Mapping Document: GCE Design & Technology (Product Design)

OCR Product Design (2013) to Pearson Product Design 9DT0 (2017)

The table below shows the existing OCR content with the correlation to the new Pearson product design specification in the right-hand columns. The page numbers relate to each specification document. Text in **BLUE** is taken from the core content.

In the interests of space, OCR content that does not match the Pearson specification has not been reproduced (for example, pop-ups and mechanical techniques, p29).

Pearson content is shown in abridged form where useful.

OCR Product Design (2013)	Page no.	Pearson Product Design 9DT0 (2017)	Page no.
		1 Materials	
Wood: • Hardwoods and softwoods: beech, ash, oak, jelutong, sycamore, maple, teak; cedar, pine, deal. • (Material focus: **resistant materials)**	33	**1.1 Woods**: a) hardwoods – oak, mahogany, beech, jelutong, balsa b) softwoods – pine, cedar, larch, redwood.	9
Metal: • Including mild steel, high carbon steels, stainless steels, cast iron, zinc, copper; brasses and aluminium alloys and tin alloys. • The properties of metal and metal products – strength, toughness, ductility and malleability, weight, durability and thermal and electrical conductivity, in terms of suitability for specific consumer products. • Up-to-date developments of new and smart metal alloys and their potential application. • (Material focus: **resistant materials and engineering)**	33	**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

Plastic sheet: • Modelling and display materials – corruflute, high impact polystyrene, acrylic, Styrofoam, polypropylene (for laminates), PVC, LDPE. • (Material focus: **graphic products)** **Plastic:** • Polystyrene, polyethylene, acrylic, polypropylene, PVC, ABS and PET, phenol resins, phenol formaldehyde, melamine formaldehyde, urea formaldehyde, epoxy resins. • Composite materials: Kevlar, carbon fibre. • Properties of plastics – hardness, brittleness, tensile strength, plasticity, compressive strength, sheer strength, strength to weight ratio, chemical resistance, elasticity, stiffness and impact resistance. • (Material focus: **resistant materials and engineering)**	29, 33	**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
Manufactured boards: • Plywood, laminated boards, chip and compressed boards. • The properties of wood and wood products – hardness, flexibility, tensile strength, compressive strength, sheer strength, strength to weight ratio, chemical resistance, elasticity, stiffness and impact resistance. • Up-to-date developments of new forms of wood products and their potential applications. • (Material focus: **resistant materials)**	33	**1.4 Composites**: a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), hardboard, chipboard, plywood.	9
Paper and boards: • The selection and use of common papers and boards including foil laminates, substrates. • Common paper terms: coating, filler, laminate, opacity, ream. • The properties of papers and boards – water resistance, strength, absorbency, density, durability.	29	**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

• Modelling and display materials – card and foam board. • Bleached and unbleached forms. • Bonded and corrugated forms. • Up-to-date developments of new and smart materials and their application in graphic products. • (Material focus: **graphic products)**			
Fibres: • The performance characteristics, selection and use of natural and manufactured fibres. • Natural fibres – cotton, flax, wool, silk. • (Material focus: **textiles)**		**1.6 Textiles**: a) natural fibres – cotton, linen, wool b) manmade fibres – nylon, polypropylene, polyester c) textile treatments – flame resistant, polytetrafluoroethylene (PTFE).	9
Smart and modern materials: • Demonstrate an understanding of up-to-date development of materials and their application in product design. • Up-to-date developments of new and smart plastic materials and their potential applications. • (Material focus: **resistant materials)**	21, 33	**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
		2 Performance characteristics of materials	
Engineering materials: • The selection and use of common ferrous and non-ferrous metals. • Strength, toughness, ductility and malleability, weight, durability and thermal and electrical conductivity in terms of suitability for specific consumer products. • The selection and use of common thermoplastics and	25	2.1 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	10

thermosetting plastics • The properties of plastics – hardness, brittleness, tensile strength, plasticity, compressive strength, sheer strength, strength to weight ratio, chemical resistance, elasticity, stiffness and impact resistance. • (Material focus: **resistant materials and engineering)**		c) elasticity d) plasticity e) malleability f) ductility g) hardness h) toughness i) durability j) biodegradability.	
		3 Processes, techniques and specialist tools	
Manufacturing methods: • Drilling, sawing, shaping, abrading. • **Wood** processes: laminating, bending, routing/profiling, turning. • **Metal** processes: milling, turning, casting, modifying characteristics using heat, pressing and stamping. • **Plastic** processes: compression moulding, injection moulding, vacuum forming, rotational moulding, extrusion and blow moulding. • Processes, materials and components used to manufacture products from differing materials. • Processes used in assembling and joining similar and dissimilar materials. • The design of simple jigs, presses and moulds. • Joining methods using fittings, adhesives, heat and common joints. • (Material focus: **manufacturing)** **Engineering processes:** • Common processes for working with engineering materials. • Modifying characteristics using heat. • (Material focus: **engineering)**	32, 34, 24, 30	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: a) heat treatments – hardening and tempering, case hardening, annealing, normalising (including use of specialist tools) c) printing – offset lithography, flexography, screen-printing, gravure (including use of specialist tools) 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	11

Manufacturing processes: • Common processes for working models and prototype graphic products. • Image setting, plate/screen production. • Photomechanical transfer techniques. • Commercial printing processes – offset lithography, screen process printing, flexography, gravure, digital printing. • Vinyl cutting. • Cutting and forming processes – die cutting, folding, perforating laser cutting. • Paper and board manufacture and production. • (Material focus: **graphic products)**		(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).	
Engineering quality control: • Tolerances, fit, performance, finish. • (Material focus: **engineering)**	25	3.2 Application of specialist measuring tools and equipment to determine and apply the accuracy 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.	11
Engineering drawing techniques: • Freehand sketching, isometric projection, perspective drawing. • Block diagrams, flow diagrams, schematic diagrams, circuit diagrams, 3rd angle projection, assembly/exploded drawings and diagrams.	24, 29	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	12

• (Material focus: **engineering)** **Package and carton design and construction:** • Closures – tab-lock, tuck-flap, slit-lock, postal-lock crash base (+automatic). • Nets for simple and complex products. • Press form design and construction. • (Material focus: **graphic products)**		b) working drawings for communicating 2D technical information – 3rd angle orthographic projection, triangulation c) nets (developments) for communicating information about 3D forms in a 2D format d) translation between working drawings, pictorial drawings and nets (developments) e) report writing.	
Engineering components: • Mechanical components – nuts, bolts, screws, springs, rivets, pins, keys, drive mechanisms and knock-down fittings. • (Material focus: **engineering)**	25	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
Finishing processes: • Varnishes – roller coat, UV, spirit. • Spot varnishing. • Lamination. • Embossing. • Foil blocking. • Paper coatings and fillers.	29	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)	12

• cropping, trimming. • (Material focus: **graphic products)** **Surface finishes:** • The nature and suitability of surface finishes and coatings across a range of products relating to decoration, resistance to decay and wear, absorption and aesthetic qualities. • Methods of preparing surfaces to accept finishes: ○ **Metal** – paints, dip coating, varnishes, lacquering and electroplating, galvanising, plastic coating. ○ The following finishes for **plastic** – edge polishing, chemical finishing. ○ **Wood** – varnishing, waxing, oiling, stains, polishing, interior and exterior finishes, chemical preservatives, pressure impregnation, lipping. • (Material focus: **resistant materials)**		b) paper and board finishing process – laminating, varnishing, hot foil blocking, embossing (including use of specialist tools).	
		4 Digital technologies	
Digital technology in designing and manufacturing processes: • CAD/CAM as used in industry/commerce. • Testing, modelling and rapid prototyping. • Stock control, monitoring, purchasing logistics in industry. • High-volume production and automation. • The implications of the use of digital technology.	20	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
		5 Factors influencing the development of products	
Ergonomics and anthropometrics: • Demonstrate an understanding of ergonomics when designing	21	5.2 Principles, applications and the influence on design of anthropometrics and ergonomics:	13

products. • Interpret and apply anthropometric data when designing.		a) sources and applications of anthropometric data b) ergonomic factors for a designer to consider when developing products and environments with which humans react.	
Aesthetics and function, shape, form, colour and taste: • Develop a critical awareness of designed objects/products in such terms as colour, form, shape, taste, texture and surface finish. • Consider the way aesthetic aspects influence appearance, contrast, composition, harmony/disharmony.	21	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
		6 Effects of technological developments	14
Value issues: • Explore environmental, moral, economic and social issues related to product design and manufacture. • Examine the effect of fashion, trends, taste, style. • Examine the effect of new technological developments. • Examine ethnic and cultural influences on the design and manufacture of products.	21	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
		7 Safe working practices, potential hazards and risk assessment	
Covered in Component 1 examination: These questions will test a candidate's understanding of health and safety.		7.1 Adopting safe working practices, recognise and react to potential hazards:	14

		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, implement control measures, recording and storing of risk assessment documentation.	
		8 Features of manufacturing industries	15
Manufacturing systems: • One-off, batch, high-volume production systems • Modular/cell production systems. • Just-in-time manufacture. • Bought-in parts and components, standardised parts. • The implications of these industrial production processes/procedures.	20	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
Principles and techniques of testing applied to product design: Be aware of a range of tests to identify characteristic/properties of materials. **Quality control and quality assurance**: • Quality control. • Quality assurance. • Total Quality Management (TQM). **Manufacturing quality control:** • Recording and use of data, tolerances, fit, finish, performance. • Quality control. • Quality assurance. • Total Quality Management (TQM).	21, 31	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 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.	15

• (Material focus: **manufacturing)**			
Manufacturing systems: • One-off, batch and high-volume production systems • Modular/cell production systems. • Just-in-time manufacture. • Bought-in parts and components, and standardised parts. • The implications of these industrial production processes/procedures. **Manufacturing processes:** • One-off, batch, high-volume production systems. • Modular/cell production systems. • Just-in-time manufacture. • Repetitive flow. • Continual flow. • In-line assembly. • Cell production. • Automated production. • Robotics. • Bought-in parts and components, standardised parts. • The implications of these industrial production processes/procedures. • Appropriate manufacturing methods that take into account the properties of different materials. • The effects of the manufacturing process on the properties and structure of materials. • (Material focus: **manufacturing)** **Manufacturing systems and control**: • Monitoring, testing and tracking during production.	20 & 31	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 (PDM), enterprise resource planning (ERP) systems i) concurrent manufacturing.	15

• Computer Integrated Manufacturing (CIM), Programmable Logic Controllers (PLCs), robotics, automation, embedded systems in industrial appliances. • (Material focus: **manufacturing)**			
		9 Designing for maintenance and the cleaner environment	16
The impact of design and manufacturing on the environment: • Issues relating to global sustainable development. • The energy needs during the life of a product or system, life-cycle assessment. • The terms availability, conservation, pollution relating to energy. • Recycling and green issues in product and systems design.	21	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 methods, energy recovery, environmental implications of disposal to landfill.	16
		10 Current legislation	17
Legislation: • Trade description and sale of goods. • BSI standards applied to products/systems. • Labelling.	20	10.1 From the consumer's point of view, the implications of consumer rights legislation to consumers and manufacturers: a) Consumer Rights Act (2015)	17

• The implications of intellectual property, registered designs, registered trademarks and copyright. • Regulations.		b) Sale of Goods Act (1979).	
Health and safety of designers, makers and the public: • The regulatory and legislative framework related to materials and equipment using Health And Safety At Work (HASAW). • COSHH. • The protection of the worker/operator. • The user/customer. • The environment. • Risk assessment.	20	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 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).	17
		11 Information handling, modelling and forward planning	
Technical data: Use and interpret technical data.	21	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

Commercial practice: • The role of marketing, including assessing consumer needs, product development, pricing, promotion and distribution. • Advertising. • Design rights and patents.	20	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
Legislation: • Trade description and sale of goods. • BSI standards applied to products/systems. • Labelling. • The implications of intellectual property, registered designs, registered trademarks and copyright. • Regulations.	20	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

The following content is new and does not match the OCR Product Design (2013) specification content: **Refer to the editable schemes of work**.

Pearson Product Design 9DT0 (2017)	**Page no.**	**Pearson Product Design 9DT0 (2017)**	**Page no.**
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 c) functionality d) innovation e) authenticity.	13	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	13

		f) Streamlining – Raymond Lowey g) Memphis – Ettore Sottsass.	
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		
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
Product Design 9DT0 (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	21		

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.			