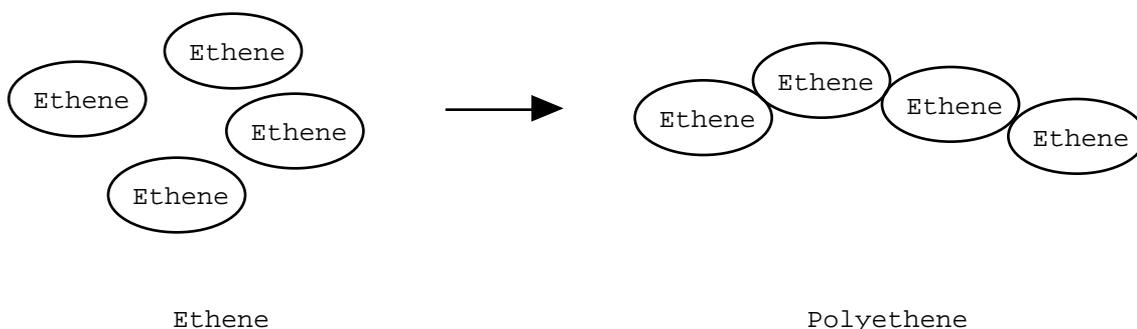


PLASTICS AND FIBRES

Plastics are man-made polymers, made by the chemical industry using raw materials obtained from crude oil.

The molecules in plastics are **polymers** - giant molecules made by linking together thousands of smaller molecules, called **monomers** - a reaction called **polymerisation**.

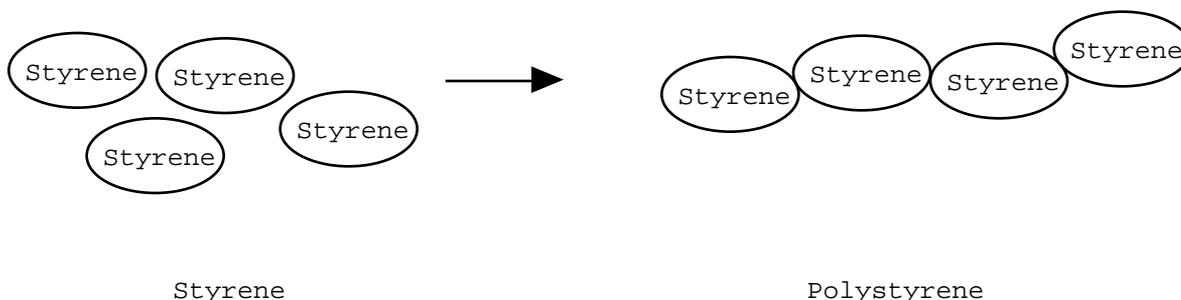
Example 1: Polyethene is made by polymerisation of Ethene.



Ethene is the monomer; Polyethene is the polymer.

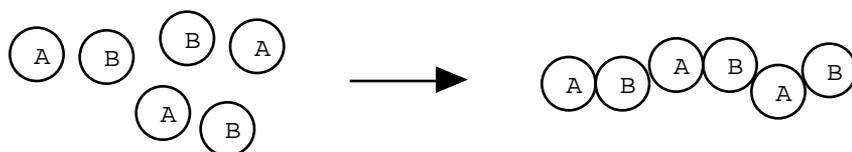
Polyethene is used to insulate electrical cables and to make plastic bags etc.

Example 2: Polystyrene is made by polymerisation of Styrene.



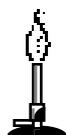
Styrene is the monomer; Polystyrene is the polymer.

Example 3: Nylon is made by polymerisation of two monomers: Sebacoyl chloride (A) and 1,6-Diaminohexane (B):

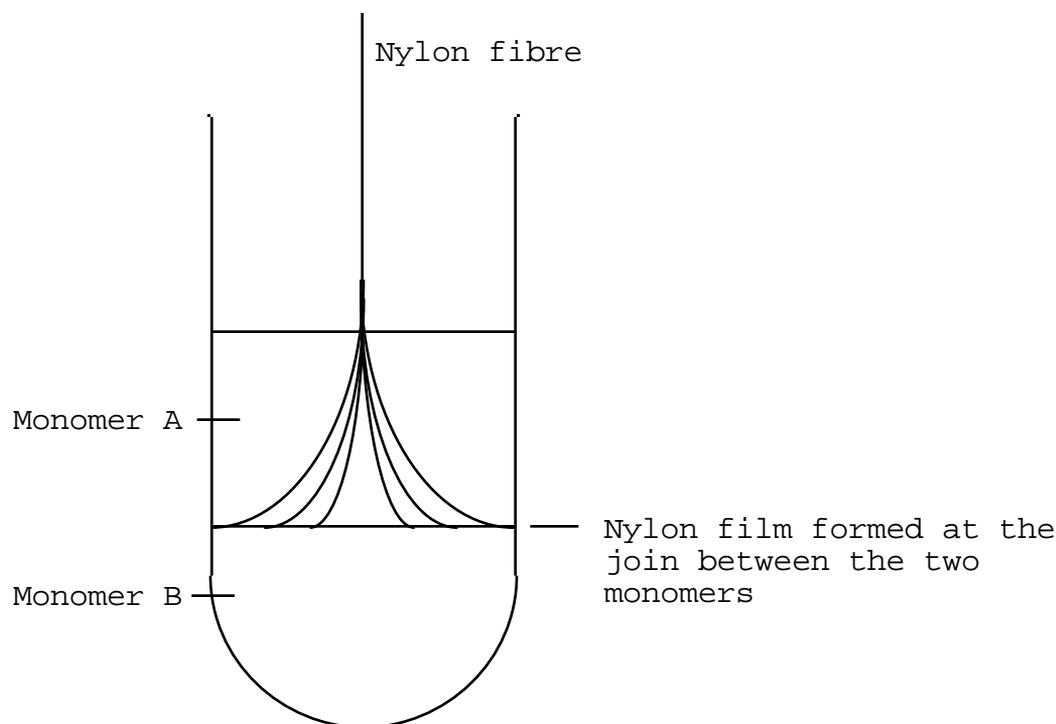


Monomers A and B

Nylon



Make some Nylon fibre in the laboratory.



The Uses of Plastics

The uses of plastics depend on their properties.

Most plastics melt on heating. They are described as **thermoplastic**. Polyesters, Nylon, Polyethene, PVC, Polystyrene, Perspex and silicones are all examples of thermoplastics. They can therefore be moulded into the shapes required e.g. drain-pipes, plastic bags etc.

Some plastics do not melt on heating e.g. Urea-methanal, Bakelite and Formica. They are described as thermosetting. Their heat resistance and low electrical conductivity makes them useful for making electrical sockets and plugs.

Polyvinylchloride (PVC) is used instead of Iron to make buckets, drain-pipes, guttering etc. because of its much lower density and the fact that it does not rust!

Kevlar, a polymer similar to Nylon, is very strong and is therefore used for making bullet-proof vests!!

The strength and low density of Nylon makes it ideal for making clothes and ropes. Its low friction (slipperiness) makes it ideal for making gears and bearings.

Clothing

Clothes are made from polymers woven into thin strands called FIBRES.

Natural fibres come from plants and animals.

Silk is a natural fibre obtained from the silk worm.

Wool is a natural fibre obtained from sheep.

Cotton is a natural fibre obtained from the cotton plant.

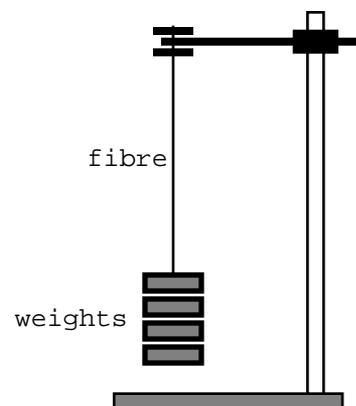
Synthetic fibres are made by the chemical industry.

Nylon and Polyesters (e.g. Terylene) are synthetic fibres.

Compared to natural fibres, synthetic fibres are stronger and less likely to get damaged in the washing machine.



Investigate the breaking strength of natural and synthetic fibres by hanging weights on these fibres until they break.



Chemists have developed ways of treating fabrics to improve their properties and appearance:

- * The bright colours of our clothes are obtained using coloured chemicals called dyes.
- * Fabrics can be fire-proofed by soaking in a solution of alum.
- * Fabrics can be water-proofed by treating with Silicones.

Some fibres (e.g. wool) form strong bonds with Water molecules; these fibres are hard to drip-dry but they do not feel 'sweaty' to wear because they soak up perspiration.

Other fibres (e.g. Nylon) form weaker bonds with Water; they drip-dry easily but can feel 'sweaty' to wear since they do not soak up perspiration.

Pollution problems

The strength and durability of all plastics is an obvious advantage over natural materials. The durability of plastics can, however, lead to environmental problems.

Natural materials (e.g. paper) are **biodegradable** - when buried, they are broken down by bacteria and fungi in the soil and rot away.

Most plastics are not biodegradable - they therefore last forever, polluting the environment.

Chemists are now trying to make plastics which **ARE** biodegradable.

e.g. Biopol is a biodegradable plastic being used for carrier bags and other disposable items.

Disposal of plastics

Burning is not an ideal means of disposal. Though the heat generated can be used as a source of energy, poisonous fumes are given off e.g. Carbon monoxide.

Burying is usually the only safe method of disposal.



Since most plastics are made from crude oil, and crude oil will not last forever, it would be sensible to recycle plastics - melt them down, re-mould them and use them again. Recycling can be difficult because of the many different kinds of plastic in common use.

Chemists are now trying to make plastics from renewable sources e.g. Rayon can be made from cotton.