

Edexcel IAL Biology A-level

2.6-2.8 - Proteins and Enzymes

Flashcards

This work by [PMT Education](https://www.pmt.education) is licensed under [CC BY-NC-ND 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)

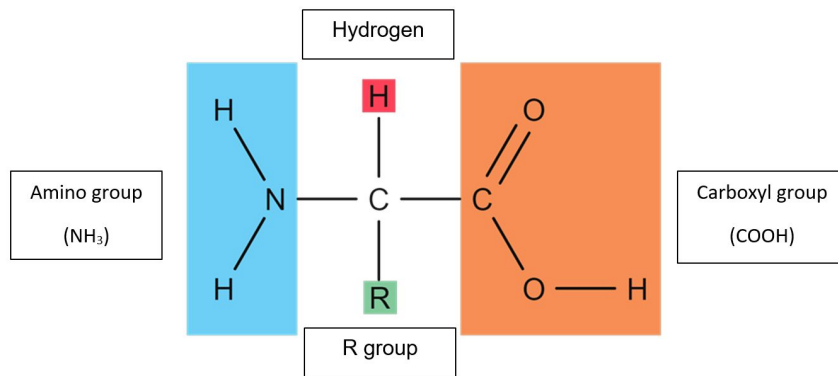


Describe the structure of an amino acid



Describe the structure of an amino acid

It contains a carboxyl group, an amino group, a hydrogen atom and a variable R group bonded to a central carbon atom



What is a dipeptide?



What is a dipeptide?

Two amino acids joined by a peptide bond

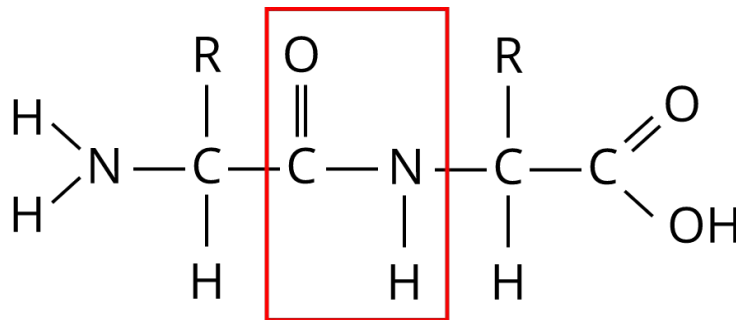


What type of bond joins two amino acids together?



What type of bond joins two amino acids together?

A peptide bond



What type of reaction forms a peptide bond?



What type of reaction forms a peptide bond?

A condensation reaction

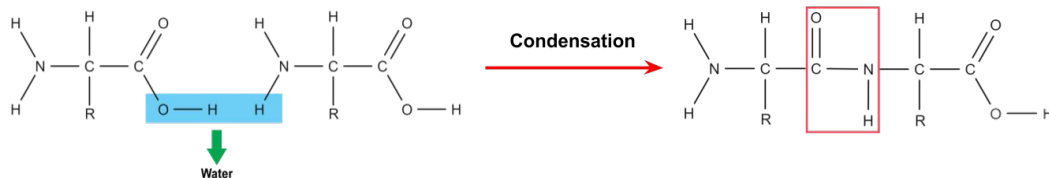


What happens during a condensation reaction?



What happens during a condensation reaction?

A bond is formed and a molecule of water is released. For example:



What is a polypeptide?



What is a polypeptide?

A **polymer** made from multiple amino acid monomers joined by peptide bonds in condensation reactions.



What is the primary structure of a protein?



What is the primary structure of a protein?

The sequence of amino acids in a polypeptide, held by peptide bonds



What is the secondary structure of a protein?



What is the secondary structure of a protein?

The local interactions of the polypeptide chain to form 3D structures such as alpha helices and beta pleated sheets. It is held together by hydrogen bonding



State two types of secondary structure
in a protein



State two types of secondary structure in a protein

- Alpha helices



- Beta pleated sheets



What is the tertiary structure of a protein?



What is tertiary structure?

The further coiling of a protein into its functional 3D shape. Held by hydrogen, ionic, and disulphide bonds, and hydrophobic interactions



How does the primary structure affect the tertiary (3D) structure?



How does the primary structure affect the tertiary (3D) structure?

R group variations produce different bonds. Sulfur atoms form disulfide bridges, oppositely charged groups form ionic bonds. Hydrogen bonds are always present as they occur between hydrogen and nitrogen/oxygen



What is the quaternary structure of a protein?



What is the quaternary structure of a protein?

- Not always applicable
- Describes the interactions of multiple polypeptide chains
- Held together by hydrogen, ionic, and disulphide bonds, and hydrophobic interactions



Give one example of a protein with a quaternary structure



Give one example of a protein with a quaternary structure

Haemoglobin



Give 5 uses of proteins in the body



Give 5 uses of proteins in the body

- Membrane proteins for transport
- Hormones
- Receptors
- Antibodies
- Enzymes



What roles do globular proteins have in the body?



What roles do globular proteins have in the body?

Metabolic roles



What roles do fibrous proteins have in the body?



What roles do fibrous proteins have in the body?

Structural roles



Describe how the structure of fibrous proteins relates to their function



Describe how the structure of fibrous proteins relates to their function

Long polypeptide chains, folded in parallel. Very little tertiary/quaternary structure aside from cross-linkages for strength. This makes them insoluble, and is useful for providing structure



Give an example of a fibrous protein and explain how its properties relate to its use



Give an example of a fibrous protein and explain how its properties relate to its use

Collagen - Hydrogen and covalent bonds make it very strong. Polypeptide chains form a triple helix which creates fibres. This makes it useful in bones, cartilage and other connective tissue



Describe how the structure of globular proteins relates to their function



Describe how the structure of globular proteins relates to their function

Compact, highly folded with complex tertiary/quaternary structures. Soluble, forms colloids in water. They are useful for hormones, antibodies, etc



Give an example of a globular protein and explain how its properties relate to its use



Give an example of a globular protein and explain how its properties relate to its use

Haemoglobin - Water-soluble, with a complex quaternary structure. Contains four haem groups that oxygen can bind to. It is therefore used to carry oxygen in the blood to respiring tissues



What are enzymes?



What are enzymes?

Biological catalysts that speed up the rate of metabolic reactions without being used up or permanently altered



Define catalysis



Define catalysis

The process where a substance speeds up a chemical reaction (by lowering the activation energy) without being used up itself



What are enzymes made of?



What are enzymes made of?

Enzymes are made of protein



What class of protein are enzymes generally made up of?



What class of protein are enzymes generally made up of?

Globular proteins



How do enzymes work?



How do enzymes work?

One area of the enzyme is called the active site, which is specific to a certain substrate. When the enzyme and substrate bind they form a complex, which lasts until the reaction is complete



What is meant by a 'specific' active site?



What is meant by a 'specific' active site?

The 3D structure of each enzyme is unique due to the side chains and branches that are present. This also makes the active site unique, and therefore only the substrates that match each active site can bind there



Differentiate between intracellular and extracellular enzymes



Differentiate between intracellular and extracellular enzymes.

- Intracellular = catalyse reactions inside cells
- Extracellular = catalyse reactions outside of cells

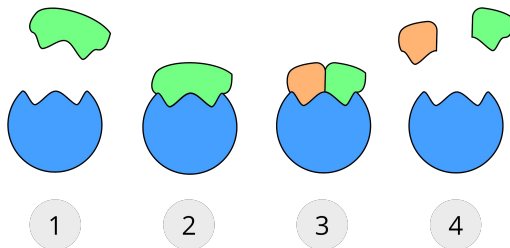


Describe the 'lock and key' model



Describe the 'lock and key' model

1. Substrate(s) and the active site of the enzyme come into contact
2. Substrate(s) binds (if it is the correct fit) and the **enzyme-substrate complex** form
3. Reaction takes place, product(s) formed in an **enzyme-product complex**
4. Product(s) released from the active site. The active site is now free to bind to another substrate

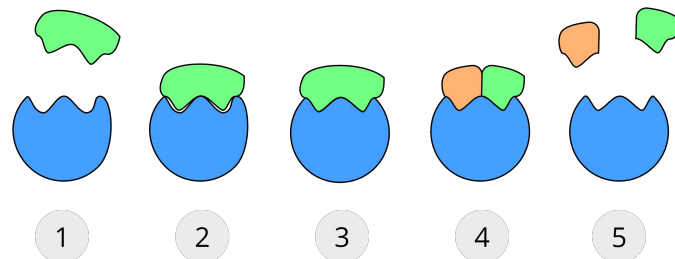


Describe the induced fit hypothesis



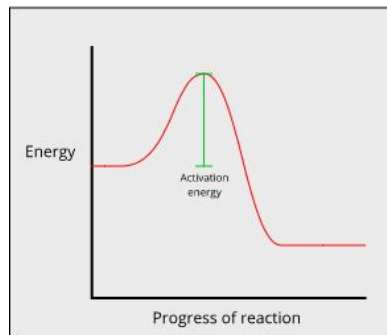
Describe the induced fit hypothesis

- 1) The enzyme approaches the substrate
- 2) The enzyme binds to the substrate
- 3) As the substrate binds, it induces a **subtle conformational change** in the active site of the enzyme so that it fits the substrate more precisely
- 4) The enzyme catalyses the reaction and creates an enzyme product complex
- 5) The enzyme releases the products

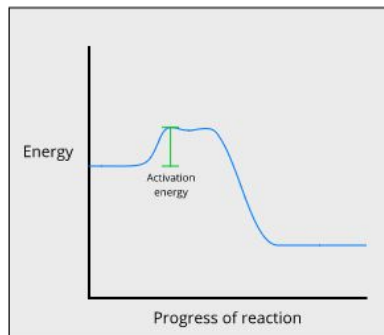


Which one of these two reaction diagrams shows an enzyme catalysed reaction?

Graph A

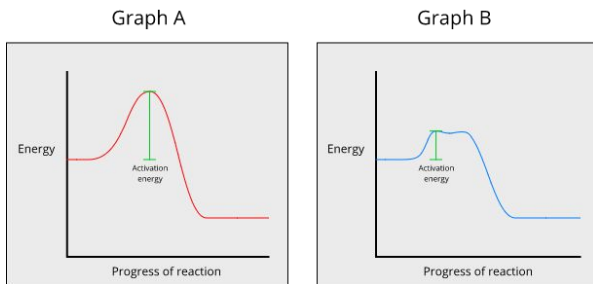


Graph B



Which one of these two reaction diagrams shows an enzyme catalysed reaction?

Graph B shows an enzyme catalysed reaction as the activation energy is lower.

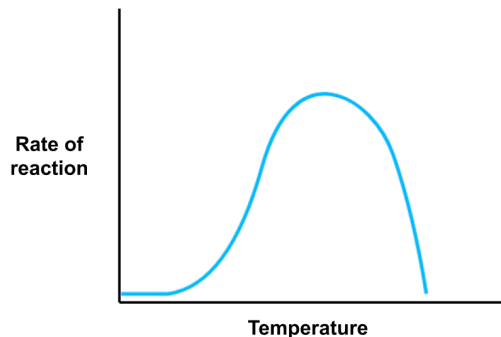


Describe the effect of temperature on the rate of an enzyme-controlled reaction



Describe the effect of temperature on the rate of an enzyme-controlled reaction

- As the temperature increases, so does the rate of reaction
- Once the temperature exceeds the optimum, the enzyme denatures and the rate of reaction decreases



Why does the rate of an enzyme-controlled reaction increase when the temperature increases?



Why does the rate of an enzyme-controlled reaction increase when the temperature increases?

- As the temperature increases, the particles have more kinetic energy
- This increases the chance of collisions between molecules being successful and leading to a reaction



If temperature increases above the optimum, how does this affect enzyme function?



If temperature increases above the optimum, how does this affect enzyme function?

- As the atoms in the active site gain more energy, they vibrate more which disrupts the bonds
- The active site will be distorted as the bonds are broken
- This denatures the enzyme and so it will no longer fit the substrate and so can't catalyse the reaction

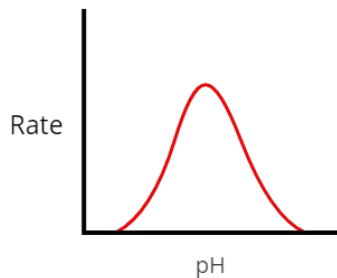


Describe the effect of pH on the rate of an enzyme-controlled reaction



Describe the effect of pH on the rate of an enzyme-controlled reaction

- The rate of an enzyme catalysed reaction is fastest at the optimum pH
- If the pH is too high or low, the enzyme will work less efficiently and the active site may be denatured at extremes of pH



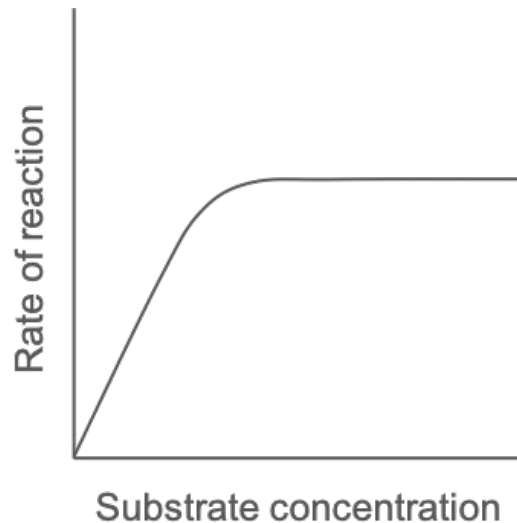
How does substrate concentration affect the rate of an enzyme-controlled reaction?



How does substrate concentration affect the rate of an enzyme-controlled reaction?

If enzyme concentration is fixed, the rate of reaction increases proportionally to the substrate concentration.

Once all active sites become full, the rate of reaction plateaus (enzyme concentration is a limiting factor)



How does enzyme concentration affect the rate of an enzyme-controlled reaction?



How does enzyme concentration affect the rate of an enzyme-controlled reaction?

If substrate concentration is fixed, the rate of reaction increases proportionally to the enzyme concentration

When all of the substrates occupy active sites, the rate of reaction plateaus (substrate concentration is a limiting factor)

