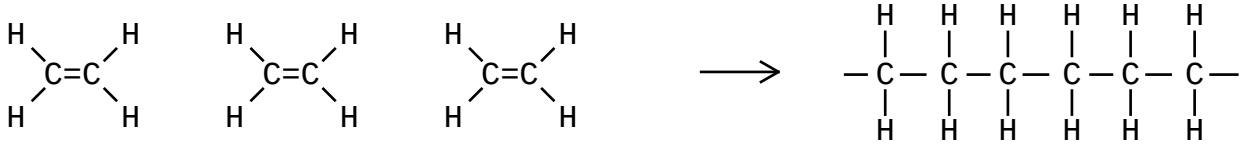
Topic 13 : Plastics and Synthetic Fibres

Revised March 2002

Polymers are large molecules made by linking together smaller molecules called monomers. The 'linking together process' is called polymerisation. Plastics and synthetic fibres are man-made polymers (Synthetic means 'man-made')

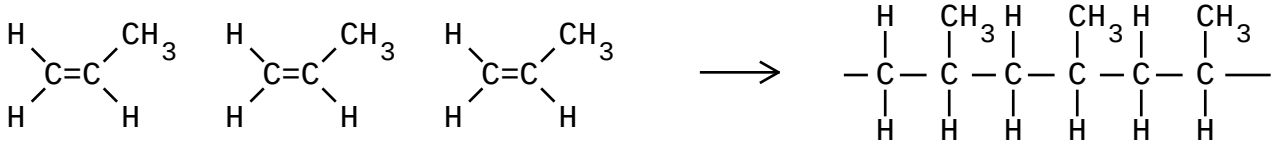
The monomers are usually alkenes, produced by cracking crude oil fractions, and other unsaturated substances. These monomers join together by addition (opening up their double bonds). Polymers called polyalkenes are formed :

Example 1 : Polymerisation of Ethene to form Polyethene.



Ethene — Polyethene

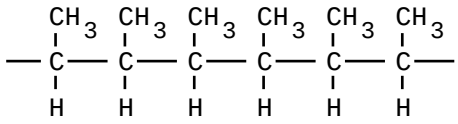
Example 2 : Polymerisation of Propene to form Polypropene.

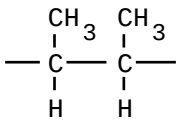


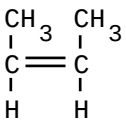
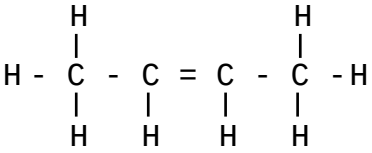
Propene — Polypropene

Both polymers are thermoplastic - they melt on heating and can therefore be moulded.

Problem From the structure of the addition polymer opposite deduce the structure of the monomer from which it was made.



Answer : repeating unit is 

so the monomer must be  **OR** 

Butene

Some polymers are thermosetting - they do not melt on heating and so cannot be moulded. Urea-Methanal is a thermosetting polymer which, because it does not melt, is used to make things which might get hot e.g. electric plugs, pot handles etc.

Uses of Polymers

The uses depend on the properties of the polymer : Polypropene is used to insulate wires because it does not conduct electricity ; expanded Polystyrene is used as a packing material because of its lightness.

Plastics have certain advantages over natural materials.

Examples :

1. They do not corrode like metals
   Polypropene can be used to make drain-pipes instead of Iron.

2. Their fibres are stronger than natural fibres.
   Nylon jumpers do not wear as quickly as those made from cotton or wool.

Plastics also have certain disadvantages which natural materials do not have.

Examples :

1. They are not biodegradable (broken down by bacteria or fungi).
   Paper is biodegradable ; paper bags, once thrown away, break down.
   Plastic bags last forever and pollute the environment.

2. They burn to give off toxic fumes and therefore cannot be disposed of by incineration.

   The particular fumes depend on the elements present in the polymer :

   - Polymers containing Carbon (Polyethene, Polypropene) give off Carbon monoxide CO

   - Polymers containing both Hydrogen and Chlorine (PVC) give off Hydrogen chloride HCl

   - Polymers containing Hydrogen, Carbon and Nitrogen (Polyurethane) give off Hydrogen cyanide HCN