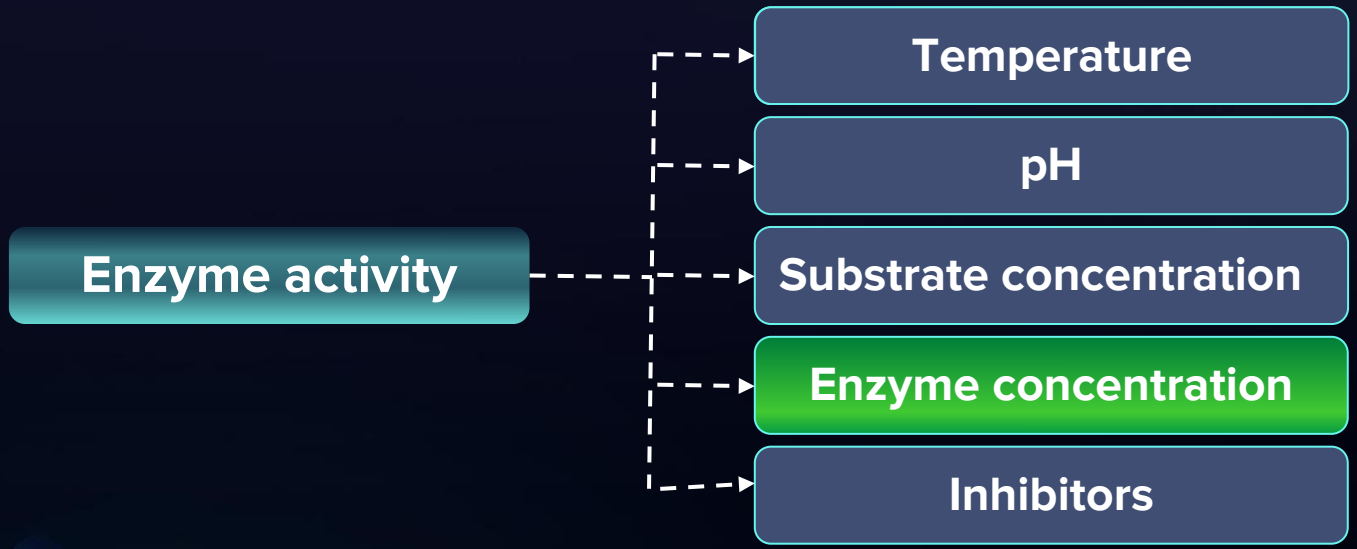


Substrate Concentration

- **Low substrate concentration:** Low enzyme activity
- **Optimum substrate concentration:** Maximum enzyme activity
- **Higher substrate concentration:** No change in maximum activity

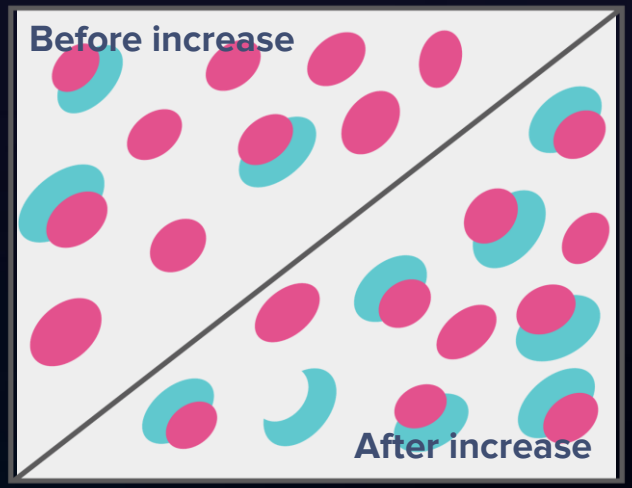


Factors Affecting Enzyme Activity



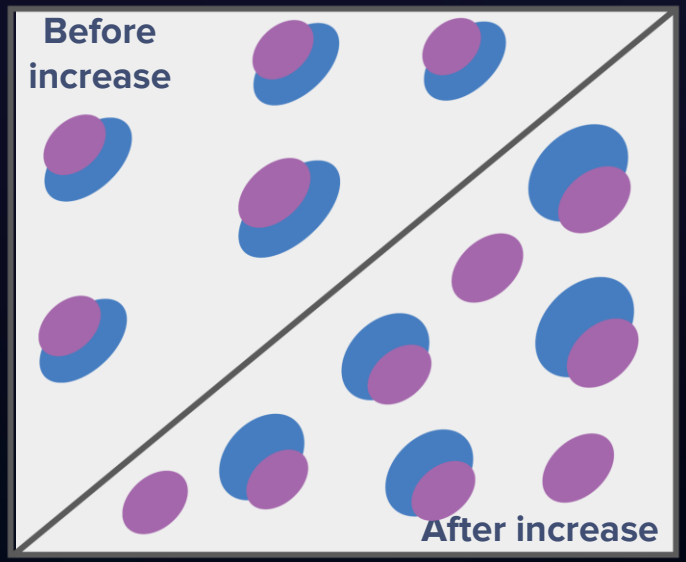
Enzyme Concentration

When the concentration of the enzyme increases, the rate of the reaction increases.



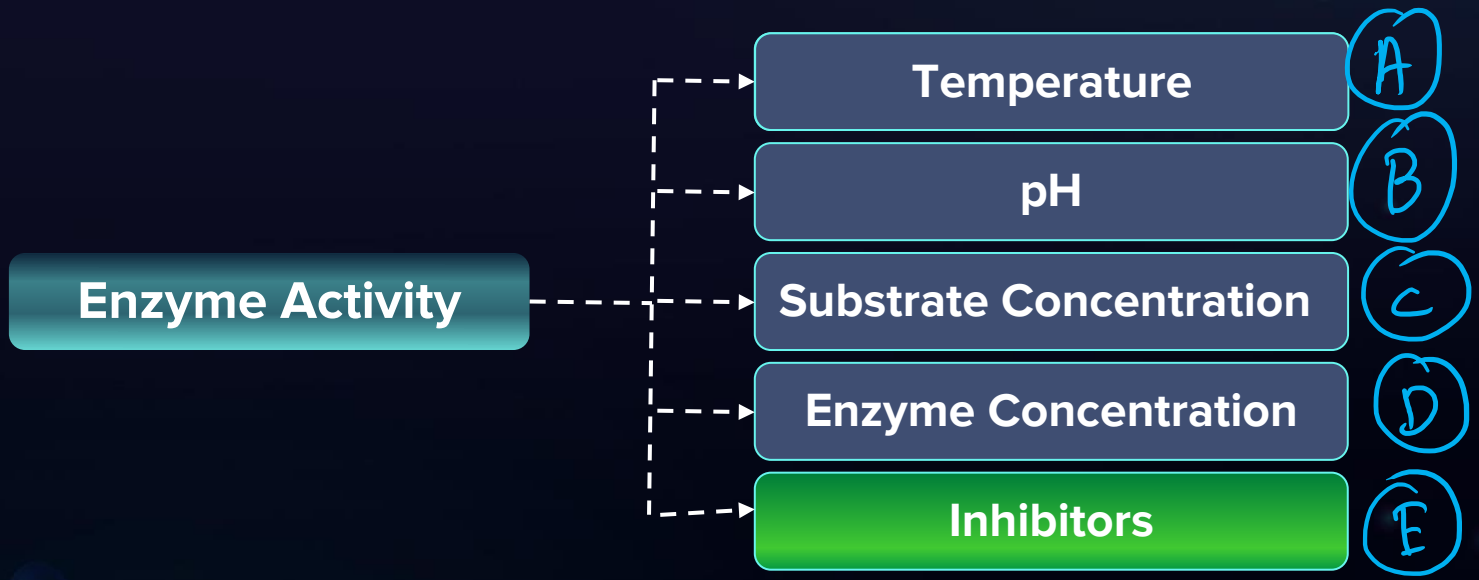
When there are more enzyme molecules, more of the substrate can be bound to form product.

Enzyme Concentration



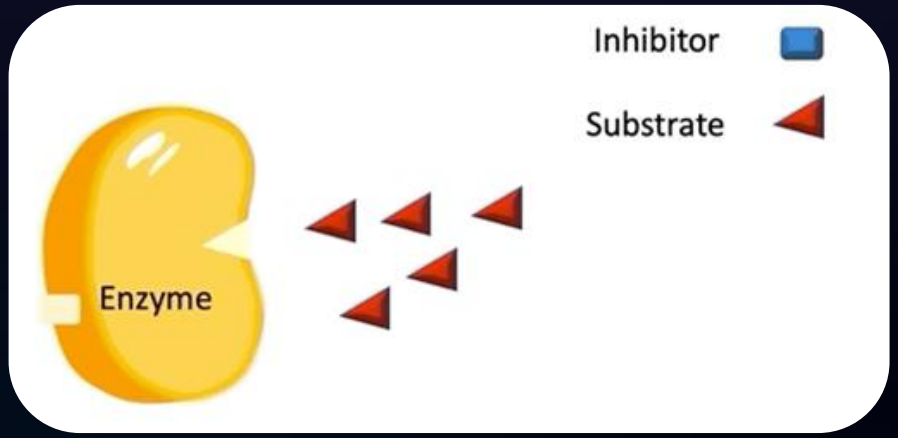
However, once all of the enzyme molecules are saturated with substrate, an increase in the concentration of either one **will not alter the rate of reaction.**

Factors Affecting Enzyme Activity



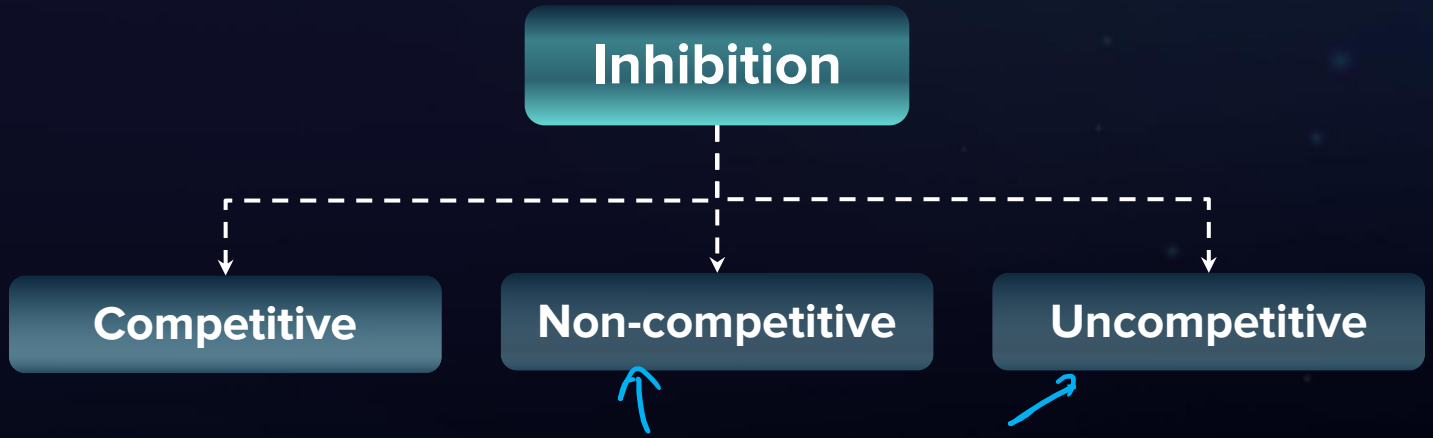
Inhibitors

- **Inhibitors:** Chemicals that shut off enzyme activity
- In other words, inhibitors inhibit enzyme activity



Types of Enzyme Inhibition

Types of Enzyme Inhibition

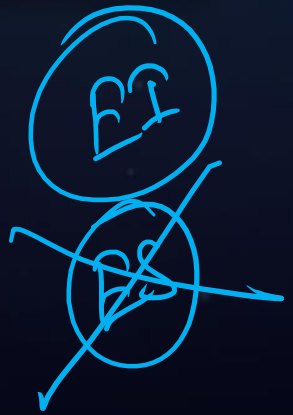


Types of Enzyme Inhibition

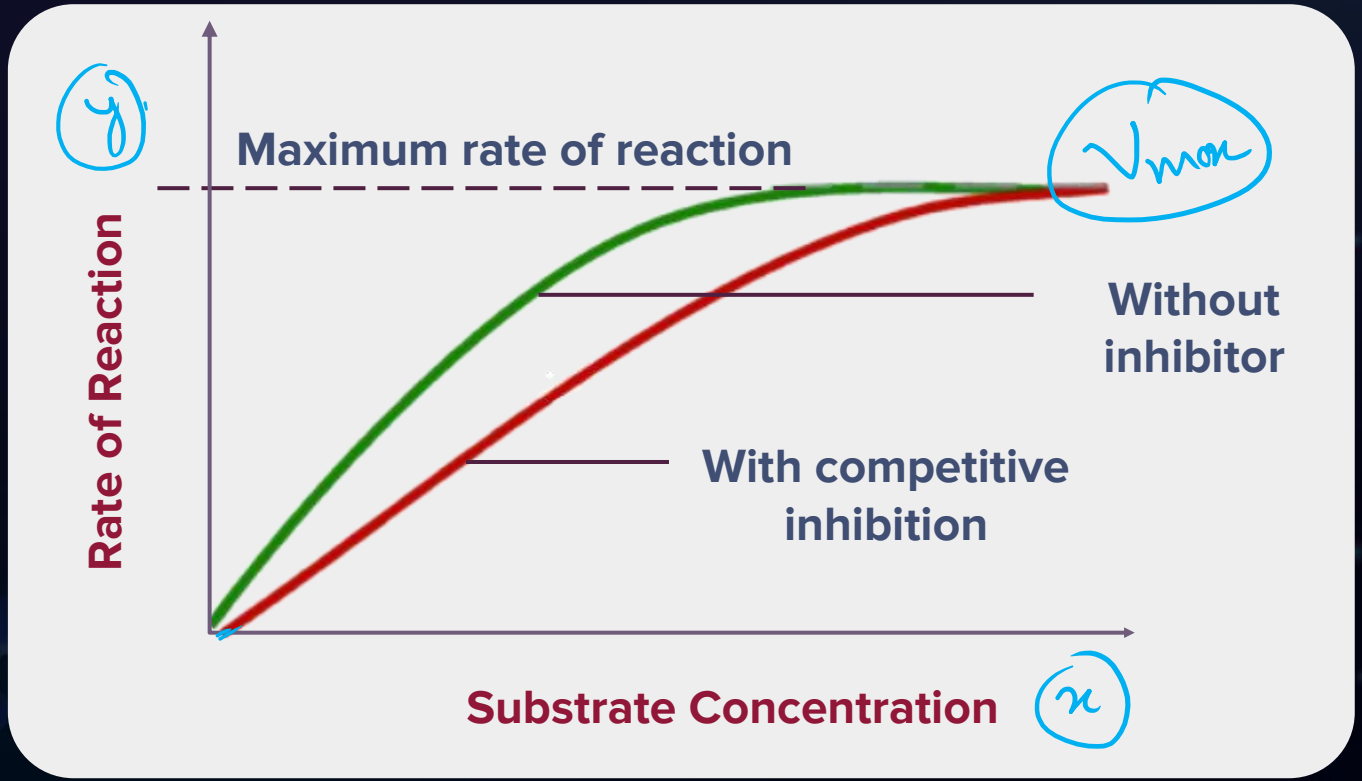
Competitive Inhibition

Competitive inhibitor

- Resembles the substrate
- Competes with substrate for active site

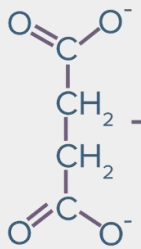


Competitive Inhibition

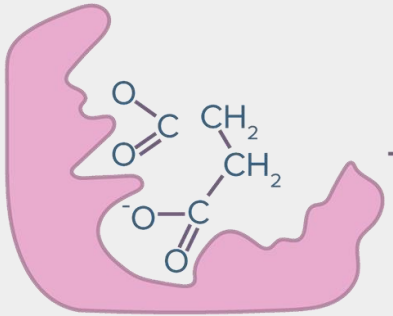


Competitive Inhibition

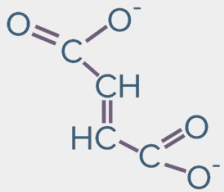
Enzyme



Succinate



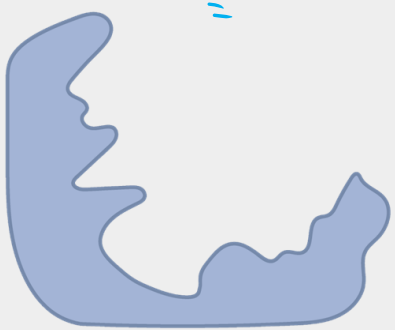
Succinate-enzyme complex



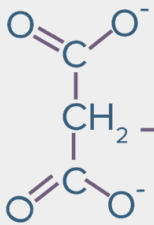
Fumarate

+

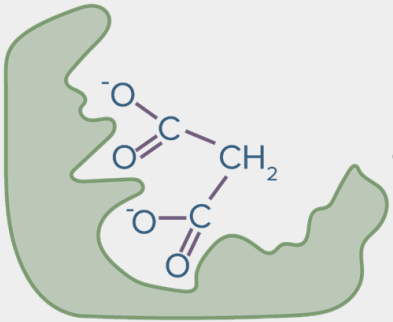
Enzyme



Enzyme



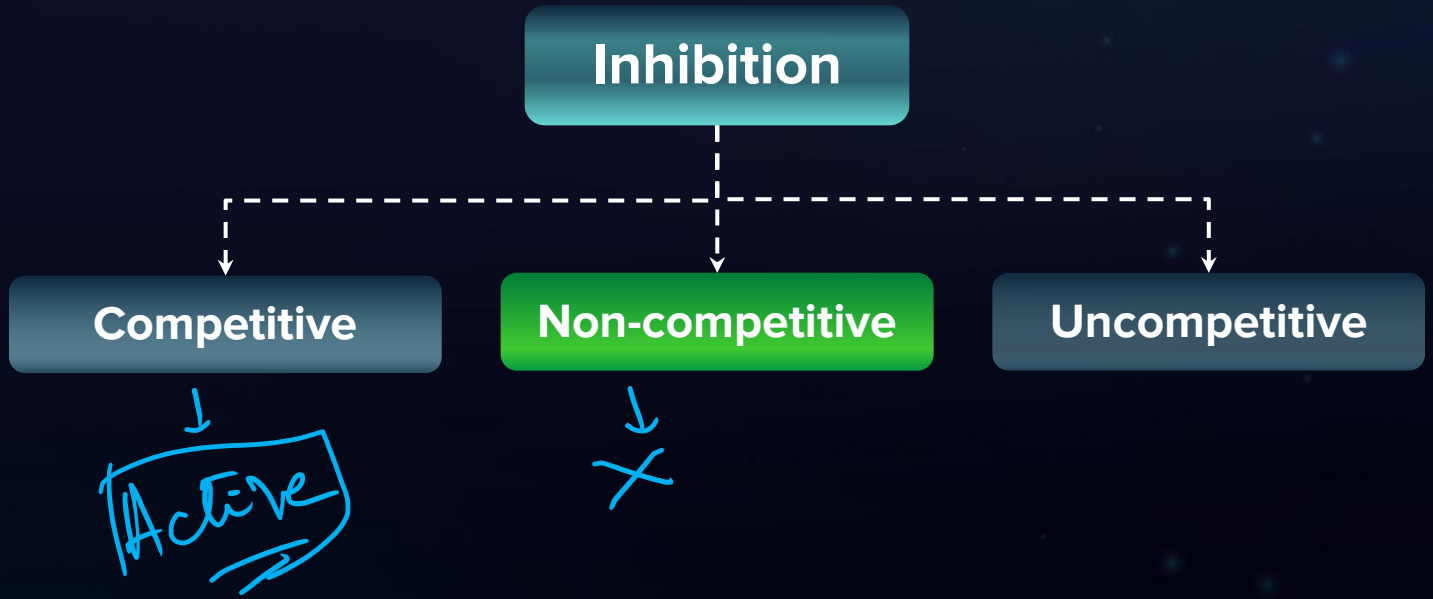
Malonate



Malonate-enzyme complex

No product is formed

Types of Enzyme Inhibition

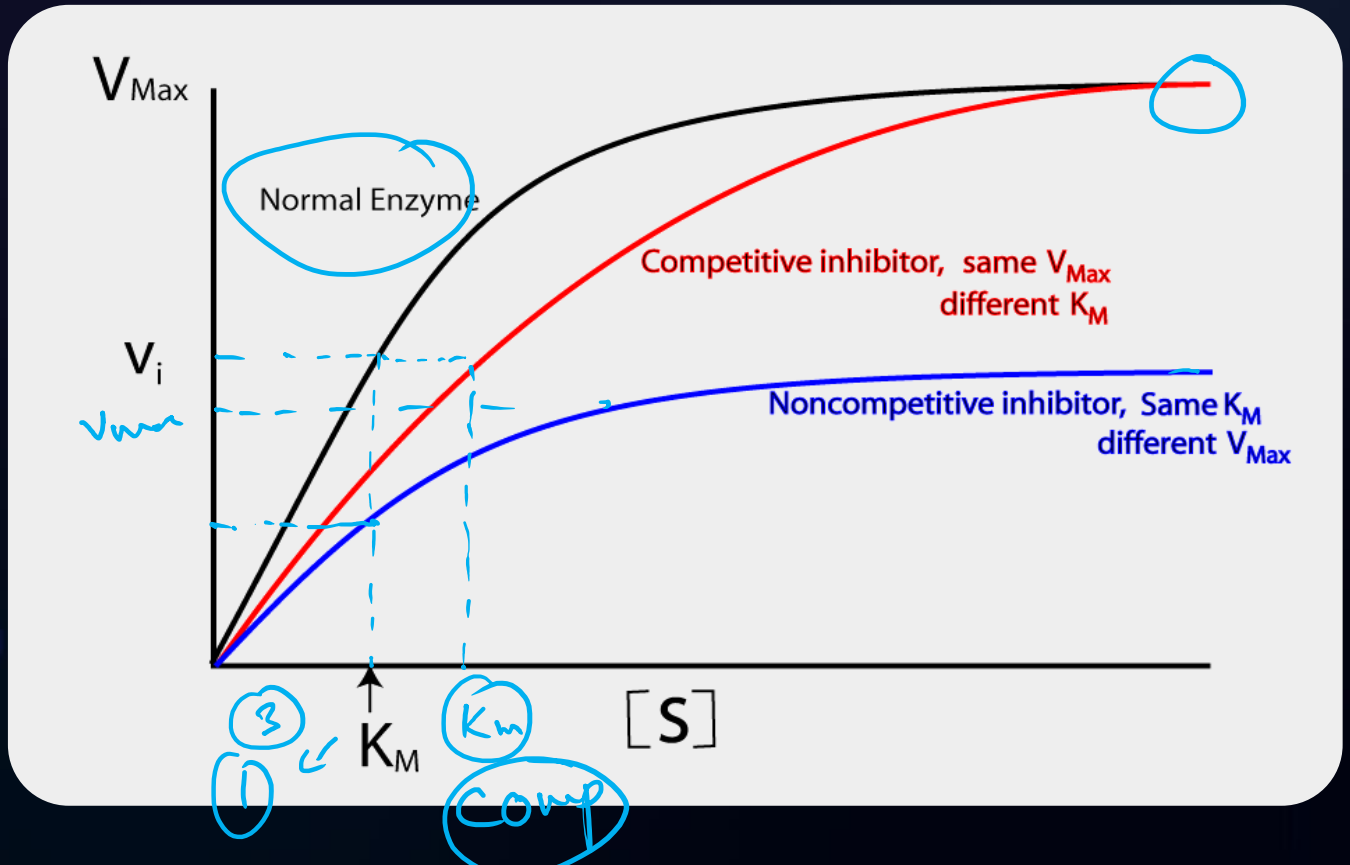


Non-Competitive Inhibition

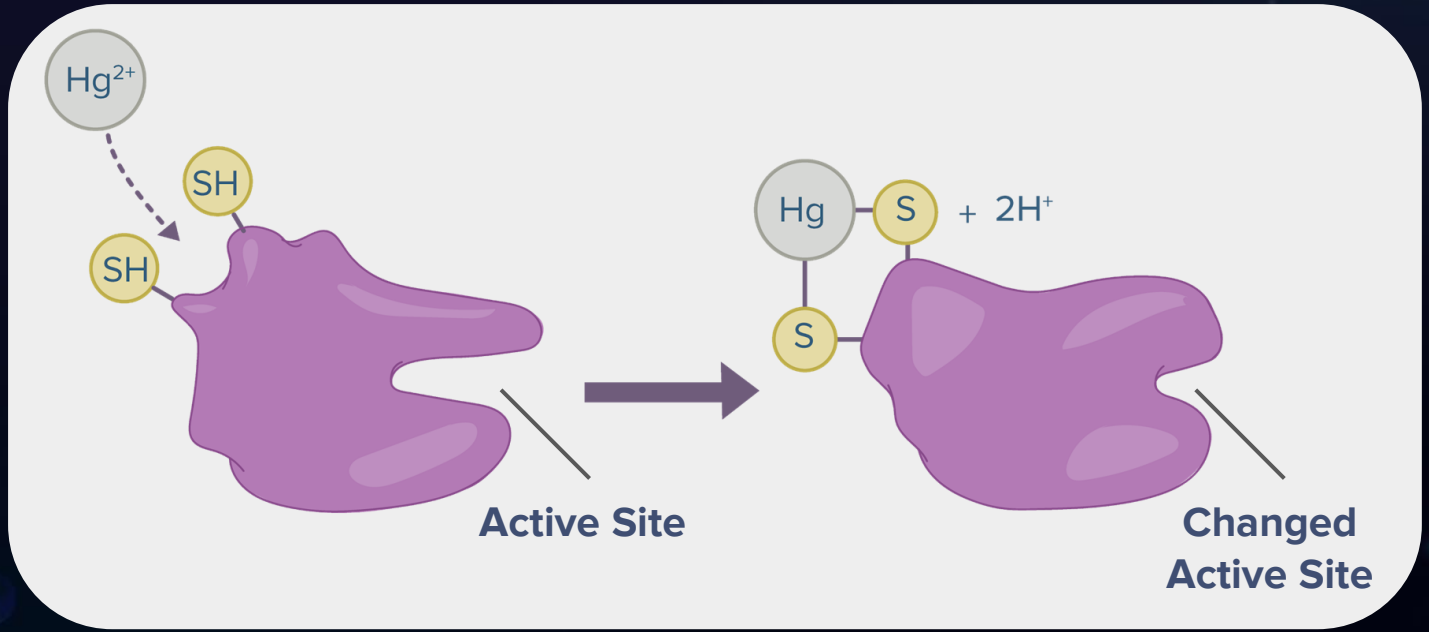
Non-competitive inhibitor

- Binds at a site other than the active site
- Changes the shape of active site such that substrate is not able to bind
- Can bind to free enzyme or enzyme-substrate complex

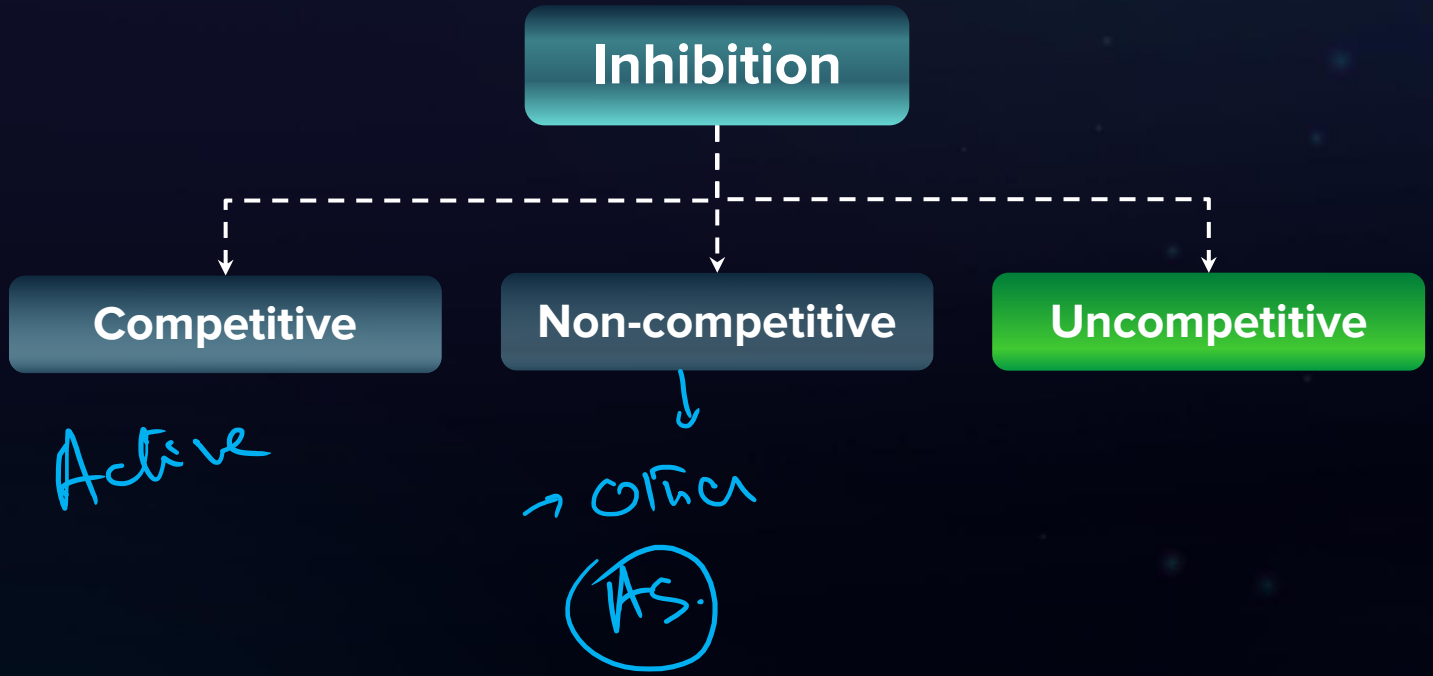
Non-Competitive Inhibition



Heavy Metal Poisoning



Types of Enzyme Inhibition



Uncompetitive Inhibition

Uncompetitive inhibitor

- Binds to the enzyme at sites other than active site
- Cannot bind to free enzyme

Naming of Enzymes

Naming of Enzymes

- Name of an enzyme includes
  - Type of reaction catalyzed
  - Name of the substrate
  - Suffix- *ase*

ATPase: Enzyme breaking down ATP

Naming of Enzymes

- Name of an enzyme includes
  - Type of reaction catalyzed
  - Name of the substrate
  - Suffix- ase

ATP Synthase: Enzyme that synthesize ATP

Nomenclature of Enzymes

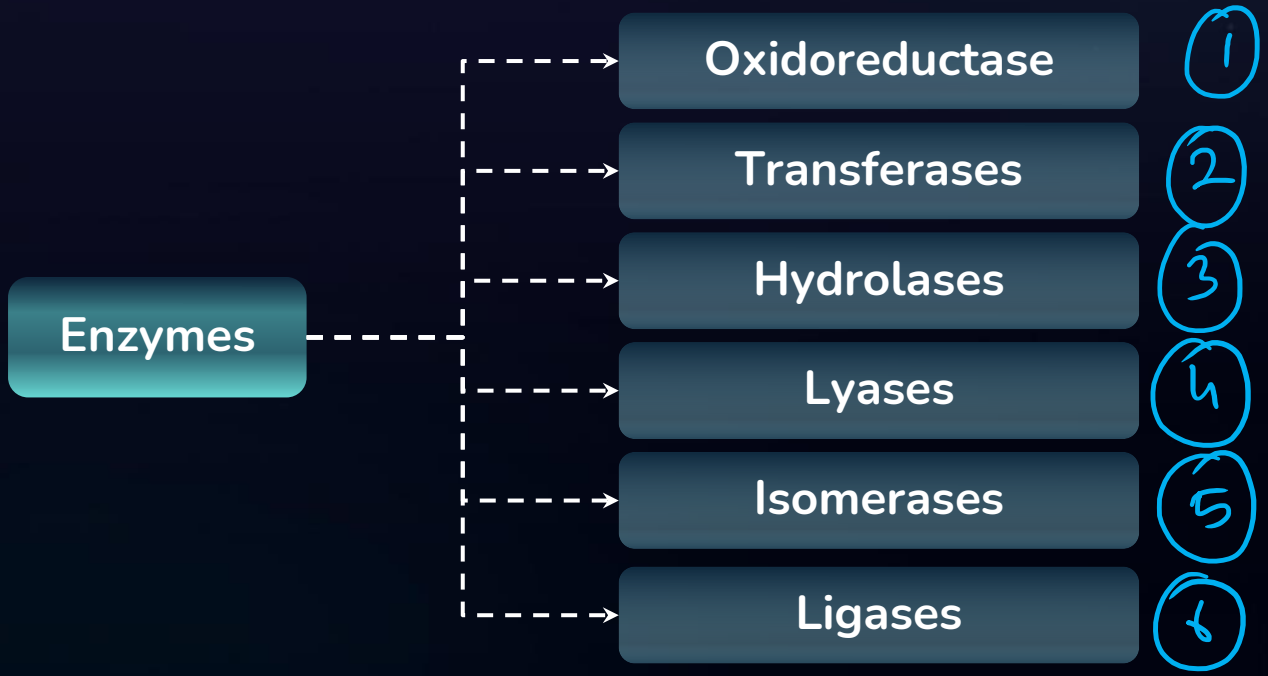
International Commission on Enzymes

Laid down rules in 1961 for naming enzymes

Enzyme Nomenclature

Classification of Enzymes

Based on type of chemical reaction catalyzed



Oxidoreductase/ Dehydrogenase

Catalyses oxidation-reduction reactions

Transferases

Catalyses transfer of groups between molecules

Hydrolases

Catalyses breaking of bonds by adding water

Lyases

Catalyses breaking of bonds without using water

Isomerases

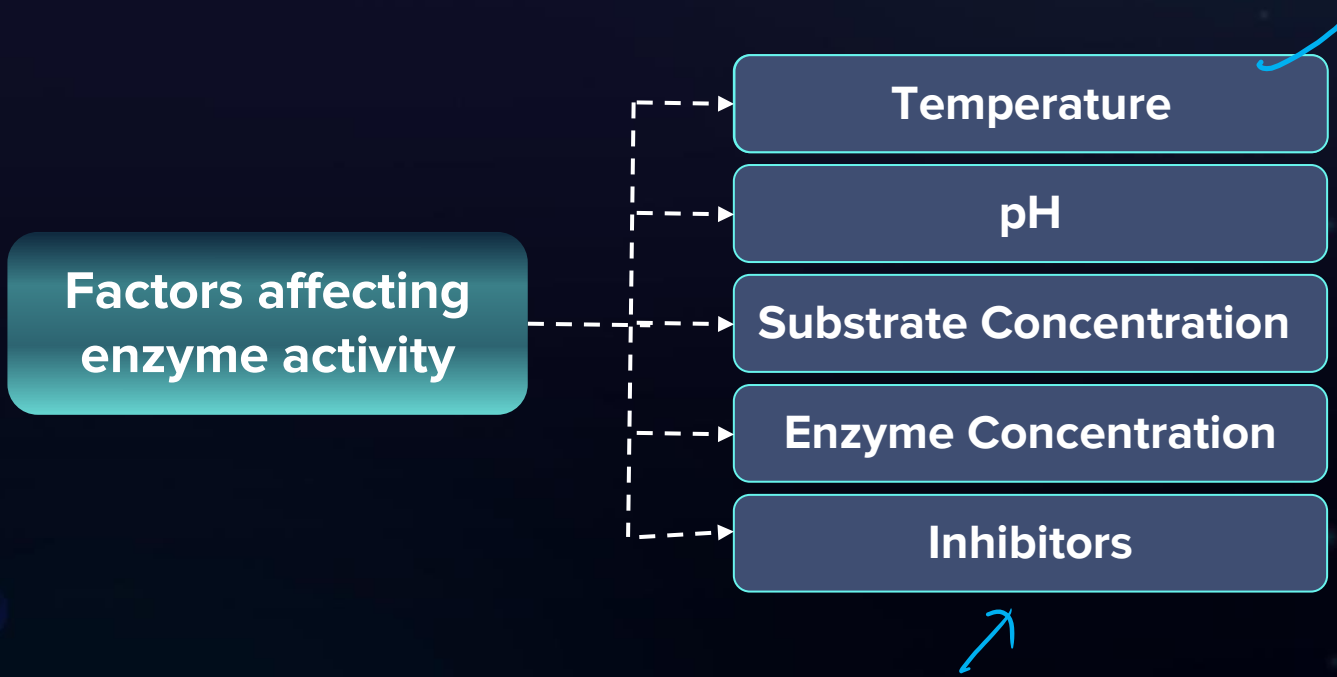
Catalyses the switch between isomers

Ligases

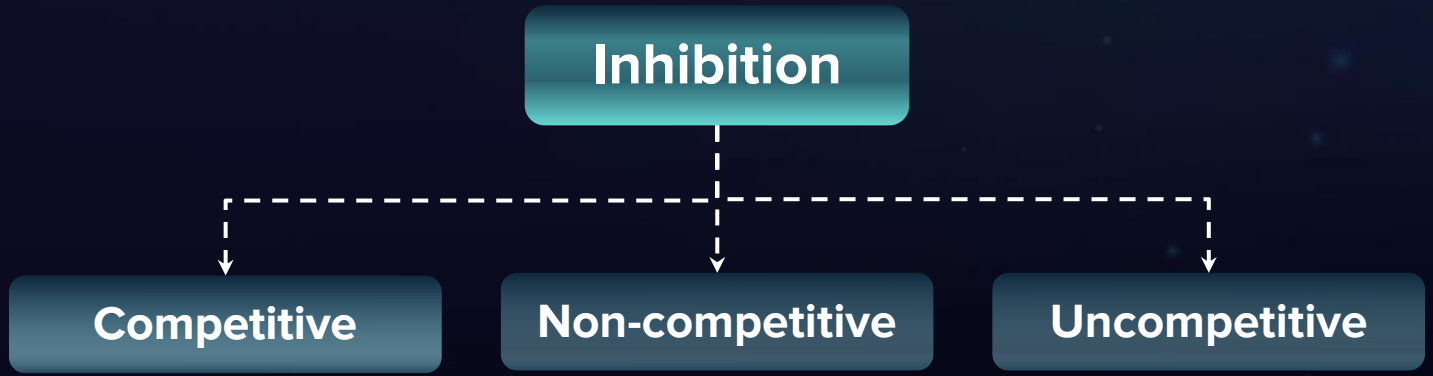
Catalyses joining of molecules by forming bonds

Summary

Summary


Factors affecting enzyme activity
Temperature
pH
Substrate Concentration
Enzyme Concentration
Inhibitors

Summary



Summary

Enzyme	Function
Oxidoreductase	Catalyses oxidation-reduction reactions
Transferases	Catalyses transfer of groups between molecules
Hydrolases	Catalyses breaking of bonds by adding water
Lyases	Catalyses breaking of bonds without using water
Isomerases	Catalyses the switch between isomers
Ligases	Catalyses joining of molecules by forming bonds

Past Year Questions

Which of the following statements are incorrect?

(NEET-2015)

A The presence of competitive inhibitor decreases the K_m of the enzyme for the substrate

B A competitive inhibitor reacts reversibly with the enzymes to form an enzyme-inhibitor complex

C In competitive inhibition the inhibitor molecule is not chemically changed by the enzyme

D The competitive inhibitor does not affect the rate of breakdown of the enzyme-substrate complex

Which of the following statements are incorrect?

(NEET-2015)

A. **The presence of competitive inhibitor decreases the K_m of the enzyme for the substrate**

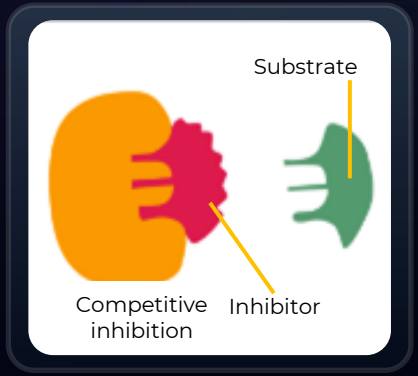
B. A competitive inhibitor reacts reversibly with the enzymes to form an enzyme-inhibitor complex

C. In competitive inhibition the inhibitor molecule is not chemically changed by the enzyme

D. The competitive inhibitor does not affect the rate of breakdown of the enzyme-substrate complex

A competitive inhibitor reacts reversibly with the enzymes to form an enzyme-inhibitor complex

- The enzyme-inhibitor (EI) complex undergoes a reversible binding which means that the bond between the two can be easily broken to release the inhibitor when substrate concentration increases.
- The bonds involved in an EI complex are generally weaker interactions like hydrogen bonds and hydrophobic interactions.



The competitive inhibitor does not affect the rate of breakdown of the enzyme-substrate complex

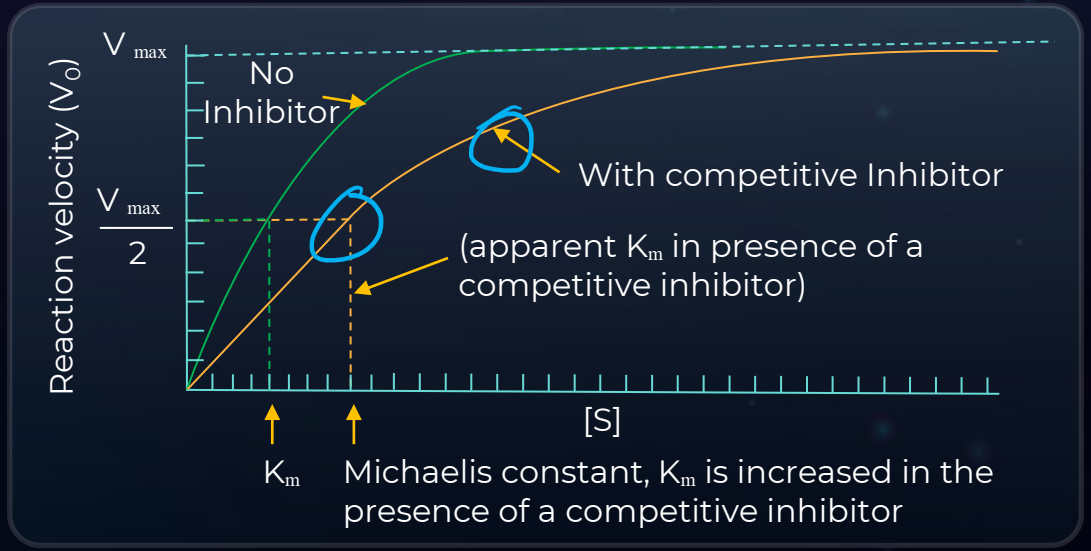
- Competitive inhibition is a type of enzyme inhibition in which the inhibitor binds to the active site on the enzyme.
- This prevents the binding of the substrate to the enzyme and hence the rate of breakdown of the enzyme-substrate complex is not affected.

In competitive inhibition the inhibitor molecule is not chemically changed by the enzyme

- The enzyme forms an enzyme-inhibitor complex that is equivalent to the Enzyme-substrate complex
- The substrate undergoes structural change to form a product, but the shape of the inhibitory molecule does not undergo any structural change, that stops the enzyme to disassociate with the substrate complex

The presence of competitive inhibitor decreases the K_m of the enzyme for the substrate

- A competitive inhibitor apparently increases the K_m of the reaction.
- It means more substrate concentration is needed to achieve ½ of V_{max}




Keep
Learning!