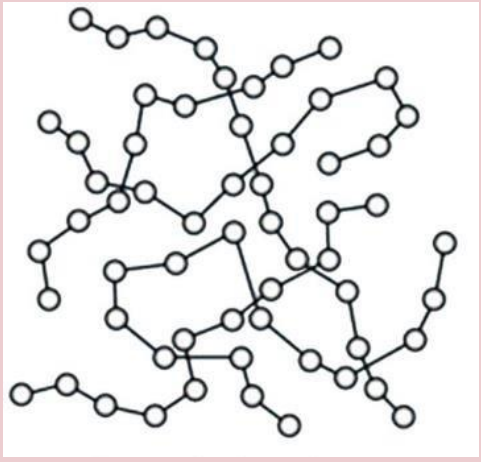
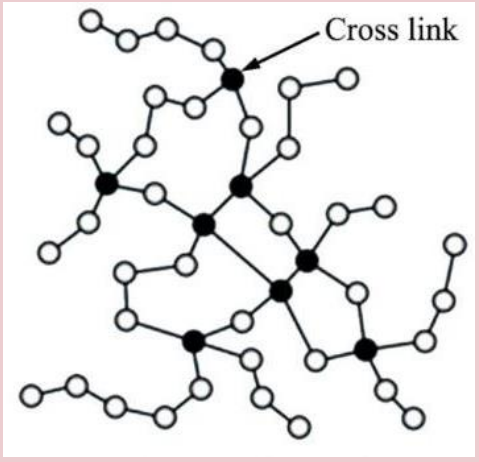
Materials - Polymers

SECTION 1.1

Where do Plastics come from?

Synthetic polymers are made from crude oil which is obtained by drilling underground or under the sea. The oil is then processed in a chemical plant to make synthetic polymers.
However, recently natural polymers are being developed from plants such as latex from trees used to make rubber or using corn starch for manufacture disposable packaging and cutlery which will break down naturally on land or sea.

There are two main types of Polymers – Thermo and Thermosetting plastics.

Thermoplastic	Thermosetting plastic
	

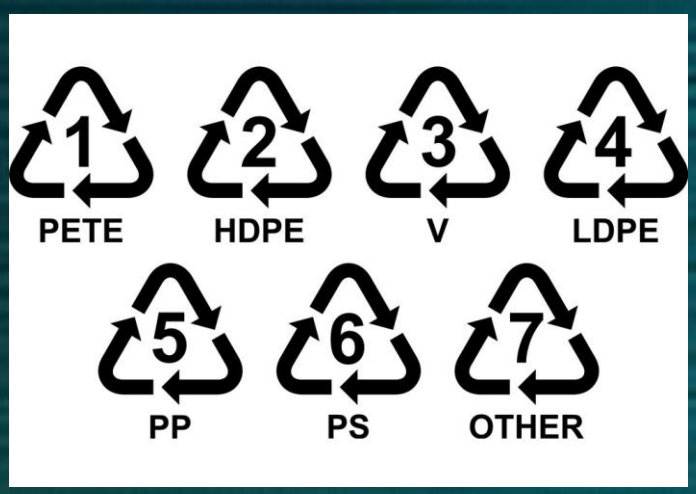
Thermoplastics

This type of plastic consist of long chains which are only weakly connected. They often resemble spaghetti in the same way they overlap each other.

When heated Thermoplastics soften and become more flexible and can be formed more easily. When the heat is removed the plastic will harden into the new shape, the heat can be reapplied and the plastic will re sofen and allow further movement and allow the plastic to be reshaped.

This makes this type of plastic very popular as companies can buy sheets or granules and then shape them using a variety of heating methods such as vacuum forming, injection mould or blow moulding.

This type of plastic also has a mark on it to identify the plastic type to allow for sorting when being recycled.



Thermosetting plastics

This type of plastic consist of long chains with cross links between the chains which stop the chains from moving and makes the polymer harder and rigid.

However, once this plastic has been formed its shaped cannot be changed or reshaped even when heated. When heat is applied they wll not melt or soften but instead stay the same shape and will eventually start to char and burn.

These polymers are usually available in liquids and granulates and when mixed together they start to harden and form a permanent shape. This means that these cannot be recycled and instead end up in a land fill.

Materials - Polymers

SECTION 1.1

Thermoplastic	Recycling symbol	Properties	Typical uses
Polyethylene terephthalate (PET)	1 PET	Clear, tough, shatter-resistant Good resistance to moisture	Drinks bottles, polyester fibres (polar fleece)
High-density polythene (HDPE)	2 HDPE	Hard, stiff Good chemical resistance Good impact strength	Bottles, buckets
Polyvinyl chloride (PVC)	3 PVC	Stiff, hard, tough, Good chemical and weather resistance	Window frames, guttering, pipes
Low-density polythene (LDPE)	4 LDPE	Tough, flexible, Electrical insulator Good chemical resistance	Detergent bottles, carrier bags
Polypropylene (PP)	5 PP	Hard Lightweight Good chemical resistance Good impact strength	Food containers, medical equipment
Polystyrene	6 PS	High Impact Polystyrene grades (HIPS) have good toughness and impact strength. Good for vacuum forming, injection moulding or extrusion.	Packaging, foam cups
ABS	9 ABS	Strong and rigid. Harder and tougher than polystyrene, but roughly twice the cost.	Plastic pipes, children's toys, keyboard keycaps
Acrylic	7 OTHER	Good optical properties – can be transparent. Hard wearing and will not shatter on impact.	Plastic windows, bath tubs, machine guards
Nylon	7 OTHER	Good resistance to wear. Low friction qualities. Ductile and durable.	Gear wheels, bearings
Polycarbonate	7 OTHER	High strength and toughness. Heat resistant. Excellent dimensional and colour stability.	Safety glasses, DVDs, exterior lighting fixtures

Thermosetting polymer	Properties	Typical uses include:
Epoxy	High strength, stiff, brittle. Excellent temperature, chemical and electrical resistance.	Printed circuit boards, cast electrical insulators
Polyester resin	Good strength and stiffness but brittle. Very good temperature, chemical and electrical resistance. Lower cost than the other resins.	Bonding or encapsulation of other materials, suitcases/luggage
Melamine resin	Stiff, hard, strong. Resistant to some chemicals and stains.	Laminate coverings for kitchen worktops, impact-resistant plastic plates
Polyurethane	Hard with high strength. Flexible, tough and low thermal conductivity.	Foam insulation panels, hoses, surface coatings and sealants
Vulcanised rubber	Higher tensile strength, elastic. Resistant to abrasion and swelling.	Tyres, shoe soles, bouncing balls

Materials - Polymers

SECTION 1.1

What are synthetics polymers made from?

What are natural polymers made from?

What two types of polymers are there?

.

.

For the first type, describe the structure of the Polymer

Sketch a diagram to explain the structure.

What are the major advantages of using this first type of Polymer?

.

.

.

Can these polymers be easily recycled?

True / false

How can this be done?

Explain which type of Thermoplastic would be best to use when manufacturing a carrier bag

Plastic type chosen:

Explanation:

Explain which type of Thermoplastic would be best to use when manufacturing a Drinks bottle

Plastic type chosen:

Explanation:

Materials - Polymers

SECTION 1.1

For the second type, describe the structure of the Polymer

Sketch a diagram to explain the structure

Name two clear advantages of this type of Polymer

.

.

Can these be easily recycled?

True / False

Explain which type of Thermosetting plastic would be best to use when manufacturing a PCB board

Plastic type chosen:

Explanation:

Explain which type of Thermosetting plastic would be best to use when manufacturing the sole of a shoe

Plastic type chosen:

Explanation:

Explain which type of Thermosetting plastic would be best to use when manufacturing a GRP suitcase

Plastic type chosen:

Explanation: