

Polymers Knowledge organiser



1. Keywords	
Plasticiser	a substance added to a synthetic material to produce or promote plasticity and flexibility and to reduce brittleness.
Atomic number:	number of protons (smaller no.) also the number of electrons in an atom.



Low-density polyethylene (LDPE) (High degree of short-chain branching + Long-chain branching)

High-density polyethylene (HDPE) (Low degree of short-chain branching)

Example of addition polymerisation
$$n \begin{pmatrix} 1 & 1 \\ C & C \\ 1 & 1 \end{pmatrix} \xrightarrow{\text{polymerisation}} \begin{pmatrix} 1 & 1 \\ C & C \\ 1 & 1 \end{pmatrix}_{n}$$
monomer repeating unit

Example of condensation polymerisation

2. Types of polymers.

Addition polymers.

- Alkenes can be used to make polymers such as poly(ethene) and poly(propene) by addition polymerisation.
- Addition polymers are very unreactive and inert because all the non-polar single C-C bonds.
- Polythene chains only have van der Waal's forces between chains so are not good for forming fibres or weaving.
- Polyethene is very useful though as it has no branches so the chains can pack closely and hence is a strong, rigid material.
- LDPE is made at high temperatures and high pressures via free radical mechanism, hence it is highly branched and less packed than HDPE so it is stretcher. HDPE is made in the presence of the Ziegler-Natta catalyst at temperatures and pressures little higher than room conditions.
- PVC (Poly(chloroethene) contains polar C-Cl bonds. This makes PVC a hard but brittle material.
- The properties of PVC can be modified using a plasticiser which makes the material softer and bendier. The plasticiser pushes the chains apart and the chains can slide making them more flexible. Plasticised PVC is used to make electrical cable insulation, flooring tiles and clothing.

Condensation polymerisation

- Condensation polymerisation involves monomers with two functional groups (COOH and OH groups or COOH and NH,groups). During the condensation water or HCl is eliminated..
- Condensation polymers can be hydrolysed so they are biodegradable.
- Common condensation polymers: Polyesters (-COO- linkage), like Terylene.
 - Polyamides (-CONH- linkage), like Nylon and Kevlar.
 - Polypeptides (-CONH- linkage), comprising all proteins.

3. Disposal of polymers.

The options for disposal are either burying in landfill, burning or reusing/recycling.

- Advantages: reduces the amount of waste going to landfill, saving raw materials and producing less CO₂ than burning the plastic.
- Disadvantages are that it is difficult to recycle; collecting, sorting and processing is expensive and the plastic can be easily the recycling process. Contaminated.

Types of recycling:

- -Mechanical recycling: types of plastics are separated, washed and ground to pellets that can be melted and remoulded.
- -Feedstock recycling: plastics are heated to produce the monomers that can be reused to make new plastic. This can be only done a limited amount of times.