Why use plastics

- Plastic are **easily formed** materials.
- The advantage to the manufacturer is that plastic products can be **mass-produced** and require **less skilled staff**.
- Plastics require little or **no finishing**, painting, polishing etc. Plastic is referred to as a **self-finishing material**. Particular finishes can be achieved at relatively low cost.
- Plastics can be easily printed, decorated or painted.
- Plastics are **corrosion resistant**, and **generally waterproof** although certain types of plastics such as UPVC can become brittle and it is possible for the sun's rays to cause the colour of the plastic to fade. It becomes bleached.
- Plastics are **lighter than metals**, giving **deeper sections** for a given weight, and hence **stronger sections**.

Origins of Plastics - **synthetic plastics**.

- The main source of synthetic plastics is **crude oil**.
- **Coal** and **natural gas** are also used.
- Petrol, paraffin, lubricating oils and high petroleum gases are bi-products, produced during the refining of crude oil.
- These gases are broken down into **monomers.** Monomers are chemical substances consisting of a single molecule.
- A process called **Polymerisation** occurs when thousands of monomers are linked together. The compounds formed as called **polymers**.
- Combining the element **carbon** with one or more other elements such as oxygen, hydrogen, chlorine, fluorine and nitrogen makes most polymers.

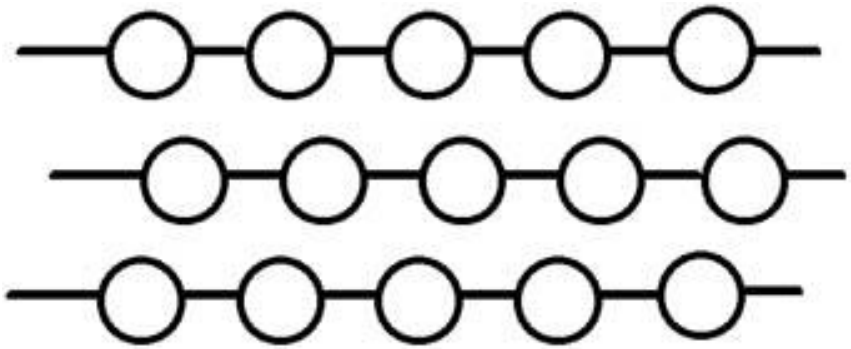
Natural Plastics

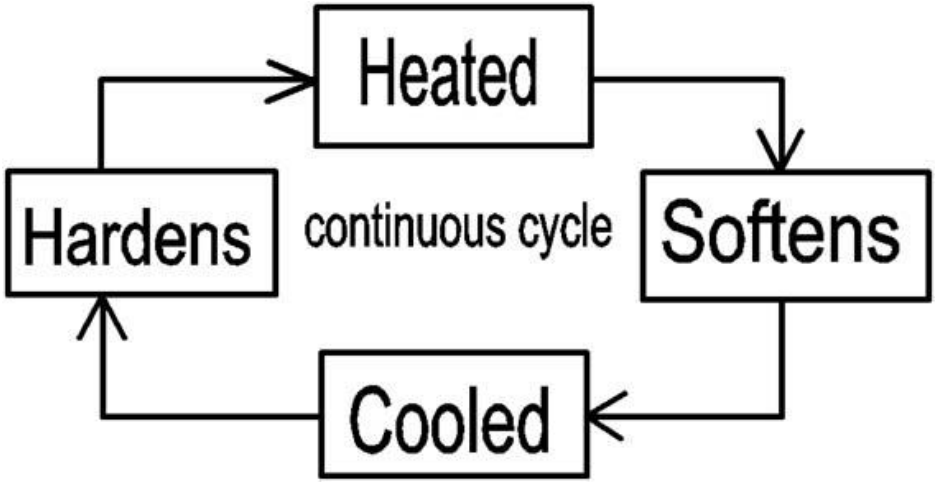
- Natural ‘plastic products’ occur in such things as animals’ horns, animals’ milk, insects, plants and trees.
- **Animals horns -** Casein (glue)
- **Animals milk -** Formaldehyde (glue)
- **Insects -** Shellac (French polishing)
- **Plants -** Cellulose (table tennis balls), Cellulose acetate (cloth, photographic film, handles), Cellophane (wrapping), Bitumen (roads, flat roofs)
- **Trees -** Latex (rubber)

Thermoplastics

- There are a wide range of thermoplastics, some that are rigid and some that are extremely flexible.
- The molecules of thermoplastics are in lines or **long chains** with very few entanglements. When heat is applied the molecules move apart, which increases the distance between them, causing them to become untangled. This allows them to become soft when heated so that they can be bent into all sorts of shapes.
- When they are left to cool the chains of molecules cool, take their former position and the plastic becomes stiff and hard again. The process of heating, shaping, reheating and reforming can be repeated many times.

Long chain molecules





Thermoplastics and Plastic Memory

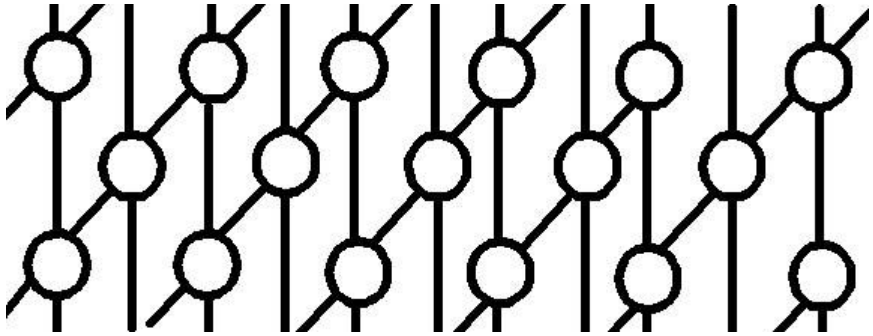
Each time a thermoplastic is reheated it will try and return to its original shape, unless it has been damaged due to overheating or overstretching. This property is called **plastic memory**.

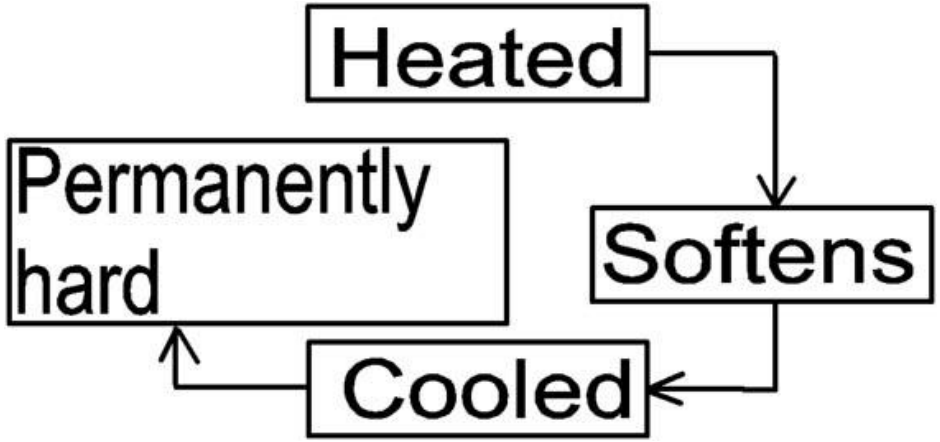
This is why a shape formed in thermoplastic becomes flat when reheated.

Thermosetting plastics

- The molecules of thermosetting plastics are heavily **cross-linked**. They form a **rigid molecular structure.**
- The molecules in thermoplastics sit **end-to-end and side-by-side**.
- Although they soften when heated the first time, which allows them to be shaped they become permanently stiff and solid and cannot be reshaped.
- Thermoplastics remain rigid and non-flexible even at high temperatures. **Polyester resin** and **urea formaldehyde** are examples of thermosetting plastics.

Cross-linked molecules





Expanded polystyrene

- This is used for disposable food packaging, disposable cups, heat insulation and **protective packaging** for electrical equipment.

- **Image**: Protective packaging

Clear Acrylic (Perspex)

- It was first used to make aircraft canopies. It is ten times more impact resistant than glass.

- **Image**: Perspex top of a container

Polystyrene

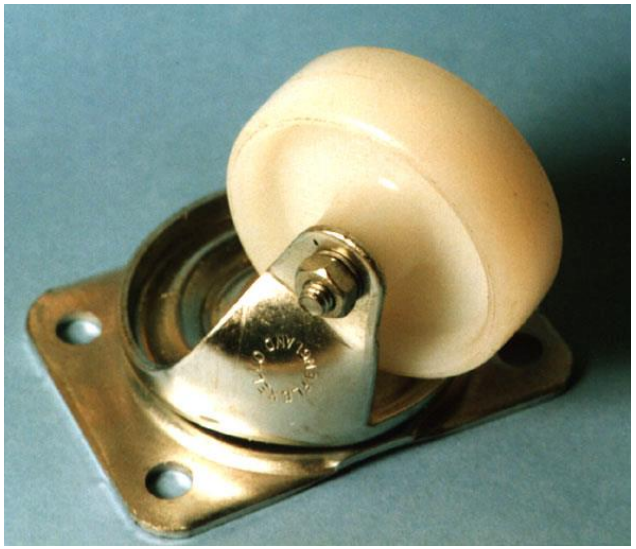
- Polystyrene is used to make **plates**, cutlery and model kits.
- It is stiff hard and comes in a wide range of colours.
- **Image**: cup and saucer

Nylon

- Nylon is hard, tough, self-lubricating, has a high melting point and has very good resistance to wear and tear.

- It has been used to make clothing, bearings and propellers.

- **Image**: A nylon castor (wheel).



PVC

- The rigid type is used to make **pipes**, **guttering** and roofing. It is very lightweight and is resistant to acids and alkalis.
- The plasticised type is used for suitcases, hosepipes, electrical wiring and floor coverings.
- **Image**: plumbing U-bend

Polythene

- High-density polythene has been used to manufacture milk crates, bottles, buckets, bowl and gear wheels.

- It is stiff, hard, can be sterilised and is dense.