Ceramics

Porcelain is used for cable supports on electricity pylons as it does not conduct electricity.

e.g. porcelain, china, pottery, glass and silicon carbide

Larger crystals form when molten ceramics are cooled slowly.

The strong bonds and rigid structure help explain the properties of ceramics.

Ceramics are generally high m.pt. solids, strong, hard, brittle, durable, non-conductors of heat and electricity and unreactive.

China is used for tableware, as it is strong and a heat insulator.

A range of hard, durable, non metallic materials, which are generally unaffected by heat, e.g. china and glass.

Structure

Ceramics often have a lattice structure with billions of atoms held together by strong bonds in a rigid grid-like pattern.

Polymers

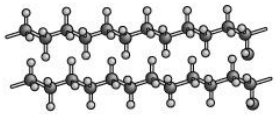
The long coiled molecules go back to their original shape when stretched, making polymers **elastic**.

Polymers are formed by joining together many small molecules called monomers.

Most synthetic polymers are made from crude oil.

e.g. poly(vinyl chloride) is used for covering electrical cables as it is flexible, strong and a non conductor of electricity.

Structure



Polymers are often long chain molecules made up of repeating groups of atoms.

Polymers are generally strong, flexible, non conductors of heat and electricity, durable and unreactive.

If cross-links are formed between chains it makes the polymer harder and less easy to melt. Vulcanisation uses sulfur to form cross-links in rubber molecules.

e.g. poly(ethene) is used for plastic bags and buckets as it is strong, flexible and durable.

Composites

e.g. in safety glass layers of glass are combined with clear polymer.

Exothermic reactions transfer energy to the surroundings so the temperature of the surroundings rises.

Endothermic reactions transfer energy from the surroundings so the temperature of the surroundings falls.

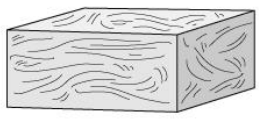
Composites are combinations of two or more different materials.

Composite materials are useful because they combine the properties of all the materials they are made from.

e.g. concrete is used for large structures because it is strong and durable.

Concrete is made by mixing cement with sand, aggregate and water.

Structure



Many composite materials contain fibres embedded in a matrix or resin.

Problems with making and using materials

Burning fossil fuels provides the energy needed to make materials but is also linked to:

- acid rain from production of sulfur dioxide
- increase in carbon dioxide levels and the greenhouse effect
- soot dirtying buildings and damaging health.

Toxic substances released in waste get into food chains.

As large animals eat lots of smaller animals, toxin levels increase (biomagnification) and can reach harmful levels in humans.

Non-biodegradable polymer waste causes pollution problems and dangers to animals for years.

Solutions to these problems include …

- removal of sulfur from fuels
- reduction in the use of fossil fuels and use of more renewable energy sources
- control of hazardous waste from factories
- use of biodegradable polymers, which break down in the soil, so they disappear more quickly.

Recycling materials to use again …

- reduces our use of landfill sites
- reduces the need to burn fossil fuels
- reduces pollution from manufacturing process
- saves our resources of raw materials, e.g. metal ores for metals and wood for paper.

Recycling saves the Earth's resources.

Examples of materials that can be recycled

Metals – by separating and melting.

Glass – by separating colours and melting.

Polymers – by using recycle labels.

Paper – by removing ink and adding water to make a pulp.

Concrete – by crushing and grading.

Endothermic and exothermic reactions

Exothermic reactions transfer energy into the surroundings and so increase the temperature around them, e.g. combustion reactions. **Endothermic reactions** transfer energy from the surroundings and so decrease the temperature around them, e.g. decomposition reactions.

Peer review: how scientific discoveries are checked

Scientists carry out investigations and write a scientific paper on their findings. They send their paper to a scientific journal. An editor reads the paper. If it is interesting the editor sends it to scientists who work in same area for peer review. The scientists check that the paper has valid conclusions, that it is original and that the experiments work.

Depending on the review, the paper is recommended for publication, amendment or rejection.