

Knowledge Organiser Plastic

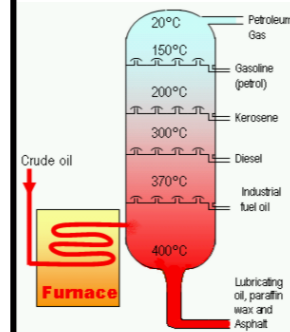
What you need to know

Know the primary sources of materials for producing polymers
Be able to recognise and characterise different types of polymers
Understand the physical working properties for a range of thermosetting and thermoplastics.

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**



Plasticisers are added to make plastic bendy.



Pigments are added to change colour.
reduce static charge



Antistatics are used to



Thermoplastics

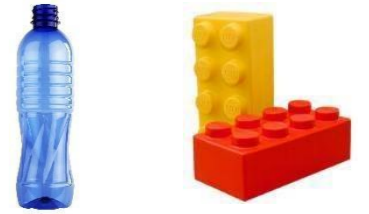
Antioxidants to reduce attack by air



Flame retardants to reduce burning



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.



THERMOSETS or thermosetting plastics 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 thermosets 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 thermoset. The bonds between the chains are 'springy' giving them a rubbery quality. Natural rubber is an example it can be vulcanised to make a rigid (ebonite). Latex is a stretchy elastomer used to make surgical gloves. Lycra is an elastomer used to make stretchy clothing.

Ebonite is an early form of plastic that was used to simulate ebony and is hard and used for bowling balls



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.



Thermosetting plastics **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, vacuum cleaners and housings for cameras and telephones.



High Density Polythene (HDPE) is tough and can be blow moulded (bottles for bleach and shampoo) injection moulded (toys and buckets) and extruded (piping)



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.



Low Density Polythene (LDPE) is Made into thin film (Carrier bags, wiring insulation and squeeze bottles)



Problems of using 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 be 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.

composite materials

Polyester Resins which are combined with fibre glass.



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



Knowledge Organiser -Plastics-

Teacher Self-Quiz Questions	Student Self-Quiz Questions	Challenge Self-Quiz Quizzing
1. Plastic is used for the casing of a plug, suggest one property that can make it suitable.	1.	1. Define the term sustainability
2. Describe what thermoplastics are.	2.	2. Describe what the carbon footprint of a product is
3. Describe what thermosetting plastics are	3.	3. What is glass reinforced plastic?
4. Give a property of melamine formaldehyde that makes it suitable for laminating worktops	4.	4. What is the name of the main industrial process through which polypropylene is processed into products?
5. Name 3 tools and equipment that can be used to cut and shape plastic	5.	5. Name a glue that is a thermosetting plastic and describe how it is mixed.
6. Acrylic, also known as Perspex is used widely in school. Why do you think this is?	6.	6. Name a plastic that is used as the basis of many paints and varnishes
7. What is the difference between LDPE (low density polythene) and HDPE (high density polythene)?	7.	7. Why is melamine Formaldehyde used for the manufacture of electrical plugs and sockets?.
8. Write the full name of the materials also called PVC	8.	8. Urea Formaldehyde can also be used for the manufacture of plugs and sockets. Why?
9. Describe some properties of PVC	9.	9. Why are polyester resins used in car body repairs, sailing boats and corrugated sheet?
10. Give the full name of HIPS and name one product manufactured from HIPS.	10.	10. What is the difference between thermosetting plastic and thermoplastic?
Total score	Total score	Total score