

KS4 Knowledge organiser – Resistant Materials

Wood:

Softwoods- pine, cheap easy to work with

Hardwoods- oak, expensive wood, strong.

Manufactured boards- plywood, strong constructed in layers

Chipboard, ridged board, relatively smooth surface

MDF, smooth surface, easy to machine

Original source- trees

Advantages and disadvantages of natural timbers versus manufacture:

- It is available in large sheets
- It is an environmentally friendly/sustainable material
- It is cost effective (cheap)
- It does not have knots/defects
- It can accept a veneer/'formica' finish

Construction details:

Wood: dovetail joints, dowel joints and nails

Metal: welding, rivets, nuts and bolts

Plastic: nuts and bolts

Joining using adhesives:

Epoxy resin- glues all materials together

Apply epoxy resin:

- Key both surfaces
- Both are clean and free from dust
- Squirt equal amounts of glue and hardener
- Mix together
- Apply with a spatula
- Clamp
- Wipe off excess
- Leave to dry

PVA-only glues wood to wood

Application of PVA

- key both surfaces
- apply to both surfaces
- clamp
- wipe off excess with wet cloth
- leave to dry

Smart materials:

- Thermo chromatic plastic- change colour when heat is applied- babies spoons
- Carbon fibre- lightweight, strong and tough- tennis rackets
- Polymorph- easily moulded with the application of heat- handles prototypes.
- Smart grease- controls the speed which a mechanism moves-drawers
- Shape memory alloy- remembers its original shape and goes back to this when heat is applied- glasses, braces
- Phosphorescent sheets-absorbs light and the releases it with a glow of light-fire exit signs.

Modelling Materials:

- Balsa wood, a soft hardwood, than can be easily cut with a knife.
- Paper and Card, easy to cut with scissors and easy to glue
- MDF, easy to cut, easy to construct into a 3d model
- Polymorph, a plastic that is easy to mould with the application of heat.

Health and safety

- Fumes, dust give breathing problems- Extraction, Well-ventilated area, dust mask
- Flying debris, can go into eyes- Wear safety goggles
- Hot items can burn hands- Wear gloves
- Heavy items can land on your feet- Wear steel toe cap shoes
- Loud noises can affect your hearing- Ear defenders worn

Processes

Plastics:

- Injection moulding- the shaping of rubber or plastic articles by injecting heated material into a mould
- Vacuum forming- is a simplified version of thermoforming, whereby a sheet of plastic is heated to a forming temperature, stretched onto a single-surface mould, and forced against the mould by a vacuum (suction of air)
- Blow moulding- produces hollow objects in large quantities, usually making bottles.
- Line bending- is an efficient process for creating one or tighter radius bends in most formable sheet plastics.

Metal:

- Welding- join together (metal parts) by heating the surfaces to the point of melting
- Casting- an object made by pouring molten metal or other material into a mould

Tools:

Coping saw- a saw that cuts curves and straight lines

Jig saw- a handheld machine that cuts curves and straight lines.

Tenon saw- a saw that cuts in straight lines

Try square- a marking tool that helps to draw straight lines and measure angles of 90 degrees.

File- smooth's the surface of a material

G clamp- a clamp that hold two pieces of material together.

Hack saw- a saw that can cut plastic and metal in straight lines.

Plane- to smooth or shape a piece of wood.

Chisel- to shape or cut the edge of wood

Plastic:

Thermoplastic- ABS, strong can be recycled

Thermosetting plastic- UF, heat resistant cannot be recycled

Original source- oil

Metal:

Ferrous- Steel, strong does rust

Non ferrous- Aluminium, lightweight doesn't rust

Original source- ore

Finishes:

Wood- varnish, protects the material

Metal- paint, adds colour and protects

Plastic- self finish material, it doesn't require a finish

Ergonomic

- Making the product easier for the user
- Moulded handles
- Added cushions

Anthropometrics

- Reference to the collection of data
- Measuring the target market
- 5th to 95th percentile

Design requirements/ Design Specification

- It must be strong
- Because it must not break when in use, this will reduce the cost to the user because it will increase the longevity of the product and then the user will not have to buy another product.
- It must be safe to use
- No one should be hurt when using the product, all products will go through testing before it get released onto the market, this is to ensure the product will be safe and no one will get hurt otherwise the product will get recalled.
- It must be ergonomically designed
- It should be comfortable to use, this will encourage the buyer to purchase the product if they could test it beforehand also and it will stop the customer from having any long term pain problems resulting from products that aren't comfortable.
- It must be environmentally friendly so the environment is not harmed, it will lower the carbon footprint of the company encouraging more customers to buy the product.