Y8 Block 1: Social Chaos & Morality

Key words

Sustainability- able to be maintained at a certain rate or level.

Recycled- convert (waste) into reusable material.

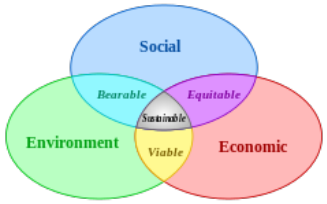
Upcycling-reuse (discarded objects or material) in such a way as to create a product of higher quality or value than the original.

Research-investigation into and study of materials and sources in order to establish facts and reach new conclusions

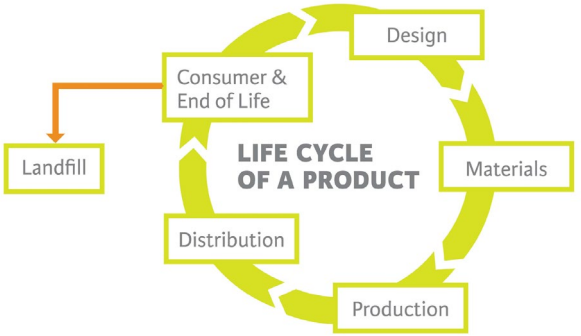
Prototype-a first or preliminary version of a device or vehicle from which other forms are developed

Client-a person or organization using the services of a professional person or company

Justify-show or prove to be right or reasonable.



Design brief: Design and make a product that is influenced by sustainable design.



SUSTAINABLE DESIGN PRINCIPLE

Low-impact materials
Energy efficiency
Emotionally durable design
Sustainable design standards
Design for reuse and recycling
Bio mimicry
Service substitution
Renewability

Design Process:

- Task analysis and research plan
- Research and evaluation
- Specification
- Research evaluation
- Initial design ideas
- Design development and prototypes
- Trials of techniques and samples
- Final design concept

Topical images:

Y8 Block 1: Social Chaos & Morality

Design Strategies

You can use design strategies to come up with initial design ideas without getting you on a bad one. Designing is a really complex process and there are several different ways of doing it:

User-Centred design: The wants and needs of the client are prioritised- their thoughts are given a lot of attention at every stage of design and manufacture

When you are designing a product it is easy to get stuck on a particular idea. This is called design fixation and it can stop you thinking creatively and coming up with innovative ideas.

Following the design strategy can help you avoid design fixation and encourage you to look at your design in a critical way to make improvements. Other ways to avoid are-

- Collaboration
- Honest feedback
- Focusing on new solutions
- Using fresh approaches

You can also annotate your designs to fully explain further using ACCESS FM

A= Aesthetics
C= Cost
C= Customer
E= Environment
S= Size
S= Safety
F= Function
M= Materials

Cross curriculum topics

Science

- Structure of polymers
- How long does it take for plastic to degrade?

Geography

- Impact of pollution on the wider world.
- How has the geography landscape changed with the rise in pollution?

Maths

- Sizing and tolerances of products
- Use of time within a practical task

English

- Justification of practical choices, evaluation techniques and improvement comments

History

- What materials were used before plastics? How in history have other countries dealt with pollution?

PSHE

- Creation of sensory items for the health hub and sensory garden at OSSMA












TIMBERS

Natural Woods

There are two basic types of tree: hardwood and softwood. Hardwoods are generally deciduous, while softwoods are generally coniferous (often called evergreen). The size of natural timber is determined by the size of the tree. All-natural woods are seasons. Approximately 80% of the wood used in the UK comes from other countered.

Hardwoods- Hardwood trees grow more slowly than softwoods. Examples of hardwood trees gown in the UK include oak, ask, beech, sycamore and willow. Imported tropical hardwoods include teak and mahogany.

Softwoods- Softwood, which grows quickly, is often managed as a sustainable resource. There are a smaller number of useable softwoods than hardwoods. Some softwoods (larch, spruce and Scots pine) is grown in the UK.

Manufactured wood- Manufactured, or man-made, wood is board produced using industrial production techniques. It consists of gluing together wood layers or wood fibres. Manufactured boards are usually made in very large sheets. Designers choose manufactured boards when they require consistency in strength, workability and texture. Their plain appearance is often disguised by more decorative material.

Examples of Hardwoods

Mahogany- Is quite expensive and is used for good quality furniture and hardwood windows. It is light brown in colour and more difficult to use compared to pine.

Oak- This is an expensive material and is used in for making quality, expensive furniture. Steel fittings such as hinges will stain oak so it is important to use brass ones.

Teak- A hardwood that contains oils which means it is resistant to decay. This is often used to make garden furniture or for wood block flooring.

Examples of Softwoods

Pine- Is a relatively cheap wood used in the building trade and for furniture. It is pale in colour, quite easy to cut and shape, and machines relatively well.

Examples of Manufactured Boards

Block board- This is built up with a core of softwood strips bonded together with adhesive and covered with a sheet of plywood on either side. Used as a building material and for furniture manufacture including fitted kitchens/bedrooms.

Chip board- This is made up of small chips of wood bonded together with resin and formed into sheets by compression. It is not as strong as plywood and block board, but it is not expensive. Chipboard is often covered with a plastic laminate or wood veneer and used in furniture.

Hardboard- This is made from wood fibres that have been pulped. The pulp is put under pressure until the fibres bond to produce a tough board that is smooth on one side and rough on the other. It is not as strong as the other boards.

Medium Density Fibre board (MDF)- A quality board, relatively cheap. This board is composed of fine wood dust and resin pressed into a board. This material can be worked, shaped and machined easily. Paint can be applied to it without the need for an undercoat or primer. Used in the building and furniture trades.

Plywood- This is made from veneers (plies) of timber with each grain layer being at right angles to each other and bonded together by resin and pressure. A number of grades are available, designed to suit a variety of situations.

Tools and Equipment

Steel ruler

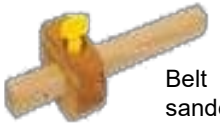
Pillar drill

Tri-square

Tenon saw

Bench hook

Vice



Belt sander

Safety goggles

POLYMERS

Thermoplastics

These plastics can be re-heated and re-shaped in various ways. They become moldable after reheating as they do not undergo significant chemical change. Reheating and shaping can be repeated. The bond between the molecules is weak and becomes weaker when reheated, allowing reshaping. These types of plastics can be recycled.

Acrylic (Perspex)- This is the most common plastic in a school workshop. Purchased in the form of sheets and comes in a range of colours. It can be translucent (e.g. smoked), transparent or opaque. It is resistant to most acids and weather conditions. Easy to cut shape. Polishes well. Examples include: Baths, safety glasses, signs.

LDPE- Low Density Polythene is tough and flexible. Softer than HDPE. Can be moulded into almost any form. Flexible, comes in range of colours. Bottles and plastic bags are made from the low density polystyrene.

HDPE- High Density Polythene which is rigid and hard. Less flexible than LDPE. Machine parts, bowls and crates are generally made from high density polystyrene. Can be moulded into almost any form. Flexible, comes in range of colours.

PP-Polypropylene (PP) is a thermoplastic often formed into products through injection and blow moulding. It is robust, strong, flexible and supplied in a range of colours. Food containers, chairs, packaging and storage units.

Nylon- Is used in engineering to make gears and bearings. It's oily nature means that friction is reduced between moving parts made from nylon. Gears, bearings, wheels and clothing.

HIPs- High Impact Polystyrene (HIPS). Light material and yet strong. Available in a range of colours. Can be vacuum formed. Thinner HIPS is quite flexible.
Used for electrical casings, packaging, trays

PVC- Polyvinyl Chloride. Better known as PVC. A tough material, purchased as either a hard (inflexible) material or alternatively a flexible form. It can be extruded, welded or bonded with an adhesive. Range of uses including water pipes, raincoats, long play records, coating on electrical wires and packaging.

Thermosetting Plastics

Once heated and moulded, these plastics cannot be reheated and remoulded. The molecules of these plastics are cross linked in three dimensions and this is why they cannot be reshaped or recycled. The bond between the molecules is very strong.

Polyurethane- This forms the basis of many paints and varnishes. Tough, water resistant.

Melamine Formaldehyde- Because of its smooth surface and hygienic qualities, used for kitchen laminates surfaces. Also used for electrical plugs and sockets, because it can be cast and it is an excellent insulator.

Urea Formaldehyde- Urea Formaldehyde has physical properties of high hardness and high toughness, making it suitable for strong, knock-resistant electrical fittings. It is also scratch resistant and a very good electrical insulator. Electrical fittings manufactured from this polymer are safe to use.

Polyester resins- Polyester resins. If resins are combined with a material such as fibre glass, the result is a very tough material that can resist impact. Known as Glass Reinforced Plastic (GRP) and is used in car body repairs, sailing boats and corrugated sheet, because of its lightness, toughness and resistance to water.

CAD/CAM

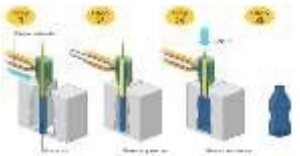
CAD- Computer Aided Design
CAM- Computer Aided Manufacture
CNC- Computer Numerical Control

	Advantages	Disadvantages
CAD	-Reduces human error -Cheaper to modify the design as you go along -More accurate than hand drawn -Save and edit ideas -Saves time -Modify existing ideas	-Staff training cost -Requires a PC -The software is expensive
CAM	-High accuracy in large scale production -Speeds up production -Consistent results (always the same)	-Staff training costs -Can be slow for one off products -The software is expensive

Manufacturing Plastics

Blow Moulding

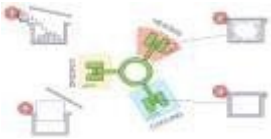
1.Parison inserted into mould.
2.Base of parison squeezed by mould.
3. 3.Air blown in to parison. Parison expands to fill mould.
4.Finished product.



Vacuum Forming

1.Air in mould removed.
2.Plastic placed over mould.
3.Plastic heated.

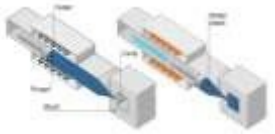
Rotational Moulding



1.The mould opens and is filled with powdered polyethylene or polypropylene and closed.
2.The mould is heated to 300oC. At the same time the mould rotates so that the powder is forced against the wall of the mould.
3.The mould moves onto the cooling stage. Cool air is blown around the mould, aided by large fans. The mould cools slowly and solidifies.
4.The finished product is then removed.

Injection Moulding

1.Plastic placed into hopper
2. Plastic forces through heaters
by screw.
3.Liquid plastic is forced into mould.
4.Mould cools and opens to remove product



The moulds used in these manufacturing processes are usually manufactured from aluminium on CNC machines. Accuracy is vital, as any fault will be repeated in the finished product, every time one is manufactured. When making the mould it is important to make sure that the pieces will need to be removed. All of these processes will allow for products to be made that are identical to each other.

PAPER & CARD

Functions of Packaging

Protect- Make sure product is safe, undamaged and unopened

Inform- Information about the product: Calorie Content, Barcode, Ingredients, Recycling Info, Allergy Advice, Contact

Contain- To keep product in, prevent leakages, be shaped to fit **T**ransport- Should be easy to transport (in bulk), must remain intact

Preserve- Make sure temperature and freshness is maintained over time

Display- Advertise product to make it look good. Window to see product (made of acetate)

Types of Paper and Card

- **Cardboard**- is thicker than paper as it is made up of a number of layers, glue or laminated together. The diagram opposite shows a net / development of a package. It can be folded to produce a carton.
- **Tracing paper-** Is used pupils, students and designers. It allows the designer to copy an existing drawing / shape. Tracing paper can be useful when there is a need to produce several drawings that are based on the same outline. Also, tracing paper makes it possible to place one design on top of another to produce a second layer. The original design can be seen under the second drawing.
- **Cartridge paper-** is used for general drawing. It is often good quality and generally 100 to 135g in thickness. This paper is used for design and technology projects and will take colour from pencils and felt pens without too much leaking to the opposite side of the paper.

- **Solid white board-** This is normally top quality cardboard made from quality bleached wood pulp. It is the best card for printing on to and consequently it is used for hard backed book and more expensive items.
- **Foil lined board-** is good quality cardboard with a aluminium foil lining. This type of container is ideal for ready made meals or take away meals. The foil retains the heat and helps keep the food warm.
- **Corrugated card-** This type of board is often used for packaging large electrical items. These large boxes (often brown in colour) protect the contents from damage. Corrugated board is strong because it is composed of a top and bottom layer and in between there is a triangulated section. A triangular section is very strong compared to its weight.
- **Duplex board-** This is used for containers and can contain liquids as it may have a water-proof liner on the inside. It can have a wax feel. This type of card is used by the food industry and

How To Make Paper:

1. A tree is cut down and the trunk is fed into a chipping machine where it is cut into very small pieces.
2. The wood chips are boiled in water to form a thick wood pulp
3. Chemicals / ingredients such as starch and bonding agents are added.
4. The pulp is poured over a fine mesh and the water escapes leaving the cellulose fibres behind. This forms the paper.

YEAR 8

METALS

Key Material Properties and Definitions

Strength- is the ability of a material to withstand a force without breaking or bending

Toughness- is the ability of a material to withstand blows or sudden shocks without breaking

Tensile strength- the resistance of a material to breaking under tension.

Brittle- hard but liable to break easily.

Ductile- is the ability of a material to deform, usually by stretching along its length.

Conductivity- is the ability of a material to conduct heat or electrical energy

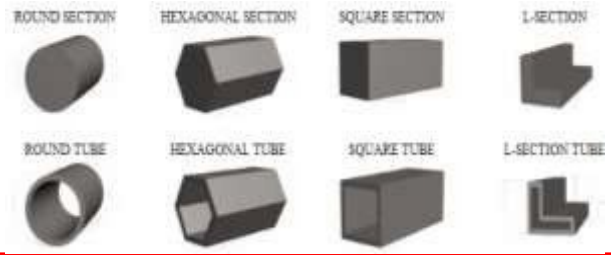
Malleable- is the ability of a material to permanently deform in all directions without cracking

Corrosion- Corrosion is the deterioration of a metal as a result of chemical reactions between it and the surrounding environment.

Hardness- is the ability of a material to resist wear, scratching and indentation

Metal Stock Forms:

If you use metals as part of a practical project a knowledge of the shape or 'section' of lengths of metals is important. The diagrams below show examples of solid lengths and also tubes. When you order metals you need to describe the section you want.



Types of Metal and Properties:

Metal is made from metal ores, which must be mined and processed to transform them into usable materials. It is rare for metals to be used in pure form. Normally they are mixed with other metals to improve their properties: the mixture is called an **alloy**. Most metals are good conductors. There are two main types of metal alloys: **ferrous and non-ferrous**.

Non- Ferrous Metals

- Non-Ferrous Metals do not contain Iron, are not magnetic and are usually more resistant to corrosion than ferrous metals.
- **Aluminium-** Ductile, soft, malleable, machines well. Very light. Window frames, aircraft, kitchen ware.
- **Copper-** Ductile, can be beaten into shape. Conducts electricity and heat. Electrical wiring, tubing, kettles, bowls, pipes.
- **Brass-** Hard. Casts and machines well. Surface tarnishes. Conducts electricity. Parts for electrical fittings, ornaments.
- **Silver-** Ductile, Malleable, solders, resists corrosion. Jewellery, solder, ornaments.
- **Lead-** Soft, heavy, ductile, loses its shape under pressure. Solders, pipes, batteries, roofing.

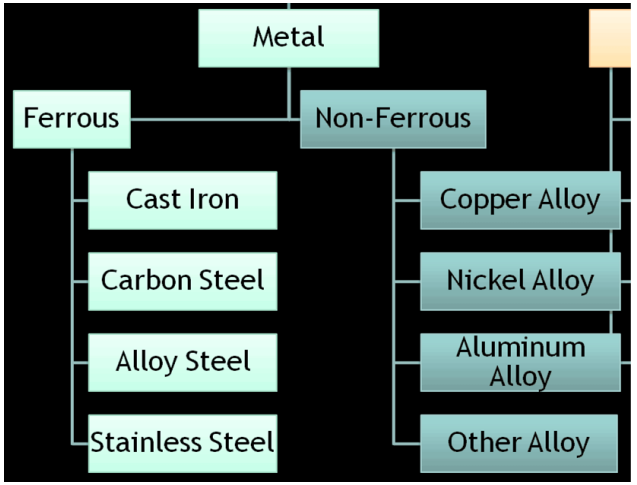
Alloys

Alloys are sometimes described as a mixture of two or more metals. However, this is misleading, as often alloys are composed of just one metal, as well as other non-metal elements. Cast iron is an example, as it is a combination of iron (metal) and carbon (non-metal).

Ferrous Metals

Ferrous Metals mostly contain Iron. They have small amounts of other metals or elements added, to give the required properties. Ferrous Metals are magnetic and give little resistance to corrosion.

- **Mild steel-** Tough. High tensile strength. Can be case hardened. Rusts very easily. Most common metal used in school workshops. Used in general metal products and engineering.
- **Carbon steel-** Tough. Can be hardened and tempered. Cutting tools such as drills.
- **Stainless steel-** Tough, resistant to rust and stains. Cutlery, medical instruments.
- **Cast iron-** Strong but brittle. Compressive strength very high. Castings, manhole covers, engines.
- **Wrought iron-** us, tough, ductile, resistant to rusting. Ornamental gates and railings. Not in much use today.



Key Material Properties and Definitions

Natural: Textile produced via plants and or animals

Synthetic: Textile that is manufactured (man-made)

Regenerated: Textile created by breaking down and re-forming old textile materials/materials

Sources and origins

The **raw materials** needed to create textiles come from all over the world. They can be natural, grown from plants or taken from animals, or synthetic, **refined** from oil.

Natural fibres

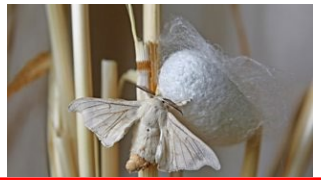
Plant based

- **cotton** - harvested from cotton plants from China, USA and Pakistan, the fibres are cleaned, **carded** between wire brushes to lie in the same direction and spun into yarn
- **bamboo** - grown in China and Japan and is **pulped** and crushed, softened and carded before being spun into yarn
- **linen** - made from the flax plant grown in Canada, France and Russia, and processed in the same way as bamboo

Animal based

- **wool** - fleeces are sheared from animals such as sheep, alpaca and goats in UK, Australia and New Zealand; the short, **staple fibres** are cleaned, carded and spun into a yarn
- **silk** - silk moth cocoons are harvested in China and India, heated to undo the filament bonds and then spun into a filament fibre

Silk moth on cocoon



Synthetic fibres

Oil based

- **polyester** - polymer chains are extracted from oil and are then forced through a small hole into a filament fibre
- **acrylic** - polymer chains of **acrylonitrile** (a **thermoforming** polymer) are extracted from oil into a filament fibre

Regenerated

- **viscose** - wood pulp from Canada or European forests is dissolved by chemicals to extract the cellulose, which is then **extruded** through a spinneret to make a fine filament fibre
- **acetate** - wood pulp from Canada or European forests is dissolved by acetic acid and then extruded

Natural fibres

Natural fibres are all derived from vegetation, cellulose-based materials, as well as products that are made from animals.

Natural fibre	Properties	Use
Cotton	Cool, cheap, strong, renewable	Denim jeans, shirts, lightweight clothing
Bamboo	Cheap, renewable, soft, absorbent, comfortable	Knitwear, socks
Linen	Renewable, strong, creases easily	Lightweight clothing
Wool	Soft, hardwearing, renewable	Knitwear, carpets
Silk	Expensive, renewable, drapes (hangs) well, good insulation properties (cool in summer, warm in winter)	Wedding dresses, ball gowns

Synthetic fibres

Synthetic fibres are not plant or animal based; they are made from polymers that are derived from **petrochemicals**.

Synthetic fibre	Properties	Use
Polyester	Cheap, durable, non-renewable	Shirts, school uniform
Acrylic	Warm and soft, non-renewable	Bedding, clothing
Viscose	Cheap, lightweight, versatile, non-renewable	Clothing, underwear
Acetate	Resistant to degradation, cheap, no elasticity, non-renewable	Shiny, reflective clothing and curtains

Blended fabrics

Fabrics can be blended to improve their properties.

Blended fabric	Properties	Use
Polycotton	Cheap blend of polyester and cotton, crease resistant	Shirts, bedding
Elastane	Stretchy, retains shape well, cheap	Sportswear, leggings
Kevlar	Five times stronger than steel, uses chemical bonds and weave patterns for strength	Bullet-proof vests, car tyres
Nomex	Heat resistant and lightweight	Firefighters' outfits
Sympatex	Breathable and waterproof	Sportswear and outdoor equipment

Stock forms

Textiles are sold as different **stock forms**, depending on the standard sizes and thicknesses:

- **rolls and bolts** - fabric is sold by the metre in the roll (circular) or bolt (flat roll) and standard sizes are 90 cm, 137 cm and 154 cm
- **denier** - the unit of weight that measures fineness, used to describe the thickness of tights, where 30 denier is thin and 100 is thick, increasing commonly in increments of 10
- **ply** - yarn (wool) is sold in coils, reels or balls, and ply is the number of threads spun together to create a yarn