Pearson Edexcel

A Level Design and Technology

Specification

Pearson Edexcel Level 3 Advanced GCE in Design and Technology

(Product Design) (9DT0)

First teaching from September 2017

First certification from 2019

Issue 2

Pearson Edexcel Level 3 Advanced GCE in Design and Technology (Product Design) specification changes

Issue 2 Changes

Summary of changes made between previous issue and this current issue	Page number
Portfolio guidance and Photographic evidence sections amended with updated information on how to submit portfolios and accompanying evidence	35

If you need further information on these changes or what they mean, contact us via our website at: qualifications.pearson.com/en/support/contact-us.html.

Contents

1 Introduction

Why choose Pearson Edexcel A Level Design and Technology (Product Design)

We've listened to feedback from all parts of the design and technology subject community, including higher education. We've used this opportunity of curriculum change to redesign qualifications that reflect the demands of a truly modern and evolving society – qualifications that enable your students to apply themselves and give them the skills to succeed in their chosen pathway.

Equipping students with design skills for the future - Students will be able to recognise design needs and develop an understanding of how current global issues, including integrating technology, impacts on today's world.

Encourages creativity and innovation - At A level students will have the confidence to innovate and produce creative design solutions as they develop their own design brief with a client/end user.

Clear routes through the specification - We've listened to your feedback and our specification aims to demystify the new rules around the new qualification requirements to make sure you know precisely what you have to teach.

Progression from GCSE and beyond to HE/Careers - We've designed the GCSE and A level qualifications together to ensure clear progression of knowledge, understanding and design/making skills so that students will have a coherent experience of moving from the breadth of the GCSE to the specialisation depth of A level and beyond.

Support with new content - To help you plan for first teaching with confidence, we'll be running training events to support you in delivering this new qualification and the new requirements for the first time. We'll also give you practical free resources to minimise your lesson planning and allow more productive time in the classroom with your students.

Supporting you in planning and implementing this qualification

Planning

- Our ***Getting Started*** guide gives you an overview of the new A Level qualification to help you to get to grips with the changes to content and assessment and to help you understand what these changes mean for you and your students.
- We will give you an editable **course planner** and **scheme of work** that you can adapt to suit your department.
- **Our mapping documents** highlight key differences between the new and current qualifications.

Teaching and learning

There will be lots of free teaching and learning support to help you deliver the new qualification, including:

- A guide on graphics content.
- A co-teachability guide.
- Hints on delivering mathematical skills.

Preparing for exams

We will also provide a range of resources to help you prepare your students for the assessments, including:

- additional assessment materials to support formative assessments and mock exams
- marked exemplars of student work with examiner commentaries.

ResultsPlus

ResultsPlus provides the most detailed analysis available of your students' exam performance. It can help you identify the topics and skills where further learning would benefit your students.

Get help and support

Our support line will ensure you receive help and guidance from us and that you can share ideas and information with other teachers. The Design and Technology team can be contacted via:

- teachingdesignandtechnology@pearson.com
- +44 (0) 207 010 2166
- @PearsonTeachDT

Learn more at qualifications.pearson.com.

Qualification at a glance

Content and assessment overview

The Pearson Edexcel Level 3 Advanced GCE in Design and Technology (Product Design) consists of one externally-examined paper and one non-examined assessment component.

Students must complete all assessment in May/June in any single year.

Component 1: Principles of Design and Technology (Paper code: 9DT0/01)*
Written examination: 2 hours 30 minutes ***50% of the qualification*** ***120 marks***
Content overview Topic 1: Materials Topic 2: Performance characteristics of materials Topic 3: Processes and techniques Topic 4: Digital technologies Topic 5: Factors influencing the development of products Topic 6: Effects of technological developments Topic 7: Potential hazards and risk assessment Topic 8: Features of manufacturing industries Topic 9: Designing for maintenance and the cleaner environment Topic 10: Current legislation Topic 11: Information handling, Modelling and forward planning Topic 12: Further processes and techniques.
Assessment overview • The paper includes calculations, short-open and open-response questions, as well as extended-writing questions focused on: ○ analysis and evaluation of design decisions and outcomes, against a technical principle, for prototypes made by others ○ analysis and evaluation of wider issues in design technology, including social, moral, ethical and environmental impacts. • Students must answer all questions. • Students must have calculators and rulers in the examination. Calculators may be used in the examination. Information on the use of calculators during the examinations for this qualification can be found in *Appendix 2: Calculators*.

*See *Appendix 9: Codes* for a description of this code and all other codes relevant to this qualification.

Component 2: Independent Design and Make Project (Paper code: 9DT0/02)

Non-examined assessment

50% of the qualification

120 marks

Content overview

- Students individually and/or in consultation with a client/end user identify a problem and design context.
- Students will develop a range of potential solutions which include the use of computer aided design and evidence of modelling.
- Students will be expected to make decisions about the designing and development of the prototype in conjunction with the opinions of the client/end user.
- Students will realise one potential solution through practical making activities with evidence of project management and plan for production.
- Students will incorporate issues related to sustainability and the impact their prototype may have on the environment
- Students are expected to analyse and evaluate design decisions and outcomes for prototypes/products made by themselves and others
- Students are expected to analyse and evaluate of wider issues in design technology, including social, moral, ethical and environmental impacts.

Assessment overview

- The investigation report is internally assessed and externally moderated.
- Students will produce a substantial design, make and evaluate project which consists of a portfolio and a prototype
- The portfolio will contain approximately 40 sides of A3 paper (or electronic equivalent)
- There are four parts to the assessment**:**
  - **Part 1: Identifying and outlining possibilities for design**
    Identification and investigation of a design possibility, investigation of client/end user needs, wants and values, research and production of a specification
  - **Part 2: Designing a prototype**
    Design ideas, development of design idea, final design solution, review of development and final design and communication of design ideas
  - **Part 3: Making a final prototype**
    Design, manufacture and realisation of a final prototype, including tools and equipment and quality and accuracy
  - **Part 4: Evaluating own design and prototype**
    Testing and evaluation

2 Subject content

The subject content sets out the knowledge, understanding and skills relevant to this qualification. Together with the assessment information, it provides the framework within which centres create their programmes of study, so ensuring the possibilities for progression to higher education.

Qualification aims and objectives

The aims and objectives of this qualification are to enable students to:

- use creativity and imagination when applying iterative design processes to develop and modify designs, and to design and make prototypes that solve real world problems, considering their own and others' needs, wants, aspirations and values
- identify market needs and opportunities for new products, initiate and develop design solutions, and make and test prototypes
- acquire subject knowledge in design and technology, including how a product can be developed through the stages of prototyping, realisation and commercial manufacture
- take every opportunity to integrate and apply their understanding and knowledge from other subject areas studied during Key Stage 4, with a particular focus on science and mathematics, and those subjects they are studying alongside A Level Design and Technology
- be open to taking design risks, showing innovation and enterprise while considering their role as responsible designers and citizens
- develop intellectual curiosity about the design and manufacture of products and systems, and their impact on daily life and the wider world
- work collaboratively to develop and refine their ideas, responding to feedback from users, peers and expert practitioners
- gain an insight into the creative, engineering and/or manufacturing industries
- develop the capacity to think creatively, innovatively and critically through focused research and exploration of design opportunities arising from the needs, wants and values of clients/end users
- develop an in-depth knowledge and understanding of materials, components and processes associated with the creation of products that can be tested and evaluated in use
- be able to make informed design decisions through an in-depth understanding of the management and development of taking a design through to a prototype
- be able to create and analyse a design concept and use a range of skills and knowledge from other subject areas, including mathematics and science, to inform decisions in design and the application or development of technology
- be able to work safely and skilfully to produce high-quality prototypes
- have a critical understanding of the wider influences on design and technology, including cultural, economic, environmental, historical and social factors
- develop the ability to draw on and apply a range of skills and knowledge from other subject areas, including the use of mathematics and science for analysis and informing decisions in design.

Mathematics

Maths skills are fundamental to design and technology. These will be embedded within the examination for this qualification. Please see *Appendix 1: Mathematical skills requirements* for full details of these.

Scientific skills, knowledge and understanding

Science skills, knowledge and understanding underpin the theory and practice of design and technology. These science skills will be embedded within the examination of this qualification. Please see *Appendix 3: Science knowledge and skills requirements* for full details of these.

Links to other relevant subjects

In addition to maths and science, the A Level GCE in Design and Technology embeds knowledge, techniques and practices from a wide range of subjects including art and design, business, computer science and geography (see *Appendix 4*).

How to use Appendices 1, 3 and 4

As part of the delivery of this qualification, teachers should use these appendices to ensure students gain an awareness and appreciation for the ways in which skills and knowledge from maths, science and other subjects inform decisions in design and the application or development of technology.

Component 1: Principles of Design and Technology

Overview

Students will be required to apply knowledge and understanding of a wide range of materials; including modern and smart materials, and processes used in product design and manufacture. They will be required to develop an understanding of contemporary industrial and commercial practices applied to designing and manufacturing products, and to appreciate the risks involved. Students should have a good working knowledge of health and safety procedures and relevant legislation.

Students must have a sound working knowledge of the use of ICT and systems and control, including modern manufacturing processes and systems, and students will be expected to understand how these might be applied in the design and manufacture of products.

Designers from the past provide inspiration for present and future designing. Students should be aware of the important contribution that key historical movements and figures have on modern design thinking.

It is increasingly important that students develop an awareness of wider issues in design and technology, that design and technological activities can have a profound impact on the environment and on society and that these, together with sustainability, are key features of design and manufacturing practice.

Mathematical and scientific principles are an important part of designing and developing products and students will be expected to apply these principles when considering the designs of others. Please see *Appendix 1: Mathematical skills requirement* and *Appendix 3: Science knowledge and skills requirement.*

Content

Topic	What students need to learn:	
1 **Materials**	To apply a knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials in order to discriminate between them and select appropriately.	
	1.1	Woods: a) hardwoods – oak, mahogany, beech, jelutong, balsa b) softwoods – pine, cedar, larch, redwood.
	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.
	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.
	1.4	Composites: a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), hardboard, chipboard, plywood.
	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.
	1.6	Textiles: a) natural fibres – cotton, linen, wool b) manmade fibres – nylon, polypropylene, polyester c) textile treatments – flame resistant, polytetrafluoroethylene (PTFE).

Topic	What students need to learn:	
	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.

Topic	What students need to learn:	
2 **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 f) ductility g) hardness h) toughness i) durability j) biodegradability.

Topic	What students need to learn:	
3 **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).
	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

Topic	What students need to learn:	
3 **Processes, techniques and specialist tools** ***continued***	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.
	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).
	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).

Topic	What students need to learn:	
4 **Digital technologies**	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.

Topic	What students need to learn:	
5 **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 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.
	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.
	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.

Topic	What students need to learn:	
6 **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.

Topic	What students need to learn:	
7 **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.

Topic	What students need to learn:	
8 **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.
	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.
	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.

Topic	What students need to learn:	
9 **Designing for maintenance and the cleaner environment**	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.
	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.

Topic	What students need to learn:	
10 **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 andSafety 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).

Topic	What students need to learn:	
11 **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.
	11.2	Modelling the costing of projects to achieve an optimum outcome: a) budgets – undertake financial forecasts b) planning for production – allocation of: o employees o materials o 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).

Topic	What students need to learn:	
12 **Further processes and techniques**	12.1	Strategies, techniques and approaches to explore, create and evaluate design ideas: a) user-centred design: o framework process o problem solving o user needs, wants and values o 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: o reduce process cycle time o reduce pollution o reduce costs o increase customer satisfaction o increase profits.
	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.

Assessment information

- First assessment: May/June 2019.
- The assessment is 2 hours and 30 minutes.
- The assessment is out of 120 marks.
- Students must answer all questions.
- The paper will include calculations, short-open, open-response and extended-writing questions.
- The paper will include questions that target mathematics at higher-tier level in a GCSE Qualification in Mathematics.
- Students must have calculators and rulers in the examination. Information regarding the use of calculators during the examinations for this qualification can be found in *Appendix 2: Calculators*.

Synoptic assessment

Synoptic assessment requires students to work across different parts of a qualification and to show their accumulated knowledge and understanding of a topic or subject area.

Synoptic assessment enables students to show their ability to combine their skills, knowledge and understanding with breadth and depth of the subject.

This component assesses synopticity.

Sample assessment materials

A sample paper and mark scheme for this component can be found in the *Pearson Edexcel Level 3 Advanced GCE in Design and Technology (Product Design) Sample Assessment Materials (SAMs)* document.

Component 2: Independent Design and Make Project

Overview

The purpose of this component is to undertake a substantial design, make and evaluate project which will test students' skills in designing and making a prototype. The term 'prototype' means an appropriate working solution to a need or want that is sufficiently developed to be tested and evaluated (for example, full-sized products, scaled working models or functioning systems).

Students are required to individually and in consultation with a client/end user identify a design possibility and design context from which they develop a range of potential solutions and then realise one through practical making activities. The project must allow candidates to apply knowledge and understanding in a product development process to design, make and evaluate prototypes.

In this project, students will be encouraged to use creativity and imagination when applying iterative design processes to develop and modify designs, and to design and make prototypes that solve real world problems, considering others' needs, wants and values. 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 take ownership of all aspects of their work in this project, in order to allow them total control of their responses and to target assessment criteria effectively, and to maximise their achievements. 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.

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 *Appendix 1: Mathematical skills requirement* and *Appendix 3: Science knowledge and skills requirement.*

This project will require students to follow the iterative design processes of exploring, creating and evaluating. The content and assessment criteria are set out in a linear format to show what is required of the total project.

Content

The tables below show each assessment area of a typical design and make project and the relevant skills and evidence expected to support this within the student's portfolio.

Part 1: Identifying and outlining possibilities for design

1. Identification and investigation of a design possibility

Content	Skills and Evidence
a) Investigation of the needs, wants and values of the client/end user. b) Identification, investigation and justification of a design possibility.	**Investigate** client/user needs, wants and values – ask pertinent questions and seek answers to learn about a broad range of user needs, wants and values that could be addressed and gain an understanding of related design considerations in order to support the informed identification of a design possibility **Identify** and **investigate** a design possibility – refine the scope of possibilities down to a focused area based on investigations. Conduct further investigation of the chosen area of focus to support a full understanding of the relevant design factors and the needs, wants and values of end users **Justify** design possibility – provide a rationale as to how and why the design possibility has been identified, supported by evidence from investigations. Provide evidence of the factors that have been considered and how their importance has been gauged. Investigation of client/end user requirements is initially likely to be in the form of a series of questions that will consider the key factors that will influence the design decisions and allow for the design needs to be established. Justification of the design possibility will establish a preliminary design brief and may include evidence of investigations conducted through the internet, interviews, newspaper clippings or user centre-based information. This section will be evidenced through any form of appropriate effective communication.

2. Investigation of needs and research

Content	Skills and Evidence
a) Assess the needs, wants and values of the client/end user and the needs of the prototype. b) Research of existing commercial products, ergonomic information and standards relevant to the design possibility, using knowledge and understanding of designing and making. c) 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. d) Consideration of levels of production and potential methods to improve the sustainability of the prototype across its life cycle.	**Assess** client/user needs, wants and values and the needs of the prototype **–** consider all of the factors that have been investigated, weighing up their importance and making decisions about how they will be addressed through the design brief and specification **Select** research sources and **make links** between the design needs and the research undertaken – conduct research into sources that have been considered and chosen for their relevance to the design possibility and the factors that have been investigated. Demonstrate the ways that the research undertaken is relevant to and informs the needs of the design (including client/end user needs, wants and values and prototype needs). Research can be presented graphically, written or digitally and may be seen throughout the portfolio.

3. Specification

Content	Skills and Evidence
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.	**Identify** and **Justify** performance requirements – outline performance requirements providing a rationale as to how they have been determined to ensure a working solution to the design possibility, supported by evidence from research and investigations. A refined design brief and specification must be produced. The design brief should reflect the needs, wants and values of the client/end user. The specification should be informed by the questions raised by research and investigation findings. Specification points should be technical and measurable to allow for realistic testing and evaluation. An effective specification is organised logically and could be achieved by using sub-headings such as: • Purpose/function • Form • User requirements • Performance requirements (considering relevant standards) • Material and component requirements • Scale of manufacture and cost Each specification point should contain more than a single piece of information, so that each statement is fully justified by giving a reason for the initial point. This section will be evidenced through any form of appropriate effective communication.

Part 2: Designing a prototype

4. Design ideas

Content	Skills and Evidence
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.	**Select** and **apply** design strategies - Consider different strategies and select them through their relevance to the design possibility and related factors and their ability to work effectively with design ideas presented. Demonstrate an ability to use the selected strategies to generate and produce design ideas. **Present** design ideas– demonstrate an ability to solve a design problem. **Use** aesthetic features – Incorporate aesthetic understanding into features of designs **Demonstrate understanding** of materials, processes, techniques and the intended use of the prototype – show an ability to select and apply relevant knowledge in the context of designing new prototypes to demonstrate understanding of its appropriate use in practice The initial design ideas will contain a ideas that show different approaches to the design possibility and solving the design problems it presents. Designs should be annotated with design decisions justified. They should also explain details of design thinking and offer thoughts on design proposals. Ideas should demonstrate interaction with client/end user and designer, possibly through the use of photographs, email, transcript or market research. This section will be evidenced through any form of appropriate effective communication.

5. Development of design ideas

Content	Skills and Evidence
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) 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. c) 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.	**Use** research – draw from information and understanding gained from research to inform ongoing developmental changes. **Use** an iterative approach – employ a process of planning, experimenting, designing, modelling, testing and reviewing, including use of input from client/end user to inform decision making, make improvements and refine designs at each stage of development. **Apply knowledge** of materials and processes - show an ability to use relevant technical knowledge to inform the development of designs **Apply** modelling/simulation techniques – use of modelling/simulation as part of an iterative design approach to visualise developing designs and inform decisions **Demonstrate understanding** of the need for testing - show an ability to select and apply knowledge of relevant testing methods in the context of designing new prototypes in order to demonstrate understanding of its importance in the development of a final prototype This section of the portfolio is likely to consist of design developments, including drawings and details of the final design idea. There will be evidence in this section of students developing a final design idea with reference to the specification and improvements being supported by appropriate annotation. The evidence of modelling should be presented through clear, well-annotated photographs or screenshots. Client/end user interaction could include the use of photographs, email transcripts, market research or client/end user annotation of designs.

6. Final design solution

Content	Skills and Evidence
a) Design proposals are refined down to a final design solution which includes all requirements for fitness for purpose, including technical details of all materials and/or component parts, processes and techniques. b) Specification of materials and/or components and processes shows consideration of sustainability. Decisions are made based on research information on the environmental costs of extracting and processing the selected materials, the prototype manufacture, lifespan and disposal. c) Application of the calculation and cost of materials based on quantities to reduce wastage.	**Refine** design proposals – Make final decisions about proposed designs and present a single design solution that meets the requirements of the design specification. **Produce** a manufacturing specification – fully document all details of the final design solution, including sufficient technical information to allow accurate interpretation by a third party. **Apply** calculations – use appropriate mathematical knowledge to determine material quantities and costs related to the production of the prototype **Demonstrate understanding** of methods of reducing wastage – use outcomes of calculations to plan the most efficient use of materials and resources in the manufacture of the prototype Evidence is likely to include a graphical representation of a final design with working/component drawings.

7. Review of development and final idea

Content	Skills and Evidence
a) Critical analysis and evaluation of their own ideas and decisions while using an iterative design process leading to refinements of designs. b) Analysis and evaluation of designs and prototypes/products produced by others, including client/end user to inform design decisions. c) Analysis and evaluation of refinements to designs based on the design decisions made by others, including the client/end user, along with a consideration of the materials, components and manufacturing techniques that will be used for making the final prototype. d) 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.	**Analyse** refinements made to designs through the development process – break down or deconstruct the refinements made to prototype designs with reasoned consideration and investigation of a range of factors including materials and/or components, processes, techniques, aesthetics and contextual/historical influences supported by reference to feedback. **Evaluate** refinements made to designs through the development process - critically review information gained from analysis of prototype designs including strengths, weaknesses and all relevant information, to form independent judgments and come to balanced and supported conclusions about the appropriateness of the final prototype design in meeting the needs of the specification, taking into account the effectiveness of the iterative design process. **Analyse** designs and prototypes made by others and **make connections** between elements of the design - break down or deconstruct prototype designs of others with reasoned consideration and investigation of a range of factors including materials and/or components, processes, techniques, aesthetics and contextual/historical influences. Showing the ways in which elements and aspects of designs are related and work together as part of the overall design.

7. Review of development and final idea (continued)

Content	Skills and Evidence
	Evaluate designs and prototypes made by others – critically review information gained from analysis of prototype designs of others, including strengths, weaknesses and all relevant information, to form independent judgments and come to balanced and supported conclusions which inform own design decisions. The review of development and final idea section is likely to accompany research, development of design ideas and the final design solution and may consist of a summative submission which would include a conclusion that incorporates the opinions of the client/end user evidenced through photographs, email transcripts and market research. Information should be communicated through logical and well-organised statements. There should be evidence of an objective evaluation of ideas set against the needs in the design brief and specification to ensure that designs are realistic, viable and fulfil the client/end user's needs, wants and values. Client/end user interaction could include the use of photographs, email, transcripts or market research. This section will be evidenced through any form of appropriate effective communication.

8. Communication of design ideas

Content	Skills and Evidence
a) Selection and skill in the use of traditional/manual graphical, digital techniques (CAD), written techniques to communicate designs.	**Select** and **use** communication techniques - Consider different communication techniques and make considered choices about which are most fit for purpose based on their ability to clearly and accurately convey design information and related factors. Demonstrate an ability to use the selected communication techniques accurately in order to effectively communicate all aspects of design proposals. Evidence to support the marks awarded in this section will be found in both the development of design ideas and the final design solution sections of the portfolio. Notes and annotations should provide sufficient information to enable others to interpret their design intentions.

Part 3: Making a final prototype

9. Tools and equipment, and 10. Quality and accuracy

Content	Skills and Evidence
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.	**Select** materials, fixtures, components and fittings – Consider different options for materials, fixtures, components and fittings that can be used and make considered choices about which are most fit for purpose based on their ability to produce a prototype that is functional and meets the requirements of the client/end user and specification. **Demonstrate understanding** of material properties, the requirements of the client/end user, and the intended purpose of the prototype - show an ability to select and apply knowledge of relevant material properties, client/end user requirements and the intended purpose of the prototype through the making of a functional prototype which meets all requirements set out. **Use tools, equipment and techniques** – Carry out required operations using selected tools and equipment and techniques for the manufacture of the final prototype, applying the required accuracy to ensure it performs as intended. **Demonstrate understanding** of the need for dimensional and geometric accuracy - show an ability to select and apply accurate making techniques in order to demonstrate an understanding of the importance of accuracy in the production of a final prototype **Demonstrate** safe working practices – document the ways in which the tools, equipment, processes and techniques used during the making of prototypes were used with regard for the safety of self and others, showing control measures used to reduce hazards and risk. **Demonstrate making skills** in the production of a functional prototype – show an ability to accurately apply appropriate making processes and techniques in relation to the complexity of design problem **Produce** a functional prototype – present and fully document the physicality and functionality of a completed prototype showing how it addresses the client/end user needs and requirements of the design specification **Apply** an iterative approach to manufacture - employ a process of planning, experimenting, making, testing and reviewing, including use of input from client/end, to inform decision making, make improvements and refine prototypes at each stage of manufacture.

9. Tools and equipment, and 10. Quality and accuracy (continued)

Content	Skills and Evidence
	As evidence of the quality of students' making skills (and the level of demand of their work), it is important that key stages of the manufacturing process are photographed in order to demonstrate that the prototype is an appropriate working solution to the identified client/end user needs, wants and values and is sufficiently developed to be tested and evaluated (for example, full sized products, scaled working models or functioning systems). Photographic evidence should also demonstrate that the final prototype is fit for purpose and in addition to being a working solution; addresses the needs, wants and values of the client/end user and is successful in meeting the criteria of the specification. Amendments to the final outcome are documented appropriately and are likely to be found in the evaluation section, they should include those made in consultation with the client/end user. Risk assessments should be appropriately evidenced in the portfolio of work.

Part 4: Evaluating own design and prototype

11. Testing and evaluating

Content	Skills and Evidence
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 the impact on the environment, including life-cycle analysis of the final prototype.	**Analyse** the final prototype - break down or deconstruct the refinements made to the final prototype during the design and manufacturing process, with reasoned consideration and investigation of a range of factors including materials and/or components, processes, techniques, aesthetics and contextual/historical influences supported by reference to feedback, the design specification, and testing against measurable criteria. **Evaluate** the final prototype - critically review information gained from analysis of the final manufactured prototype, including strengths, weaknesses and all relevant information, taking into account the effectiveness of the iterative process during manufacture and the intended purpose of the prototype, drawing balanced and supported conclusions. **Analyse** the potential impacts of the prototype - break down or deconstruct the potential social, moral, ethical and environmental impacts of the prototype with reasoned consideration and investigation of a range of factors including impact of materials and manufacturing processes, supported by reference to feedback, the design specification, and testing against measurable criteria **Evaluate** the potential impacts of the prototype - critically review information gained from analysis of the potential social, moral, ethical and environmental impacts of the prototype, including strengths, weaknesses and all relevant information, drawing balanced and supported conclusions. Annotated photographs, written responses or represented data related to market research/field trials as evidence of testing undertaken. There should be evidence of analysis and evaluation of wider issues in design and technology including social, moral, ethical and environmental impacts. Tests should be objective and carried out by the client/end user to gather third-party feedback. There should be evidence of client/end user interaction with the final prototype.

Assessment information

- Internally assessed, externally moderated
- The assessment will be carried out under controlled conditions, as specified on pages 33 to 36 of the specification.
- First assessment: June 2019.
- Students will produce a substantial design, make and evaluate project which consists of 120 marks
- The project will consist of a portfolio and a prototype
- The final prototype must be produced under immediate guidance or supervision.
- The teacher responsible for overseeing the student's work must ensure that a Candidate Assessment Booklet* (CAB) is completed for each student.
- The portfolio and CAB for each student in the sample **must** be sent to Pearson, in May in the year of assessment. Please see our *UK Information Manual* for the submission deadline date.

  * Further information about how to complete the CAB is provided in the Task taking and marking section.

Synoptic assessment

Synoptic assessment requires students to work across different parts of a qualification and to show their accumulated knowledge and understanding of a topic or subject area.

Synoptic assessment enables students to show their ability to combine their skills, knowledge and understanding with breadth and depth of the subject.

This component assesses synopticity.

Task setting, taking and marking

Task setting

Students should identify a design context and brief with the support of their teacher.

Setting the task

The context of the design possibility should be suitably challenging as to allow a range of alternative approaches to be taken, and allow students to investigate the wider implications of their design decisions. Students must individually identify a design need in negotiation with their teachers.

Task taking

Project controls relating to student independence and teacher guidance to students

Teachers:

Can:

- provide broad parameters for student's design contexts (including areas for investigation, availability of equipment, time constraints)
- explain what a commercial design methodology is
- advise on health and safety considerations, the use of equipment and potential ethical concerns of certain types of materials
- discuss with students their initial design possibilities and their approaches to solving design problems
- provide general levels of feedback to individuals or groups and allow students to revise and re-draft work

Must:

- confirm that the design and make project has the potential to meet the assessment criteria and offer general guidance on any necessary amendments
- review each student's design brief. In this review teachers should ensure that the proposed design brief can access the specification requirements suitably, teachers should give general guidance on the methodology and design tools that the student plans to use
- promote good practice such as referencing and using a bibliography system
- store work securely once it is handed in for formal assessment
- ensure that students keep photographic records of the manufacturing process to evidence the quality of manufacturing
- give students guidance on the safe use of unfamiliar tools and equipment
- ensure that good-quality photographs are used to evidence the marks being allocated by the centre

Must not:

- give students a choice of titles or tasks from which they then choose
- give detailed feedback to individual students about how to improve work to meet the assessment criteria. The guidance provided before final submission should enable students to take the initiative in making amendments only, rather than detailing what amendments should be made. This means that teachers must not provide templates and model answers for the work of specific students
- mark work provisionally and share that mark so that the student may then improve it
- return work to students after it has been submitted and marked

- give guidance on how to make improvements to the design portfolio in order to meet the assessment criteria so that students are no longer engaged in independent learning.

If teachers give any assistance which goes beyond general advice, they must then record this assistance in the CAB and take it into account when marking the work, for example[1]:

- providing detailed specific guidance on how to improve design ideas to meet the assessment criteria
- giving detailed specific guidance on errors and omissions that limits student's opportunities to show initiative themselves
- intervening personally to improve the presentation, manufacture or content of work.

Learning hours are not specified because the process of producing the design portfolio is iterative and undertaken by the student, on their own, at the school/college. The prototype is manufactured under immediate guidance (under direct supervision of a teacher) in school/college. Where specialist processes or equipment are required beyond the school/college capabilities they may be utilised but this must be documented and authenticated in the appropriate section of the *Pearson Edexcel Level 3 Advanced GCE in Design and Technology (Product Design) Candidate Assessment Booklet (CAB).*

Annotation should be used to explain how marks were applied in the context of the additional assistance given.

If teachers give specific guidance which goes beyond general guidance and is not taken into account when marking the work, this will be considered as malpractice. If malpractice is suspected, we will investigate. If malpractice is found to have taken place a penalty will be applied dependent on the circumstances and severity of the malpractice.

For full information regarding malpractice please see the JCQ document 'Suspected Malpractice in Examinations and Assessments'.

Task writing

Authenticity

Teachers and centres must be satisfied that the work is the student's own and should sign the Candidate Assessment Booklet.

Health and safety

Centres should develop their own mechanisms so that students know the importance of ensuring their own safety and that of others. This should include developing risk assessments as part of the manufacturing process, for example by using model risk assessments or Health and Safety Executive pro forma to assess likely hazards and risk. Students who might be lone working should be provided with additional information and guidance and the centre must have suitable policies and procedures for lone working. Practical making activities must be supervised at all times at school/college.

Resources

Students should have equal access to resources. They should have access to a range of resources, literature and sources of information to enable them to make choices as required for their design and make task. Students should have access to the tools and equipment they will require in order to manufacture their final prototype with a high degree of accuracy and skill.

[1] First three bullet points as per the JCQ *Instructions for conducting non-examination assessment*, section 4.2.

Portfolio guidance

It is recommended that students produce an electronic portfolio equivalent of approximately 40 sides of A3 paper, for their design, make and evaluate project along with any models and their prototype. Electronic portfolios must use either Adobe or Power Point and be submitted electronically. Students will not be penalised specifically on the basis of the amount of work that they produce. However, excessively high or low amounts of work may restrict student's ability to evidence the skills outlined in the marking criteria.

Photographic evidence

As proof of the quality of students' making skills it is important that all stages of the manufacturing process are photographed in order to evidence that the prototype is an appropriate working solution to a need or want that is sufficiently developed to be tested and evaluated (for example, full sized products, scaled working models or functioning systems). Photographic evidence should also demonstrate that the final prototype is fit for purpose and in addition to being a working solution; addresses the needs, wants and values of the intended client/end user and is successful in meeting the criteria of the specification. Images should show fully the details of the prototype, which will require photographs being taken from a range of angles to show details of all sides and features of a 3D outcome. Photographs should be coloured, well lit, and of a high resolution in order to clearly show details of the final outcome. Photographs should be submitted as jpegs, with a maximum individual file size of 3 MBs. There should be sufficient photographic evidence to support the award of marks, however a maximum quantity of 20 photographs per project is suggested.

Marking, standardisation and moderation

Once work has been submitted for marking it may not be given back to students.

Teachers should mark the project using the assessment criteria on the following pages. Teachers may annotate students' work but should also include any comments on the CAB to justify the marks awarded. Please refer to the 'General Marking Guidance' provided in the CAB for further information on how to apply these assessment criteria grids accurately.

Where marking has been carried out by more than one teacher in a centre, there must be a process of internal standardisation carried out to ensure that there is a consistent application of the assessment criteria.

Marks awarded by the centre will be subject to external moderation by Pearson. Moderation will ensure consistency with national standards. Pearson will notify centres of the students whose work has been selected for moderation. This sample will take cohort size into account.

The portfolio and CAB for each student in the sample **must** be sent to Pearson, in May in the year of assessment. Please see our *UK Information Manual* for the submission deadline date. A copy is made available to all examinations officers and is available on our website: qualifications.pearson.com

If the moderation indicates that centre assessment does not reflect national standards, an adjustment will be made to students' final marks to compensate.

For further information please refer to the Joint Council for Qualifications (JCQ) document *Instructions for conducting non-examination assessments (new GCE and GCSE specifications)* on the JCQ website: www.jcq.org.uk. The assessment of this qualification must comply with these instructions.

Component 2: Assessment Criteria

Teachers must mark students' work using the following assessment criteria. Please refer to the 'General Marking Guidance' provided in the CAB for further information on how to apply these grids accurately.

Part 1: Identifying and outlining possibilities for design

Please refer to the information provided on page 22 of the specification relating to the skills and evidence outlined for this grid.

Grid 1

Level	Mark	Identification and investigation of a design possibility (AO1 1a 9 marks)
	0	No rewardable material.
Level 1	1–3	• Evidence of basic investigation of superficially relevant design possibilities. • Basic identification and justification of a design possibility. • Basic investigation of the needs, wants and values of the client/end user to inform design requirements.
Level 2	4–6	• Evidence of sound investigation of relevant design possibilities. • Competent identification and justification of a design possibility. • Sound investigation of the needs, wants and values of the client/end user to inform design requirements.
Level 3	7–9	• Evidence of in-depth investigation of pertinent design possibilities. • Effective identification and justification of a design possibility. • Comprehensive investigation of the needs, wants and values of the client/end user to inform design requirements.

Please refer to the information provided on page 23 of the specification relating to the skills and evidence outlined for this grid.

Grid 2

Level	Mark	Investigation of needs and research (AO1 1a 15 marks)
	0	No rewardable material.
Level 1	1–3	• Superficial assessment of the needs, wants and values of the end user. • Superficial assessment of the needs of the prototype with limited consideration of form, and function. • Limited links between the design needs and the research undertaken. • Basic selection of research sources, including existing products, ergonomic information and standards, which provide limited insight to the design context, showing a partial understanding of the design possibility and related design problems.
Level 2	4–7	• Partially developed assessment of the needs, wants and values of the end user. • Partially developed assessment of the needs of the prototype with generally relevant consideration of form, function and sustainability. • Partially sound links between the design needs and the research undertaken. • Partially sound selection of research sources, including existing products, ergonomic information and standards, which provide a partially sound insight to the design context, showing a consistent understanding of the design possibility and related design problems.
Level 3	8–11	• Mostly developed assessment of the needs, wants and values of the user. • Mostly developed assessment of the needs of the prototype with relevant consideration of form, function, sustainability and level of production. • Sound links between the design needs and the research undertaken. • Sound selection of research sources, including existing products, ergonomic information and standards, which provide a sound insight to the design context, showing a considered understanding of the design possibility and related design problems.
Level 4	12–15	• Comprehensively developed assessment of the needs, wants and values of the user. • Comprehensively developed assessment of the needs of the prototype with pertinent consideration of form, function, sustainability and level of production. • Perceptive links between the design needs and the research undertaken. • Perceptive selection of research sources, including existing products, ergonomic information and standards, which provide perceptive insight to the design context, showing a comprehensive understanding of the design possibility and related design problems.

Please refer to the information provided on page 24 of the specification relating to the skills and evidence outlined for this grid.

Grid 3

Level	Mark	Specification (AO1 1b 9 marks)
	0	No rewardable material.
Level 1	1–3	• Basic design brief that reflects some of the investigated needs, wants and values of the client/end user. • Superficial range of specification points which are realistic, technical and measurable in relation to a basic design problem. • Limited justification of the performance requirements for the prototype.
Level 2	4–6	• Considered design brief that reflects most of the investigated needs, wants and values of the client/end user. • Developed range of specification points which are realistic, technical and measurable in relation to an effective design problem. • Sound justification of the performance requirements for the prototype.
Level 3	7–9	• Comprehensive design brief that fully reflects the investigated needs, wants and values of the client/end user. • Comprehensive range of specification points which are realistic, technical and measurable in relation to a sophisticated design problem • Perceptive justification of the performance requirements for the prototype.

Part 2: Designing a prototype

Please refer to the information provided on page 25 of the specification relating to the skills and evidence outlined for this grid.

Grid 4

Level	Mark	Design ideas (AO2 9 marks)
	0	No rewardable material
Level 1	1–3	• Basic selection and use of design strategies to inform decisions. • Present ideas that show a limited consideration for the user needs and specification parameters. • Basic use of aesthetic features with basic consideration of historical and cultural influences showing a limited understanding of the intended use of the prototype. • Ideas demonstrate a basic understanding of relevant materials and processes.
Level 2	4–6	• Considered selection and use of design strategies to inform decisions. • Present ideas that show sound consideration for the user needs and specification parameters. • Effective use of aesthetic features with sound consideration of historical and cultural influences showing a sound understanding of the intended use of the prototype. • Ideas demonstrate a sound understanding of relevant materials, processes and techniques.
Level 3	7–9	• Sophisticated selection and use of design strategies to inform decisions. • Present ideas that show an in-depth consideration for the user needs and specification parameters. • Accomplished use of aesthetic features with perceptive consideration of historical and cultural influences showing an in-depth understanding of the intended use of the prototype. • Ideas demonstrate an in-depth understanding of relevant materials, processes and techniques.

Please refer to the information provided on page 26 of the specification relating to the skills and evidence outlined for this grid.

Grid 5

Level	Mark	Development of design ideas (AO2 9 marks)
	0	No rewardable material
Level 1	1–3	• Superficial use of research to inform ongoing developmental changes. • Basic use of an iterative approach to the development of a design solution, including superficial input of client/end user feedback to inform decisions throughout the process. • Changes and alternatives to designs are informed by the basic application of technical knowledge of materials and processes. • Limited application of modelling/simulation techniques to inform decisions showing a basic understanding of the need for testing in the development of a final prototype.
Level 2	4–6	• Considered use of research to inform ongoing developmental changes. • Sound use of an iterative approach to the development of a design solution, including considered input of client/end user feedback to inform decisions throughout the process. • Changes and alternatives to designs are informed by the sound application of technical knowledge of materials and processes. • Effective application of modelling/simulation techniques to inform decisions showing a sound understanding of the need for testing in the development of a final prototype.
Level 4	7–9	• Perceptive use of research to inform ongoing developmental changes. • Accomplished use of an iterative approach to the development of a design solution, including perceptive input of client/end user feedback to inform decisions throughout the process. • Changes and alternatives to designs are informed by the in-depth application of technical knowledge of materials and processes. • Sophisticated application of modelling/simulation techniques to inform decisions showing an in-depth understanding of the need for testing in the development of a final prototype.

Please refer to the information provided on page 27 of the specification relating to the skills and evidence outlined for this grid.

Grid 6

Level	Mark	Final design solution (AO1 3 marks, AO2 6 marks)
	0	No rewardable material
Level 1	1–3	• The manufacturing specification generally addresses the needs and wants of the client/end user and includes basic technical details to allow partially accurate interpretation by a third party. • Basic refinement of design proposals to generate a design solution that generally meets the requirements of the design specification. • Basic project management including application of calculations to determine material quantities and costs related to the production of the prototype, showing a basic understanding of methods which can be applied to reduce wastage.
Level 2	4–6	• A manufacturing specification that effectively addresses the needs and wants of the client/end user is presented that includes effective technical details to allow mostly accurate interpretations by a third party. • Effective refinement of design proposals to generate a design solution that effectively meets the requirements of the design specification. • Effective project management including application of calculations to determine material quantities and costs related to the production of the prototype, showing an effective understanding of methods which can be applied to reduce wastage.
Level 3	7–9	• A manufacturing specification that comprehensively addresses the needs and wants of the client/end user is presented that includes comprehensive technical details to allow fully accurate interpretation by a third party. • Sophisticated refinement of design proposals to generate a design solution that comprehensively meets the requirements of the design specification. • Accomplished project management including application of calculations to determine material quantities and costs related to the production of the prototype, showing a thorough understanding of methods which can be applied to reduce wastage.

Please refer to the information provided on page 27 of the specification relating to the skills and evidence outlined for this grid.

Grid 7

Level	Mark	Review of development and final idea (AO3 1a 6 marks, AO3 1b 6 marks)
	0	No rewardable material
Level 1	1–3	• Superficial analysis of the refinements made to designs through the development process with limited references to feedback made by others and consideration of materials, components and manufacturing techniques. • Limited and imbalanced evaluation of the refinements made to designs through the development process, which draw limited conclusions about the appropriateness of the final prototype in meeting the needs of the specification. • Superficial analysis of the designs and prototypes made by others, which considers a limited range of factors and makes superficial connections between elements of the design. • Limited and imbalanced evaluation of the design and prototypes made by others, which begins to inform their own design decisions.
Level 2	4-6	• Partially developed analysis of the refinements made to designs through the development process, supported by generally relevant references to feedback made by others and consideration of materials, components and manufacturing techniques. • Partially sound and partially balanced evaluation of the refinements made to designs through the development process, which is used to draw partially sound conclusions about the appropriateness of the final prototype in meeting the needs of the specification. • Partially developed analysis of the designs and prototypes made by others, which considers a generally relevant range of factors and makes partially developed connections between elements of the design. • Partially sound and partially balanced evaluation of the designs and prototypes made by others, which coherently informs their own design decisions.
Level 3	7-9	• Mostly developed analysis of the refinements made to designs throughout the development process, mostly relevant references to feedback made by others and consideration of materials, components and manufacturing techniques. • Sound and mostly balanced evaluation of the refinements made to designs through the development process, which is used to draw sound conclusions about the appropriateness of the final prototype in meeting the needs of the specification. • Mostly developed analysis of the designs and prototypes made by others, which considers a mostly relevant range of factors and makes mostly relevant connections between elements of the design. • Sound and mostly balanced evaluation of the designs and prototypes made by others, which effectively informs their own design decisions.

Level	Mark	Review of development and final idea *(continued)* (AO3 1a 6 marks, AO3 1b 6 marks)
Level 4	10-12	• Comprehensively developed analysis of the refinements made to designs through the development process, pertinently supported by references to feedback made by others and consideration of materials, components and manufacturing techniques. • Perceptive and balanced evaluation of the refinements made to designs through the development process, which is used to draw perceptive conclusions about the appropriateness of the final prototype in meeting the needs of the specification. • Comprehensively developed analysis of the designs and prototypes made by others, which considers a comprehensive range of factors and makes comprehensive connections between elements of the design. • Perceptive and balanced evaluation of the designs and prototypes made by others, which is used perceptively to inform their own design decisions.

Please refer to the information provided on page 28 of the specification relating to the skills and evidence outlined for this grid.

Grid 8

Level	Mark	Communication of design ideas (AO2 6 marks)
	0	No rewardable material
Level 1	1–2	• Basic selection and appropriate use of traditional/manual graphical techniques to communicate design proposals. • Basic selection and appropriate use of computer-aided design (CAD) techniques to communicate design proposals. • Basic selection and appropriate use of written techniques to communicate design proposals.
Level 2	3–4	• Considered selection and effective use of traditional/manual graphical techniques to communicate design proposals. • Considered selection and effective use of computer-aided design (CAD) techniques to communicate design proposals. • Considered selection and effective use of written techniques to communicate design proposals.
Level 3	5–6	• Perceptive selection and accomplished use of traditional/manual graphical techniques to communicate design proposals. • Perceptive selection and accomplished use of computer-aided design (CAD) techniques to communicate design proposals. • Perceptive selection and accomplished use of written techniques to communicate design proposals.

Part 3: Making a final prototype

Please refer to the information provided on pages 29-30 of the specification relating to the skills and evidence outlined for this grid.

Grid 9

Level	Mark	Tools and equipment (AO2 12 marks)
	0	No rewardable material
Level 1	1–3	• Basic selection of materials, fixtures, components and fittings some of which are appropriate for the final prototype, showing a limited understanding of the intended purpose of the prototype. • Limited use of tools and equipment to prepare materials for the manufacture of the prototype, showing a limited understanding of the need for dimensional accuracy. • Demonstrate a generally adequate degree of safe working practice for self and others.
Level 2	4–6	• Adequate selection of materials, fixtures, components and fittings which are generally appropriate for the final prototype, showing a partially sound understanding of the requirements of the end user and the intended purpose of the prototype. • Some skilful use of tools, equipment and techniques to prepare materials for the manufacture of the prototype, showing a generally sound understanding of the need for dimensional or geometric accuracy. • Demonstrate a fully adequate degree of safe working practice for self and others.
Level 3	7-9	• Mostly sophisticated selection of materials, fixtures, components and fittings which are mostly appropriate for the final prototype, showing a sound understanding of the requirements of the end user and the intended purpose of the prototype. • Mostly Skilful use of tools, equipment and techniques to prepare materials for the manufacture of the prototype, showing a sound understanding of the need for dimensional or geometric accuracy. • Demonstrate a generally high degree of safe working practice for self and others.
Level 4	10–12	• Sophisticated selection of materials, fixtures, components and fittings which are fully appropriate for the final prototype, showing an in-depth understanding of material properties, the requirements of the end user, and the intended purpose of the prototype. • Accomplished use of tools, equipment and techniques to prepare materials for the manufacture of the prototype, showing an in-depth understanding of the need for dimensional and geometric accuracy. • Demonstrate a consistently high degree of safe working practice for self and others.

Please refer to the information provided on pages 29-30 of the specification relating to the skills and evidence outlined for this grid.

Grid 10

Level	Mark	Quality and accuracy (AO2 18 marks)
	0	No rewardable material
Level 1	1–4	• Produce a prototype that demonstrates mostly adequate making skills in relation to a basic design problem. • Produce a partly functioning prototype which matches the end user needs. • Produce a prototype that superficially meets the design specification. • Basic application of an iterative approach to manufacture and to produce a prototype.
Level 2	5–9	• Produce a prototype that demonstrates some skilful making skills at an advanced level in relation to a partially effective design problem • Produce a generally functioning prototype which matches the end user needs. • Produce a prototype that partially meets the design specification. • Considered application of an iterative approach to manufacture to produce a prototype.
Level 3	10–14	• Produce a prototype that demonstrates skilful making skills at an advanced level in relation to an effective design problem. • Produce a mostly functional prototype which matches the end user needs. • Produce a prototype that mostly meets the design specification. • Accomplished application of an iterative approach to manufacture to produce a prototype.
Level 4	15–18	• Produce a prototype that demonstrates accomplished making skills at an advanced level in relation to a sophisticated design problem • Produce a fully functional prototype which matches the end user needs. • Produce a prototype that fully meets the design specification. • Sophisticated application of an iterative approach to manufacture to produce a prototype.

Part 4: Evaluating own design and prototype

Please refer to the information provided on page 31 of the specification relating to the skills and evidence outlined for this grid.

Grid 11

Level	Mark	Testing and evaluation (AO3 1a 3 marks, AO3 1b 3 marks, AO3 2a 3 marks, AO3 2b 3 marks)
	0	No rewardable material
Level 1	1–4	• Superficial analysis of the final prototype, taking into account refinements implemented during the development and manufacturing process and the client/end user specification, showing a limited approach to testing against measurable criteria. • Limited evaluation of the prototype, taking into account the iterative design process and the intended purpose of the prototype, drawing imbalanced conclusions from testing. • Superficial analysis of the social, moral, ethical and environmental impact of materials and manufacturing processes of the prototype • Limited evaluation o of the social, moral, ethical and environmental impact of the prototype.
Level 2	5–8	• Developed analysis of the prototype, taking into account refinements implemented during the development and the client/end user specification, showing a sound approach to testing against measurable criteria. • Sound evaluation of the prototype, taking into account the iterative design process and the intended purpose of the prototype, drawing mostly balanced conclusions from testing against measurable criteria. • Developed analysis of the social, moral, ethical and environmental impact of materials and manufacturing processes of the prototype • Sound evaluation of the social, moral, ethical and environmental impact of the prototype.
Level 3	9–12	• Comprehensively developed analysis of the prototype, taking into account refinements implemented during the development and the client/end user specification, showing a perceptive approach to testing against most measurable criteria. • Perceptive evaluation of the prototype, taking into account the iterative design process and the intended purpose of the prototype, drawing balanced conclusions from testing against measureable criteria. • Comprehensively developed analysis of the social, moral, ethical and environmental impact of materials and manufacturing processes of the prototype • Perceptive evaluation of the social, moral, ethical and environmental impact of the prototype.

Security and backups

It is the centre's responsibility to keep the work that students have submitted for assessment secure.

Secure storage is defined as a securely-locked cabinet or cupboard. Where students are producing artefacts, secure storage is defined as a classroom studio or workshop that is locked or supervised from the end of one session to the start of the next.

The rules on storage also apply to electronic data. For example, centres should collect memory sticks for secure storage between sessions or restrict student access to specific areas of the centre's IT network.

For materials stored electronically, centres are strongly advised to use firewall protection and virus-checking software, and to employ an effective backup strategy, so that an up-to-date archive of students' evidence is maintained.

Further information

For up-to-date advice on teacher involvement and administration of non-examination assessments, please refer to the Joint Council for Qualifications (JCQ) document *Instructions for conducting non-examination assessments (new GCE and GCSE specifications)* available on the JCQ website: www.jcq.org.uk

Assessment Objectives

Students must:		% in GCE A Level
AO1	Identify, investigate and outline design possibilities to address needs and wants	15
AO2	Design and make prototypes that are fit for purpose	25
AO3	Analyse and evaluate • design decisions and outcomes, including for prototypes made by themselves and others • wider issues in design and technology	25
AO4	Demonstrate and apply knowledge and understanding of • technical principles • design and making principles	35
Total		**100%**

Breakdown of Assessment Objectives

Component	Assessment Objectives				Total for all Assessment Objectives
	AO1 %	AO2 %	AO3 %	AO4 %	
Component 1: Principles of Design and Technology	–	–	15	35	50%
Component 2: Independent Design and Make Project	15	25	10	–	50%
Total for GCE A Level	**15%**	**25%**	**25%**	**35%**	**100%**

NB Totals have been rounded either up or down.

3 Administration and general information

Entries

Details of how to enter students for the examinations for this qualification can be found in our *UK Information Manual*. A copy is made available to all examinations officers and is available on our website: qualifications.pearson.com

Discount codes and performance tables

Centres should be aware that students who enter for more than one GCE qualification with the same discount code will have only one of the grades they achieve counted for the purpose of the school and college performance tables. This will be the grade for the larger qualification (i.e. the A Level grade rather than the AS grade). If the qualifications are the same size, then the better grade will be counted (please see *Appendix 9: Codes*).

Students should be advised that if they take two GCE qualifications with the same discount code, colleges, universities and employers they wish to progress to are likely to take the view that this achievement is equivalent to only one GCE. The same view may be taken if students take two GCE qualifications that have different discount codes but have significant overlap of content. Students or their advisers who have any doubts about their subject combinations should check with the institution they wish to progress to before embarking on their programmes.

Access arrangements, reasonable adjustments, special consideration and malpractice

Equality and fairness are central to our work. Our equality policy requires all students to have equal opportunity to access our qualifications and assessments, and our qualifications to be awarded in a way that is fair to every student.

We are committed to making sure that:

- students with a protected characteristic (as defined by the Equality Act 2010) are not, when they are undertaking one of our qualifications, disadvantaged in comparison to students who do not share that characteristic
- all students achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Language of assessment

Assessment of this qualification will be available in English. All student work must be in English.

Access arrangements

Access arrangements are agreed before an assessment. They allow students with special educational needs, disabilities or temporary injuries to:

- access the assessment
- show what they know and can do without changing the demands of the assessment.

The intention behind an access arrangement is to meet the particular needs of an individual student with a disability, without affecting the integrity of the assessment. Access arrangements are the principal way in which awarding bodies comply with the duty under the Equality Act 2010 to make 'reasonable adjustments'.

Access arrangements should always be processed at the start of the course. Students will then know what is available and have the access arrangement(s) in place for assessment.

Reasonable adjustments

The Equality Act 2010 requires an awarding organisation to make reasonable adjustments where a person with a disability would be at a substantial disadvantage in undertaking an assessment. The awarding organisation is required to take reasonable steps to overcome that disadvantage.

A reasonable adjustment for a particular person may be unique to that individual and therefore might not be in the list of available access arrangements.

Whether an adjustment will be considered reasonable will depend on a number of factors, which will include:

- the needs of the student with the disability
- the effectiveness of the adjustment
- the cost of the adjustment, and
- the likely impact of the adjustment on the student with the disability and other students.

An adjustment will not be approved if it involves unreasonable costs to the awarding organisation, timeframes or affects the security or integrity of the assessment. This is because the adjustment is not 'reasonable'.

Special consideration

Special consideration is a post-examination adjustment to a student's mark or grade to reflect temporary injury, illness or other indisposition at the time of the examination/ assessment, which has had, or is reasonably likely to have had, a material effect on a student's ability to take an assessment or demonstrate their level of attainment in an assessment.

Further information

Please see our website for further information about how to apply for access arrangements and special consideration.

For further information about access arrangements, reasonable adjustments and special consideration, please refer to the JCQ website: www.jcq.org.uk.

Malpractice

Candidate malpractice

Candidate malpractice refers to any act by a candidate that compromises or seeks to compromise the process of assessment or which undermines the integrity of the qualifications or the validity of results/certificates.

Candidate malpractice in controlled assessments discovered before the candidate has signed the declaration of authentication form does not need to be reported to Pearson.

Candidate malpractice found in controlled assessments after the declaration of authenticity has been signed, and in examinations **must** be reported to Pearson on a *JCQ Form M1* (available at www.jcq.org.uk/exams-office/malpractice). The form should be emailed to candidatemalpractice@pearson.com. Please provide as much information and supporting documentation as possible. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report candidate malpractice constitutes staff or centre malpractice.

Staff/centre malpractice

Staff and centre malpractice includes both deliberate malpractice and maladministration of our qualifications. As with candidate malpractice, staff and centre malpractice is any act that compromises or seeks to compromise the process of assessment or undermines the integrity of the qualifications or the validity of results/certificates.

All cases of suspected staff malpractice and maladministration **must** be reported immediately, before any investigation is undertaken by the centre, to Pearson on a *JCQ Form M2(a)* (available at www.jcq.org.uk/exams-office/malpractice). The form, supporting documentation and as much information as possible should be emailed to pqsmalpractice@pearson.com. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report malpractice itself constitutes malpractice.

More detailed guidance on malpractice can be found in the latest version of the document *General and Vocational Qualifications Suspected Malpractice in Examinations and Assessments Policies and Procedures,* available at www.jcq.org.uk/exams-office/malpractice.

Awarding and reporting

This qualification will be graded, awarded and certificated to comply with the requirements of Ofqual's General Conditions of Recognition.

This A Level qualification will be graded and certificated on a six-grade scale from A* to E using the total subject mark. Individual components are not graded.

Students whose level of achievement is below the minimum judged by Pearson to be of sufficient standard to be recorded on a certificate will receive an unclassified U result.

The first certification opportunity for this qualification will be 2019.

Student recruitment and progression

Pearson follows the JCQ policy concerning recruitment to our qualifications in that:

- they must be available to anyone who is capable of reaching the required standard
- they must be free from barriers that restrict access and progression
- equal opportunities exist for all students.

Prior learning and other requirements

There are no prior learning or other requirements for this qualification.

Students who would benefit most from studying this qualification are likely to have a Level 2 qualification such as a GCSE in Design and Technology.

Progression

Students can progress from this qualification to:

- tertiary education and/or work-based study including product design, engineering and architecture
- further training in the design, creative, engineering and/or manufacturing industries
- employment in a relevant sector.

Appendices

Appendix 1: Mathematical skills requirement

This appendix is taken from the document *Design and Technology GCE subject content* published by the Department for Education (DfE) in December 2015.

The mathematical skills listed will be assessed in the examination only. The minimum level of mathematics in the examinations will be equivalent to higher tier in a GCSE Qualification in Mathematics.

These skills will be sampled in each examination and covered over the lifetime of the specification. Examples of mathematical questions are Q1(d), 4(c) and 4(d) in the *Sample Assessment Materials.*

Reference	Mathematical skills requirement	Potential applications
a	Confident use of number, percentages and percentiles	Calculation of quantities of materials, costs and sizes.
b	Use of ratios	Scaling drawings.
c	Calculation of surface areas and/or volumes	Determining quantities of materials.
d	Use of trigonometry	Calculation of sides and angles as part of product design.
e	Construction, use and/or analysis of graphs and charts	Representation of data used to inform decisions and evaluation of outcomes. Presentation of market data, user preferences, outcomes of market research.
f	Use of coordinates and geometry	Use of datum points and geometry when setting out design drawings.
g	Use of statistics and probability as a measure of likelihood	Interpret statistical analyses to determine user needs and preferences. Use data related to human scale and proportion to determine product scale and dimensions.

Appendix 2: Calculators

Students may use a calculator in assessments for this qualification, and centres are responsible for making sure that calculators used by their students meet the requirements highlighted in the table below.

Students must be told these regulations beforehand and they must be familiar with them before their assessments for this qualification.

Students must have a calculator with them for their examinations which they may use.

<table>
<tr>
<td>Calculators must be:
of a size suitable for use on a desk
either battery or solar powered
free of lids, cases and covers that have printed instructions or formulae.</td>
<td rowspan="2">Calculators must not:
be designed or adapted to offer any of these facilities:
language translators
symbolic algebraic manipulation
symbolic differentiation or integration
communication with other machines or the internet
be borrowed from another candidate during an examination for any reason*
have retrievable information stored in them, and this includes:
databanks
dictionaries
mathematical formulae
text.</td>
</tr>
<tr>
<td>The candidate is responsible for the following:
the calculator’s power supply
the calculator’s working condition
clearing anything stored in the calculator.</td>
</tr>
</table>

*An invigilator may give a student a replacement calculator

Appendix 3: Science knowledge and skills requirement

This appendix is taken from the document *Design and Technology GCSE subject content* published by the Department for Education (DfE) in December 2015.

These skills will be sampled in each examination and covered over the lifetime of the specification. Example of science knowledge and skills questions are Q2(a), 3(c) and 4(b) in the *Sample Assessment Materials.*

Students must know and apply the following scientific skills, knowledge and understanding:

Reference	Science knowledge and skills requirement	Example of applications
b	Describe the conditions that cause degradation	Ensure products are designed to take account of potential corrosion caused by environmental factors.
c	Know the physical properties of materials and explain how they are related to their uses	Understand the appropriate use of materials, including glass and ceramics, polymers, composites, woods, and metals, based on their physical properties.

Appendix 4: Links to other relevant subjects

The following table show how this qualification links to other relevant subjects As part of the delivery of this qualification, teachers should use this appendix to ensure students gain an awareness and appreciation for the ways in which other subjects inform decisions in design and the application or development of technology.

These links will be sampled over the lifetime of the qualification through the assessment of the related Design & Technology content. For example, in the *Sample Assessment Materials*, Q4(e) is linked to Business A Level subject criteria (*operations management: quality and productivity*), while Q8 is linked to Art and Design A Level subject criteria (*explore relevant resources; analyse, discuss and evaluate images, objects and artefacts; make and record independent judgements*).

Links to other subjects	Examples of links to other A Level subject criteria	Examples of Design and Technology Content
Business	Operations management: • Quality • Productivity	**Component 1** 5.1 – The importance and influence of ensuring products are fit-for-purpose and meet the criteria of specifications when designing, making and evaluating 11.2 – Modelling the costing of projects to achieve an optimum outcomes
	Business analysis: • Decision making	**Component 1** 12.2 – Project management strategies
	Business analysis: • Forecasting • Data analysis	**Component 1** 11.1a– Marketing research
	Marketing: • Identifying and anticipating customer needs • Product life cycle	**Component 1** 5 – Factors influencing the development of products 11.1a– Marketing research 12.3 - The cost, sales, profit and market implications to the designer and manufacturer of the stages of a product's life cycle
Art and Design	Explore relevant resources; analyse, discuss and evaluate images, objects and artefacts; and make and record independent judgements.	**Component 2** Part 1: Identifying and Outlining Possibilities for Design • Identification and investigation of a design possibility • Investigation of needs and research

Links to other subjects	Examples of links to other A Level subject criteria	Examples of Design and Technology Content
Art and Design (continued)	Record experiences and observations, in a variety of ways using drawing or other appropriate visual forms; undertake research; and gather, select and organise visual and other appropriate information.	**Component 1** 3.3 – Use of media to record to recognised standards, explain and communicate information and ideas to recognised standards **Component 2** Part 1: Identifying and Outlining Possibilities for Design • Identification and investigation of a design possibility • Investigation of needs and research
	Explore relevant resources: analyse, discuss and evaluate images, objects and artefacts: and make and record independent judgements	**Component 1** 5.3 – Aesthetics 5.4 – Design theory **Component 2** Part 1: Identifying and Outlining Possibilities for Design Part 2: Investigation of needs and research
Geography	Global systems	**Component 1** 6.1c – the global marketplace
Computer Science	The individual (moral), social (ethical), legal and cultural opportunities and risks of digital technology.	**Component 1** 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 9.1 – Characteristics, application, advantages and disadvantages of 'cleaner' design and technology – a product's life cycle in relation to sustainable development issues

Appendix 5: Command word definitions

This table lists the command words that will be used in the examination for this qualification and their definitions.

Command word	Definition
Give/State/Name	All of these command words are really synonyms. They generally all require **recall** of one or more pieces of information.
Describe	Give an account of a 'process' listing the steps or stages of the process **in the correct order/sequence,** or give an account of 'something' listing a series of features/points/trends. The number of points/depth of answer required will be indicated by the mark allocation.
Describe using sketch and notes/annotation	Using graphical depiction with annotation, give an account of a 'process' showing the steps or stages of the process **in the correct sequence/order,** or give an account of 'something' showing a series of features/points/trends. The number of points/stages required will be indicated by the mark allocation.
Calculate	Work out a numerical problem using mathematical processes or formulae using the appropriate processes in their response. Requires showing how they have worked out the answer. Points-based mark scheme may credit use of correct formulae, use of correct steps/stages of calculation (evidenced by showing workings), correct outcome.
Explain	Providing an answer and a **reason** or **set of reasons** qualifying the answer, such as reasons why something can be considered to fulfil a need, provide a purpose, communicate an intention. The answer must contain some element of reasoning/justification; may be used to support a given statement.
Outline	This is a **broad** command that is looking for a **clear and coherent** approach that communicates the **essential features** of a process, system, technique, philosophy or concept. Does **not** require a conclusion.
Construct/Produce/Draw (a 2-point perspective drawing/working drawing)	Use graphical means to communicate/demonstrate understanding and application of drawing conventions. Requires use of maths skills/coordinates/measuring for accuracy.
Consider/Discuss	Identify the issue/situation/problem/concept/argument in the question. **Explore aspects** of the issue/element/situation/problem/concept/argument. Investigate the issue/situation etc by reasoning or argument. Uses subject-specific language and demonstrates use of evidence (scientific, mathematical, data) to support points of discussion. Does **not** require a conclusion.

Command word	Definition
Justify	Used where a developed argument or discussion that reaches a conclusion requires **legitimising** or requires backing up. To provide the **rationale** as to **why** a conclusion has been reached. Where opinions are expressed, the factors that have been considered and how their importance and effect been gauged. **Clear trajectory/path** is central to the response, response has a clear route and a coherent flow throughout. Uses subject-specific language and provides the evidence or structure to a conclusion.
Analyse	To **break down** or **deconstruct** a process, system, technique, philosophy, concept, design movement or product, together with reasoned consideration, **scrutiny** and investigation of a range of factors – contextual influences, researched and recalled information or data (scientific, mathematical), subject-specific language and formal discussion. Consideration of the components and factors in relation to one another.
Evaluate	Critically review information gained from analysis, investigations – bring it **together** to form a **conclusion**, drawing on evidence, data (scientific, mathematical), including strengths, weaknesses, and relevant information. Come to a supported conclusion in relation to a given context. Will be part of the process making independent judgements, **communicating own** views as an informed student.

Please refer to the *Pearson Edexcel Level 3 Advanced GCE in Design and Technology (Product Design) Sample Assessment Materials (SAMs)* and any associated Levels Descriptors for further guidance relating to each command word.

Appendix 6: The context for the development of this qualification

All our qualifications are designed to meet our World Class Qualification Principles[1] and our ambition to put the student at the heart of everything we do.

We have developed and designed this qualification by:

- reviewing other curricula and qualifications to ensure that it is comparable with those taken in high-performing jurisdictions overseas
- consulting with key stakeholders on content and assessment, including learned bodies, subject associations, higher-education academics, teachers and employers to ensure this qualification is suitable for a UK context
- reviewing the legacy qualification and building on its positive attributes.

This qualification has also been developed to meet criteria stipulated by Ofqual in their documents *GCE Qualification Level Conditions and Requirements* and *GCE Subject Level Conditions and Requirements for* Design and Technology, published in February 2016.

[1] Pearson's World Class Qualification Principles ensure that our qualifications are:

- **demanding**, through internationally benchmarked standards, encouraging deep learning and measuring higher-order skills
- **rigorous**, through setting and maintaining standards over time, developing reliable and valid assessment tasks and processes, and generating confidence in end users of the knowledge, skills and competencies of certified students
- **inclusive**, through conceptualising learning as continuous, recognising that students develop at different rates and have different learning needs, and focusing on progression
- **empowering**, through promoting the development of transferable skills, see *Appendix 7*.

From Pearson's Expert Panel for World Class Qualifications

" The reform of the qualifications system in England is a profoundly important change to the education system. Teachers need to know that the new qualifications will assist them in helping their learners make progress in their lives.

When these changes were first proposed we were approached by Pearson to join an 'Expert Panel' that would advise them on the development of the new qualifications.

We were chosen, either because of our expertise in the UK education system, or because of our experience in reforming qualifications in other systems around the world as diverse as Singapore, Hong Kong, Australia and a number of countries across Europe.

We have guided Pearson through what we judge to be a rigorous qualification development process that has included:

- extensive international comparability against the highest-performing jurisdictions in the world
- benchmarking assessments against UK and overseas providers to ensure that they are at the right level of demand
- establishing External Subject Advisory Groups, drawing on independent subject-specific expertise to challenge and validate our qualifications
- subjecting the final qualifications to scrutiny against the DfE content and Ofqual accreditation criteria in advance of submission.

Importantly, we have worked to ensure that the content and learning is future oriented. The design has been guided by what is called an 'Efficacy Framework', meaning learner outcomes have been at the heart of this development throughout.

We understand that ultimately it is excellent teaching that is the key factor to a learner's success in education. As a result of our work as a panel we are confident that we have supported the development of qualifications that are outstanding for their coherence, thoroughness and attention to detail and can be regarded as representing world-class best practice. "

Sir Michael Barber (Chair)

Chief Education Advisor, Pearson plc

Professor Lee Sing Kong

Director, National Institute of Education, Singapore

Bahram Bekhradnia

President, Higher Education Policy Institute

Professor Jonathan Osborne

Stanford University

Dame Sally Coates

Principal, Burlington Danes Academy

Professor Dr Ursula Renold

Federal Institute of Technology, Switzerland

Professor Robin Coningham

Pro-Vice Chancellor, University of Durham

Professor Bob Schwartz

Harvard Graduate School of Education

Dr Peter Hill

Former Chief Executive ACARA

Appendix 7: Transferable skills

The need for transferable skills

In recent years, higher education institutions and employers have consistently flagged the need for students to develop a range of transferable skills to enable them to respond with confidence to the demands of undergraduate study and the world of work.

The Organisation for Economic Co-operation and Development (OECD) defines skills, or competencies, as 'the bundle of knowledge, attributes and capacities that can be learned and that enable individuals to successfully and consistently perform an activity or task and can be built upon and extended through learning.' [1]

To support the design of our qualifications, the Pearson Research Team selected and evaluated seven global 21st-century skills frameworks. Following on from this process, we identified the National Research Council's (NRC) framework as the most evidence-based and robust skills framework. We adapted the framework slightly to include the Program for International Student Assessment (PISA) ICT Literacy and Collaborative Problem Solving (CPS) Skills.

The adapted National Research Council's framework of skills involves: [2]

Cognitive skills

- **Non-routine problem solving** – expert thinking, metacognition, creativity.
- **Systems thinking** – decision making and reasoning.
- **Critical thinking** – definitions of critical thinking are broad and usually involve general cognitive skills such as analysing, synthesising and reasoning skills.
- **ICT literacy** – access, manage, integrate, evaluate, construct and communicate. [3]

Interpersonal skills

- **Communication** – active listening, oral communication, written communication, assertive communication and non-verbal communication.
- **Relationship-building skills** – teamwork, trust, intercultural sensitivity, service orientation, self-presentation, social influence, conflict resolution and negotiation.
- **Collaborative problem solving** – establishing and maintaining shared understanding, taking appropriate action, establishing and maintaining team organisation.

Intrapersonal skills

- **Adaptability** – ability and willingness to cope with the uncertain, handling work stress, adapting to different personalities, communication styles and cultures, and physical adaptability to various indoor and outdoor work environments.
- **Self-management and self-development** – ability to work remotely in virtual teams, work autonomously, be self-motivating and self-monitoring, willing and able to acquire new information and skills related to work.

Transferable skills enable young people to face the demands of further and higher education, as well as the demands of the workplace, and are important in the teaching and learning of this qualification. We will provide teaching and learning materials, developed with stakeholders, to support our qualifications.

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[1] OECD – *Better Skills, Better Jobs, Better Lives* (OECD Publishing, 2012)

[2] Koenig J A, National Research Council – *Assessing 21st Century Skills: Summary of a Workshop* (National Academies Press, 2011)

[3] PISA – *The PISA Framework for Assessment of ICT Literacy* (2011)

Appendix 8: Level 3 Extended Project qualification

What is the Extended Project?

The Extended Project is a standalone qualification that can be taken alongside GCEs. It supports the development of independent learning skills and helps to prepare students for their next step – whether that be higher education or employment. The qualification:

- is recognised by higher education for the skills it develops
- is worth half of an Advanced GCE qualification at grades A*–E
- carries UCAS points for university entry.

The Extended Project encourages students to develop skills in the following areas: research, critical thinking, extended writing and project management. Students identify and agree a topic area of their choice for in-depth study (which may or may not be related to a GCE subject they are already studying), guided by their teacher.

Students can choose from one of four approaches to produce:

- a dissertation (for example an investigation based on predominately secondary research)
- an investigation/field study (for example a practical experiment)
- a performance (for example in music, drama or sport)
- an artefact (for example creating a sculpture in response to a client brief or solving an engineering problem).

The qualification is coursework based and students are assessed on the skills of managing, planning and evaluating their project. Students will research their topic, develop skills to review and evaluate the information, and then present the final outcome of their project.

The Extended Project has 120 guided learning hours (GLH) consisting of a 40-GLH taught element that includes teaching the technical skills (for example research skills) and an 80-GLH guided element that includes mentoring students through the project work. The qualification is 100% internally assessed and externally moderated.

How to link the Extended Project with design and technology

The Extended Project creates the opportunity to develop transferable skills for progression to higher education and to the workplace, through the exploration of either an area of personal interest or a topic of interest from within the design and technology qualification content.

Through the Extended Project students will develop skills that support their study of design and technology, including:

- investigation and analysis of a problem within a context
- conducting, organising and using research
- independent reading in the subject area
- planning, project management and time management
- production of a design brief and specification to direct, inform and evaluate their design practice
- collecting, handling and interpreting data and evidence
- critically analyse and evaluate their own ideas and decisions while using an iterative design and make process
- consideration of social, moral and ethical factors
- critical thinking.

In the context of the Extended Project, critical thinking refers to the objective analysis and evaluation of prototypes/products made by others and the students themselves. This supports the development of evaluative skills, through evaluating design decisions, and using qualitative and quantitative evidence to support informed judgements and propose evidence-based solutions to real-world problems.

Types of Extended Project related to design and technology

Students may produce a dissertation on any topic that can be researched and argued, for example a controversial business issue such as child labour, executive pay or advertising to children.

A dissertation might involve an investigation such as:

- the impact of digital downloads on the music industry
- an investigation into the ease of doing business in a chosen country.

The dissertation uses secondary research sources to provide a reasoned defence or a point of view, with consideration of counter-arguments.

An alternative might be an investigative project or field study involving the collection of data from primary research, for example:

- a study of the impact of unemployment on the local community
- a statistical survey of changing social attitudes towards online purchasing.

A field study might consider an issue that lends itself to primary research, for example an investigation into the motivation techniques used in a chosen business.

Using the Extended Project to support breadth and depth

In the Extended Project, students are assessed on the quality of the work they produce and the skills they develop and demonstrate through completing this work. Students should demonstrate that they have extended themselves in some significant way beyond what they have been studying in design and technology. Students can demonstrate extension in one or more dimensions:

- ***deepening understanding*** – where a student explores a topic in greater depth than in the specification content. This could be an in-depth exploration of one aspect of design and make principles leading to the production of their prototype
- ***broadening skills*** – where a student learns a new skill. This might be learning new processes or techniques that can be applied in their independent design and make project
- ***widening perspectives*** – where the student's project spans different subjects. A student studying design and technology with geography may wish to research the impact of technology on a particular region or locality. A student studying design and technology with mathematics may wish to use statistical techniques to analyse market data and research one aspect of a market in more detail.

A wide range of information to support the delivery and assessment of the Extended Project, including the specification, teacher guidance for all aspects, an editable scheme of work and exemplars for all four approaches, can be found on our website.

Appendix 9: Codes

Type of code	Use of code	Code
Discount codes	Every qualification eligible for performance tables is assigned a discount code indicating the subject area to which it belongs. Discount codes are published by DfE in the RAISEonline library (www.raiseonline.org)	VF2
Regulated Qualifications Framework (RQF) codes	Each qualification title is allocated an Ofqual Regulated Qualifications Framework (RQF) code. The RQF code is known as a Qualification Number (QN). This is the code that features in the DfE Section 96 and on the LARA as being eligible for 16–18 and 19+ funding, and is to be used for all qualification funding purposes. The QN will appear on students' final certification documentation.	The QN for this qualification is: 603/0697/X
Subject codes	The subject code is used by centres to enter students for a qualification. Centres will need to use the entry codes only when claiming students' qualifications.	A Level – 9DT0
Component codes	These codes are provided for reference purposes. Students do not need to be entered for individual components.	Component 1: 9DT0/01 Component 2: 9DT0/02

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Edexcel, BTEC and LCCI qualifications

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