



Edexcel GCSE Chemistry

Topic 9: Separate chemistry 2

Polymers

Notes



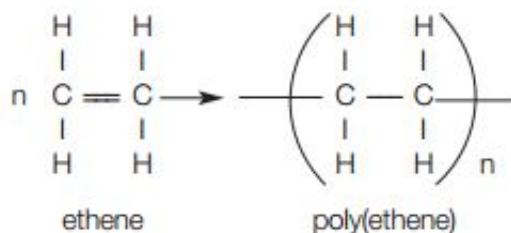


9.17C Recall that...

- A polymer is a substance of high average relative molecular mass made up of small repeating units

9.18C Describe: how ethene molecules can combine together in a polymerisation reaction and that the addition polymer formed is called poly(ethene) (conditions and mechanisms not required)

- Alkenes can be used to make polymers such as poly(ethene) and poly(propene) by addition polymerisation. In this reaction, many small molecules (monomers) join together to create very large molecules (polymers). For example:



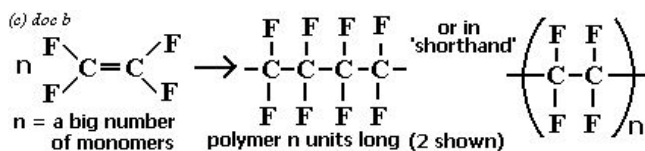
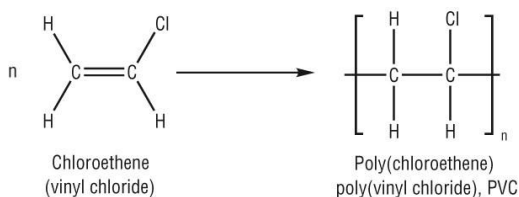
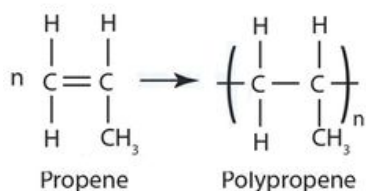
- The repeat unit has the same atoms as the monomer because no other molecule is formed in the reaction





9.19C Describe how other addition polymers can be made by combining together other monomer molecules containing C=C, to include poly(propene), poly(chloroethene) (PVC) and poly(tetrafluoroethene) (PTFE) (conditions and mechanisms not required)

- any alkene can be used as a monomer to create a polymer due to the C=C bond



9.20C Deduce the structure of a monomer from the structure of an addition polymer and vice versa

- Monomer is the same as the repeat unit, just replace C-C with C=C and remove brackets and "n"

9.21C Explain how the uses of polymers are related to their properties and vice versa: including poly(ethene), poly(propene), poly(chloroethene) (PVC) and poly(tetrafluoroethene) (PTFE)

- Poly(ethene)
 - Properties: flexible, cheap, electrical insulator
 - Uses: plastic bags and bottles, coating on electrical wires
- Poly(propene)
 - Properties: flexible & strong
 - Uses: buckets and crates
- Poly(chloroethene) or PVC
 - Properties: tough, cheap and long lasting
 - Uses: window frames



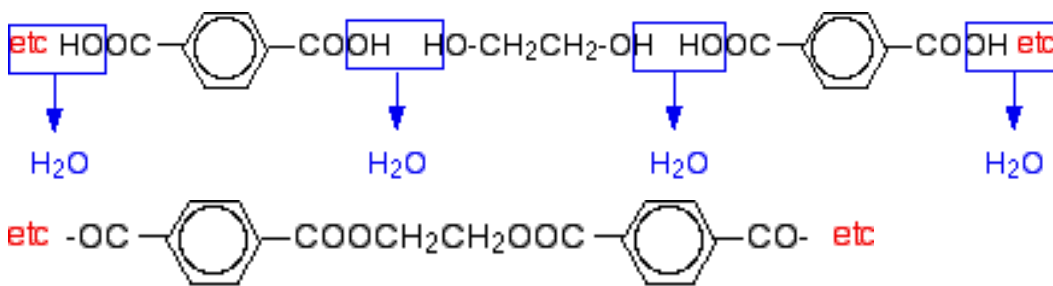


- PTFE
 - Properties: tough & non-stick
 - Uses: non-stick coating on pans

9.22C (HT only) Explain:

- *Why polyesters are condensation polymers:*
 - In condensation polymerisation, a small molecule is formed as a by-product each time a bond is formed between two monomers
 - Alcohol and carboxylic acid functional groups react, losing a small molecule – water
 - This is an ester – therefore a polyester is a lot of these monomers (esters)
- *How a polyester is formed when a monomer molecule containing two carboxylic acid groups is reacted with a monomer molecule containing two alcohol groups*
 - the dicarboxylic acid loses the OH group off of each COOH group
 - the di-alcohol loses the H off of each OH group
 - the remaining molecules join together to make a polyester
- *How a molecule of water is formed each time an ester link is formed*
 - the OH and H groups combine to make H₂O

See example below:



9.23C Describe some problems associated with polymers

- Polymers are formed by the joining up of many small molecules with strong covalent bonds
- The presence of strong covalent bonds make polymers unreactive and chemically inert, hence, they are usually non-biodegradable
- When non-biodegradable polymers such as plastics are thrown at landfills, they cause landfills to fill up quickly as decomposers are unable to break them down.
- Polymers also release carbon dioxide, which is a greenhouse gas when they are decomposed via combustion. This can lead to climate change.
- Polymers which contain chlorine such as PVC releases toxic hydrogen chloride when burned. If polymers are incinerated by incomplete combustion, carbon monoxide may be released which is harmful to the respiratory system.



9.24C Evaluate the advantages and disadvantages of recycling polymers, including economic implications, availability of starting materials and environmental impact

- Advantages
 - Reuse waste materials – better for environment than burning them or putting them in landfills
 - Saves crude oil (a finite resource)
 - More economically viable instead of making more polymers
- Disadvantages
 - Difficult and expensive to first separate the different polymers (they need to be sorted into types)

9.25C Recall that:

- DNA is a polymer made from 4 different monomers called nucleotides (names of nucleotides not required)
- Starch is a polymer based on sugars
- Proteins are polymers based on amino acids

