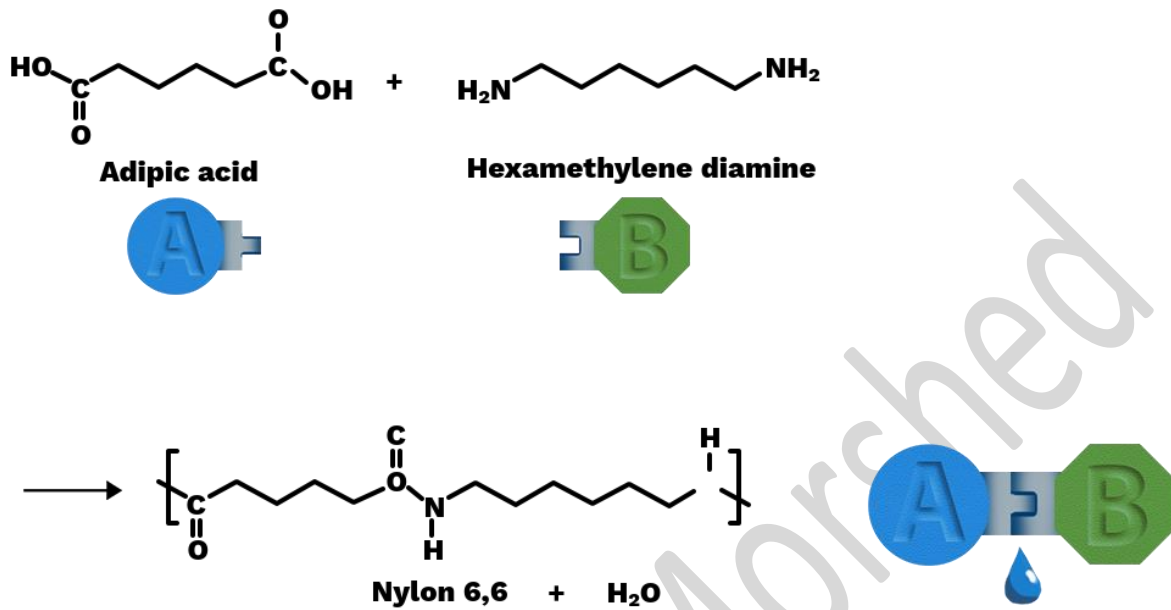
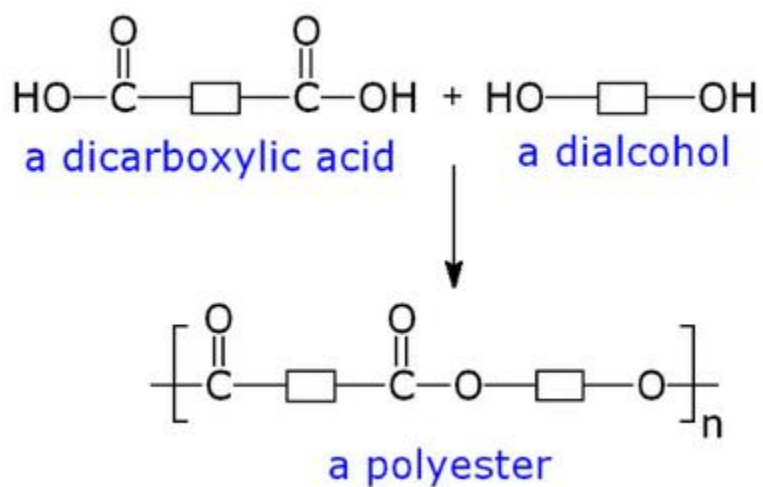


Condensation Polymers

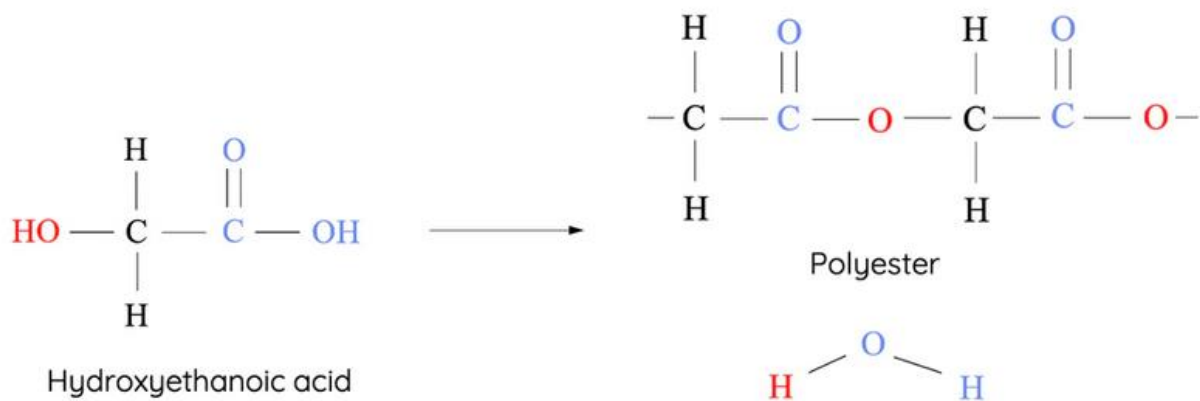


Polyesters

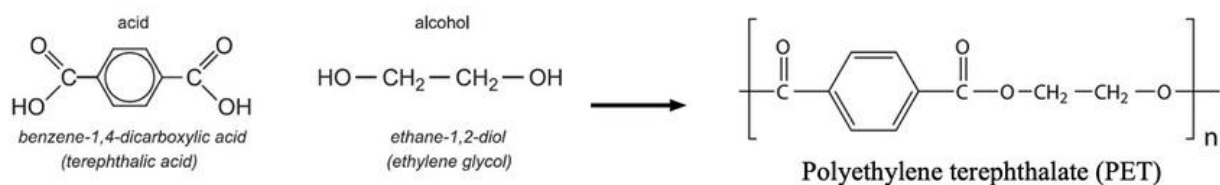
- **Structure:** monomers are joined together **via esterification** i.e. reaction between **an alcohol and a carboxylic acid** functional group.
- A water molecule is eliminated every time two monomers are joined.
- A polyester can be produced by reacting dicarboxylic acids and di-alcohols.



- A polyester can be produced by using a monomer that contains both **carboxylic acid and alcohol functional** groups.



- **Polyethylene terephthalate (PET)** is the specific polyester used in textiles. It is produced using **two monomers: a dicarboxylic acid and a di-alcohol**.



Properties of Polyesters

- High tensile strength
- Can be drawn into fibres
- Abrasion-resistant
- Heat-resistant
- Crease/wrinkle-resistant
- UV-resistant
- Thermoplastic
- Hydrophobic; greater moisture resistance

Uses

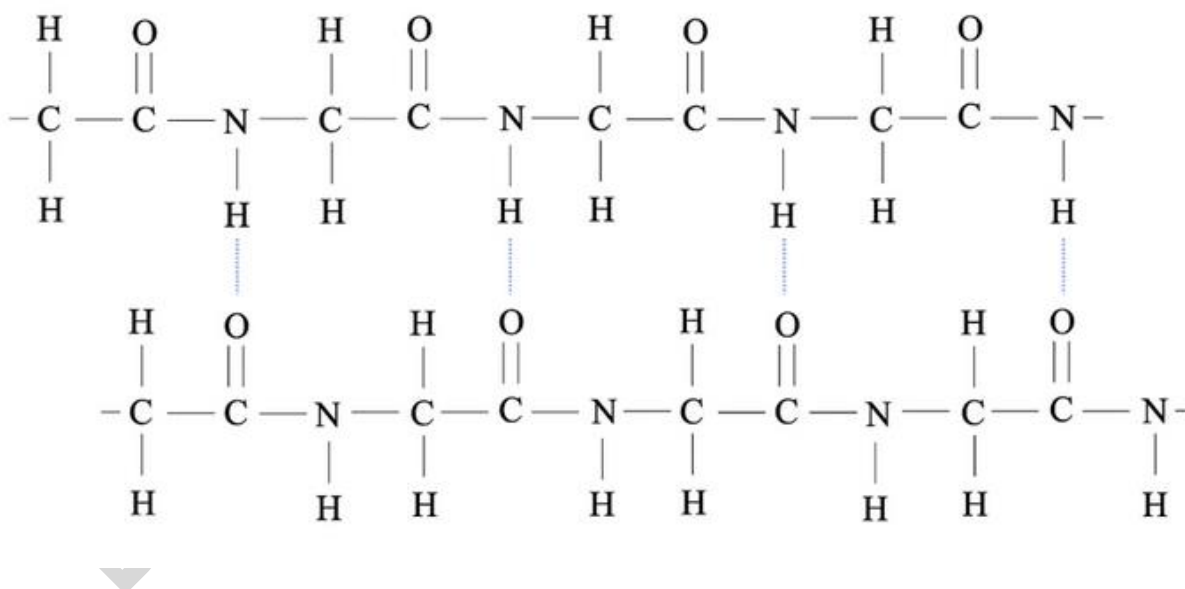
- ✓ Clothing
- ✓ Carpets and other textiles
- ✓ Fruit containers
- ✓ Single-use plastic bottles

- ✓ Toasters
- ✓ Shower headers

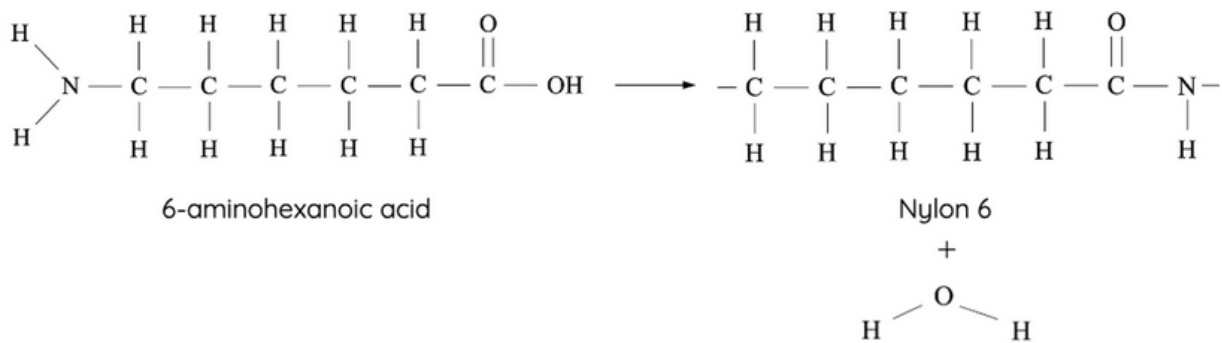
Polyamides

- Structure: monomers are joined together via **amidation**, that is a reaction between a **carboxylic acid and an amine functional group**. A **water molecule is eliminated** every time a dicarboxylic and a diamine molecule join together.
- In addition to dispersion and dipole-dipole forces, hydrogen bonds are also formed between polyamide chains. This is because polyamide molecules contain **hydrogen atoms bound to nitrogen atoms**, which allows them to **donate hydrogen bonds to oxygen** atoms in nearby polyamide chains.

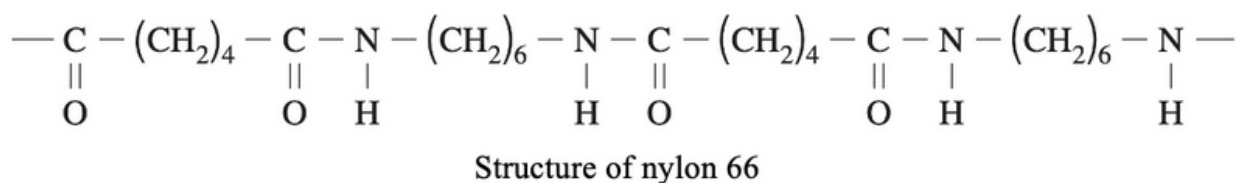
Below Diagram shows **hydrogen bonds formed** between adjacent polyamide chains



Nylon 6 is a common polyamide produced from 6-aminohexanoic acid (monomer).



Nylon 6,6 is another common polyamide produced from two monomers: hexandioic acid (adipic acid) and hexan-1,6-diamine.



Properties of Nylon:

- ❖ High tensile strength
- ❖ Can be drawn into fibres
- ❖ Abrasion-resistant
- ❖ Elastic
- ❖ Thermoplastic
- ❖ Absorbs moisture

Uses:

- ✓ Clothing: Lingerie, tights, raincoats and swimwear
- ✓ Carpets, drapes and bedding
- ✓ Seat belts
- ✓ Ropes, nets, sleeping bags, tents

Polyesters vs Polyamides

Property	Polyamide (nylon)	Polyester (PET)
Structure	<ul style="list-style-type: none"> • Both are condensation polymers. • Both uses carboxylic acid functional group in monomer(s). • Production of polyamides and polyesters produce water as byproducts • Unlike polyesters, hydrogen bonds are formed between polyamide chains. 	
Properties	<p><i>Similarities</i></p> <ul style="list-style-type: none"> • High tensile strength • Both can be drawn into fibres: good for textile use • Abrasion-resistant • Thermoplastic: can be re-shaped and recycled via melting <p><i>Differences</i></p> <ul style="list-style-type: none"> • Polyesters are more heat resistant • Polyamides have greater tensile strength than polyesters • Nylon can absorb moisture whereas polyesters are more hydrophobic so they are less able to do so. 	
Uses	<p><i>Similarities</i></p> <ul style="list-style-type: none"> • Both are useful in textiles e.g. clothing and carpets due to their high tensile strength, ability to be drawn into fibres and recyclable nature (thermoplastic) <p><i>Differences</i></p> <ul style="list-style-type: none"> • Polyesters are more heat resistant, so they are found in appliances that are exposed to high temperatures such as toasters. • Polyesters are found in plastic containers for fruits and plastic bottles. • Nylon is also found in fishing nets and ropes, applications that require greater tensile strength. 	