

Plastics

Name: _____

There are many different types of plastic and can be split into four groups :

Man made (synthetic) plastics have replaced wood and metal in the manufacture of a wide range of products. The 1st synthetic plastic was celluloid. It was made from cotton and camphor and used for table tennis balls and film. Commercial production of plastics really started after the 2nd World War. The raw materials used were either coal or oil. They contain a number of different chemicals which can be separated into parts by a process called Fractional Distillation. Some of the fractions contain chemicals that are small molecules (Monomers). The monomers are chemically joined together to make longer molecular 'chains' called Polymers.

THERMOPLASTICS are made from long chain polymers, joined by weak chemical bonds. When the plastic is softened by heat the bonds break making the plastic 'semi fluid' and able to be shaped. As the plastic cools, new weak bonds form and the shape will be fixed. Because no chemical reaction has taken place this process can be repeated many times, making them recyclable, however excessive heat will permanently damage the chemical structure.



THERMOSETTING are plastics which are converted into their final form by heat. Once set, they cannot be softened by further heating as they undergo a chemical change. They have strong chemical bonds that hold the long chains together. These make thermosetting heat resistant but not recyclable. It is difficult to make products by extrusion or injection moulding as they harden as soon as heated. Manufacturing methods include casting, moulding and laminating.



ELASTOMERS are a type of thermosetting. The bonds between the chains are 'springy' giving them a rubbery quality. Natural rubber is an example it can be vulcanised to make a stiff rubber. Latex is a stretchy elastomer used to make surgical gloves. Lycra is an elastomer used to make stretchy clothing.



COMPOSITES are when materials are combined to achieve specific advantages. Examples of composites are Kevlar, GRP (Glass reinforced plastic), Graphite and Carbon Fibre. These are used extensively for sporting uses e.g. Bike parts, motor racing car bodies and tennis rackets.



Plasticisers are added to make plastic bendy.

Pigments are added to change colour.

Antistatics are used to reduce static charge.



Antioxidants to reduce attack by air.



Flame retardants to reduce burning.



Problems with plastics

Plastic products have a long shelf life, however it also means that they are difficult to dispose of;

- Because they **do not rot or corrode** they are difficult to dispose of
- If burnt they produce black choking gasses
- When molten they are sticky and can **cause severe burns**
- **Thermoplastics** can be **recycled** by melting them down and reforming their shape, but usefulness can become limited with frequent heating
- Plastic production itself can **be polluting**
- PVC contains many nasty pollutants and it is one of the most difficult plastics to recycle.

THERMOPLASTICS

- Acrylonitrile Butadiene Styrene (ABS) is strong, tough, scratch resistant and resists heat and chemicals. It is injection moulded to make Lego bricks and is used extensively for household appliances like Kettles and vacuum cleaners.
- Polystyrene (PS) is used to make vending cups and model kits. It is light, transparent but quite brittle. It is vulcanised to make High Impact Polystyrene (HIPS) This is used for Vacuum forming in thin sheets, which are cheap and easy to work with. Expanded Polystyrene (EPS) is used as thermal insulation for packaging and food cartons. It is 90% air.
- High Density Polythene (HDPE) is tough and can be blow moulded (bottles for bleach and shampoo) injection moulded (toys and buckets) and extruded (piping)
- Low Density Polythene (LDPE) is Made into thin film (Carrier bags, wiring insulation and squeeze bottles)



THERMOSETTING

- Polyester Resins which are combined with fibreglass to produce GRP.
- Phenol Formaldehyde is tough and heat resistant often black in colour. (Used for saucepan handles)
- Epoxy Resins which are mixed with a hardener and left to set. They can be used to make adhesives and flooring.



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