Mapping Document: GCE Design & Technology (Product Design)

Pearson Resistant Materials Student Book ISBN 9780435757786 and Pearson Graphic Products Student Book ISBN 9780435757793 to the 2017 Pearson GCE Design and Technology (Product Design) (9DT0) Specification

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AS Component 1: Principles of Design and Technology (Paper code: 8DT0/01)			Edexcel A Level Design and Technology Product Design: **Resistant Materials Technology** ISBN 978-0-435757-78-6		Edexcel A Level Design and Technology Product Design: **Graphic Products** ISBN 978-0-435757-79-3	
Materials	1.1	Woods: a) hardwoods – oak, mahogany, beech, jelutong, balsa b) softwoods – pine, cedar, larch, redwood.	Woods: a) hardwoods - oak, mahogany, beech b) softwoods – pine	Page Ref: 30	Woods: a) hardwoods - jelutong, balsa b) softwoods – pine	Page Ref: 38–39
	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.	Metals: a) ferrous metals – mild steel, carbon steels, cast iron b) non-ferrous metals – aluminium, copper, zinc c) alloys (ferrous and non-ferrous) – stainless steel, duralumin, brass.	25–28	Metals: a) ferrous metals – mild steel b) non-ferrous metals – aluminium, tin c) alloys (ferrous and non-ferrous) – stainless steel, duralumin.	34–35
	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.	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)	28–29	Polymers: a) thermoplastics – acrylic, polyethylene, polyethylene terephthalate (PET), polyvinyl chloride (PVC), polypropylene (PP), Polystyrene (PS). b) thermosetting plastics – epoxy resins (ER)	36–38 Epoxy Resin 57
	1.4	Composites: a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), hardboard, chipboard, plywood.	Composites: a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), chipboard, plywood.	30–32	Composites: a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF).	39–41
	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.			Papers and boards: a) drawing papers – layout, tracing, copier, cartridge b) commercial printing papers – bond, coated c) boards – mounting board, recycled card, corrugated board, folding box board, foil-lined board.	31–33
	1.6	Textiles: a) natural fibres – cotton, linen, wool b) manmade fibres – nylon, polypropylene, polyester c) textile treatments – flame resistant, polytetrafluoroethylene (PTFE).				
	1.7	Smart and modern materials: a) thermo-ceramics b) shape memory alloys (SMA) c) reactive glass d) liquid crystal displays (LCD) e) photo-chromic materials f) thermo-chromic materials g) quantum tunnelling composites.	Smart and modern materials: a) thermo-ceramics b) shape memory alloys (SMA) c) reactive glass d) liquid crystal displays (LCD) e) photo-chromic materials f) thermo-chromic materials g) quantum tunnelling composites.	33–35 Thermochromic 114	Smart and modern materials: b) shape memory alloys (SMA) c) reactive glass d) liquid crystal displays (LCD) f) thermo-chromic materials	42–44, 117
Performance characteristics of materials	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	Performance characteristics of woods, metals, polymers, smart and modern materials, papers, boards, textiles and composites in order to discriminate between materials and select appropriately: d) plasticity	25 Biodegradeable Polymers only 90*		

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		b) strength c) elasticity d) plasticity e) malleability f) ductility g) hardness h) toughness i) durability j) biodegradability.	e) malleability f) ductility g) hardness j) biodegradability			
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: a) heat treatments – hardening and tempering, case hardening, annealing, normalising (including use of specialist tools) b) alloying (including use of specialist tools) c) printing – offset lithology, flexography, screenprinting, 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 (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).	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) b) alloying (basic) d) casting – sand (to include investment), die e) machining – milling/routing, drilling, turning (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)	60–61 25* 43–45 45–48 49–51 94	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: b) alloying (basic) c) printing – offset lithology, flexography, screenprinting, gravure (including use of specialist tools) f) moulding – blow moulding, injection moulding, vacuum forming, (including use of specialist tools) g) lamination (paper and board only)	34* 66–69 60–61 62
	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	Application of specialist measuring tools and equipment to determine and apply the accuracy and precision required for products to perform as intended. g) jigs and fixtures	52		

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		h) go and no-go gauges.				
	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 information about 3D forms in a 2D format d) translation between working drawings, pictorial drawings and nets (developments) e) report writing.			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, c) nets (developments) for communicating information about 3D forms in a 2D format d) translation between working drawings, pictorial drawings and nets (developments).	49–52
	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).	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 (tensol) cement,epoxy resin, polyvinyl acetate (PVA), hot melt glue, polystyrene cement (including use of specialist tools) b) mechanical – screws, nuts, bolts, washers, rivets, (including use of specialist tools) c) heat – oxy-acetylene welding, MIG welding, brazing, hard soldering, (including use of specialist tools)	56–58 Screws 37–38 53–54 55–56	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), polystyrene cement (including use of specialist tools)	57
	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).	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 – galvanisation	26*	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: b) paper and board finishing process – laminating, varnishing, hot foil blocking, embossing (including use of specialist tools).	62–64
Digital technologies	4.1	Set up, safe and accurate operation, advantages and disadvantages of the following digital technologies:	Set up, safe and accurate operation, advantages and disadvantages of the following digital technologies:	63–65	Set up, safe and accurate operation, advantages and disadvantages of the following digital technologies:	88–90 65 vinyl cutting

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		a) computer-aided design – 2D and 3D design to create and modify designs and create simulations, 3D modelling for creating 'virtual' products. b) computer-aided manufacture and rapid prototyping – CNC lathes, CNC routers, CNC milling machine, CNC laser, CNC vinyl cutters, rapid prototyping.	a) computer-aided design – 2D and 3D design to create and modify designs and create simulations, 3D modelling for creating 'virtual' products. b) computer-aided manufacture and rapid prototyping – CNC lathes, CNC routers, CNC milling machine, CNC laser, rapid prototyping.		a) computer-aided design – 2D and 3D design to create and modify designs and create simulations, 3D modelling for creating 'virtual' products. b) computer-aided manufacture and rapid prototyping – CNC vinyl cutters, rapid prototyping.	
Factors influencing the development products	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				
	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.	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.	134–137	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.	137–140
	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.	The influence of aesthetics, ergonomics and anthropometrics on the design, development and manufacture of products: a) form over function b) form follows function.	132–133	The influence of aesthetics, ergonomics and anthropometrics on the design, development and manufacture of products: a) form over function b) form follows function.	135–136
	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 Loewy g) Memphis – Ettore Sottsass.	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 – Marcel Breuer d) Art Deco – Eileen Gray e) Post Modernism – Philippe Starck f) Streamlining – Raymond Loewy g) Memphis – Ettore Sottsass.	116–131	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 – Marcel Breuer d) Art Deco – Eileen Gray e) Post Modernism – Philippe Starck f) Streamlining – Raymond Loewy g) Memphis – Ettore Sottsass.	119–134
Effects of technological developments	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	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	110–112 112–114	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	113–115 115–117

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		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.	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.	115–116	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.	118
Safe working practices, potential hazards and risk assessment	7.1	Adopting safe working practices, recognise and react 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, implement control measures, recording and storing of risk assessment documentation.	Adopting safe working practices, recognise and react 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, implement control measures, recording and storing of risk assessment documentation.	70–75	Adopting safe working practices, recognise and react 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, implement control measures, recording and storing of risk assessment documentation.	74–~79

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Investigation of needs and research	1	a) Identification, investigation and justification of a design possibility. b) Assess the needs, wants and values of the client/end user and the needs of the prototype. c) Research of existing commercial products, ergonomic information and standards relevant to the design possibility, using knowledge and understanding of designing and making. d) Consideration of user-centred design, taking into account the investigation of the identified design possibility, design context, and the needs, wants and values of the client/end user. e) Consideration of potential methods to improve the sustainability of the prototype across its life cycle.	a) Identification, investigation and justification of a design possibility. b) Assess the needs, wants and values of the client/end user and the needs of the prototype. c) Research of existing commercial products, ergonomic information and standards relevant to the design possibility, using knowledge and understanding of designing and making. d) Consideration of user-centred design, taking into account the investigation of the identified design possibility, design context, and the needs, wants and values of the client/end user. e) Consideration of potential methods to improve the sustainability of the prototype across its life cycle.	Page Ref: 161–163	a) Identification, investigation and justification of a design possibility. b) Assess the needs, wants and values of the client/end user and the needs of the prototype. c) Research of existing commercial products, ergonomic information and standards relevant to the design possibility, using knowledge and understanding of designing and making. d) Consideration of user-centred design, taking into account the investigation of the identified design possibility, design context, and the needs, wants and values of the client/end user. e) Consideration of potential methods to improve the sustainability of the prototype across its life cycle.	Page Ref: 165–168
Specification	2	a) Production of a refined design brief based on outcomes of research and investigations. b) Production of a technical design specification considering form, function, sustainability and standards relevant to the needs, wants and values of the intended client/end user. c) Evidence of client/end user influence in the specification. d) Identification and justification of performance requirements for the prototype. e) Consideration of scale of manufacture and how this reflects on relevant cost.	a) Production of a refined design brief based on outcomes of research and investigations. b) Production of a technical design specification considering form, function, relevant to the needs, wants and values of the intended client/end user. c) Evidence of client/end user influence in the specification. d) Identification and justification of performance requirements for the prototype. e) Consideration of scale of manufacture and how this and how this reflects on relevant cost.	164–165	a) Production of a refined design brief based on outcomes of research and investigations. b) Production of a technical design specification considering form, function, relevant to the needs, wants and values of the intended client/end user. c) Evidence of client/end user influence in the specification. d) Identification and justification of performance requirements for the prototype. e) Consideration of scale of manufacture and how this and how this reflects on relevant cost.	168–170
Design ideas	3	a) Production of a range of design proposals that are realistic, workable, and which address the criteria in the specification. b) Exploration of different design approaches, processes and techniques to produce realistic design ideas. c) Selection and application of design strategies and knowledge of materials and/or components, processes and techniques to produce design ideas that address client/end user needs, wants and values. d) Design ideas show consideration and use of aesthetics, including cultural and historical influences. e) Decisions made in consultation with the client/end user.	a) Production of a range of design proposals that are realistic, workable, and which address the criteria in the specification. b) Exploration of different design approaches, processes and techniques to produce realistic design ideas. c) Selection and application of design strategies and knowledge of materials and/or components, processes and techniques to produce design ideas that address client/end user needs, wants and values. d) Design ideas show consideration and use of aesthetics. e) Decisions made in consultation with the client/end user.	166–168	a) Production of a range of design proposals that are realistic, workable, and which address the criteria in the specification. b) Exploration of different design approaches, processes and techniques to produce realistic design ideas. c) Selection and application of design strategies and knowledge of materials and/or components, processes and techniques to produce design ideas that address client/end user needs, wants and values. d) Design ideas show consideration and use of aesthetics. e) Decisions made in consultation with the client/end user.	170–173
Review of initial ideas	4	a) Critical analysis and evaluation of their own ideas and decisions while using an iterative design process.	a) Critical analysis and evaluation of their own ideas and decisions.	168–169	a) Critical analysis and evaluation of their own ideas and decisions.	173–174

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		b) Evaluation of how well the specification and initial design ideas meet the needs, wants and values of the client/end user reflecting on decisions made.	b) Evaluation of how well the specification and initial design ideas meet the needs, wants and values of the client/end user reflecting on decisions made.		b) Evaluation of how well the specification and initial design ideas meet the needs, wants and values of the client/end user reflecting on decisions made.	
Development of design ideas into a final design	5	a) Demonstration of the application of an iterative approach to design development. This is informed by the application of knowledge of materials and the needs, wants and values of the client/end user. b) Ongoing developmental changes are informed by technical application of research, experimenting, and client/end user feedback in order to improve, refine and realise a design. c) Modelling/simulation used to test appropriate features including proportions, scale, function, sub-systems. Modelling/simulation can be achieved through the use of traditional materials, or 2D and/or 3D computer simulations. d) Design proposals are refined down to a final design idea which includes all requirements for fitness for purpose, including technical details of all materials and/or component parts, processes and techniques. e) Details of materials and/or components and processes shows consideration of sustainability. Decisions are informed by research information on the environmental costs of extracting and processing the selected materials, the prototype manufacture, lifespan and disposal. f) Application of calculations to determine quantities and costs, including ways of reducing wastage.	b) Ongoing developmental changes are informed by technical application of research, experimenting, and client/end user feedback in order to improve, refine and realise a design. c) Modelling/simulation used to test appropriate features including proportions, scale, function, sub-systems. Modelling/simulation can be achieved through the use of traditional materials, or 2D and/or 3D computer simulations. d) Design proposals are refined down to a final design idea which includes all requirements for fitness for purpose, including technical details of all materials and/or component parts, processes and techniques.	169–173	b) Ongoing developmental changes are informed by technical application of research, experimenting, and client/end user feedback in order to improve, refine and realise a design. c) Modelling/simulation used to test appropriate features including proportions, scale, function, sub-systems. Modelling/simulation can be achieved through the use of traditional materials, or 2D and/or 3D computer simulations. d) Design proposals are refined down to a final design idea which includes all requirements for fitness for purpose, including technical details of all materials and/or component parts, processes and techniques.	175–177
Review of development and final idea	6	a) Analysis and evaluation of refinements made to their own ideas based on decisions made throughout the iterative design process, including use of feedback from the client/end user. b) Analysis and evaluation of designs and prototypes/ products produced by others to inform own design decisions. c) Draw conclusions based on the analysis and evaluation, drawing together considerations about the appropriateness of the final prototype in meeting the needs of the specification.	a) Analysis and evaluation of refinements made to their own ideas based on decisions made throughout the design process, including use of feedback from the client/end user. b) Analysis and evaluation of designs and prototypes/ products produced by others to inform own design decisions. c) Draw conclusions based on the analysis and evaluation, drawing together considerations about the appropriateness of the final prototype in meeting the needs of the specification.		a) Analysis and evaluation of refinements made to their own ideas based on decisions made throughout the design process, including use of feedback from the client/end user. b) Analysis and evaluation of designs and prototypes/ products produced by others to inform own design decisions. c) Draw conclusions based on the analysis and evaluation, drawing together considerations about the appropriateness of the final prototype in meeting the needs of the specification.	
Communication of design ideas	7	a) Selection and skill in the use of traditional/manual graphical, digital (CAD) and written techniques to	a) Selection and skill in the use of traditional/manual graphical, digital (CAD) and written techniques to	174	a) Selection and skill in the use of traditional/manual graphical, digital (CAD) and written techniques to	177–179

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		communicate designs.	communicate designs.		communicate designs.	
Tools and equipment Quality and accuracy	8&9	a) Production of a high-quality prototype that is appropriate to an advanced level of demand, meeting the requirements of the design specification. b) Selection and technical skill in application of material, range of tools, techniques, fixtures, components and finishes used in the manufacture of the final prototype. c) Demonstration of safe working practice, including for self and others with whom they may be working. d) Demonstration of an iterative approach to the manufacture of the final prototype. e) Measuring, determining, and applying of the degree of accuracy and precision required for prototypes to perform as intended.	a) Production of a high-quality prototype that is appropriate to an advanced level of demand, meeting the requirements of the design specification. b) Selection and technical skill in application of material, range of tools, techniques, fixtures, components and finishes used in the manufacture of the final prototype. c) Demonstration of safe working practice, including for self and others with whom they may be working. e) Measuring, determining, and applying of the degree of accuracy and precision required for prototypes to perform as intended.	176–181	a) Production of a high-quality prototype that is appropriate to an advanced level of demand, meeting the requirements of the design specification. b) Selection and technical skill in application of material, range of tools, techniques, fixtures, components and finishes used in the manufacture of the final prototype. c) Demonstration of safe working practice, including for self and others with whom they may be working. e) Measuring, determining, and applying of the degree of accuracy and precision required for prototypes to perform as intended.	181–187
Testing and evaluating	10	a) An analysis of the prototype is performed that includes testing against the specification. b) Evaluation of the prototype in meeting the needs, wants and values of the client/end user and specification. c) An analysis and evaluation of social, moral, ethical and environmental impacts of the final prototype.	a) An analysis of the prototype is performed that includes testing against the specification. b) Evaluation of the prototype in meeting the needs, wants and values of the client/end user and specification. c) An analysis and evaluation of environmental impacts of the final prototype.	181–184	a) An analysis of the prototype is performed that includes testing against the specification. b) Evaluation of the prototype in meeting the needs, wants and values of the client/end user and specification. c) An analysis and evaluation of environmental impacts of the final prototype.	187–189

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Materials	1.1	Woods: a) hardwoods – oak, mahogany, beech, jelutong, balsa b) softwoods – pine, cedar, larch, redwood.	Woods: a) hardwoods - oak, mahogany, beech b) softwoods – pine	Page Ref: 30	Woods: a) hardwoods - jelutong, balsa, b) softwoods – pine	Page Ref: 38–39
	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.	Metals: a) ferrous metals – mild steel, carbon steels, cast iron b) non-ferrous metals – aluminium, copper, zinc c) alloys (ferrous and non-ferrous) – stainless steel, duralumin, brass.	25–28	Metals: a) ferrous metals – mild steel b) non-ferrous metals – aluminium, tin c) alloys (ferrous and non-ferrous) – stainless steel, duralumin.	34–35
	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.	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)	28–29	Polymers: a) thermoplastics – acrylic, polyethylene, polyethylene terephthalate (PET), polyvinyl chloride (PVC), polypropylene (PP) b) thermosetting plastics – epoxy resins (ER)	36–38 Epoxy Resin 57
	1.4	Composites: a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), hardboard, chipboard, plywood.	Composites: a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), chipboard, plywood.	30–32	Composites: a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF).	39–41
	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.			Papers and boards: a) drawing papers – layout, tracing, copier, cartridge b) commercial printing papers – bond, coated c) boards – mounting board, recycled card, corrugated board, folding box board, foil-lined board.	32–33
	1.6	Textiles: a) natural fibres – cotton, linen, wool b) manmade fibres – nylon, polypropylene, polyester c) textile treatments – flame resistant, polytetrafluoroethylene (PTFE).				
	1.7	Smart and modern materials: a) thermo-ceramics b) shape memory alloys (SMA) c) reactive glass d) liquid crystal displays (LCD) e) photo-chromic materials f) thermo-chromic materials g) quantum tunnelling composites.	Smart and modern materials: a) thermo-ceramics b) shape memory alloys (SMA) c) reactive glass d) liquid crystal displays (LCD) e) photo-chromic materials f) thermo-chromic materials g) quantum tunnelling composites.	33–35, 114	Smart and modern materials: b) shape memory alloys (SMA) c) reactive glass d) liquid crystal displays (LCD) f) thermo-chromic materials	117, 42–44
Performance characteristics of materials	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 c) elasticity d) plasticity e) malleability	Performance characteristics of woods, metals, polymers, smart and modern materials, papers, boards, textiles and composites in order to discriminate between materials and select appropriately: d) plasticity e) malleability f) ductility g) hardness j) biodegradability	25 Biodegradeable Polymers only 90*		

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		f) ductility g) hardness h) toughness i) durability j) biodegradability.				
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: a) heat treatments – hardening and tempering, case hardening, annealing, normalising (including use of specialist tools) b) alloying (including use of specialist tools) c) printing – offset lithology, 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 (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).	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) b) alloying (basic) d) casting – sand, die e) machining – milling/routing, drilling, turning, (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)	60–61 25 43–45 45–48 49–51 94	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: b) alloying (basic) c) printing – offset lithology, flexography, screenprinting, gravure (including use of specialist tools) f) moulding – blow moulding, injection moulding, vacuum forming (including use of specialist tools) g) lamination (paper and board only)	34 66–69 60–61 62
	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	Application of specialist measuring tools and equipment to determine and apply the accuracy and precision required for products to perform as intended. g) jigs and fixtures	52		
	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,			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,	49–52

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		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			c) nets (developments) for communicating information about 3D forms in a 2D format d) translation between working drawings, pictorial drawings and nets (developments).	
	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).	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 (tensol) cement,epoxy resin, polyvinyl acetate (PVA), hot melt glue, polystyrene cement (including use of specialist tools) b) mechanical – screws, nuts, bolts, washers, rivets, (including use of specialist tools) c) heat – oxy-acetylene welding, MIG welding, brazing, hard soldering (including use of specialist tools)	56–58 Screws and rivets 37–38 53–54 54–56	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), polystyrene cement (including use of specialist tools)	57
	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).	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 – galvanisation	26	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: b) paper and board finishing process – laminating, varnishing, hot foil blocking, embossing (including use of specialist tools).	62–64
Digital technologies	4.1	Set up, safe and accurate operation, advantages and disadvantages of the following digital technologies: a) computer-aided design – 2D and 3D design to create and modify designs and create simulations, 3D modelling for creating 'virtual' products. b) computer-aided manufacture and rapid prototyping – CNC lathes, CNC routers, CNC milling machine, CNC laser, CNC vinyl cutters, rapid prototyping.	Set up, safe and accurate operation, advantages and disadvantages of the following digital technologies: a) computer-aided design – 2D and 3D design to create and modify designs and create simulations, 3D modelling for creating 'virtual' products. b) computer-aided manufacture and rapid prototyping – CNC lathes, CNC routers, CNC milling machine, CNC laser, rapid prototyping.	63–65	Set up, safe and accurate operation, advantages and disadvantages of the following digital technologies: a) computer-aided design – 2D and 3D design to create and modify designs and create simulations, 3D modelling for creating 'virtual' products. b) computer-aided manufacture and rapid prototyping – CNC lathes, CNC routers, CNC milling machine, CNC laser, CNC vinyl cutters, rapid prototyping.	88–90 65 vinyl cutting
Factors influencing the development of products	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				

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		b) purpose c) functionality d) innovation e) authenticity.				
	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.	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.	134–137	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.	137–140
	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.	The influence of aesthetics, ergonomics and anthropometrics on the design, development and manufacture of products: a) form over function b) form follows function.	132–133	The influence of aesthetics, ergonomics and anthropometrics on the design, development and manufacture of products: a) form over function b) form follows function.	135–136
	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 Loewy g) Memphis – Ettore Sottsass.	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 – Marcel Breuer d) Art Deco – Eileen Gray e) Post Modernism – Philippe Starck f) Streamlining – Raymond Loewy g) Memphis – Ettore Sottsass.	116–131	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 – Marcel Breuer d) Art Deco – Eileen Gray e) Post Modernism – Philippe Starck f) Streamlining – Raymond Loewy g) Memphis – Ettore Sottsass.	119–134
Effects of technological developments	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.	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.	110–112 112–114 115–116	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.	113–115 115–117 118–119
Safe working practices, potential hazards and risk assessment	7.1	Adopting safe working practices, recognise and react 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 –	Adopting safe working practices, recognise and react 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 –	70–75	Adopting safe working practices, recognise and react 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 –	74–79

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		identification of potential hazards, identification of people at risk, evaluation of risks, implement control measures, recording and storing of risk assessment documentation.	identification of potential hazards, identification of people at risk, evaluation of risks, implement control measures, recording and storing of risk assessment documentation.		identification of potential hazards, identification of people at risk, evaluation of risks, implement control measures, recording and storing of risk assessment documentation.	
Features of manufacturing industries	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.	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.	41–42	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.	47–49
	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.	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.	66–68	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.	70–73
	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.	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 g) quick response manufacturing (QRM) h) data integration – product data management (PDM), enterprise resource planning (ERP) systems i) concurrent manufacturing.	86 105–107 103–105 98–102 101 95–96 99–101 96–97	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: 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 g) quick response manufacturing (QRM) h) data integration – product data management (PDM), enterprise resource planning (ERP) systems i) concurrent manufacturing.	108–110 106–107 101–105 104 99 102–103 99–100
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		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.	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.		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.	
	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.	The wider issues of using cleaner technologies: b) sustainability – designing without jeopardising the potential for people in the future to meet their needs.	149–150	The wider issues of using cleaner technologies: b) sustainability – designing without jeopardising the potential for people in the future to meet their needs.	153
Current legislation	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).				
	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).	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).	70–75	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).	74–79
Information handling, modelling and forward planning	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.	Collection, collation and analysis of information and the use of this to make informed decisions: a) marketing – marketing analysis	84*		
	11.2	Modelling the costing of projects to achieve an optimum outcome: a) budgets – undertake financial forecasts	Modelling the costing of projects to achieve an optimum outcome: b) planning for production – allocation of:	86*	Modelling the costing of projects to achieve an optimum outcome: b) planning for production – allocation of:	47–49*

Mapping Document: GCE Design & Technology (Product Design)

Pearson Resistant Materials Student Book ISBN 9780435757786 and Pearson Graphic Products Student Book ISBN 9780435757793 to the 2017 Pearson GCE Design and Technology (Product Design) (9DT0) Specification

The table below compares the content of the 2008 Pearson A Level textbooks with the 2017 Pearson A Level Design and Technology specification. Page numbers stated relate to the relevant textbook.

** Page numbers marked with an asterisk are brief mentions only and require further reading.* Items in RED indicate specification content that is **not** covered in the textbooks.

A Level Component 1: Principles of Design and Technology (Paper code: 9DT0/01)			Edexcel A Level Design and Technology Product Design: **Resistant Materials Technology** ISBN 978-0-435757-78-6		Edexcel A Level Design and Technology Product Design: **Graphic Products** ISBN 978-0-435757-79-3	
		b) planning for production – allocation of: - employees - materials - scale of production c) selection of appropriate tools, machines and manufacturing processes.	- employees - materials - scale of production c) selection of appropriate tools, machines and manufacturing processes.	41–42* 41–42*	- employees - materials - scale of production c) selection of appropriate tools, machines and manufacturing processes.	
	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.				
	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).	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).	8, 68–69	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).	9, 73
Further processes and techniques	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.				
	12.2	Applications, characteristics, advantages and disadvantages of the following project management strategies: a) critical path analysis – the handling of complex and time sensitive operations b) scrum – how flexible, holistic product development is achieved c) Six Sigma – the improvement of output quality of a process by identifying and removing the causes of defects and setting value targets of: - reduce process cycle time - reduce pollution - reduce costs - increase customer satisfaction - increase profits.				
	12.3	The cost, sales, profit and market implications to the				

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		designer and manufacturer of the stages of a product's life cycle: - Introduction Stage - Growth Stage - Maturity Stage - Decline Stage.				