

Year 10 Topic Table - GCSE Design and Technology

In year 10 we teach the following topics over the course of the year. Each topic draws on prior learning from previous years and builds on understanding from the KS3 programme of study. Each topic develops and deepens the Core knowledge that will underpin all areas of the curriculum at KS4 and KS5.

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

• New and emerging technologies • energy generation and storage • developments in new materials • systems approach to designing • mechanical devices • materials and their working properties. All of this section must be taught and all will be assessed in the final GCSE examination.

New and Emerging Technologies 3.1.1 – Theory Lessons					
Unit	Rationale	Topic	Knowledge acquisition	Key vocabulary	Skills and enrichment
New and Emerging Technologies 3.1.1	<i>Students will be taught the impact of new and emerging technologies on contemporary and potential future scenarios in relation to the topics covered in the knowledge acquisition column of this table.</i>	People Society & Culture	Market pull and technology push	Technology push/market pull, technological change and trends.	<ul style="list-style-type: none"> • Problem solving- Redesigning products to meet a new brief. • Evaluation- Evaluation of ethical considerations surrounding a design/product. • Analysis- Analyse the life cycle of existing products in relation to its ecological impact. • Creativity- Redesigning products to meet a design brief. • Literacy- Produce a written case study. <p>Subject Specific Skills:</p> <ul style="list-style-type: none"> • Freehand sketching and the use of colour markers. • Annotation of designs in terms of sustainability. • Life cycle assessments of products.
		People Society & Culture	Design for disability	Inclusive design and moral impacts.	
		People Society & Culture	Impact of society and culture on design.	Social impacts and cultural impacts.	
		Informing Design Decisions	Life cycle graph and technological impact	Planned obsolescence, life cycle graph.	
		Informing Design Decisions	Design for maintenance.	Design for disposal, design for disassembly, design for maintenance, standard components, WEEE directive.	
		Sustainability & The Environment	Responsible design	Finite, non-finite, global warming and pollution.	
		Sustainability & The Environment	Life cycle assessment	Life cycle assessment, ecological footprint, environmental impact, product miles and carbon footprint	
		Sustainability & The Environment	Continuous improvement	Continuous improvement, kaizen, efficient working reduce, reuse, rethink, reduce, recycle and refuse.	
		Industry & Enterprise	Evolution of industry	New and emerging technologies, automation, robotics.	
		Industry & Enterprise	Product Innovation	Organisation of the workplace, product development and 3D printing.	
Industry & Enterprise	Marketing and organisations	Crowd funding, virtual marketing and retail, co-operatives and fair trade.			

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New and Emerging Technologies 3.1.1 – NEA Style Project: Credit Card Multi Tool					
Unit	Rationale	Topic	Knowledge acquisition	Key vocabulary	Skills and enrichment
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">New and Emerging Technologies 3.1.1 & Materials and their working properties 3.1.6</p>	<p><i>This project is intended to familiarise students with the iterative design process and to give them experience of carrying out a task similar to their NEA assessment. The NEA undertaken in year 11 has strict guidelines regarding the feedback permitted by teachers. This offers students the opportunity to trial run the NEA with specific feedback from teachers prior to NEA regulations taking effect.</i></p> <p><i>This project also covers the following knowledge content from the exam specification:</i></p> <ul style="list-style-type: none"> New and emerging technologies 3.1.1 Using and working with materials 3.2.5 Communication of ideas 3.3.5 Materials and their working properties 3.1.6 	NEA Style Project	Design Brief	Analysis, context, design brief, problem, client, and customer.	<ul style="list-style-type: none"> Problem solving- Redesigning products to meet a new brief. Evaluation- Evaluation of the social needs and wants considerations surrounding a design/ product. Analysis- Analyse existing products in relation impact of design choices. Creativity- Redesigning products to meet a design brief. Literacy- Produce a written case study. <p>Subject Specific Skills:</p> <ul style="list-style-type: none"> Freehand sketching. Research Annotation of designs. <p>Materials:</p> <ul style="list-style-type: none"> Problem solving- match materials properties to the materials categories. Analysis- Analyse existing products in relation to their materials and explain how each material chosen is suitable for the application.
		NEA Style Project	Existing Product Research	ACCESSFMM- Aesthetics, customer, cost of manufacture, safety, size, form, function, materials, manufacture.	
		NEA Style Project	Client Profiling	Customer requirements, needs, profile.	
		NEA Style Project	Specification	Specification, justification, measurable.	
		NEA Style Project	Generating design ideas: sketching	Sketching, rendering and design development and feedback.	
		NEA Style Project	Generating design ideas: prototyping	Card modelling, scale, tolerance, dimensions and feedback.	
		Production Techniques & Systems	CAD and CAM	Computer aided design and computer aided manufacture	
		Production Techniques & Systems	Automation	Automation and handmade manufacturing.	
		Production Techniques & Systems	Flexible manufacturing systems	Flexible manufacturing systems, CNC milling and CNC laser cutting	
		Production Techniques & Systems	Lean manufacturing	Lean manufacturing and just in time production	
		NEA Style Project	Generating design ideas: CAD	CAD, rendering, tolerance, axis, and work plane.	
		Materials & their working properties	Properties and categorisation of polymers	Polymers, thermoforming, thermosetting, thermoplastics, thermosets.	
		Materials & their working properties	Properties and categorisation of metals	Ferrous, non-ferrous, alloy, ore, furnace, bauxite, carbon, oxidise, Verdigris, patina.	
NEA Style Project	Evaluation	Evaluation against specification and evaluation against design brief.			

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Energy Generation and Storage 3.1.2 – Theory Lessons					
Unit	Rationale	Topic	Knowledge acquisition	Key vocabulary	Skills and enrichment
Energy Generation and storage 3.1.2	<i>Students will learn how energy is generated and stored and how this is used as the basis for the selection of products and power systems.</i>	Energy Generation	Non-renewable sources of energy	Coal, gas, and oil. Plus nuclear.	<ul style="list-style-type: none"> • Problem solving- Decide upon suitable power sources for a range of different geographical locations. • Evaluation- Evaluate the positive and negative socioeconomic and ecological impacts of different energy sources. • Oracy- Discuss the arguments for and against nuclear power and explain how it has an effect on local communities.
		Energy Generation	Renewable sources of energy	Wind, solar, tidal, hydro-electrical, biofuel and biomass.	
		Energy Storage	Forms of Energy	Kinetic, motion, potential energy and energy transfer.	
		Energy Storage	Energy Systems	Pneumatics, hydraulics, compression, cell, batteries (alkaline and declarable)	
		Energy Storage	Stomp Rocket Competition	Stomp rocket	

Development in New Materials 3.1.3 – Theory Lessons				
Unit	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
Developments in New Materials 3.1.3	<i>Students will learn about developments in new materials as well as advantages of modern materials and their applications.</i>	Modern Materials	Corn starch polymer, biodegradable, polylactic acid (PLA), biopol, flexible MDF, titanium, fibre optics, graphene, liquid crystal display (LCD), nanotechnology, metal foam and polymorph.	<ul style="list-style-type: none"> • Analysis- Analyse the categories of materials in relation to their properties and suggest uses. • Creativity- Create a set of revision cards for each of the materials categories. • Literacy- Define each of the materials covered in this section. Investigate the roots of the words and understand how this relates to their properties. • Oracy- Discuss the examples of materials and suggest uses for them. <p>Subject Specific Skills:</p> <ul style="list-style-type: none"> • Reading and interpreting materials technical specifications.
		Smart Materials	Thermochromic, photochromic, hydrochromic, shape memory alloy (SMA), nitinol, self-healing materials, quantum tunnelling composite (QTC), piezoelectric material, litmus paper.	
		Composite Materials	Glass reinforced plastic (GRP), carbon reinforced plastic (CRP).	
		Technical Textiles	Gore-Tex fabric, Kevlar, conductive textiles (e-textiles), fire resistant textiles (nomex), Microfibers and microencapsulation.	

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Systems Approach to Designing and Electronic Systems Processing 3.1.4 – Project Systems Buggy					
Unit	Rationale	Topic	Knowledge acquisition	Key vocabulary	Skills and enrichment
Systems approach to designing & Electronic Systems Processing 3.1.4 & Materials and their working properties 3.1.6	<i>This project is intended to families students with how to consider electronic systems, including programmable components, to provide functionality to products and processes, and enhance and customise their operation.</i>	Electronic Systems	Input, Process and Output	Systems, subtask, subsystem, open loop system and closed-loop system.	<ul style="list-style-type: none"> • Problem solving- Extracting information from technical specifications. Identifying input, process and out components in a circuit. • Numeracy- Calculations of voltage, current and resistance. <p>Subject Specific Skills: Populating a PCB.</p> <p>Materials:</p> <ul style="list-style-type: none"> • Problem solving- match materials properties to the materials categories. • Analysis- Analyse existing products in relation to their materials and explain how each material chosen is suitable for the application
		Systems Control	Automated Control	Monostable, astable,	
		Components	Input, process and output components	Peripheral interface controller (PIC), integrated circuits (IC), microcontroller.	
		Systems Diagrams	Circuits diagrams and Flowcharts	Flowcharts, circuits, and symbols	
		Buggy Project	Building the buggy circuit	Soldering, push to make, resistor (and values), motor, PCB, PIC and L293D.	
		Materials & their working properties	Properties and categorisation of papers and card	Cellulose, pulping process, paper weight, bleed proof, cartridge, grid, layout, tracing, corrugated cardboard, duplex, foil lined, foam core, solid white and ink jet.	
		Buggy Project	Chassis Design: card modelling	Card modelling, scale, tolerance, dimensions and feedback.	
		Buggy Project	Programming	Circuit wizard, route brief, specification, accuracy, trial and error.	
		Buggy Project	Planning and carrying out testing	Focus group, visual testing, weigh test, and program test.	
		Buggy Project	Chassis Design: CAD	CAD, rendering, tolerance, axis, and work plane.	
		Buggy Project	Body Design: Nets	Personalisation, graphics, dimensions, joining and shaping.	
		Buggy Project	Buggy Track Day	Final assessment	
Buggy Project	Evaluation and Reflection	Evaluation against specification and evaluation against design brief.			

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Mechanical Devices 3.1.5– Theory Lessons				
Unit	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
Mechanical Devices 3.1.5	<i>Students will be taught the types of motion and the mechanical systems which can allow for a change of motion or force.</i>	Motion	Linear, reciprocating, oscillating and rotary.	<ul style="list-style-type: none"> • Problem solving- Visualise and represent 2D and 3D objects including 2D diagrams of mechanisms/ mechanical movement. • Numeracy- The action of forces and how levers and gears transmit and transform the effects of forces. Arithmetic and numerical computation e.g. use ratios. Use angular measures in degrees. Knowledge of the function of mechanical devices to produce different sorts of movement, changing the magnitude and direction of forces. • Creativity- Create a visual revision aid showing movement types and mechanisms. <p>Subject Specific Skills:</p> <ul style="list-style-type: none"> • Produce a number of demonstration models to demonstrate principles of motion, levers and linkages.
		Lever	Mechanical advantage, fulcrum, effort, load, equilibrium.	
		Linkages	Reverse motion linkage, parallel motion or push/pull linkage, bell crank linkage, crank and slider, treadle linkage.	
		Rotary Systems	Camshaft, follower, dwell, eccentric cam, pear cam, snail cam, heart shaped cam, flat follower, knife edged follower, roller follower, gear train, pulley and belt.	

Common Specialist Technical Principles 3.2 – Theory Lessons					
Unit	Rationale	Topic	Knowledge acquisition	Key vocabulary	Skills and enrichment
Common Specialist Technical Principle 3.2	<i>Students will learn about the responsibilities of designers in ensuring their product function under stress and forces before moving onto ecological issues designer must acknowledge. Students must also have an understanding of production scales.</i>	Forces and Stresses	Impact of stress and force on different materials.	Tension, compression, bending, torsion, shear forces and stresses	<ul style="list-style-type: none"> • Problem solving- Decide upon suitable improvements to design to withstand forces and stresses acting on products. • Evaluation- Evaluate the positive and negative socioeconomic and ecological impacts designing products. • Oracy- Discuss the arguments for and against the selection of production processes and scale.
		Improving Functionality	Enhancing materials to resist and work with forces and stresses.	Functionality, improvement, folding, bending, strengthening, enhancing, reinforcing, webbing, stiffening,	
		Ecological and Social Footprint	Social and government responsibility to address pollution	Greenhouse gases, pollution, deforestation, mining, drilling, farming, product miles and working conditions	
		The Six Rs	Reducing waste and the demand on finite resources.	Sustainability, refuse, rethink, reduce, reuse, repair, and recycle, miniaturisation and upcycling.	
		Scales of Production	Volume production	Prototypes, one offs, batch, jigs, patterns, templates, mass and continuous.	

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Designing Principles 3.3.1 – NEA Style Project: Desk Tidy				
Topic	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
Designing Principles 3.3.1	<p><i>This project is intended to familiarise students with the iterative design process and to give them experience of carrying out a task similar to their NEA assessment. The NEA undertaken in year 11 has strict guidelines regarding the feedback permitted by teachers. This offers students the opportunity to trial run the NEA with specific feedback from teachers prior to NEA regulations taking effect.</i></p> <p><i>This project also covers the following knowledge content from the exam specification:</i> Selection of materials or components 3.2.1 Using and working with materials 3.2.5 Communication of ideas 3.3.5 Ecological and social footprint 3.2.3 Design strategies 3.3.4 Stock forms types and sizes 3.2.6 Scales of production 3.2.7</p>	Analysis of a given context	Analysis, context.	<ul style="list-style-type: none"> • Problem solving- Produce a viable solution for a set design brief which meets the needs of a client or user group and conforms to a specification. • Evaluation- Evaluating the suitability of designs, prototypes and materials in order to produce the most suitable outcome to fulfil the brief. Evaluation of design work and final outcome against a specification, clients' needs and a design brief. • Analysis- Analysis of research in order to inform the production of a design specification. • Creativity- Design and make a product which meets a specific brief whilst taking inspiration from existing products and the work of other designers. • Literacy- Producing a concise and coherent design portfolio which fluently communicates design intentions. • Numeracy- Calculating materials quantities for manufacturing specification. CAD/ CAM. <p>Subject Specific Skills:</p> <ul style="list-style-type: none"> • Construction of third angle orthographic projections. • Production of exploded drawings. • Rendering presentation drawings. • Implementing an iterative design strategy. • CAD/ CAM
		Development of a design brief	Design brief, problem, client, and customer.	
		Questionnaire, survey and interview design	Primary research, open and closed questions.	
		Client profiling	Customer requirements, needs, profile.	
		Research and analysis of existing products	ACCESSFMM- Aesthetics, customer, cost of manufacture, safety, size, form, function, materials, manufacture.	
		Research and analysis of influential designers and design movements.	Mood board, key features, socioeconomic influences.	
		Research and analysis of potential customers/ users ergonomics and anthropometrics	Ergonomics, anthropometrics, 5 th , 50 th and 95 th percentile.	
		Writing a justified specification	Specification, justification, measurable.	
		Generating design ideas- sketching and CAD	CAD, rendering, tolerance, axis, work plane.	
		Generating design ideas- starting with the properties of a material	Mechanical and physical properties, hardness, toughness, durability, flexibility, ductility, malleability, strong, annotation.	
		Generating design ideas- inspired by an iconic design	E1027 Table- Eileen Gray Barcelona chair- Ludwig Mies van der Rohe Eames Lounge Chair- Charles and Ray Eames Jucy Salif- Philippe Starck Braun RT20 Radio- Dieter Rams	
		Generating design ideas-thumb nail sketches	Crating in, isometric, form.	
		Generating design ideas-card modelling	Prototype, scale, dimensions, feedback.	
Generating design ideas- from a theme	Memphis (Modernism), Art Deco, Streamlining, Arts and Crafts, Industrial revolution.			

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<p><i>Investigation, primary and secondary data 3.3.1</i> <i>Specialist techniques and processes 3.2.8</i> <i>Material management 3.3.9</i> <i>Tolerances 3.3.8</i> <i>Surface treatments and finishes 3.2.9</i> <i>Forces and stresses 3.2.2</i></p>	Idea Development	Tonal rendering, presentation drawing, joining and shaping, material finishes, dimensions, standard components, stock form, KD fittings, adhesives.	<ul style="list-style-type: none"> • Selecting appropriate tools and equipment for manufacturing prototypes. • Practical manufacturing of products from wood, metal, paper and boards.
	Working Drawings	Third angle Orthographic projection, exploded drawings, drawing conventions, BS:8888	
	Manufacturing Specification	Cutting list, scale of production. QA, QC,	
	Manufacture	Manufacturing log, health and safety, QA and QC.	
	Planning and carrying out Testing	Focus group, visual testing, Hardness testing, drilling test, filing test, weigh test, smoothness test, conductivity.	
	Evaluation	Evaluation against specification. Third party feedback, evaluation against design brief, Modifications.	

Materials and their working properties 3.1.6 & Timber Based Material 5B– Theory Lessons					
Unit	Rationale	Topic	Knowledge acquisition	Key vocabulary	Skills and enrichment
<p>Materials and their working properties 3.1.6 & Timber Based Material 5B</p>	<p><i>Students will be taught the physical and mechanical properties of materials and how to analyse products in relation to these properties.</i></p> <p><i>The students will further specialise in the material of timbers and learn the sources and origins. Students will analyse how to work with timber and how they are used commercially in manufacturing.</i></p>	Material Properties and Definitions	Physical properties and mechanical properties	Absorbency, density, fusibility, electrical conductivity, thermal conductivity. Strength, hardness, toughness, malleability, ductility, elasticity.	<ul style="list-style-type: none"> • Problem solving- match materials properties to the materials categories. • Analysis- Analyse existing products in relation to their materials and explain how each material chosen is suitable for the application. • Literacy- Scientific vocabulary e.g. physical and chemical differences between materials e.g. types and properties across a range of materials.
		Materials & their working properties	Properties and categorisation of timbers	Hardwood, softwood, deciduous, coniferous, evergreen.	
		Sources and origins of Timbers	Processes involved in creating workable forms of timber	Seasoning, forestry management, felling, conversion, faults, manufactured boards and compression	
		Working with Timbers	Commercial stock forms	Standardisation, PAR, rough sawn, fixings, components, tools, waste, turning, joints, lamination and bending	
		Commercial Manufacturing of Timbers	Timber selection for products	Flat pack furniture, natural, manmade, routing, turning, automation, quality control, tolerance, finishes, preservation and environmental impact.	

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NEA Project (to continue in year 11)				
Topic	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
Section A- Identifying & investigating design possibilities	By analysing the contextual challenge students will identify design possibilities, investigate client needs and wants and factors including economic and social challenges. Students should also use the work of others (past and/or present) to help them form ideas. Research should be concise and relate to their contextual challenge. Students are also advised to use a range of research techniques (primary/secondary) in order to draw accurate conclusions. Students should be encouraged to investigate throughout their project to help inform decisions.	Analysis of a given context	Analysis, context.	<ul style="list-style-type: none"> • Problem solving- Produce a viable solution for a set design brief which meets the needs of a client or user group. • Evaluation- Evaluating the suitability of product ideas in order to produce the most suitable outcome to fulfil the brief. Evaluation of design work and final outcome against clients' needs and a design brief. • Analysis- Analysis of research in order to inform the production of a design specification. • Creativity- Design and make a product which meets a specific brief whilst taking inspiration from existing products and the work of other designers. • Literacy- Producing a concise and coherent design portfolio which fluently communicates design intentions. • Numeracy- Collecting data from primary and secondary research to inform design decisions <p>Subject Specific Skills:</p> <ul style="list-style-type: none"> • Construction of portfolio • Implementing an iterative design strategy.
		Development of a design brief	Design brief, problem, client, and customer.	
		Questionnaire, survey and interview design	Primary research, open and closed questions.	
		Client profiling	Customer requirements, needs, profile.	
		Research and analysis of existing products	ACCESSFMM- Aesthetics, customer, cost of manufacture, safety, size, form, function, materials, manufacture.	
		Research and analysis of influential designers and design movements.	Mood board, key features, socioeconomic influences.	
		Research and analysis of potential customers/ users ergonomics and anthropometrics	Ergonomics, anthropometrics, 5 th , 50 th and 95 th percentile.	