Cambridge IGCSE Chemistry

Topic 14: Organic chemistry

Synthetic polymers

Notes

Name some typical uses of plastics and of man-made fibres such as nylon and Terylene

- Plastics:
  - Plastic bags
  - Clingfilm
  - Buckets, other plastic tools
- Man-made fibres such as nylon and Terylene:
  - Drawn into very fine fibres and woven into cloth for clothing
  - Other natural fibres (e.g. cotton) can be mixed with nylon or polyester fibres to make a soft but hard-wearing cloth

(Extended only) Explain the differences between condensation and addition polymerisation

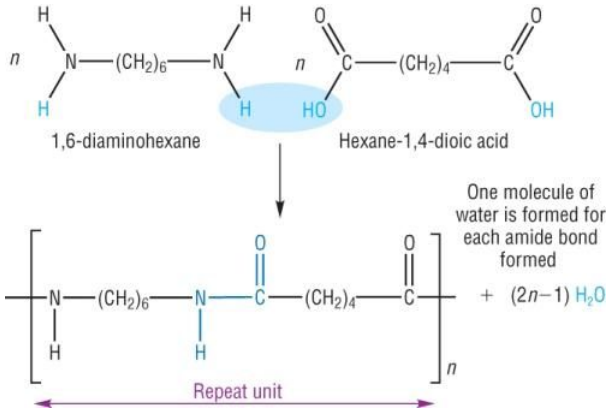
- Addition polymerisation involves the removal of a C=C double bond to form a –C-C- bond, i.e. it joins up unsaturated molecules to form a long saturated molecule
- Condensation polymerisation involves the reaction of two different functional groups to form one long molecule by the removal of a small molecule, such as water H_2O
  - This means that there can be more than one monomer used in condensation polymerisation (unlike addition which only uses one)

(Extended only) Deduce the structure of the polymer product from a given alkene and vice versa

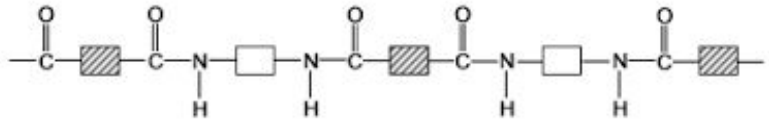
- the polymer product would be a long chain of the alkene without the C=C and instead with –C .... C- at the end, i.e. open branches

(Extended only) Describe the formation of nylon (a polyamide) and Terylene (a polyester) by condensation polymerization

Formation of nylon:

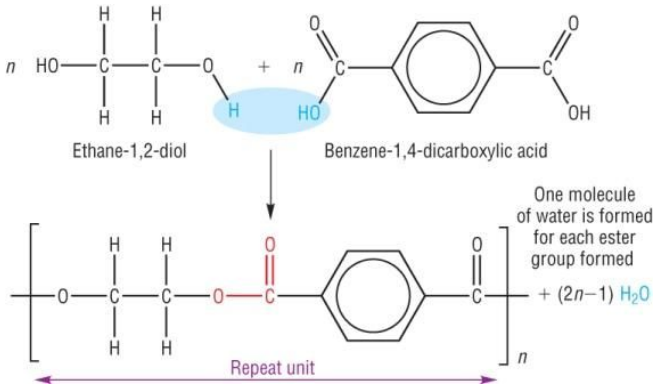


- this is the only detail you need to know the structure of nylon in:

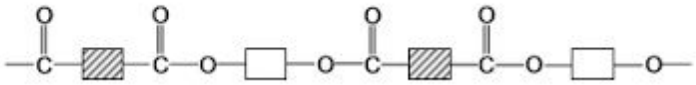


- Polyamides are condensation polymers
    - Amine and carboxylic acid functional groups react, losing a small molecule – water
- A polyamide is formed from:
    - a monomer molecule containing two carboxylic acid groups (dicarboxylic acid) reacting with a monomer molecule containing two amine groups
    - or a single monomer molecule with both carboxylic acid and amine functional groups
- -OH + -COOH -> -COO- (+H_2O removed)

Formation of Terylene: (a polyester)



- this is the only detail you need to know the structure of terylene in:



- Polyesters are condensation polymers
- A polyester is formed from:
    - a monomer molecule containing two carboxylic acid groups (dicarboxylic acid) is reacting with a monomer molecule containing two alcohol groups (diol)
    - or a single monomer molecule with both carboxylic acid and alcohol functional groups
- -OH + -COOH -> -COO- (+H_2O removed)

Describe the pollution problems caused by non-biodegradable plastics

- Unable to biodegrade, because the polymers that form these plastics are inert / unable to react therefore, microorganisms and bacteria are unable to break them down
    - *o* Thus, the landfills are bad for the environment as the plastics will remain in the ground, unable to break down/decompose
- They produce toxic gases when they are burned
    - *o* Carbon dioxide is also released – which adds to global warming