A level Design and Technology Summer Bridging work

We hope you will have a safe and enjoyable summer at this strange time. Sadly due to the Corona Virus you were unable to complete your GCSE course in its usual manor so we have prepared some materials to help support you throughout your time and make sure you are in an excellent situation when we start back.

Please complete the 3 documents found in the DT folder. There is no set order to complete these activities and we do not expect you to be able to complete all of it however the more you can complete the better knowledge you will have when completing the course. If you research and complete it all you will have a massive head start on your course mates.

Document 1 – A level Prod Design material case studies

This is a document that helps you to understand and remember key materials we will study. All materials are in relation to products you will be familiar with. A little research and you will be able to complete the case studies. This can then stay with you in you're a level folder as a revision tool or something to use as a reference in lessons or when completing coursework.

Document 2 – A level Sketch manufacturing processes

As in your GCSE you will know that the processes used to manufacture products is also key, so this document shows you some diagrams of the main processes used in D&T. In your exams you will have to be able to recite and draw these processes so this is an opportunity to sketch some; and find out a few key facts about them too. Youtube is a great tool to see these in action!

Document 3 – Summer work Definitions

Lastly our usual summer work is simple and can be completed as you complete the other 2 documents. It's simply every key work or definition you will need in this subject. Some you will already know some, but others may need some research, a look in a revision guide or via youtube. Remember they all relate to D&T so you may need to use some common sense when searching.

Ie. *A level Design and Technology lamination* **or** *Lamination process timbers*

for example to find out about lamination of timbers.

Any problems send an email to

d.mears@theacademycarlton.org

Name: …… **Class**: …….

Case Studies of Materials with their Properties and Associated Manufacturing Techniques

In the exam you may be given images of a product and be expected to identify the material used, why it is appropriate for certain uses or products and the manufacturing methods associated with that material. Learning a case study for each material gives you an advantage in that you have a specific product to write about instead of possibly falling into the danger of being too vague.

You will be expected to know about the following materials and be familiar with products made from various types of materials within these groups.

Ferrous Metals
- Mild Steel
- Stainless Steel
- Cast Iron
- High Carbon Steel

Non-Ferrous Metals
- Aluminium
- Brass
- Titanium
- Gold

Composites
- CFRP (Carbon Fibre Reinforced Plastic)
- GFRP (Glass Fibre Reinforced Plastic)
- Concrete
- Cermets ('ceramic-metals')

Polymers

Thermoplastics
- PET (1)
- HDPE (2)
- PVC (3)
- LDPE (4)
- PP (5)
- Polystyrene (6)
- Nylon (7)
- Polycarbonate (7)
- PMMA (Acrylic) (7)

Thermosets
- UF (7)
- ABS (7)
- PF (7)
- Melamine Formaldehyde (7)

Elastomers
- TPE (Thermoplastic Elastomer) (7)

Bioplastics
- Oxo-Biodegradable
- Biodegradable: PLA (Polylactic Acid)

'New'/Modern Materials
- Kevlar
- Polymorph
- 'Gore-Tex' textiles

Woods
- Softwoods - Pine
- Hardwoods - Teak

Manufactured Board
- Plywood
- MDF (Medium Density Fibreboard)
- Laminated Chipboard

Smart Materials
- QTC (Quantum Tunnelling Composite)
- Thermochromic pigment
- Photochromic pigment
- SMA (Shape Memory Alloy) aka Nitinol
- Piezo-Electric Materials

PLEASE NOTE

THIS LIST OF MATERIALS AND EXAMPLES OF THEIR APPLICATIONS IS NOT EXHAUSTIVE, IT IS JUST A SELECTION SO THAT YOU HAVE SOME SOLID REFERENCE POINTS.

Properties of Materials

Mechanical Properties
Working properties of material, how it responds to changes in applied force

- **Durability**
  - Ability to last a long time
- **Elasticity**
  - Extent to which material can be deformed and then return to original shape
  - Point at which permanent deformation occurs
  - Elastic limit
- **Rigidity**
  - Ability to resist flexing or deformation when subjected to a force
- **Flexibility**
  - Ability to bend without breaking
- **Strength**
  - Ability to withstand forces
    - **Compressive** (squashing)
    - **Tensile** (pulling)
    - **Torsion** (twisting)
    - **Bending**
    - **Shear** (breaking due to 2 opposing forces. Eg scissors)
  - Strength to weight ratio very important
- **Ductility**
  - Ability to be cold stretched ie. making wires
- **Stability**
  - Physical properties
    - Resistance to change
      - size
      - Shape
    - Caused by exposure to UV light, time, temperature. Moisture etc
- **Toughness**
  - Opposite of ‘brittleness’
  - Ability to resist sudden impact without breaking
- **Brittleness**
  - Tendency to break On sudden impact
  - Opposite of ‘*toughness*’
- **Malleability**
  - Resistance to being bent/worked without breaking
  - Called ‘*work hardening*’
  - eg. Twisting/bending wire in same place till it breaks
  - Alters crystalline/atomic structure at breaking point
- **Hardness**
  - How easy it is to Scratch or mark the surface

Malleability is not the same as **ductility**

Physical Properties
Inherent characteristics of materials

- **Softness**
  - ‘Feel’ of finish Eg spongy vs hard
- **Permeability**
  - Ability for fields/substances to pass through material
    - Radiation
    - Air & other gasses
    - Electrical fields
    - Liquids
    - Magnetic fields
- **Texture**
  - Slippery, lack of adhesion
  - Smooth
  - Abrasive
  - Rough
- **Fusibility**
  - Melting point (temperature at which material turns to liquid)
- **Availability**
  - Local or imported
  - Rare/endangered
- **Resistance to:**
  - Fire/heat
  - Decay
  - Water
  - Electric current
  - Chemicals
  - Distortion
  - Friction/Wear
  - Corrosion
  - Lubrication
  - Can be treated
    - eg. paint, oil, galvanising, chroming
- **Health & Safety**
  - Carcinogenic
  - Allergic reaction
  - Dust inhalation
  - Toxicity
- **Cost**
  - Cost-effectiveness vs best functioning material
    - eg. Gold is excellent conductor but Copper is cheaper
- **Smell**
  - Toxic emissions
    - Exposed to chemicals
    - When heated
- **Appearance**
  - Refractive Index
    - Ability to ‘bend’ light as it passes through
  - Transparent
  - Translucent
  - Opaque
    - Matte
    - Gloss
- **Conductivity**
  - Ability to directly Transmit energy
    - Electrical
      - Insulator
      - Semi-conductor
      - Conductor
    - Thermal
      - Differential expansion in materials

Conductivity is not the same as **permeability**

Case Study for Mild Steel (Ferrous Metals)

Park bench

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for Stainless Steel (Ferrous Metals)

Eating utensils and cookware

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Sustainability:

Manufacturing methods or key terms:

Case Study for Cast Iron (Ferrous Metals)

House Radiators

Sustainability:

Properties of this material which make it a good choice for this product:

Manufacturing methods or key terms:

Pros:

Cons:

Case Study for High Carbon Steel (Ferrous Metals)

Food preparation knife

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for Aluminium (Non-Ferrous)

Climbing Carabiner (anodised)

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for Brass (Non-Ferrous)

Tap

Properties of this material which make it a good choice for this product:

Pros:

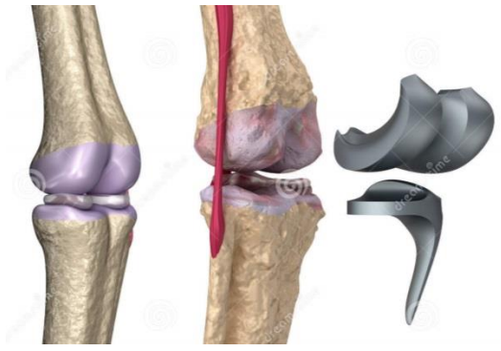
Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for Titanium (Non-Ferrous)

Replacement Joints



Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for Gold (Non-Ferrous)

Jewellery

Sustainability:

Properties of this material which make it a good choice for this product:

Manufacturing methods or key terms:

Pros:

Cons:

Case Study for CFRP (Carbon Fibre Reinforced Plastic)

Prosthetic Limb

Sustainability:

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Manufacturing methods or key terms:

Case Study for GFRP (Glass Fibre Reinforced Plastic)

Canoe

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for PET

Drinks Bottles

Category of polymer?

……

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Sustainability:

Manufacturing methods or key terms:

Case Study for HDPE

Product Bottles
Eg Milk bottle

Category of polymer?

……

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for PVC

Pipework

Category of polymer?

……

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for LDPE

Plastic bags

Category of polymer?

……

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

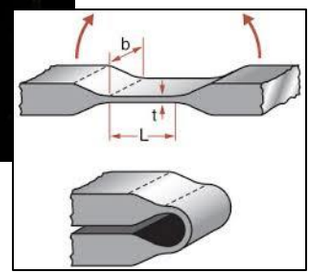
Manufacturing methods or key terms:

Case Study for Polypropylene (PP)

Lid with living hinge

Category of polymer?

……



Also durable , inexpensive chairs

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Sustainability:

Manufacturing methods or key terms:

Case Study for PS (Polystyrene) 6

Cup or Packaging

Category of polymer?

……

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for Nylon

NUTS AND BOLTS

CLIPS

BAGS / HOLDALLS

BEARINGS

GEARS / PULLEYS

YARN / STRING

WATERPROOF CLOTHING

Category of polymer?

……

Pros:

Properties of this material which make it a good choice for this product:

Cons:

Manufacturing methods or key terms:

Case Study for Polycarbonate

Helmet Visor
Safety Goggles

Category of polymer?

……

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Sustainability:

Manufacturing methods or key terms:

Case Study for Acrylic (PMMA)

Outdoor signage

Category of polymer?

……

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for ABS

Motorcycle Fairing
Helmets
Also Electrical Goods

Category of polymer?
…….

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Sustainability:

Manufacturing methods or key terms:

Case Study for UF (……)

Electrical Plug

Category of polymer?

……

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for PF

Heat-resistant handle for cookware

Category of polymer?

……

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for Melamine Formaldehyde

Eating/drinking utensils

Category of polymer?

……

Worktop surface

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Sustainability:

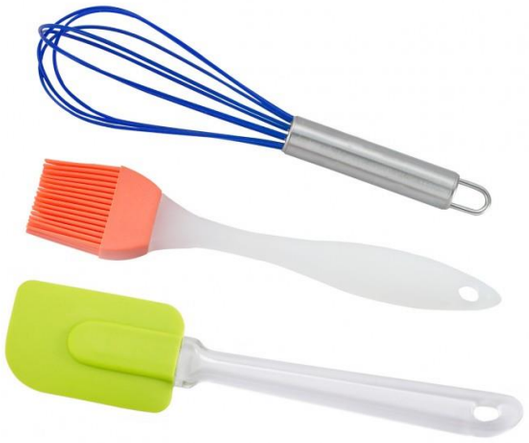
Manufacturing methods or key terms:

Case Study for TPE (Thermoplastic Elastomer)

Flexible, elastic
Cooking utensils

Category of polymer?

……



Grip on toothbrush

Properties of this material which make it a good choice for this product:

Pros:

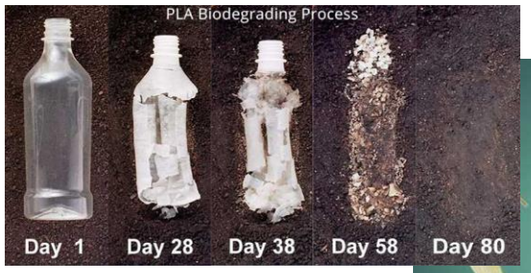
Cons:

Sustainability:

Manufacturing methods or key terms:

Case Study for biodegradable plastics: PLA

Bioplatic made from natural starch used in 3D printer, biodegradable packaging nuggets, drinks bottles, bags



Sustainability:

Properties of this material which make it a good choice for this product:

Manufacturing methods or key terms:

Pros:

Cons:

Case Study for Oxo-Biodegradable Plastics

Bags – made from crude oil but with additives to break down the plastic under UV light (sunlight)

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for Softwoods: Pine

Inexpensive indoor furniture

Properties of this material which make it a good choice for this product:

Sustainability:

Manufacturing methods or key terms:

Pros:

Cons:

Case Study for Hardwood:Teak

Outdoor Furniture

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for Plywood

Laminated chair

What family of materials does this belong to?

……

Skateboard

Sustainability:

Properties of this material which make it a good choice for this product:

Manufacturing methods or key terms:

Pros:

Cons:

Case Study for Concrete

Outdoor Street Furniture

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for MDF

Inexpensive furniture

Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Manufacturing methods or key terms:

Case Study for Laminated Board

Laminated Chipboard for inexpensive furniture

Sustainability:

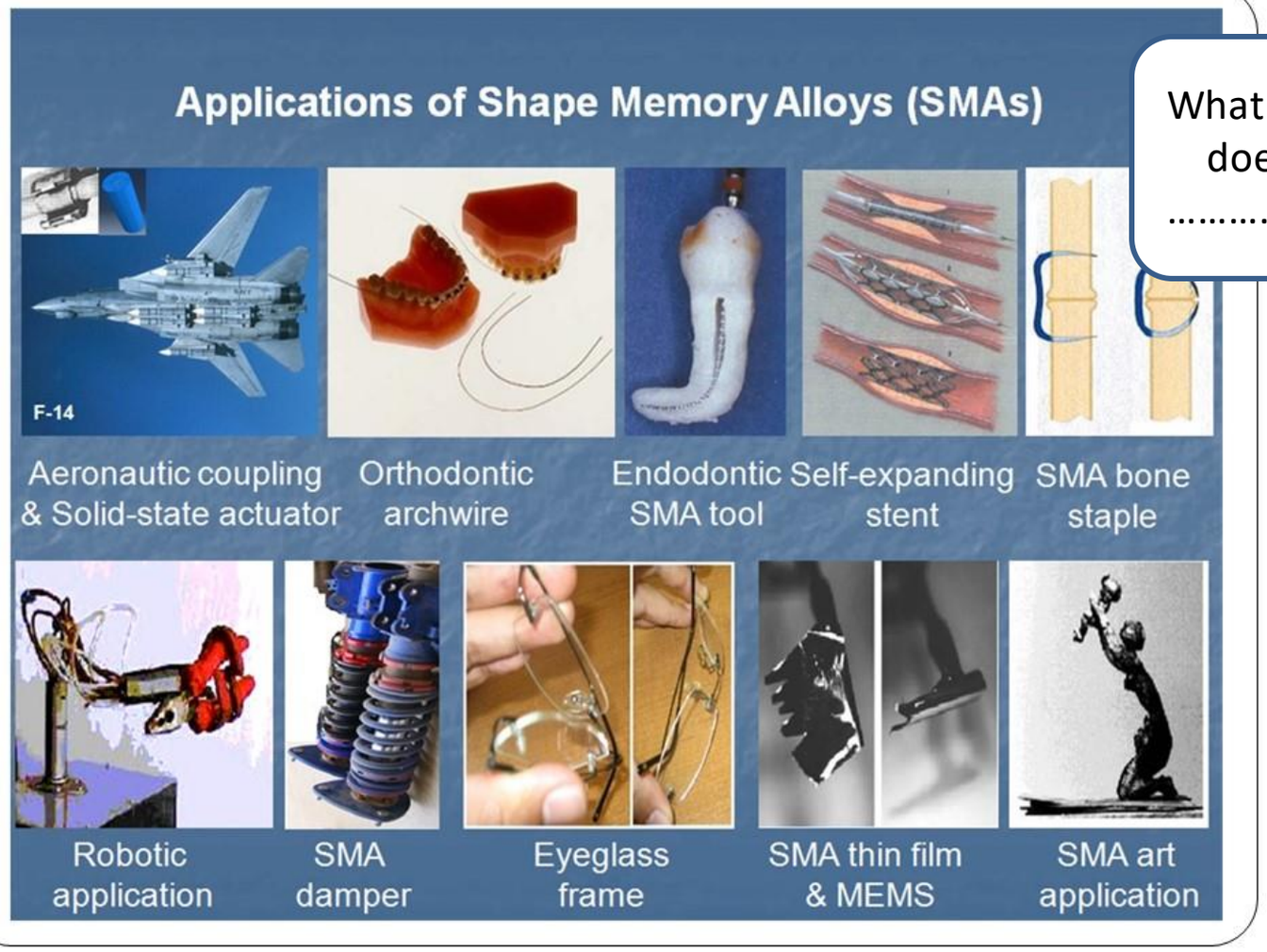
Properties of this material which make it a good choice for this product:

Pros:

Cons:

Manufacturing methods or key terms:

Case Study for SMA (Shape Memory Alloy) aka Nitinol



What family of materials does this belong to?

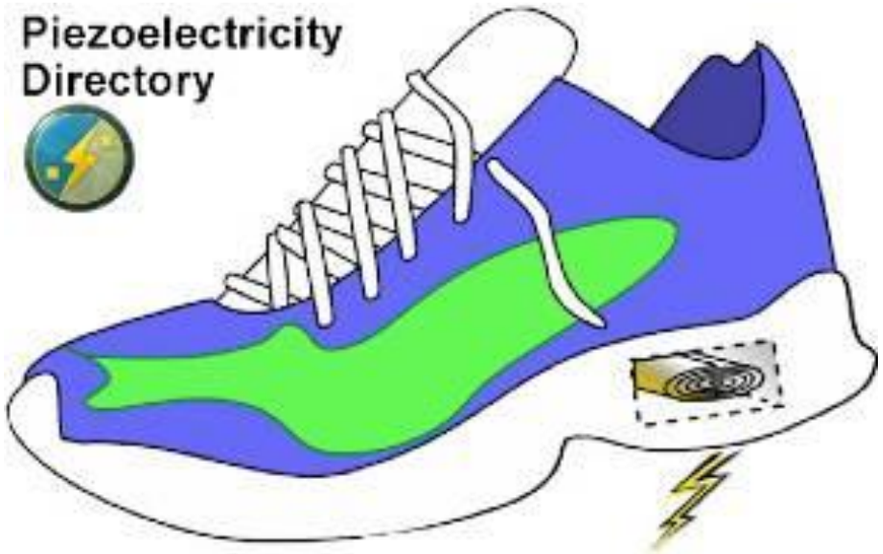
……

Pros:

Cons:

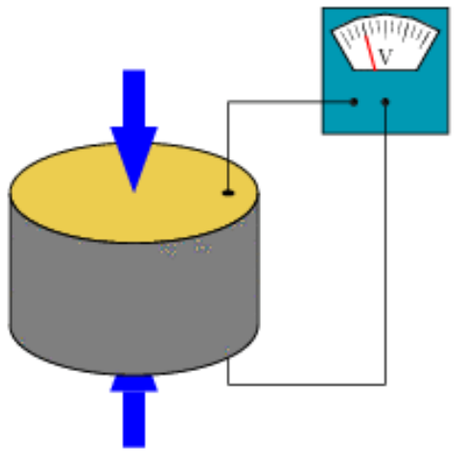
Properties of this material which make it a good choice for this product:

Case Study for Piezo-Electric Materials



What family of materials does this belong to?

……



Pros:

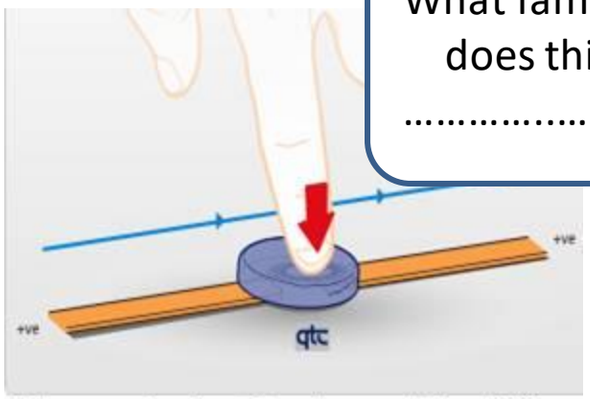
Cons:

Properties of this material which make it a good choice for this product:

Case Study for QTC (Quantum Tunnelling Composite)

What family of materials does this belong to?

……



Under compression, the resistance drops gradually and QTC can be capable of passing high currents.

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Case Study for Thermochromic Pigment

Baby thermometer

What family of materials does this belong to?

……

Colour-changing kettle

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Case Study for Photochromic Pigment

Colour-changing Lens or visor (depending on exposure to sunlight)

What family of materials does this belong to?

……

Phosphorescent emergency sign

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Case Study for Kevlar

Stab-Resistant Vest

What family of materials does this belong to?

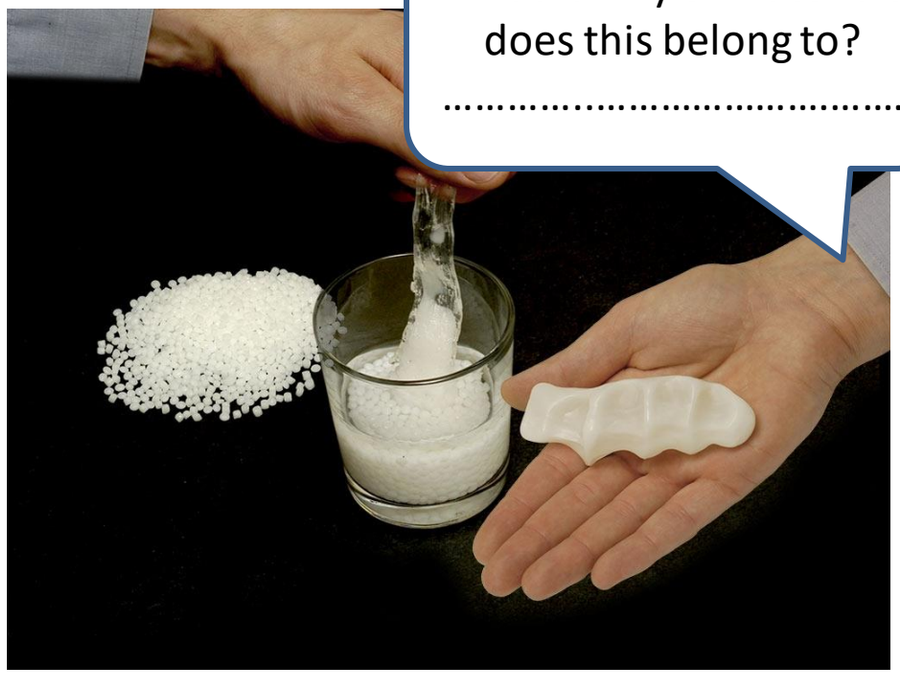
……

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Case Study for Polymorph



Properties of this material which make it a good choice for this product:

Pros:

Sustainability:

Cons:

Case Study for Breathable Fabric eg Gore-Tex®

What family of materials does this belong to?

……

Properties of this material which make it a good choice for this product:

Pros:

Cons:

Case Study for Cermets

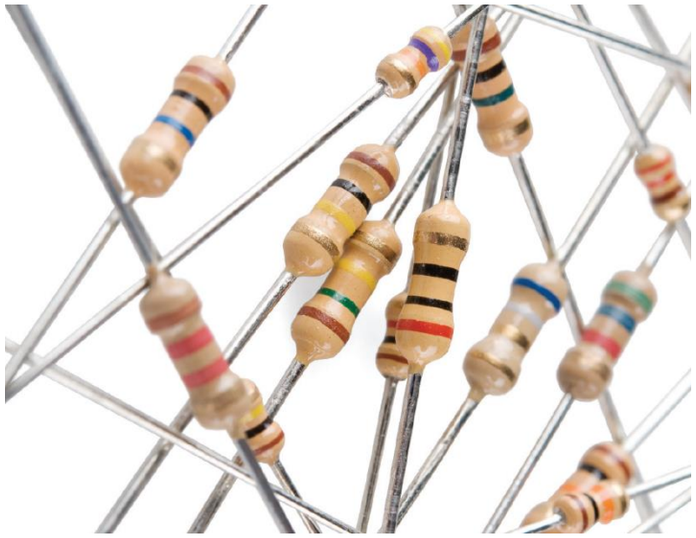
'A cermet is a composite material composed of ceramic (cer) and metallic (met) materials.

A cermet is ideally designed to have the optimal properties of both a ceramic, such as high temperature resistance and hardness, and those of a metal, such as the ability to undergo plastic deformation.'

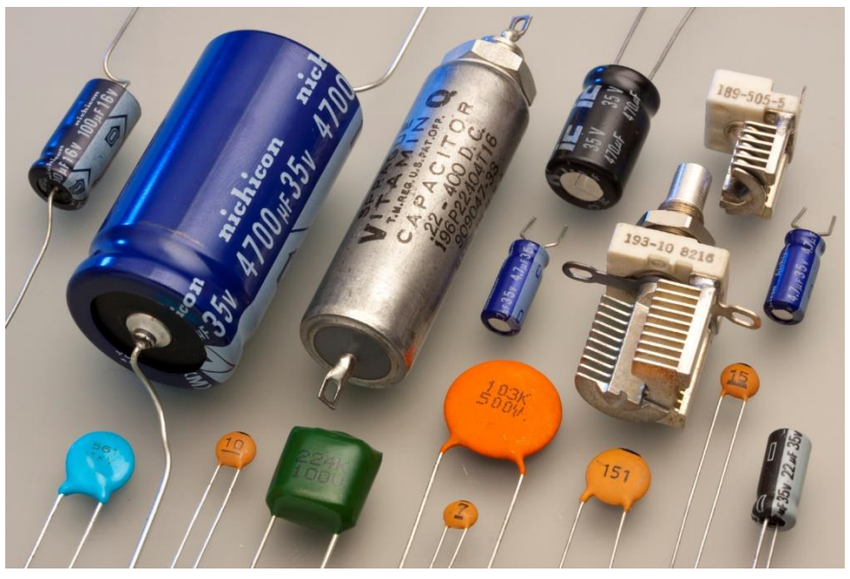
https://en.wikipedia.org/wiki/Cermet

Electronic Components

Resistor



Capacitors



Properties of this material which make it a good choice for this product:

Pros:

Cons:

Name: …… **Class**: ……

Manufacturing Techniques

In the exam you will be expected to know about many manufacturing techniques associated with metals and polymers, be able to sketch and annotate/describe the process and know its strengths, weaknesses and what sort of products are made this way.

METAL FORMING METHODS
Press-forming
Cupping
Deep drawing
Drop-forging
Wrought iron
Blanking

POLYMER REDISTRIBUTION METHODS
Injection moulding
Blow moulding
Rotational Moulding
Compression Moulding

METAL REDISTRIBUTION METHODS
Die casting
Investment casting
Spinning
Sand casting
Extrusion
Pressing

Try to draw each process and label yourself to familiarise with the processes.

Make sure to check out the processes on Youtube to get a better understanding and complete the boxes using your own research.

If you know these processes you will be in a great place for learning when you start your a level studies.

Keywords or terms which you encounter and wish to record:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

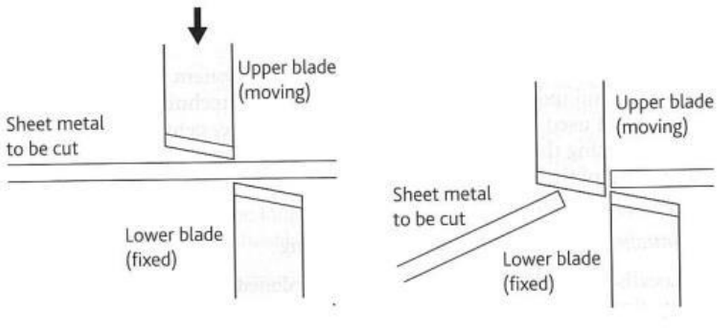
Specific name of material/s used in this manufacturing method: ……

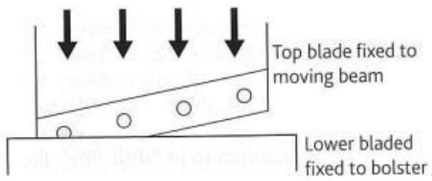
Wasting processes (relating to metals)

Blanking and piercing

Sheet metals can be cut to a required shape using punches. These cut through the material using a shearing action, much in the same way that scissors cut through paper.

A guillotine is usually used to cut sheet metal off a roll into useable sheet sizes. These sheets are then passed into either manually operated or automatic machines that will cut the material to shape and/or punch holes into it.

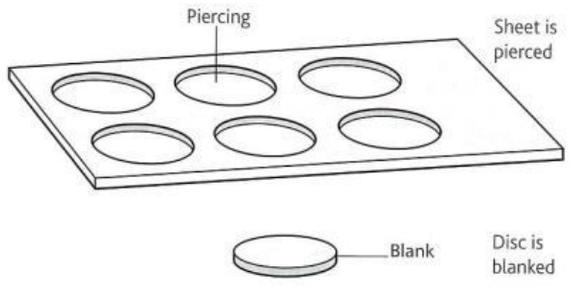




When a sheet of metal has a hole punched into it, it has been pierced. When the piece that has been punched out of the sheet is to be used, it is called a 'blank'.

Products, such as soft drinks cans, are made by punching disc-shaped blanks from the sheet material. The process is set up to maximise efficiency with as little waste metal left as possible. .

Some products require both blanking and piercing, e.g. casings for desktop computers.



Blanking and piercing

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……

Die casting

Die casting is the term used for the processes of casting metals with a low melting point into alloy steel dies (or moulds). It is known as a permanent mould process, and the molten metal either enters the mould under the action of gravity or it is forced into the mould under pressure.

The alloys cast in this way are generally zinc, aluminium and magnesium based alloys. Their low melting temperatures make them particularly useful for large-scale production. (See Table 13.)

The processes involved in die casting vary due to the amount of pressure/ force applied to the molten metal as it enters the mould. In general, the higher the force applied, the quicker the process and the finer the detail being produced.

Did you know?

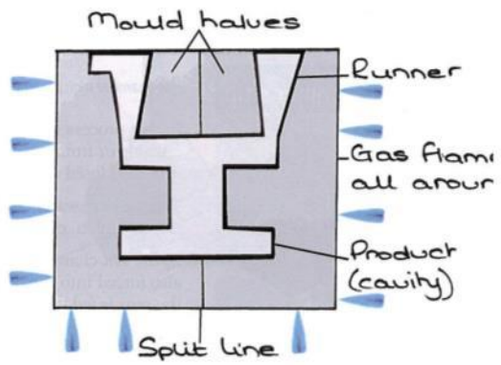
Borax is used as a flux when joining by brazing. It is known as an 'active flux'; when heated it will clean the joint as well as keep it clean during the joining process.

Gravity die casting

In this process the molten metal is poured into the dies through runners, in a similar way to that seen in sand casting. The process uses the force of gravity to ensure the molten metal reaches all parts of the metal mould.

- The dies are made from alloy steel and are split to allow for removal of the completed product.
- Gas rings around the outside of the die keep the mould heated, ensuring even cooling of the cast metal.
- **Fluxes** are also used to prevent oxidation of the metal as it is being cast.

Gravity die casting



Examples of products made with in this way:

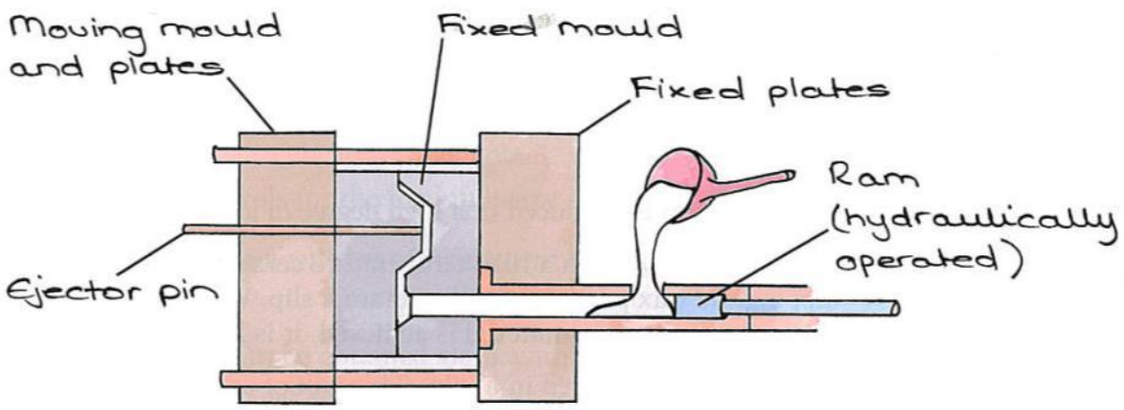
Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……



Cold chamber high pressure die casting

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

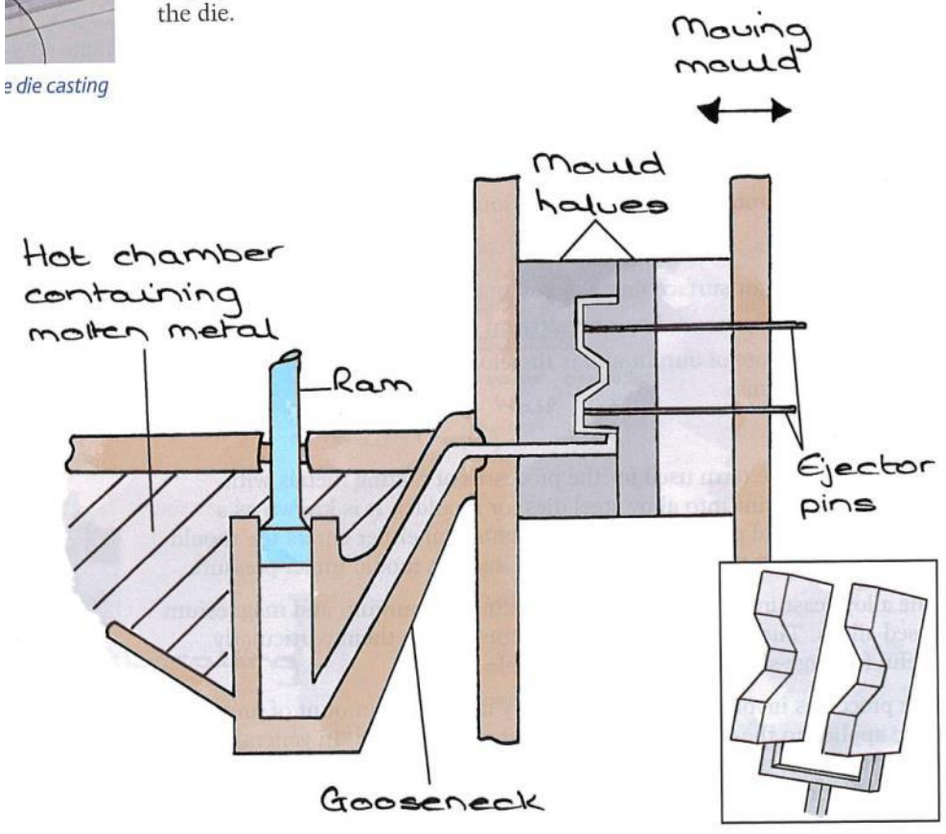
Specific name of material/s used in this manufacturing method: ……

e die casting

Pressure die casting

Die casting processes can also use high or low pressures to force the molten material into the die. The additional pressure is required to ensure that the molten metal reaches all parts of the more intricate dies.

High pressure die casting uses a hydraulic ram to force the material into the die.



Examples of products made with in this way:

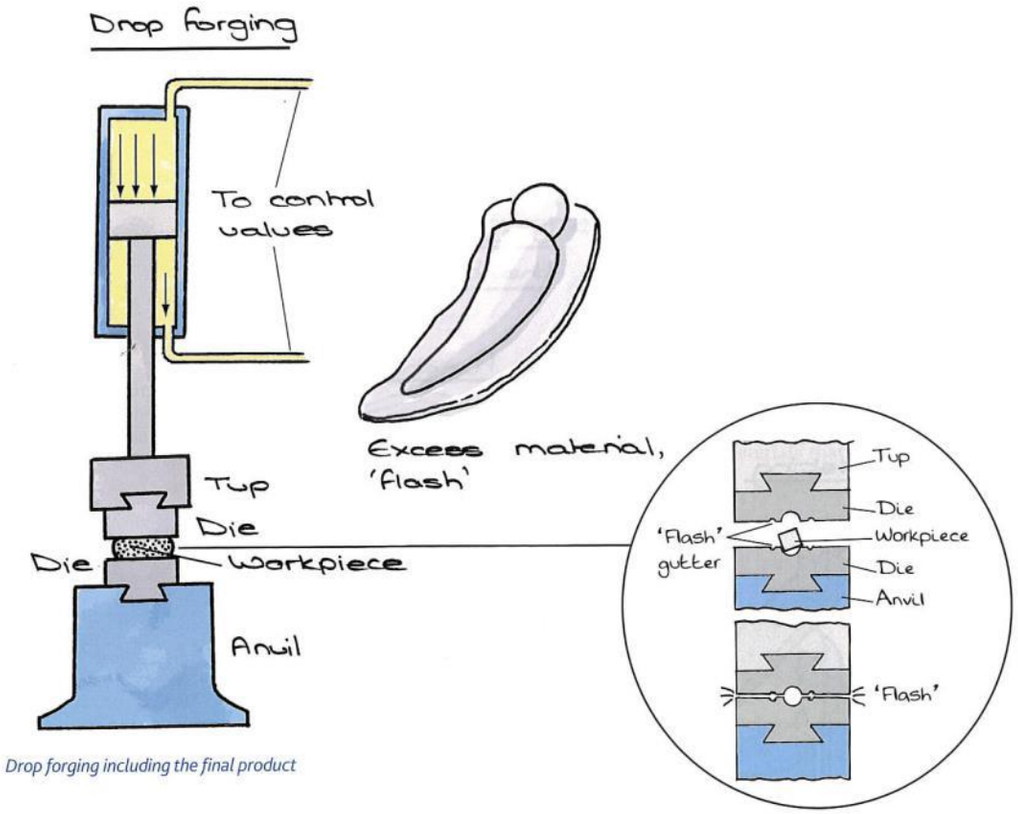
Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……



Drop forging including the final product

Examples of products made with in this way:

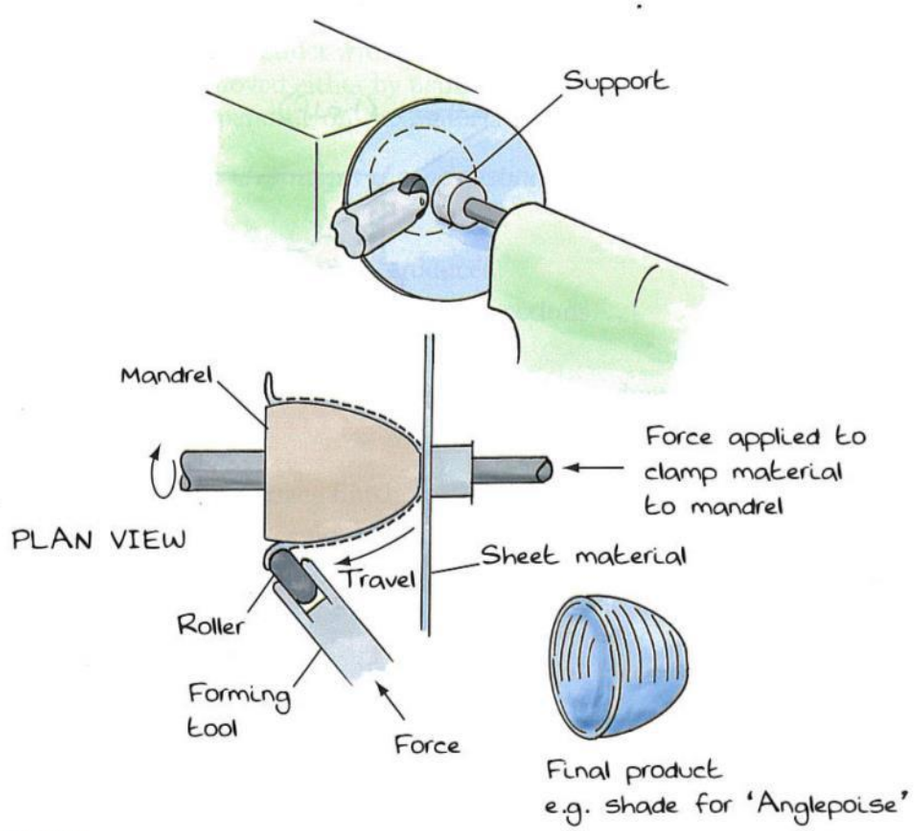
Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……



Spinning

Examples of products made with in this way:

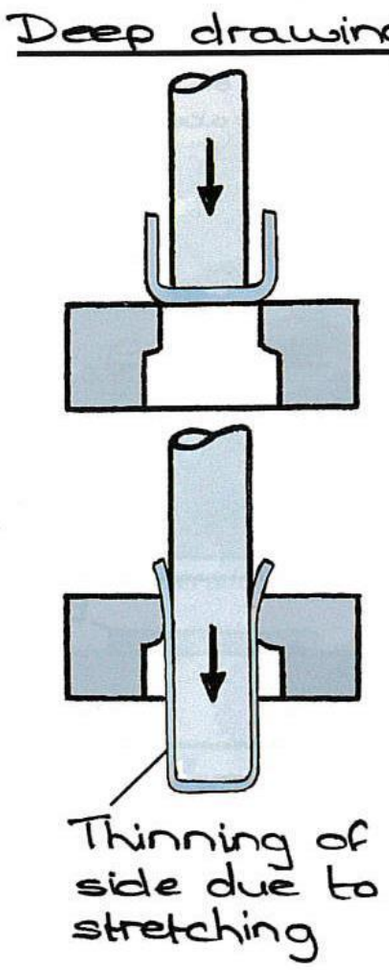
Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……



Deep drawing

Examples of products made with in this way:

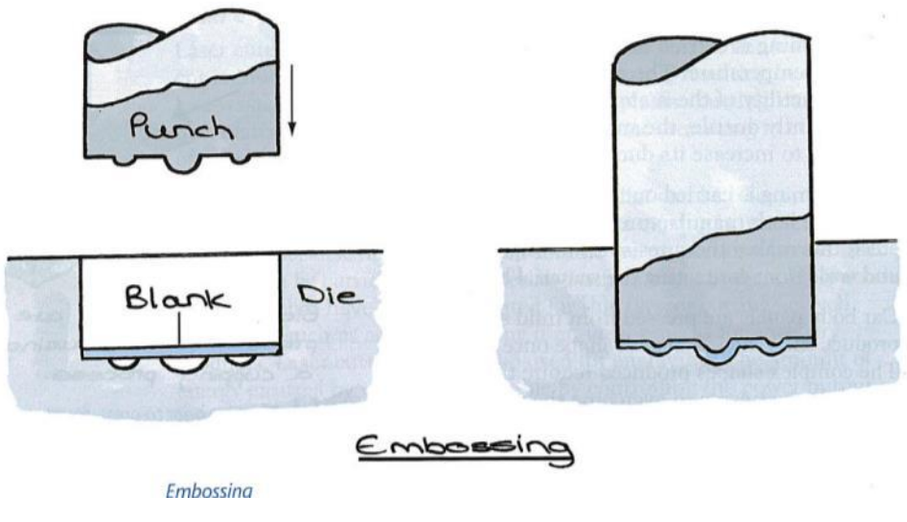
Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……



Embossing

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……

Forging

Forging processes can be carried out either by hand or machine. Most forging processes are carried out while the metal is hot; this avoids the risk of work hardening and also requires less energy to achieve the required result.

Basic hand processes are carried out with the use of hammers, swages and anvils. Larger forces can be achieved by the use of mechanical hammers. Processes include: bending; drawing down; punching and drifting; twisting and scrolling; and drop forging.

Bending

A bend is produced in the piece being worked; the bend can be either sharp or gradual. A more gradual bend can be achieved with the material cold, while a sharp bend will require the metal to be hot.

Drawing down

This process reduces the thickness of the material but, unlike the drawing process, which stretches the material by putting it under tension, the metal is hammered into a thinner section. This usually results in increasing the length of the piece being worked.

Punching and drifting

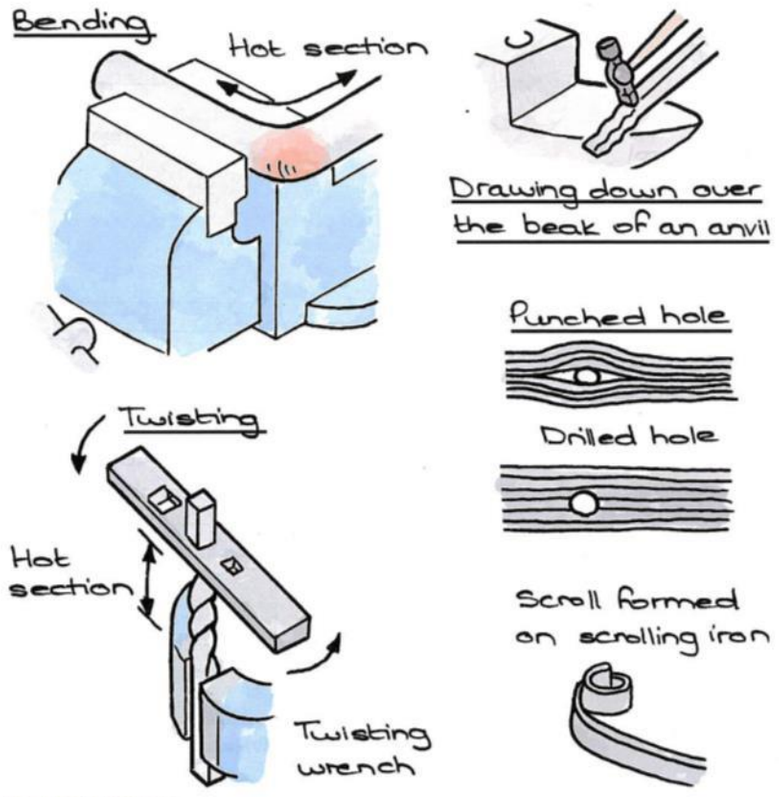
Punching is achieved by hammering a spiked tool into the piece being worked, while a drift is used in a similar manner to tidy up the hole that has been produced. Holes can be produced in any shape; it depends on the shape of the punches and drifts.

Twisting and scrolling

These two processes can be carried out with the metal cold or hot – the result will depend on the metal being forged.

All of these processes require manual labour and a high degree of skill, resulting in its suitability for relatively small numbers only.

Products made in this way include wrought iron gates, horseshoes, and stirrup irons for riding.



Hand-forging processes

Examples of products made with in this way:

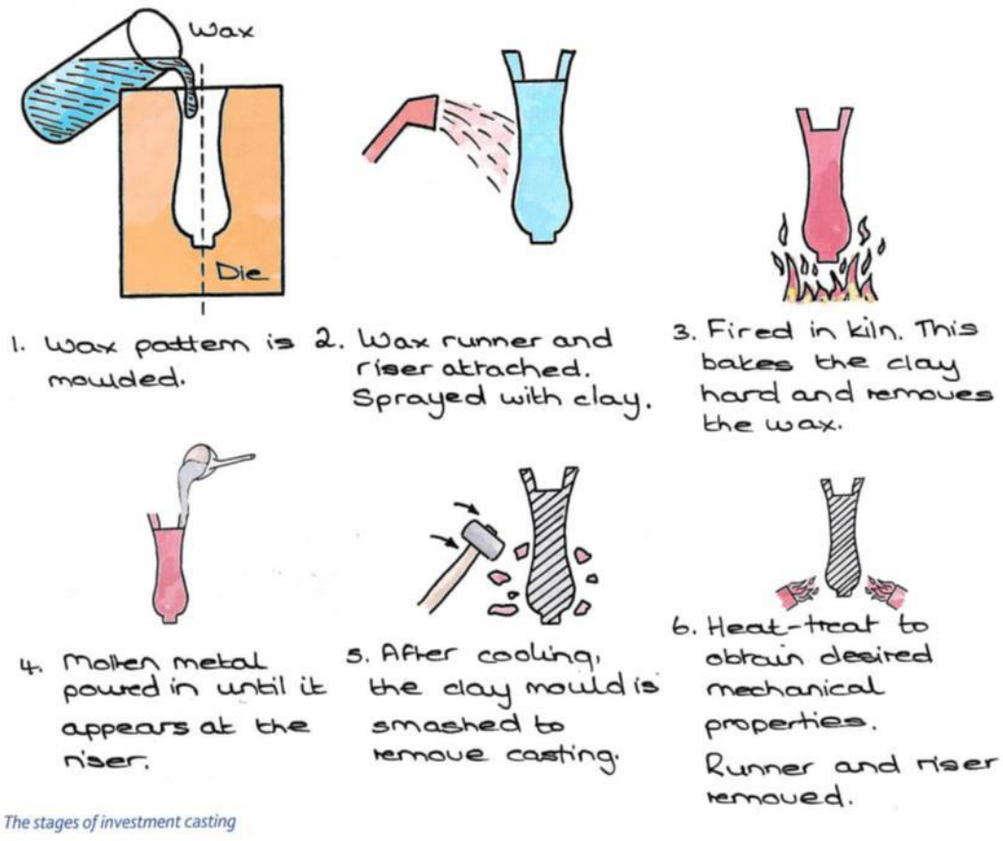
Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……



The stages of investment casting

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

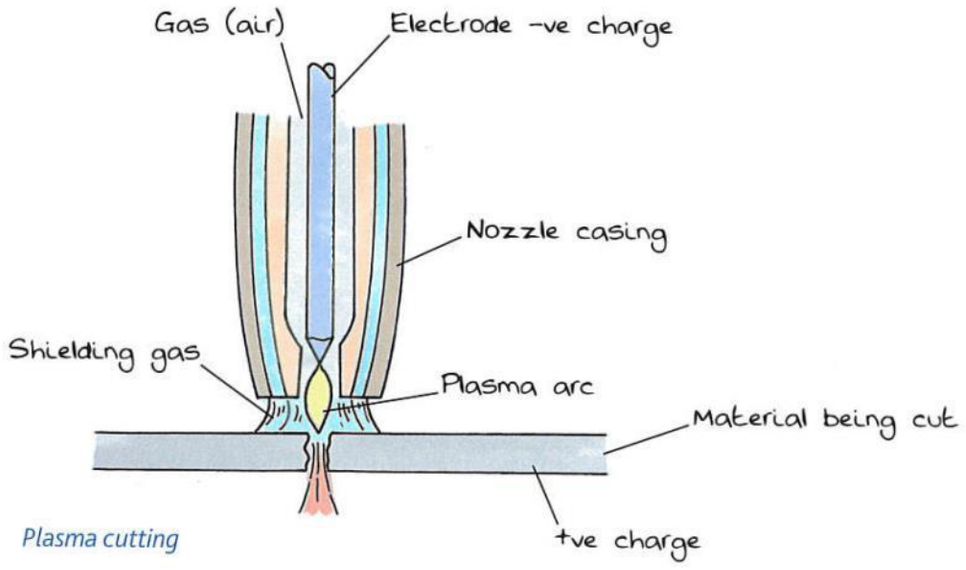
Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……

Plasma cutting

Plasma cutting uses an electric arc to generate the heat energy required, plus the energy of either compressed air or an inert gas such as argon to blast through the material. This process produces very little waste material. A fine cut is achieved with little or no **finishing** required to remove burrs.



Plasma cutting

Examples of products made with in this way:

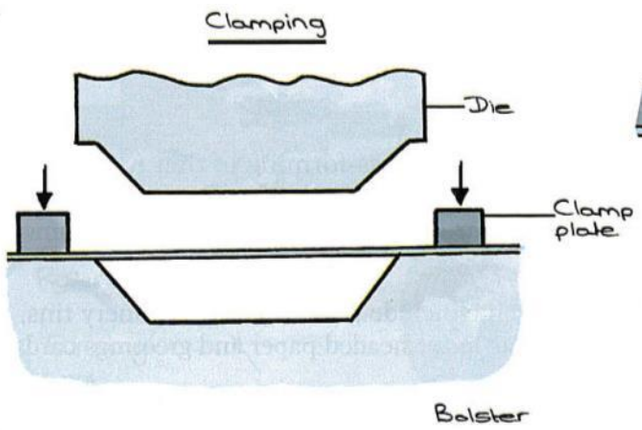
Pros of this manufacturing method:

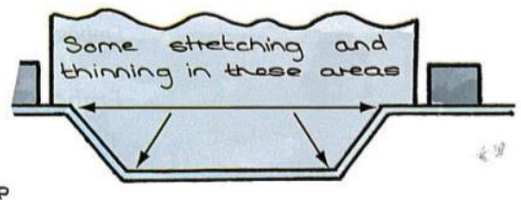
Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……





Stretching and thinning of the material occurs as it takes the shape of the die.

Press-forming

Press-forming is carried out with the material at room temperature. The process relies heavily on the ductility of the material being pressed. If insufficiently ductile, the material may have to be annealed to increase its ductility.

Press-forming is carried out using a punch and a die which are both manufactured from toughened die-steel; this makes them resistant to impacting loads, and wear from contacting the material being pressed.

Car body panels are pressed from mild steel sheet to produce the vehicle's overall shape once assembled. The complex shapes produced require the generation of very high stresses to overcome the resistance of the material being pressed.

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

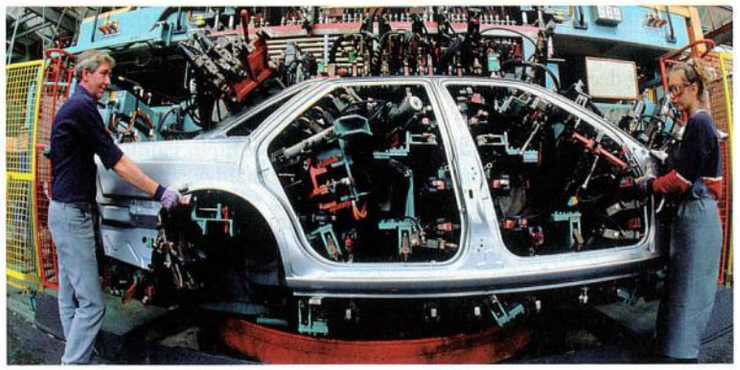
Specific name of material/s used in this manufacturing method: ……

Sheet metals being pressed

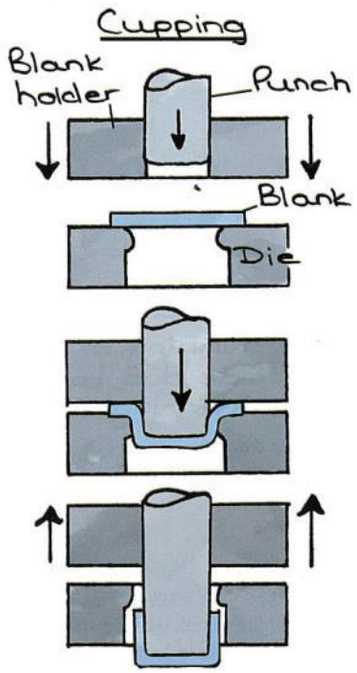
There are advantages of pressing a sheet material to a more 3-D shape, including that of greatly increased stiffness. This, in effect, has the benefit of reducing the amount of material necessary to build the vehicle to a good safety standard.

In addition to forming to shape, press tools can also incorporate shears to cut sections away. If we look again at the completed car body panel, we can see the holes have been cut to form door pillars and windows.

Other examples of press-formed sheet materials include domestic radiator panels, kitchen products such as meat trays, and cooker tops.



Press-formed car body panel



Cupping

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

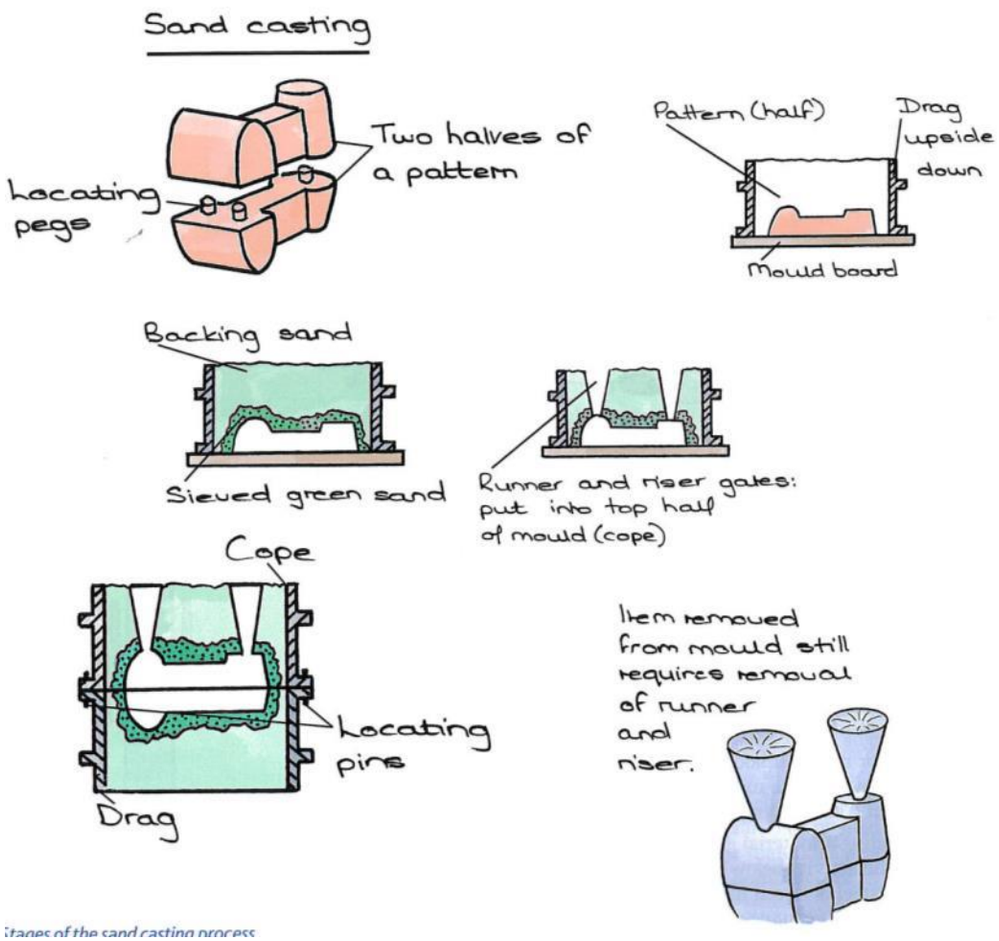
Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……

Sand casting

In this process, sand is used for the moulds. The sand is especially prepared to contain oils that act as binders to help it hold its shape while the hot metal is being cast into it.



stages of the sand casting process

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

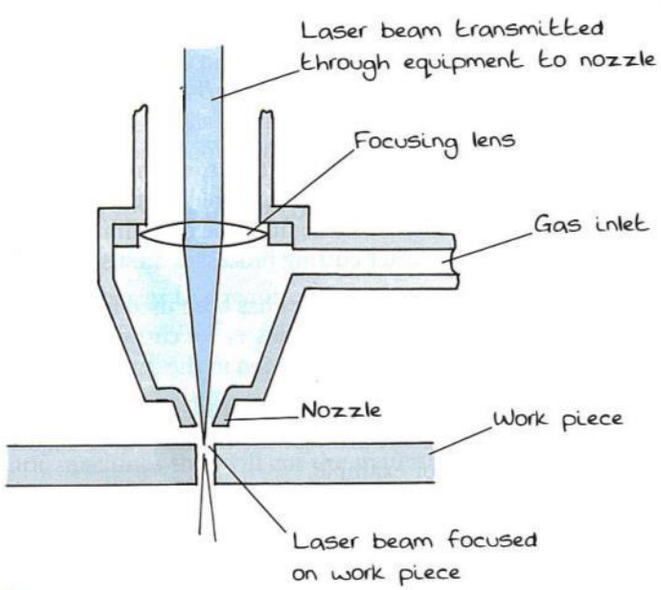
Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……

Laser cutting

Laser cutting can produce profiles of much finer detail. The width of cut is much narrower than that of plasma cutting, resulting in even less waste material. Laser cutting, as well as plasma cutting, can be automated using fully controlled CNC machines resulting in components of consistent quality.

There is a much broader range of materials that can be laser cut compared to those for plasma cutting. Plasma cutting is restricted largely to metals because of their electrical conductive properties whereas laser cutting can be carried out on materials such as paper and card, plywoods and MDF that have been formulated for this type of cutting, as well as plastics such as acrylics, making it an ideal process for jewellery products. Laser cutting can also be used for engraving. The amount of energy emitted by the laser is variable by controlling the power output, but a finer control can be achieved by altering the speed at which the laser travels over the material. Altering the speed and power settings determines whether the material is to be cut or engraved.



Laser cutting

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

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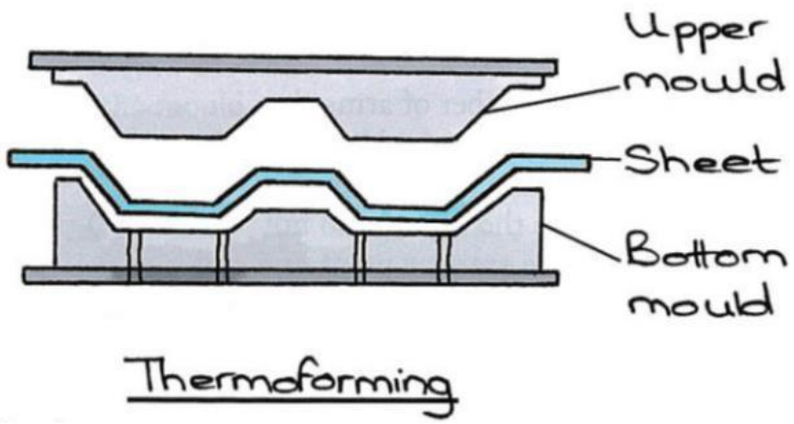


Thermoforming

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

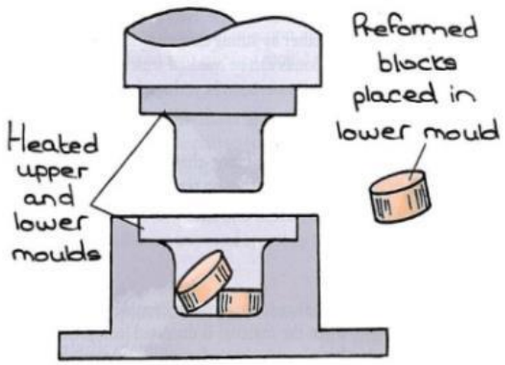
Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……

Compression moulding

Compression moulding is probably the most important moulding process for manufacturing with thermosetting plastics. A combination of heat, pressure and time is needed to ensure all of the material's form and structure changes.



Compression moulding

Compression moulding

Stages of the process:

Step 1 A preformed 'slug' (compressed powder) of material is placed between the two halves of the mould.

Step 2 The mould is heated to a temperature that will allow the **cross-links** to form within the material.

Step 3 The mould is closed onto the preform and the pressure used will force out any excess material. The moulds are held closed under pressure at the required temperature for a period of time that is sufficient to allow all of the material to be 'cured', i.e. all cross-links formed.

Step 4 When the mould is opened, the product can be ejected while it is still hot (it does not have to be cooled) and the process can begin again.

Advantages and disadvantages of compression moulding

Advantages

- Moderately complex parts can be produced over long production runs.
- Although there is some heavy machinery involved, start-up costs are relatively low; moulds are less expensive than those used in injection moulding.
- There is little waste material.

Examples of products made with in this way:

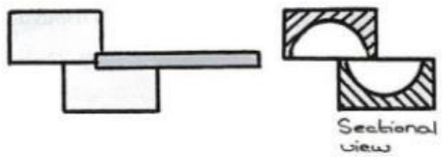
Pros of this manufacturing method:

Cons of this manufacturing method:

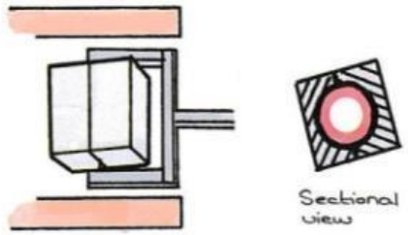
Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

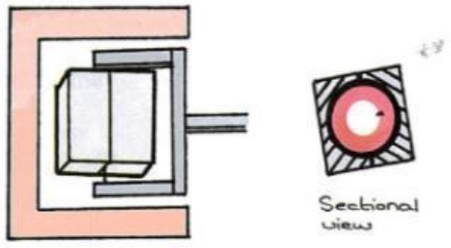
Specific name of material/s used in this manufacturing method: ……



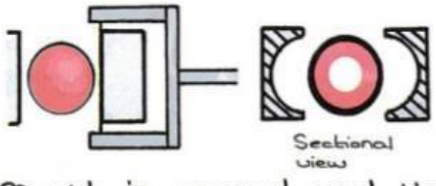
1. Open mould is filled with plastic powder.



2. Mould is heated and the plastic melts, coating the inside.



3. Mould is cooled to set the plastic.



4. Mould is opened and the product removed.

Rotational moulding

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……

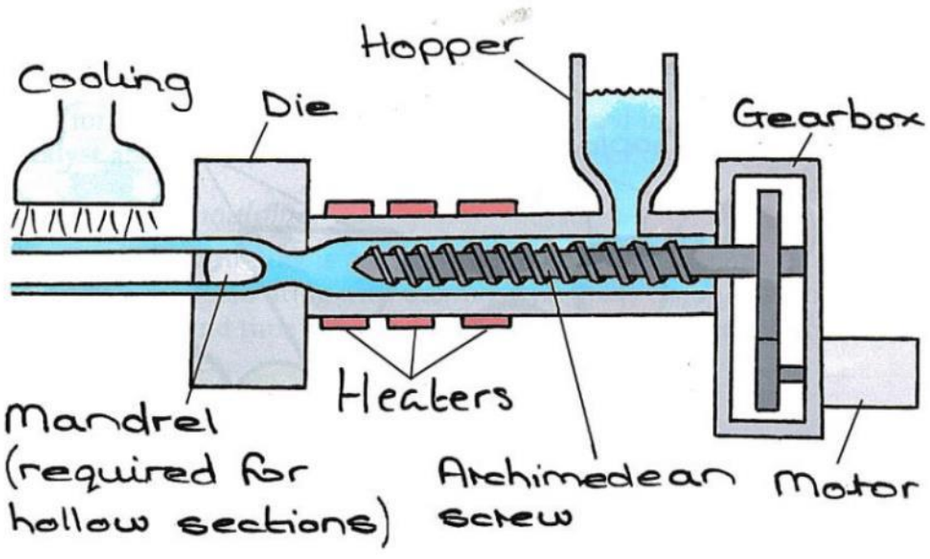
Extrusion

Extrusion is the process used where products with a continuous cross-section are required.

In essence, the process forces molten plastic through a die that has the required cross-sectional shape.

Stages of the process:

Step 1 Thermoplastic powder is placed in the hopper; this powder then falls onto the rotating Archimedean screw, which in turn pushes the material towards a heated section of the extruder.



Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

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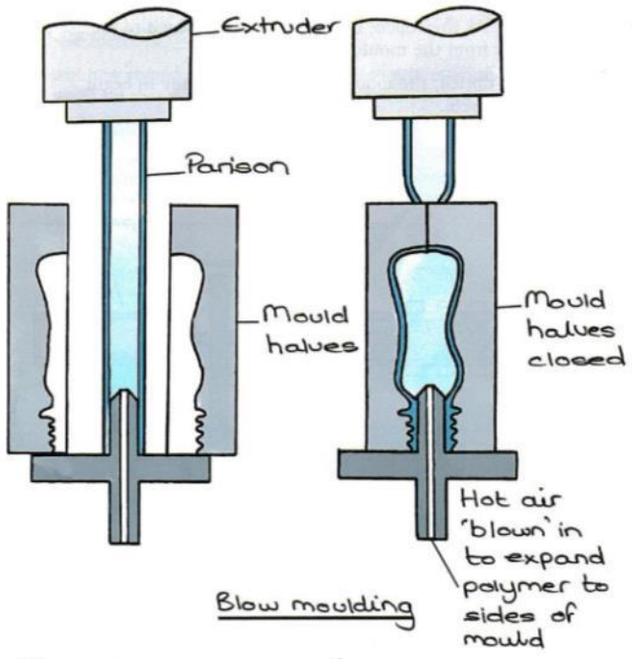


Blow moulding

Examples of products made with in this way:

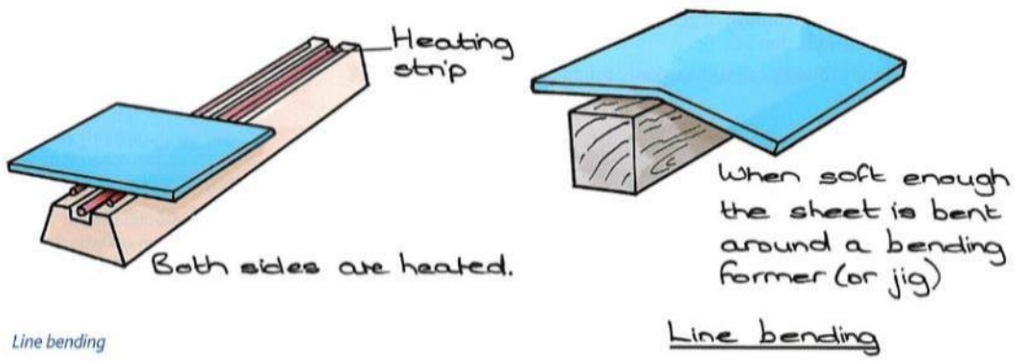
Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……



Line bending

Examples of products made with in this way:

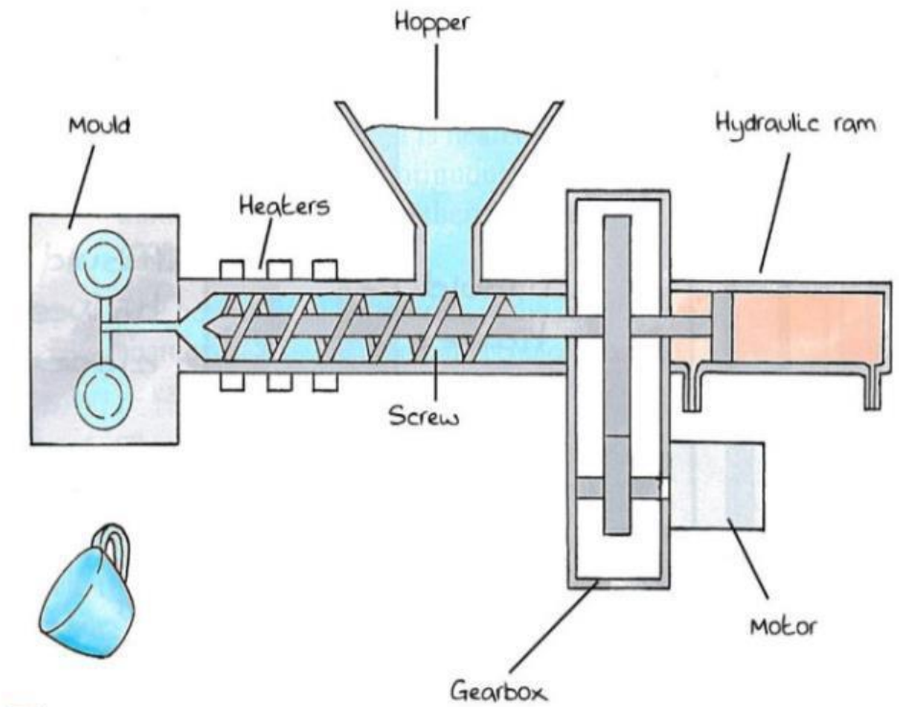
Pros of this manufacturing method:

Cons of this manufacturing method:

Draw and Label the process repeatedly until you can do it in without thinking!

Name of Process: …… **Category/family of materials associated with this manufacturing method:** ……

Specific name of material/s used in this manufacturing method: ……



Injection moulding

Examples of products made with in this way:

Pros of this manufacturing method:

Cons of this manufacturing method:

SUMMER WORK FOR PRODUCT DESIGN

Research the definitions for the keywords given. You could also add pictures/ diagrams to help you remember each one.

You WILL be tested on these words during the first week back in September.