Enzymes

Enzymes:

Enzymes are proteins that act as catalysts for biological reactions. They **speed up the chemical reactions** without undergoing any change themselves, and they **lower the activation energy** of the reaction.

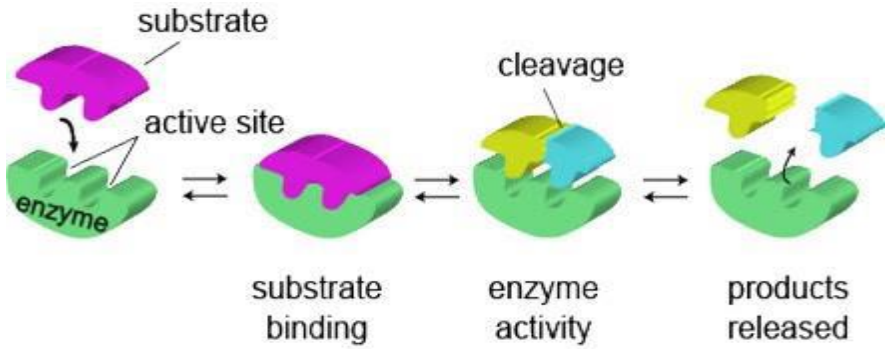
All biochemical reactions in the body **are catalysed by enzymes.**

They **can be denatured** under extreme conditions.

Most enzymes have **optimum activity** at a **neutral pH** and at **body temperature.**

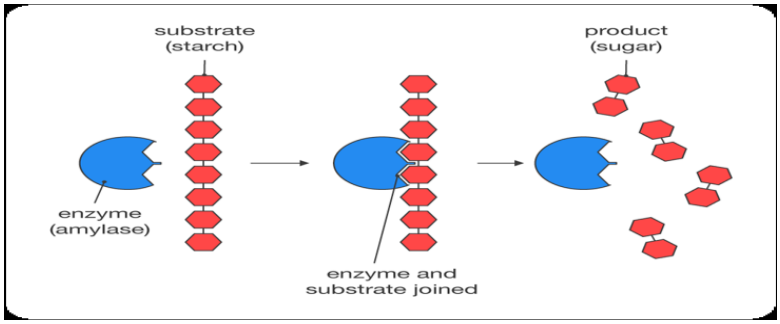
Enzymes are also very specific, they only act on one substrate. The reason for this is that the active site of the enzyme is complementary in shape to the substrate.

For example: **Amylase** enzyme is responsible for **hydrolyzing starch**



In the presence of **amylase,** a sample of **starch will be hydrolyzed into shorter polysaccharides,** dextrins, maltose, and glucose.

The extent of hydrolysis depends on how long it is allowed to react, if it is hydrolyzed completely, the resulting product will be **glucose.**

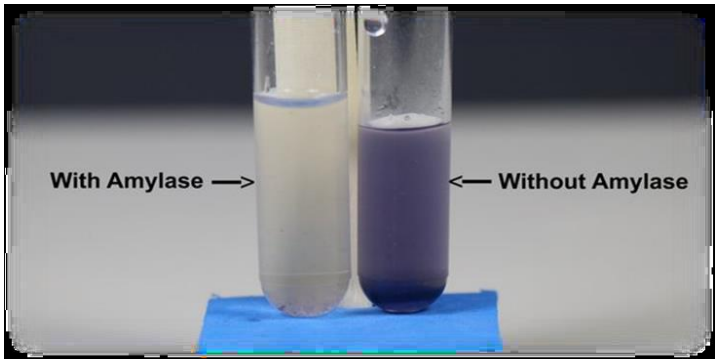


In these tests:

You will **test for the presence or absence of starch in the sample by using Iodine solution.**

Iodine forms a **Dark Blue/Dark Purple** color when it reacts with **starch**; however, it does not react with glucose.

Therefore, the faster the blue color of starch is lost, the faster the enzyme amylase is working.



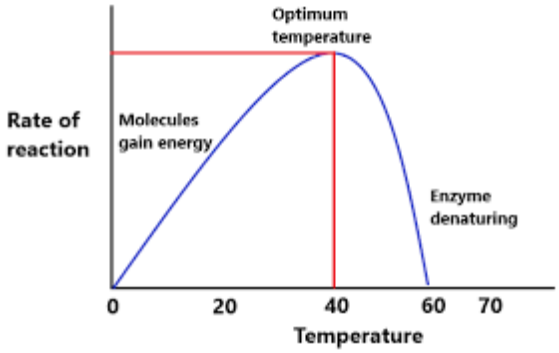
Enzyme activity on starch

1 - Effect of amylase on starch: (37° C)

- In a clean test tube, take **1 ml of Starch** solution.
- Add **1 ml of Amylase** solution (stored at 37° C).
- Add **1-2 drops of Iodine** solution, a dark blue or purple color should appear.
- Place the test tube in **water bath set at (37° C).**
- Record the color of the sample every 1 minute, notice any changes.

Effect of temperature on the activity enzymes: All reactions are **faster at higher temperature**; however, they become slower if the temperature gets too high, **because enzymes start to denature.**

Therefore, enzymes have **an optimum temperature for their maximum activity.**



2. Effect of temperature: (100° C)

- In a clean test tube, take **1 ml of Starch** solution.
- Add **1 ml of Boiled Amylase** solution (kept at 100° C).
- Add **1-2 drops of Iodine** solution, a dark blue or purple color should appear.
- Place the test tube in **water bath set at (37° C).**
- Record the color of the sample every 1 minute, notice any changes.

Effect of pH on the activity enzymes:

Each enzyme has an optimum pH, any changes above or below it will lower the activity of that enzyme.

The **optimum pH** of enzymes **corresponds to the pH of its natural environment.**

For **most enzymes in the body,** the optimum pH value is **= 7.** For **pepsin,** which is active in the stomach **= 2.** For **Trypsin,** which is active in the small intestine **= 8.**

3. Effect of pH on amylase: (pH_{opt} = 7)

- In a clean test tube, take **1 ml of Starch** solution.
- Add **1 ml of Amylase in acid** solution.
- Add **1-2 drops of Iodine** solution, a dark blue or purple color should appear.
- Place the test tube in **water bath set at (37° C).**
- Record the color of the sample every 1 minute, notice any changes.

Proof of enzyme activity: In order to prove that **all starch molecules indeed turned into simple glucose molecules,** another test is needed.

Any test that is specific for reducing sugars should provide a proof for the presence of glucose in the sample.

4. Benedict test as proof: (Test for reducing sugars)

- Add **1 ml of Benedict reagent** to the sample solution.
- **Boil** the solution for **≈2 minutes.**
- If a **red/green/yellow precipitate** is observed, then the **presence of reducing sugars (glucose) is confimed.**

This means that the enzyme amylase was able to break down the starch into simple monosaccharides.