Mapping Document: GCE Design & Technology (Product Design)

AQA Product Design (2014) to Pearson Product Design 9DT0 (2017)

The table below shows the existing AQA content with the correlation to the new Pearson product design specification in the right-hand columns. The page numbers relate to each specification document.

AQA Product Design (2014)	**Page no.**	**Pearson Product Design 9DT0 (2017)**	**Page no.**
3.1 Unit 1 PROD1 Materials, Components and Application	5	**Component 1: Principles of Design and Technology**	8
Materials: Candidates should develop an understanding of the physical and mechanical properties of a broad range of materials and components. They should understand why these are used in specific applications with particular emphasis on the life-cycle of products including manufacture, use and disposal.	5	**2.1 Materials**: Performance characteristics of woods, metals, polymers, smart and modern materials, papers, boards, textiles and composites in order to discriminate between materials and select appropriately: a) conductivity b) strength c) elasticity d) plasticity e) malleability f) ductility g) hardness h) toughness i) durability j) biodegradability.	10

Ferrous metals: • Ferrous metals including mild steel, high carbon steel, cast and wrought iron. • Availability of stock forms such as sheet, bar, tube and angle. • Applications for ferrous metals such as car body panels, tools, white goods and machine parts. **Non-ferrous metals:** • Non-ferrous metals including aluminium, copper, zinc, gold, silver and titanium. • Availability of stock forms, e.g. sheet, tube and ingot. • Applications for non-ferrous metals such as kitchenware, jewellery, food wrapping, cans and electronics. **Alloys:** • Ferrous alloys including stainless steel, high-speed steel and die (tool steel). • Applications for ferrous alloys, e.g. kitchenware, street furniture, cutting and press tools. • Non-ferrous alloys including bronze, brass, pewter and duralumin/aluminium alloys. • Applications for non-ferrous alloys such as ornaments, valves, boat fittings, sculpture, coins and jewellery.	5	**1.2 Metals**: a) ferrous metals – mild steel, carbon steels, cast iron b) non-ferrous metals – aluminium, copper, zinc, tin c) alloys (ferrous and non-ferrous) – stainless steel, duralumin, brass.	9
Polymers: • Thermoplastics including ABS, PET, PMMA (acrylic), Polypropylene, High Impact Polystyrene, Expanded Polystyrene, Low and High Density Polyethylene, Nylon and UPVC. • Applications for thermoplastics such as mobile communications products, toys, car parts, packaging, kitchenware, pipes and window frames. • Thermosets including: Epoxy resins, Polyester resins, Urea	5, 6	**1.3 Polymers:** a) thermoplastics – acrylic, polyethylene, polyethylene terephthalate (PET), polyvinyl chloride (PVC), polypropylene (PP), acrylonitrile butadiene styrene (ABS) b) thermosetting plastics – epoxy resins (ER), urea formaldehyde (UF), polyester resin (PR) c) elastomers – rubber.	9

Formaldehyde and Melamine Formaldehyde. • Applications for thermosets such as decorative laminates, casting and encapsulation, tableware and electrical fittings. **Biodegradable polymers:** • Degradable polymers (oxo-degradable). • Biodegradable polymers ('bio-batch' additive mixed polymers). • Compostable polymers including cellulose-based polymers such as Biopol and cornstarch-based polymers such as Polylactide (PLA). • Applications for 'biodegradable polymers' such as carrier bags, plastic bottles and detergent sachets. • Absorbable/water soluble polymers including lactide, glycolide, ('Lactel') and 'Ecofilm'. • Medical applications such as slow-release medication, bone repair fixings and detergent washing liquid sachets.			
Natural woods: • Hardwoods including beech, oak, ash, mahogany and teak. • Softwoods including Scots pine, spruce and Douglas fir. • The availability of stock forms including rough sawn and P.S.E, and 'FSC' marked softwood. • Applications for natural woods, e.g. furniture, decorative products, jewellery/craft and construction.	5	**1.1 Woods:** a) hardwoods – oak, mahogany, beech, jelutong, balsa b) softwoods – pine, cedar, larch, redwood.	9
Man-made boards: • Man-made boards including plywood, aero ply, flexi ply, marine ply, chipboard, MDF and hardboard. • Applications for man-made boards, e.g. furniture, work surfaces and exterior projects. **Composites:** • Fibre-reinforced polymers including glass (GRP), carbon fibre (CFRP) and Kevlar applications for FRP such as boat building,	5	**1.4 Composites**: a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), hardboard, chipboard, plywood.	9

sports car manufacture, performance sports equipment and body armour. • Particle-based composites including concrete and cermets such as tungsten carbide.			
Laminates and veneers: • Veneers such as beech, ash, oak, walnut, paper and foil backed. • Laminates such as 'Formica' (coated printed paper or foil laminates). • Applications for veneers and laminates, e.g. decorative surfaces, laminate flooring, jewellery and furniture.	5	**See 1.5:** b) commercial printing papers – bond, coated c) boards – mounting board, corrugated board, foam board, folding box board, foil-lined board.	9
Elastomers: • Common elastomers such as Thermoplastic Elastomers (TPE), Thermoplastic Rubber (TPR) and Liquid Silicon Rubber (LSR). • Applications for elastomers such as car bumpers and trims, and product grips (over mouldings).	6	**See 1.3:** c) elastomers – rubber.	9
Smart materials: • Shape Memory Alloy (SMA), such as 'Nitonol' (Nickel-Titanium alloy). • Applications such as flexible spectacles (super-elastic wire), heat-activated cable connectors, muscle wires and fire sprinkler control. • Thermochromic pigment (smart colours). • Applications such as thermometers, baby feeding products, kettles, steam irons, thermal warning patches and hi-tech jewellery. • Thermochromic sheet. • Applications such as thermal warning patches, battery condition indicators and jewellery. • Photochromatic pigment. • Applications such as sunglasses, anti-flash visors, sun-blocking	6	**1.7 Smart and modern materials**: a) thermo-ceramics b) shape memory alloys (SMA) c) reactive glass d) liquid crystal displays (LCD) e) photochromic materials f) thermochromic materials g) quantum tunnelling composites.	10

products and radiation indicators. • Phosphorescent pigment. • Applications such as emergency exit signs, jewellery and toys. • Polymorph. • Applications such as modelling grip prototypes. **Modern materials:** • Metal-based, including coated metals, e.g. anodised aluminium sheet, nickel-plated steels, polymer-coated aluminium, aluminium composite (polythene-cored aluminium sheet), aluminium foam and titanium. • Wood-based, including flexible MDF, flexi-ply, aircraft grade plywood, Hexaboard and paper-backed veneers.			
Compliant materials: • Paper including layout paper, bleed proof, photo quality cartridge and watercolour. • Applications such as design drawings, presentations and graphic products. • Card including carton board, multi-sheet, laminated, corrugated, metal effects and mount board.	6	**1.5 Papers and boards**: a) drawing papers – layout, tracing, copier, cartridge b) commercial printing papers – bond, coated c) boards – mounting board, corrugated board, foam board, folding box board, foil-lined board.	9
Processes and manufacture: e.g. the application of materials and components to suit specific production processes, from one-off to mass-production. **Manufacturing systems:** Volume of production – one-off, batch, team and mass-production techniques. **Manufacturing systems:** • Planning production procedures, methods. • Craft to industrial, one-off to mass production. • The implications of these methods for the product, the designer, the maker and user.	16, 18	**8.1 Characteristics and stages of the following methods of production when applied to products and materials:** a) one-off production b) batch production c) high-volume production.	15

Plastics: Techniques including: vacuum forming, thermoforming and line bending. **Polymers**: Moulding processes including injection moulding, blow moulding, rotational moulding and compression moulding. **Wasting processes:** • Common wasting processes including drilling, turning and milling. • Profile or shape cutting using routers, millers, flame cutting and laser cutting. • Piercing and blanking processes. **Redistribution methods**: • Casting, including sand, die and investment. • Extrusion techniques to manufacture bar and profiles.	8	**Processes, techniques and specialist tools** 3.1 Processes, applications, characteristics, advantages and disadvantages of the following, in order to discriminate between them and select appropriately, including the selection of specific and relevant tools to be used for domestic, commercial and industrial products and systems, and use safely when experimenting, improving and refining in order to realise a design: d) casting – sand (to include investment), die, resin, plaster of Paris (including use of specialist tools) e) machining – milling/routing, drilling, turning, stamping, pressing (including use of specialist tools) f) moulding – blow moulding, injection moulding, vacuum forming, extrusion, rotational moulding (including use of specialist tools) g) lamination (including use of specialist tools) h) marking out techniques – woods, metals, polymers, paper and boards (including use of specialist tools).	11
Illustration, selection and use of appropriate 2D/3D techniques: Sketching, drawing, use of mixed media etc. **Enhancement**: • Rendering – use of line/tone/colour/form. • Texture to represent materials and surface finishes. • Presentation – two-dimensional and three-dimensional products. **Information drawing:** • Quantitative – graphs, pie charts, bar charts, pictograms.	17	3.3 Use of media to convey design decisions, to record to recognised standards, explain and communicate information and ideas using the following methods and techniques: a) pictorial drawing methods for representing 3D forms – isometric, 2-point perspective b) working drawings for communicating 2D technical information – 3rd angle orthographic projection, triangulation c) nets (developments) for communicating	12

• Organisational and topological – flow charts, sequential, schematic, etc. **Communication methods – detail and form of products, environments and systems so that they may be manufactured:** Identify and use appropriate means to communicate ideas, design proposals and evaluations to a range of audiences, which includes clients and potential users of the product.		information about 3D forms in a 2D format d) translation between working drawings, pictorial drawings and nets (developments) e) report writing.	
Product components: • Knock Down fittings including: Barrel nut and bolt, corner plates, block connectors and dowels. • Common applications, e.g. Flat Pack furniture. • Fastenings including wood screws, self-tapping screws and bolts. • Common applications such as temporary joining methods. **Adhesives:** Common adhesives and uses including: Solvent Cement/Tensol 12 for joining acrylic; PVA for wood and papers; Contact Adhesive (Evostik) for mixed materials such as laminate to MDF; Epoxy resin (Araldite) for mixed materials such as metals to woods; UV hardening adhesive (Superglue substitute). **Woods:** • Traditional joining methods including mortise and tenon, dowel, dovetail and comb. • Knock Down Fittings and fastenings. **Metals:** • Permanent joining methods such as soldering, brazing, riveting, welding (including oxy-acetylene, MIG and spot). • Temporary joining methods such as self-tapping screws, machine screws, nut and bolt. **Plastics:** Permanent joining methods including plastic welding and bonding with adhesive.	6–8	3.4 Uses, characteristics, advantages and disadvantages of the following permanent and semi-permanent joining techniques in order to discriminate between them, select appropriately and use safely: a) adhesives – contact adhesive, acrylic cement, epoxy resin, polyvinyl acetate (PVA), hot melt glue, cyanoacrylate (superglue), polystyrene cement (including use of specialist tools) b) mechanical – screws, nuts, bolts, washers, rivets, press (including use of specialist tools) c) heat – oxy-acetylene welding, MIG welding, brazing, hard soldering, soft soldering (including use of specialist tools) d) jointing – traditional wood joints, knock-down fittings (including use of specialist tools).	12
Quality control: • Inspection of stock materials for defects.	9	3.2 Application of specialist measuring tools and equipment to determine and apply the accuracy	11

• Use of measuring devices including callipers, micrometers and go/no go gauges. • Use of drilling jigs and templates. • Use of mitre saws and mitre blocks. • Use of welding jigs or fixtures.		and precision required for products to perform as intended: a) marking, cutting and mortise gauges b) odd leg, internal and external callipers c) squares (set, try, engineers and mitre) d) micrometer and vernier callipers e) densitometer f) dividers g) jigs and fixtures h) go and no-go gauges.	
		Processes, techniques and specialist tools 3.1 Processes, applications, characteristics, advantages and disadvantages of the following: a) heat treatments – hardening and tempering, case hardening, annealing, normalising (including use of specialist tools).	11
Finishing materials and processes			
Woods: • Common forms of wood preservatives including water-based, exterior, stains, yacht varnish and polyurethane varnish. • Finishes to enhance aesthetics, e.g. gloss paints, stains and colour wash and wax finishes. • Methods of application including spray, dip and pressure treating. • Laminate coverings for sheet material. **Metal primers:** • Including zinc and red oxide primers. • Paints including acrylic and cellulose-based. • Method of application including brush, spray, dip and powder	9	3.5 Application, advantages and disadvantages of the following finishing techniques and methods of preservation in order to discriminate between them and select appropriately for use, including for the prevention of degradation: a) finishes – paints, varnishes, sealants, preservatives, anodising, electro-plating, powder coating, oil coating, galvanisation, cathodic protection (including use of specialist tools) b) paper and board finishing process – laminating, varnishing, hot foil blocking, embossing (including use of specialist tools).	12

coating. • Plating including chrome, silver and tin-plated. • Galvanizing. • Dip coating with polymers. • Brushed/polished stainless steel. **Polymers:** • Pigments and stabilisers. • Applied finishes including acrylic paints and chrome effects.			
		Processes, techniques and specialist tools 3.1 Processes, applications, characteristics, advantages and disadvantages of the following: c) printing – offset lithology, flexography, screen-printing, gravure (including use of specialist tools).	11
CAM processing: For example: • CNC laser cutters for 2D cutting and engraving sheet materials. • CNC routers for 3D machining of block and sheet materials. • CNC plotter cutters for 2D printing and cutting of vinyl. • Use of 3D printers or stereo-lithographic modellers to prototype designs. **Use of ICT in design:** Selection and use of CAD, word processing and DTP. **Modelling:** Using 3D forms, mock ups, prototypes, scale models, etc.	8, 17	4.1 Set up, safe and accurate operation, advantages and disadvantages of the following digital technologies: a) computer-aided design (CAD) – 2D and 3D design to create and modify designs and create simulations, 3D modelling for creating 'virtual' products b) computer-aided manufacture (CAM) and rapid prototyping – CNC lathes, CNC routers, CNC milling machine, CNC laser, CNC vinyl cutters, rapid prototyping.	13
Quality assurance and quality control: During the stages of design, development and manufacturing, 'right first time' use of specifications, product testing, continuous improvement.	17	8.2 Characteristics, application, advantages and disadvantages of the following types of quality monitoring systems: a) quality control – the monitoring and achieving of high standards and degree of tolerance by inspection and testing, computer-aided testing	15

		b) quality assurance – monitoring the quality of a product from its design and development stage, through its manufacture, to its end-use performance and degree of customer satisfaction c) Total Quality Management (TQM) – when applied to quality assurance procedures and its impact on employees at every stage of the production process (ISO 9000).	
Safety legislation: Understand the implications of health and safety as an element of design activity and safety standards imposed by BSI and other regulatory bodies. Apply relevant legal requirements.	16	11.4 Implication to designers, manufacturers and consumers of the following standards when developing designs and manufacturing products: a) British Standards (BSI and kite mark) b) European (CEN and CE) c) International Standards (ISO).	18
Health and safety: • COSHH (Control of Substances Hazardous to Health). • Health and safety precautions associated with common school workshop processes. • General health and safety measures carried out to protect employees in manufacturing industries. • Risk assessments for hand and commercial processing. **Safety**: A recognition of the application of risk assessment to the design and manufacture of products and the relationship between the user and the product. **Safety:** Be aware of the possible hazards found in a manufacturing environment. Adopt safe procedures and working practices.	9, 16, 18	**10 Current legislation** 10.2 The principles and applications of health and safety laws and regulations and their impact on the designing and making process, including the consequences of non-adherence: a) health and safety regulation – the Health and Safety Executive (HSE) and an awareness of relevant regulations to manufacturing industries b) Health and Safety at Work, etc. Act (1974) – the procedures to safeguard the risk of injury to people: personal protective equipment (PPE), signage, warning symbols c) Control of Substances Hazardous to Health (COSHH) regulations – the storage and use of solvent-based substances containing volatile organic compounds (VOCs). **7 Safe working practices, potential hazards and risk assessment**	17, 14

		7.1 Adopting safe working practices, recognising and reacting to potential hazards: a) understanding safe working practices for yourself and others when designing and making, including when selecting and safely using machinery, equipment and tools in order to ensure safe working environments b) understanding the need for risk assessments – identification of potential hazards, identification of people at risk, evaluation of risks, implementation of control measures, recording and storing of risk assessment documentation.	
3.3.3 Section C: Processes and Manufacture		**8 Features of manufacturing industries**	15
Systems and control: • An understanding of simple control systems and their application including mechanical systems, energy sources, forms, storage conversion, transmission and efficient use. These may be related to either the function or manufacture of a product. • Systems diagrams – input, process, output. • The importance of feedback and control. • Application of control systems and sub-systems within both the manufacture and functioning of a range of products. **ICT applications**: • Appreciation and understanding of the use of CAM for industrial production. • Use of ICT in manufacturing data control (EDI). • CAA (computer-aided administration). • CAD (computer-aided design) product modelling. • PPC (production planning and control) networking. • CIM (computer-integrated manufacture). • Flexible manufacturing systems.	17, 18	8.3 Characteristics, processes, application, advantages and disadvantages and the importance of considering accuracy of production and efficiency of modern manufacturing methods and systems when designing for manufacture for small-, medium- and large-scale production: a) production scheduling and production logistics b) robotics in production – robots on fully-automated production and assembly lines/cells c) materials handling systems – automated storage and retrieval systems (ASRS), automatic guided vehicles (AGVs) d) flexible manufacturing systems (FMS), modular/cell production systems e) lean manufacturing using just-in-time (JIT) systems f) standardised parts, bought-in components g) quick-response manufacturing (QRM) h) data integration – product data management	15

		(PDM), enterprise resource planning (ERP) systems i) concurrent manufacturing.	
3.3.2 Section B: Design and Market Influences		**6 Effects of technological developments**	14
Major developments in technology: Developments in material technology and processing equipment which affect application, material properties and manufacturing processes, to include the history of style and product evolution. **A study of manufactured products and systems:** Appraisal of functional, aesthetic, technical and economic considerations in the design and manufacture of products, considering aspects of their physical surroundings as shaped by designers, craftsmen and technologists. **The influence of design and technology in society:** • Awareness and understanding of the work of designers and technologists. • Human needs and the effects of products and systems on society, including aspects of the use and conservation of energy in relation to both the manufacture and performance of products.	16	6.1 Current and historical technological developments that have had an effect on the work of designers and technologists and their social, moral and ethical impacts: a) mass production – the consumer society, built-in obsolescence, the effect mass production has on employment b) the 'new' industrial age of high-technology production – computers and the development and manufacture of products, miniaturisation of products and components, the use of smart materials, products from innovative applications c) the global marketplace – multinational companies in developed and developing countries, manufacturing 'offshore' in developing countries and local and global production.	14
The work of past and present designers: As related to consumer products in particular, but also to include design movements and the inherent influences of socio-economic changes. **The influence of design and technology in society:** • Design and Technology awareness and understanding. • The influence of designers and technologists.	17	5.4 Design theory through the influences and methods of the following key historical movements and figures: a) Arts and Crafts – William Morris b) Art Nouveau – Charles Rennie Mackintosh c) Bauhaus Modernist – Marianne Brandt d) Art Deco – Eileen Gray e) Post Modernism – Philippe Starck f) Streamlining – Raymond Lowey g) Memphis – Ettore Sottsass.	13

Ergonomics and anthropometrics: The application of ergonomics and anthropometrics such as in the use of product shaping, textures, colours and physical size to promote ease of use.	7	5.3 The influence of aesthetics, ergonomics and anthropometrics on the design, development and manufacture of products: a) form over function b) form follows function.	13
Human factors: • Ergonomics and anthropometrics – the relationship between people, products and the environment. • Working triangle, colour.	17	5.2 Principles, applications and the influence on design of anthropometrics and ergonomics: a) sources and applications of anthropometric data b) ergonomic factors for a designer to consider when developing products and environments with which humans react.	13
3.3.2 Section B: Design and Market Influences		**9 Designing for maintenance and the cleaner environment**	16
Product life-cycle: To include design introduction, evolution, growth, maturity, decline and replacement. **Design and market influences:** • e.g. the evolution, selection and application of materials for the manufacture of modern products. • How the use and conservation of both energy and raw materials affect the selection and application of materials for the production and function of products today. **Sustainability and environmental concerns:** • Use of natural resources, materials utilisation, conservation, waste disposal/management, pollution, recycling, green technology, environmental problems and planned obsolescence. • Suitability for intended environment.	16, 17	9.1 Characteristics, application, advantages and disadvantages of 'cleaner' design and technology – a product's life-cycle in relation to the following sustainable development issues: a) material selection – source, quantity, quality, range, recyclability, biodegradability b) manufacture – minimising energy use, simplification of processes, achieving optimum use of materials and components, giving consideration to material form, cost and scale of production c) distribution – efficient use of packaging, reduction of transport, alternatives to fossil fuels d) use – repair versus replacement, energy efficiency, efficiency ratings e) repair and maintenance – standardisation, modular construction, bought in parts f) end of life – design for disassembly, recovered material collection, sorting and re-processing	16

		methods, energy recovery, environmental implications of disposal to landfill.	
Environmental/sustainability issues: • Selection of materials and manufacturing processes to reduce environmental impact. • The 3Rs (Reduce, Reuse, and Recycle) and their application to design and manufacture.	7	9.2 The wider issues of using cleaner technologies: a) cost implications to the consumer and manufacturer b) sustainability – designing without jeopardising the potential for people in the future to meet their needs.	16
		10 Current legislation	
Consumer safety: At AS Level, candidates should have an understanding of the main methods designers and manufacturers employ to ensure products are safe to use. They should be able to describe basic safety features in products such as electrical consumer goods and toys. Candidates should be able to describe simple safety tests that they might use on products.	7	10.1 From the consumer's point of view, the implications of consumer rights legislation to consumers and manufacturers: a) Consumer Rights Act (2015) b) Sale of Goods Act (1979).	17
Copyright protection: To include patenting and its importance to the designer and manufacturer.	17	11.3 The importance, implications and ways of protecting the intellectual property rights of designers, inventors and companies: a) patents b) copyrights c) design rights d) trademarks.	18
		5 Factors influencing the development of products	
Design methods: Develop and use specifications which suit the requirements of potential clients in terms of price, quality and marketability.	17	5.1 The importance and influence of user-centred design in ensuring products are fit-for-purpose and meet the criteria of specifications when designing, making and evaluating in relation to: a) user needs, wants and values b) purpose	13

		c) functionality d) innovation e) authenticity.	
		11 Information handling, modelling and forward planning	
Design in the human context: Human needs and the effects of products and systems on society. **Human needs:** • Specific to various groups of people – consumers, young, old, disabled, workers. • To meet physical and psychological needs.	17	11.1 Collection, collation and analysis of information and the use of this to make informed decisions: a) marketing – marketing analysis, research techniques, raw data/analysed data to enable enterprise to be encouraged b) innovation management – cooperation between management, designers and production engineers, the encouragement of creativity c) the use of feasibility studies on the practicability of proposed solutions.	18

The following content is new and does not match the AQA Product Design (2014) specification content: **Refer to the editable schemes of work**.

Pearson Product Design 9DT0 (2017)	**Page no.**	**Pearson Product Design 9DT0 (2017)**	**Page no.**
12.1 Strategies, techniques and approaches to explore, create and evaluate design ideas: a) user-centred design: framework process, problem solving, user needs, wants and values, limitations of end user consideration b) circular economy – biologically-based systems and an understanding of how waste and pollution can be eliminated c) systems thinking – the influence of systems on commercial activity to enable all elements of a manufacturing enterprise to work together.	19	12.3 The cost, sales, profit and market implications to the designer and manufacturer of the stages of a product's life-cycle: • Introduction Stage • Growth Stage • Maturity Stage • Decline Stage.	19

1.6 Textiles: a) natural fibres – cotton, linen, wool b) manmade fibres – nylon, polypropylene, polyester c) textile treatments – flame resistant, polytetrafluoroethylene (PTFE).	9		
Product Design 9DT0 (from 2017)			
Component 2: Independent Design and Make Project			
Overview There are no limits to project selection beyond the time and resources available and the appropriateness of selection in matching individual students' potential. Students are expected to follow an iterative design process. In order to reach high attainment levels, students must adopt a commercial design approach to their work, reflecting how a professional designer might deal with a design problem and its resolution. Design and development are now separate assessment areas. Planning is no longer assessed as a discrete component. Mathematical and scientific principles are an important part of designing and developing products, and students will be expected to be able to apply these principles when considering their designs and the designs of others. Please see the specification Appendix 1: Mathematical skills requirement and Appendix 3: Science knowledge and skills requirement.	21		