Design Technology

KING EDWARD VI
SCHOOL LICHFIELD

GCSE Design Technology

CURRICULUM KNOWLEDGE OVERVIEW

Written Examination = 50% of the GCSE. You will be required to have learned all content seen in sections A, B & C.

Section A – Core technical principles (20 marks)
A mixture of multiple choice and short answer questions assessing a breadth of technical knowledge and understanding.

Section B – Specialist technical principles (30 marks)
Several short answer questions (2–5 marks) and one extended response to assess a more in-depth knowledge of technical principles.

Section C – Designing and making principles (50 marks)
A mixture of short answer and extended response questions.

In addition, at least 15% of the exam will assess mathematics & at least 10% of the exam will assess science.

Non-Exam Assessment NEA = 50% of the GCSE. You will be required to practically apply all content seen in sections A, B & C.

- Section A - Core technical principles
- Section B - Specialist technical principles
- Section C - Designing and making principles

SECTION A : 3 CORE TECHNICAL PRINCIPLES

In order to make effective design choices you will need a breadth of core technical knowledge and understanding that consists of:

- new and emerging technologies (3.1.1)
- energy generation and storage (3.1.2)
- developments in new materials (3.1.3)
- systems approach to designing (3.1.4)
- mechanical devices (3.1.5)
- materials and their working properties (3.1.6)

3.1.1 New and Emerging Technologies

Industry

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How does industry design and organise the workplace including automation and the use of robotics? 2. How are buildings and the place of work impacted by new and emerging technologies? 3. What new and emerging tools and equipment are used in industry?		None	

Enterprise

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is crowd funding? 2. What are the benefits of virtual marketing and retail? 3. What are co-operatives? 4. What is fair trade?		1. None	

Sustainability

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is the impact of resource consumption on the planet? 2. What are finite and non-finite resources? 3. How do we dispose of waste?		1. Consider the ecological and social footprint of materials.	

People

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How does technology push/market pull affect people and their choices. 2. How are changing job roles due to the emergence of new ways of working driven by technological change.			

Culture

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How do changes in fashion and trends in relation to new and emergent technologies impact on designers? 2. Why should designers consider and respect people of different faiths and beliefs.			

Society

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How are products designed and made to avoid having a negative impact on people with disabilities? 2. How are products designed and made to avoid having a negative impact on the elderly? 3. How are products designed and made to avoid having a negative impact on people with different beliefs and faiths?			

Environment

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How do new and emerging technologies provide continuous improvement and efficient working lifestyles? 2. How can new and emerging technologies impact positive and negatively on pollutions and global warming?			

Production techniques and systems

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How do new and emerging technologies influence the contemporary and potential future use of production techniques and systems?	1. What is automation? 2. What is computer aided design (CAD)? 3. What is computer aided manufacture (CAM)? 4. What is flexible manufacturing systems (FMS)? 5. What is just in time (JIT)? 6. What is lean manufacturing?		

How the critical evaluation of new and emerging technologies informs design decisions

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. Why is it important to consider scenarios from different perspectives? 2. Why do designers implement planned obsolescence in terms of company sustainability? 3. Why do designers integrate design for maintenance within their products? 4. How do ethics and the environment influence designers?			

3.1.2 Energy generation and storage

You must know how energy is generated and stored and how this is used as the basis for the selection of products and power systems.

Fossil Fuels

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How is power is generated from coal, gas & oil. 2. What are the arguments for and against the selection of fossil fuels.		How to choose appropriate energy sources.	

Nuclear

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How is nuclear power is generated? 2. What are the arguments for and against the selection of nuclear power?			

Renewable Energy

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How is power is generated from wind, solar, tidal, hydro-electrical and biomass? 2. What are the arguments for and against the selection of renewable energy?			

Energy storage systems including batteries

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is a kinetic pumped storage system? 2. What are alkaline and re-chargeable batteries?			

3.1.3 Developments in New Materials

You must know what are the developments in new materials.

Modern Materials

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How has the introduction/invention of modern materials impacted on the development of products? 2. How have modern materials been altered to provide functionality to everyday products?	1. What are self healing materials? 2. What are the materials characteristics of Graphene, Metal Foams and Titanium?	Classification of the types of properties of a range of materials. Selecting appropriate materials. Extracting information from technical specifications.	

Smart Materials

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is a SMART material and what defines them as such? 2. Where can SMART materials be used and how can they improve the functionality of products?	1. What are Shape memory Alloys and Shape Memory Polymers? 2. What are thermochromic and photochromic materials? 3. What is a phosphorescent pigment? 4. What is polymorph? 5. What is motion controlled Gel?		

Composite Materials

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How can combining materials (two or more) create an enhanced material?	1. What is glass reinforced plastic (GRP) and 2. What is carbonfibre reinforced plastic (CRP).		

Technical Textiles

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How can fibres be spun to make enhanced fabrics?	1. What are conductive fabrics? 2. What are fire resistant fabrics? 3. What is Kevlar? 4. What are microfibres incorporating micro encapsulation?		

3.1.4 Systems approach to designing

You should consider electronic systems including programmable components to provide functionality to products and processes, and enhance and customise their operation.

Inputs

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How can we integrate light sensors, temperature sensors, pressure sensors and switches into products?		Extracting information from technical specifications. Component names, interaction and operation.	

Processes

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How can designers programme microcontrollers as counters, timers and for decision making, to provide functionality to products and processes?		Extracting information from technical specifications. Component names, interaction and operation.	

Outputs

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What electronic components can be used to provide functionality to products and processes?	What is a Buzzer? What is a Speakers? What is a Lamp? What is an LED?	Extracting information from technical specifications. Component names, interaction and operation.	

3.1.5 Mechanical Devices

You should consider electronic systems including programmable components to provide functionality to products and processes, and enhance and customise their operation.

Different types of Movement

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
What are the forms of motion and how can they be observed in mechanical devices?	1. What is Rotary motion 2. What is Reciprocating motion? 3. What is Linear motion? 4. What is Oscillating motion?	Visualise and represent 2D and 3D objects including 2D diagrams of mechanisms/ mechanical movement.	

Changing magnitude and direction of force

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is a Lever? 2. What is a Linkage? 3. What is a CAM/CAM follower? 4. What are gears? 5. What is a pulley and belt?	1. What is a 1st, 2nd and 3rd class lever? 2. How do you calculate velocity ratio, efficiency and mechanical advantage? 3. What is a bell crank? 4. What is a parallel motion linkage? 5. What is a reverse motion linkage? 6. What is an eccentric cam, pear cam, snail cam, heart cam? 7. What is a flat foot follower, roller follower and v follower? 8. What is a gear train? 9. What is an idler gear? 10. What are compound gear trains? 11. What is a bevel gear, rack and pinion gear and wormwheel? 12. How do you calculate velocity ratio in gears including compound gear trains? 13. How do you calculate Output speed in gears? 14. What is a pulley and belt? 15. What is a chain and sprocket system?	The action of forces and how levers and gears transmit and transform the effects of forces. Arithmetic and numerical computation eg use ratios. Use angular measures in degrees, visualise and represent 2D and 3D objects including 2D diagrams of mechanisms/ mechanical movement. Knowledge of the function of mechanical devices to produce different sorts of movement, changing the magnitude and direction of forces.	

3.1.6 Materials and their working properties

You should know and understand the categorisation of the types and properties of the following materials.

Papers and Boards

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What are the material characteristics and practical applications of common papers and boards used in the design industries?	1. What is bleed proof paper? 2. What is cartridge paper? 3. What is grid paper? 4. What is layout paper? 5. What is tracing paper? 6. What is corrugated card? 7. What is duplex board? 8. What is foil lined board? 9. What is foam core board? 10. What is ink jet card? 11. What is solid white board?	Classification of the types and properties of a range of materials. Physical properties of materials related to use and knowledge applied when designing and making.	

Natural and Manufactured Timbers

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What are the key physical and working properties of natural timbers? 2. What are the key physical and working properties of manufactured boards.	1. What is the difference between a hardwood and a softwood? 2. What are the characteristics and working properties of hardwoods; such as mahogany, oak, beech, ash and balsa? 3. What are the characteristics and working properties of soft woods; such as larch, pine and spruce? 4. What are the characteristics of manufactured boards; such as medium density fibreboard (MDF), plywood, chipboard and OSB?		

Metals and Alloys

1. What are the key physical and working properties of ferrous metals? 2. What are the key physical and working properties of non ferrous metals? 3. What are the key physical and working properties of alloys?	1. What is the difference between a ferrous and a non ferrous metal? 2. What are the practical applications of ferrous metals and non ferrous metals? 3. What is an alloy? 4. What are the characteristics and working properties of ferrous metals; such as low carbon steel, cast iron and high carbon/tool steel. 5. What are the characteristics and working properties of non ferrous metals, such as aluminum, copper, tin and zinc. 6. What are the characteristic and working properties of alloys including brass, stainless steel and high speed steel?		

Polymers

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What are the key physical and working properties of thermo plastics? 2. What are the key physical and working properties of thermosetting plastics?	1. What are the key characteristics of the following thermo plastics and what are their practical applications? • acrylic (PMMA) • high impact polystyrene (HIPS) • high density polythene (HDPE) • polypropylene (PP) • polyvinyl chloride (PVC) • polyethylene terephthalate (PET) 2. What are the key characteristics of the following thermosetting plastics and what are their practical applications? • epoxy resin (ER) • melamine-formaldehyde (MF) • phenol formaldehyde (PF) • polyester resin (PR) • urea-formaldehyde (UF)		

Textiles

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What are the key physical and working properties of natural fibres? 2. What are the key physical and working properties of synthetic fibres? 3. What are blended and mixed fibres? 4. What re woven and non woven fibres? 5. What is a knitted textile?	1. Where is cotton, wool & silk commonly used (natural fibres) ? 2. Where are polyester, polyamide & elastine commonly used (synthetic fibres) ? 3. How does cotton & polyester used together impact on the fabric (blended fibre) ? 4. What is a plain weave? 5. What are bonded fabrics? 6. What is a felted fabric? 7. What is a knitted fabric?		

Material Properties

You should have an understanding of the working and physical properties of the materials studied.

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is meant by material physical properties? 2. What is meant by material working properties? 3. How are material physical and working properties tested?	Physical 1. What is absorbency? (resistance to moisture) 2. What is density? 3. What is fusibility? 4. What is electrical and thermal conductivity? Working 1. What is strength? 2. What is hardness? 3. What is toughness? 4. What is malleability 5. What is ductility 6. What is elasticity?		

SECTION B : 3.2 SPECIALIST TECHNICAL PRINCIPLES

In addition to the core technical principles you should develop an **in-depth knowledge and understanding** of the following specialist technical principles:

- selection of materials or components (3.2.1)
- forces and stresses (3.2.2)
- ecological and social footprint (3.2.3)
- sources and origins (3.2.4)
- using and working with materials (3.2.5)
- stock forms, types and sizes (3.2.6)
- scales of production (3.2.7)
- specialist techniques and processes (3.2.8)
- surface treatments and finishes (3.2.9)

Each specialist technical principle should be delivered through **at least one** material category or system. **YOU DO NOT NEED TO LEARN ABOUT ALL 6 AREAS.** The categories through which the principles can be delivered are:

- papers and boards
- timber based materials
- metal based materials
- polymers
- textile based materials
- electronic and mechanical systems

Selection of materials or components

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What are the factors / considerations when selecting materials or components?	1. What is Functionality? (application of use, ease of working) 2. What are Aesthetics? (surface finish, texture and colour) 3. What are Environmental factors? (recyclable or reused materials) 4. What is Availability? (ease of sourcing and purchase) 5. What is Cost? (bulk buying) 6. What are Social factors? (social responsibility) 7. What are Cultural factors? (sensitive to cultural influences) 8. What are Ethical factors? (purchased from ethical sources such as FSC)	Calculation of material costs. Selection and use of materials considering end of life disposal.	

3.2.2 Forces and Stresses

In relation to **at least one** material category or system, you should know and understand the impact of forces and stresses and the way in which materials can be reinforced and stiffened.

Forces

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What are the main forces that can be applied to materials?	1. What is tension? 2. What is compression? 3. What is torsion? 4. What is shear? 5. What is bending?		

Structural Integrity

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How can materials be reinforced or stiffened to achieve greater structural integrity?	1. What is lamination? 2. What is bending? 3. What is folding? 4. What is webbing? 5. What is fabric interfacing?		

3.2.3 Ecological and Social Footprint

1. In relation **to at least one** material category or system, you should have a knowledge and understanding of the ecological and social footprint left by designers.

Ecological issues in the design and manufacture of products

1. What is the physical impact on the environment when extracting renewable and finite sources? 2. What is a lifecycle analysis? 3. What are the ways in which carbon is produced during the manufacture of products?	1. What impact does Deforestation, mining, drilling and farming have on our environment? 2. Why is it important to analyse a product from raw material source, manufacture, distribution, user location and final disposal. 3. What is carbon offsetting?		

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What are the Six R's. 2. How do the 6 R's impact on both the consumer and the designer?	**Rethink** - How can we be mindful of what we buy? Ask yourself if you really need something. **Refuse** - How can we be encouraged to refuse to buy products that cannot be recycled or reused. Don't buy something you don't need. **Reduce** - What can be done to cut down on the amount of products and services we use? **Re-use** - How do we take a product / item and repurpose it? **Repair** - Why is it important to fix products? **Recycle** - What is meant by the term recycle?	Selecting appropriate materials. Understanding of how to choose appropriate energy sources.	

Social Issues in the design and manufacture of products

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is industries responsibility for social issues in the design and manufacture of products?	1. How does industry ensure safe working conditions for employees? 2. How does industry reduce the detrimental (negative) impact on employees and other? 3. How does industry reduce the detrimental (negative) impact on the environment? E.g. reducing oceanic/ atmospheric pollution	Ethical factors and the social footprint of materials used in products.	

3.2.4 Sources and Origins

In relation **to at least one** material category or system, you should have a knowledge and understanding of the ecological and social footprint left by designers.

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. Where do materials come from? 2. How are materials extracted? 3. How is the raw material converted into a usable form?	**1. Paper and board** (how are cellulose fibres which are derived from wood and grasses, converted into paper?) **2. Timber based materials** (what is seasoning and conversion?) **3. Metal based materials** (How are metals extracted and refined?) **4. Polymers** (what is the refining of crude oil, fractional distillation and cracking?) **5. Textile based materials** (how do you obtain raw materials from animal, chemical and vegetable sources, processing and spinning?)		

3.2.5 Using and working with materials

In relation to **at least one** material category or system, you should know and understand in addition to material properties, the factors listed below

Properties of Materials

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How are different properties of materials and components are used in commercial products? 2. how do properties influence use and affect performance? 3. How do the physical and mechanical properties of materials affect the use and performance of commercial products within your chosen area/s?	What are the physical and mechanical requirements of materials to ensure the products within your chosen area/s perform as expected? **1. Papers and boards** (flyers/leaflets and card based food packaging) **2. Timber based materials** (traditional timber children's toys and flat pack furniture) **3. Metal based materials** (cooking utensils and hand tools) **4. Polymers** (polymer seating and electrical fittings) **5. Textile based materials** (sportswear and furnishings) **6. Electronic and mechanical systems** (motor vehicles and domestic appliances).		

The modification of properties for specific purposes

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How can materials be enhanced to provide better functionality?	How can materials be enhanced to provide better functionality of the products associated within your chosen area/s? **1. Papers and boards** (Additives to prevent moisture transfer) **2. Timber based materials** (Seasoning to reduce moisture content of timbers) **3. Metal based materials** (Annealing to soften material to improve malleability) **4. Polymers** (Stabilisers to resist UV degradation) **5. Textile based materials** (Flame retardants reduce combustion and fire hazards) **6. Electronic and mechanical systems** (Photosensitive PCB board in PCB manufacture and anodizing aluminium to improve surface hardness)		

How to shape and form using cutting, abrasion and addition

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What methods of cutting and abrasion can be applied to materials (subtractive processes)? 2. What methods of shaping can be applied to materials to alter their physical form and appearance? **PLEASE ALSO SEE 3.2.8**	What are the processes typical applied to the material area/s of your choice? **1. Papers and boards** (how to cut, crease, score, fold and perforate card). **2. Timber based materials** (how to cut, drill, chisel, sand and plane). **3. Metal based materials** (how to cut, drill, turn, mill, cast, braze and weld). **4. Polymers** (how to cut, drill, cast, deform, print and weld). **5. Textile based materials** (how to sew, pleat, gather, quilt and pipe). **6. Electronic and mechanical systems** (how to cut, drill and solder).		

3.2.6 Stock Forms

In relation to **at least one** material category or system, you should know and understand the different stock forms types and sizes in order to calculate and determine the quantity of materials or components required.

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What are the commonly available stock forms of materials? 2. What is a standardised component? 3. What are the industry standard sizes, weights and costs of materials?	**Papers and boards: (**sheet, roll and ply • sold by size eg A3, thickness, weight and colour • standard components eg fasteners, seals and bindings • cartridge paper and corrugated card.) **Timber based materials: (**planks, boards and standard moldings • sold by length, width, thickness and diameter • standard components eg woodscrews, hinges, KD fittings) **Metal based materials: (**sheet, rod, bar and tube • sold by length, width, thickness and diameter • standard components eg rivets, machine screws, nuts, and bolts) **Polymers**: (sheet, rod, powder, granules, foam and films • sold by length, width, gauge and diameter • standard components eg screws, nuts and bolts, hinges) **Textile based materials: (**yarns and fabrics • sold by roll size, width, weight and ply • standard components eg zips, press studs, Velcro) **Electrical and mechanical components**: (sold by quantity, volt and current rating • standard components eg E12 resistor series, dual in line IC packages (DIL), microcontrollers (PIC).	Calculation of material quantities and sizes. Calculate surface area and volume eg material requirements for a specific use. Efficient material use, pattern spacing, nesting and minimising waste.	

3.2.7 Scales of Production

In relation to **at least one** material category or system, you should know and understand in addition to material properties, the factors listed below

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How are products produced in different volumes? 2. The reasons why different manufacturing methods are used for different production volumes	1. What is a prototype? 2. What is one-off production? 3. What is batch production? 4. What is mass production? 5. What is continuous production? 6. What is Just in Time (JIT) ?		

3.2.8 Specialist techniques and Processes

The use of production aids

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How can QA and QC be achieved within manufacturing processes ?	1. How do manufacturers use measurements/reference points? 2. What is a template? 3. What is a jig? 4. What is a mould? 5. What is a pattern?		

Tools, Equipment and Processes

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What tools, equipment and processes are used to shape, fabricate, construct and assemble high quality prototypes?	What methods of wastage, addition, deforming and reforming can be applied to materials within your chosen area/s? **1.** **wastage**, such as: • die cutting • perforation • turning • sawing • milling • drilling • cutting and shearing **2.** **addition**, such as: • brazing • welding • lamination • soldering • 3D printing • batik • sewing • bonding • printing **3.** **deforming and reforming** such as: • vacuum forming • creasing • pressing • drape forming • bending • folding • blow moulding • casting • injection moulding & extrusion		

How materials are cut shaped and formed to a tolerance

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is a tolerance? 2. Why so manufactures allow a tolerance and work to minimum and maximum measurement?			

Commercial Processes

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How are products manufactured in industry? **PLEASE ALSO SEE 3.2.8**	**1. Papers and boards** (offset lithography and die cutting). **2. Timber based materials** (routing and turning). **3. Metal based materials** (milling and casting). **4. Polymers** (injection molding and extrusion). **5. Textile based materials** (weaving, dying and printing). **6. Electrical and mechanical systems** (pick and place assembly and flow soldering).		

Quality Control

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is Quality Control (QC)?	What methods are used to ensure products are made consistently and to the desired quality? **1. Papers and boards** (registration marks). **2. Timber based materials** (dimensional accuracy using go/no go fixture). **3. Metal based materials** (dimensional accuracy using a depth stop). **4. Polymers** (dimensional accuracy by selecting correct laser settings). **5. Textile based materials** (dimensional accuracy checking a repeating print against an original sample). **6. Electrical and mechanical systems** (UV exposure, developing and etching times in PCB manufacture).		

3.2.9 Surface treatments and finishes

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is meant by surface preparation? 2. What is a surface finish? 3. How do surface finishes enhance functional and aesthetic properties?	What surface finishes can be applied to materials within your chosen area/s? **1. Papers and boards** (printing, embossing and UV varnishing). **2. Timber based materials** (painting, varnishing and tanalising). **3. Metal based materials** (dip coating, powder coating and galvanizing). **4. Polymers** (polishing, printing and vinyl decals). **5. Textile based materials** (printing, dyes and stain protection). **6. Electronic and mechanical systems** (PCB lacquering, and lubrication).		

SECTION C : 3.3 DESIGNING AND MAKING PRINCIPLES

You should know and understand that all design and technology activities take place within a wide range of contexts. You should also understand how the prototypes you develop must satisfy wants or needs and be fit for their intended use.

For example, the home, school, work or leisure. You will need to demonstrate and apply knowledge and understanding of designing and making principles in relation to the following areas:

- investigation, primary and secondary data (3.3.1)
- environmental, social and economic challenge (3.3.2)
- the work of others (3.3.3)
- design strategies (3.3.4)
- communication of design ideas (3.3.5)
- prototype development (3.3.6)
- selection of materials and components (3.3.7)
- tolerances (3.3.8)
- material management (3.3.9)
- specialist tools and equipment (3.3.10)
- specialist techniques and processes (3.3.11)

3.3.1 Investigation of Primary and Secondary Data

Use primary and secondary data to understand client and/or user needs

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is the difference between Primary and Secondary data? 2. What is ergonomics? 3. What is anthropometrics?	1. How do you use market research, interviews and human factors including ergonomics? 2. What is the function of a focus groups and product analysis and evaluation? 3. How do designers use of anthropometric data and percentiles?	Analysing responses to user questionnaires. Frequency tables and information on design decisions. Presentation of client survey responses. Percentiles ranges used in anthropometrics and/or ergonomics	

How to write a design brief and produce a design and manufacturing specification

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is a design Brief? 2. What is a manufacturing specification?	1. How do you 'frame' the brief? 2. What are the core components that are required to complete a manufacturing specification?		

Carry out investigations in order to identify problems and needs

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. Why does a designer consider alterations to a brief and modify the brief as required?			

3.3.2 Environmental, social and economic challenge

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How do environmental factors such as deforestation and increase in C02 present opportunities and constraints that influence the processes of designing and making? 2. What is fairtrade and what is the social impact?	1. What is deforestation and what are the consequences? 2. What are the alternatives to deforestation? 3. Why does an increase carbon dioxide lead to global warming? 4. What is fair trade?	Selection of materials based on ethical factors and social and environmental footprints.	

3.3.3 The work of others

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
Why is it important to study the work of others when developing design solutions?	You should investigate the work of a **minimum of two** of the following designers: • Alexander McQueen • Aldo Rossi • Aljoud Lootah • Charles Rennie Macintosh • Coco Chanel • David Adjaye • Elsie Owusu • Ettore Sottsass • Gerrit Reitveld • Harry Beck • Joe Casely-Hayford • Karim Rashid • Kusheda Mensah • Marcel Breuer • Louis Comfort Tiffany • Mary Quant • Morag Myerscough • Norman Foster • Philippe Starck • Pierre Davis • Raymond Templier • Rei Kawakubo • Sir Alec Issigonis • The Singh Twins • Vivienne Westwood • William Morris • Yinka Ilori • Zaha Hadid		

	You should investigate the work of a **minimum of two** of the following companies: • Alessi • Apple • Braun • Dyson • Gap • Primark • Under Armour • Zara.		

3.3.4 Design Strategies

Generate imaginative and creative design ideas using a range of different design strategies

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. Why is it important to use a range of design strategies when developing ideas?	1. What does it mean to design in collaboration? 2. What is user centered design(UCD) 3. What is a systems approach to designing? 4. What is iterative designing? 5. How can you avoid design fixation?		

Explore and develop their own ideas

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
What methods can be used to explore and develop initial ideas?	1. How can sketching be used to develop ideas? 2. What methods of modelling can be used to develop ideas? 3. How can you test your models? 4. What evaluative methods can be used to improve outcomes?		

3.3.5 Communication of design ideas

Generate imaginative and creative design ideas using a range of different design strategies

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What designing methods can be used to communicate all intentions / details to a third party?	1. How does freehand sketching compare to isometric and other perspective drawing? 2. What is the difference between 2D and 3D drawings? 3. What are system and schematic diagrams? 4. How do you develop annotated drawings that explain detailed development or the conceptual stages of designing? 5. How can you produce exploded diagrams to show constructional detail or assembly ? 6. What is a working drawing? 7. How do you produce 3rd angle orthographic drawings that include conventions, dimensions and scale? 8. Why are audio and visual recordings used in support of aspects of designing: eg interviews with client or users? 9. What is mathematical modelling? 10. What computer based tools can be used to communicate designs? 11. Why are models vital when communicating ideas (working directly with materials and components, eg card modelling, producing a toile when designing garments, constructing a circuit using breadboard)	Scale	

Explore and develop their own ideas

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
How do you design and develop prototypes in response to client wants and needs? Why is it important to evaluate prototypes?	How can you develop prototypes to : 1. satisfy the requirements of the brief 2. respond to client wants and needs 3. demonstrate innovation 4. demonstrate functionality 5. consider aesthetics 6. be potentially marketable How do you evaluate prototypes and be able to: 1. reflect critically, responding to feedback when evaluating their own prototypes 2. suggest modifications to improve them through inception and manufacture 3. assess if prototypes are fit for purpose		

3.3.7 Selection of materials and components

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What materials should models be made from? **PLEASE ALSO SEE 3.2.5**	1. How do you select and use materials and components appropriate to the task considering: • functional need • cost • availability	SI units; identify appropriate commercially available stock forms and select appropriately. Composition of some important alloys; selecting appropriate metal alloys as required.	

3.3.8 Tolerances

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is a tolerance? **PLEASE ALSO SEE 3.2.8**	1. How can you work accurately using tolerances? 2. How are materials cut out, shaped and formed to designated tolerances? 3. Why are tolerances are applied during making activities?	1. SI units eg accurate use of appropriate tolerances +/- 2mm, resistor tolerance and seam allowance.	

3.3.9 Material management

Cut materials efficiently and minimise waste

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. Why is it important to plan the cutting and shaping of material to minimise waste? (eg nesting of shapes and parts to be cut from material stock forms) 2. How can additional material be removed by a cutting method or required for seam allowance, joint overlap etc.	1. What is tessellation or nesting?	1. Expression in decimal and standard form eg calculation of required materials. Calculate surface area and volume eg material requirements. Angular measures eg measurement and marking out. SI units eg measurement of materials and components using standard units as appropriate. The use of reference datum points and coordinates.	

Use appropriate marking out methods, data points and coordinates

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. What is the value of using measurement and marking out to create an accurate and quality prototype?	1. How do you use data points and coordinates including the use of reference points, lines and surfaces, templates, jigs and/or patterns?	Use angular measures eg tessellation of component parts. Calculating material area eg working out the quantity of materials required. SI units eg accurate use of appropriate units of measurement to calculate material requirements.	

3.3.10 Specialist tools and equipment

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How do you select and use specialist tools and equipment, including hand tools, machinery, digital design and manufacture, appropriate for the material and/or task to complete quality outcomes. 2. How do you use them safely to protect themselves and others from harm. **PLEASE ALSO SEE 3.2.8**			

3.3.11 Specialist techniques and processes

Surface treatments and finishes

Big Questions	Small Questions	Mathematical / Scientific Link	Link to resource
1. How are surface treatments and finishes applied for functional and aesthetic purposes. 2. How do you prepare a material for a treatment or finish. 3. How do you apply an appropriate surface treatment or finish. **PLEASE ALSO SEE 3.2.9**			