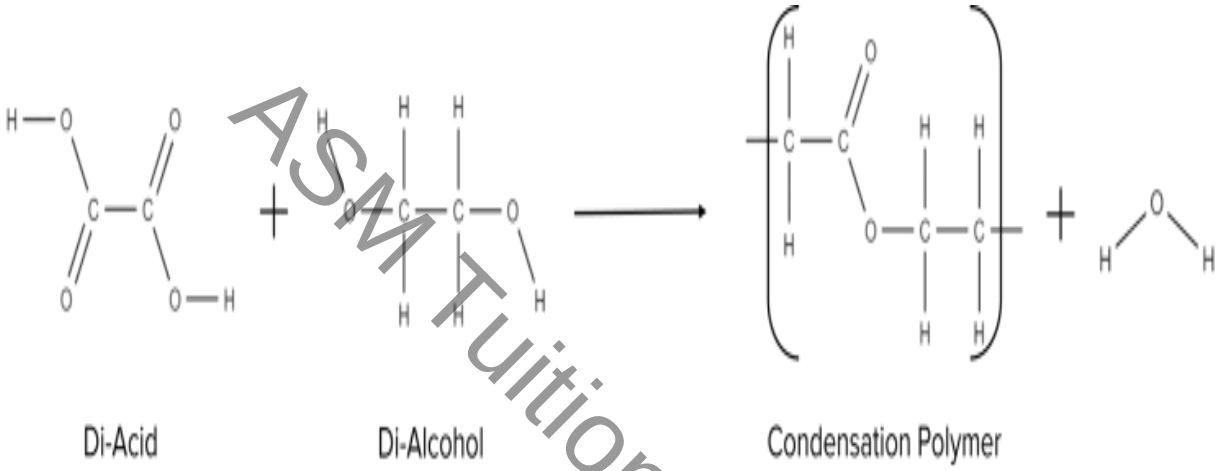
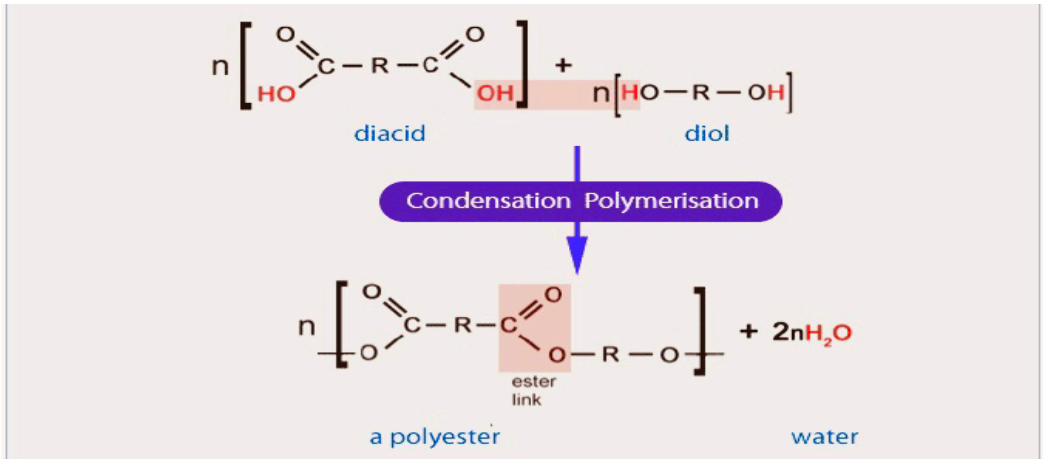
Condensation Polymerisation

- Unlike addition polymerisation, which involves monomers with the **same** functional groups, condensation polymerisation involves monomers with **different** functional groups.
- **For example**, condensation polymers will be formed when a **di-alcohol** (a molecule with two **alcohol** functional groups) and a **di-acid**(a molecule with two **carboxylic acid** functional groups).

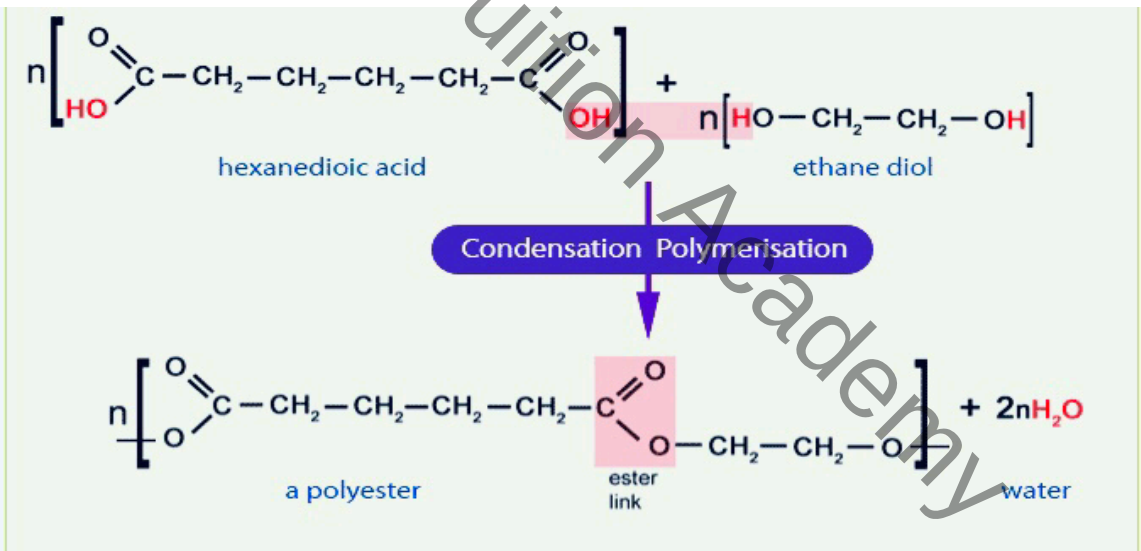


- Unlike addition polymerisation, condensation polymerisation will yield **two** products, one **large polymer chain** and one **simple molecule**, often water.
- **For example,** in the polymerisation reaction given above, for **each new bond** formed, **one water molecule** is also produced. This happens because, upon reaction, theOHOH group of the **acid** breaks away and removes the HH atom from the **alcohol group**.
- In most cases, condensation polymerisation will involve **two molecules** that each contain a **pair of functional groups** that are the same.
- In some cases the molecules involved are more complex. This is the case for the **natural polymers** like **DNA**.



Representing Condensation Polymers

An example of a condensation polymer is **polyester**, which is formed from ethane diol and hexanedioic acid. Water is also formed in this reaction. When polymerisation occurs, each repeating unit of the polymer contains a functional group from each monomer.



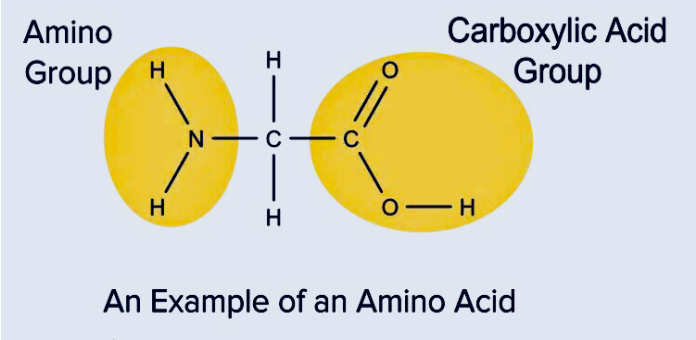
Nauring occurring polymers

1. AminoAcid
2. DNA

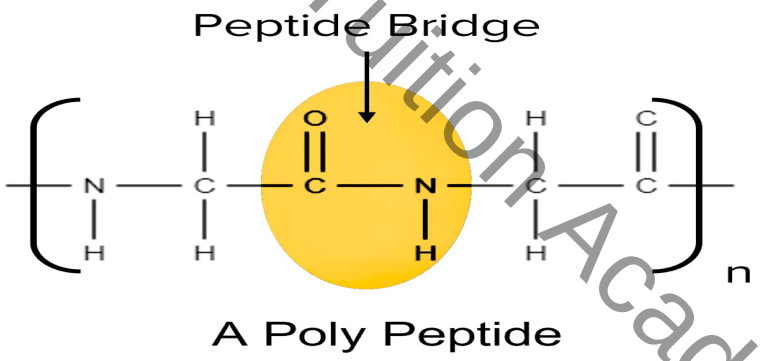
1. Amino Acids

➤ Amino acids are **naturally** occurring molecules that contain both a **basic amino** (–NH2)(–NH2) group and an **acidic carboxylic acid** (–COOH)(–COOH) group.

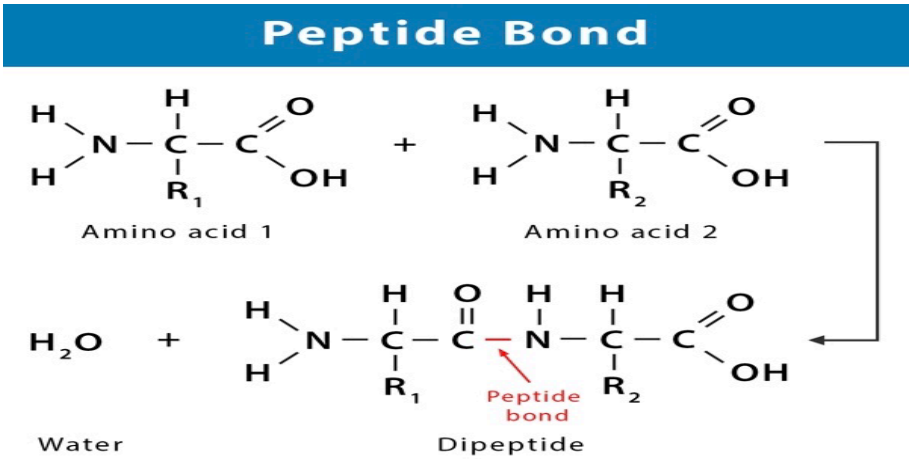
- Amino acids are able to undergo **condensation polymerisation** with themselves to form a special type of natural polymer called a **polypeptide**. Polypeptides get their name from the **peptide bridges**(peptide bonds) they contain.



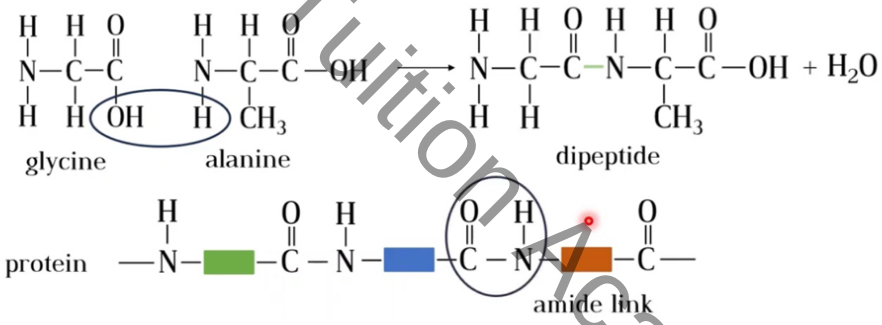
- A **peptide bridge** is a **functional group** consisting of a carbon double bonded to an oxygen and single bonded to a nitrogen atom, which is itself bonded to another carbon atom on the other side. Peptide bridges connect organic molecules together, building up large polymer chains.



- Polypeptides can consist of repeating chains of the **same** amino acid or of **different** amino acids arranged in different patterns. Long combinations of **different** amino acids form natural **proteins** found in living matter.
- Polypeptides are formed from condensation reactions, there will be an additional product in the form of a molecule of **water**.



- Proteins are the polymer of amino acids



2. DNA

- **DNA (Deoxyribonucleic Acid)** is another example of a **natural polymer**. DNA is **essential** for all life on earth.

- DNA is formed of **two** long **polymer chains**, built out of the combination of **four** types of monomers called **nucleotides**. These two polymer chains are **wrapped** around each other in a structure known as the **double helix.**
- 4 Types of nucleotide are:

① **Adenine (A)**
② **Thymine (T)**
③ **Cytosine (C)**
④ **Guanine (G)**

- The **two strands** of the helix is held together by links between **base pairs**. The sequence of these pairs contain the **code** used by living organisms to control the building of **proteins**. Other examples of natural polymers include starch and cellulose.