

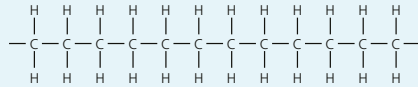
Knowledge organiser: phone holder (Theory Focus)

Monomers, polymers and plastics

- Polymers are made of a large number of similar, smaller chemical units called **monomers**.
- These monomers bond together to form polymer chains.



A simple monomer



The structure of the polymer polyethylene

- Monomers can come from two sources:
 - Natural – from nature
 - Synthetic – made by humans






Types of polymers

Polymers can be split into two main types:

- Thermoplastic polymers** become softer and flexible when heated.
- Thermosetting polymers** cannot be reshaped when heated – instead they may start to char and burn.



Types of thermoplastic polymers

Symbol	Type	Common uses
	Polymethylmethacrylate (PMMA – also known as acrylic and perspex)	Plastic windows, bath tubs
	High-density polyethylene (HDPE)	Pipes, buckets, bowls
	PET	Drinks bottles, food packaging
	High-impact polystyrene (HIPS)	Packaging
	Other, e.g. Polylactic acid (PLA)	3D printing, children's toys

Types of thermosetting polymers

Type	Common uses
Epoxy resin	Printed circuit boards, cast electrical insulators
Polyester resin	Car bodies, boats, suitcases/luggage
Melamine formaldehyde	Laminate coverings for kitchen worktops

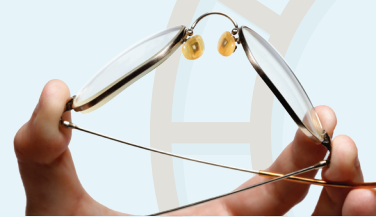
Smart materials

Smart materials have a property that changes when their environment changes. This change can be reversed if the environment changes again. Some examples are:

Thermochromic pigments change colour with temperature.



Shape memory alloy (SMA), if bent, will return to its original shape when heated.



Photochromic pigments change colour with light.

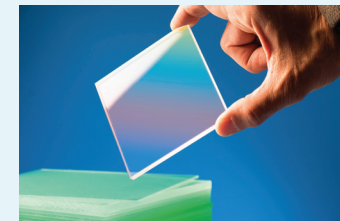


New materials

New materials have one or more properties that are better than an existing material.

Graphene

- About 300 times stronger than steel.
- Conducts electricity better than copper.
- Extremely flexible, but also tough and strong.
- One possible use is foldable screens for phones and televisions.



Composites

- A **composite** material is made up of two or more different materials, combining their properties.
- If you look at the structure of the composite material under a microscope, you can still see the separate materials it is made from.



Canoes made from moulded GRP