

TIMBERS

Timber is wood that has come from tree trunks, debarked and dried out (seasoned) and cut into usable planks and boards. It is a sustainable resource, as we can grow more of it. Timbers can be split into 3 categories:

HARDWOODS (LOSES LEAVES IN WINTER (DECIDUOUS)).

Name	Properties / description	Advantages	Disadvantages	Uses
OAK	Strong, durable	Attractive grain. Can be used outside	Expensive, hard to work with corrodes iron and steel Warp when cut too thin	Furniture, park benches, boats
Ash	Strong, tough, flexible.	Finishes well. Strong, tough, flexible	Low resistance to rot and insect attack	Cricket bats, tool handles
BEECH	Tough and hard	Does not splinter	Expensive. Difficult to work with. Not resistant to moisture, so unsuitable for outside.	Toys, furniture, workbenches, tool handles

SOFTWOODS (KEEP LEAVES IN WINTER (EVERGREENS)).

Name	Properties / description	Advantages	Disadvantages	Uses
PINE	Yellow colour, wide grain due to quick growth	Durable. Easy to work Cheap, as grow quickly. Strong, lightweight	Can warp, crack & splinter.	Housing, roof joists, floorboards. Furniture, doors, woodwork.
CEDAR	Reddish tinge. Attractive grain.	Natural oils make it resistant to fungal growth	More expensive than pine, but not as strong	Outdoor furniture, fences, sheds, boats
LARCH	Tough, durable, water resistant	Can be used outside, untreated.	Expensive compared to other softwoods	Small boats, yachts, exterior cladding buildings

MANUFACTURED BOARDS (MAN-MADE TIMBER).

Name	Properties / description	Advantages	Disadvantages	Uses
PLYWOOD	Made up of veneers. Looks stripy	Flat, strong Resistant to warping, cracking, twisting	Expensive Edges can splinter	Caravan interiors, furniture Boats, shelving
MDF	Made from tiny wood fibres. Glued and compressed into sheets. No grain, so smooth.	Good for painting or staining. Easy to work with. Cheap	Does not look good. Needs a finish. Weak when compared to wood. Tools blunt quickly because of glue. Linked to cancer.	Cheap flat-pack furniture. Wall panels, display cabinets, storage units
CHIP-BOARD	Wood chips, mixed with glue and pressed into flat sheets	Uses waste wood materials, so cheap.	Not much structural strength when damp. Needs a plastic coating as surface is rough.	Desks, kitchen worktops, cheap flat-pack furniture.

JOINING METHODS	MATERIAL	ADHESIVES	ASSEMBLING
	Woods	Pva, Contact adhesive Epoxy resin (eg. Araldite)	Screws, Nails, Wood joints, laminating,, Knock down fittings(KDF)
	Metals	Contact adhesive Epoxy resin (eg. Araldite)	Machine screws / bolts /washers /rivets /Brazing/ soldering/ welding, Taps and dies.
	Polymers	Araldite, tenso, liquid cement	Machine screws/bolts/ washers

Tools & Machines

Marking out tools

Process: Measuring / Marking Out
Mark out the shape and size of a piece before cutting

Cutting tools

Process: Cutting
Using a Rip saw, Tenon saw, junior hack saw, coping saw or hack saw to saw material the size needed. Use a chisel to remove material to shape it, as needed.

Process: Tapping a thread
Using a tap and die set to cut a thread into a hole or around metal rod, so a nut can be screwed onto or into the material.

METALS

Metals come from underground. Metal is a finite resource (we cannot grow more of it). Some are pure metals. Some are alloys (when 2+ metals are mixed together to improve its physical properties). Metals can be split into 2 categories:

FERROUS (CONTAINS IRON. MAGNETIC, RUSTS)

Name	Properties / description	Advantages	Disadvantages	Uses
MILD STEEL	Tough, durable, rusts, magnetic	Cheap, Readily available, tough	Needs a finish to prevent corrosion (rust).	Car bodies Screws Nails, bikes, scooters
STAINLESS STEEL	Alloy of carbon steel, chromium, nickel and manganese. sometimes magnetic.	Rust resistant, hard, tough, resists wear,	Difficult to cut.	Kitchen wear, sinks, cutlery, medical equipment.
CAST IRON	Hard, magnetic, good in compression	Hard, good in compression, magnetic	Brittle Can corrode (rust).	Vices, weights Man hole covers

NON-FERROUS (DOES NOT CONTAIN IRON. NOT MAGNETIC).

Name	Properties / description	Advantages	Disadvantages	Uses
BRASS	Alloy of copper & zinc. Not magnetic, Polishes well.	Does not rust Casts well	Expensive	Musical instruments Door fittings – knockers, door handles
COPPER	Reddish brown, malleable, ductile, tough, can be worked with hot or cold.	Corrosion-resistant, easily machined, good heat and electricity conductor, polishes well	Expensive	Electrical wire, gas and water pipes, printed circuits.
ALUMINIUM	Grey in colour Shiny, lightweight, polishes well	Does not rust Lightweight Doesn't require a finish.	Relatively soft, needs to be alloyed to improve properties.	Aircraft, window frames, drink cans

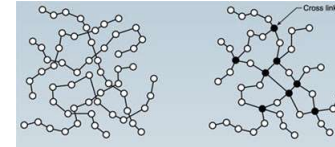
PROPERTIES of MATERIALS

Hardness	Ability to resist wear and scratches
Toughness	Ability to absorb being hit without breaking
Brittleness	Material shatters / breaks when hit.
Malleability	Ability of material to be shaped without rupturing/ breaking
Ductility	Ability of material to be stretched. .
Durable	lasts a long time
Aesthetics	appearance of a material eg wood grain , colour, texture.
Corrosion	Rusts. Metal is eaten away as it reacts with oxygen + water.
Magnetism	attracted to magnetic materials

POLYMERS

Polymers (Plastics) come from oil, found underground. It is a finite resource (we cannot grow more of it). Plastics can be split into 2 categories: Thermoplastics (thermoplastic) and Thermosetting Polymers.

Thermoplastic polymers have chains of molecules, which flow freely, which means it can be heated and reshaped repeatedly



Thermosetting polymers have cross links on the chains of molecules, which prevent the plastic from being reshaped when heated. This makes recycling very difficult.

THERMOPOLYMERS (CAN BE REHEATED AND RESHAPED)

Name	Properties / description	Advantages	Disadvantages	Uses
ACRYLIC	Tough, easily finished/self finishing, range of colours.	Shaped easily by heat, lots of colours and forms (rods, sheets)	Breaks if dropped – Brittle. Easily scratched	Shop signs, menu holders, car lights.
HIPS	(High Impact Polystyrene Sheet). Available as sheets , rods and tubes. Range of colours. Low melting point	Lightweight, high stiffness, impact resistant,	Easily scratched, becomes brittle when exposed to sunlight too long	Used for vacuum forming moulds.
BIOPOL	Made from biodegradable materials (soya plants, fibres etc). Weak in compression (squashed).	Degrades in soil. Can use it for injection moulding and vacuum forming.	Expensive, weak in compression	Disposable cups, razors, cutlery, packaging, surgical stitches.

THERMOSETTING POLYMERS (CANNOT BE REHEATED)

Name	Properties / description	Advantages	Disadvantages	Uses
POLYESTER RESIN	Rigid, Brittle, electrical / heat insulation.	Can be used with fibre glass – lightweight and strong products. Easily polished.	Brittle – chips if dropped.	Boat hulls, cast into decorative forms.
UF	UREA FORMALDEHYDE Powder, granules.	Rigid, hard, heat resistant, good insulator. Can be coloured.	Can break if dropped	Plugs, toilet seats, sockets, switches, pcb circuit boards.

Finishes	Woods	<ul style="list-style-type: none"> Oil – Apply oil onto a rag and rub into the grain of the wood. Varnish – Apply varnish with a brush and brush on wood in thin layers Stain – Apply stain with a rag or brush, rub into grain and wiping off excess Wax – Apply with a rag rubbing into grain vigorously. Shellac – Apply with a brush in multiple, sanding after each layers Paint – Apply with a brush in thin layers until even smooth coverage
	Metals	<ul style="list-style-type: none"> Plastic dip coating – Metal heated to 250 degrees and dipped in plastic Painting – Metal sanded paint applied with brush in thin layers Oil bluing – Metal heated to 450 degree and dipped / quenched in oil.
	Polymers	Polymers don't usually require a finish as they are self finishing but if they are cut then the edges that have been cut need to be filed, sanded and polished to achieve the aesthetic quality.

RESISTANT MATERIALS

HOMEWORK WEEKS 1-6

Drilling tools

Process: Drilling
Using a pillar drill,, electric hand drill or manual hand drill, to cut circular holes in piece of material to various sizes. Choice of drill bits to make different sized holes. A holesaw cutter is useful for making wheels.

Abrading tools

Process: Abrading / Sanding
Wood can be sanded to size and given a smooth finish using the belt sander, or hand finished with sandpaper. Sandpaper has different grades of coarseness. The higher the number the finer it is.

Process: Filing
Files can be also be used to get a smooth finish on a variety of materials. They come in a variety of shapes and sizes.

Lathe Tools

Process: Wood Lathing
Using a lathe to secure a piece of wood into the chuck and tail stock, before using a gouge or scraper to shape the material as it spins. Useful for making wheels, candlesticks, baseball bats, bowls etc.

Homework 1 – Timbers (23 marks available)



- Name the three categories of timber. [3]
- Describe the difference between them. [3]
- Name two examples of each category, and say what they are used for. [6]
- Read through each scenario below, then choose a timber and explain why you have chosen that timber.
 - i) You have been asked to design and make a **wooden toy** for a child of 6 years old
 - ii) You have been asked to design and make a **wooden model of a plane**.
 - iii) You have been asked to design and make a piece of **high quality wooden furniture**
 - iv) You have been asked to design and make a **low cost piece of wooden furniture**
 - v) You have been asked to design and make **timber cladding** panel to go on a building [10]
- How could you permanently join two pieces of wood together? [1]

Homework 2 – Metals (20 marks available)



- Name the two categories of metals [2]
- Describe a difference between these categories of metals [1]
- Name two metals from each category [4]
- Read through each scenario below, then choose a metal and explain why you have chosen that metal:
 - i) You have been asked to design and make a set of cutlery for a household.
 - ii) You have been asked to design and make a set of screws to join timber.
 - iii) You have been asked to design and make a cover for a drain
 - iv) You have been asked to design and make a metal takeaway container
 - v) You have been asked to design and make a pipe to carry hot water
 - vi) You have been asked to design and make a door knocker for a front door of a house. [12]
- Explain one method you could use to join aluminium sheet to mdf. [1]

Homework 3 – Polymers (plastics) (21 marks available)



- Name the two categories of polymers [2]
- Draw a diagram, and explain the difference between them. [2]
- Name two types of each category of polymer [4]
- Read through each scenario below and choose a polymer. Explain your choice.
 - i) You have been asked to design and make a plastic bag to hold wood waste in a kitchen
 - ii) You have been asked to design and make a plastic shop sign
 - iii) You have been asked to design and make a plastic toy for a toddler
 - iv) You have been asked to design and make a plastic hulls for a sports car
 - v) You have been asked to make a new plastic plug socket for use in an office. [10]
- Describe the word “Toughness” and explain why this property is necessary for a child’s toy. [2]
- How could you permanently join two pieces of plastic together. [1]

Homework 4 – Workshop Equipment (16 marks available)

Marking out tools

- Explain how a tri square is used to mark out a piece of material such as wood. [2]
- What advantage does a Tri square have over a ruler when marking out wood to make it “square”? [1]
- Explain how to use a marking gauge. [2]
- What advantage does a marking gauge give you when marking out on a piece of material? [1]

Drilling

- Name the drill you used on your Pull along toy. Explain why this type of drill was used. [2]
- If you were to drill holes for wheel axles made from 6mm Dowel, which size drill bit would you use, and why? [2]

Cutting

- Name the saw you used to cut out your pull along toy base. Why was this one was chosen? [2]
- If you needed to cut curves what type of saw would you choose? [1]
- Explain why this saw would be suitable. [1]

Abrading tools

- What type of abrading tool could you use on your pull-along toy letter? [1]
- Explain why this type of tool was used. [1]

Homework 5 – Processes (17 marks available)

Marking out

- Before cutting out materials why is it necessary to **mark out** pieces accurately? [1]
- Name two pieces of equipment that would allow use to mark out accurately. [2]

Cutting

- Name two pieces of equipment that can be used to **cut wood** [2]
- Describe how a **tenon** saw should be used in a workshop. [2]

Drilling

- Before using a **pillar drill**, what needs to be done before it is switched on? [3]
- What metal working tool could be used to make drilling more accurate? [1]

Wood Lathe

- Describe the action of a Lathe and what can this piece of equipment is used for? [3]

Tapping

- Describe the tapping process, and draw a diagram to explain. [3]

Homework 6 – Surface Finishes (12 marks available)

- Name the **finishes** that you have used on your Pull along toy [2]
- Explain why** these finishes have been used and advantage they give to the product. [2]
- Read through each of the following scenarios and name a suitable finish you would use. Explain your choice.
 - i) A piece of furniture made from MDF
 - ii) A piece of furniture that needs a high lustre / shine and won't be near water or a heat source
 - iii) A wooden bench that is to be placed outdoors
 - iv) A child's wooden toy [8]



CAD (Computer-Aided Design)

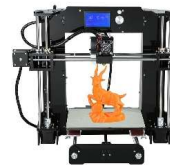
C.A.D. involves products being designed on a computer, using specialist software (we use AutoCad Inventor). Designs can be saved, edited, and copied many times. The design can be 2D or 3D, and some software can even simulate how a product will work in real life.



Advantages of CAD	Disadvantages of CAD
Can be more accurate than hand-drawn designs - it reduces human error.	Requires a computer.
Ideas can be tested on screen, to see if they would work in real life. This would save time and money for the company.	Staff need to be trained how to use the software, which also adds to costs.
You can save and edit design ideas, which makes it easier and cheaper to modify your design as you go along, which saves time.	The software itself can be expensive so initial costs are high. (There are free software packages though).
Many copies can be made in one go, consistently and accurately, because computer-aided machines will understand the instructions from the software.	

CAM(Computer-Aided Manufacture)

C.A.M. uses computer numerical control (CNC) to make CAD designs. CAD software creates the 3D coordinates of the design. The CAM machine can then make the product. The machine we could use is a 3D Printer.



Advantages of CAM	Disadvantages of CAM
Computer Aided Manufacture (CAM) has meant that products and components can be made repeatedly to the same high standard.	Expensive equipment
Accuracy of machining is consistently high, and machining through CAM is much faster than machining by human control / by hand	Needs maintenance
Large quantities can be produced 24 hours a day, reducing the final cost/price.	Replaces humans, so they could lose their jobs.
Products can be made directly from CAD files	Staff need training

Name	Appearance	Advantages	Disadvantages
Butt		Easy to make, it is just square ends glued together	<ul style="list-style-type: none"> Weak: there is no mechanical strength, just the glue Not aesthetically pleasing
Dowel		Automated machines can drill the dowel holes quickly and accurately	Hard to line up the dowels accurately by hand
Lap		Quite easy to cut	Not very strong
Housing		<ul style="list-style-type: none"> Holds a shelf or divider securely in the middle of a carcass (frame) Pairs well with corner lap joints 	<ul style="list-style-type: none"> Can be tricky to cut neatly on a wide board Very accurate marking out and cutting required to ensure a shelf is exactly level
Mitre		<ul style="list-style-type: none"> Looks good because no end grain shows Good for picture frames 	Weak, it is only a butt joint at 45°
Hortise and tenon		<ul style="list-style-type: none"> A strong joint Good for joining a table or chair frame to legs 	Time consuming to cut by hand
Dovetail		<ul style="list-style-type: none"> A very strong joint - the dovetails lock together securely Good for a drawer front that will get pulled hard 	Very tricky to cut accurately by hand

What is Deforestation?

Deforestation is a global problem, with trees being cut down faster than they grow. Most of Europe was deforested hundreds of years ago and deforestation is now a major problem for areas of the developing world, such as South America and West Africa.

Deforestation can cause a lot of accompanying environmental issues such as soil erosion. For example, in Nepal deforestation has caused problems with landslides. Worldwide about 46,000–58,000 square miles of forest are lost each year. That is an area the size of England every year, or equivalent to 48 football fields every minute.

Because trees absorb carbon dioxide from the air, scientists think that having fewer trees will make the greenhouse effect worse, which will warm the Earth and affect the climate and sea levels for the whole world.

What effect can Deforestation have on communities?

Sometimes logging (cutting trees for timber), an industry, brings jobs and money to an area. However, in many poorer regions, such as the Amazon rainforest, logging is badly managed and large companies log in areas where indigenous people live. Logging activity often pushes them out of their ancestral homes, leaving them with nowhere to go, and destroys their traditional way of life and the wildlife they depend on for food.

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What are the most and least useful parts of a tree?

The trunk of a tree will be used for planks, but other parts of the tree such as small branches and leaves that are not useful will be left to rot or burnt if the land is being cleared for farming. Larger branches and the waste from the trunk after cutting into useful planks may be turned into chipboard or MDF. As timber has become scarcer it has become more expensive.

Habitat destruction and loss

When an area of forest is destroyed, the animals that live there lose their habitat, and they usually have nowhere else to go. Some well-known animals including tigers, gorillas, orangutans and elephants are in danger due to loss of habitat, and there are hundreds more species of animals, birds and insects that are at risk of extinction if deforestation continues

Homework 7 – 3D CAD (Computer Aided Design) and 3D printing

1. State **three benefits** of using 3D CAD
2. State **two disadvantages** of using 3D CAD
3. From your lessons on Auto desk Inventor, explain how to create a **3D form** (shape).
4. Explain how to **edit a shape by curving the corners**
5. Explain how you would **assemble** a 3D model together
6. Explain how you would create a **working drawing** from a **3D model, (project the views)**.
7. State **two benefits** of using a **3D Printer**
8. Name a **disadvantage** of using a **3D printer**
9. Think of a **limitation** of using a 3D printer when **making** a product

**Homework 8 – Wood joints****Butt Joint**

1. Sketch down what a **butt joint** looks like.
2. Name **two advantages** and **two disadvantages** of using a **butt joint**.
3. Name a product where a butt joint has been used.

Dowel Joint

4. Sketch down what a **dowel joint** looks like.
5. Name **two advantages** and **two disadvantages** of using a **dowel joint**.
6. Name a product where a **dowel joint** could be used

Mitre Joint

7. Sketch down what a **mitre joint** looks like.
8. Name two advantages and two disadvantages of using a Mitre joint.
9. Name a product where a **mitre joint** has been used.

Housing joint

10. Sketch down what a **housing joint** looks like.
11. Name **two advantages** and **two disadvantages** of using a housing joint.
12. Name a product where a **housing joint** has been used.

13. Read the following scenarios. State **which wood joint** you would use in each scenario and give a **reason** why:

- I. A **wooden chest of drawers** in a bedroom has 4 drawers, which wood joint would be most suitable to join the **drawer fronts** to the rest of the drawers?
- II. The same piece of furniture needs the drawers to have a **bottom piece** to hold items in place. Which wood joint would be best to join this bottom piece to the rest of the drawer?
- III. A **picture frame** is made up of four pieces of timber. Which wood joint is the best to join these pieces together so that none of the **end grain** is showing?
- IV. A **dining room table** has four legs which need to connect to **horizontal** supports. Which wood joint would be best for this purpose?

Homework 9 – Timber issues - Deforestation

1. What does the term “**deforestation**” mean?
2. How are **animals** directly affected by deforestation?
3. How might **indigenous people** of the rainforests be affected by deforestation?
4. Explain why removing trees from a rainforest is damaging to the **rest of world**.
5. What is the **most useful** part of the tree to **woodworkers**?
6. What about the **least useful** part of the tree to **woodworkers**?
7. Explain how the **least useful** parts of a tree could be used to **conserve** precious resources.