Year 10 Topics

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.

Topic	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
New and Emerging Technologies 3.1.1	***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.***	Robotics, automation and production in industry.	New and emerging technologies, automation, robotics.	• ***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. **Subject Specific Skills:** • Freehand sketching and the use of colour markers. • Annotation of designs in terms of sustainability. • Life cycle assessments of products.
		Production techniques and systems- automation.	Product data management (PDM), digital integration.	
		Enterprise, market pull and technology push.	Crowd funding, virtual marketing and retail, co-operatives, fair trade, market pull and technology push.	
		People society and culture.	Technology push/market pull, technological change, trends, inclusive design, social, moral and cultural impacts.	
		Sustainability and the environment.	Finite, non-finite, reduce, reuse, rethink, reduce, recycle, refuse, LCA.	
		Critical evaluation of new and emerging technologies- planned obsolescence.	Planned obsolescence, life cycle graph.	
		Design for maintenance.	Knock down fillings, non-permanent fixtures and fittings, standard components, WEEE directive.	
		Ethics.	Ecological and social footprint.	
		The environment.	Continuous improvement, kaizen, efficient working (JIT, flexible manufacture) pollution, carbon footprint, product miles, global warming.	

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Energy Generation and storage 3.1.2	***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.***	Renewable and non-renewable resources.	Coal, gas, oil, wind, solar, tidal, hydro-electrical, biofuel and biomass.	• ***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.
		Nuclear energy energy storage kinetic pumped storage systems Alkaline and rechargeable batteries	Radioactive, pneumatics, compression, bar, kinetic, motion, potential energy, cell.	

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Systems approach to designing 3.1.4	***Students will learn how to consider electronic systems, including programmable components, to provide functionality to products and processes, and enhance and customise their operation.***	Input, process and output components	Polarity, pole, throw, transducer driver, integrated circuits (IC), microcontroller, analogue signal, digital signal, peripheral interface controller (PIC), monostable, astable, frequency and hertz.	• ***Problem solving-*** Extracting information from technical specifications. Identifying input, process and out components in a circuit. • ***Numeracy-*** Calculations of voltage, current and resistance. **<u>Subject Specific Skills:</u>** Populating a PCB.
		Systems diagrams	System, subtask, subsystem, open loop system, closed-loop system and feedback.	

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Mechanical Devices 3.1.5	***Students will be taught the types of motion and the mechanical systems which can allow for a change of motion or force.***	Types of motion	Linear, reciprocating, oscillating and rotary.	• ***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, 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. Measurement of degrees and ratios. • ***Creativity-*** Create a visual revision aid showing movement types and mechanisms. **Subject Specific Skills:** Produce a number of demonstration models to demonstrate principles of motion, levers and linkages.
		Levers, linkages and rotary systems.	*Levers:* 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.	

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Developments in new materials 3.1.3	***Students will learn about developments in new materials as well as advantages of modern materials and their applications.***	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.	• ***Problem solving-*** • ***Evaluation-*** • ***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.
		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.	• **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. **Subject Specific Skills:** • Reading and interpreting materials technical specifications.

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Materials and their working properties 3.1.6	***Students will be taught the physical and mechanical properties of materials and how to analyse products in relation to these properties.***	Material properties definitions	*Physical properties:* Absorbency, density, fusibility, electrical conductivity, thermal conductivity. *Mechanical properties:* Strength, hardness, toughness, malleability, ductility, elasticity.	• ***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. metals/non-metals and physical and chemical differences between them e.g. types and properties across a range of materials.
		Properties and categorisation of timbers	Hardwood, softwood, deciduous, coniferous, evergreen.	
		Properties and categorisation of polymers	Polymers, thermoforming, thermosetting, thermoplastics, thermosets.	
		Properties and categorisation of metals	Ferrous, non-ferrous, alloy, ore, furnace, bauxite, carbon, oxidise, Verdigris, patina.	

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NEA Style Project	***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.*** ***This project also covers the following knowledge content from the exam specification:*** ***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***	Analysis of a given context	Analysis, context.	• ***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. **<u>Subject Specific Skills:</u>** • Construction of third angle orthographic projections.
		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, 5th, 50th and 95th 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-thumbnail 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.	

	Investigation, primary and secondary data 3.3.1 ***Specialist techniques and processes 3.2.8*** ***Material management 3.3.9*** ***Tolerances 3.3.8*** ***Surface treatments and finishes 3.2.9*** ***Forces and stresses 3.2.2***	Idea Development	Tonal rendering, presentation drawing, joining and shaping, material finishes, dimensions, standard components, stock form, KD fittings, adhesives.	• Production of exploded drawings. • Rendering presentation drawings. • Implementing an iterative design strategy. • CAD/ CAM • 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.	