GCSE TECHNOLOGY – KNOW IT OR FAIL IT!

Key idea	What students need to learn:
1.1 The impact of new and emerging technologies	To apply a breadth of technical knowledge and understanding of the characteristics, advantages and disadvantages of the following in relation to new and emerging technologies.
	1.1.1 Industry: a unemployment b workforce skill set c demographic movement d science and technology parks.
	1.1.2 Enterprise: a privately-owned business b crowd funding c government funding for new business start-ups d not-for-profit organisations.
	1.1.3 Sustainability: a transportation costs b pollution c demand on natural resources d waste generated.
	1.1.4 People: a workforce b consumers c children d people with disabilities e wage levels f highly-skilled workforce g apprenticeships.

Key idea	What students need to learn:
	1.1.5 Culture: a population movement within the EU b social segregation/clustering within ethnic minorities.
	1.1.6 Society: a changes in working hours and shift patterns b Internet of Things (IoT) c remote working d use of video conference meetings.
	1.1.7 Environment: a pollution b waste disposal c materials separation d transportation of goods around the world e packaging of goods.
	1.1.8 Production techniques and systems: a standardised design and components b just-in-time (JIT) c lean manufacturing d batch e continuous f one off g mass.

Key idea	What students need to learn:
1.2 How the critical evaluation of new and emerging technologies informs design decisions; considering contemporary and potential future scenarios from different perspectives, such as ethics and the environment	To recognise the importance of the evaluative process and respective criteria when considering the impact of new and emerging technologies to a range of scenarios.
	1.2.1 How to critically evaluate new and emerging technologies that inform design decisions: a budget constraints b timescale c who the product is for d the materials used e manufacturing capabilities.
	1.2.2 How critical evaluations can be used to inform design decisions, including the consideration of contemporary and potential future scenarios: a natural disasters b medical advances c travel d global warming e communication.
	1.2.3 Ethical perspectives when evaluating new and emerging technologies: a where it was made b who was it made by c who will it benefit d fair trade products.
	1.2.4 Environmental perspectives when evaluating new and emerging technologies: a use of materials b carbon footprint c energy usage and consumption during manufacture and transportation d life cycle analysis (LCA).

Key idea	What students need to learn:
1.3 How energy is generated and stored in order to choose and use appropriate sources to make products and power systems	The processes, applications, characteristics, advantages and disadvantages of the following, in order to be able to discriminate between them and to select appropriately.
	1.3.1 Sources, generation and storage of energy: a fossil fuels – oil, gas, coal b biofuels – biodiesel and biomass c tidal d wind e solar f hydroelectric.
	1.3.2 Powering systems: a batteries and cells b solar cells c mains electricity d wind power.
	1.3.3 Factors to consider when choosing appropriate energy sources to make products and power systems: a portability of the power source b environmental impact c power output d circuit/system connections e cost.
1.4 Developments in modern and smart materials, composite materials and technical textiles	To apply technical knowledge and understanding of the characteristics, applications, advantages and disadvantages of the following.
	1.4.1 Modern and smart materials: a shape-memory alloys (SMAs) b nanomaterials c reactive glass d piezoelectric materials e temperature-responsive polymers f conductive inks.
	1.4.2 Composites: a concrete b plywood c fibre/carbon/glass d reinforced polymers e robotic materials.

Key idea	What students need to learn:
	1.4.3 Technical textiles: a agro-textiles b construction textiles c geo-textiles d domestic textiles e environmentally friendly textiles f protective textiles g sports textiles.
1.5 The functions of mechanical devices used to produce different sorts of movements, including the changing of magnitude and the direction of forces	The performance, principles, applications and the influence on the design of products of the following.
	1.5.1 Types of movement: a linear b reciprocation c rotary d oscillation.
	1.5.2 Classification of levers: a class 1, 2 and 3 b calculations related to mechanical advantage (MA), velocity ratio (VR), load, effort and efficiency.
	1.5.3 Linkages: a bell crank b reverse motion linkages.
	1.5.4 Cams: a pear shaped b eccentric (circular) c drop (snail).
	1.5.5 Followers: a roller b knife c flat followers.
	1.5.6 Pulleys and belts: a V-belt b velocity ratio (VR) c input and output speeds.

Key idea	What students need to learn:
	1.5.7 Cranks and sliders.
	1.5.8 Gear types: a simple and compound gear train b idler gear c revolutions per minute (RPM) calculations d bevel gears e rack and pinion.
1.6 How electronic systems provide functionality to products and processes, including sensors and control devices to respond to a variety of inputs, and devices to produce a range of outputs	Recognise and apply knowledge and understanding of the working characteristics, applications, advantages and disadvantages of the following.
	1.6.1 Sensors, including: a the role of sensors in electronic systems b light-dependent resistors (LDRs) c thermistor.
	1.6.2 Control devices and components, including: a the role of switches in electronic systems b transistors c resistors.
	1.6.3 Outputs, including: a the role of outputs in electronic systems b buzzers c light-emitting diodes (LEDs).
1.7 The use of programmable components to embed functionality into products in order to enhance and customise their operation	The performance and functionality of using programmable components.
	1.7.1 How to make use of flowcharts.
	1.7.2 How to switch outputs on/off in relation to inputs and decisions.
	1.7.3 How to process and respond to analogue inputs.
	1.7.4 How to use simple routines to control outputs with delays, loops and counts.

Key idea	What students need to learn:
1.8 The categorisation of the types, properties and structure of ferrous and non-ferrous metals	To apply knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials, in order to be able to discriminate between them and select appropriately.
	1.8.1 Ferrous metals, including: a mild steel b stainless steel c cast iron.
	1.8.2 Non-ferrous metals, including: a aluminium b copper c brass.
	1.8.3 Properties, including: a ductility b malleability c hardness.
1.9 The categorisation of the types, properties and structure of papers and boards	To apply knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials, in order to be able to discriminate between them and select appropriately.
	1.9.1 Paper, including: a copier paper b cartridge paper c tracing paper.
	1.9.2 Board, including: a folding boxboard b corrugated board c solid white board.
	1.9.3 Properties, including: a flexibility b printability c biodegradability.

Key idea	What students need to learn:
1.10 The categorisation of the types, properties and structure of thermoforming and thermosetting polymers	To apply knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials, in order to be able to discriminate between them and select appropriately.
	1.10.1 Thermoforming polymers, including: a acrylic b high impact polystyrene (HIPS) c biodegradable polymers – Biopol®.
	1.10.2 Thermosetting polymers, including: a polyester resin b urea formaldehyde.
	1.10.3 Properties, including: a insulator of heat b insulator of electricity c toughness.
1.11 The categorisation of the types, properties and structure of natural, synthetic, blended and mixed fibres, and woven, non-woven and knitted textiles	To apply knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials, in order to be able to discriminate between them and select appropriately.
	1.11.1 Natural, including: a animal – wool b vegetable – cotton.
	1.11.2 Synthetic, including: a polyester b acrylic.
	1.11.3 Woven, including: a plain – calico b twill – denim.
	1.11.4 Non-woven, including: a felted wool fabric b bonded fibres/webs.
	1.11.5 Knitted, including: a weft-knitted fabrics b warp-knitted fabrics.
	1.11.6 Properties, including: a elasticity b resilience c durability.

Key idea	What students need to learn:
1.12 The categorisation of the types, properties and structure of natural and manufactured timbers	To apply knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials, in order to be able to discriminate between them and select appropriately.
	1.12.1 Natural timbers – hardwoods, including: a oak b mahogany c beech d balsa.
	1.12.2 Natural timbers – softwoods, including: a pine b cedar.
	1.12.3 Manufactured timbers, including: a plywood b medium density fibreboard (MDF).
	1.12.4 Properties, including: a hardness b toughness c durability.
1.13 All design and technological practice takes place within contexts which inform outcomes	Performance characteristics of a wide range of materials, components and manufacturing processes, in order to be able to discriminate between them and select appropriately.
	1.13.1 A wide range of materials, components and manufacturing processes for a range of contexts, to inform outcomes, including: a the properties of materials and or components b the advantages and disadvantages of materials and components and manufacturing processes c justification of the choice of materials and components and manufacturing processes.

Key idea	What students need to learn:
1.14 Investigate environmental, social and economic challenges when identifying opportunities and constraints that influence the processes of designing and making	Implications for designers and manufacturers of the following when developing designs and manufacturing products.
	1.14.1 Respect for different social, ethnic and economic groups who have different needs and values when identifying new design opportunities.
	1.14.2 An appreciation of the environmental, social and economic issues relating to the design and manufacture of products, including, fair trade, carbon offsetting, product disassembly and disposal.
	1.14.3 The main factors relating to 'Green Designs'.
	1.14.4 The main factors relating to recycling and reusing materials or products.
	1.14.5 Human capability.
	1.14.6 Cost of materials.
	1.14.7 Manufacturing capability.
	1.14.8 Environmental impact – life cycle analysis (LCA).
1.15 Investigate and analyse the work of past and present professionals and companies in order to inform design	Strategies, techniques and approaches employed when investigating and analysing the work of others.
	1.15.1 Analysing a product to the following specification criteria: a form b function c client and user requirements d performance requirements e materials and components/systems f scale of production and cost g sustainability h aesthetics i marketability j consideration of innovation.
	1.15.2 The work of past and present designers and companies: a Alessi b Apple c Heatherwick Studio d Joe Casely-Hayford e Pixar f Raymond Loewyg Tesla h Zaha Hadid.

Key idea	What students need to learn:
1.16 Use different design strategies to generate initial ideas and avoid design fixation	Strategies, techniques and approaches employed when generating design ideas.
	1.16.1 Use of different design strategies, including: a collaboration b user-centred design c systems thinking.
1.17 Develop, communicate, record and justify design ideas, applying suitable techniques	Techniques employed when communicating and recording design ideas.
	1.17.1 Develop and use a range of communication techniques and media to present the design ideas, including: a freehand sketching (2D and/or 3D) b annotated sketches c cut and paste techniques d digital photography/media e 3D models f isometric and oblique projection g perspective drawing h orthographic and exploded views i assembly drawings j system and schematic diagrams k computer-aided design (CAD) and other specialist computer drawing programs.
	1.17.2 Record and justify design ideas clearly and effectively using written techniques.

7 – Timbers

Key idea	What students need to learn:
7.1 Design contexts	7.1.1 When designing or modifying a product, students should be able to apply their knowledge and understanding of timbers, components and manufacturing processes.
7.2 The sources, origins, physical and working properties of each natural and manufactured timber and their social and ecological footprint	To apply knowledge and understanding of the advantages, disadvantages and applications of the following materials, in order to be able to discriminate between them and select appropriately.
	7.2.1 Natural timbers – hardwoods: a oak (in topic 1) b mahogany (in topic 1) c beech (in topic 1) d balsa (in topic 1) e jelutong f birch g ash.
	7.2.2 Natural timbers – softwoods: a pine (in topic 1) b cedar (in topic 1) c larch.
	7.2.3 Manufactured timber: a plywood (in topic 1) b medium density fibreboard (MDF) (in topic 1) c chipboard.
	7.2.4 Sources and origins – where natural and manufactured timbers are resourced/manufactured and their geographical origin: a Alpine forests – pine, cedar, larch b European forests – oak, beech, ash, birch c Amazonian forests – mahogany.
	7.2.5 The physical characteristics of each timber: a knots b colour c grain structure d density.

Key idea	What students need to learn:
	7.2.6 Working properties – the way in which each material behaves or responds to external sources: a hardness (in topic 1) b toughness (in topic 1) c durability (in topic 1) d elasticity e tensile strength f compressive strength.
	7.2.7 Social footprint: a trend forecasting b impact of logging on communities c ease and difficulty of recycling and disposal.
	7.2.8 Ecological footprint: a sustainability b deforestation c habitat destruction and loss d processing e transportation f wastage g pollution.
7.3 The way in which the selection of each natural and manufactured timber is influenced	The influence of the following factors when selecting materials for a specific application.
	7.3.1 Aesthetic factors: a form b colour c texture.
	7.3.2 Environmental factors: a sustainability b genetic engineering c seasoning d upcycling.
	7.3.3 Availability factors: a use of stock materials b use of specialist materials c environmental impact of hurricanes, storms and disease.
	7.3.4 Cost factors: a quality of material b manufacturing processes necessary c treatments: fire proofing, tanilized.

Key idea	What students need to learn:
	7.3.5 Social factors: a use for different social groups b trends/fashion c popularity.
	7.3.6 Cultural and ethical factors: a avoiding offence b suitability for intended market c the consumer society d the effects of mass production e built-in product obsolescence.
7.4 The impact of forces and stresses on each natural and manufactured timber and how they can be reinforced and stiffened	An awareness of the influence of forces and stresses that act on materials and the methods that can be employed to resist them.
	7.4.1 Forces and stresses: a compression b tension c shear d natural forces within the timber as it grows e pre-stressed construction beams.
	7.4.2 Reinforcement/stiffening techniques: a frame structures b suitable fabrication/assembly/construction processes c lamination d use of braces and tie bars e embedding composite materials.
7.5 Typical stock forms, types and sizes used in order to calculate and determine the required quantity of each natural and manufactured timber	To apply knowledge and understanding of the advantages, disadvantages and applications of the following forms/sizes of materials, in order to be able to discriminate between them and select appropriately.
	7.5.1 Stock forms/types: a regular sections b mouldings c dowels d sheets.
	7.5.2 Sizes: a PAR/PSE/imperial and metric b cross-sectional area c diameter d board sizes – 2440 mm × 1220 mm, 1220 mm × 610 mm.

Key idea		What students need to learn:
7.6	**Alternative processes that can be used to manufacture typical products of each natural and manufactured timber to different scales of production**	Application, advantages and disadvantages, of the following processes, scales of production and techniques when manufacturing products, in order to be able to discriminate between them and select appropriately for use.
		7.6.1 Processes that can be used to cut and shape materials: a routing b sawing c use of a mortise d use of a bag press.
		7.6.2 Scales of production: a one off b batch c mass production d continuous.
		7.6.3 Techniques for quantity production – methods that are employed when making products in quantity: a marking-out methods (use of reference points, lines and surfaces) b jigs c fixtures d templates e patterns f sub-assembly g computer-aided manufacturing (CAM) h quality control i working within tolerance j efficient cutting to minimise waste.

Key idea	What students need to learn:
7.7 Specialist techniques, tools, equipment and processes that can be used on each natural and manufactured timber to shape, fabricate, construct and assemble a high-quality prototype	Application, advantages and disadvantages, of the following specialist techniques when manufacturing products, in order to be able to discriminate between them and select appropriately for use.
	7.7.1 Tools and equipment: a hand tools b machinery c digital design and manufacture.
	7.7.2 Shaping: a drilling b cutting c planing d chiselling e turning – face plate and between centres f abrading – glass paper g carving h use of rasps/surforms.
	7.7.3 Fabricating/constructing: a lamination b veneering c use of screws d nailing e use of adhesives – PVA, contact adhesive f jointing – butt, dowel, lap, housing, mitre, mortise and tenon, dovetail g wastage h addition.
	7.7.4 Assembling: a knock-down fittings b hinges c ironmongery.

Key idea	What students need to learn:
7.8 Appropriate surface treatments and finishes that can be applied to each natural and manufactured timber for functional and aesthetic purposes	Application, advantages and disadvantages of the following finishing techniques and methods of preservation, in order to be able to discriminate between them and select appropriately for use.
	7.8.1 Surface finishes and treatments: a painting b staining c varnishing d wax e oil f shellac g veneering.