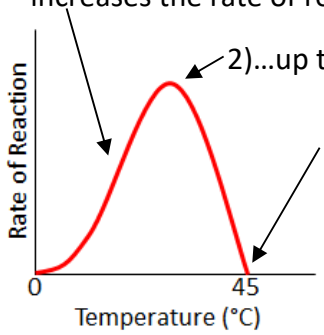
Enzymes

Enzymes are **biological catalysts** – a substance that speeds up a reaction without being changed or used up.
Enzymes are **proteins** made from amino acid chains folded into specific shapes.

Effect of Temperature

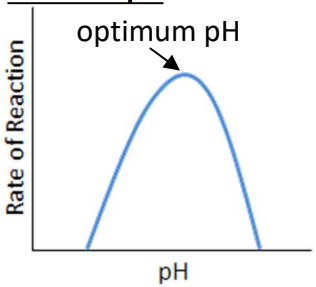
1) Increasing temperature increases the rate of reaction…



2)…up to a point – the **optimum** temperature

3) At high temperatures the enzymes become **denatured** – the bonds holding the enzyme together break, changing the shape of the active site so the substrate cannot fit.

Effect of pH



If the pH is too high or too low it can weaken the bonds that maintain the shape of the enzyme.
This causes the active site to change shape (denature) so the substrate cannot fit.

Investigating Enzymes Reactions

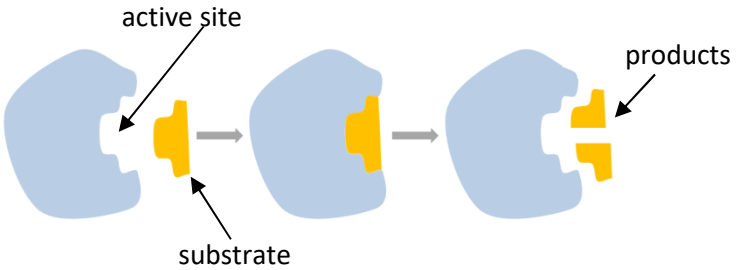
REQUIRED PRACTICAL
SEE PRACTICAL SHEET FOR DETAIL

The effect of pH and temperature on the rate of enzyme controlled reactions can be investigated

How Enzymes Work

The active site is a specific shape, allowing only one substrate to fit into it. Different enzymes are needed to catalyse different reactions.

This diagram shows the lock and key 'lock and key' model. It is over simplified – actually the active site can change shape slightly to allow a tighter fit with the substrate. This is called the 'induced fit' model.



Enzymes in Digestion

Carbohydrases – these break down carbohydrates into sugars
Amylase breaks down starch (a carbohydrate) into maltose (a sugar).
Amylase is produced in the salivary glands, pancreas and small intestine.

Proteases – break down proteins into amino acids
Proteases is produced in the stomach (where it is called pepsin), pancreas and small intestines.

Lipases – break down lipids (fats) into glycerol and fatty acids
Lipase is produced in the pancreas and small intestine.

The stomach is acidic so the optimum pH for pepsin is **pH2**. When the contents of the stomach passes into the small intestine **bile** is added. This **neutralises** the stomach acid, allowing lipase and carbohydrases to work at their optimum **pH of 7**.

Bile also **emulsifies** fats to give them a **larger surface area** for the enzymes to work on.