

Task: Many gift shops sell products that have been batch or mass manufactured on production lines to ensure quality and consistency. They utilise a range of techniques including the use of jigs, templates and moulds. You have been asked as a year group to manufacture a product that could be sold using production line techniques to raise money for charity.

No.	Process	Description
1	Sand casting	Using <u>petrobond sand</u> a <u>mould</u> is created using a <u>pattern</u> . Molten <u>aluminium</u> is poured into the mould through a <u>sprue</u> and left to cool. The mould is the broken up and the casting released.
2	Cutting up casts	Using a <u>hacksaw</u> the individual casts and cut away from the <u>sprues</u> to leave the body.
3	Facing off – centre lathe	The body is secured in the jaws of the chuck on the <u>centre lathe</u> . Using the cutting tools the faces and sides of the casting are removed to make them smooth, removing the textured surface.
4	Marking, centre punch & drill body (top)	Using a <u>template</u> , mark the 5 positions for the holes are marked, then with a <u>centre punch</u> an indentation is made. The body is <u>clamped</u> in place on the <u>pillar drill</u> and a <u>twist drill</u> is used to drill the holes.
5	Marking, centre punch & drill body (base)	Using a <u>template</u> , the 3 positions for the holes are marked, then with a <u>centre punch</u> an indentation is made. The body is <u>clamped</u> in place on the <u>pillar drill</u> and a <u>twist drill</u> is used to drill the holes.
6	Surface finishing of casting	Using <u>emery cloth</u> the surfaces and edges of the body are rubbed down smooth, no rough edges.
7	Tapping base holes	Using a <u>tapping tool</u> and <u>cutting compound</u> , cut a <u>thread</u> in the 3 holes on the base of the body,
8	Marking, cutting & drilling acrylic pieces	Using a <u>template</u> , mark the 3 positions for the holes are marked. The acrylic is <u>clamped</u> in place on the <u>pillar drill</u> and a <u>twist drill</u> is used to drill the holes. Drill slowly as the acrylic is brittle.
9	Marking & cutting aluminium	Using a set of <u>dividers</u> , mark out the base circles on the aluminium and then rough cut the circles using <u>tin snips</u> , held in the <u>bench vice</u> .
10	Marking & drilling aluminium	Using a <u>template</u> , the 3 positions for the holes are marked, then with a <u>centre punch</u> an indentation is made. The body is <u>clamped</u> in place on the <u>pillar drill</u> and a <u>twist drill</u> is used to drill the holes.
11	Fitting & filing acrylic pieces	Using 3 <u>machine screws</u> attach an acrylic piece to the base of the body. Then file to fit with a <u>flat file</u> .
12	Fitting & filing aluminium pieces	Attach an aluminium piece on the base using the existing machine screws. Then file to fit.
13	Polishing cast aluminium body	Using Brasso <u>metal polish</u> and a soft cloth or the <u>polishing wheel</u> , polish the main body of the desk tidy.
14	Quality control checkers	QC is to check the fit of every part, that there are no <u>flaws</u> , sharp edges or missing components. Anything that is not up to standard must be returned to the correct station for the issue to be sorted.
15	Assembly	The charity logos are cut out using <u>scissors</u> and then placed in between the acrylic and aluminium base pieces. These must then be <u>assembled</u> using a <u>screwdriver</u> , ensuring the logo is correctly <u>aligned</u> .

WHAT are the Health & Safety rules?

1. Always store your bags & coats safely in the cubby holes.
2. Always wear an apron for practical lessons.
3. Stack stools away for practical lessons.
4. Do not run in a workshop, kitchen or classroom.
5. Wash your hands after a practical lesson in the workshop.
6. Carry tools and equipment carefully – sharp points downwards.
7. Always replace tools and equipment carefully so that they will not fall or injure someone else.
8. Do not touch or use a piece of equipment that you have not been instructed on or do not know how to use.
9. Never use a tool for a purpose it was not designed for.
10. Always wear goggles when using machines in the workshop.
11. Never have more than one person using a machine or piece of equipment.
12. Always clear up after a practical lesson and leave your work area tidy for the next person.
13. Make sure you know where the Emergency stop buttons are in the workshops.
14. Always follow the instructions from your teacher and listen carefully to them.
15. Always follow the printed safe operating procedures for machines in the workshop.

WHY do we need to consider health & safety?

- To ensure that we are all safe
- To make sure that you know what to do
- To stop any accidents happening (or reduce the risk)
- To make sure that the equipment does not get broken or damaged
- To increase your awareness in the classroom, kitchen or workshop
- To increase your confidence
- To increase your skills and knowledge
- To ensure consistency in what we do

WHEN do we consider Health & Safety?

- Every lesson, every minute!
- You need to be aware of all the possible dangers
- Remind each other of the rules, including staff
- Look out for each other at all times!

Year 9 Workshop Unit 1: Desk Tidy Sand Casting Knowledge Organiser

Date: _____

Casting is a shaping process. The shape of a product is made by melting the material and pouring it into a mould. In industry sand casting is a common process to shape iron or aluminium. This is carried out at a high temperature with a mould made from sand. It is a relatively low-cost and quick method of shaping metal.

Stage 1: The mould is prepared in 2 halves – the cope (top) and the drag (bottom). The pattern is placed at the bottom of the drag. It is dusted with a release agent. Then sieve the sand over the pattern and fill the drag, ramming it firmly. Once full any excess is scraped off.

Stage 2: The drag is turned over and the cope placed on top. Place the other half of the pattern on top – if a split mould. Position the sprue pins at either end of the pattern.

Stage 3: Sieve more sand into the cope being careful not to move the pins. The sand is rammed into the cope and filled to the top. Create the pouring basin at the top of the sprue pins to allow the metal to flow into the mould.

What type of sand is used in sand casting and why?

.....

.....

.....

.....

.....

.....

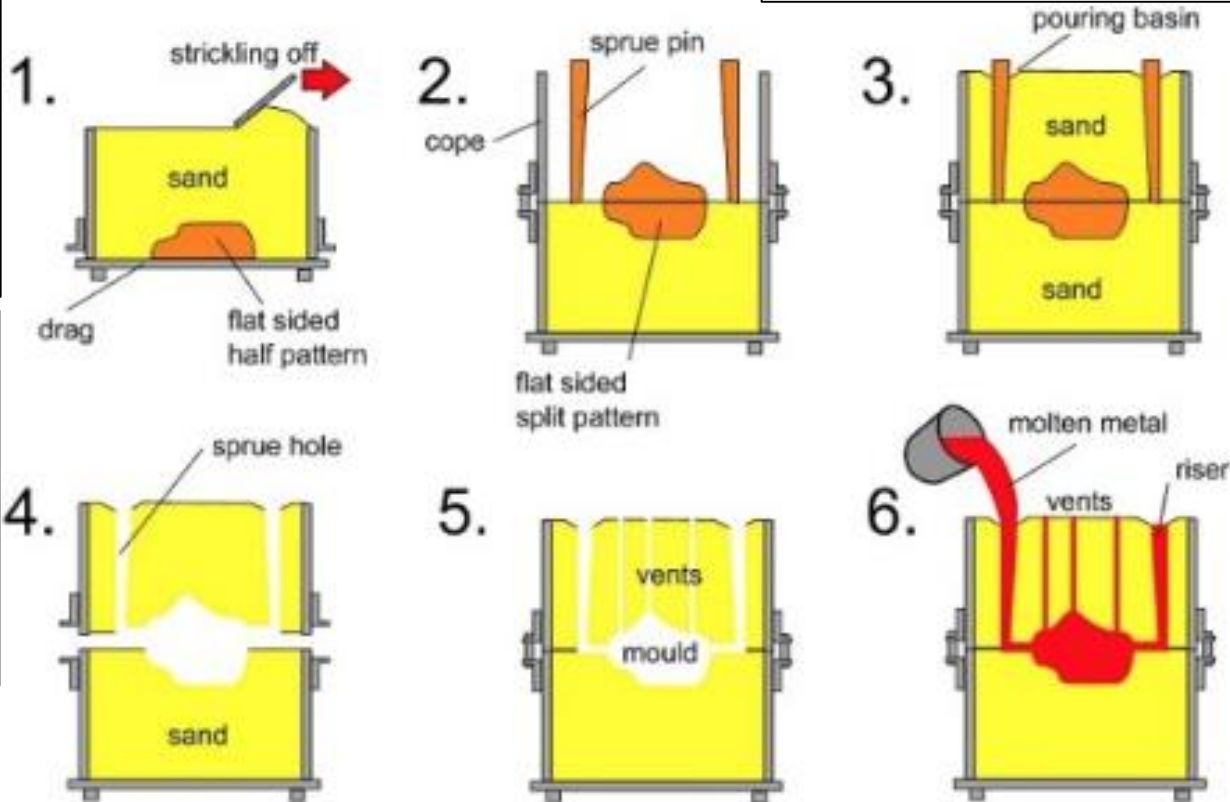
.....

.....

Stage 4: Remove the sprue pins carefully. Then separate the cope and the drag. Remove the pattern pieces carefully. Insert vent holes if necessary and remove any loose sand from the mould cavity. Remember to wear goggles.

Stage 5: Place the cope back on top of the drag carefully lining up the connector pins. The whole casting flask then needs to be carefully carried to the casting area, ready for pouring.

Stage 6: The extractor system must be turned on. The aluminium will be pre-melted and all of the correct PPE must be worn. The molten metal should be poured in a single smooth operation to prevent voids (air pockets) forming. The aluminium is then left to cool with the extraction hood placed over the top.



Key word definitions:

Cope

Drag

Sprue

Mould

Pattern

Use the key word definitions to look up the answers and fill in the gaps
This should have been completed in your booklets already.

Year 9 Workshop Unit 1: Desk Tidy

The average person in the UK uses about 19,000kg of metal during their lifetime.

Metals are made from metal ores, which are dug from quarries or mines and can cause significant damage to the environment and ecosystems. The metal is extracted from the ore using heat, which produces carbon dioxide emissions.

Once a metal is no longer needed it can usually be recycled. Recycling saves up to 95% of the energy needed to obtain metal from ore and produces less carbon emissions. For example, recycling one aluminium drinks can saves enough energy to charge a mobile phone about 25 times!!!

Key Words

Ore – a type of rock containing metal

Alloy – a mixture of 2 or more metals

Ferrous Metal – a metal that mainly contains iron

Non-ferrous Metal – a metal that does not contain iron

Casting – a process where items are made from molten metal

Most metals are not used as pure elements but mixed with other metals to improve the properties.

Carbon steels are the most widely used metals in the world. They typically cost less than non-ferrous metals but are prone to corrosion which causes them to rust. Stainless steel is a ferrous alloy, other elements are added to reduce corrosion but this increases the cost.

Metals knowledge organiser

Date:

Type	Alloying elements	Typical Uses
Cast Iron	3-3.5% carbon	Anvils, engineering vices
Low-carbon steel	> 0.3% carbon	Nails, screws, car bodies, steel sheet
High-carbon steel	0.8 – 1.4% carbon	Tools such as saw blades, hammers & chisels
Stainless steel	At least 11.5% chromium	Cutlery, medical equipment, sinks, taps

Knowledge Check questions (Page 65)

- 1.
- 2.
- 3.
- 4.
- 5.









This should have been completed in your booklets already. If you missed this lesson then you can either copy from a friend or come and see Miss Pring.

Year 9 Workshop Unit 1: Desk Tidy Tools knowledge organiser

How to handle & store tools

- Tools & equipment should be **correctly placed** back in the tool cupboard
- Machines should **not** be left turned on or untidy
- EVERY tool should be **carried correctly** so that they are not dropped
- EVERY tool that has a sharp edge, corner or point should be **carried face down**
- Do **not** pass tools point/blade first

- Tools should **not** be left near the edge of a bench or overhanging (especially if sharp)
- Tools should only be **used for the job** they are designed for
- Tell a teacher or technician if a tool is **damaged or broken**
- Always **clean** down a tool or machine if needed after use e.g. sawdust, paint
- If a tool or piece of equipment is too heavy then do not carry or lift






Tool	Name	How to store/leave	Health & Safety (handling)
	Centre punch	Slot into the block in the tool cupboard, sharp point down.	Carry pointing down, always pass to someone with the point away. Do not use for anything else other than centre punching.
	Pin hammer	Place in the named slot in the right hand tool cupboard. Place in the middle of the work bench.	Carry with the handle and the metal head to the ground, always pass to someone handle first.
	Hacksaw	Hang on the rails in tool cupboard. Never leave on the edge of a bench.	Carry with blade pointing down, always pass to someone handle first. Only use with metal or plastic. Cuts on the push.
	Twist drill bit	Slot into the block positioned on the wall next to the pillar drill. Make sure it is in the correct hole.	Carry with point down, always pass to someone carefully.
	Thread tapping tool	Always remove the tap from the handle. Place carefully in the box and do not leave in the work	Do not overtighten of force the tool when tapping otherwise it will get stuck or even break. Handle with care.
	Tin snips	Place carefully back in the tray, ensuring that they are closed. Never leave near the edge of the bench.	Carry point downwards, always pass to someone with handle first. Always clamp into a bench vice when using.
	Hand file	Place in the named slot in the left hand tool cupboard. Place in the middle of the work bench.	Never use hit files together, they can spark. Only use with metal or plastic. Always pass to someone with handle first. Only file forwards otherwise the teeth can be damaged.
	Screwdriver	Place in the named slot in the right hand tool cupboard. Place in the middle of the work bench, ensuring that it doesn't roll off.	Carry point downwards, always pass to someone with handle first. Do not use for anything else other than adding or removing screws.

Year 9 Workshop Unit 1: Desk Tidy Machines & equipment knowledge organiser

How to handle machines & equipment

- Machines should **not** be left turned on or untidy
- EVERY machine should be checked before use
- EVERY machine should be turned off after use.

- Tell a teacher or technician if a tool is **damaged or broken**
- Always **clean** down a tool or machine if needed after use e.g. sawdust, paint
- If a piece of equipment is too heavy then do not carry or lift

Tool	Name	How to store/leave/use	Health & Safety (handling)
	Casting furnace	Trained staff and students can use with the correct PPE. Caution must be taken when using and after the pouring has taken place all excess aluminium must be poured out and not left in the crucible.	PPE must be worn as molten metal can cause severe burns. No student is to operate the furnace. Cold metal must not be placed into the crucible as there is a risk of the pot cracking. The extraction system must be turned on whilst any casting is taking place and once the mould has been poured to vent fumes.
	Casting flask	The flask must be stored safely under the preparation table after use. The flask must be brushed clean and the 2 halves left joined together.	PPE must be worn at all times when handling equipment. The lifting must be done correctly, bending at the knees not the back to avoid musculoskeletal injuries.
	Centre (metal) lathe	The machine must be completely brushed down after use and all metal swarf placed in a bin. The swarf must not be handled. The machine must be switched off on the machine when not in use and turned off at the wall for safety.	PPE must be worn at all times and aprons tied at the back to avoid them getting caught in the machine. The machine must not be left on if unattended. Only one person at a time should be controlling the machine. Follow all instructions given and if the machine does not sound right then press the stop button. The work piece must be tightly secured in the chuck & checked.
	Pillar drill (& bench pillar drill)	The machine must be completely brushed down after use and all metal swarf placed in a bin. Any clamps must be stored correctly. The machine must be switched off on the machine when not in use and turned off at the wall for safety.	PPE must be worn at all times and aprons tied at the back to avoid them getting caught in the machine. The machine must not be left on if unattended. Only one person at a time should be controlling the machine. Follow all instructions given and if the machine does not sound right then press the stop button. The work piece must be tightly secured with a g-cramp.
	Polishing wheel	The machine must be switched off on the machine when not in use and turned off at the wall for safety. Any clamps must be stored correctly after use.	PPE must be worn at all times and aprons tied at the back to avoid them getting caught in the machine. The machine must not be left on if unattended. Only one person at a time should be controlling the machine. Hold the workpiece at the centre point on the wheel or below, <u>never</u> above.

Year 9 Workshop Unit 1: Desk Tidy

Key words and definitions

Word/Phrase	Definition
petrobond sand	It is sand with a special oil binder. No steam is generated when the metal is poured. This means that there is a reduced need for venting.
mould	A hollow container used to give shape to molten or hot liquid material when it cools and hardens.
pattern	A replica (copy) of the object to be cast.
aluminium	Is a light silvery-grey non-ferrous metal. It is lightweight, it has a low density, is non-toxic, has is a very good conductor.
sprue	A vertical passage where liquid material is introduced to the mould.
cope	The top part of a 2-part casting flask for sand casting.
drag	The bottom part of a 2-part casting flask for sand casting.
hacksaw	A hand saw used to cut metal or plastic.
lathe	A machine to turn meatal into cylindrical shapes.
centre punch	A tool to make a small indentation in metal to mark the centre of a circle before drilling
clamp	A tool to hold pieces of work whilst drilling or cutting
pillar drill	A machine used to drill various size holes in wood, metal or plastic
twist drill	A piece of equipment clamped in a pillar drill to drill holes
emery cloth	A rough coated fabric used to smooth metal surfaces
align	Means to match up
screwdriver	A tool used to insert or remove screws on a product
quality control	A method used to check the quality of every part of a product
thread	a helical ridge on the outside of a screw, bolt, etc. or on the inside of a cylindrical hole, to allow two parts to be screwed together.
template	a shaped piece of rigid material used as a pattern for processes such as cutting out, shaping, or drilling.

Word/Phrase	Definition
sand casting	Process to cast aluminium using a mould made from sand
production line	An arrangement in a factory in which a product being manufactured is passed through a sequence of operations
dividers	Instrument for measuring, transferring, or marking off distances, consisting of two straight adjustable legs
tin snips	A pair of clippers for cutting sheet metal
bench vice	Two parallel jaws to hold the workpiece
machine screw	A fastening device similar to a bolt but having a socket in its head which allows it to be turned with a screwdriver.
file	A type of hand tool used to smooth, deburr and shape a range of materials
metal polish	A substance that is rubbed on metal to give it a smooth and shiny surface
polishing wheel	A piece of equipment used to polish metal
flaw	A mark, blemish, or other imperfection which mars a substance or object
assembly	Putting all the parts together to make a product
ore	A type of rock containing metal
alloy	A mixture of 2 or more metals
ferrous	A metal that mainly contains iron
Non-ferrous	A metal that does not contain iron