Knowledge Organiser **Timber**

Resistant Materials

Hardwood

Timber from a deciduous tree. They are slower growing and more expensive.

ash: a pale and attractive hardwood. Tough, flexible. Open grained.
Used in furniture, steam bending, wood turning.

balsa: soft and lightweight, the wood is actually from a deciduous flowering plant, not a tree. Very light in colour with a distinct, straight grain.
Used in model making, prototypes, craft, model aeroplanes.

beech: hard, tough, strong/close grained, white/pinkish brown. Prone to warping.
Used in functional furniture, chairs, tables, tools, veneers.

Iroko: African tropical hardwood. Deep reddish brown, is a less ecologically damaging alternative to mahogany. Also known as African Teak.
Used in boat-building, decorative furniture, traditional musical instruments.

mahogany: fairly strong, medium weight, durable. Interlocking grain. Pink reddish brown. Prone to warping.
Used in indoor furniture, panelling, veneers

oak: strong, heavy, durable, hard and tough. Open grained. Light brown. Finishes well. Expensive.
Used in construction, high-class furniture, boat building, veneers.

teak: very strong, hard, durable. Natural oils make it resistant to moisture. Golden brown. Very expensive. Blunts tools easily.
Used in quality furniture, outdoor furniture, boat building, veneers.

walnut: an extremely durable, tight-grained wood. Its hard, dense grain make it ideal for machining and joint making. Polishes to a high quality finish.
Used in restaurant tabletops, cabinet making, decorative features such as handles, bannisters, veneers and layers in plywood.

Softwood

Timber from an evergreen or coniferous tree. Fast growing.

Douglas Fir: pale to medium red/brown colour. Works well. Straight grained, dries quickly, fast growing.
Used in construction, railway sleepers, joinery, flooring, decking.

Paraná Pine: fairly strong and durable. Straight grain. Pale yellow, red/brown streaks. Almost knot free. Tends to warp.
Used in best quality indoor joinery, staircases, built-in furniture.

Scots Pine: pronounced straight grain. Light brown/yellow in colour. Polishes well.
Used in general construction work and joinery.

spruce: fairly strong with small, hard knots. Creamy white, resistant to splitting. Not very durable.
Used in general indoor work such as stud-walls, shelves.

Western Red Cedar: straight silky grain, dark reddish brown. Lightweight and not very strong. Natural oils make it durable against weather.

Properties of Timber and Sheet Materials

Property	Definition	Found in
hardwood	Timber from a deciduous tree.	oak, ash, mahogany, walnut, beech, balsa
softwood	Timber from an evergreen or coniferous tree.	pine, red deal, cedar
tight-grained	Timber with a high ring count, slower growing and denser.	oak, beech
loose-grained	Timber with a low ring count- faster growing.	scots pine, red deal
dense	Can be deformed without losing toughness.	oak, beech
straight-grained	Timber which has grown straight, has a uniform grain.	oak, beech, red deal
knot	Irregularity in wood grain, where a branch or offshoot existed.	spruce, ash, some plywood
weather resistant	A tight-grained timber has good water and heat resistance.	oak, beech, ash, plywood
stiff	A timber that does not bend easily.	oak, ash, beech, plywood, MDF
easy to work	A timber that is either low or medium density. Easy to cut and shape.	red deal, scots pine, balsa, MDF
lightweight	A timber that is light in weight.	balsa, plywood, MDF
attractive grain	When polished or varnished, a timber's grain is eye-catching.	walnut, oak, ash, some plywood

Timber products

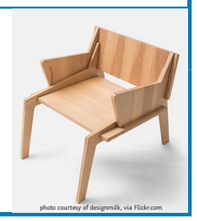
Sheet materials manufactured from layers or particles of wood including MDF, plywood and hardboard.

MDF: mid-brown colour. Will swell if exposed to moisture. Sheets can be heavy. Smooth finish. No grain. Available in a wide range of sheet sizes and thicknesses.
Used in flat-pack furniture, vacuum-form moulds, product modelling, architectural models. Often covered in veneer for a natural timber appearance.

veneer: very strong, hard, durable. Natural oils make it resistant to moisture. Golden brown. Very expensive. Blunts tools easily.
Used in table tops, flat pack furniture, plywood, cabinet-making.

hardboard: Made from wood chip and pulp, cheaper substitute to plywood. Used when space filling as opposed to requiring strength. No regular grain.
Used in countertops, flooring, flat-pack furniture.

plywood: Reddish brown or white in colour. Layered in odd numbered sheets. Strong. Susceptible to splintering
Used in sheds and cladding, furniture, flooring, boats (marine ply).



Wasting

Wasting timber by hand

Most solid woods can be easily wasted and shaped using a range of workshop tools.

- **Sawing:** tenon saw, bench saw, coping saw, jigsaw.
- **Filing:** rasp, bastard, second cut, half round, round.
- **Chiselling:** chisels are used along with vices and mallets to remove areas that have been pre-cut.
- **Planing:** shape and finish edges using a plane or spoke-shave. Edges require no further finishing after planing.

Wasting timber using machinery

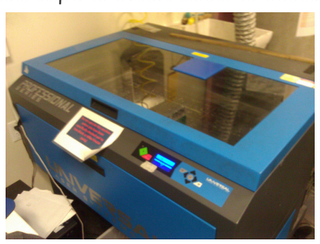
Using machinery to waste timber can speed up the manufacturing process and give accurate results.

- **Turning:** lathes, used with special chisels, allow the shaping along the profile of a piece of solid wood, or laminated MDF as it is spun. Formers for vacuum forming can be made in this way.
- **Drilling:** chain drilling solid wood and sheet materials can speed up the wasting progress. A series of holes are drilled along a path, the waste is then removed using a coping saw or chisel.

Wasting timber using CAD/CAM

Sheet timber lends itself to being wasted on flat-bed machinery. CAD files can be easily prepared to control these machines.

- **Laser cutters:** can quickly cut thin sheet timber such as MDF and plywood. Precision features such as joints can be cut accurately on a laser cutter.
- **Computer controlled routers and milling machines:** can effectively translate a computer design into a component. Double-sided tape is often used to secure the timber to the machine's



Addition

Addition using adhesives

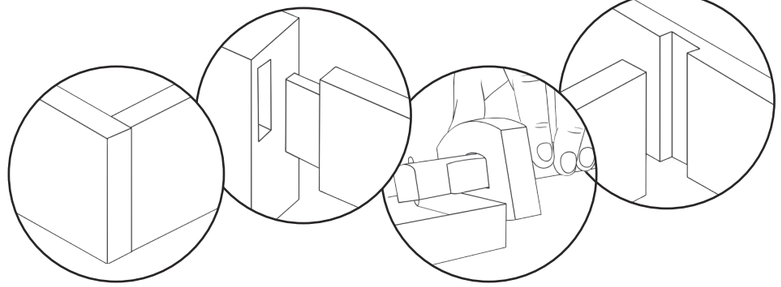
- **White glue (PVA):** a strong and inexpensive glue to use with all timber.
- **Sheet material:** easily glued surface-to-surface, as the large surface area gives a strong bond.
- **Some decorative detail:** can be added using white glue alone.
- **Cramps:** should be used to tighten the joint whilst the glue is drying.

For most other joins, white glue is used in combination with other addition methods.

Addition using joints

Solid wood can be precisely cut using chisels and a tenon saw to create tight-fitting joints which lock together. This can look attractive and give a strong join, especially when glued.

All joints require careful marking out and cutting. A **marking gauge** is crucial in this process.



Addition using slotting

Sheet timber products can be joined using slots in the same way as sheet polymers. Slots can be cut by hand or cut using CAM machinery.

Timber fastening hardware

The use of fasteners and joining hardware can be used in the addition of timber in combination with joints and adhesives. These include:

- **Woodscrews**
- **Coach bolts**
- **Dowel**

Deforming and Reforming

- **Steaming:** soaking a thin length of solid wood or plywood in a special steamer box makes the timber flexible enough to twist and bend.
- **Laminating:** thin sheets of wood can be pressed together in a mould to form a three-dimensional structure. This technique requires plenty of space, glue and clamps!
- **Kerfing:** a technique which allows a strip or sheet of timber (either solid or man-made) to be deformed into curves and bends. Cuts are made along the inside of the material at regular intervals. The closer together, the tighter the bend. Once the cuts have been made, glue is applied to the cuts and the material is manipulated into shape and cramped to set.

Reforming Timber

The term most commonly applies to the range of timber products that have been manufactured from solid wood. These include:

- **MDF (Medium Density Fibreboard):** this sheet material is reformed from material recycled from solid wood manufacturing. The tiny fibres are pressed together and bonded with a resin which gives the material its density. Easy to shape, but prone to causing dust.
- **Chipboard (Particleboard):** this sheet material is reformed from larger chips left over from solid wood manufacturing. Glue and sawdust is added and these are pressed together to create the sheet material Chipboard. This is a low-grade material and used most commonly in building projects such as barns, garages, flooring.
- **Hardboard:** this sheet material is reformed from pulped wood waste. The pulp is steamed under pressure before glue is added and the material is pressed flat with one smooth, hard side, and one textured surface. Low cost, this material can be used in a range of projects, but is not suitable for outdoor use.

Paper and Board Knowledge Organiser
Compliant/ Resistant Materials

Virgin Products

Mount Board: A thick, flexible board, available usually in black or white.

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Moulded Pulp Board: Recycled paper and card is turned into a pulp and moulded into shape which forms protective packaging.

Used in drinks bottles, food packaging, cosmetic packaging.

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Corrugated Card: Thick, lightweight and strong, this laminate board is used widely in transit packaging. Normally only printed on one side and unbleached.

Used in transit packaging/ warehouse storage.

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Foam Board: Thick, lightweight and stiff. A layer of foam is laminated between bleached card. Can be slotted and jointed to give strength to larger constrictions.

Used in model-making, architectural prototypes.

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Carton Board: Durable, lightweight card, can have glossy or matt finish. Excellent print qualities and bends easily into nets.

Used in dry food packaging.

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Paper Weights and Uses

Weight (grams per square metre)	Suitable for
80gsm	printing, general use
90gsm	standard printer paper, thick enough to be colour-printed
100gsm	good quality paper for letters, certificates, drawing
120gsm	stiff, printable paper, suitable for menus, leaflets, small scale packaging
160gsm	light card suitable for printing/cutting/plotting, packaging

Properties and Definitions of Paper and Boards

Property	Definition	Found in
virgin	A paper or board product which has been made from tree pulp without the addition of any recycled or alternative fibres. All true white paper products are virgin.	printer paper, envelopes, books etc.
recycled	A paper or board product which has been made using some or all waste material, usually from paper mills. Colour tends to be grey (from the print on the paper used) of dyed darker colours.	paper towels, toilet roll tubes, greetings cards, newspapers
laminated	Layers of paper or card glued together to create stiffer product.	foam board, corrugated cardboard, mount board
compliant	Bends, twists, tears and folds easily and without tools.	thinner paper and board products.
resistant	Does not deform easily without tools or force.	thicker/laminated paper, board products
stiffness	A material that resists bending, remains rigid.	foam board, corrugated card
tough (durable/ strong)	Able to withstand rough handling or treatment. Offers good weather resistance.	corrugated card, carton board
tension	A pulling force. Paper and board products when assembled often are glued in tension.	glued together packages
corrugated	In card, a rippled middle layer is laminated between two flat layers, thus creating a thick, lightweight yet stiff board.	transit packaging

Paper and Board Knowledge Organiser

Wasting

Most paper and board can be cut and shaped easily with basic equipment.

Hand Punch

Advantages:

Quick, perfect holes.

Disadvantages:

Limited range of hole sizes available. Not suitable for very thin paper or thicker card.

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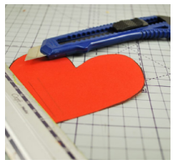
Craft Knife and Safety Rule

Advantages:

No set-up time, good for one-offs

Disadvantages:

Finish relies on the skill-levels of the maker. Not suitable for repeat-production.



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Wasting Paper and Board Using CAD/CAM

Thin card can be wasted effectively using CAM such as laser cutters and cutter/plotters. Nets are developed on CAD software such as 2D Design and CorelDRAW. These files are sent to the CAM machine for accurate cutting and scoring.

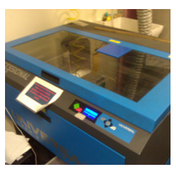
Laser Cutter

Advantages:

Allows for repetitive flow production, with reliable, identical results.

Disadvantages:

Not suitable for foam-board due to the fumes released.



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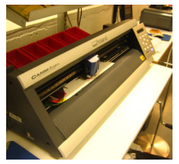
Cutter/Plotter

Advantages:

Allows for repetitive flow production, with reliable, identical results.

Disadvantages:

Not suitable for thicker card products.



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Addition

Prototype modelling uses a wide range of addition or joining techniques, but often leaves a low-quality finish.

Permanent addition methods suitable for high quality finish include:

Double-Sided Tape

Advantages:

Instant, permanent, strong bond. Invisible.

Disadvantages:

Cannot be undone. Fiddly.

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Hot Glue

Advantages:

Permanent, strong bond.

Disadvantages:

Cannot be undone. Can leave a stringy or thick edge.

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White Glue (such as PVA)

Advantages:

Permanent, strong bond, even on small tabs. Invisible.

Disadvantages:

Cannot be undone, takes a long time to set.

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Temporary Addition Methods:

Adhesive Velcro

Advantages:

Allows for adjustment.

Disadvantages:

Expensive, not suitable for thinner, less stiff materials.

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Paper Fasteners

Advantages:

Easily undone. Quick.

Disadvantages:

Hard to disguise, Sharp edges make it unsuitable for many applications.

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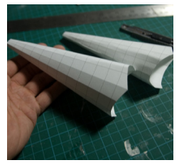
Deforming and Reforming

Paper and thin board are compliant materials and will bend and fold easily in one direction. Stiffer or thicker board requires the use of specific techniques.

Paper Fasteners Scoring and Folding

For most prototype package and models, scoring and folding is the best method. This can be done by hand but also using CAD/CAM by carefully designating the lines to be scored a colour which controls a lighter, scoring pressure on the cutting head of the machine.

With research and skill, sophisticated three-dimensional shapes can be created by scoring and folding nets or developments.



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Press Moulding (using paper pulp)

Although the finish of press-moulded products is quite poor, strong inserts can be created for products such as food and perfumes to ensure bottles and jars are held tightly inside the container. Because pulp is made from recycled paper, this method can help a product have an 'environmentally friendly feature'.

GCSE D&T Knowledge Organiser

Woods and Boards

Natural Timbers

Softwoods are generally cheaper than hardwoods as they are more available, since they grow quicker.
But because man-made boards are manufactured they are cheaper than timbers.
Man-made boards also come in a better variety of sizes since they don't depend on tree growth.

Stock forms for both include; sheets, dowel, planks, etc

Hardwoods come from **Deciduous Trees.** These trees loose leaves in winter and grow fruit and flowers in spring

Material	Key info	Examples
Ash	Flexible, tough and shock resistant	Sports equipment Tool Handles
Beech	Fine finish, tough and durable	Toys, furniture and veneers
Mahogany	Easily worked, durable, high quality finish	High-end furniture
Balsa	Very soft and spongy. Light	Modelling
Oak	Tough, durable and hard	Flooring, furniture and veneers

Softwoods come from **Coniferous Trees.** These have thin, needle-like leaves and grow all year round. Often have pine cones and sometimes nuts and seeds

Material	Key info	Examples
Larch	Durable, tough, good water resistance and finishes well	Furniture, flooring and used outdoors
Pine	Light, easy to work with but can split	Cheap furniture, construction and decking
Spruce	Easy to work with, high stiffness but can decay quickly	Furniture, musical instruments and construction

Man-Made Boards

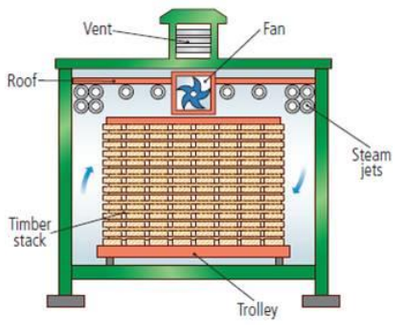
Manufactured boards are made from wood chips/dust/ layers and glue.

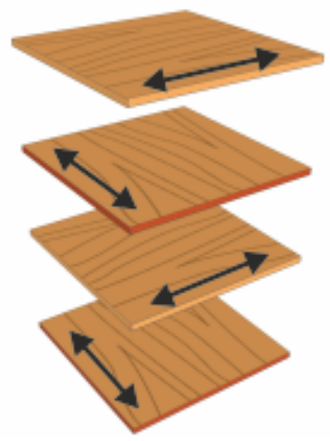
Material	Key info	Examples
Chipboard	Prone to chipping but good compressive strength. Not-water resistant	Flooring, low-end furniture, flat-pack
MDF	Rigid and stable. Easy to finish. Absorbs liquid easily	Flat-pack furniture and kitchen unites
Plywood	Very stable. Exterior veneer can be used from more expensive woods	Shelving, furniture, toys

Primary Processing of Papers and Boards

Trees are cut then converted into planks by cut using saws
It is then seasoned to reduce the moisture in the wood.
This is done by either:

Air-drying – Planks are stacked and air allowed to circulate; causing evaporation
Kiln-drying – Where planks are put into a kiln and dried rapidly. This process is more costly than air-drying





Manufactured boards can be either be made by lamination or compression

Lamination – Layers of woods and adhesive are layered and compressed together. Usually with a more expensive wooden veneer on the top

Compression – Wood is shredded, heated and compressed with adhesive under extreme pressure

Metals Knowledge Organiser
Resistant Materials

ferrous: Metals that contain iron. Besides iron itself, all ferrous metals are alloys.

iron: Heavy and strong, iron is most commonly found nowadays in various alloys. Historically, iron was the key material which enabled the industrial revolution to thrive in the UK. Machines, bridges and weapons could all be cast in iron, allowing mass-production.

Used in heavy kitchen skillets, radiators and fireplaces in older houses.

The Iron Bridge (opened 1781) in Shropshire was the first bridge to use cast-iron structurally.

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ferrous alloys

mild steel: General purpose metal for general engineering. Good strength and cold-forging properties. Corrodes quickly without protection. Can be welded and braised.

Used in structural components, general workshop projects.

high speed steel: Very hard, resistant to frictional heat.

Used in lathe cutting tools, drills, milling cutters.

high carbon steel: Very hard, difficult to cut, easily joined by carbon treatment.

Used in hand tools, hammers, screwdrivers, chisels.

stainless steel: Hard, tough, resists wear, corrosion resistant, difficult to cut.

Used in dishes, sinks, teapots, cutlery.

non-ferrous: Metals that do not contain iron.

aluminium: High strength to weight ratio, light, soft, difficult to join.

Used in kitchen utensils, packaging, cans, foils, window frames.

copper: Bright and decorative colour when polished. Corrosion resistant. Soft and easy to work by hand. Good heat and electrical conductor.

gold: Soft, malleable, ductile, often alloyed to give more strength, doesn't corrode or tarnish.

Used in jewellery, electronics, hi-fi equipment, dentistry.

tin: Soft, corrosion-resistant pure metal. Silver-coloured and bright when polished. Can be worked by hand. Used to plate other metals.

non-ferrous alloys

brass: Corrosion resistant, casts well, work-hardens, polishes well.

Used in castings, boat fittings, ornaments.

bronze: Corrosion resistant, casts well, work-hardens, polishes well.

Used in castings, boat fittings, ornaments, statues.

pewter: Soft alloy of tin, copper, lead or silver. Low melt temperature makes it ideal for casting projects.

Used in sand-casting, old-fashioned tableware.

solder: Soft alloy, usually made from copper and tin. An added substance, called flux, allows the solder to flow over other metals when heated.

Used in jewellery manufacture, electronics.

Properties of Metals

Property	Definition	Found in
brittle	Hard, but easily broken or cracked.	cast-iron, steel with high carbon content.
conductor	Metal which allows heat or electricity to flow through it easily.	copper, gold, brass.
corrode	To become damaged by chemical reaction (normally water).	ferrous metals in the form of rust, some alloys become powdery.
corrosion-resistant	A metal which resists damage by chemical reaction.	copper, gold, bronze.
ductile	Can be deformed without losing toughness.	lead, copper, gold.
hard	Not easily bent or broken.	steel, iron, brass.
lightweight	A metal which has a good strength-to-weight ratio.	aluminium, duralumin.
malleable	Can be deformed by beating, bending or pressing into shape.	lead, copper, gold, silver, tin
soft	Metals with comparatively low melting temperatures. Easily scratched and malleable.	lead, copper, gold, tin.
tensile strength	A material with good tensile strength resists breaking under tension.	steel, iron, aluminium.
tough/durable/ strong	Able to withstand rough handling or treatment.	iron, stainless steel.

Metals Knowledge Organiser

base metal: Pure, non-precious metals, such as iron, copper and tin. Commonly electro-plated with other metals such as chromium to achieve a higher quality finish.

alloy: Metals which are a mixture of two or more elements, at least one of which is a metal. The purpose of an alloy is to create a metal with improved properties over the original.

precious metals: Pure metals which are valued for their ductility, colour and lustrous natural finish and other properties. Platinum, gold and silver are commonly used in jewellery design.

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Wasting

Wasting metals by cutting and shaping.

Metals can be very resistant to shaping by wastage and tools require special blades to cut metals accurately.

Sawing: hacksaw, junior hacksaw, abra file, jigsaw (with metal cutting blade).

Shearing: Thin sheet metal can be marked out and cut with special metal sheers or tin snips.

Filing: Edge shaping and finishing can be achieved by hand with a range of metal files.

Wasting metals by drilling and boring.

Metals need specially hardened bits for holes to be bored or milled successfully.

Drilling: Hand drill and pillar drill with high-speed bits.

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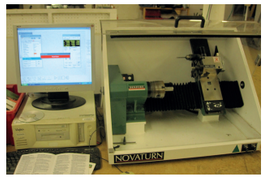
Turning: CAM or manual metal lathes can waste metal rod accurately by both boring and turning.

Milling: Using a flat-ended slot drill, a milling machine cuts laterally, giving a high degree of control to the three-dimensional wasting of metals.

Wasting Metals Using CAD/CAM

Computer controlled milling machines and lathes are used in schools and industry to waste and shape metals. Aluminium is the most common material used to mill in schools.



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Addition

Permanent bonding

Metals require specific joining methods based on the type of material and shape of product.

Adhesives

Some metals can be bonded permanently with solvent adhesives such epoxy resin.

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Welding/Brazing

Using high temperatures, welding creates fused joints which can be as strong as the material. Brazing uses lower temperatures to melt a soft alloy, which flows between the joint and creates a bond.

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Fixing and Fastening

Riveting

Riveting gives a quick and clean alternative to welding. It requires an overlap in the material.

Temporary Fixing

Nuts and bolts, machine screws, self-tapping screws.

Washers are often needed to create a secure, vibration proof fastening.

Deforming and Reforming

Cold Forming

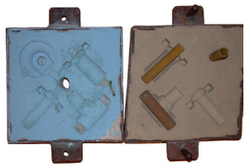
Thin sheet material and narrow-gauge rod and wire can be deformed using a range of cold-forming processes. Simple bends can be made using a vice and ball-peen hammer.

Bending

Thicker rod materials can be bent and shaped when heated to red-hot. Quenching the material will harden the bend.

Casting

In industry, casting can produce highly successful products. Some schools have sand casting facilities, which allow an alloy to be re-formed into a three-dimensional shape.



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GCSE D&T Knowledge Organiser

Plastics

Plastics

Plastics come from crude oil. **Stock forms** are sheets, powders, granules and rods

Thermoplastics can be reheated and reshaped and infinite amount of times		
Material	**Key info**	**Examples**
PET	Easily **blow moulded,** food safe and easily recycled	Bottles, packaging, etc
PVC	Flexible, tough, easily **extruded**	Pipes, tape, hard hats
HIPS	Flexible, lightweight, food safe and easily **vacuum formed**	Containers and yoghurt pots
Acrylic	Tough, brittle, easily scratched	Car lights, baths, displays/ signs

Thermosets once heated and set **cannot** be reshaped		
Material	**Key info**	**Examples**
Melamine Formaldehyde	Food safe, hygienic, hard and brittle	Kitchenware and work surfaces
Urea Formalehyde	Good insulator, hard and brittle	Electrical casings, buttons and handles
Polyester Resin	Strong, heat resistant, can be transparent	Coatings, casings

Primary Processing of Plastics

Crude oil is extracted from the earth and then processes into different types of fuels, etc. This is called **Fractional Distillation**

A process called **Cracking** then converts the large hydrocarbon molecules into plastics

Fibres and Fabrics Knowledge Organiser

Natural Fibre Products

Traditional fibres from plants and animals.

Wool: Fibres from sheep's wool are spun into yarn and can be woven and knitted. The fibres can also be spun into finer yarn which is turned into cloth. Absorbent, soft or coarse handle, not durable.

Used in yarn form in knitwear, scarves, gloves, bags, dresses and suits.

Cotton: Thread is spun from fibres from the cotton plant. Used widely due to its good durability and soft handle. Can be machine washed, but requires ironing as creases easily. Highly-absorbent.

Used in canvas, muslin, calico and denim, clothing, home furnishings

Silk: Natural fibre from silkworms, woven into fine fabric, which has a high sheen or lustre. Cool to wear.

Used in high-class clothing and home furnishings in Satin form.

Linen Made from fibres of the flax plant, linen is a traditional fabric. Does not cause allergies and is cool to wear. Highly absorbent.

Used in home furnishings, summer clothing.

Leather: Made from animal skins, leather is not strictly a fabric. Comfortable in both hot and cold conditions. Untreated, leather is absorbent but can be treated with a range of finishes to improve its effectiveness and durability. Tough and elastic.

Used in clothing, car upholstery, home furnishings.

Manmade Fibre Products (synthetic)

Modern fibres manufactured using polymers.

Nylon: Strong and durable manmade polymer fibre. Has a wide range of applications, as a clothing fabric and in other uses where durability is important. Warm to wear, non-absorbent and good drape. Can be made with soft or coarse handle.

Used in wide range of clothing in pure and blended form. Waterproof coats, tents.

Polyester: Very durable polymer fibre, non-absorbent and cool to wear. Often blended with cotton to produce low cost, breathable fabrics and used widely in place of pure cotton.

Used in clothing and home furnishings, industrial polyester used for ropes, seat-belts.

Organza: A lightweight, sheer fabric traditionally made from silk, although more often now made from polyester. Its decorative properties make it popular for embellishments on clothing.

Used in home furnishings, hat decorations, wedding dresses.

Lycra (brand name for spandex/elastane): A 20th century 'wonder material', Lycra is commonly found in sportswear due to its breathable and elastic qualities. Excellent shape retention. When blended with natural fibres, clothing with the feel of natural fire, and the elasticity of Lycra can be achieved.

Used in tight-fitting sports wear, stockings and leggings, blended in denim, woollen clothing.

Property	Definition	Found in
absorbent	A fabric's ability to hold moisture.	wool, cotton, limen, non-woven fabrics such as felt
blended	A fabric or yarn made from a mix of natural and manmade fibres, purposefully created to use the features of both.	
breathable	A fabric that uses specific fibres and weave that allows air to pass through the clothing, thereby preventing heat and moisture build-up.	sportswear blended fabrics, line, cotton, wool
drape	The way a fabric looks when it is hanging down. Clothing designers must consider the drape of a fabric when choosing the material for a garment.	all fabrics
durable	Hard-wearing, stain resistant. Man-made fibres are mainly more durable, and are therefore blended with natural fibres to create more durable products.	nylon, polyester, denim, lycra
handle	What a fabric feels like to the touch, for instance: smooth, rough, stiff.	all fabrics
sheen	A smooth and slightly reflective surface finish to a fabric.	silk and synthetic satins, polyester products, some leathers
sheer	Fabrics that are flimsy and semi-transparent.	organza, voile, muslin lingerie products
shape retention	A fabric's ability to keep its shape and not become deformed through use.	lycra and lycra blends, leather, polyester, nylon
water-repellent	Non-absorbent. A fabric's natural ability, or manufactured finish, allowing water to not penetrate through the weave.	polyester, nylon, leather

Smart Fabrics

Advancements in modern technology have implications for fabrics and design. **Wearable technology** and **performance enhancing textiles** are important strands of sports and fashion design in the modern age.

This acupuncture therapy shirt allows the wearer to receive specific therapy at the same time as getting on with their job.

This light emitting fabric is an example of how designers can use fibre-optics to create high-impact visual clothing and accessories.

Wasting	Addition	Deforming and Reforming
Fabrics are a compliant material and are relatively easy to cut and shape. They are, however, an unforgiving material, and an incorrect cut will be often difficult to undo or disguise. Cutting: Fabric is normally cut with textile shears. The blades are 150mm long and the lower handle is always bigger. This allows for a steadier, longer cut. Rotary cutters are used for cutting non-woven fabrics such as felt. Shearing: Although shearing and cutting are the same force and movement, pinking shears give a zig-zag edge to their cut. This prevents woven fabric from fraying **Wasting Fabrics with CAD/CAM** Sections of fabric can be wasted effectively using a laser cutter. A pattern can be created using CAD software such as 2D Design and used to control the laser cutter. Identical patterns can be created very quickly using this method with a high level of accuracy. **Seam Allowance** Fabrics require a seam allowance; the material where the stitch joins two pieces of fabric together. This means fabric must be cut larger than the size needed by approximately 10mm on all sides where a join is required.	**Addition by hand-stitching** All projects will require some degree of hand-stitching. This may be to add a button, join one piece of fabric over the top of another, such as in applique, or embroidering by hand. There are a range of stitches which can be done using a needle and thread: • **Running stitch:** Quickly joints two fabrics along a line • **Overstitch:** Loops over the edge of the fabric preventing fraying. • **Blanket-stitch:** Ornamental stitch effective on decorative work. • **Back stitch:** Stronger that a running stitch and good for seams. Zips, buttons, hook and eye, press-studs and Velcro can all be added to fabrics and used to add and fasten pieces together. **Addition by machine-sewing** The correct method for joining fabrics is dependent on the type of fabric being used, and the loads and stresses that will act upon the join. An overlock machine is good for professional looking products as it binds the seam inside the join. Sewing machines are required to add fasteners such as zips. **Addition by computer sewing machine** Many jobs can be completed by a programmable CAM sewing machine. Some schools have embroidery machines. A design is created on a computer, before being uploaded to the embroidery machine. Decoration, detail and personalised names can be added to a panel of a product this way.	**Deforming by tailoring** Once the pattern and fabric pieces have been cut, the main tool for shaping an item of clothing is a tailor's dummy. Re-forming, adjustment and fitting can be done whilst seeing the overall shape of the product. Because fabrics are compliant materials, they deform as part of their nature. Imagine wearing a pair of skinny jeans which didn't deform as you moved! **Deforming by pleating and gathering** Shape can be created and accentuated through the use of gathering. Pleating can create a strong visual effect and allow for movement in a garment. **Pleat:** Repeated folds in a textiles product, usually stitched at the top. **Gather:** To shorted a piece of fabric by drawing it together, like the top of some curtains. **Deforming by heat and liquids** **Heat treatment:** Some specially laminated fabrics can be formed into shape using heat. This is useful where the designer needs parts of a design to hold a shape without support, such as collars. **Blocking:** Traditionally, moulded hats, for both men and women have been created by deforming felt on wooden blocks. A felt hood or cone is placed on the block and a liquid stiffener is applied. A steam iron is then used to shape the felt around the block before shaping the brim and cutting off waste material.

GCSE D&T Knowledge Organiser

Modern and Smart Materials

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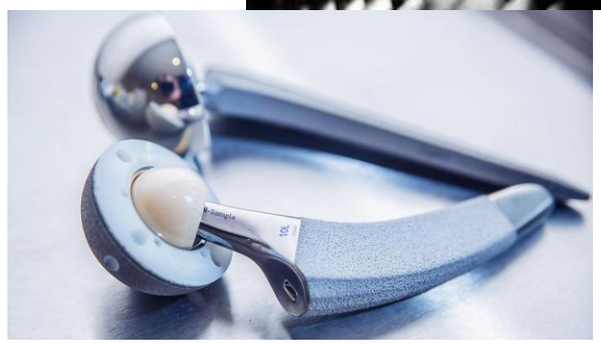
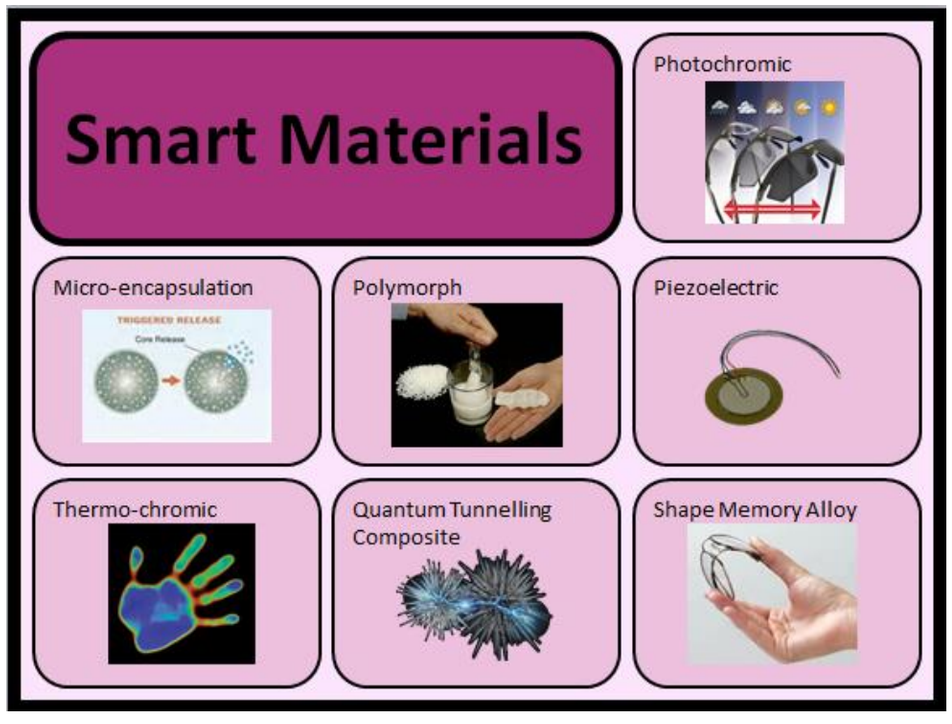


Modern Materials are materials that have been developed recently		
Material	**Key info**	**Examples**
Corn-starch Polymers	These are plant-based polymers that are a replacement for plastics that are **biodegradable** but cannot be recycled.	Plastic bottles, tubs, food containers, etc
Flexible MDF	Made in the same way as normal MDF but with grooves cut into the surface so it is flexible. **Flexiply** is the same but for Plywood. These can easily be shaped into curves	Modern furniture, interior walls and room dividers
Titanium	High strength to weight ratio. Doesn't corrode or rust. Suitable for medical use as its hypo-allergneic	Prosthetics, medical applications, sports cars, etc
Kevlar	A woven polymer with a high strength to weight ratio.	Bullet-proof vests, tyres, helmets, etc



Smart Materials are materials that change and react to the stimuli		
Material	**Key info**	**Examples**
Thermochromic Pigments	Change colour in reaction to heat	Kettles, baby bottles, etc
Photochromic Pigments	Change colour in reaction to light	Colour changing glasses, windows, etc
Shape Memory Alloy	Returns to its original shape, in reaction to heat	Braces and glasses
Polymorph	Granules that once exposed to hot water, become a modelling material (like a dough or clay)	Modelling and repairs

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Industry and Enterprise

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Automation

This is when machines and robotics help make products or make them for you.
Often this is done by **CAD (Computer Aided Design)** and **CAM (Computer Aided Manufacture)**

This helps products be made quicker, with more accuracy. Reducing errors humans make to products.

However, these machines are expensive to buy, need specialist training to use and need constant maintenance to keep them working properly

Virtual Marketing

This is when websites, social media and email are used to promote and sell products. This has become very popular in recent years, with big social media apps being funded by advertisers

Companies can also pay search engines to push their company further to the top of the results page, so customers are more likely to click it.

Cooperatives

A Cooperative is an Enterprise that is run by members that are part of the workforce or customers.

This means the organisation is democratic and often supports the local community. They are set-up to protect the rights of their members and ensure the same rules apply to everyone

Enterprise

This is when an idea is developed into a business and produces a viable product.

Often, one of the biggest enterprises in in apps for smartphones

To make sure ideas are protected from being copied, a **Patent** can be applied for. This legally protects your idea on invention from being stolen.

Crowdfunding

This is where ideas are funded by large groups of ordinary people.

www.Kickstarter.com is a good example of this.

Fair Trade

This is an organisation that promotes fair pay, working conditions and better trade with farmers in developing countries

You can tell when something is Fairtrade as it will often have the symbol on the product or packaging. Common Fairtrade items include; bananas, cotton and chocolate.

FAIRTRADE

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People. Society and Culture

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Market Pull and Technology Push

Technology Push is the development of new technology, materials and manufacturing methods to create new products or improve old ones.

Examples include; Smart Phones, Electricity, Mass Production, etc

Market pull is the demand from consumers for new products and improvements in old ones; this is often found via reviews, polls, surveys, etc

Examples include; Product **Aesthetics,** making products easier to use, etc

Cultures, Faith and Belief

Different groups of people have different interests and have to be catered for.

Different countries and cultures also react to products differently.

E.g. In India McDonalds don't sell beef burgers as it has a large Hindu population, and cows are seen as sacred – in contrast the UK sells its most amount of fish and chips on a Friday as it is a Christian tradition to not eat meat on that day.

Case Study: £5 note

Hindu, Sikh and some other faith-based communities may choose to follow a vegetarian diet, and this is part of their culture. In addition to not eating meat, many followers of these faiths, as well as vegans and vegetarians, take every opportunity to avoid using animal products in their day-to-day lives.

The revelation in 2016 that the new polymer Bank of England £5 note contained tallow, an animal fat-based substance, upset a number of communities. There was a prompt call for the Bank of England to find an alternative way to produce the note and in the first two days of an official petition well over 100,000 signatures were received.

Shortly after the Bank of England admitted that the new polymer £5 note contained the animal by-product, some establishments refused to take the notes as a method of payment. One café owner was repulsed by the idea that the note contained tallow and believed that her customers supported her view. They received no complaints.

The Bank of England say they currently have no plans to change the manufacturing process.

Fashion and Trends

Fashion and Trends will change quickly, and you can see major differences in fashions over decades.

Designers have to make sure their products meet the fashion and trends of the area they are designing and selling the product to.

The change of products over time is called **Product Evolution**. This is caused by Market Pull, Technology Push and Fashion and Trends.

Some products are seen as **timeless.** These products are called **Iconic Designs.** These products are timeless because they were innovative, set a bench mark for following products, changed their industry and are often copied.
Examples include; iPod, iPhone, Angle-Poise Lamp, Swiss Army Knife, Converse Shoes, Levi's Jeans, Classic Mini Cooper

Inclusive vs. Exclusive Design

Inclusive Design: The aim to create a product that as many people as possible can use

Examples include; Cars, Doorframes, Adjustable Products, etc

Exclusive Design: The aim to create a product for a particular group and their needs

Examples include; Car seats for babies, Wheelchairs, Stair Lifts

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Environment

The 6Rs	Meaning
Reuse	To use a product again either for the same purpose or a different one
Reduce	To have less of material/packaging/pollution when making products by making them more efficient
Recycle	Breaking down and forming the material into another product
Refuse	Customers not buying or supporting products that make an environmental impact
Rethink	Designers and customer rethinking their decisions when making and buying products.
Repair	Fixing a product rather than throwing it away. Extending its life rather than using more resources to make another Often products are **Designed for Maintenance** so can easily be repaired. E.g. Using screws so even non-specialists can take a product apart, or using components that can easily be replaced like fuses or batteries

Life Cycle Assessment

This is when a designer looks at the environmental impact a product makes over its life time and how it could be reduced. Including:

- Impact of materials
- Impact of processes
- Product Miles (how far a product has to travel to get from factory to consumer)
- Impact while in use
- Impact when disposed of (6Rs)

Sustainability is maintaining our planet and its resources and making a minimal negative impact

Finite Resources *Will run out of eventually*	**Infinite Resources** *Can be re-grown and re-bread. Will not run out of*
Plastics	Paper
Metals	Boards
Polymers (Textiles)	Natural Timbers
	Cotton
	Leather

Planned Obsolescence	This is where products "die" after a certain amount of time. E.g. Disposable cups, Phones, Lightbulbs, Printer Ink, etc This can have a big environmental impact as customers are throwing away lots of products, and resources are being used to create new ones.