

CAIE Biology IGCSE

5: Enzymes

Notes

(Content in **bold** is for Extended students only)

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Enzymes

Enzymes are proteins that act as **biological catalysts**. A catalyst is a substance which **speeds up the rate of reaction** in chemical reactions, without being used up. The enzyme is **not changed** by the reaction and can be used repeatedly. Enzymes are crucial to living organisms as they speed up **metabolic reactions** which would take **too long to occur without them**.

Enzyme action:

All enzymes contain an active site, which is a sequence of amino acids with a specific shape.

The shape of the active site is **complementary** to the substrate. **When the enzyme breaks the substrate down, the substrate enters the active site to form an enzyme-substrate complex.**

The substrate is broken down and the product is released. The enzyme can then bind to another substrate molecule.

Each enzyme is complementary to only one type of substrate; hence it cannot break down other substrates. For example, proteases break down proteins so that amino acids can be absorbed into the blood. Proteases cannot, however, break down other molecules such as carbohydrates, which can only be broken down by carbohydrase enzymes.

Factors affecting enzyme action:

- **pH** - enzymes have an **optimum pH** that they work best at. As the pH moves away from this, the **rate of reaction decreases**. **The change in pH causes the shape of the active site to change. This means that the substrate cannot fit in the active site, hence no enzyme-substrate complexes can form.** This means that the enzyme has become **denatured**.
- **Temperature** - As the temperature increases up to the enzyme's optimum, the rate of reaction increases. **This is because the molecules have more kinetic energy, thus move faster. Consequently, more successful collisions occur, and more enzyme-substrate complexes can form.** At very high temperatures above the optimum, the enzymes become **denatured and the active site changes shape. This decreases the rate of reaction as enzyme-substrate complexes cannot form.**

