Year 9 Resistant Materials - Specialist Materials and Processes

Properties of Timber and Sheet Materials

Property	Definition	Found in
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

Hardwood

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

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.

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.

Wasting

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.

Manufactured Boards

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

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.

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.

Addition

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

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.

Wasting processes for Metals

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.

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.

Surface finishes for Wood

A range of surfaces finishes can be applied to wood either for decoration or protection of the surface, Examples wood be :

Bees Wax—rubbed in with a dry cloth. Enhances the grain.

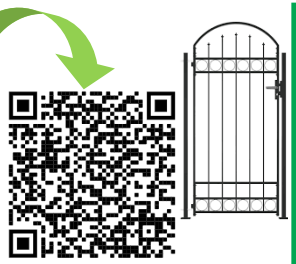
Varnish—painted on with a brush. Provides great surface protection

Wood Dye—painted or sponged on. Wood dye changes the woods colour but still brings out the wood grain. Provides no real protection.

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.



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.

Year 9 D&T Core Knowledge Organiser

Design Influences

The Impact on the Environment: Life Cycle Assessment

Designers must be aware of the impact that the manufacturing, use and disposal of their products may have. Understanding the materials used, components and energy sources involved help to build a picture of how environmentally friendly a product's production and use could be.

The main stages of Life Cycle Assessment are:

Raw Materials

- product requires reduced amount of raw materials;
- product uses recycled materials extensively.

Manufacturing

- production conserves energy;
- production conserves materials/allows recycling of raw materials
- prevention of pollution to air, water and underground water.

Distribution

- product uses simplified packaging;
- product is distributed more efficiently;
- product is delivered by low-emissions vehicle.

Consumer Use

- product consumes less power;
- reduced use of additional materials (for instance water, oils,

Post-Consumer Use

- product is designed for disassembly/easier recycling;
- product uses lower amounts of harmful substances.

6R's of Sustainability

REDUCE What parts can you reduce in size to save material? Are all the parts needed to make the product function the way you designed it?	**REFUSE** What materials could you refuse to use? Could you refuse to use materials that have not been responsibly sourced?
RETHINK How could you rethink the design to use less material? Could you choose more environmentally friendly materials?	**RECYCLE** Could parts be made from recycled material? Could you use materials that can be recycled?
REUSE Could the product have another use? Could its parts be used in other products to extend the products life?	**REPAIR** Is the product easy to repair when its broken? Can fixings be easily accessed?

Manufacturing Techniques

Bought-In Parts

Many products and manufacturers make use of 'Bough-In' parts and standard components. These may include zips, buttons, nuts and bolts, wood dowels or hinges for example. This is often to reduce costs, use less specialist machines and make manufacturing simpler.

Computer Aided Manufacturing (CAM)

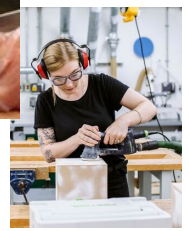
A range of computer guided machines can be used by manufacturers to complete highly accurate products or components at speed. Due to the machines following step-by-step code (generated by a computer), it is possible for parts to be replicated over and over. Examples of CAM include computer guided laser cutters, embroidery machines, Routers and Vinyl cutters. Robotic Arms also allow flexibility in manufacturing and the ability for products or parts to be moved between machines automatically.

Computer Controlled Laser Cutter

Robotic Arm

Health and Safety

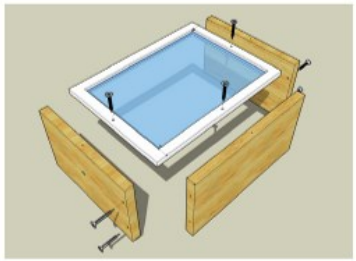
When moving on to practical work for your projects, the rules associated with a classroom in D&T are vital to keep you and others safe. You need to be able to recall these rules and understand their importance. Based on different locations or activities, you should be able to identify associated risks and state at least two separate control measure that can be put in place to help reduce potential risks to those undertaking the activity and others around them. The use of PPE (Personal Protective Equipment) is one important way of staying safe in any practical room. This may include the use of aprons, goggles, ear defenders or gloves for example. Health and hygiene is also vital in areas such as kitchens.



Design Communication and Manufacture

Exploded Drawings

These technical drawings can be useful in helping to explore how components and parts fit together. They can be drawn up more accurately and form a plan for the assembly of parts when producing a final prototype.



Mathematical Modelling

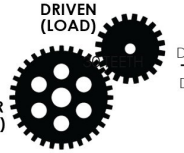
All models can contain some mathematical information to help a designer, but sometimes it is necessary to create a special model, for the purpose of gaining mathematical information about the intended product. This might include:

- calculating the amount of material required;
- researching joining solutions;
- using structural strength data;
- making calculations to do with the overall size and weight of the product.

Maths in D&T

Working out gears ratio (velocity).

In your GCSE exam there could possibly be questions referring gears and mechanisms. You will need to work out the gear ratio, often referred to as velocity.



$$\frac{\text{Distance moved by Effort}}{\text{Distance moved by Load}} = \frac{60}{30} = \frac{1}{2}$$

$$= 1:2$$

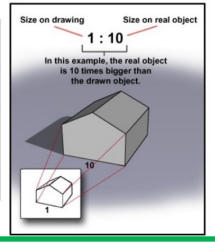
Working out scale in technical drawings: Ratio & Proportion.

Ratios are used in everyday life and can help you work out problems including scale drawings and reading maps. In a scale drawing, all dimensions have been reduced by the same proportion.

When producing orthographic drawings such as product plans it is not almost possible to draw them on a single piece of paper.

Instead they are drawn to a smaller, reduced size. The size reduced becomes its ratio.

Twice as small = 2:1
Ten times smaller = 10:1



Ratios are usually written in the form A:B.

After all an Architect couldn't draw a full size house on a single piece of paper.