St. Bede's Catholic Comprehensive School & Byron Sixth Form College

St Joseph's Catholic Academy

St. Wilfrid's R.C.College

KS4 BTEC ENGINEERING Knowledge Organiser

Level 2 Tech Award in 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		
MODULE 4		
MODULE 5		
MODULE 6		

Intent, Implementation and Impact in KS4 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.

Course Structure KS4 BTEC Engineering

Level 2 Tech Award in Engineering

- BTEC Tech Award (equivalent to 1 GCSE)
- 3 components covered over 2 years
- Graded Pass (C) / Merit (B) / Distinction (A) / Distinction* (A*)

Component 1
Exploring Engineering Sectors and Design Applications
30% Internally assessed assignment/practical work **A** Understand engineering sectors, products and organisations, and how they interrelate **B** Explore engineering skills through the design process

BTEC

Research into Two Components

Having thought about the whole London Eye I realised it was very complicated, so I am just going to look at a small part, how it turns around. The picture below shows this.

Course Structure KS4 BTEC Engineering

Component 2

Investigating an Engineering Project

30% Internally assessed assignment/practical work

A Understand materials, components and processes for a given engineered product

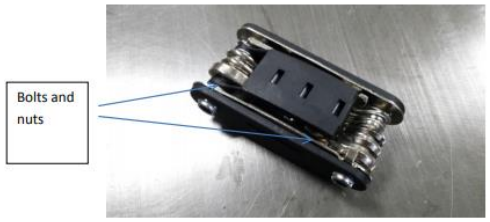
B Investigate a given engineered product using disassembly techniques

C Plan the manufacture of and safely reproduce/inspect/test a given engineered component.

Bike Multi-tool

Part One

This is the multi-tool that I was given to investigate. It is held together by two allen head bolts and steel nuts.



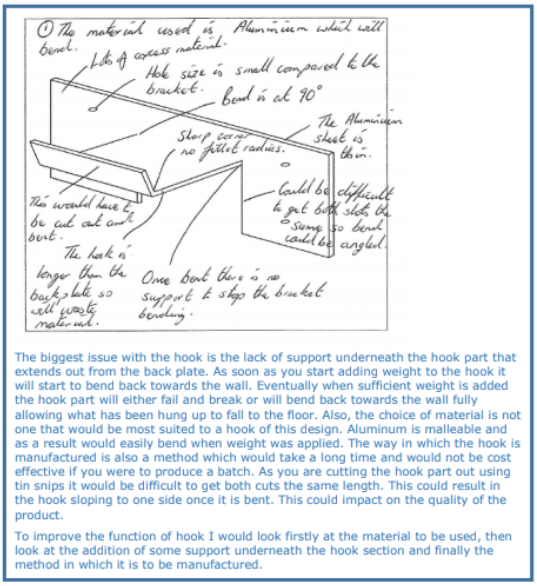
The first thing I did was to use an Allen key to remove the two long bolts that held the mult-tool together. I did not need a spanner becase the plastic casing stopped the nut from turning at first. As the bolts got loose I used a spanner to hold the lock nut and was able to undo the bolt the rest of the way. I did not need any other tools to undo the mult tool. I used the assembly drawing provided by Mr Marsden to help identify what each part was so I could take it apart in a good sequence and safely and so I knew the materials used to make it.

Component 3

Responding to an Engineering Brief

40% Externally assessed synoptic set task

AO1 Understand how to respond to an engineering brief AO2 Select skills and techniques in response to an engineering brief AO3 Apply skills and techniques in response to an engineering brief AO4 Evaluate and review the outcomes of the application of skills and techniques in response to an engineering brief



The biggest issue with the hook is the lack of support underneath the hook part that extends out from the back plate. As soon as you start adding weight to the hook it will start to bend back towards the wall. Eventually when sufficient weight is added the hook part will either fail and break or will bend back towards the wall fully allowing what has been hung up to fall to the floor. Also, the choice of material is not one that would be most suited to a hook of this design. Aluminum is malleable and as a result would easily bend when weight was applied. The way in which the hook is manufactured is also a method which would take a long time and would not be cost effective if you were to produce a batch. As you are cutting the hook part out using tin snips it would be difficult to get both cuts the same length. This could result in the hook sloping to one side once it is bent. This could impact on the quality of the product.

To improve the function of hook I would look firstly at the material to be used, then look at the addition of some support underneath the hook section and finally the method in which it is to be manufactured.

Learning Journey
KS4
BTEC Engineering

Research & Development

Task analysis
Existing product analysis
Material Properties
Components
Cutting, Shaping , Joining and Forming techniques

Record

Measuring /recording data
Displaying data
Anomalous results and evaluating the testing process
Carrying out a process and Planned procedures

Modelling

Final design solution
Evaluation of ideas
Circuit diagrams
Design for manufacture
Prototypes

Evaluation & Redesign

Evaluation
Evaluation using a brief
Patterns , trends and modifications

Revision

Data collection and tabulating
Materials and their processes
Analysis and evaluating

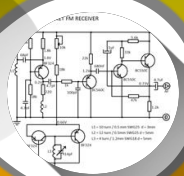
To Btec Level 3 and beyond

Investigate

Practical skills & Product Analysis
Reverse Engineering
Disassembly
Health & Safety

Design & Manufacture

2D and 3D sketching
Exploded diagrams
How to write a specification
Design ideas
CAD



Planning

Types of engineering information
Different componentry
Planning
Process exploration
Justifying the process

Engineered world

Fulfilling a primary purpose
Wider factors
Engineering sectors
Sector products
Jobs roles in engineering

Exams

Component 3 Exam
Responding to an Engineered Brief
Part1: Practical task testing and evaluating
Part2: Design and Justify

Content KS4 BTEC Engineering

Component 1

Learning aim A: Understand engineering sectors, products and organisations, and how they interrelate
A1 Engineering sectors, engineered products and interconnections
A2 Engineering organisations, functions, job roles and career progression
You will explore the interconnections between engineering sectors, organisations and job roles.

Learning aim B: Explore engineering skills through the design process
B1 The design process
You will produce a design proposal for an engineered product to meet the requirements of a customer.

Component 2

Learning aim A: Understand materials, components and processes for a given engineered product
A1 Materials
A2 Components
A3 Processes
You will investigate the materials, components and processes used in the production of engineered products.

Learning aim B: Investigate a given engineered product using disassembly techniques
B1 Practical engineering skills
B2 Disassembly techniques
B3 Product design specification
You will prepare a product design specification (PDS) for an engineered product by investigating its construction and manufacture.

Learning aim C: Plan the manufacture of and safely reproduce/inspect/test a given engineered component
C1 Engineering
C2 Develop a production plan
You will reproduce a component from the previously dismantled product using the same materials and making processes

Component 3

Learning Aim A: Carry out a process to meet the needs of an engineering brief
A1 Carry out a process
A2 Recording the process
A3 Interpretation of data
You will develop an understanding of practical procedures and explore how to record, collect and interpret data in an engineering context.

Learning Aim B: Provide a design solution for an engineered product against the needs of an engineering brief
B1 Interpretation of a given brief for an engineered product
B2 Redesign
B3 Evaluation
You will develop an understanding of how to interpret a brief and explore design ideas, including their viability as a final solution.

Learning Aim C: Provide solutions to meet the needs of an engineering brief
C1 Analysing engineering information associated with the problem
C2 Selecting a solution
C3 Problem solution
You will develop an understanding of how to analyse information in an engineering context and will explore how to select a suitable solution and implement it to meet the brief.

Knowledge Organiser: KS4 BTEC Engineering

Component 1 A1:
Engineering sectors, engineered products and interconnections

Key skills

To become an engineer, you will need:

- Effective technical and problem-solving skills
- Commercial awareness
- Good attention to detail
- Creativity
- Interpersonal and communication skills
- Presentation skills
- The ability to work as part of a team

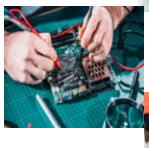
Key words

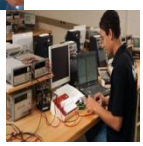
Chemical
Civil
Electrical
Mechanical
Communication
Computer
Maintenance
Aerospace
Automotive

Key knowledge

Chemical Engineering	The activity of applying chemistry to the solution of practical problems.
Civil Engineering	Civil engineering is a field of engineering that deals with the construction and maintenance of the structures that are required for human civilization, such as buildings, roads, and sewers.
Electrical Engineering	Definition of electrical engineering. the branch of engineering science that studies the uses of electricity and the equipment for power generation.
Mechanical Engineering	Mechanical engineering is the application of physical principles to the creation of useful devices, objects and machines.
Communication Engineering	Engineering concerned with the sending and receiving of signals especially by means of electrical or electroacoustic devices and electromagnetic waves.
Computer Engineering	Computer Engineering is defined as the discipline that embodies the science and technology of design, construction, implementation, and maintenance of software and hardware components of modern computing systems and computer-controlled equipment
Maintenance Engineering	Maintenance Engineering is the discipline and profession of applying engineering concepts for the optimization of equipment, procedures, and departmental budgets to achieve better maintainability, reliability, and availability of equipment
Aerospace	Aerospace is the human effort in science, engineering, and business to fly in the atmosphere of Earth (aeronautics) and surrounding space (astronautics).
Automotive	The automotive industry comprises a wide range of companies and organizations involved in the design, development, manufacturing, marketing, and selling of motor vehicles.






Knowledge Organiser: KS4 BTEC Engineering

Component 1 A2:
Engineering organisations, functions, job roles and career progression

Key skills	
Education	• To access an apprenticeship in any sector you will need good GCSE's including at least a 4/5 in English and Math so you can communicate and work things out. • Some roles you will need a degree so you have to study engineering at level 3 or A Levels to get on the course. • Some degrees have specialist units for the different sectors but a lot of them are general and you learn transferrable skills to use in all sectors of engineering.
Financial goals	• All engineering companies aim to make money so as to be successful. • Maximizing profit by reducing costs and maximizing sales. To do this, all companies need to borrow money when they start up and when they make significant investments to development.

Key knowledge

Advantages of using engineers from different sectors to produce the different components

- Sectors will have experts who have experience of working with the specific product or type of product being designed, this means they will be aware of potential opportunities such as developments in new technology or legislation. For example, an engineer working on a mobile phone will need to know about different technology and regulations to one designing a platform for an oil rig.
- By having different sectors working on their specific products engineers are more able to stay focused and up to date on the latest developments in their area of the industry.
- Specialist engineers will also know the different potential issues with their specific product or component and be able to give specialist, focused advice based on their knowledge and experience.
- Staff in each sector are already experienced, they will require limited additional training and input when generating new products.
- Experienced engineers working on a project makes mistakes less likely.
- Where a product crosses over different sectors, like the electric bike, by having experts in each sector, the design team can be confident that they are getting the best possible outcome for their customer.

Key words

Sector
Career
Components
Experience
Organisation
Profit
Sales
Investment
Finance
Technology
Legislation
Knowledge
Skills
Customer
User
Client
Industry

Curriculum Links

Maths: Profit, time scale, planning.
Science: chemical and industrial processes.

English: research skills and written communication
ICT: word processing, flow charts.

Careers/ Cultural Capital: sectors and roles in engineering, successful business ventures, analytical skills.

Knowledge Organiser: KS4 BTEC Engineering

Component 1 B1:
Engineering organisations, functions, job roles and career progression

Key skills

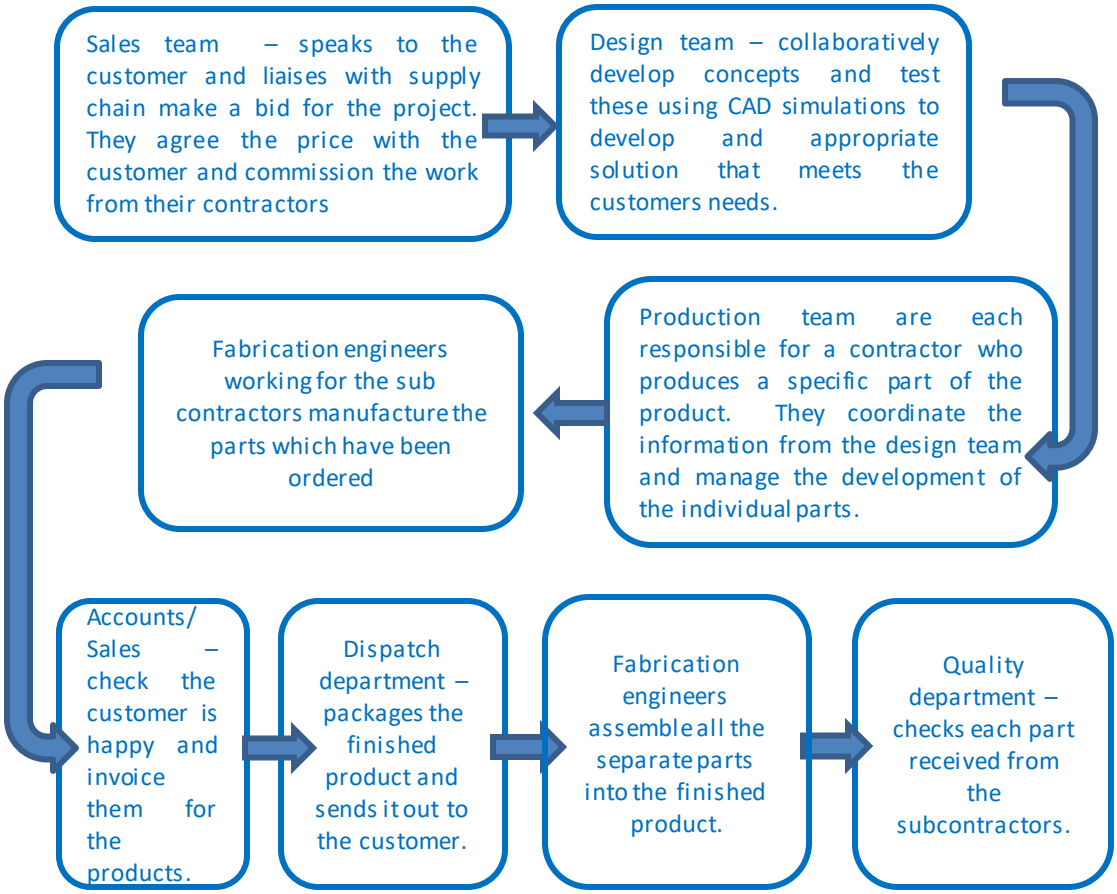
- Interpersonal and communication skills . The need for communication is prized as an engineer and happens through many mediums. Spoken communication is an obvious skill but what if language barriers cause unintended confusion of grey areas. This is where drawings/diagrams are extremely useful. But these can also come in many forms so being able to understand them and which are best suited to a task is very important.
- The ability to work as part of a team.

Key words

Sector
Career
Components
Experience
Organisation
Interpersonal
Barriers
Team
Fabrication
Production

Key knowledge

As the example below shows, a product may pass through many engineer's hands before reaching completion. Understanding that it is a team effort to manufacture successfully is a key part of being an engineer.
Example Organisation: Shimano (Bicycle gear systems)



Knowledge Organiser: KS4 BTEC Engineering

Component 2 A1: Materials - Metals

Key knowledge

Where is metal sourced?
Metal is sourced below the earth's crust. It is found in mineral deposits known as ORE. It is excavated from the ground using explosives and heavy earth-moving machinery. It is then refined through melting processes to separate the different ores and waste materials.

What is a ferrous metal?
Ferrous metals contain IRON, also known as iron ferrite. Iron in it's pure form is a soft grey material that is difficult to machine and gives a poor surface finish and the material is also magnetic. The addition of carbon changes and improves its properties, allowing for the production of steel and cast iron, these materials are prone to corrosion(rust) when exposed to water.

What is a non ferrous metal?
Non ferrous metals do not contain iron and are widely used in engineering sectors due to their properties. They tend to withstand corrosion from weather and aren't magnetic. They tend to be more considerably more expensive due to this beneficial property.

Key words

Extraction
Ore
Ferrous
Non-ferrous
Resistance
Corrosion
Malleable
Ductile
Magnetic
Electrical
Ferrite
Pure
Alloy
Magnetic
Dies
Electrical
Machinable
Beneficial
Properties
Refined

Name	Properties		Uses	Ferrous/Non Ferrous
Copper	Corrosion resistant Malleable & Ductile	Good electrical Easily machined	Electrical wires Pipes	Non ferrous
Stainless steel	Hard Tough	Sometimes magnetic Difficult to cut	Cutlery Sinks Medical equipment	Ferrous
Mild Steel	Tough Ductile	Magnetic Malleable	Screws Nails Bolts	Ferrous
Tool Steel	Hardness Resistance to abrasion	Resistance to deformation	Tools Shaping dies Cutting tools	Ferrous
Aluminium	Corrosion resistant Malleable	Ductile Easily machined	Aircraft Foil Drinks cans	Non ferrous

Knowledge Organiser: KS4 BTEC Engineering

Component 2 A1: Materials - Polymers

Key knowledge

Plastics are manufactured by joining Carbon and Hydrogen atoms to create polymer chains. The correct term to describe plastic materials is **POLYMERS**. Polymers are sub divided into 2 main categories **THERMO** Polymers and **THERMO-SETTING** Polymers. Thermoplastics are often more durable and much easier to recycle.

What are environmental issues of using polymers?
It is becoming increasingly important to recycle polymers to reduce their impact. The extraction, manufacture and disposal of polymers is very damaging due to the amount of energy and waste that is produced.

Key words

Thermoplastic
Thermosetting
Durable
Recycle
Decompose
Rigid
Degrade
Resistant
Stabilise

What is a thermoplastic?
They can be softened by heat and reshaped, allowing them to be recycled. They do, however, become brittle when this process is repeated.

Name of plastic	Properties	Uses/ Image
Acrylic	**Strong Rigid Light**	**Lenses Replacement for glass Bent or moulded**
HDPE	**Flexible Good moisture barrier**	**Plastic Bottles Recycled into low grade plastic products (bin bags)**
PET	**Highly ductile Very tough Easily re-formed**	**Plastic bags**
HIPS	**Impact resistance Low cost Machinability**	**Appliance components e.g. casings Toys.**
Expanded Polystyrene	**Lightweight Good resistance to compression Good insulator**	**Protective cover on electronics/ fragile items**

What is a thermosetting plastic?
Create cross links in their polymer chains that stop them from being reformed by heat. They are useful around electrical products and cooking implements

Name of plastic	Properties	Uses
Urea Formaldehyde	**High strength Rigid Cost effective**	**Electrical components e.g. Plugs**
Phenol Formaldehyde	**Easily moulded Good resistance to freezing temperatures Poor conductor**	**Pan handle Circuit boards**
Melamine Formaldehyde	**Scratch resistant Good heat resistance**	**Laminate worktops Plastic cups plates**
Epoxy resin	**Good electrical insulator, hard, brittle unless reinforced, resists chemicals well.**	**Used for casting, bonding of other materials. Surface coatings.**

Knowledge Organiser: KS4 BTEC Engineering

Component 2 A2: Components

Key skills

Accuracy: Being able to accurately measure components will help you to identify and quantify them.
Tolerance: Noting small differences from the specification and whether they will make any difference in your final product and when it could/would become a problem.

Key words

Proprietary
Component
Resistor
Capacitor
Diode
Cir clip
Fuse
Tolerance

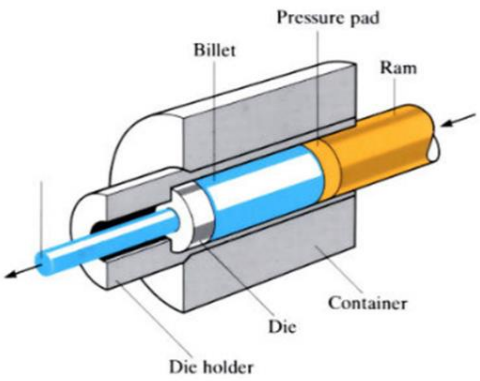
Key knowledge

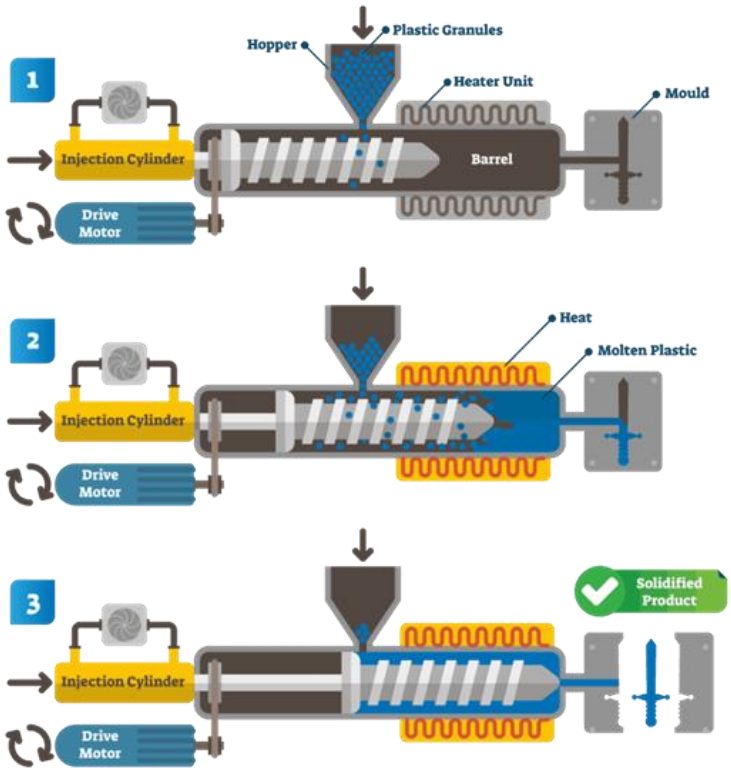
What is a proprietary component?
A product that is manufactured in stock sizes at large quantities by one company to be sold to others at a low cost due to mass manufacture and provide ease of supply.

Proprietary Component	Description	Uses/ Image	Permanent/semi permanent
Nut and bolt	Two threaded components that are twisted together to hold materials in place through holes.		semi permanent
Screw	A component that has a thread which digs itself into materials. Many different varieties		semi permanent
Cir clip	Flexible, can be pushed into a groove to allow rotation but no lateral movement.		semi permanent
Key	Has a contoured shape to fit a lock and rotate a barrel to typically hold doors in place.		semi permanent
Electronic Component	**Description**	**Uses/ Image**	**How is the value measured?**
Resistor	These are used to reduce current flow in a circuit and have differing values		Ohms
Capacitor	They smooth out power supplies and can be used to filter signals.		Farad
Fuse	A protective safety device that breaks a circuit if too much current is drawn.		Amps
Diode	Is used to ensure current flows in the right direction and prevent short circuits and damage to other parts		Resistance

Knowledge Organiser: KS4 BTEC Engineering

Component 2 A3: Processes

Key knowledge		Key words
Process Name	Extrusion	Extrusion Forming Injection Moulding Work piece Die Cross Section Regular Pellet Pressure
	Metal extrusion is a metal forming process in which a work piece, of a certain length and cross section, is forced to flow through a die of a smaller cross sectional area, thus forming the work to the new cross section. It can be performed either hot or cold and can be used to make lengths of material with complex but regular cross sections.	

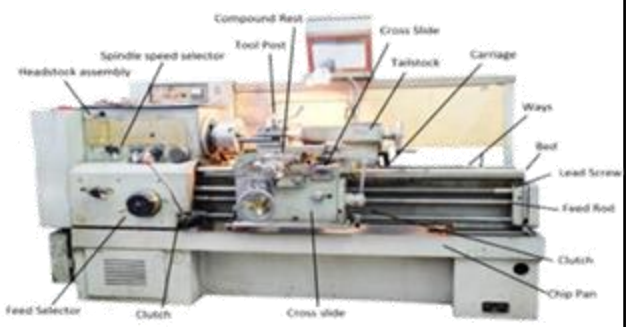
Process Name	Injection Moulding
	**Injection** – the molten thermoplastic material, which has been melted by pellet form in the barrel of the machine, is injected under pressure into the mould through either a screw or ramming device. **Dwelling** – once the molten plastic is injected into the mould, more pressure is exerted to make sure all the mould's cavities are filled, using hydraulic or mechanical pressure. **Cooling** – the plastic is left to cool and solidify within the mould. **Opening** – the movable platen is separated from the fixed platen to separate the mould. **Ejection** – ejection is completed by the use of rods, a plate or an air blast to remove the plastic component completely from the mould.

Knowledge Organiser: KS4 BTEC Engineering

Component 2 B1: Practical engineering skills

Key knowledge

Turning



Milling

Lathe (Turning)

Description of process	Products produced	Advantages	Disadvantages
Turning is a machining process in which parts are created by cutting away unwanted material from a larger piece. Material is cut away as the **work piece** is rotated at high speeds. Turning refers to shaping material on a manual or automatic **lathe**. The lathe grips the material within a **chuck**, and a cutting tool, which can be of various shapes and sizes, is used to produce cylindrical shapes.	**Non-permanent fastening components**  **Engine parts** 	An advantage of a lathe machine is that it can perform very detailed and intricate designs. Produces perfect circular work even from square stock. High quality surface finish. Can also be used to drill.	A disadvantage of a lathe machine is that these machines are more expensive than other types of machines used to produce this type of work. Takes a lot of experience and skill to produce detailed work repeatedly. Slow production rate, unless used with CNC equipment.

Milling Machine

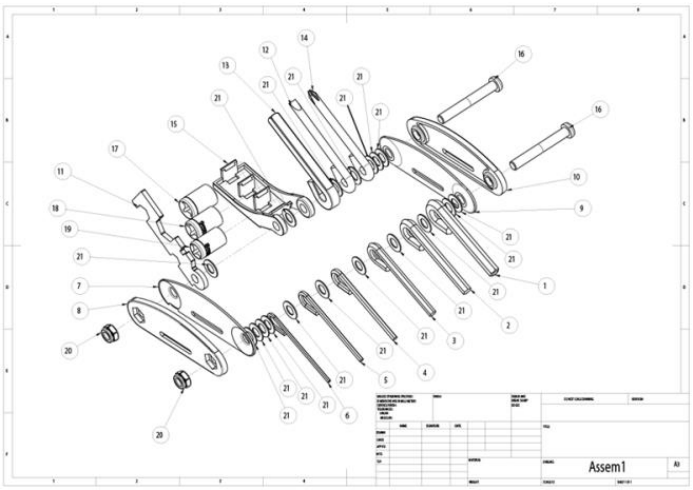
Description of process	Uses	Advantages	Disadvantages
Horizontal Milling They can also be used to create **slots** and **recesses**. A milling machine does this by using a rotating cutter with multiple teeth that remove material from the surface of the work piece. **Vertical milling** Vertical milling machines differ from horizontal ones in that they are fitted with cutters that have multiple cutting edges, and most feature CNC systems. Many commercially milled items are produced on a CNC milling machine- particularly complex shape, which can be programmed and then accurately repeated time after time.	**Wide variety of mechanical components** 	The metal is removed at a faster rate as the cutter has got multiple cutting edges and rotates at a higher speed. The table of the machine can be moved to an accuracy of 0.02mm. It is very useful since various cutters and precise tools can be machined.	The cost of the milling machine is high. As milling cutters cost high, the investment for procuring tools is more. The tooling cost will increase if we need to add a CNC unit to produce more detailed shapes, quicker.

Knowledge Organiser: KS4 BTEC Engineering

Component 2 B2: Disassembly techniques

Key knowledge

What do we mean by the term disassembly?
The action of taking something to pieces, for us as engineers this is to see how the product is made and how it fits together. There are valuable things to be learned on how a product can be improved when we look at how it is currently made.



Here you can see an example of an exploded drawing. This drawing is of a bicycle maintenance/repair tool. By using this drawing technique you can see how the parts fit together in sequence and it's easier to see each individual part. They are numbered and these numbers will correspond to a description table.

Although you may not be able to draw a drawing to this standard at first it is important you know how they work and the reason they are used.

When you are disassembling a product it is important that you log each part and describe it accurately using correct terms and measurements (see chart below). Noting any issues when disassembling can also aid in how you might improve future products.
Observing and recording : Visual features, surface features, mass, colour, degradation(wear), identification marks

<u>Disassembly Techniques:</u>

- Removal of semi-permanent fixings
- Parts removal and layout
- Replacement of non-reusable consumables or fixings

Key words

Disassembly
Construction
Manufacture
Exploded
Techniques
Reverse engineering
Maintenance
Repair
Sequence
Description
Function
Visual
Mechanical
Surface Features
Degradation
Fixing
Consumable
Thread
Japanned
Plated
Identification marks
Development

#	Component	Description	Material
20	M6 hex nut	The lock nuts are M6 in size and have a mass of 8g. it is 6mm thick. There is a lot of wear on the edges of the nuts where they have been tightened and probably the spanner has slipped. The inside of the nut has a piece of black nylon that grips the thread of the bolt. The nut is silver in colour and shiny.	Chrome plated steel and nylon
16	M6 40mm hex socket cap bolt	The bolts are 45mm long and has a mass of 15g each. They have been Japanned to give them a black colour. The bolts have a screw thread that is 20mm long and the steel colour can be seen through them. There is some wear to the bolt head where Allen keys have been used to open it up before. There are no identification marks.	Mild steel with Japanned finish.
6	2mm Hex	The Allen keys range from 58mm to 63mm long and 3mm to 6mm wide. The loop is a little bit bigger than 6mm diameter. The Allen keys are a shiny silver colour. There are some marks on the sides and ends of the Allen keys where they have been used. There are no identification marks. The assembly drawing and parts list shows that there are 3mm, 4mm, 5mm, 6mm and 8mm Allen keys and a square key to use with the sockets	Chrome plated steel
5	2.5mm Hex		
4	3mm Hex		

Knowledge Organiser: KS4 BTEC Engineering

Component 2 B3: Product design specification

Key skills

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?

Key knowledge

A specification gives clear guidelines about the criteria that we must follow to make sure that our product is safe and able to meet our needs or that of the client. You will also need a detailed brief to judge whether your solution is successful when you EVALUATE it at the end of the design process. The more detail in your product design specification the easier it will be to evaluate it.

You may have heard or seen specifications before they tend to appear on a lot of electrical products and highlight the features of the product (shown in example) They are very important, imagine you buy a product that says it can do certain things and then it can't, you would not buy from that company again would you?

Knowledge Organiser: KS4 BTEC Engineering

Component 2 C1: Engineering manufacture process

Key skills

You must
- Define the problem.
- Develop possible solutions.
- Choose a solution.
- Manufacture using engineering processes.
- Inspect and test your chosen solution.

Key words

Development
Disassembly
Environment
Production
Scale
One-off
Batch
Mass
Continuous

A
C
C
E
S
S
F
M

Key knowledge

- Examine the product using the same ACCESSFM we use for the specification to try and highlight any problems or areas for improvement. This may also include disassembly of the product.
- Complete research on the manufacturing methods used to make the product. e.g. if it has die cast what are the advantages of that process.
- Do the manufacturing process suit the product needs, could there be a more cost effective method of making the product or is there a more environmentally friendly method/material that could be used.
- Research alternatives using the internet , resources or books available to find a possible improvement.
- Ultimately are the processes suitable for the scale of production? Check the table below to see how production scales are defined.

Name/ Type	How many	Key Info	Examples of Products
One-off Production	1	• Also known as Bespoke or Prototype manufacture • Custom-made products • Specialist workers/ skills • Specialist machines and materials • High Quality but expensive	Towers / Bridges One-off Houses Custom made cars
Batch	10s-1000s	• Uses a mix of workers and machinery • Uses jigs, moulds and templates to help make identical products • Stations of workers e.g. cutting station, painting station, etc • Can have some variation e.g. colour, finish, flavour	Limited edition car Clothing Furniture
Mass	10,000s - 100,000s	• Big assembly lines (and sub-assembly lines) • Heavily automated • Standard and identical products • Little worker input	Cars Microchips Plain shirts
Continuous	100,00s +	• 24/7 production • Heavily automated • Standard and identical products • Little worker input	Energy Electrical components Screws/Nails

Knowledge Organiser: KS4 BTEC Engineering

Component 2 C2: Develop a production plan

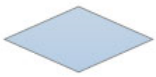
Key skills

Planning documents should include:

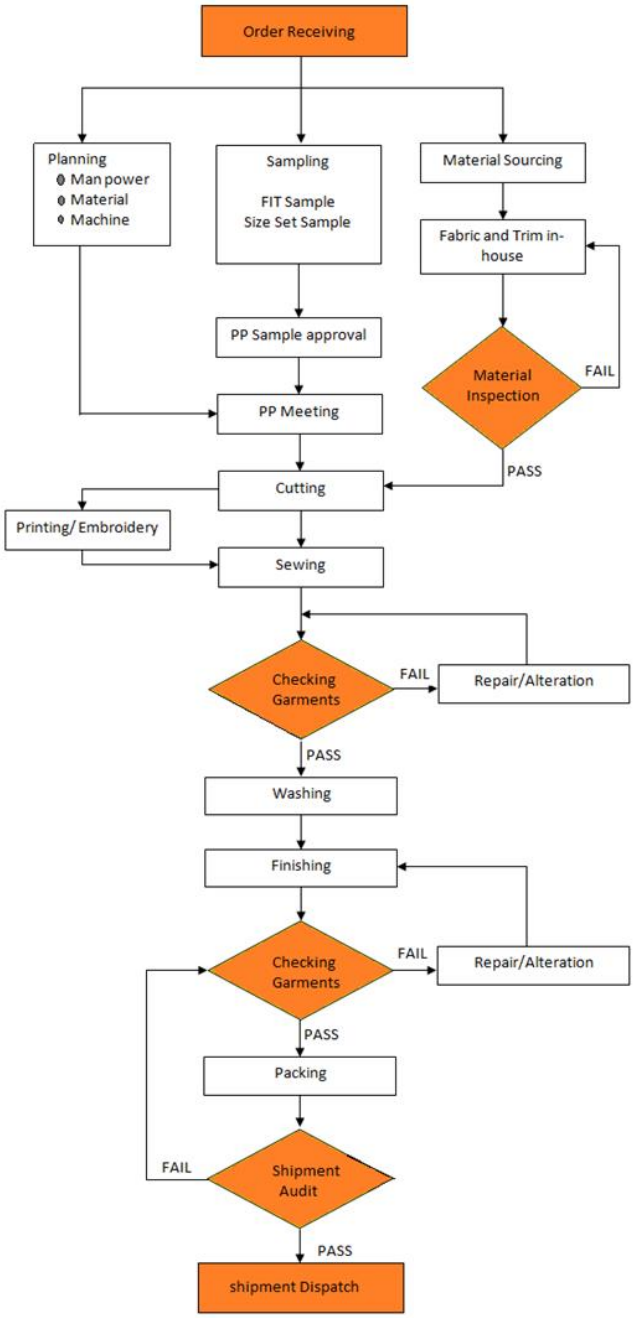
- health and Safety information
- operation/processes
- inspection, testing and quality standards
- equipment/tools
- materials and components
- quantity, e.g. one-off, batch, mass production

Key knowledge

There are a few ways to plan production/manufacture of a product but flow chart are one of the clearest. The basic symbols are below.

Symbol	Name	Function
	Start/end	An oval represents a start or end point
	Arrows	A line is a connector that shows relationships between the representative shapes
	Input/Output	A parallelogram represents input or output
	Process	A rectangle represents a process
	Decision	A diamond indicates a decision

They can differ in use as some companies/programs (as you can see in the example to the right) like to us their own systems and some can get very complicated but there will always be a key to explain what the shapes indicate is happening.
There are also (Bills of Materials) B.O.M, which are basically a list of the components their dimensions/weight and quantities needed for the job just like a shopping list.



Why use planning documents?

- Clear understanding of process , responsibilities and their stages
- Straighten out any issues that could possibly arise and put plans in place.
- Helps give guidance for those unfamiliar with the process.
- Can also be used to provide timescales.
- Can help with providing demand for stock levels.

Knowledge Organiser: KS4 BTEC Engineering

Component 3 A1: Carry out a process

Key skills

- Following planned procedures.
- Using and testing a prototype/model.
- Assembling, handling and using materials, equipment and machinery.

Key words

Prototype	Testing
Experiment	Correlation
Conclusions	Data

Key knowledge

In your exam you will be asked to follow a set of instructions to complete a practical task under exam conditions. There will be a demonstration first.

TEACHER DEMO:

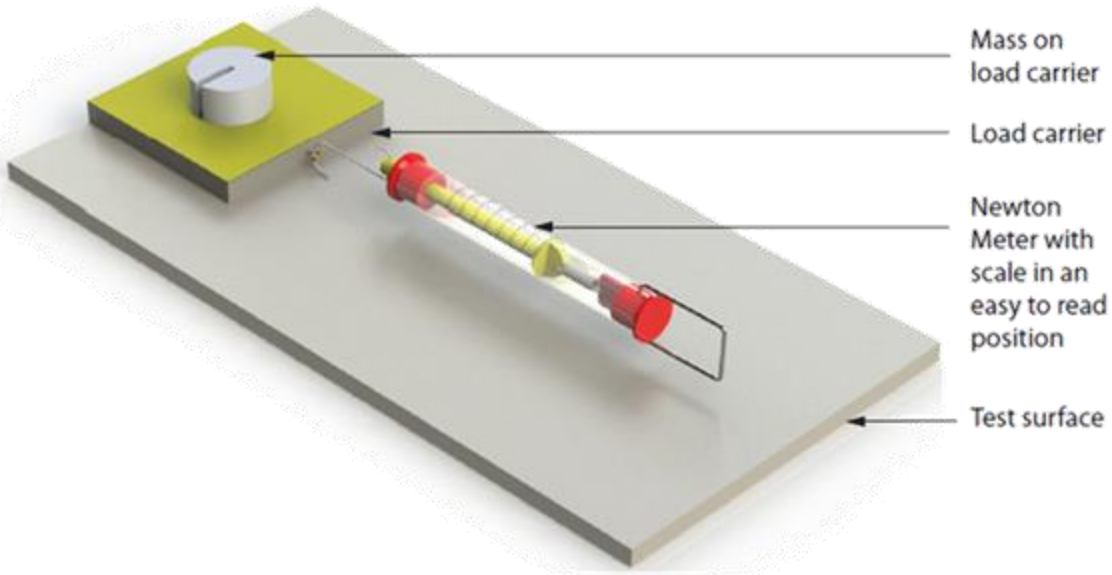
- Watch the teacher carefully
- Look for issues with the design of the experiment
- Consider how fair the test is / whether the data will be accurate and robust
- Make notes of anything you think could be improved

PUPIL ACTIVITY:

- Follow the instructions from the demonstration and in the paper to get your own results.
- Record the results on scrap paper as you go through.
- When complete fill in the table in the paper (marks for neatness/clarity)
- Use regular spacing for data e.g. every 10s or 10mm – be logical!
- Take enough data to fill the table
- Put the table in order e.g. smallest to largest
- Include units (and titles if needed)

Past Paper Example

Here is an example of a task from a past paper where students had to create a table of results by varying the mass on the scale and drawing conclusions as to the effect it would have.



Knowledge Organiser: KS4 BTEC Engineering

Component 3 A2: Recording the process

Key skills

- Follow, or create as needed, the instructions.
- Record the results on paper as you go through.
- When complete fill in the table in the paper (marks for neatness/clarity).
- Use regular spacing for data e.g. every 10s or 10mm – be logical!
- Take enough data to fill the table.
- Include units (and titles if needed).

Key words

Data	Units
Quality	Measurement
Axis	Investigation
Scaling	Tally
Labelling	Anomalies
Best fit	Regular
Tabulate	Horizontal
Record	Vertical

Key knowledge

- <u>Tabulating data</u>
- A) Take measurements using suitable measuring equipment.
- B) Record the results of the investigation in the graph paper or if it is a fairly simple collection of data perhaps use a tally chart as shown below.

Diameter of screw (mm)	Tally	Total
4 x 30	~~IIII IIII IIII~~ III	18
5 x 40	~~IIII IIII~~ II	12
6 x 50	~~IIII IIII IIII IIII~~ III	23
8 x 60	~~IIII IIII IIII~~ IIII	19

- Refer to the **data** and identify the **anomalies**
- As a quality controller you need to be carrying out regular checks to spot issues
- When an issue is seen then the process should be stopped to solve it
- Some example suggestions you can consider as potential solutions are:
  - Improve the quality of tooling – is a more expensive/more accurate version available?
  - Improve the quality of machinery – could you add tooling e.g. jigs or fixtures, or automation?
  - Check correct speeds/feeds are being used– are the machines set up correctly and checked frequently?
  - Do staff need more training?
  - Could including additional help or staff improve the reliability or accuracy? Are staff fatigued – more breaks or changes in activity?

Knowledge Organiser: KS4 BTEC Engineering

Component 3 A3: Interpretation of data

Key skills

Measuring and recording data

Accuracy: Depends on the way in which measurements are taken and how they are recorded.

Degree of accuracy (Tolerance):is half a unit on either side of the unit of measure; if the unit is 1, then any measurement between 9.5 and 10.5 will be measured as 10.

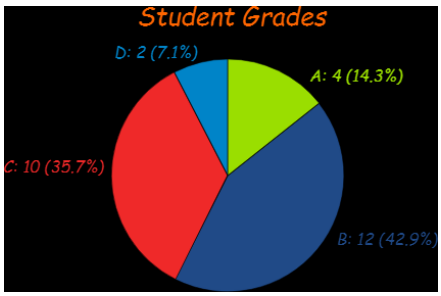
Reliability: Depends on their being only small variations in data and measurements being within tolerance.

Precision: Refers to the closeness of two or more measurements to each other. For example, if you weigh a given substance five times, and get 3.2kg each time, then your measurement is very precise.

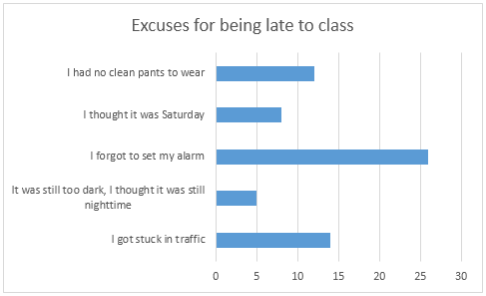
Key knowledge

Chart/Graph types

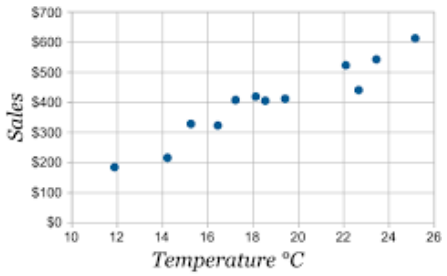
Pie Chart



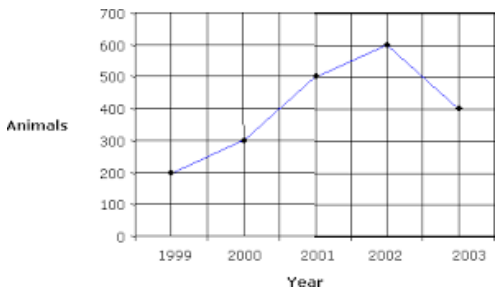
Bar Chart



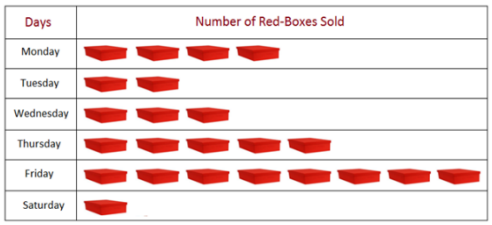
Scatter Graph



Line Graph



Pictograph



These are the main types you need to be confident in using. They all have their uses but the main thing is that you choose the best for communicating your data effectively and clearly using the skills above.

Key words

Tabulating
Units
Measurement
Investigation
Tally
Anomalies
Data
Quality
Axis
Scaling
Labelling
Best fit
Pie
Bar
Scatter
Line
Pictograph
Precision
Reliability
Accuracy
Tolerance
Horizontal
Vertical
Repeatability

Knowledge Organiser: KS4 BTEC Engineering

Component 3 A3: Interpretation of data

Key Skills

Interpreting data

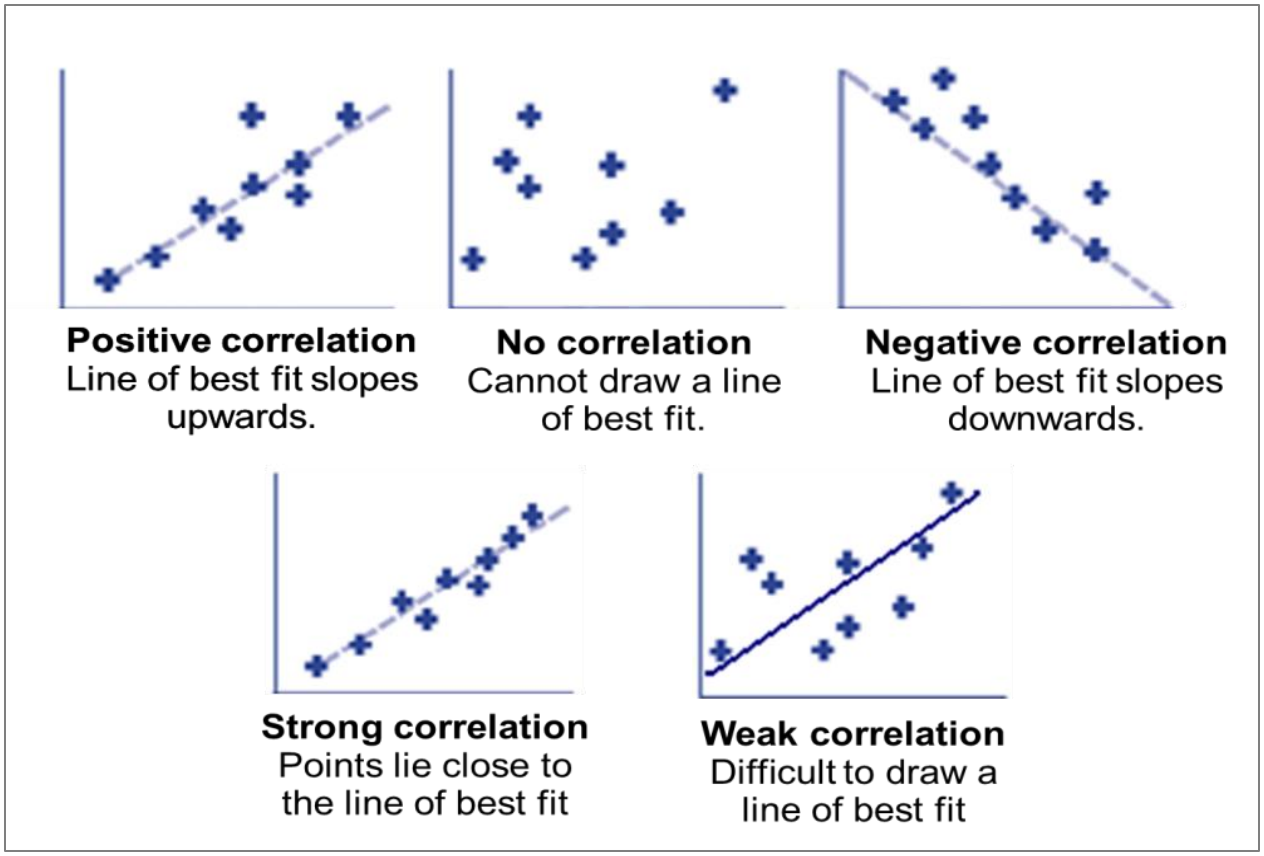
- Identifying ANOMALOUS results or sources of error.
- Comparison of trends/patterns in data, to include tables , charts and graphs.
- Evaluating the process, to include testing process used, recording /processing results.
- Drawing valid conclusions.
- Making recommendations related to engineering briefs.

Presenting Data

Scatter graphs are used to compare two sets of data (e.g. age and height). They can be used to look for a connection between the two sets of data. This connection is called a **correlation**.

LINES OF BEST FIT

- When there is a connection between two sets of data, we can draw a **line of best fit**.
- The line of best fit shows the **general trend** of the data.
- You can draw the line wherever you think it fits best.
- But ideally it should have an equal number of markers on each side of it.



Knowledge Organiser: KS4 BTEC Engineering

Component 3 B1: Interpretation of a given brief for an engineered product

Key skills

- Underline key words in the brief – what are they focusing on (e.g. tolerance, measurements, attributes = function).
- Analyse product fully with ACCESS FM.
- Identify successes of the product.
- Describe any weaknesses.
- Explain the impact of any weaknesses on the product.

Key words

Brief
Interpretation
Analysis
Impact
Material
manufacture

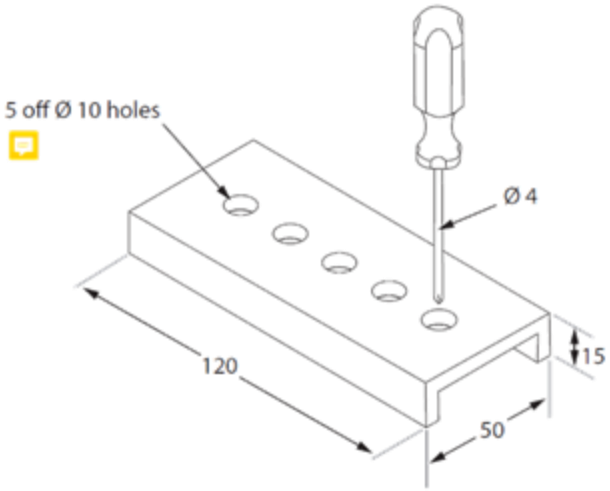
Key knowledge

Below is an example of an exam question around an engineering brief there are some keys highlighted.

Set task information

Engineering Brief

A customer wants to place an order for 1000 stands to hold screwdrivers. The screwdrivers will be placed into the 10mm diameter holes. A technician at your company designs and makes the stand shown below as a possible solution. The stand is made from medium carbon steel which is supplied as a rectangular section that is 15mm thick.



To make the stand, the technician:

- marked out the length, the position of the holes and the slot at the bottom
- cut the steel to length
- cut the slot underneath using a milling machine
- drilled the 10mm holes using a pillar drill

A
C
C
E
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F
M

WEAKNESSES: The main weakness in this product comes from the fact that the base is only 15mm off the surface and the screwdrivers will fall over as they will not go through far enough.
Other weaknesses:

- Sharpe edges
- Grooved channel along bottom section is a waste of material and time.
- Material can corrode.
- Lots of wasted space.

SUCCESSES: The aren't many as the point of these exam questions is that they are prototypes and they're problematic as they are in their development stages. The few positives are:

- Material used cost effective.
- Holes are correct size to brief.
- Simple shape.

Using ACCESSFM will help you complete a thorough evaluation of the brief against the prototype produced. Take into account the processes(technician steps below) used to make the product. What would you change?

Knowledge Organiser: KS4 BTEC Engineering

Component 3 B2: Redesign

Key skills

- Sketch clearly (isometric or orthographic – no difference in marks awarded)
- Make sure all of the idea can be understood.
- Annotate fully with ACCESS FM.
- Link design back to the brief requirements.
- Include dimensions.
- State materials and manufacturing information – give a step by step explanation of how the process works.
- State what changes you have made.
- Explain why this improved the product.
- Link the improvements back to the brief.

Key words

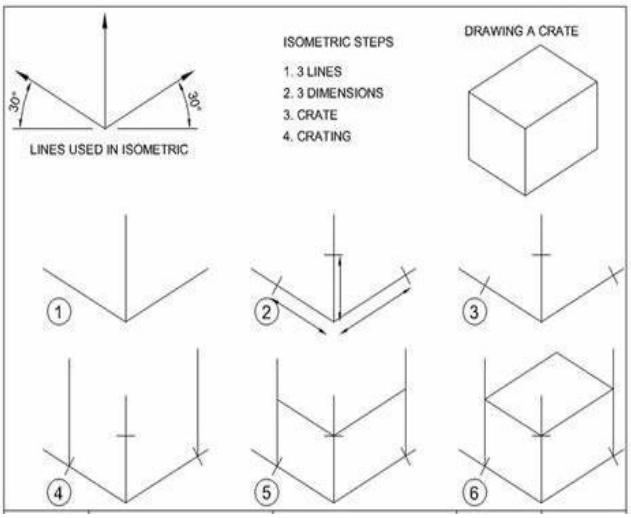
Sketching
2D
3D
Annotation
Fabricate
Componentry
Dimensions

Key knowledge

The best way to communicate a design or redesign changes is through a sketch as it can make things clear as to how something is shaped. Apart from regular 2D sketches there are some key drawing methods you must be familiar with.

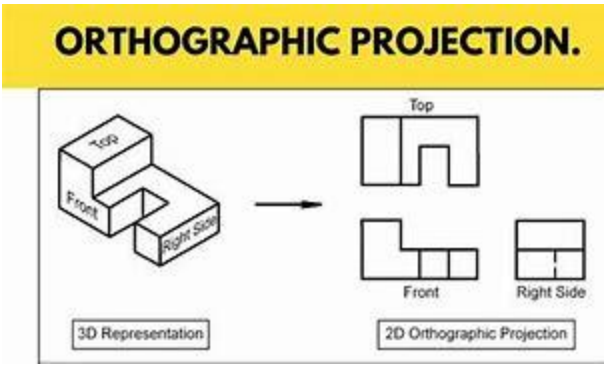
ISOMETRIC

A basic 3D drawing method which puts the drawing at a 30 degree angle so you can see the 3 sides (Top, Front, Side) needed to get a good idea of the shape. In the example shown (Right) is how to set up a simple box or crate as it is known. This 'Crate' can for the box to help draw more complicated shapes such as cylinders. Try using the method to draw a rectangular product you are familiar with.



ORTHOGRAPHIC PROJECTION

Is a lot more complex and tends to be used show products in a lot more detail, usually in the final production stages when dimensions are clear. It basically shows the drawing from the 3 views(Top, Front, Side) in the order shown to give clear dimensions and to a scaled size. It may also include a 3D view.



ANNOTATION

Although the drawings help , annotation alongside to help point out key manufacture points or materials, textures etc. are still key to getting your redesign across.

Knowledge Organiser: KS4 BTEC Engineering

Component 3 B3: Evaluation

Key skills

- Reviewing the credibility/reliability of the design ideas given the needs of the brief.
- Selecting the most appropriate design solution.
- Justification of the design solution.
- Justification of the processes to be used.

Key words

Requirements	Credibility
Processes	Justification
Quality	Client
Modification	

Key knowledge

This section is only as valuable as the effort you put in. The more thorough you are the better the information and the more evidence that you have tried to enhance your product to be as successful as possible. Companies spend massive amounts on these sorts of strategies as the results can be invaluable and possibly change the end product and save it from costly failures! For each section try to ask the following questions:

1. Does the design meet the requirements of the client needs?: Have you meet ALL points made in the brief? Have you met all of your design requirements? If not how could you adapt or change it to do so?
2. Can it be made?:With the materials and processes you chose can it be made? Are there any drawbacks e.g. initial cost of certain production methods or material properties etc.? Have you included enough detail to pass this on to someone else to begin the manufacturing process? As engineers rarely work alone, it is not helpful for one person to have it all in their head and not on paper.
3. Will it meet quality standards?: What ways have you employed to ensure that during the manufacturing process things are done correctly and uniformly every time? How can you ASSURE this will happen (hint hint)?
4. Would your design benefit from being modified?: Accepting faults or oversights is not a weakness, your product will only be successful if you continue to improve it. What improvements could you make that have been highlighted by peer/self assessment? How will this benefit the product or client?

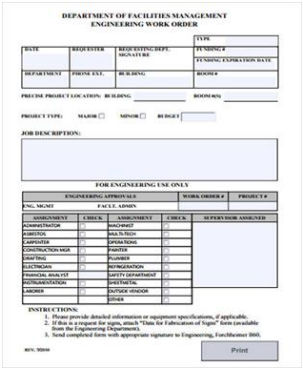
You must enter into the evaluation process objectively and not let pride or your favourite idea get any preferential treatment. Otherwise you will skip through the development stages and end up with an idea that is not fit for purpose and a waste of time and resources. Remember you can even take the best bits from each design and make some far better than any one single idea.

Knowledge Organiser: KS4 BTEC Engineering

Component 3 C1: Analysing engineering information associated with the problem

Key knowledge

Research each of these types of Engineering information <u>Work instructions</u>: Describes how a part or component should be manufactured. They provide information on how to complete a task one step at a time.

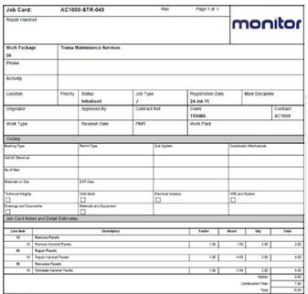


<u>Production data/plans:</u> The process is broken down in to stages so you complete them in the correct order. They will specify:

- Required materials/components
- Tools/equipment used
- Speeds and feeds, how fast they should be going
- Q.C. checks completed
- Timings for each operation

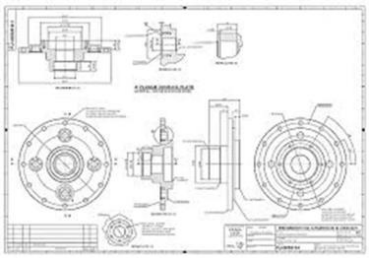
<u>Job cards</u>:
Form of instruction, engineering organisations use these as a way of showing all requirements that need to be carried out. This may include:

- Tools/materials/components needed
- Staffing details
- Timings for activity



<u>Test reports:</u> Should be completed when a specific performance requirement needs to be met. Used to report trends patterns in data of production activity.

<u>Engineering Drawing:</u> Now you have made your own versions of these so you should know what they look like. Find an example of a one for another product



Knowledge Organiser: KS4 BTEC Engineering

Component 3 C2: Selecting a solution

Key skills

- Possible solutions for current and /or potential issues e.g. design, tooling, process.
- Extent to which these solutions have fulfilled their primary purpose.
- Any wider factors that need to be considered in order to meet the brief e.g. resources, need for batch production, safety restrictions, environmental impact.
- Ways in which the solution might be improved on against its primary purpose and/or other factors.
- Using the best fit approach to select the best solution.
- Identifying advantages and disadvantages/limitations/constraints.
- Justifying the best solution.
- Reflecting on processes and making recommendations for improvements to the best solution.

Key words

Identify
Justify
Reflect
Evaluation
Constraints
Matrix
Peer
Client
Modification
Feedback
Review
Gauge

Key knowledge

Once a range of designs have been created it can be very challenging to work out which idea to go forward with. That's where the brief and specification come back into play, using these in EVALUATION MATRIX like the example below to help work out which idea is the strongest overall or which parts of the brief each idea is successful in.

	CRITERIA						RESULTS		
WEIGHTS	15%	17%	23%	5%	19%	21%			
OPTIONS	Size of Target Market	Level of Competition	Ease of Manufacture	Time to Market (Development time)	Profitability & Rate of Return	Tangible Benefits to user	BASE SCORE (Out of 60)	WEIGHTED SCORE	RANK OF IMPORTANCE
Idea 1	8	8	7	5	6	9	43	7.45	2
Idea 2	7	5	8	4	6	7	37	6.55	5
Idea 3	9	2	8	8	5	7	39	6.35	6
Idea 4	8	8	9	7	9	8	49	8.37	1
Idea 5	7	6	7	8	7	8	43	7.09	3
Idea 6	5	6	4	8	7	8	38	6.1	7

PEER /CLIENT REVIEW

As well as this peer/client feedback can be used to help gauge the success of ideas and how they feel you have interpreted the brief. Done correctly this can be very constructive and lead to positive development in your product. There should be at least three areas considered, strengths, weaknesses and ideas for modifications.

Knowledge Organiser: KS4 BTEC Engineering

Component 3 C2: Problem solution

Key skills

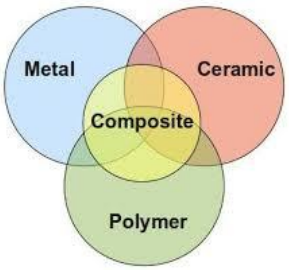
- Identify resources required and their use, to include materials, tools, components, equipment, apparatus, e.g. instruments, sensors.
- Design of solution, to include diagrams, sketches, including measurement, labels/annotation.
- Make processes, to include following the steps needed to create a prototype solution, e.g. rapid prototyping.
- Processes to follow, e.g. in relation to using tools , equipment, and health and safety.
- Manufacturing processes to use, e.g. casting, forging, welding, use of jigs and tools.
- Data collection, analysis and quality, to include trends, meeting specifications, possible solutions.
- Safety considerations, to include hazards and requirements of Control of Substances Hazardous to Health(COSHH) Regulations 2002 where appropriate.
- Considering timescales.

Key words

Equipment
Annotation
Processes
Safety
Consideration
Timescale
COSHH
Regulation
Specification
Quality
Control
Assurance
Hazard
Risk
Assessment
Trends

Key knowledge

The MANUFACTURING SPECIFICATION is obviously more how you would look to make this product you are designing, with the key areas being Materials, Processes and Quality Control.



1. Materials: What materials will you make each section of the product from? There should be some similar areas (Casing, Handle, Lens etc.) but you may have some parts that are individual to your design. Although by this point you may have some basic grasp of possible materials and their properties take some time to research the ones you pick and their benefits/drawbacks.
2. Processes: The materials used will have to go through some sort of manufacturing process to make them into the product you intend. Again take the time to research the process such as injection moulding, extrusion moulding, casting techniques, welding techniques.
3. Quality Control: This is a very important area of your design journey, what you decide here will ensure that product is successful and can be produced in large quantities. Just the use of simple things like jigs, measurement templates (Go/No Go) can vastly improve the end product and speed up the whole process.

Structuring your answers in Engineering

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 think the product should be…*
EXPLAIN	Say WHY you think it.	*This is because…*
EVIDENCE	Say what RESEARCH you've done to back this up.	*I know this from my research into…*

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?

Structure Strips in Engineering

State			Pass
Example Question State two reasons why corrugated cardboard is used as packaging for cooked pizzas.			
1	Reason 1 (1 mark)	It is a rigid material that won't flex and bend as easily as other types of cardboard which offers protection to the pizza.	
2	Reason 2 (1 mark)	The thermal properties of the material as cavities in the cardboard keep the pizza warm.	

Give			Pass
Example Question In 2010 the use of renewable energy in the UK accounted for 6.5% of total energy usage. By 2015 this figure had increased to 25%. Give two reasons for the increase in the use of renewable energy sources.			
1	Reason 1 (1 mark)	The Government set specific targets to reduce CO2 emissions.	
2	Reason 2 (1 mark)	People now have an increased awareness of environmental issues and are more conscientious about them.	

Describe			Pass
Example Question Describe two ways that materials and/or products are strengthened or reinforced. Give examples in your answer.			
1	Description 1 (1 mark)	Layering materials can make materials stronger as you can lay them with their grain in different directions. This ensures the weak lines of the grain are strengthened.	
2	Example (1 mark)	Plywood is created in layers to strengthen the material.	
3	Description 2 (1 mark)	Laminating is adding a plastic coating to a material to make it more rigid, tougher and weather resistant.	
4	Example (1 mark)	Plastic coating is added to card and paper to make the materials more wear resistant and rigid, for example a restaurant menu.	

Explain (written)			Pass
Example Question Explain what is meant by the term 'anthropometrics' and why it is important for designers to consider.			
1	Define key word (1)	Anthropometrics is the study of human measurements.	
2	Give 3 reasons why (3)	Designers need to consider anthropometric data in order to: • ensure that wearable items fit • ensure that products are comfortable • ensure that products are easy to use	

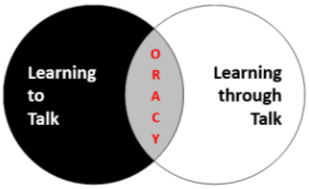
Explain (notes and sketches)			Merit
Example Question Name one industrial process used in the manufacture of a polymer toy musical instrument. In the box below, use notes and/or sketches to explain this process in detail.			
1	Identify (1)	A suitable process would be Injection Moulding	
2	Describe (2)	A polymer is placed in the hopper and enters the chamber of the injection moulding machine. The chamber is heated until the plastic melts. The plastic is then forced in to a mould where it cools to create the shape of the object.	
3	Sketches to help with description (2)	Sketch of injection moulding machine and movement of plastic.	
4	Explain why (1)	Injection moulding is suitable because it is quick and cheap for mass produced parts and it does not require finishing.	

Evaluate			Merit
Example Question Evaluate the apple watch in terms of its suitability for the user.			
1	Positives / Advantages (1-2)	• Waterproof which allows for use when outdoors and does not absorb sweat. • Clear display screen which is easy to read even when moving.	
2	Negatives / Disadvantages (1-2)	• Flat screen susceptible to reflection • Screen can scratch easily	
3	Summary (1)	Overall the watch is well suited to the user as it has a range of specific features which are suited to the environment in which it will be used and the negative design features are minimal.	

Justify			Distinction
Example Question Justify the design decisions which have been made to make the apple watch more aesthetically appealing and gender neutral for the user.			Q:
1	Identify / underline each key word	• Aesthetically appealing • Gender neutral	
2	Define each key word (2)	• An aesthetically appealing product is one which looks attractive to its specific target market. • A gender neutral product is not aimed specifically at one gender, but it may have options to target each gender.	
3	Promote Positives / Advantages (2)	• Black in colour which is neutral and sophisticated which will appeal to an adult target market. • A plain colour that will not date/go out of fashion and appropriate for a wide range of settings • Brightly coloured icons on the screen that are attractive and easy to recognise • Geometric, simple styling that can be worn by men or women.	
4	Discount Negatives / Disadvantages (2)	• Black is a boring colour that will not excite, but you can purchase alternative straps to make it more personalised. • Square shape face may not appeal to all users or may appeal masculine, however, this has featured on previous products and they have sold well.	
5	Summary (2)	Previous sales show that the latest apple watch is appropriate for the target market as it sells in high volumes. As it can be personalised through different straps, the customer can tailor the watch to their personal style which makes it more aesthetically appealing to them and the original watch being gender neutral allows this to be done effectively.	

Evaluate			Distinction
Example Question Designers sometimes choose materials according to their impact on society and the environment. Examples include the use of fair trade cotton, recycled components and biodegradable packaging. Evaluate how the use of such materials might be seen as the ethical choice.			
1	Identify / underline each key word	• Biodegradable Packaging • Fair trade Cotton • Recycled components • Ethical choice	
2	Define each key word (3 marks)	• Biodegradable Packaging is made from materials which decompose much more quickly so that less waste is left in landfill • Fair trade Cotton is produced by cotton farmers who are paid a living wage which allows them to survive and earn enough money to feed their families • Recycled Components are made from waste products where the material has been melted down and reformed. • An ethical choice is one which avoids harm to people, animals and the environment.	
3	Positives / Advantages (3 marks)	**Biodegradable packaging:** • Require less energy to process into a useable material. • Are easier to recycle/use less energy to recycle. • Are non-toxic when they break down. **Fair trade Cotton:** • Ensures workers / farmers get a fair price for their labour / products. • It gives small scale farmers access to global markets. • Buying this product shows your support for these communities. **Recycled components:** • Often contain valuable materials such as gold, copper, aluminium. • Saves landfill space.	
4	Negatives / Disadvantages (3 marks)	**Biodegradable packaging:** • Are relatively new materials and not currently widely used. • May be more expensive. **Fair trade Cotton:** • Paying a higher wage results in products having a higher overall cost/price. **Recycled components:** • Are non-renewable and are becoming more difficult and costly to find.	
5	Summary (1 mark)	Overall, the main disadvantage of choosing these materials seems to be cost. However, I think that they are ethically right as they reduce the impact on the environment and are more socially acceptable as well and I think this is more important than the fact that products will be more expensive.	

Oracy in Engineering



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

✓ **Invited someone else to contribute** ✓ **Challenged someone's opinion** ✓ **Summarised their thinking or the group opinion** ✓ **Clarified someone's idea**	✓ **Gave a good example** ✓ **Used appropriate body language** ✓ **Used technical language / key words**

Revision Strategies in Engineering

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.	
mnemonics	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 story board (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 you 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 you 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: KS4 BTEC 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.

BTEC Engineering REVISION PLC

Topic	R	A	G
Name all 9 of the sectors of engineering we are learning about and give a definition and example company for each.			
Name 3 of each group of ferrous, non-ferrous and alloys and example products for each.			
Name and describe the difference between the two main types of plastics then give 2 examples of each.			
Explain what a proprietary component is and why they are used by companies. Give three examples.			
Draw the process for extrusion moulding and what example products it's used for			
Draw the process of injection moulding and name the benefits of using the process			
Use ACCESSFM without looking at what the letters stand for and evaluate a product you are familiar with.			
Name the stages of production and give estimate number of products and examples for each.			
Use a flow chart with the correct symbols to complete the process of making a cup of tea/coffee (at least 10 steps)			
Create a bar chart, line graph, scatter graph using the number of streams of your 5 favourite songs.			
Draw a line of best through the scatter graph you have created and correctly name what type of correlation it has.			
Draw an object of your choice using both the isometric and orthographic method			
Name the 5 ways in which engineering information is communicated and why each one is used			
Target Topics:			

BTEC Engineering REVISION PLC

Topic	R	A	G

Target Topics:

RED TOPIC STRATEGIES

Topics I need to review and practice more:	Topics I need peer support or to attend a DIG session for:	Topics I need 1-2-1 teacher support with: