

KS3 DESIGN TECHNOLOGY Knowledge Organiser

CAD & ENGINEERING

NAME:

CLASS:

TEACHER:

Target Grade		WAG	Mod 1	Mod 2	Mod 3
DD Group	Bauhaus	Memphis	Art Nouveau		

MODULE REVIEW CLOSING THE LOOP	WWW	EBI
MODULE 1		
MODULE 2		
MODULE 3		

Intent, Implementation and Impact in KS3 Technology

Our Mission Statement:

'We aim to use an iterative and explorative design cycle to empower students to become creative and critical thinkers. To find solutions to everyday problems that meet users' needs and make the world a better environment for all in an inclusive way.'

What this means in your lessons:

➤ ***An iterative and explorative design cycle***

We want you to try to always be improving your ideas and looking for new solutions.

➤ ***Creative and critical thinkers***

We want you to think outside the box and challenge the ordinary designs you see every day.

➤ ***Solutions to everyday problems***

We want you to be the people who solve the challenges the world is facing through your new thoughts and exciting ideas.

➤ ***Meet users' needs***

We want you to think about what your users need every step of the way so your design is 'human centred.'

➤ ***Make the world a better environment***

We want you to help protect and improve the world for future generations to come.

➤ ***In an inclusive way***

We want you to design with an awareness of the challenges and barriers your customers may have.

Programme of Study KS3 Design Technology

Core Content	
Research	Use research and exploration to identify and understand user needs. Develop specifications to inform the design of innovative, functional, appealing products. Analyse the work of past and present professionals and others to develop and broaden understanding.
Design	Identify and solve design problems and use a variety of approaches to generate creative ideas and avoid stereotypical responses. Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools.
Make	Select and use specialist tools, techniques, processes, equipment and machinery precisely. Select and use a range of materials, components and ingredients, taking into account their properties.
Test	Test and refine ideas and products against a specification, taking into account the views of intended users and other interested groups.
Evaluate	Evaluate outcomes and existing products considering developments in design and technology, impacts on individuals, society and the environment, and the responsibilities of designers, engineers and technologists.
Specialist Content: Food Technology	
Healthy Eating	Know the key food groups and understand the variety of foods required to provide the nutrients needed to maintain health and energy levels.
Cook a range of dishes	Cook a repertoire of predominantly savoury dishes to allow a healthy and varied diet.
Cooking techniques	Become competent in a range of cooking techniques for example, selecting and preparing ingredients; using utensils and electrical equipment; applying heat in different ways and adapting and using existing recipes.
Appropriate ingredients	Know the function of different ingredients within recipes and be able to select ingredients based on the need of the recipe being made.
Taste, smell and texture	Use an awareness of taste, texture and smell to decide how to season dishes and combine ingredients.
Food Sources	Understand the sources, seasonality and characteristics of a broad range of ingredients.
Specialist Content: Electronic Products	
Structural knowledge	Understand the importance of product form and construction to achieve functioning solutions.
Material and Component Properties	Select and use materials based on their physical properties and suitability for different purposes for example, polymers, timbers and electrical components.
Manufacturing Processes	Become competent in a range of manufacturing techniques which are appropriate to the materials being explored and used for example, hand tools, vacuum forming, laser cutting, belt sanding and drilling.
Power Sources	Explore how electrical and electronic systems can be powered and used in products for example, circuits with heat, light, sound and movement as inputs and outputs. Understand how energy can be stored and used, including the development of renewable energy sources.
Specialist Content: CAD and Engineering	
Structural knowledge	Understand the importance of product form and construction to achieve functioning solutions.
Material and Component Properties	Select and use materials based on their physical properties and suitability for different purposes for example, polymers, metals and alloys.
Manufacturing Processes	Become competent in a range of manufacturing techniques which are appropriate to the materials being explored and used for example, hand tools, heat treatment, laser cutting, drilling and welding.
Design Communication and realisation	Explore how CAD CAM systems can be used in the development of products for example, 3D modelling, virtual testing, technical drawings, CAM production. Understand the value of computer aided design in 3-D and mathematical modelling, oral and digital presentations and the flexibility of computer-based tools.

Learning Journey KS3 Design Technology

Y7 Food Technology

Safe Food Preparation

Create and respond to a Design Brief for a Pizza product
Develop a specification
Healthy eating
Preparing hot and cold dishes



Analysis and Evaluation

Curry practical and evaluation
3rd Party feedback
Meal planning and budgeting
Effective use of ingredients
Bolognese practical



Materials and Design

Create and respond to a Design Brief for an MP3 amp
Develop a specification
Materials and processes
Use and understand the vacuum former



Y9 CAD & Engineering

Design and idea development

Create and respond to a Design Brief for a coat hook for disabilities
Develop a specification
Materials and processes
Use of modelling



Analysis and Evaluation

Give and collect 3rd part feedback
Final construction
Testing and evaluation



To KS4 – GCSE Product design and BTEC Engineering...

Function of Ingredients

Making Oaty biscuits
Understand functions of ingredients
Cooking chicken safely
Commercial food production
Batch production chicken goujons



Y8 Electronic Products

Practical and Soldering

What is electricity
Using machinery safely
Learning to solder effectively
Components and their uses



Analysis and Evaluation

Give and collect 3rd part feedback
Final construction
Testing and evaluation



Practical and metal work

How are CAD programs used
Drawing to scale
Orthographic drawing
Spot Welding
Shaping and working with steel



Extra-curricular

Opportunities to enter design competitions.
Opportunities to visit national engineering and design events

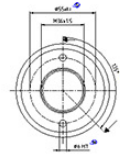


Course Structure KS3 CAD & Engineering

Module	Content	Skills & Knowledge
1	Research and design specification Design idea development CAD Modelling	<ul style="list-style-type: none">• Identifying user needs• Planning and timing• Idea communication and development• CAD modelling and design skills
2	Card modelling Orthographic drawing on cad Marking out and cutting metal Shaping and bending metal	<ul style="list-style-type: none">• Manufacturing and hand skills.• Measuring and cutting accurately.• Identifying and selecting materials and processes.• Using industrial processes safely.
3	Product completion and testing Testing and evaluating Design improvement and development Manufacturing research End of year assessment	<ul style="list-style-type: none">• Testing and correcting issues• Analysing and evaluating to improve.• Responsible design decisions.• Cost analysis• Retention of key knowledge

Knowledge Organiser: KS3 CAD & Engineering

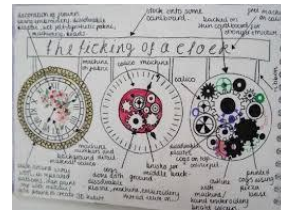
Material Properties and Technical Drawings



Key skills

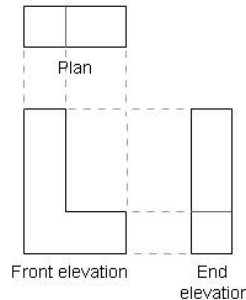
Product Specification: The 'specification' is probably the most important part of the design process because it makes sure your product is going to do what it needs to do. It is a list of points which outline the design criteria for the product, with each point referring to research work you have done. You can organize your points so you don't miss anything using ACCESS FM and expand your writing using PEE chains.

Design idea development: First develop a range of initial ideas and compare them with your specification. You can then see any areas which are less good and look at how to improve them to produce a final idea. Annotation helps explain designs fully and using 3D sketching and ACCESS FM for your annotation will make your ideas clear. Improving and developing designs based on feedback is called iterative design.



Technical Drawings: Technical drawings have to conform to BS 8888 which is a set of rules that the drawing must follow. Drawing Standards exist so that everyone using the drawing can understand them clearly and shows the information in the same way. Often the parts being shown on the drawings are too big to draw full size, so they are drawn to scale. This means drawing them in model but as a smaller size than they really are. The scale being used is shown on the drawing in the title block.

Orthographic drawing layout:



2D drawing technique which shows the top (plan), front and side (end) view of a product. Used to show technical information such as dimensions clearly.

Key knowledge

2D Command Tools:

2D Design commands	Button	Description of use
Line tool		Used to draw a line
Erase		Used to erase a whole shape
Circle tool		Used to draw a circle
Text tool		Used to add text to a drawing
Scale		Used to set dimension scale
Grid lock		Used to draw directly onto the grid
Hatching		Used to add areas of block colour
zoom		Used to Zoom in and out of a drawing

Quality control and Quality Assurance:

Quality control is a system of maintaining standards in manufactured products by testing a sample of the output against the specification. Quality Assurance is a way of preventing mistakes and defects in manufactured products and avoiding problems when delivering products or services to customers. Quality assurance makes sure quality is created during the designing phase. Whereas in quality control, quality is created at the production stages. Quality Assurance is a preventive action, but Quality Control is a corrective measure.

Key words

Specification
ACCESS FM
(Appearance, cost, customer, environment, size, safety, function, materials and manufacturing method)

Annotation
Technical drawing
BS 8888

Orthographic
2 dimensional
3 dimensional
Quality Control
Assurance

Curriculum Links

Literacy:
Specification writing, PEE chains, justification and analysis skills, use of acronyms.

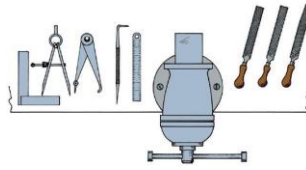
Numeracy:
Costing, dimensions, scale, proportion, graphical representation.

Careers:
Problem solving, software skills, communication skills.

Cultural Capital:
Specification writing, design skills, communication.

Knowledge Organiser: KS3 CAD & Engineering

Manufacturing Safely



Key words

Manufacture
Risk
Assessment
Welding
Quality
Laser cutting
Drilling
Vectorise
Import
Hazard
Control
DXF file
Safety
Strength
Ductility
Elasticity
Ductility
Plasticity
Tensile

Key skills

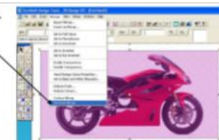
Manufacturing: Using key manufacturing skills safely and practicing to develop your skill and accuracy so that the products you make are high quality. In Engineering this includes hand tools, heat treatment, Laser cutting, drilling and welding.



Laser cutting process: Draw your image on 2D design, or vectorise an existing image. Then change cut lines to red and engrave lines to black.

Another method is to vectorise the entire image.

In the Bitmap menu, select Vectorise Bitmap. Click on the image. In the Colour Selection for Vectorisation window, click OK



In the Bitmap Vectorisation Settings window, click OK.



The image is now completely vectorised. Select the image and click on Fill.



Check the No Fill button.

Click OK. Change the line colour. (Red to cut or Blue to engrave)

Export the image as a DXF file to the laser cutter. Place the material into the laser and follow the settings and safety rules in the handbook to cut it out correctly.

Risk Assessment: This term is used to describe the overall process or method where you: Identify hazards and risk factors that have the potential to cause har. After hazard identification, you then consider appropriate ways to eliminate the hazard, or control the risk when the hazard cannot be eliminated, this is called risk control.

Key knowledge

Material properties:

Strength – The ability of a material to stand up to forces being applied without it bending, breaking, shattering or deforming in any way.

Elasticity – The ability of a material to absorb force and flex in different directions, returning to its original position.

Ductility - The ability of a material to change shape (deform) usually by stretching along its length.

Plasticity - The ability of a material to be change in shape permanently.

Tensile Strength - The ability of a material to stretch without breaking or snapping.

Advantages and Disadvantages of welding:

Advantages:

- Strong
- Lightweight joint
- More effective than riveting
- Look neat and tidy
- Quick to produce
- Rigid
- No noise

Disadvantages:

- Brittle
- Don't cope well with fatigue
- Skilled labor needed to weld
- Electricity is required for welding.
- Inspection of welding work is more difficult and costly than riveting. Easy to get defects in the joint which are difficult to detect.
- Risks are higher from welding flash

Properties of steel: Steel is an alloy of iron and carbon and, sometimes, other elements such as chromium. Because of its high tensile strength and low cost, this material is best used in buildings, infrastructure, tools, ships, trains, cars, machines, electrical appliances, and weapons.

Curriculum Links

Literacy:

Risk assessment, processing instructions, use of technical documentation.

Numeracy:

Planning, dimensions, marking out.

Careers:

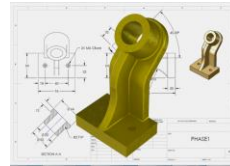
Problem solving, hand skills, communication skills.

Cultural Capital:

H&S/Risk awareness, manufacturing skills, communication.

Knowledge Organiser: KS3 CAD & Engineering

Computer Aided Design

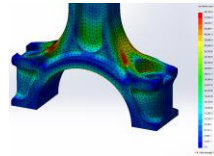


Key words

Testing
Evaluating
Computer Aided Design
Modelling
Rendering
Virtual
Technical
3rd party feedback
Heat treatment
Crystalline
Characteristic
Forge
Shade
Tone

Key skills

Testing and Evaluating: By comparing your finished product with the specification and also by asking for 3rd party feedback, you can identify strengths and weaknesses with the design and manufacture of the item. You can use this information to suggest ways it could be improved or developed in the future.



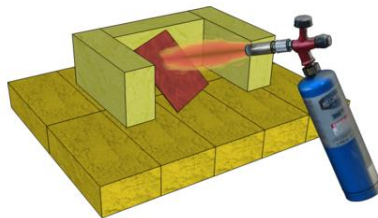
CAD: 3D computer modelling means using a computer programme to create a virtual representation of a real object. This drawing can then be used to programme a piece of machinery to cut out a real physical product. The model can also be rendered to make it look real by choosing a colour and a material. A number of 3D model parts can be put together to make an assembly. Once the complete 3D model is created, it can be used to create a technical drawing. These drawings are used when the product is made to make sure it is the right shape and size.

Card modelling: Card modelling is another way to test a design before proper production begins. One major advantage of using card is if you make a mistake, each part can be remodeled at very little cost. When assembled correctly they can be really strong and last for many years.

Creating a card model is easy and can quickly show what a product will look like so it can be evaluated.



Heat treatment: Heat Treatment in Design and Technology involves the use of heat to raise the temperature of a material (*usually metal*) to a point where changes in its crystalline structure occur and alter its working characteristics. Often this means it is easier to work with and shape. The source of heat could be a Blow Torch but in industry, more consistency and accuracy is achieved by the use of temperature controlled ovens and kilns.



Curriculum Links

Literacy: Risk assessment, processing instructions, use of technical documentation. Evaluation.

Numeracy: Checking, estimating, dimensions, marking out.

Careers: Problem solving, hand skills, communication skills.

Cultural Capital: Manufacturing skills, communication, production.

Key knowledge

Target audiences: When designing you need to think about the customer, client and end user. Sometimes they will be the same, but often they are different people who will have different needs and wants from the product. For example a dog bowl. The client might be a pet shop, the customer would be the pet owner and the end user would be the dog. Whose needs are most important will depend on the product being made.

Environmental impacts of products: When designing a product it is important to think about the environmental impacts all the way through the product's life. This might be the energy used in the extraction of raw materials or during manufacturing. It could be the transport of materials or finished products for sale. It will also include any consumable items when the product is being used, like batteries, as well as how the product will be disposed of at the end of its life.



Structuring your answers in Design Technology

P.E.E Chains



In Technology we use PEE chains to expand our answers so we are communicating our thoughts and ideas clearly. This makes sure that we say what we think and then back up, or justify, our thoughts with explanations and evidence from research which support them.

POINT	Say WHAT you think.	<i>I think the product should be...</i>
EXPLAIN	Say WHY you think it.	<i>This is because...</i>
EVIDENCE	Say what RESEARCH you've done to back this up.	<i>I know this from my research into...</i>

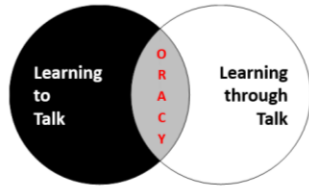
ACCESS FM

ACCESS FM is an analysis and annotation tool which makes sure we consider all the important design criteria and the impact they have on products we are investigating, designing or evaluating,

A	Appearance	Where did the designer get their inspiration? Could the product look better? Do you think it looks attractive or ugly, Why? What does the product look like? THINK shape, form, materials, size, beauty, ugliness.
C	Cost	Is it affordable to your customer? Will it make a profit? Is it value for money? How much does it cost to make?
C	Customer	What impact would it have on a customers life? Why would a customer buy it? What makes it suitable for them? Who would buy it? Who would use it?
E	Environment	What is the products impact on the environment? THINK batteries, rethink, refuse, reduce, reuse, recycle, lifecycle. How would the product be disposed of? Is the product needed or wanted? How long will it last?
S	Safety	Is the product high quality? Does it meet safety standards? How has the designer considered safety? Could the product hurt anyone? Are there any sharp edges?
S	Size	Is it an appropriate size? Would it work better if it was bigger or smaller? Does it come in different sizes? How big is it?
F	Function	Does the product work? Could the product work better? How does the product work? Why is the product needed? What does the product do? Is it easy to use?
M	Materials/ Manufacture	What impact could the designer's choice of material have on the environment? Would a different material make it better? What material has it been made from? What process would be used to make it?



Oracy in Design Technology



Oracy means being able to express yourself clearly using spoken language. We build oracy tasks into Technology lessons to help you develop the technical language and understanding that you need to be able to communicate your ideas and opinions effectively to others. These are some of the activities which we use in lessons, but you can try them out at home too!

RANT

You need to discuss and explain all the negatives you can think of on the topic you have been given.

Success Criteria

- Consider all the potential negatives
- State your opinion clearly
- Take turns with your partner / group
- Explain your reasons
- Give examples
- Don't lose your temper!

Sentence Starters

- The problems are...
- I disagree with you because...
- The effects of that are...
- That's true but have you considered...
- I hear what you are saying but...



RAVE

You need to discuss and explain all the positives you can think of on the topic you have been given.

Success Criteria

- Consider all the potential positives
- State your opinion clearly
- Take turns with your partner / group
- Explain your reasons
- Give examples
- Be enthusiastic!

Sentence Starters

- The benefits of this are...
- I feel this is positive because...
- The effects of that are...
- That's true but have you considered...
- I hear what you are saying but...

Talk Detective

You need to observe conversations and identify examples of good oracy.

Success Criteria

- Look for what people are doing well
- Record specific phrases and names
- Give praise in your feedback
- Use positive body language when you feedback

Things to look for:

- | | |
|--|--|
| <ul style="list-style-type: none"> ✓ Invited someone else to contribute ✓ Challenged someone's opinion ✓ Summarised their thinking or the group opinion ✓ Clarified someone's idea | <ul style="list-style-type: none"> ✓ Gave a good example ✓ Used appropriate body language ✓ Used technical language / key words |
|--|--|

Talk Detective



Revision Strategies in Design Technology

Technique	Difficulty	Description	Used
Revision Cards	Hard Challenge	Write out 'flash cards' which have questions on the front and answers on the back which can be used for testing yourself/each other.	
Memory Map	Challenge	Mind map all the key points and key words related to the topics. Use images as appropriate.	
mneumonics	Hard Challenge	Use the first letter of key words to spell out a word or phrase to remember lists or large chunks of information e.g. Richard of York gave battle in vain (colours of the rainbow: red, orange, yellow, green, blue, indigo, violet) or ACCESS FM.	
Self Test	Challenge	Use flash cards or the practice questions in the book to test your knowledge of topics.	
	Hard Challenge	designing your own question and mark scheme for the topic	
	Extreme Challenge	Create a model answer for the question you designed.	
Smartass Lists	Extreme Challenge	Write down impressive/unusual key words or expressions which you could use to answer a question on that topic	
Example Q&A	Hard Challenge	Make up an example exam question on the topic and write a mark scheme for it using the revision guide. Then test a peer with the question, mark their work and work in pairs to develop the mark scheme.	
Songs/Poems	Hard Challenge	Write a poem or a rhyme (you could even include a tune) which will help you to remember the key words or points for a topic.	
Pictograms	Challenge	Draw images surrounded by key words which will remind you of the key information or help to summarise the topics. This may be a single image (e.g. materials/tools) or a storyboard (e.g. processes)	
Bullets/Lists	Challenge	Number or bullet point the key information on a topic. Try and list them in order of importance.	
Audio Tape	Challenge	Create an audio account of the key information which you can then play back to yourself to help you remember the key points.	
	Hard Challenge	In pairs write and record an interview which includes the key information about a topic and requires the interviewee to explain and justify the information being covered.	
Physical Map	Challenge	Put key points about a topic around the room. Move to that point and either read out loud or write down the fact/point/information. This means that the information then becomes associated with this specific place and thinking about the place should trigger the recall of information.	
Round Robin	Challenge	In teams of 3-4, take it in turns to relay the information about a topic until you run out of key points. Then check that you covered all the information by using the revision guide/notes as a checklist.	
Quiz Quiz Trade	Hard Challenge	Create quiz, quiz, trade cards and use them in small groups to cover the information for a topic. Each card should feature a question and a sub-question or hint on one side, with the answer on the reverse.	
Talk Pair Share/speed dating	Hard Challenge	Talk in pairs and cover the main points of a topic (make a note of what you remember together in your revision books) Then pair up with someone else and add to your notes, repeat this until you think you have all the information – then check against the revision guide.	
Talking Tables	Challenge	Similar to Talk, Pair, Share - working in teams of 3-4 cover the main points of a topic (make a note of what you remember together in your revision books) and then move teams and add to your notes, repeat this until you think you have all the information – then check against the revision guide.	
Consensus	Hard Challenge	Useful for key words. Independently define a key word, then in teams of 3-4 bring definitions together and synthesise the information to create the best definition possible. Can also be used to develop responses to exam questions.	

Personalised Learning Checklist: KS3 CAD & Engineering

Create a **revision aid** for each of the statements below, to prove you can do each one.




•If you can definitely do the full task, tick green.

•If you can do some of the task, tick amber.

•If you can do less than half of the task, tick red.

If you have not ticked green, spend some extra time revising that area!

What's a revision aid? This could be revision notes, a mind map, a list, flashcards. Whatever works for you! Look at the revision strategies page for more ideas.

KS3 CAD & ENGINEERING			
Year 9 Module 1 – Material Properties and Technical Drawings			
Make a poster showing all the different material properties.			
Draw the top front and side view of your mobile phone on the back.			
Create a table showing the different materials properties.			
Give an example of each type of material and why it is used.			
Explain the views shown in an orthographic drawing and why they are used.			
Create a table showing the different materials properties.			
Give an example of each type of material and why it is used.			
Year 9 Module 2 – Manufacturing Safely			
Write a plan for making a coat hook.			
Write a paragraph explaining each of the stages and what safety measures you needed to take when working.			
In a table, identify each stage in making your coat hook and say what tools were needed.			
Write a risk assessment showing who might be harmed and how at each stage.			
Include the control measures used to prevent you from being harmed.			
Year 9 Module 3 – Computer Aided Design			
Explain what is meant by CAD.			
Write a paragraph explaining the benefits of using CAD and CAM in engineering.			
In a table compare and contrast the advantages and disadvantages of using CAD and CAM.			
Write a conclusion of what you have found.			
Write an essay discussing the following statement: Using CAD and CAM is bad for people because it costs jobs.			