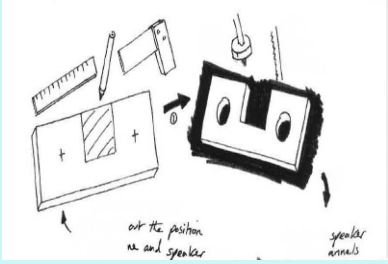
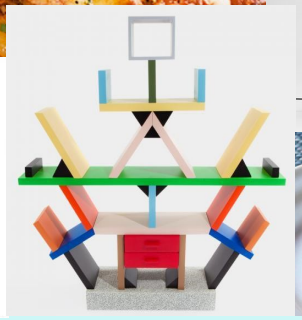
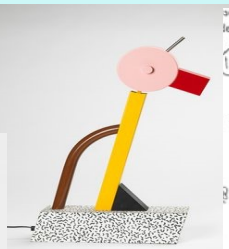
Year 9
Design & Technology Pathway

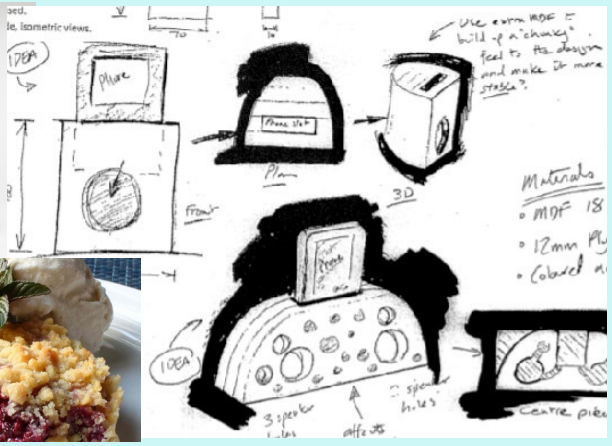
Knowledge Booklet

This is your copy to KEEP for the entire school year

Name:

Class:



What will you have learnt by the end of Year 9?

Design and Technology Pathway:

Year 9 Resistant Material

	Year 7	Year 8	Year 9
Core Projects	• Dave the desk tidy • Door mouse	• Electronics • The Trox	• Acoustic dock • Metal bottle opener
Additional Projects	• Avian housing	• Spatula • Money box • Metal twist	• Mirror organiser • Acrylic sliding top box

In Resistant Materials, we teach these modules, because…

Students are able to build on the activities undertaken in the workshop in Y8 and Y7 by using a range of tools and processes to realise a directed/ personalised outcome. Students will be able to learn about meeting the needs of a client, designing and planning using data, iterative modelling and realisation skills

Year 9 Catering: "World food, nutrition, costings time plans and briefs"

	Year 7	Year 8	Year 9
Core Projects	• Scones • Small cakes • Fruit salad	• Cheese straws • Bread and butter pudding • Rock cakes	• American-cookies • England– fruit crumble • Italy-Pasta bolognaise Bake
Additional Projects	• Pizza	• Fruit kebabs	• Spain-Risotto

In year 9, we teach these modules because…

Pupils need to have the knowledge and skills to design and make food products effectively and as independently as possible. When planning menus they need to understand and use the physical, chemical and nutritional properties of foods to meet a specified need. They need to understand about today's diverse population and demographics that are needed to implement their design, hygienically and effectively. Students will research an individual theme and produce a final outcome for a potential client.

What will you learn in the Design and Technology Pathway?

You will learn about tools/ processes in the workshop/catering room, the dynamics of sound, designing for a client, drawing conventions, healthy eating, health and safety. The work of others- designers and movements, famous chefs

Why?

To give you an opportunity to gain an understanding of 'real life' practical skills. You will be learning through a broad range of practical activities and theoretical elements to enable you to become confident in your D&T lessons. Health and Safety is an important part of the D&T environment, so you must understand safety rules and expectations. Throughout your time in D&T, you will be encouraged to improve your design skills through practice and demonstration, be creative and have high expectations of yourself!

Assessment

Within the Design and Technology subject are predominantly practical, assessment and verbal feedback is an essential aspect of most lessons- this may be teacher led, peer or self-assessment.

At the end of each module, each student will be given grades based upon the work they have completed in addition to an Attitude to Learning and Homework grade.

At the end of the year there will be an 'End of Year' assessment which will be a written test with a set of questions to answer about Design and Technology.

Wider Understanding

Each subject has a Scheme of Work geared towards teaching essential skills, knowledge and understanding with progression towards the KS4 GCSE courses in mind. Please find some resources listed below for wider reading in each subject area:

Catering

'Hospitality and Catering' - Anita Tull and Alison Palmer 'Exploring Food and Nutrition KS3' - Yvonne Mackey

'Essential Equipment for the Kitchen' - Peter Fiell

www.eatwell.gov.uk www.thinkfast.co.uk www.health4schools.net

www.bbc.co.uk/schools/gcsebitesize/hospitality

Resistant Materials

'How Things Work' - Conrad Mason 'The Design of Everyday Things' - Don Norman

'Starting Product design Exerciser: Questions and Answers' - Artiom Dashinsky

www.carlclerkin.co.uk www.dornob.com www.alessi.com www.designmuseum.org

www.technologystudent.com/ www.design-technology.info/home.htm

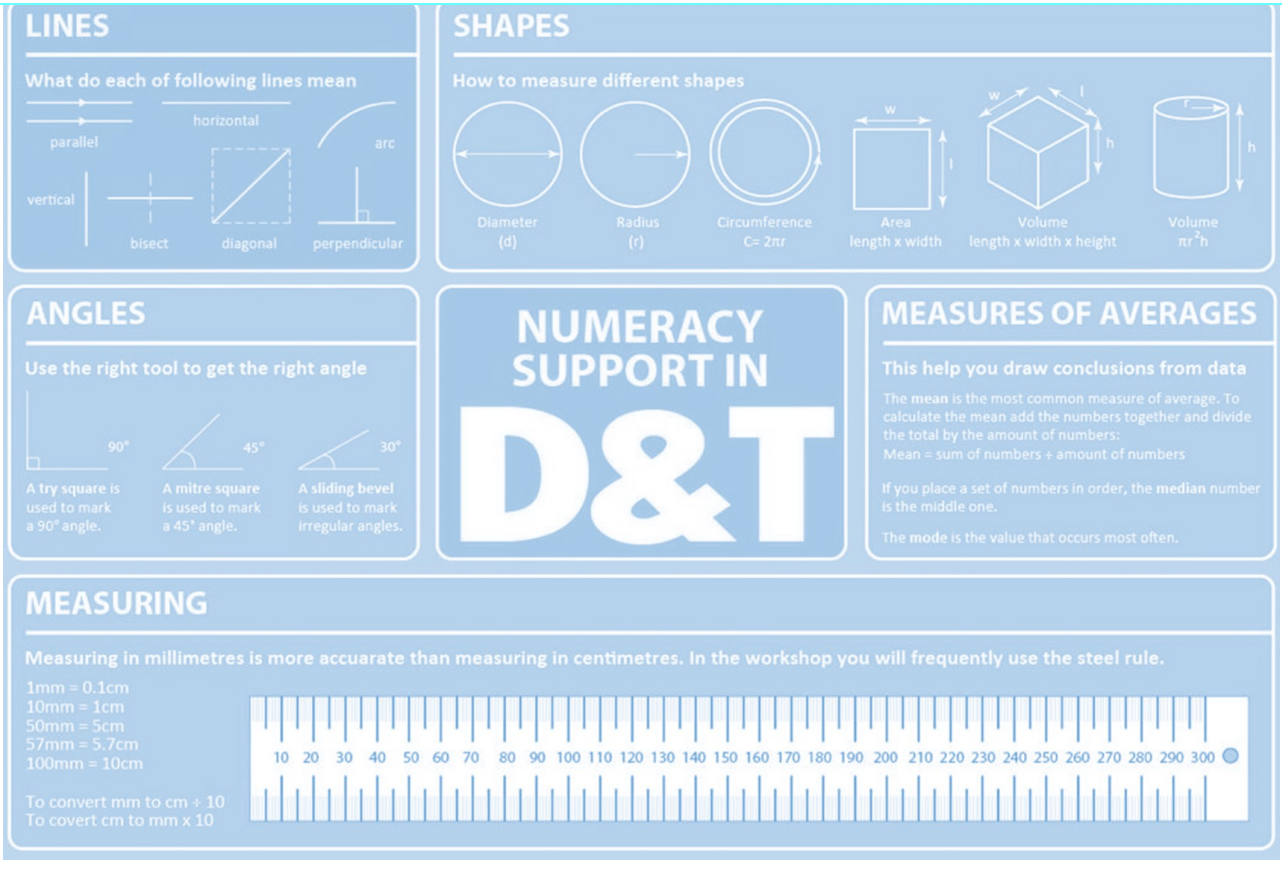
During Year 9 Design and Technology pathway you will….

Progress by: Understanding the concepts of sound and sustainability (scientific principles and materials- manufactured boards) – Design for a Client - Present a range of appropriate design ideas – Be able to produce a brief and specification -Be able to explain Function Vs Aesthetics and be able to link existing designers/ movements to their work – Use advanced measuring/marking – Show quality design presentation through a range of styles - Produce iterative card models – Show developmental decision making – Understand and use scales of production- Manufacture with a high level of precision – Use a range of surface finishes – Test, Evaluate and develop their work- Be aware of Emerging materials (including Smart) & related tech processes (eg laser and 3D printing)

Develop Literacy skills:	Develop Numeracy skills:	Develop Scientific skills:
Literacy: There are a range of extended writing opportunities for each of the projects - both within and outside of the classroom **Oracy:** Students will answer questions in full sentences during discussion work and encouraged to read out loud where appropriate **Keywords:** Designers, Sustainability, Social, Aesthetics, Ergonomics, Anthropometrics, Thermosetting, Thermoforming, Fibres, Fabrics, Upcycle, Life cycle Assessment, Functionality, Iterative Design, Reuse, Recycle, Texture, Ecological, Ethics, Fabricate, Smart materials	• Calculations of sizes • Use of metric systems • Scaling drawings • Determining the amount of materials required • Graphic presentation of ideas to others • Analysis of client survey responses • Measurement and marking out • Extracting information from technical specifications	• Protecting materials from corrosion/ rot • Selection of appropriate materials • Use of scientific principles when developing a brief or specification • Measurement of materials and selection of components • Classification of materials and their properties (to include Smart materials) • Knowledge of material properties to be applied when designing and making

Final Endpoints– by the end of the project, you should be able to:

Work to a given context, scenario, personal brief or specification to independently use a wide range of materials and processes to research, design, model, develop (through iterative designing) and realise a product to meet the needs of an identified user/ groups that shows a clear link to an existing designer or movement. Understand the development, use and potential for Smart materials and polymer based materials/ processing and products.



Personal Machine Training Record

As part of your Design and Technology course, you will be expected to use a range of equipment to help make your work to the highest standard. You will be taught how to use the equipment either individually, or as part of a group and as this happens you will be asked to tick and date the chart, below, to show that you are trained and confident. **Under no circumstances should you use equipment that you have not been trained or approved to use!**

Make sure that you have made yourself aware of the safety signage and information located within your practical area.

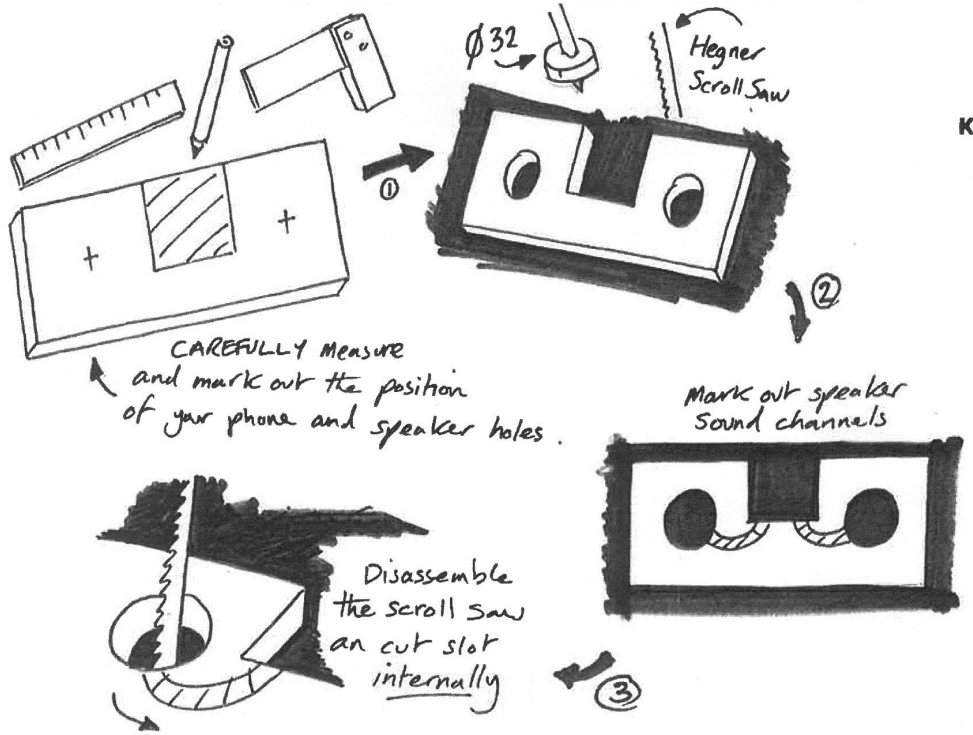
Equipment Name	Date	Trained (tick)
Tenon saw		
Chisel		
Scroll Saw		
Belt Sander		
Pillar Drill		
Flame Torch		
Ceramic Chip Hearth		
Strip Heater		
Bobbin Sander		
Kitchen knives		
Ovens		
Hobs		
Kitchen utensils		

If you require further instruction on the machinery during your lessons, ask!

Design and Technology Pathway

Year 9 D&T: Acoustic Dock

Objective: To create a useful inert acoustic dock using a HUGE range of skills and techniques!



Health and Safety- the basics!

- Always cut away from your body
- Never leave a machine switched on
- Clamp work down firmly
- Wear goggles when using machinery
- Tie long hair back and wear an apron
- Be aware of those around you
- Behave sensibly at all times

Key Skills

- Research and investigation
- Designing and planning
- Prototyping and testing
- Making
- Analysis and evaluating

Key Vocabulary	
Identify	To **identify needs**, you must both listen and ask the right questions. After **identifying needs**, always check for additional or related **needs**. Use your knowledge and experience to **identify** and present the right solutions to meet your User or Client **needs**
Investigate	The action of investigating something or someone; formal or systematic examination or research
Acoustic	The branch of physics concerned with the properties of sound.
Design	A plan or drawing produced to show the look and function or workings of a product before it is made.
Prototype	A first or preliminary version of a design idea from which other ideas or versions are developed.
Analyse	Examine (something- eg information, a product, Client feedback) methodically and in detail, typically in order to explain it.
Evaluate	Use feedback or observations to form an idea of the value of something eg 'does it work?'
Make	Create (something) by putting parts together or combining materials and components

Manufactured Boards	Manufactured boards are timber sheets which are produced by gluing wood layers or wood fibres together. Manufactured boards often made use of waste wood materials. Manufactured boards have been developed mainly for industrial production as they can be made in very large sheets of consistent quality. Boards are available in many thicknesses

Outcome

Once your prototype has been finished, **how could it be further developed**?

Could it be more portable, have the speaker ports moved to enhance sound quality

or be re designed for a different user group?

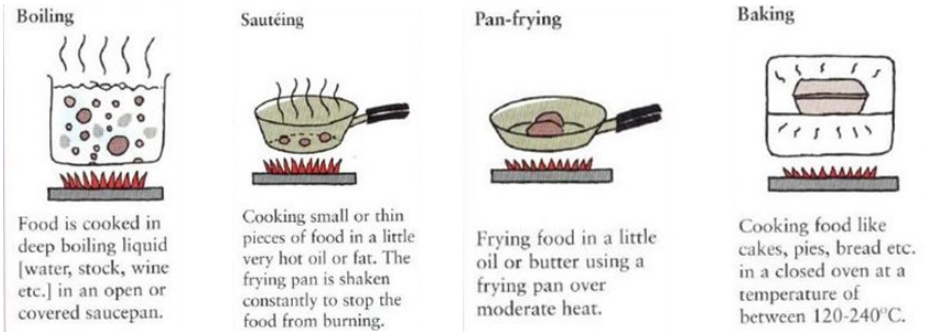
Year 9 Catering

Big Question: To investigate world foods, convenience foods and how food can be adapted to suit clients' needs.

Key Skills
Shallow Frying
Sautéing
Baking
Boiling

Menu

American– cookies
England– Fruit crumble
Italy- Pasta bolognaise bake



Convenience Foods

"Convenience foods make life easier"

Typically a complete meal that has been pre-prepared commercially and so requires minimum further preparation by the consumer.

Health & Safety
Wash hands before you begin
Long hair should be tied back
Remove jewellery
Aprons must be worn
Behave sensibly at all times
Listen to instructions

Key Vocabulary	
Time plans	Schedules of work
Costings	The price of the item per portion with profit
Shopping and equipment lists	What is needed and where is it purchased from?
Evaluations	Review of customer satisfaction and any subsequent changes

Catering The Environment and the Provenance of Food	
Homework 1	**Due Date**
Read the text below in readiness for a test on this subject:	**w/c**

Why does the UK import food from other countries?

Foods that need a different climate to the UK are usually grown in other countries. These include rice, bananas and cocoa (which is used to make chocolate). Some foods are grown elsewhere for other reasons. For example, New Zealand are well-known for producing lamb and they export meat to many other countries.

Where does food come from?

Different countries produce different types of food, which is often dependent on their climate. For example, Asian countries grow rice, African countries grow cocoa, South American countries produce oil crops, and European countries produce a lot of milk and fish. Of all arable land in the world, around half is farmed.

Modern food production allows some, but not all, of the world's population to enjoy a varied diet throughout the year. For example, it is possible to eat strawberries in winter in the UK. This scale of food production can have negative impacts on people, animals and places.

Increasing food miles adds to global climate change. This is because fuel is required to move food between countries, which leads to increased carbon emissions.

Why is global food consumption increasing?

Millions of people go hungry each year and may not be able to eat for extended periods.

Farmers try to produce more food. Trees are cut-down to make more farmland and more cattle are squeezed into fields. This causes soil erosion and deforestation.

When the demand for food exceeds the supply, prices increase. Many of the most vulnerable people cannot afford to eat.

Food is a basic human need. Food shortages can lead to conflict.

Catering

Homework 2 Why do we eat certain foods?	Due Date
Read the text below in readiness for a test on this subject	w/c

Food choices

The food we eat is usually because of our own personal choice. We can make our choice because of ethical, religious or medical reasons.

Vegans- will not eat any food or product from an animal. They believe that it is wrong to kill any living thing. For example they will not eat eggs, milk, or honey as these foods are all produced from animals.

Vegetarians- will not eat the flesh of any animal for the same reasons stated above. However, some they may eat fish, they are called **Pescatarians.**

Coeliac- people cannot eat products made from wheat, such as pasta and bread, as the body cannot digest it.

Lactose intolerance– people cannot eat any milk products as the body cannot digest dairy.

Low fat diet- people who wish to lose weight will reduce the amount of fat / calories they are consuming

Diabetics- need to be careful about the amount of sugar they are consuming. The body cannot control blood sugar levels and produce insulin naturally.

Hindus- will not eat beef as the cow is seen as a sacred animal

Muslims- will not eat pork as a pig is seen as an unclean animal. Meat has to be Halal (slaughtered in a certain way).

Jews– will not eat pork. They will not eat meat and milk at the same time, or cooked together. Meat has to be kosher (cooked to Jewish guidelines).

Catering

Homework 3	Due Date w/c

Read the text below in readiness for a test on this subject

The Kitchen Brigade

- A group of chefs in a large kitchen is called a **Brigade**
- Every chef has a specific job to do and has a rank position within the kitchen
- Each chef has a different name for the type of food they cook
- Each area in the kitchen is called a station

Executive head chef- this person is in overall charge of the kitchen. Their role is to create menus. They also recruit staff, and ensure all staff are trained in all Health and Safety procedures.

Sous chef– this chef is second in charge of the kitchen and is the head chefs deputy. They will do the same roles as the executive chef.

Commis chef- this chef is a trainee chef and will learn every station. They will train and their aim is to become a head chef.

Chefs de partie- this is a chef that does a specific type of cooking, within an area, such as meat, vegetables, frying, desserts, pantry, sauces etc. They will be a specialist chef in their own right.

Kitchen porter- the kitchen porter is very important within the kitchen. They do the washing up, maintain all equipment, check deliveries and put away stock.

Expeditor– this person relays messages between the chefs and other areas of a restaurant and hotel.

Catering

Homework 4	Due Date
Food related causes of ill health You need to research and explain the following key terms, you can do this as a mind map or as a table • Bacteria • Contaminate • Cross- contamination • Food spoilage • Micro- organism • Moulds • Pathogenic • Toxins • Yeasts	w/c
Homework 5	**Due Date**
Environmental health officers You will need to do some research and then answer the following questions in full sentences: • Give 3 reasons why inspections are carried out in food premises by environmental health officers • List 4 things that the environmental health officer does during an inspection • List 2 things that an environmental health officer is allowed to do by law if they find a food business has broken food safety laws	w/c
Homework 6	**Due Date**
Different menu styles Find the meaning of these different types of menu and the type of restaurant they would be used: • Ala Carte • Cyclic menu • Du jour menu • Table d hote • Explain how interactive and online menus can help the customer	w/c

Resistant Materials

Homework 1 : The 6R's in Design	Due Date
The 6R's in Design: Create an informative, A3 sheet on sustainability in Design and Industry. Staff will explain full details. See sheet in Knowledge Organiser.	**w/c**

Homework 2: Designers Research	Due Date
From the list, below, create an interesting, thoughtful and illustrated biography of your chosen person or design company • **Gerrit Reitveld** • **Aldo Rossi** • **Ettore Sottsass** • **Charles Rennie Macintosh** • **Marcel Bruer** • **Braun** You will produce a 150 word, edited report which shows a good range of examples of the subjects work and analyse your examples in terms of personal opinion, materials, aesthetics, costs etc. The work should be completed on 1 side of A4 and must be printed if completed on the computer.	**w/c**

Homework 3 : Types of Metals	Due Date
Types of Metals: Create an informative, A3 sheet on non-ferrous and ferrous metals. Staff will explain full details.	**w/c**

Homework 4 : Smart Materials	Due Date
On 1 side of A4 paper, create an informative report on the subject of 'Smart Materials'. What are they? Where did they come from? When were they discovered? What are they're benefits? Where are they in use? Give 3 examples of products which use Smart Materials eg IPhone.	**w/c**

Homework 5: Design Movement Research	Due Date
Pick ONE Movement from the list, below. Create an interesting, thoughtful and illustrated report. • **Memphis** • **Futurism** • **Surrealism** You will produce a 150 word, edited report showing a good range of examples of the subjects work and analyse your examples in terms of personal opinion– such as materials, aesthetics, costs etc. The work should be completed on 1 side of A4 and must be printed if completed on the computer.	

Homework 6: What are the main manufactured board types?	Due Date
Read the text about different types of manufactured boards and complete the set of questions. Pages 16 to 17 of the knowledge organiser.	

Resistant Materials

Homework 7: Product Analysis	Due Date
Research the Dyson product - *'Pure Cool TP00'* ventilation fan created by James Dyson. Use the worksheet provided on page 18 to analyse the product using ACCESSFM.	**w/c**
Homework 8: Forces and Stresses– Reading and Test	**Due Date**
Using the sheet provided, read through and revise the information on page 19 on *'Forces and Stresses'*. Ready for a test in your next lesson.	**w/c**
Homework 9: Circular Economy Research	**Due Date**
On A4, create a detailed and informative sheet based on what the concept of the *'Circular Economy'* is. Use a combination of text and images to explain what it is, why it is important, what effect it might have on the planet etc. As a start, consider visiting: https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview	**w/c**
Homework 10 : Manufacturing Process-How to create a wooden baseball bat	**Due Date**
Create a flowchart or 'step by step' diagram of how a wooden baseball bat is made– from the moment the raw timber is shaped and finished into the final bat product You might want to include sketches and photographs to explain your work– you decide!	**w/c**
Homework 11: Industrial Processes	**Due Date**
Research 'metal welding' – how does the process work? To do: Write a 'step by step' to show how welding joins together metals and what are the different methods?	**w/c**
Homework 12: Design Task	**Due Date**
Research the design company *'Braun'* and sketch design a new radio inspired by the your findings about the company's products. Make sure you annotate your design using ACCESSFM.	**w/c**
Homework 13: Sourcing Metals- Reading and Test	**Due Date**
Read through sheet provided and revise the information on *'Sourcing Metals'* on page 20. Ready for a test in your next lesson.	**w/c**
Homework 14: Specialist Techniques and Processes	**Due Date**
Use the informative sheet on *'Specialist Techniques and Processes'* to complete the table on pages 21 to 22. Add a sketch/drawing to represent the manufacturing process. Add a description which explains the process.	**w/c**
Homework 15: Key terms in the Workshop	**Due Date**
Look up keyword and terms, commonly used in the design workshop and explain their meanings- in your own words on page 23.	**w/c**

Resistant Materials Homework Checklist/Calendar

Once finished, tick off the homework you have completed. Remember to keep your work safely stored in your class folder

Homework	Date	Done ✓
Homework 1: The 6R's in Design	Term / Week 1 W/C:	
Homework 2: Designers research	Term / Week 3 W/C:	
Homework 3: Types of Metals	Term / Week 5 W/C:	
Homework 4: The history of SMART AND MODERN MATERIALS	Term / Week 1 W/C:	
Homework 5: Design Movement research	Term / Week 3 W/C:	
Homework 6: What are the main manufactured board types?	Term / Week 5 W/C:	
Homework 7: Product analysis	Term / Week 1 W/C:	
Homework 8: Forces and Stresses– Reading and Test	Term / Week 3 W/C:	
Homework 9: Circular Economy Research	Term / Week 5 W/C:	
Homework 10 : Manufacturing Process-How to create a wooden baseball bat	Term / Week 1 W/C:	
Homework 11: Industrial Processes	Term / Week 3 W/C:	
Homework 12: Design task	Term / Week 5 W/C:	
Homework 13: Sourcing Metals- Reading and test	Term / Week 1 W/C:	
Homework 14: Specialist Techniques and Processes	Term / Week 3 W/C:	
Homework 15: Key terms in the D&T workshop	Term / Week 5 W/C:	

6R's FOR ONE PRODUCT

Pick out one product from your recycling tub and try to apply as many of the 6r's as you can to it. Create an informative, A3 sheet on sustainability in Design and Industry

Example: baked bean tins

- **RECYCLE-** cans are made of steel and have an inner layer of tin or plastic. For recycling all metal is, sorted using magnets, shredded and melted, purified using electrolysis and then poured into moulds and cooled. There are many benefits associated with scrap metal recycling. Conserving our natural resources from being mined, reducing greenhouse gasses and water pollution by recycling, reduce landfill dumping of metal that could have been recycled, with the most important benefit is the substantial energy saving that is made from recycling scrap metal compared to manufacturing from raw materials on the environment and our economy. Making steel from recycled cans uses 75% less energy than when producing steel from raw materials. Recycled steel can be used to make steel girders for the construction industry.
- **REUSE-** tin cans can be used for many different things, for example plant pots, pen holders and storage. When re-using you have to be careful that the edges are not sharp.
- **REDUCE-** reduce the amount of cans made by buying food in bulk. This would save raw materials as well as energy and is therefore preferable to recycle and reusing.
- **REFUSE-** to buy tinned food all together. Make your own baked beans in bulk and freeze in re-usable tubs.
- **RETHINK-** how could energy and resources be saved?

  Could the concept of supermarkets and food shopping be re-considered? How about buying food from farmers markets and making your own from locally sourced, seasonal foods. This would save on a lot of unnecessary packaging, food miles and waste.

Homework 6: What are the main manufactured board types?

As part of your KS3 course, it is important that you understand where materials come from and their properties. This project will be giving you the opportunity to use a range of 3 manufactured board types. Read the notes, below, then answer the questions to, perhaps, help you to decide on your own final choice

Plywood

Plywood is made by gluing together a number of thin veneers or 'plies' of softwood or hardwood.

Advantages:

- There is always an odd number of veneers and each ply is at a right angle to the one below, this gives the material its strength. The more veneers used, the stronger the plywood becomes.
- The finish quality of plywood varies considerably, some plywood have attractive grains while others can contain knots.
- Plywood may be used inside and outside. Plywood is quality graded for exterior or interior use depending upon the water resistance of the glue used to stick the plies together. To help designers, builders and manufacturers make the right choice, code letters shows this grading on each sheet.
- Plywood is sold in 2440 x 1220mm and 1525 x 1525mm sheets. The most common thicknesses are 4, 6, 9 and 12 mm. Plywood can be nailed and screwed. Thin plywood is flexible and can be formed into curved shapes

Medium Density Fibreboard (MDF)

MDF is a type of hardboard, which is made from wood fibres glued under heat and pressure.

Advantages:

- There are a number of reasons why MDF may be used instead of plywood or chipboard. It is:
    - dense
    - flat
    - rigid
    - has no knots
    - easily machined
- MDF can be painted to produce a smooth quality surface or be veneered with a high end wood or laminate finish
- Because MDF has no grain, it can be cut, drilled, machined and filed without damaging the surface

Disadvantages:

MDF can be dangerous as it contains a substance called urea formaldehyde, which may be released from the material through cutting and sanding. Urea formaldehyde may cause irritation to the eyes and lungs. Proper ventilation is required when using it and facemasks are needed when sanding or cutting large quantities of MDF with machinery. The dust produced when machining MDF is dangerous, so masks and goggles should always be worn.

Homework 6: What are the main manufactured board types?

Chipboard

Made by gluing together wood particles with an adhesive, under heat and pressure makes chipboard. This creates a rigid board with a relatively smooth surface. Chipboard is available in a number of densities: -normal, medium and high-density. It is often used for kitchen tops (which are laminated with melamine) and fire doors. All grades of chipboard except the high-density variety tend to soak up water. Once it is water logged, chipboard tends to swell and breakdown. Iron/ gluing on strips of veneer may be needed to disguise the unattractive edge of veneered chipboard (see the edge of your school desk)

Questions:

1. Name 3 thicknesses that manufactured boards can come in

_____

2. How are the plies of plywood joined together?

_____

_____

3. What does 'MDF' stand for?

_____

_____

4. What are the two types of plywood?

_____

_____

5. Name two benefits to a designer or manufacturer of using a manufactured board

_____

_____

6. Name three manufactured boards

_____

_____

7. Name three advantages that MDF has as a material

_____

_____

8. Which manufactured board would be most likely used to make a kitchen worktop or a school desk? How would it be visually or functionally enhanced?

_____

9. Name two pieces of PPE that should be used when processing large amounts of MDF eg in a furniture factory

_____

_____

Homework 7: Product Analysis

We use **ACCESS FM** to help us write a **specification** - a list of requirements for a design - and to help us **analyse and describe** an already existing product.

ACCESS FM - Helpsheet

A is for **Aesthetics**

Aesthetics means **what does the product look like?**
What is the: Colour? Shape? Texture? Pattern? Appearance? Feel? Weight? Style?

C is for **Cost**

Cost means **how much does the product cost to buy?**
How much does it: Cost to buy? Cost to make?
How much do the different materials cost? Is it good value?

C is for **Customer**

Customer means **who will buy or use your product?**
Who will buy your product? Who will use your product?
What is their: Age? Gender?
What are their: Likes? Dislikes? Needs? Preferences?

E is for **Environment**

Environment means **will the product affect the environment?**
Is the product: Recyclable? Reuseable? Repairable? Sustainable? Environmentally friendly? Bad for the environment?
6R's of Design: Recycle / Reuse / Repair / Rethink / Reduce / Refuse

S is for **Size**

Size means **how big or small is the product?**
What is the size of the product in millimeters (mm)? Is this the same size as similar products? Is it comfortable to use? Does it fit? Would it be improved if it was bigger or smaller?

S is for **Safety**

Safety means **how safe is the product when it is used?**
Will it be safe for the customer to use? Could they hurt themselves? What's the correct and safest way to use the product? What are the risks?

F is for **Function**

Function means **how does the product work?**
What is the products job and role? What is it needed for? How well does it work? How could it be improved? Why is it used this way?

M is for **Material**

Material means **what is the product made out of?**
What materials is the product made from? Why were these materials used? Would a different material be better? How was the product made? What manufacturing techniques were used?

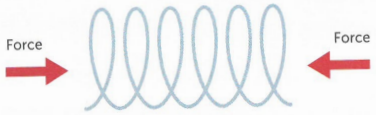
FORCES AND STRESSES

Materials and objects

All materials, structures and products must withstand stress as certain forces are applied to them when in use. The ability to withstand stress is what allows them to perform their functions successfully.

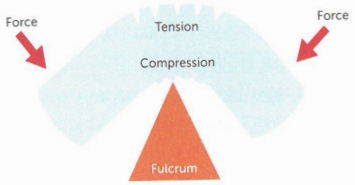
Compression

Compression occurs when a pushing force is applied to either end of a material



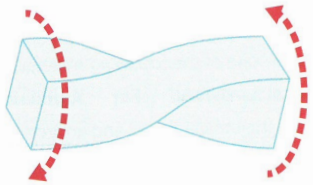
Bending

Bending is both tension and compression forces; tension on one side with compression on the other.



Torsion

Torsion forces occur when a material is twisted.

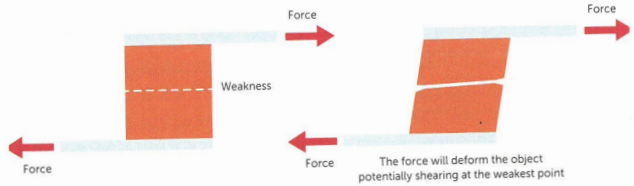


Tension

Tension occurs when a pulling force is applied to either end of a material.

Shear

Shear force acts on an object in a direction perpendicular to its length



ENHANCING MATERIALS

Materials can be enhanced to resist or work with a variety of forces and stresses. This can improve functionality. They may be:

- **Reinforced** – strengthened by the addition of other materials.
- **Strengthened** – made stronger or more rigid to resist certain forces.
- Made more **flexible**.

Bending

Adding curves, arches and tubes can add considerable strength to products, using a minimum amount of material.

Webbing

A strong fabric made from high-strength material, it is usually woven into flat strips and used for items under high tension.

Folding

This can add strength, but also flexibility by enabling a material to bend easily.

Fabric interfacing

Used in textiles, this adds an additional layer to give structure, shape and support.

Lamination

By bonding two or more materials together, a product's strength and stability are improved. It can also add to the aesthetics by giving a new finish.

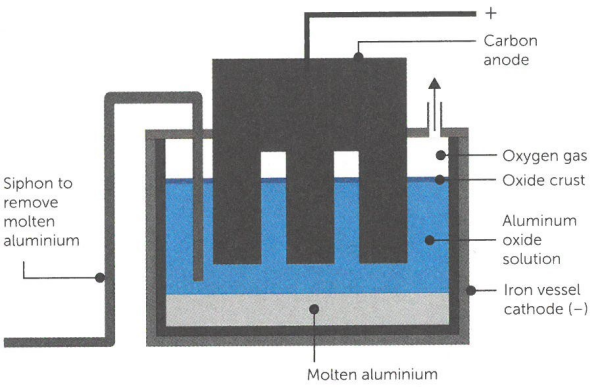
Homework 13: Sourcing Metals- Reading and Test

SOURCES AND ORIGINS

Metal ores are found in the earth's crust and are obtained by mining. Metals are extracted or separated from the ore and refined ready for use. Metals are extracted by different methods:

Electrolysis

Aluminium is extracted from **bauxite**. The bauxite is purified to produce aluminium oxide. This is converted to aluminium by electrolysis; a process that passes an electrical current through melted aluminium oxide. The pure molten aluminium is separated and collected.



Liquation

Liquation is used with metals with a low melting point, such as tin and lead, to separate the metal from an ore or an alloy. The impure metal is heated inside a sloped container. Once it has melted, the liquid metal runs off leaving behind any impurities.

Distillation

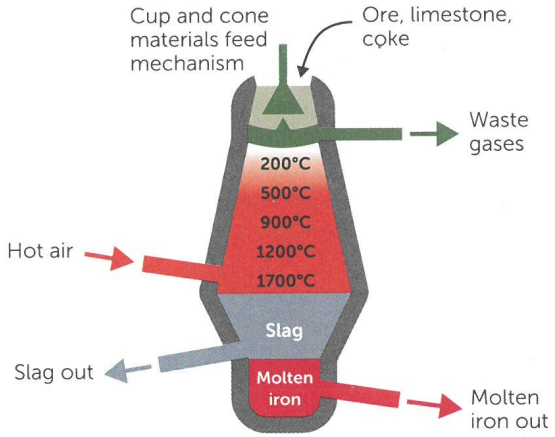
Metals such as mercury and zinc have a low boiling point and can be distilled to remove impurities. When mercury is heated, it will vaporise leaving behind the impurities. The vapour is collected and condensed to produce pure mercury.

Refining metals

Refining purifies an impure metal. Different processes are used according to the type of metal, such as fire refining or chemical refining. Electrolysis is also used to separate copper from any impurities.

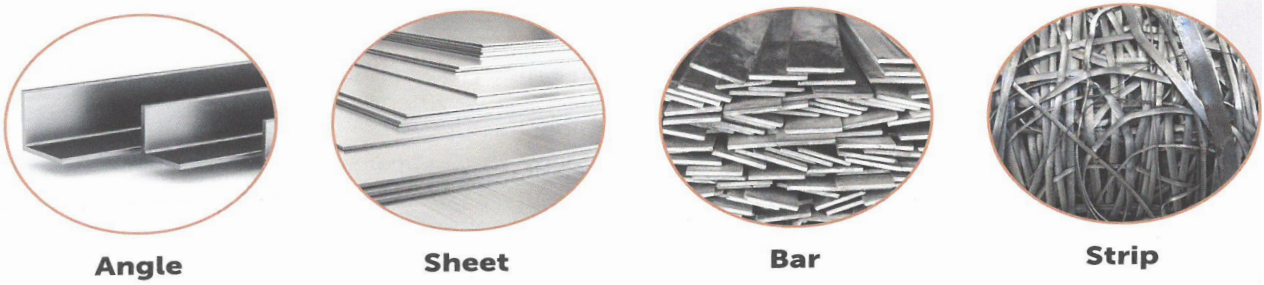
Blast furnace

Metals are separated from the waste material by heating in a blast furnace. Iron is extracted from iron ore by heating it to around 1700°C until it becomes liquid. The liquid descends through the furnace and separates from the waste ore or slag.



Standard dimensions

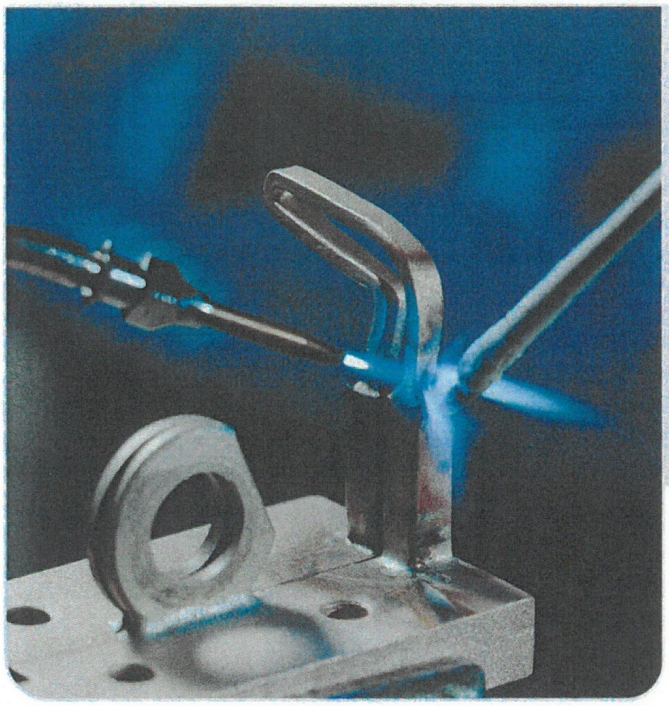
Dimensions are given in mm.
Standard dimensions for **sheet** and **flat bar** are given as length × width × thickness.
Box sections and shaped profiles – profile shape plus the length.
Rod – diameter × length. **Tube** – diameter × length plus the thickness of the wall or the gauge.



Angle | Sheet | Bar | Strip

SPECIALIST TECHNIQUES AND PROCESSES

Metals can be joined together using brazing, soldering and welding.



Brazing

Brazing uses a molten filler, such as brass spelter, to join two surfaces of metals together.

- Enables two different metals to be joined.
- It is a high-temperature process, but a lower temperature than welding for the same base metals.
- The work piece does not melt, just the molten filler, which solidifies when cool.
- Provides a strong joint.

Soldering

Metals are joined with a metal filler known as solder. Solder has a lower melting point than the adjoining metals. Soft soldering is commonly used in manufacturing electrical circuits and plumbing with copper components. Flux is used to help the solder flow and keep the join clean. Hard soldering is used for joining precious metals.

Welding

Welding fuses together metals at a very high temperature.

- The high heat melts the base materials.
- A metal filler (welding rod of the same or similar base metal) is melted to fill the joint.
- As they cool the parts fuse together, creating a very strong join.

Spot welding is a quick process often used to join thin sheets of metal. Automated machines can spot weld to increase speed of production. The weld is not suitable for all purposes as it is small and less strong.

Homework 14: Specialist Techniques and Processes

Use the informative sheet on *'Specialist Techniques and Processes'* to complete the table below		
Process	**Sketch/Drawing**	**Description**
Brazing		
Soldering		
Welding		

Homework 15: Key terms in the Workshop

Keyword/Term	Meaning
Alloy	
Anthropometrics	
Carbon Footprint	
Corrosion	
Ergonomic	
Ferrous Metal	
Finite Resource	
Lean Manufacturing	
Market Pull	
Non-ferrous Metal	
Planned Obsolescence	
Prototype	
Quality Control	
Smart Material	
Technology Push	
Tolerance	
Yarn	

Notes